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THE A. I. E. E. WHITE MOUNTAINS CONVENTION.

Notwithstanding the slim attendance last week at the annual A. I. E. E. convention, which registered only 178, including guests, thus making the lowest record for many years, the meeting in several respects was a successful one. With only 20 items on the program, in only a few cases was there an insufficiency of time for the proper presentation and discussion of the papers. Moreover, the limit set to the program resulted in eliminating papers of a purely commercial or highly specialized character, and those presented were, in fact, of general interest and of high grade. Although there were available at the meeting place numerous sources of entertainment for those who wished to indulge in pleasure, the side attractions were not such as to interfere with the attendance at the technical meetings, for which primarily a convention is held.

Aside from the presentation and discussion of papers, abstracts of some of which are given elsewhere in this issue, much interest was manifested in the subject of local sections, almost all of which were represented by delegates. Owing to the improved standing given to sections during President Stillwell's administration, to the encouragement now being offered for individual effort by the local sections and to the promised increased co-operation among the sections and with the Institute administration, there should be an early widening of the influence of the A. I. E. E. geographically. It would appear, however, that in order to enable any broad sectional policy to be developed and put in action, its principles should be incorporated in the organic law of the institute, and thus not exposed to frequent tinkering and occasional lapses in enforcement.

Among the items of general interest on the program were certain suggested amendments to the standardization rules which will be submitted to the membership of the Institute for approval. Most of the amendments relate to definitions of apparatus that has been developed recently or has become of importance industrially during recent years. Changes of this nature represent progress in electrical engineering application, and it is fitting that the devices introduced should be properly and uniformly designated by all who have occasion to refer to them. A noteworthy exception is found in a new definition of "efficiency" as a "physical dimensional quantity." It would seem that this definition had been introduced for the purpose of covering an incorrect designation of the specific output of an electric lamp which has appeared in the standardization rules of the Institute for many years. Just why the addition of a second error in the form of an incorrect term should be considered to correct the existing error it is difficult to perceive. Any argument based upon the fact that the specific output of a lamp in candles per watt is often referred to as an efficiency carries no weight whatsoever, for an examination of existing electrical engineering literature will show a still greater use of the term "efficiency" for the specific consumption in watts per candle. Moreover, the argument that the term efficiency can

correctly be applied to the specific output in candles per watt owing to its occasional use in this connection has in this case no standing for the reason that the Institute rule is in itself responsible for the prevalent inaccurate use of the term.

Three of the papers presented are of especial interest at this time dealing as they do with phenomena which are of predominating importance at the limits of electrical engineering development now being reached by certain of the latest long-distance installations, namely, the dielectric strength of air and of oil. Valuable information concerning the properties of transformer oil was given in a paper by Mr. H. W. Tobey. A convincing investigation of the critical disruption voltage of the air surrounding a transmission conductor was reported by Prof. J. B. Whitehead. Results of a surprising nature were reported by Dr. C. P. Steinmetz and Mr. J. L. R. Heyden in a paper dealing with the disruptive strength of oil and air with transient voltages. The investigations made by the last-named authors indicated that even in air the disruptive discharge requires not merely a sufficiently high voltage, but an application thereof for a finite though small period of time. That is to say, a definite minimum amount of energy must be expended in the dielectric before disruption takes place. It has been known for many years that solid and liquid dielectrics are able to resist for a short time e.m.fs. much in excess of the voltage which they can withstand continuously, but it has usually been assumed that the break-down of air takes place instantaneously. According to the investigations reported by Messrs. Steinmetz and Heyden an exactly similar effect is found in air when used as the dielectric, the only difference being in the time required for break-down and the energy consumed previous to disruption. The authors expressed the belief that the "disruptive energy" of oil is about 30 times as great as that of air, and that of solid dielectrics is probably still greater. The existence of a greater "time lag of discharge" in oil or solid dielectrics than in air is of more than theoretical interest, since it renders possible the effective protection, from lightning and similar transient phenomena of generating and transforming apparatus, by a spark-discharge air-gap across which an arc will form with such rapidity as to relieve the system of the excess voltage before the insulation of the apparatus can be punctured.

THE INTERNATIONAL ELECTROTECHNICAL COMMISSION.

The first annual report of the International Electrotechnical Commission has just been published in the French and English languages, side by side. The document is notable in that it presents the status of international co-operation toward unity of standards in electrical machinery, of nomenclature, and symbology in electrotechnical literature. It is to be hoped that this first report will be the herald of a succession of valuable achievements along these and other electrotechnical lines. The subjects which have thus far occupied the attention of the commission are nomenclature, the unit of candle-power, symbols, and standards for electric machinery. In regard to electrotechnical nomenclature, it is evident that before machinery and apparatus can be internationally standardized it is necessary to have precise mutual recognition of the terms and definitions involved. Consequently, a certain amount of definite nomenclature is a prerequisite to standardization work. The preparation of such definitions has occupied the attention of several national committees, and especially of the British, Danish and French committees, which have prepared certain lists of definitions of technical terms. Within the empire of the commission, the divisions in industrial practice, as well as in technological practice, are practically the same as the divisions of language, so far as concerns the continent of Europe. That is to say, very little difference of opinion or of tradition is likely to be expected within the borders of France, or Germany, or Italy. Engineers speaking the same language are accustomed, in general, to think alike, and to act alike, in these matters. Differences of opinion and differences of technical custom are only to be expected with differences of language. The English language forms a curious exception. Engineers speaking the English language come from India in Asia, The Cape in South Africa, England in Europe, Canada and the United States in America, New Zealand and Australia in Australasia. The differences in local conditions and in engineering practice between the United States and England are at least as great as any existing within the boundaries of Europe. These differences engender differences in usage, and in definitions that no committee can either ignore or control. Consequently, when we come to the English language, we find the system of natural cleavage does not coincide with the system of language difference. All we can hope to accomplish with Great Britain, in this matter, is to accord with its nomenclature wherever possible, and, in return, to ask that terms which cannot be harmonized, owing to fixed difference of usage across the Atlantic, may be omitted from official definition as far as possible.

In regard to the unit of candle-power, England, France and the United States have, through the initiative of the Illuminating Engineering Society, agreed upon a common international unit, but the movement rests at this stage. In regard to symbols for the principal quantities in electrical engineering literatude, the British committee has proposed that attention be concentrated at first upon the symbols entering into Ohm's law. The outcome of this suggestion has not yet been vouchsafed. Unfortunately, there is more difference of established usage on the symbols for current strength and for resistance entering Ohm's law than on almost any other quantity; whereas upon about a dozen quantities there already exists almost complete international agreement in usage. To commence with Ohm's law is, therefore, to attack the problem along the lines of most resistance. In regard to standards for machinery, no formal action has yet been attempted.

An informal conference has been called, by the courtesy of the Belgian committee, for the week of Aug. 7-13 this year, in Brussels. It is understood that while there will be no formal voting, there is to be a free interchange of opinions, particularly with respect to machinery ratings, with perhaps some record of any resolutions reached. It is to be hoped that, at this meeting, such exchange of views may occur as may lead to the formulation of definite proposals for consideration at the official meeting, expected to be held at Berlin in 1911. It would certainly be a sad requiting of the courtesy of the Belgian committee if the gathering this year broke up without leading to potential co-operation, in addition to personal acquaintanceship.

THE PRECISION OF PHOTOMETRY.

In a recent paper before the Illuminating Engineering Society (British) especial attention was given, partly by design and partly by accident, to the question of the practical precision of photometric measurements under different conditions and with different types of instruments. The general consensus of opinion was not altogether comforting to the photometrist. As to the particular type of photometer giving the best results there was sufficient disagreement to leave an impression of uncertainty. It is very curious that long as the Bunsen and Lummer-Brodhun types of photometers have been in use, their relative value as instruments of precision still remains in doubt. Most authorities agree that the Lummer-Brodhun contrast prism gives somewhere about half the average error of setting obtained with the Bunsen disk, assuming the lights to be of the same color. Yet a few experienced men claim that the latter can be made as sensitive as the former even in its original form of the grease spot.

It has been our strong impression that if any type of the Bunsen screen is comparable with the Lummer-Brodhun instrument, it is the modification known as the Leeson disk, where the translucent spot is obtained by placing thin paper between two opposed holes in cardboard. A disk of this form made in the shape of a deep pointed star certainly gives good results, yet we should greatly hesitate to believe that it is capable, even with lights of the same color, of giving quite as good results as the contrast prism or even as the ordinary Lummer-Brodhun prism. With either of the latter forms the mean error of a single setting is considerably less than 1 per cent, while few reports from the Bunsen photometer are quite so good as this, especially for the grease-spot variety. The contrast prism, in fact, can usually be trusted to work pretty steadily down to 0.3 or 0.4 of a per cent as the mean error of a single setting. When it comes to comparing lights of different colors the situation is much more complicated. Some observers get much better results with the Bunsen screen than with the Lummer-Brodhun instruments, while others find very little difference between the two, an added proof of the very large subjective factor in all photometric measurements. Extraordinary and perhaps ill-founded claims have been made for the flicker photometer in the comparison of lights of different colors. In this matter the question is a somewhat intricate one because there are two quite different things to be considered—first, the mean error of setting as compared with the average in a single series of measurements; and second, the constancy of the average obtained on different occasions.

In the first instance it may be regarded as rather doubtful whether the flicker photometer would give any closer readings than any of the other types. This, however, is not the vital question, for consistency is no proof of precision in photometry or elsewhere. In comparing with ordinary photometers two lights of varying color, the observer naturally falls at once into a particular habit of reading, and then is likely to run off his settings with a good deal of precision. Can he, however, come back to the same lights three or four days later after other photometric work has intervened and obtain results consistent with the previous ones? Generally speaking, he cannot, a fact which was beautifully brought out at the meeting in question by a report from the National Physical Laboratory, showing the variations obtained by different observers on different days when comparing two lights even as close in color as an incandescent lamp at 3.1 watts per candle and one at 4 watts per candle. The results of such a comparison on one day may vary by 1 per cent or more from those obtained on the same lamp by the same observer on another day, an error certainly much larger than the mean variation obtained in any single set of readings. There was a sort of rough consistency in the variations from day to day, which may be partly due to idiosyncrasy of the observer and partly due to the entrance of conditions affecting all the observers alike. The psychological differences, so to speak, would be greatly increased in the case of a greater variation in color than that here considered.

Just how far the flicker instrument can aid in avoiding these inconsistencies between the readings on one day and those on another has not yet been properly shown. Observers who are familiar with the flicker photometer and who like to work with it, claim greatly improved results, while those who find it trying and difficult can hardly be expected to add to its reputation. It is certain that the flicker photometer is for many and perhaps most observers an extremely difficult and trying thing to use, but its precision of setting appears to be much better than seems possible when first using the instrument. It would be rather desirable to have comparative tests of the three or four conspicuous forms of photometers, including one or more varieties of the flicker instrument, by half a dozen independent observers, all measuring the same series of pairs of lamps on several well separated occasions with each of the instruments concerned. Comparative measurements have been made many times, but never yet have any measurements been published taken by enough independent observers under enough diverse conditions to eliminate personal idiosyncrasies. One of the reports on photometry which particularly needs to be examined in the course of such an investigation is that remarkable one from the Netherlands Gas Commission some years since in which the Bunsen photometer is given a degree of merit quite inconsistent with that obtained in any other series of observations. It would be well also to work with chromatic differences at least as great as between a 4-watt carbon lamp and the tungsten lamp, and preferably with differences enhanced by not too strongly tinted screens. The instruments now current are altogether too discordant to be tolerated.

OIL SWITCHES IN CENTRAL-STATIONS.

Among the papers read at the Jefferson Convention of the American Institute of Electrical Engineers, one of particular interest to operating engineers was that of Mr. A. R. Cheyney on the use and behavior of oil switches. As we all know, oil switches are a most important adjunct to a central-station system. Much depends upon their reliable operation if a short-circuit occurs. It is a remarkable fact attested to, both in the paper and in the discussion, that no case has recently occurred in which a central oil switch failed to break a short-circuit when called upon to do so. Nevertheless, many switches have suffered damage in rupturing short-circuits, and they often throw oil badly under stress. The recent tendency of large stations has been to collect larger and larger powers on central-station busbars. As was pointed out in the discussion there is a prudent limit to this procedure. A single oil switch cannot be expected to rupture unlimited power. The necessity

may develop of inserting protective reactances, not only between each generator unit and the busbars, but also between different sections of the busbars. The sectioning of the bars by such insertion of reactances is a clumsy and space-consuming device; but it may be necessary to resort to it in the future in order to set some upper limit to the power that a single oil switch may have to disrupt.

CARBON FILAMENT LAMPS AS PHOTOMETRIC STANDARDS.

An important paper on this topic was presented by Messrs. Rosa and Middlekauff last week before the Jefferson convention of the American Institute of Electrical Engineers. The presentation was timely, in view of the fact that we now happily possess an international standard of candle-power in common with France and Great Britain. It is very important to know what are the probabilities and technical methods of its maintenance over so extensive a domain. The human eye is a marvelous piece of mechanism. It is extremely sensitive to radiant energy within the particular spectral range to which it has become adapted by millions of years of experiments. As yet it stands unrivaled in sensitiveness by any apparatus hitherto made in the laboratory. Moreover, even if we could produce a laboratory instrument which would be capable of responding definitely to the impact on a few square millimeters of radiant energy from a naked candle at the distance of a kilometer our instrumental difficulties would only intensify. It would then become necessary to graduate the sensibility of the instrument in such a manner that it should not respond to any amount of radiant energy outside the visible spectrum, while it should respond to radiant energy within the limits of that spectrum according to a certain curve—the visual sensibility curve—as determined experimentally for the average human eye. The ideal instrument, thus adjusted, would then be capable of measuring luminous intensity and illumination. It is evident, upon considering the difficulty of arriving at such a delicate yet complex mechanism as that above described, that we are very far from realizing any suitable apparatus for measuring light in the subjective sense. Even the much simpler problem of measuring light in the objective sense, by measuring the intensity of impinging radiant energy, wave-length by wave-length, is still far from being satisfactorily solved. Consequently, the human eye remains its own arbiter and measurer. As to the intensity of light or of illumination, the eye itself is the only instrument we possess. We have as yet no means of determining whether the average eye of to-day is the same in its response to radiant energy as the average eye of the last year, or decade, or century. We only know that the response of a particular eye is not quite the same at all ages, and that different eyes are not, in general, quite the same, in the same age, in their relative responses. Setting aside color-blind eyes as markedly abnormal it is questionable whether any two eyes are precisely of the same absolute sensibility at any single wave-length, or of the same relative sensibilities at different assigned wave-lengths.

The paper of Rosa and Middlekauff describes the improvements which have recently been made to produce seasoned carbon incandescent lamps. A new lamp diminishes somewhat in resistance at first. Its resistance then becomes practically stationary for a time, and finally it steadily increases with age. We may assume that the two opposing tendencies are present from the start, the tendency to increase being due to reduction of cross-section as the filament evaporates, and the tendency to decrease being due to a physical modification in the structure of the filament under the influence of voltage and high temperature. The tendency to decrease is most marked at the start, and then more than cancels the steady tendency to increase. After a time the two tendencies cancel for a space, and finally the tendency to decrease is much weakened and is completely overcome by the tendency to increase. The lamp is reliable for standard purposes only during the period of steady resistance, perhaps 100 burning-hours in all. At the Bureau of Standards, by the use of potentiometers, the resistance of the lamp can be supervised throughout the tests. The falling-off in candle-power during the period of stationary resistance has been found to depend in the main upon the condensation of carbon vapor on the walls of the globe, which thereby become blackened and diminished in transparency. To minimize this source of error the standard filaments for the Bureau are inserted in large globes, so as to reduce the density of the condensed and deposited layer. The authors also show that when a lamp, in the steady resistance state, is operated at constant watts, its candle-power is much more nearly steady than when operated either at constant volts, or at constant amperes.

By the use of a double photometer, or two photometers connected in series, the number of photometric measurements that can be taken, in a given number of burning-hours of the standard lamp, can be practically doubled. Moreover, much economy of time has been effected by registering automatically the photometer readings on suitably prepared paper, which eliminates the necessity of computing ratios of inverse square distances. The precision of measurement attainable with the eye, in comparing photometrically two candle-powers of the same color, is only about 1 part in 200, with good photometric apparatus and good observers not specially trained. The Bureau claims, however, a precision of about 1 part in 500, for a single comparison, with specially trained observers. By using six standard lamps of a batch, in rapid succession, the mean precision of the set will increase, by the laws of probability in measurement, with the square root of the number of measurements; so that with half a dozen observations the precision should be at least 1 part in 1000. By employing four trained observers in succession, on the same batch of lamps, the precision will naturally be still further increased. By economizing the burning-hours of a batch of standard lamps the paper shows that they are capable of serving for 100 years, if used twice a year, for half an hour at a time, without exceeding the period of reliable standard use. In the course of that time 6000 comparisons can be made with each lamp, for the maintenance, checking and comparison of international candle-power.

Incidentally, and without desiring to offer undue criticism, it may be asked what possible use there is for standardizing lamps on the hypothesis that they are to be rotated when in use. There may be cases when it is desirable to rotate a lamp under measurement for the purpose of determining its mean horizontal candle-power, although we hope to see this particular measurement soon dropped out of sight in favor of a mean spherical measurement expressed either in candles or [illegible] but we fail to see the least necessity for having

standard lamps, in which the highest precision is desired, exposed to the added risk of rotation to no possible good purpose. A standard with a filament of such contour as to give quite uniform horizontal distribution and furnished with suitable sight marks for alignment on the photometer bar is much more convenient and probably also more materially reliable than a rotating standard. Moreover, metallic filament lamps, which are already in very great commercial use, do not lend themselves readily to rotation, even if anyone wants to rotate them; and hence there is less use for real or imaginary measurements in rotation than there ever has been before.

THE ELECTRIFICATION OF RAILROADS.

Last week we printed an abstract of a paper to be presented by Mr. George Westinghouse before the joint meeting in England of the American and British Societies of Mechanical Engineers, and in this issue give an abstract of a paper by Mr. W. B. Potter, to be read at the same meeting. The two papers deal from very different points of view with the larger problems of railway electrification. As might be expected, Mr. Westinghouse holds a brief for single-phase methods as best suited to universal electrification, while Mr. Potter has strong hopes of 1200 volts or higher pressure for direct-current traction, and damns the single-phase system with the faintest possible praise. This much might have been written down without reading the respective papers, but there is much in them beside polemics and they will repay a careful study, Mr. Potter's paper as a résumé of things as they are, Mr. Westinghouse's as an appreciation of things as they might be. The former is looking at the problems as they daily present themselves, the latter is directed to the inscrutable future. Mr. Westinghouse takes the large view that just as time has shown the necessity for a standard gauge on railways so as to permit of the free interchange of rolling stock, just so the future will demand that in the general electrification to which Mr. Westinghouse looks forward, the energy supplied shall be of such kind and so delivered to the locomotives or motor cars that their service shall be interchangeable, even as the service of the steam locomotives is at the present time. It is somewhat unsafe to phophesy save after the fact, yet granting the thesis that the electrification of railway lines will assuredly extend until it is well-nigh universal, then obviously Mr. Westinghouse is right in calling for a universal method of traction. With the indications strongly in favor of his position that direct current is out of the running in operations upon the scale presupposed, Mr. Potter's tacit assumption is that railway electrification must be considered as a thing to be accomplished here and there in response to local necessities as a special requirement and not a general necessity. Granting this premise, there is evidently room for direct-current traction, for three-phase traction on mountain divisions and for the single-phase traction which Mr. Potter considers so uneconomical.

One of the most interesting phases of the psychology of argument is the facile way in which two honest and competent men can reach diametrically opposed conclusions suitable to their desires from the same set of concrete facts. Given the experience of the past decade with direct-current and single-phase traction, Mr. Westinghouse and Mr. Potter come to diametrically opposite conclusions that are based on experience. The former shows by a series of very instructive diagrams that in the large and on the whole the distribution expenses, direct and indirect, are so greatly reduced by single-phase traction that any slight increase in investment and depreciation as regards single-phase locomotives may be quite dropped out of sight. Mr. Potter, on the contrary, proves quite to his satisfaction that expense of upkeep and depreciation and interest on single-phase apparatus is so prodigious as to render it entirely impracticable from the financial standoint, a view which he backs up by many carefully aligned figures. Now it is perfectly clear that one of these excellent gentlemen must be occasionally wrong in his figures, or, what is more probable, in the particular hypotheses which he has chosen as a foundation for his figures.

We are glad to see that Mr. Potter lays stress upon depreciation, which has been sadly neglected in traction equipment of every kind since the earliest days of the art. It would be interesting, however, to discover on what concrete data he bases his estimate that the single-phase locomotive will cost twice as much for maintenance as the direct-current locomotive at either 600 or 1200 volts. If he has concrete and reliable figures on this theme to present, we are quite sure that the engineering public would be most glad to receive the benefit of them. It would be also interesting to ascertain from what data he ascertains alternating-current motor cars for interurban service cost more than three times as much in annual fixed charges as do ordinary 600-volt, direct-current cars. To the casual observer it would look as though Mr. Potter has exaggerated the difference on one side as Mr. Westinghouse very possibly may have on the other. If there are data to back up Mr. Potter's figures we should be most glad to publish them with proper authentication of their origin so that there should be no possible chance for critics to carp at the figures presented. We extend the same polite invitation to Mr. Westinghouse with respect to his figures upon cost of motive power.

Really it would seem as though such mutual laying down of cards upon the table would furnish the only reliable data upon which the engineering public may form just conclusions as to the facts. We have no doubt that both the parties in discussion have presented the facts as they see them from data at hand, but the discrepancy is so great as to require verification from the data. In all these discussions of cost it must be remembered that the chief example of single-phase traction, that on the New York, New Haven & Hartford Railroad, is most emphatically not an example on which it is safe to base estimates of future expense, since in the first place, owing to the lack of independent entrance into New York, the locomotives were enormously more complicated and costly than normal single-phase locomotives for similar service would be; and in the second place, there were some natural and costly expenses incident to reduction to normal practice which should not be laid up against the system. As to the general propositions regarding the probabilities of future service, far be it from us to play the prophet. The logic of development lies with unification of method; the logic of finance, which is that of last resort in industrial matters, lies with the maintenance of the status quo, since most of the American railroads are already so overcapitalized that the question before them is not how to build for the future, but how to get reasonable credit for the necessities of the present.

Plans for Summer Convention New England Section N. E. L. A.

The second summer convention of the New England Section of the National Electric Light Association will be held at The Griswold, Pleasant Point, New London, Conn., on Tuesday and Wednesday, Sept. 13 and 14, 1910. The success of the first summer convention at Newcastle, N. H., in 1909 promises an interesting and enthusiastic meeting this year on Long Island Sound in the home territory of President A. J. Campbell. Since the Newcastle meeting the membership has increased from 240 to 675 members, over 100 members having been added since the winter meeting in Boston. The plans for the New London meeting include a special train leaving Boston at 3 p. m., Monday, Sept. 12, arriving at New London at 5:30 p. m. Transfer to Pleasant Point will be made by steamer, and in the evening the officers, executive committee and accompanying ladies will give a reception. The business sessions will begin on Tuesday, Sept. 13, at 10 a. m. The papers will be limited to four, in order to secure the most thorough reading and discussion. On Tuesday morning there will be a topical discussion of "The Best System of Rates and Charging," based upon the points brought out on the paper by Mr. R. S. Hale on "Central-Station Rates" read before the section at the recent Boston meeting. Special attention will be given to the systematization of rates and charging methods in New England, as considered by a committee appointed at the Boston meeting to attempt to secure some degree of standardization in this matter. Following the rate discussion will be a paper on "The Development of the Electric Sign Business."

Tuesday afternoon will be devoted to a general entertainment, with a banquet in the evening. On Wednesday, Sept. 14, at 10 a. m., the business sessions will be resumed and the topics for consideration will be "Special and Decorative Street Lighting" and the "Best General Policy of Central-Station Publicity." An executive session will be held on Wednesday afternoon. Mr. L. D. Gibbs, Edison Electric Illuminating Company, Boston, is secretary of the New England Section of the N. E. L. A.

Early Construction of Chicago Subway Is Probable.

By a decision of the Illinois Supreme Court, handed down on June 29, the city of Chicago is given power to expend for subway or other traction purposes the "special traction fund" contributed by the surface street railway companies as the city's portion of their receipts under the traction settlement ordinances. This fund now amounts to about $4,350,000, and, in addition, the city, by the terms of the franchise settlement ordinances, can call on the companies to contribute $5,000,000 toward the construction of a subway. Thus there is between $9,000,000 and $10,000,000 in sight, and with the last remaining legal question cleared away it is likely that the work on the long-proposed Chicago subway will be begun within a year, or possibly within a few months.

Mr. Bion J. Arnold, the city's subway engineer, is quoted as saying that the actual working plans for the subway will be ready by fall. The subway will not only relieve the surface of the streets of railways on some of the busiest downtown thoroughfares, but will also provide for water-pipes, gas-pipes, electric wires and other buried utilities.

In its decision the Supreme Court held that the city has power to acquire or construct city railways, and that "street railways," properly construed, mean elevated, surface or underground railways; that the city of Chicago may exercise this power in accordance with the traction ordinance of 1907, and may expend for such purpose either the special traction fund or any other available corporate funds belonging to the city. Undoubtedly the subway will be municipally controlled, as well as municipally built, but perhaps the right of operating it will be leased to a private company.

It is probable that the first section of the subway will be built in State Street, running north from Twenty-second Street to Randolph Street, west to La Salle Street, north through the La Salle Street tunnel under the Chicago River to Chicago Avenue. It is estimated that the cost of construction will be $1,000,000 a mile, exclusive of property damages. This subway will through-route north-and-south surface street railway lines. Whether the elevated trains shall also be taken in the subway, whether the subway shall be of one-deck or two-deck construction, whether there shall be provision for four or six tracks on each level, and whether the subway shall be excavated clear across the street, from building line to building line, with pipe and wire galleries, are questions still to be determined.

Plan Niagara Energy for Detroit.

Following the vote taken by the citizens of Windsor, Ont., the Canadian city opposite Detroit, approving a bond issue of $100,000 to take Niagara power by extending the 110,000-volt transmission line from London, 108 miles distant, a company has been formed in Detroit to purchase the surplus block of 12,000 hp which is available to Windsor, and to import this power for resale in the American city. London, Ont., which has a manufacturing population of over 100,000, will shortly be using Niagara energy for lighting and street-railway operation. Windsor can itself utilize only about 1500 hp or 2000 hp, and proposes to merchandise the rest of its share, if contracted for, to its American neighbor, aggregating about 13,000 hp. For Niagara energy, the Ontario Hydroelectric Commission's rate to Windsor will be $27.50 per hp-year. The Canadian Government withstands the expense of constructing the line to the city limits, the municipality paying for the transforming and distribution plant. The recent vote by Windsor citizens, approving the expenditure of $100,000 for this purpose, was very close—618 voting nay against 622 approving the measure. The company formed to import Niagara energy from Canada is called the Electrical Distributing Company of Detroit. It is composed of Messrs. M. J. Dee, G. H. Hendrie, J. L. Land and P. C. Renaud, of Detroit, and C. E. Fleming, John Davis and W. C. Kennedy, of Windsor. Several large manufacturers are reported to be interested in the proposition and the securing of energy to operate their plants. One has discussed taking a block of 2000 hp in case the deal goes through, it is said. A steam auxiliary station may be built. Mr. Paul C. Renaud, who has been quite active in organizing the American company, recently served as secretary of the Committee of Fifty prominent Detroit business men, which investigated local traction conditions. Detroit is 220 miles from Niagara Falls.

Ohio Independent Telephone Situation.

The Chamber of Commerce, of Pittsburgh, has asked business men of Cleveland, Toledo, Columbus and other Ohio cities to aid in securing better rates from the American Telephone & Telegraph Company on long-distance business. It is claimed by Pittsburgh business men that the recent increase in rates was made without notice and that it is unreasonable and out of proportion to the service rendered. Owing to the close connection between Pittsburgh and all the large cities of Ohio, arising out of the iron and steel, coal, oil and natural gas industries, the telephone wires are used extensively and the advance in rates is felt keenly when the monthly bills for tolls are made up.

The plan contemplates concessions in rates through conferences of business men with representatives of the company, but if nothing is accomplished in this way, then the matter will be taken to the Interstate Commerce Commission which, under a new law, is said to have jurisdiction over interstate telephone rates. Unless the company should be arbitrary in its stand it is the desire of those interested to settle the matter themselves. They say they would not have objected to a reasonable advance if the company could show that it was not making a profit under the old schedule, but the advance is more than 100 per cent in many cases and is considered far too great.

The Hudson Telephone Company has taken charge of the business of both the Bell and the Independent offices at Hudson. Service will be given all subscribers of both exchanges by means of a connection made between them. Later on the Hudson Telephone Company will have an exchange equipped that will serve all from one exchange and the poles and wires will be removed from the streets and put under ground. The exchange will connect with both the Bell and Independent long-distance lines. Hudson is to be a model town under the patronage of Mr. J. W. Ellsworth, the wealthy coal operator, whose birthplace was at that place, and where he now maintains a handsome country home.

Large Vancouver Hydroelectric Development.

The British Columbia Electric Railway Company and the Vancouver Power Company will soon commence the development of water-powers on the outlets of Chilliwack and Jones Lakes outlets in the Chilliwack Valley, about 60 miles east of Vancouver. Tht Jones Lake development will include a huge dam near the northwest end, and a tunnel 10,000 ft. long. The dam will be designed for an eventual head of 50 ft., which will enable 35,000 hp to be developed. Initially the dam will only be built 20 ft. high. The Chilliwack Lake development will similarly include a dam 50 ft. high, only 20 ft. of which is to be completed at once. From the latter dam the water will be carried to the power house, three miles away, by high-pressure steel pipes, which for part of the length will pass through a tunnel as in the case of the other development. The pipe line will converge into that from Jones Lake at a short distance from the power house. It is stated that there will be a fall of 1800 ft. between the lakes and the power house. The present outlet of Jones Lake, as well as that of Chilliwack Lake, will be closed by the dams to be constructed. Fully 50 per cent of the water used in the turbines can be reused for irrigation purposes. The Government has agreed to sell such lands as are necessary for the development at $10 per acre, while the lake rights are held by virtue of a grant from the Provincial Government a number of years ago. The approximate ultimate cost, which does not include the purchase of land and the preliminary work, is $9,357,000. The project will be completed in 2½ to 5 years, although 10 years are allowed by the charter of the companies.

Important Rate Decision in Massachusetts.

The Massachusetts Gas and Electric Light Commission has issued an order under date of June 27 reducing the price of gas from 90 cents to 85 cents on the system of the Charlestown Gas & Electric Company, the reduction taking effect Aug. 1. The decision is of interest on account of the location of the company within the city limits of Boston, its relationship to the Boston, Cambridge and Somerville distributing problems, and the comments of the board upon certain aspects of the rate determination. The petition was brought before the board by customers of the company upon the grounds of price and quality of gas supplied. The company has removed the causes of trouble in regard to gas quality by improving the delivery conditions. Since Jan. 1, 1906, the price of gas sold by the company has been 90 cents net. The price of the Boston Consolidated Gas Company is now 80 cents. The Cambridge Gas Light Company, which supplies that part of the city of Somerville not within the territory of the Charlestown company, charges 85 cents. For several years the company has purchased all of the electricity sold by it from the Boston Edison Company, and since May, 1909, the Edison prices have prevailed. The Charlestown company's gas sales increased from 182,000,000 cu. ft. in 1905 to 230,000,000 cu. ft. in 1909, but increases in operating cost, combined with price reductions, have reduced the gas profits from $68,778 in 1905 to $57,026 in 1909. At the hearing the petitioners urged a reduction in price chiefly on the ground of the 80-cent rate in other portions of the city of Boston.

In its discussion of the rate-making problem the board says: "In a proceeding against a company for a reduction in price, evidence which merely calls attention to prices elsewhere is not conclusive as to the fair rate for the respondent company. Such suggestion, however, is never without force and calls for a careful inquiry as to what differences of condition or circumstances, if any, exist in the companies compared, particularly in the case of adjacent companies and those sharing the area of the same municipality. Perhaps the most important difference between the Charlestown and the Boston Consolidated companies lies in the very great difference in their outputs. The Boston company, selling nearly 20 times the amount of gas sold by the Charlestown company, is able to take advantage of methods and processes economical in their operation, but so costly in their installation as to require an investment which in the smaller company would be prohibitive. It has at the same time other such advantages as are incident to large industrial corporations generally.

"The reduction by the Cambridge company and the resulting differences in rates in different parts of Somerville is a more forceful suggestion relative to the Charlestown company's price. Although the two companies operating side by side have certain notable differences, they have many commercial similarities. They buy their materials in the same market, and the costs of delivery and of wages cannot be appreciably different. Cost in the holder and dividend charges were notably larger in Charlestown per 1000 cu. ft. sold than in the Cambridge. For a number of years both of these companies have paid the same annual dividend of 10 per cent, but for the same rate per cent the cost per 1000 cu. ft. is appreciably larger in Charlestown. . . . . The outstanding capital stock of the Charlestown company is greater in proportion to its output than that of Cambridge. It is also larger as to book values and apparently to the actual values of their respective plants.

"The decisions of the courts seem to establish clearly that a company's reasonable rate of profit is not to be based upon the volume of its outstanding securities, but is dependent rather upon the actual value of the plant devoted to the public use. Whatever may be a fair and reasonable rate of return to either company on this basis, it does not necessarily require that it must be sufficient to maintain the same rate of dividend in both. The Cambridge price and dividend, made as they are voluntarily by the company, may be assumed to be not unreasonably low. The Charlestown dividend is only fair when it can be earned with a reasonable price. Under most conditions a fair and reasonable rate of dividend is a very important factor in determining a reasonable price. Under other circumstances other factors may be of the greater importance.

"In an inquiry like this the board must determine what price is reasonable, not merely for the stockholders, but for the public in view of all the circumstances surrounding the case. The public is in any case entitled to the lowest reasonable price at which a company can afford its service, irrespective of prices elsewhere. But this is not the only rule to be considered, for in process of time and under some conditions, a certain standard of price may become so well established that a company may be bound to meet it even though such action may involve some risk to the continuance of a well-established and otherwise not unfair return. Although companies of this class may exercise a practical monopoly within their respective areas of supply, they are not wholly relieved from the competitive force of rates elsewhere. The reason which apparently led the Charlestown company to reduce its electric prices, both for public and commercial lighting, to the level of those in other parts of Boston, are a virtual recognition of the truth of these propositions.

"In view of the decrease in the company's electric income and the increase in expenses already noted, a reduction in the price of gas may have some temporary effect upon the present rate of dividend. It may, nevertheless, be confidently expected that the price named will yield under all the circumstances a reasonable return upon the value of the property which the company is employing for the supply of gas in the territory which it serves. The board is not convinced that under present condi-

tions the Boston price is a reasonable price for Charlestown. On the other hand, the board has reached the conclusion that the Charlestown company may no longer reasonably charge its customers more than the present price in Cambridge and a part of Somerville, and that there is nothing in the present condition of the company's affairs or in its future prospects to render such a reduction commercially impracticable or inexpedient."

First Aid in Electric Shocks.

Dr. J. E. McGowan, surgeon for the Commonwealth Edison Company and the Chicago Telephone Company, addressed the Electric Club of Chicago at its regular mid-day lunch meeting June 29 on the subject, "First Aid to the Injured with Special Reference to Injuries Due to Electrical Work."

Dr. McGowan first called attention to the fact that while a man may be apparently dead from electric shock, every effort should be used to revive him before giving him up. The first thing is to start the heart to beating, if it has ceased. He cited one case where a man receiving a shock in a switch-house was bounced on the floor by one of his companions to start the heart action. This succeeded, although it was rather rough treatment. The best method is to warm all parts and begin artificial respiration. Heat can be applied by hot-water-soaked cloths or bricks. Anything properly to supply artificial warmth to the body and extremities is good. The Commonwealth Edison Company emergency box has a hypodermic syringe with doses of one-twentieth grain of strychnine to be used for starting heart action, and a pair of tongue forceps for the purpose of drawing the tongue forward out of the throat if it is drawn back. Foremen are instructed in the use of this syringe.

Symptoms of a severe shock are a cold skin, a pallor and sometimes unconsciousness. In the case of electric shocks hysterical condition is sometimes one of the symptoms.

He considered that 500 volts is usually required to kill a person. In one case which came under his notice, a man working behind a switchboard at the Twentieth Street substation of the Chicago City Railway received a 360-volt shock, which killed him. This was the lowest voltage which in his knowledge had caused death. Hysterics and nervous conditions seem more likely to follow low-voltage shocks than high-voltage shocks. A person may be badly burned from a high-voltage shock. On the other hand, a shock of 110 volts, alternating current, such as telephone operators sometimes receive, seems to create a hysterical nervous condition. If a shyster lawyer is able to get hold of such a case he is frequently able to get some temporarily apparent grounds to make out all sorts of absurd claims as to permanent injury done.

Mr. McGowan stated positively that if a person is not killed by electric shock no permanent injury is done by the shock except for the burns which may be received. There are no after-effects and all claims that there are such effects are without foundation. As to the treatment of burns in the first stage, wrap the burns with sterile gauze and send the patient to the hospital. Things which may be safely applied to burns in such cases are any of the following: Oil, solution of soda, boracic acid, a mixture of linseed oil and lime water.

In answer to a number of questions at the close of his remarks, Dr. McGowan said if a man's eyes are suffering from the effect of an electrical flash a cold compress with a solution of boracic acid over the eyes may be applied. A spoonful of boracic acid in a cupful of water is the proper strength. Men recovering from tremendous shocks usually report that they felt at the time of receiving the shock as if they were hit from all directions at once, or as if a house had fallen on them. Electric burns are not usually painful until they begin to heal. There is no way of determining by post mortem examination of the interior of the body whether death was caused by electric shock. Nausea in electrical shock is caused in the same way as in other shocks by reflex action on the nervous system. There is coagulation of the blood at the point where the electric current has passed. Vomiting blood can generally be taken as evidence of internal injury from a fall, and not caused by electric shock where a shock and fall occur together. In the application of hypodermic injection with the syringe care must be taken to have the liquid fill the point of the syringe before insertion, because if air bubbles are injected into the system they may cause an abscess under the skin or a clot of blood if in a vein. As to the danger of giving up hope too soon, he cited a case in Ohio recently where a man was revived after six hours' work. He was black for two hours following shock. A person killed by electric shock is almost always burned. The burn may appear simply as a little black spot at first, but in a few days may develop into a large hole due to the sluffing away of burned flesh.

Electrification of Railroads.

At a joint meeting of the American Society of Mechanical Engineers and the British Institution of Mechanical Engineers, to be held on July 28 in London, Mr. W. B. Potter, railway and traction engineer of the General Electric Company, Schenectady, N. Y., will present a paper entitled "Economics of Railway Electrification."

The author compares the various electric systems now available: The three-phase system is considered as out of the running in the United States for all service except where heavy grades are encountered, and a detailed comparison of the single-phase and high-voltage, direct-current systems results decidedly in favor of the direct-current system.

The development of the commutating pole has made practicable the operation of direct-current motors at voltages considerably in excess of the present standard of 600. A great many roads are now using 1200 volts and 1500 volts, and Mr. Potter suggests that the standard e.m.f. for high-tension, direct-current systems may be as high as 1800 volts or 2400 volts.

Judged from the requirements of interurban service, the author lists the following disadvantages of the single-phase system: Excessive weight of rolling stock; excessive cost of rolling stock; high cost of equipment maintenance; increased power consumption; rapid depreciation of motor; rapid depreciation of car bodies and trucks; increased cost of maintaining tracks and roadbed.

A cost analysis of trunk-line service shows results in favor of the direct-current systems, except where the traffic is light and the distance great. The cost of substations is given as follows: Six hundred volts, direct current, $26 per kilowatt; 1200 volts, direct current, $28 per kilowatt; 11,000 volts single-phase, $11 per kilowatt; 1,000 volts three-phase, $12 per kilowatt.

COMPARISON OF COST OF INTERURBAN SYSTEMS.

	600 volts d. c.	1200 volts d. c.	6600 volts a. c.
First cost	$[illegible]	$612,500	$694,000
Fixed charges	81,200	70,600	88,400
Operation and maintenance	75,800	82,300	104,000
Annual cost	$176,000	$152,700	8172,400
Based on 1,075,000 car miles per year, additional annual charge per car mile above the cost for 1200 volts, in cents.	2.10		3.6

Yearly operation and maintenance are taken as $5,000 for direct-current and $2,500 for alternating-current stations. The cost of locomotives shows the single-phase to cost about one-third more than the 1200-volt, direct-current type, while the 600-volt costs less than the 1200-volt machine, and the three-phase costs less than the single-phase and about one-third more than the 600-volt locomotive. The maintenance per locomotive mile of the single-phase machine is 8 cents, which is twice as much as that (4 cents) taken for the direct-current and nearly twice as much as the figure (5 cents) taken for the three-phase system.

Assuming a definite set of conditions corresponding to an interurban road with moderate traffic—conditions which are stated to be most favorable to single-phase operation—the author compares the costs of 600-volt, direct-current, 1200-volt, direct-current, and 6600-volt, alternating-current systems.

The cost analysis shows that for these three systems the transmission line cost is the same, the substation cost of the 600-volt system about ten times, and that of the 1200-volt system about five times greater than that of the 6600-volt system; the cost of the secondary distribution system was about the same for all systems, the cost of the bonding the same for all and the cost of cars of the 6600-volt system about three times as much as the direct-current cars. Under maintenance $10,900 is charged against the single-phase system as excess track maintenance and shop costs over the direct-current systems due to the heavy cars. The totals of these analyses are given in the table herewith.

The Engineer's Duty as a Citizen.

At the Atlantic City meeting of the American Society of Mechanical Engineers, Rear-Admiral Geo. W. Melville, U. S. N., delivered an address in which, after sketching what society owes to the engineer, directs attention to some of the duties which the engineer owes to society.

In this "age of the engineer," the engineer, he says, should not rest content simply with doing the work which makes for our comfort and happiness, at the command of others, men who are lawyers or simply business men, but should himself take a vital and directing part in the administration of affairs. It may be objected that an engineer's professional work is so engrossing and exacting that he cannot become a politician in the sense that a politician is a man who gives all his time to pulling wires and filling offices; and while this is doubtless true, where it is a matter of self-interest, the engineer, like other men, can find time for this extra work.

In view of the enormously important part which the engineer plays in the life of to-day, it is incumbent upon him, more than upon most other men, to take a vital interest in the work of government and to lend his trained ability and judgment to its perfection. This does not imply that the engineer should do routine professional work for the Government without compensation, but that in the discussion of public improvements and the administration of governmental departments, he should take an active public stand to influence and guide the non-expert part of the population. It is notorious that enormous amounts of money have been squandered on great public works because they were undertaken in a way which every engineer knew must be inefficient and uneconomical. If engineers had a keen sense of duty in this respect, and would properly utilize their experience and ability through the daily press, the magazines and the reviews by public discussion and in the daily intercourse of life, as well as by impressing the truth upon our representatives in municipal and national affairs, he would accomplish an immense amount of good.

Many questions prominently before the public are peculiarly such as require engineering knowledge for their proper understanding and regulation. The word trust has come to have such a sinister meaning that it is only necessary to fasten it upon an enterprise to render it criminal in the popular estimation. Recently much has been heard about the so-called water-power trust, the charge being that all the available power sites were being grabbed so as to subject our citizens at some future time to the payment of tribute for electric power derived from them.

Engineeers know these water-powers cannot be made available except by the expenditure of large sums of money. Indeed, it would be easy to point out the fortunes that have been lost in the attempted exploitation of these supposedly lucrative natural gifts. The general public is utterly misled by statements that these power sites are obtained for nothing, the idea being that the development is a matter of small expense. Here the engineer can do a work of real benefit by disseminating correct information. Again, in the consideration of public-service corporations, the engineer knows the cost of installation and operation, and so can discuss intelligently whether rates are fair or exorbitant, and whether capital represents real investment or water. These are problems of the greatest importance, and for their proper solution, the electorate needs training that can be given by no one else so well as by the engineer.

While engineers often show public spirit, it is mostly in cases of unusual importance and relatively infrequent. Admiral Melville said, however, that what he is pleading for is a habit of mind that will cause engineers to take an active part in all public questions, great or small, where their knowledge and experience will enable them to contribute to the common good.

We have often heard engineers complain that the profession did not receive due praise and credit for its splendid work. This is true enough, but is the reason not very largely because the engineer hitherto has been content to do the work and then fade into the background, leaving the talking and the management to the lawyer and the politician? With the advance of technical education, engineers are more and more becoming the high officials of our large corporations. It is to these men, whose talents and trained ability have made them the leaders in manufacturing and in business, that the country has the right to look for leaders in the affairs of government; and not until the engineer of all grades has done his part toward the promotion of the highest efficiency of the Government can he truly say that he is, in the fullest sense of the term, a good citizen of the Republic.

Association of Railway Telegraph Superintendents.

The twenty-ninth annual convention of the Association of Railway Telegraph Superintendents was held in the Hotel Alexandria, Los Angeles, Cal., on June 20-24, inclusive. Mr. Joseph Scott, president of the Chamber of Commerce of Los Angeles, welcomed the visitors on Monday, June 20. The response was made by Mr. E. P. Griffith (Erie Railroad), Jersey City, N. J. Vice-President I. T. Dyer (of the San Pedro, Los Angeles & Salt Lake Railroad), of Los Angeles, presided in the absence of Mr. John L. Davis (Chicago & Eastern Illinois), of Chicago. Mr. Dyer was also chairman of the entertainment committee. Mr. P. W. Drew, of Chicago, the secretary of the association, was also unable to be present, and his place was filled temporarily by Mr. F. H. Van Etten, of Chicago. There is unusual activity in the telegraph departments of the various railroads, due to construction work, and many busy officials could not leave their offices. The attendance at the convention was about 75.

At the first day's session Mr. W. F. Williams (Seaboard Air Line), Portsmouth, Va., read a paper on "Train Blocking by Telephone," and this was followed by a paper by Mr. H. P. Ryner, of the Hoeschen Signal Company, whose subject was "Automatic Block and Highway Crossing Signaling." Other papers presented were on "Wireless Telegraphy," by Mr. William Maver, Jr.; "Education for Efficient Railroad Service," by Mr. D. C. Buell (Union Pacific); "Protecting Telephone Lines from Lightning and Other Disturbances," by Mr. M. E. Launbranch, of the United States Electric Company; "Telephone Train Dispatching," by Mr. E. E. Dildine (Northern Pacific); "Testing of Telegraph and Telephone Circuits," by Mr. V. E. Kissinger (Chicago, Burlington & Quincy), and "Telephoning to and from Trains," by Mr. E. P. Griffith (Erie).

Officers were elected as follows: President, I. T. Dyer (San Pedro, Los Angeles & Salt Lake), Los Angeles, Cal.; first vice-president, John B. Sheldon (Union Pacific), Omaha, Neb.; second vice-president, William Bennett (Chicago & Northwestern), Chicago; secretary and treasurer, P. W. Drew (Minneapolis, St. Paul & Sault Ste. Marie), Chicago. Boston was selected as the next place of meeting. An interesting feature of the closing session was the presentation of a gold watch, suitably inscribed, to Miss Adrienne E. Dyer, the 17-year-old daughter of the new president, who is known as the "daughter of the association."

A varied and attractive program of entertainments was presented. In the banquet hall at the hotel a number of new appliances interesting to railway telegraph superintendents were shown by manufacturers.

The Annual Convention of the A. I. E. E.

Almost ideal conditions as to location, temperature and weather surrounded the American Institute of Electrical Engineers during its annual convention held at Hotel Waumbek from June 28 to July 1. While persons in the cities were experiencing disagreeable hot weather, those who were present at the convention were enjoying the delightful cool breezes of the White Mountains. With a technical program containing only 20 items, it was possible to confine the presentation and discussion of papers to four meetings and devote the remaining time of the four days to entertainment features of a social or athletic nature. A trip to Mount Washington, which required from early morning until late in the afternoon on Thursday, furnished recreation for most of the members and guests on that day. Almost continuously the golf links and tennis courts were being used by the devotees of the corresponding diversions, while a game of baseball between the "Ares" and "Hasbeens" furnished amusement to many on Wednesday afternoon. The dance and reception on Tuesday evening was well attended and proved a thoroughly enjoyable affair. Late Thursday afternoon Prof. V. Karapetoff, of Cornell University, gave a piano recital which represented the polished work of a master and contained no intimation of an amateurish performance. The closing feature of the convention was a dinner and discussion given by the educational committee on Friday evening. As the leading speaker during the discussion, Dr. C. P. Steinmetz outlined the defects in American methods of instruction and claimed that American colleges are institutions of teaching, whereas they should be institutions of learning. He advocated increasing the length of college instruction, raising the entrance requirements and improving the staff of instructors.

TUESDAY AFTERNOON SESSION.

The first item on the program of the technical sessions was the annual address delivered by President Stillwell, entitled "The Conservation of Water-Power." Mr. Stillwell proposed that a tax be imposed on all sources of power found upon public lands—a royalty on coal mined and a rental upon water-power. He suggested that the charge imposed upon water-powers be based upon the amount of water appropriated and the effective head resulting from the topography of the Government lands concerned.

The address was received with much enthusiasm. It was moved by Dr. C. P. Steinmetz and seconded by Mr. W. S. Lee that the paper be endorsed as expressing the attitude of the American Institute of Electrical Engineers and be called by the board of directors to the attention of the proper Government officials. This motion was carried unanimously. The address was considered by all as a source of much educational information, both for the public and the government.

Dr. A. E. Kennelly presented the report of the standards committee suggesting certain amendments to the standardization rules of the Institute. After some discussion by Prof. G. F. Sever, Mr. Gano S. Dunn and Dr. C. P. Steinmetz, it was decided to send to each member a printed list of the suggested additions and changes, so that those items meeting with the approval of the membership can be included in the next edition of the rules to be issued in the fall.

A paper describing tests made upon head-lamps used upon steam locomotives was presented by Prof. G. F. Harding, of Purdue University, and discussed by Messrs. J. B. Taylor, G. H. Stickney, H. Barker, C. P. Steinmetz, C. F. Scott, H. P. Wood and J. C. Lincoln.

A paper entitled "Carbon-Filament Lamps as Photometric Standards," by Messrs. E. B. Rosa and G. W. Middlekauff, of the Bureau of Standards, was read by Prof. W. L. Robb as chairman of the electric lighting committee. This paper was discussed by Dr. C. P. Steinmetz and Prof. A. E. Kennelly.

Mr. A. R. Cheyney, of the Philadelphia Electric Company, read a paper entitled "The Modern Oil Switch with Special Reference to Systems of Moderate Voltage and Large Ampere Capacity," which was discussed by Messrs. P. Junkersfeld, F. W. Harris, C. W. Stone, D. B. Rushmore, C. P. Steinmetz, W. I. Donshea and V. Karapetoff.

WEDNESDAY MORNING SESSION.

Three papers dealing with the dielectric strength of oil and air were read at this session, as follows: "Disruptive Strength with Transient Voltages," by Messrs. J. L. R. Heyden and C. P. Steinmetz, of Schenectady; "The Electric Strength of Air," by Prof. J. B. Whitehead, of Baltimore, and "Dielectric Strength of Oil," by Mr. H. W. Tobey, of Pittsfield. These three papers were discussed by Messrs. D. B. Rushmore, V. Karapetoff, P. H. Thomas, A. E. Kennelly, W. H. Pratt, E. E. F. Creighton, J. C. Lincoln, C. F. Scott and R. D. Mershon.

Dr. A. E. Kennelly, of Harvard University, read a paper in which attention was called to the present confusion in textbooks relating to the direction of rotation of vectors used in representing alternating-current quantities. After a conversational discussion of the paper by Messrs. L. T. Robinson, J. B. Taylor, W. W. Crawford, G. S. Dunn and D. C. Jackson it was decided to bring the matter to the attention of the International Electrotechnical Commission in order that some one direction of rotation may be standardized.

Prof. Adolph Shane, of the Iowa State College, described a method for determining the voltage regulation of transformers under load conditions by the use of a duplicate transformer and an auxiliary variable-ratio transformer. The method described was discussed by Messrs. E. A. Wagner and L. T. Robinson.

WEDNESDAY EVENING SESSION.

Telegraphy and telephony were represented at the convention by two papers, namely, "American Telegraph Engineering; Notes in History and Practice," by Messrs. W. Maver and D. McNicol, and "Telephone Engineering Around the Golden Gate," by Mr. A. B. Smith. These papers were discussed by Messrs. R. W. Pope, J. B. Taylor, G. S. Dunn and W. B. Hale.

Mr. F. G. Gasche, of the United States Steel Corporation, read a paper giving a mathematical analysis of the interaction of flywheels and motors when driving roll trains by induction motors. The discussion was participated in by Messrs. C. P. Steinmetz, C. F. Scott and G. S. Dunn.

FRIDAY MORNING SESSION.

Four papers dealing with electric railway subjects were presented at the Friday morning session, as follows: "Electric Locomotive Design," by Messrs. N. W. Storer and G. M. Eaton; "A Method of Determining the Adequacy of an Electric Railway System," by Mr. R. W. Harris; Power Economy in Electric Railway Operation—Coasting Clock Tests on the Manhattan Elevated Railway," by Mr. H. S. Putnam and "Economy in Car Operation," by Mr. Cyril J. Hopkins. These papers were discussed by Messrs. W. McClellan, A. F. Batchelder, F. J. Sprague, A. H. Armstrong, E. G. Reed, J. B. Taylor, L. B. Stillwell and G. H. Hill.

A paper by Messrs. C. H. Sharp and W. W. Crawford, of the Electrical Testing Laboratories, New York, entitled "Some Recent Developments in Exact Alternating-Current Measurements" was discussed by Messrs. V. Karapetoff, L. T. Robinson, W. H. Pratt and C. P. Steinmetz.

SECTIONS ACTIVITY.

At a meeting of the sections' delegates, held Thursday evening, President Stillwell outlined the policies of the administration with especial reference to the work of the sections. He stated that the activity of the Institute along technical lines has been maintained and broadened by the formation of technical committees, of which there are now six, namely, telegraph and telephony, industrial power, high-tension, electric lighting, railway and educational. Another important change has been the authorization of the sections to hold local meetings of the Institute having equal standing with the meetings held in New York. Meetings of this kind have been held in Boston, San Francisco and Charlotte, and much good has resulted therefrom. During the year the secretary of the Institute visited many of the sections and branches throughout the whole of the United States, making for this purpose a trip covering 17,000

miles. President Stillwell expressed the need for a code of ethics for electrical engineers, outlining in this connection the unsatisfactory condition surrounding the independent consulting electrical engineer who must compete with the large manufacturing companies, which give consulting services without direct charge therefor. He called attention to the unprofessional conduct of unnamed electrical engineers and stated that the expulsion of one or two of its members would be of benefit to the Institute.

Upon being introduced by the retiring president, President-elect D. C. Jackson said that the activity and influence of the sections had been enormously increased during President Stillwell's administration. He contended that the growth of the Institute, both in numbers and influence, demands the maintenance of both central headquarters and a central control. He entered a plea for hearty co-operation of the membership through the sections during his term of office and for the future for the distribution of good from each member to the whole membership.

In the absence of Mr. P. M. Lincoln, the chairman of the sections committee, the sections meeting was presided over by Past-president C. F. Scott, whom President Stillwell introduced as the father of the sections. The following delegates, being called upon, reported the conditions of their sections and made suggestions as to the needs of the sections: Messrs. M. C. Beebe, Madison, Wis.; E. B. Bush, Minneapolis, Minn.; J. M. Bryant, Urbana, Ill.; W. A. Hillebrand, San Francisco, Cal.; G. A. Hoadley, Philadelphia, Pa.; A. S. Langsdorf, St. Louis, Mo.; A. A. Miller, Seattle, Wash.; E. L. Nichols, Ithaca, N. Y.; W. H. Powell, Milwaukee, Wis.; H. B. Stabler, Washington, D. C.; H. W. Tobey, Pittsfield, Mass.; E. A. Wagner, Fort Wayne, Ind.; H. R. Wakeman, Portland, Ore.; H. L. Wallaw, Cleveland, Ohio; J. B. Whitehead, Baltimore, Md.; H. P. Wood, Atlanta, Ga.; W. E. Reed, Pittsburgh, Pa.; W. B. Hale, Mexico City, Mexico; E. N. Lake, Chicago, Ill.; J. F. Vaughan, Boston, Mass., and C. P. Steinmetz, Schenectady, N. Y. As a result of the discussion by the delegates it was decided to suggest to the incoming administration the formation of a subcommittee to the sections committee to be composed by members selected by the sections themselves. It was also suggested that the university branches should be allowed to send representatives to the next annual convention. In order to facilitate the co-operative work of the sections three committees to determine upon the policies of the sections were appointed, each consisting of three members, as follows: Messrs. Wood, Wagner and Lake; Messrs. Nichols, Hillebrand and Hale, and Messrs. Reed, Langsdorf and Tobey. It was decided that the sections delegates should meet on the first day of the next annual convention in order to perform satisfactorily the numerous duties devolving upon them at that time.

Summer Convention of Wisconsin Electrical Association.

While the attendance was not large, and extremely warm weather was encountered, the summer convention of the Wisconsin Electrical Association, at Oshkosh, Wis., on June 28 and 29, well repaid those who attended, owing to the practical nature of the discussions. There was no formal program, and no papers were prepared in advance. Two sessions were held, and the principal subject for discussion was rates, both for electric railways and electric-service plants. The meetings were held at the handsome house of the Oshkosh Yacht Club, and the Wisconsin Electric Railway Company placed special cars at the disposal of the visitors. The president of the association, Mr. Clement C. Smith, of Milwaukee, was unable to be present, owing to illness, and Mr. Irving P. Lord, of Waupaca, vice-president, occupied the chair.

THE ELECTRIC-RAILWAY RATE SITUATION.

The first speaker was Mr. C. N. Duffy, auditor of the Milwaukee Electric Railway & Light Company. He referred to the effort of the city of Milwaukee to compel the company to carry people on the local street-railway system for 3 cents each. At present six tickets are sold for 25 cents. The question has been argued exhaustively, and it now rests with the Wisconsin Railroad Commission to decide the matter on the evidence submitted.

Turning to Massachusetts, it was remarked that if the companies in that State had not made their rates too low there would be no necessity of raising them. The same observation applies to Oshkosh, Wis., where the interurban company has asked the State commission for an increase of rates.

RATES FOR ELECTRIC LIGHT AND POWER.

Considering rates for electricity sold for lamps and motors, Mr. Duffy said that this subject was also very important. Companies, or departments of companies, ought to be just as careful in putting out a schedule of rates for supplying electric service as in making rates for carrying passengers. The speaker believes in a liberal and flexible schedule, and referred to the comparatively simple scale of rates in use in Milwaukee, where the price for electricity used for lighting varies from 12 cents to 4 cents a kw-hour, depending on consumption, and the rate for electricity used for motors varies from 8 cents to 3 cents per kw-hour.

However, the Milwaukee schedule is not entirely satisfactory. It does not contain adequate provisions for the long-hour user with a small installation, or for very large motor installations.

Mr. Duffy, in closing his instructive address, warmly advocated a more intense development of the business, as he styled it, and he said that a special effort in this direction would do more toward the establishment of equitable rates and toward securing harmonious relations with customers than almost any other improvement in the business that could be mentioned.

RAILWAY TESTIMONY FROM MANITOWOC.

Mr. Thomas Higgins, president of the Manitowoc & Northern Traction Company, of Manitowoc, Wis., agreed with Mr. Duffy that a mistake was often made in the early days of electric railroading in establishing too low rates on interurban lines.

Commenting on the general situation, Mr. Lord said there was something like a mania for reducing rates, both for electric service and in the electric-railway business. The people sometimes clamor for reduction; public-utility companies are good targets, and too often they give way to the pressure of the public. In this rate situation, the companies should be very careful, not arrogant or grasping, but safe. The holders of the securities have a right to expect payment in full. This expectation cannot be realized unless there is an adjustment of rates on a policy involving 100 cents on the dollar.

RESIDENCE LIGHTING.

Mr. W. H. Winslow, general manager of the Superior Water, Light & Power Company, of Superior, Wis., gave a thoughtful talk based on his study of the problem of rates for residence lighting. He began by saying that the tungsten lamps have supplanted the ordinary carbon lamps for the use of commercial customers.

Residence lighting is barely remunerative at the present rates. Hence the companies are approaching a crisis. Shall they push the tungsten lamps for residence lighting, and can they do so at present rates? As lamp efficiencies go up, rates per kw-hour must go up, apparently, to keep up the revenue.

In view of the impending introduction of tungstens for residence lighting, Mr. Winslow believes that the companies must put their rates on a basis where better lamp efficiencies will mean a reduction in central-station revenue not greatly in excess of the corresponding reduction in central-station expenses. He spoke of a new residence lighting rate which he has devised and is seriously considering for introduction in the city of Superior. It consists of three elements: First, a "consumer charge" of, say, 40 cents a month; second, a "capacity charge" of, say, 10 cents a room a month for the area lighted; third, a kw-hour charge of, say, 3 cents, excluding renewals, and 3½ cents, including renewals. The "consumer charge" includes the meter cost for each customer. The plan

will make the customer feel free to put in convenience lamps, which may not be used twice a year, and the tendency should be to encourage the liberal use of electric light, and also to encourage the introduction of other electrical devices, like flat-irons, heating-pads, electric cooking devices, etc. However, there may be objection to the introduction of this proposed rate schedule on the part of some small residence customers. As an alternative, to meet this objection to the "area rate" suggested, Mr. Winslow proposes a controlled flat rate of 1 cent per month per watt of the maximum allowed by the indicator installed. If this rate is chosen, it is proposed to install 25-watt tungsten lamps with a maximum consumption of perhaps 300 watts.

The "area rate," or capacity-charge rate, has not been presented to the State commission, but the speaker is of the opinion that the commission will endorse it. The proposed capacity-charge plan would increase the total revenue of the company only slightly; but it would mean a readjustment of rates so that all customers would be paying customers. In concluding, Mr. Winslow said that the present rate of 10 cents a kw-hour for electricity, so widely made by central-station companies, is almost a crime when considered in connection with residence lighting. Ten cents a kw-hour is absurdly low for some customers, and absurdly high for others.

Mr. Duffy spoke in favor of a demand charge. The rate should be so much for the first 50 kw-hours, so much for the next 50, and so on. This principle can be applied to small consumers as well as to large ones. Mr. Duffy remarked that the "room assessment" plan, so to speak, outlined by Mr. Winslow, prevails, in principle, in Detroit.

Mr. Francis A. Vaughn, consulting engineer, Milwaukee, formerly with the Milwaukee company, spoke of the effort to work out an equitable rate in that city. He said that the really equitable rate for residence customers was found to be from 20 cents to 24 cents a kw-hour. He said also that it was hard to place the small-hour customer on an equitable basis. He spoke furthermore of an investigation he has made into the electric lighting rates in towns of less than 6000 population in Wisconsin. Mr. Vaughn has found that there is absolutely no uniformity in the making of rates in these small towns. Decimal prices, such as 10 cents a kw-hour, $1 minimum and 25 cents a month meter rental, seem to be particularly popular, possibly because of their convenience in reckoning. He believed it possible that new small central stations built at the present time might use straight tungsten-lamp equipment, eliminating the carbon lamp entirely. It might be possible in that case to establish a system of rates for residence lighting from the beginning that would be satisfactory both to the company and to the customer.

Mr. H. C. Sterling, superintendent of the municipal plant at New London, Wis., told of his efforts for the establishment of a sliding scale in that city. The authorities, however, insisted on a flat 9-cent rate.

Mr. Winslow, referring again to his proposed capacity charge rate, explained that customers could use irons, heating appliances, etc., as much as they wanted to without increasing their area rate for rooms lighted.

In answer to a question from Mr. Duffy, Mr. Sterling said that the New London municipal plant showed a profit, if depreciation and taxes were disregarded.

Mr. H. G. D. Nutting, manager of the municipal light and water plant at Fort Atkinson, outlined briefly a tentative system of rates for electric lighting, which he has planned out on a theoretical basis. This proposed rate includes, first, a service charge, and, second, a demand charge, this demand charge being divided into two parts—a light-load demand and a heavy-load demand; third, there should be a kw-hour charge, which should not much more than cover the cost of actual power-house operation. Mr. Nutting told how to determine these various charges. The demand should not be based on a proportion of the connected load; this method is unscientific and unsatisfactory, in the speaker's judgment. Mr. Nutting also contended that the same rate should be made, regardless of the use to which the electricity is to be put. The central-station company is selling kw-hours plus service. In the rates which Mr. Nutting has particularly worked out on a theoretical basis the great question is to determine the demand charge. His method of determining different charges is to imagine various hypothetical plants necessary to supply the particular demand.

Mr. John S. Allen, of Lake Geneva, said that he has two convictions on the rate problem. The first is that the central-station company should not rush into reduced rates unless it is very sure it is justified in doing so. The second proposition on which Mr. Allen laid emphasis was that rates should be simplified. The speaker also, in a few words, explained how he has a heavy summer load in Lake Geneva, which is a well-known summer resort. The load curve is very even from June 1 to Dec. 1.

Mr. Lord said that his company's rate in Waupaca was mostly 10 cents a kw-hour, but 15 cents was charged on installations in such places as churches, opera house and blacksmith shops. An 8-cent rate was made to saloon keepers, hotel owners and other large long-hour customers. A meter rental of 25 cents to 50 cents a month is charged. Objection is made by some customers to this meter rental, and Mr. Lord has secured the approval of the State Railroad Commission to a rate of 20 cents a kw-hour for inconstant customers, with a discount of 25 per cent to those who come to the office of the company and pay their bills before the 10th of the month. All customers, except a few irregular consumers mentioned above, are on a 15-cent rate, with the privilege of the following special rates on yearly contract: First 10 kw-hours, 12½ cents; next 90 kw-hours, 10 cents; second 100 kw-hours, 9 cents; next 200 kw-hours, 8 cents; next 300 kw-hours, 7 cents; thereafter, 6 cents a kw-hour. Under this schedule the minimum monthly charge has been reduced from $1.25 to 75 cents. Mr. Lord's practical and shrewd way of explaining his new schedule was appreciated by his hearers.

INCREASE IN INTERURBAN RATES NEAR OSHKOSH.

Mr. J. P. Pulliam, of Oshkosh, manager of the Wisconsin Electric Railway Company, told how his company had raised its interurban railway rates within the last few months. The company operates several interurban lines. One of them, between Oshkosh and Neenah, is 15 miles long. The rate of fare has fluctuated rather curiously. Originally it was 20 cents, then it was increased to 25 cents, then decreased to 20 and recently has been again increased to 25. With the increased rate, the actual amount of traffic has shown increase also. The line from Oshkosh to Fond du Lac is 18 miles long, and the rate here has been raised from 30 cents to 35 cents. The rate of fare on the line to Omro has also been increased. In every instance the traffic has increased, following the increase in rate of fare. In Oshkosh there is a straight 5-cent fare, with universal transfers. A workingman's rate of 3 cents is made between the hours of 6 a. m. and 7 a. m. and 6 p. m. and 7 p. m. The local conditions are such that the street railway system is badly laid out, and the rate of fare should be 6 cents, or, really, 7. In Fond du Lac the conditions are such that the company can make a fair profit at a 5-cent fare.

AFFILIATION WITH NATIONAL ELECTRIC LIGHT ASSOCIATION.

From the committee appointed at the convention in Milwaukee last January to consider the subject of possible affiliation with the National Electric Light Association, Mr. L. L. Tessier, of De Pere, asked for further time to consider the subject, and at his suggestion the matter went over until the convention of next January. Later a letter was read from Mr. W. S. Putnam, of Menominee, addressed to President C. C. Smith, of the association and written at the instance of Mr. Korst, chairman of the committee, in which Mr. Putnam gave it as his opinion that the proposed affiliation was not advisable. He mentioned the fact that it would be necessary to eliminate

from the association all men connected with the municipal plants, to which he was opposed. The financial objection was also a strong one, as apparently the Wisconsin association would have to raise about twice as much money as at present in order to carry on its own work and to pay its dues to the national association. Furthermore, there was the question of combined railway and lighting companies to be considered, but as the national association is not a railway association, that question, while it might be satisfactorily settled, would cause some difficulty.

BUSINESS AND ENTERTAINMENT FEATURES.

After adjournment on Tuesday afternoon, some of the delegates enjoyed the bathing facilities provided. In the evening there was an enjoyable open-air concert at Electric Park, the Wisconsin Electric Railway Company supplying a special car for the trip and making all other arrangements.

At the Wednesday morning session an invitation was received from Mr. William Wallen, manager of the Oshkosh Gas Light Company, to inspect the Oshkosh central-station which this company owns.

Mr. Lord alluded pleasantly to the retirement of Mr. John H. Harding, of La Porte, Ind., an old member of the Northwestern association, who has sold out his electric-lighting business and is taking a trip around the world.

Vice-president Lord and Secretary Allen brought up the question of the payment of dues. The dues of active paying members are 1/20 of 1 per cent of the gross business of the preceding year, or of the electric light, power and railway departments of joint companies. There was a general discussion on the scope of the association. It was pointed out that its educational work is very important. It should educate the people and the legislators of the State on the real conditions of the electric light and railway business. Mr. Ernest Gonzenbach, of Sheboygan, moved that a pamphlet be prepared, giving the constitution and by-laws and a list of members of the association, together with other information about the organization, to be printed for general distribution. This motion was adopted.

SERVING TWO OR MORE BUILDINGS FROM ONE METER.

Mr. P. E. Cowles, of Fond du Lac, told of some conditions in that city. He particularly brought up the question: "How far does a service extend on a consumer's premises?" He told of one man who installed electric service in a shoeshop, with one meter, of course. This man now has three buildings, all getting energy through one meter. These buildings are on the same lot, or at any rate adjoining one another, simply with air spaces between. This customer has now another building across the street, and he wants to add that building to the same service with the one meter. The company objects to this, and it is a question how far it shall go in extending service from one meter.

Mr. Lord told of the case of the court house and jail in one square in Waupaca. He presented two contracts to the county clerk, one for each building, but the latter in return offered one contract for the two. The matter was referred to the State commission, which decided that the two buildings were distinct, and that a meter was required for each one. A house and barn on one lot, however, do not come within this classification, according to the commission, and can be served from one meter. Mr. Gonzenbach remarked that the Fond du Lac and Waupaca cases illustrated the weakness of a sliding scale based exclusively on energy used. He believes very thoroughly in the Doherty rate system.

STREET LIGHTING.

Considerable time was taken up at the Wednesday session by a discussion in relation to the manner of charging for street lighting. Mr. Lord cited the case of one Wisconsin city where the company furnished the electricity only, instead of getting paid so much a lamp. In this case the city took care of the street lighting and installed and maintained the poles, wires, lamps, etc. The company found this a very satisfactory method, being paid on a kw-hour basis for the electricity furnished, and being relieved from all trouble for maintenance.

Mr. W. B. Jackson, consulting engineer, Chicago, is opposed to the plan adopted by the company to which Mr. Lord referred. He said that there is no argument in favor of the city owning poles and wires for street lighting where the company supplying the electricity for that street lighting is also engaged in general commercial service.

Mr. Lord said that the complaints of city authorities in relation to outages, etc., were sometimes annoying. He is rather in favor of selling electricity for street lighting on a kw-hour basis, still, however, owning the poles, wires, lamps, etc., and maintaining them.

Mr. Gonzenbach brought up the subject of establishing standards for lamps for street lighting. He said that many places in Wisconsin still operate under the old plan of providing so many "1200"-cp or "2000"-cp arc lamps. In some cases it appears the word "nominal" is not inserted in the contract, as is usually the case.

CONCLUDING BUSINESS.

Secretary Allen said that his office receives many requests for information, and he might undertake to furnish the members the important rulings of the State Railroad Commission if desired. The secretary might also establish a sort of employment exchange, bringing unengaged men and open positions together.

Mr. Allen also mentioned the fact that the Madison Gas & Electric Company, of Madison, Wis., has been most helpful to the association in days past, and that it would be an act of simple justice for the association to show its appreciation in some maner. On motion, the matter was made a special order for the annual convention to be held in Milwaukee next January.

The thanks of the association were extended to the Wisconsin Electric Railway Company, and particularly to Mr. Pulliam, of that company; the Oshkosh Gas Light Company, and particularly to Mr. Wallen of that company, and also to the Oshkosh Yacht Club for extending the courtesies of its beautiful building.

Meeting of the S. P. E. E.

The eighteenth annual meeting of the Society for the Promotion of Engineering Education was held at the University of Wisconsin on June 23, 24 and 25. The attendance was the largest in the history of the society, being equalt to 20 per cent of the number of members as shown by the last membership list. One hundred and fifteen teachers and practitioners were elected to membership at the meeting. The meeting was largely attended by representative members, including the deans or directors of many of the important technical schools and a few college presidents. A number of heads of departments and several prominent non-teaching engineers were in attendance. The success of the meeting demonstrated that it is now possible to hold meetings of this society practically without reference to those of other technical societies, and that the Western members are numerous enough to insure the success of a meeting 1000 miles from New York.

The officers elected for the coming year are: President, Prof. A. N. Talbot, professor of municipal and sanitary engineering, University of Illinois; vice-presidents, Prof. William Kent, consulting mechanical engineer, and Prof. M. S. Ketchum, dean of the College of Engineering, University of Colorado; secretary, Prof. H. H. Norris, head of the department of electrical engineering, Cornell University, and treasurer, Mr. W. E. Wiley, publisher, New York City.

The Madison meeting consisted of five sessions for the reading and discussion of reports and papers. In addition the council held three meetings. The principal interest centered in the reports of three committees; namely, those on entrance requirements, on engineering degrees and on the teaching of

mathematics to engineering students. The committee on technical books for libraries also reported by title. The reports of the first-named three committees were printed in full in advance of the meeting. In addition to the reports a number of excellent papers were presented and discussed. Before describing the reports in detail, a few of the more important papers will be mentioned.

Prof. G. C. Shaad, of the electrical engineering department of the University of Kansas, and W. T. Magruder, of the mechanical engineering department of the Ohio State University, took up, in independent papers, the matter of inspection trips for technical students. Such trips have become, in many institutions, an important feature in technical instruction. Professor Shaad, when at the Massachusetts Institute of Technology, had charge of a course in which generating and manufacturing plants were regularly and systematically visited. His experience has shown that the advantages of such trips are "to furnish inspiration to the students and to allow them to become acquainted by actual observation with the large variety and the great magnitude of modern public-service enterprises and industrial establishments; to become more or less familiar with the details of construction, operation and methods of manufacture of machines, or the preparation of materials with which they may have to do in their advanced school work and after graduation; to furnish material for practice in the writing of technical reports, the preparation of descriptive reports forming excellent training along this line. Engineers in responsible charge of public-service or manufacturing plants are always willing to co-operate with the teachers in this work. The Ohio State University, during the past spring, conducted an extensive and well-planned trip under the general direction of Professor Magruder. A feature of this undertaking was the preparation of a booklet giving every detail of the proposed trip, with descriptions of the plants to be visited. Copies of this booklet were sent to the members of the Society for the Promotion of Engineering Education several weeks before the Madison meeting in preparation for the discussion of Professor Magruder's paper. In the paper were described the actual details of the trip, which were handled in a business-like manner. As the trip is required of all engineering students, the party is a large one, and special concessions were obtained in transportation and accommodation. The description of this trip and the outline given by Professor Shaad will be stimulating and suggestive to the faculties of other technical schools.

The society this year took up an unusual but important topic, namely, technical instruction in foreign countries. Such work in Germany was discussed in papers by Dean G. H. Shepard, of Syracuse University, and Mr. Frank Koester, consulting engineer. Dean Shepard spent last summer in an inspection of leading technical universities in Germany, and he made many interesting observations. In general, he concludes that the opportunity for the student to do advanced work is greater in Germany than in this country. Further, the teacher has better facilities for outside practice with resulting reflex influence upon instruction. The faculties are larger in proportion to the number of students, giving each student a better opportunity to come in contact with his instructors. The concentration of instruction in a few large, state-supported institutions makes possible well-equipped laboratories and elaborate lecture-room equipment. On the whole, however, the speaker was impressed more by the similarities than by the differences between German and American practice in technical instruction. Mr. Koester discussed in detail the courses of instruction in technical universities, and he also analyzed the differences between American and German engineers. He pointed out certain superiorities of the latter over the former and explained the reasons for these. The last paper in this series was by Prof. W. H. Adams, of the Imperial Pei Yang University, Tientsin, China. He reported on the work being done by that university, and showed that while technical instruction is new in China, progress is being made.

In Dean Shepard's paper mention was made of the close connection between engineering practice and technical instruction in Germany. That this co-operation may exist in this country was illustrated by the description of the work done for the Wisconsin Railroad and Tax Commissions by members of the faculty of the University of Wisconsin. Profs. W. D. Pence, J. G. D. Mack and C. P. Burgess outlined, in three brief papers, the work which they and their respective departments have been engaged in for several years. They are really a board of consulting engineers for the state commissions. As a result the state gets first-class engineering work on all public utilities, the teachers earn a fair compensation in addition to their salaries, and the instruction is improved by the close contact between the teachers and engineering practice.

The remaining papers presented at the meeting dealt with various topics, such as clearness and accuracy in composition, character training, recent progress in co-operative technical education, etc.

An experiment in the program of the Madison meeting was made in devoting some time to symposiums on efficiency in technical instruction, and on engineering mathematics with particular reference to calculus. Circular letters were sent by the president to the members of the society some weeks before the meeting requesting their co-operation, and asking a number of leading questions. The response to these was very general, and many practical suggestions were brought out. While the lengthening of the engineering course is being seriously considered by many schools, the more efficient use of time and facilities in the present courses deserves careful study. The results of the discussions comprising these symposiums should, therefore, be useful to the members of the society.

The report of the committee on engineering degrees brought out an animated discussion. The committee was appointed to consider and report upon the practicability of simplifyng the character of degrees conferred in engineering. After securing data from nearly 100 colleges and universities the committee made an analysis of present practice in conferring degrees. It was found that, although certain tendencies exist, there is absolutely no uniformity in this matter. Taking as a basis what seems to be the most important tendencies, the committee made several recommendations, as follows:

"That a four-year engineering course should normally lead to the degree of bachelor of science, to which should be added a specifying phrase, as, for example, bachelor of science in civil engineering.

"That the completion of an undergraduate course in engineering by a bachelor of arts should normally lead to the degree of bachelor of science in engineering.

"That the completion of a second undergraduate course in engineering by a bachelor of science should normally lead to the same degree with specifications of the second branch of engineering.

"That one year of resident work in graduate engineering and scientific subjects by a bachelor of science in engineering should normally lead to the degree of master of science with the specifying phrase.

"That the degrees doctor of science and doctor of engineering should be given for not less than three years of resident work in graduate engineering and scientific subjects by a bachelor of science in engineering, or for not less than two years in case of a master of science in engineering.

"That the professional engineer degrees, C.E., M.E., etc., should be given only to graduates who present satisfactory evidence of professional work of superior quality extending over not less than three years, and who submit satisfactory thesis.

"That the same degrees, C.E., M.E., etc., may be given to engineers as honorary degrees.

"That the degree of doctor of engineering, historically an honorary degree, may properly continue to be so regarded, although it is believed that, as the work of engineering schools is extended, and the granting of degrees in course becomes

more frequent, its use as an honorary degree should diminish.

"That professional and honorary degrees should in general be different from those which are given in course."

It is evident that, if the suggestions by the committee be adopted by the institutions granting degrees, the meanings of the various degrees will become more uniform.

The report of the committee on entrance requirements gave detailed analysis of the various subjects which should be required of applicants for admission to technical schools. The standard set by the committee is high, corresponding closely to the present practice of a few schools. In the debate which followed the presentation of the report the members did not agree on the requirements in mathematics. There is a general belief that too high a requirement in this subject is detrimental to the progress of the student. The advanced mathematical subjects, such as advanced algebra and solid geometry, can be taught better in the technical school than in the high school. The report was, therefore, referred back to the committee for further investigation.

The committee on the teaching of mathematics to engineering students has on hand a task of great magnitude. The purpose of the committee is to compile a complete syllabus of all mathematical branches taught in the technical school. Teachers of engineering subjects and teachers of mathematics agree that fewer topics should be treated in the mathematical subjects and that these should be taught in such a way as to make the mathematics usable. Obviously if the committee succeeds in its purpose progress will be made in the desired direction. The fact that the teachers of mathematics are joining the society in considerable numbers indicates a desire on their part to come into closer contact with other teachers of prospective engineers. The report of the committee will be distributed to the membership in a few weeks, and it will be the subject of discussion during the coming year and at the next annual meeting.

The revised report of the committee on technical books for libraries was presented at the meeting by title. The society has had in circulation for some years a report on this subject. This report was preliminary in character and it is already far out of date, so that a revision is absolutely necessary. The revision has been in progress for two years, and it has turned out to be a task of very great difficulty. The purpose of the report is excellent, and if it can be produced in satisfactory form it will be useful not only to libraries, but to all other users of technical books. The report has now been referred to the program committee of the society, which will decide soon regarding its publication.

The society has now grown to such a size that it seems practicable to put into operation some means for keeping the members more closely in touch with each other during the year. The principal publication so far has been an annual volume of *Proceedings*, which has appeared from 8 to 11 months after the meeting. It is now proposed to issue a monthly periodical and this project was a topic of great interest at the meeting. A sample number was prepared and distributed so that the members could discuss the plan intelligently. A committee appointed early in the meeting to report on ways and means for improving the work of the society reported that, in the judgment of the committee, the publication of the proposed *Bulletin* will constitute as great an advance as is feasible for the society to undertake at this time. The project is now in the hands of the program committee and the council, and it will be decided upon in a few weeks.

As one of the most important purposes of any national society is to promote friendship among its members, an account of this meeting would not be complete without a statement of the social side of the program. An afternoon and an evening were given up to an inspection of the buildings of the University of Wisconsin and of the natural scenic beauty of the surrounding country. A luncheon was served at the neighboring golf club, after which, with his audience grouped about him in the open air, President Charles R. Van Hise, of the university, delivered an informal address on "The Conservation of our National Resources." The resident ladies also entertained in various ways the ladies of the convention. The meeting was highly successful in promoting a friendly spirit among the leaders in our principal technical schools. If it had done no more than this it was fully justified.

Wisconsin Commission News.

The Wisconsin Commission has refused to grant the application of the Darlington Electric Light & Water Power Company for an increase in its rates. The company based its claim for an increase upon the fact that the present primary rate of 8 cents per kw-hour for the first forty hours use per month gives practically no return upon the investment. A primary rate of eighteen cents per kw-hour for the first fifty hours use per month was prayed for in the application.

An appraisal of the plant was made by the commission as well as an analysis of the rather meager records of the company. At the hearing the company claimed a valuation of $37,700, which it subsequently reduced to $30,049. According to the valuation as made by the commission the cost of the plant, if reproduced new, would amount to $24,154 and, excluding certain non-operating properties, the existing value aggregates approximately $17,000. In its valuation the company claimed, among other items, a total of $20,000 capital stock. It was shown at the hearing, however, that the present owners paid but $16,000 for this stock.

The rates for pumping water and street lighting are fixed by contract with the city. When the gross earnings and operating expenses were properly distributed over the different departments, it was found that the average percentage on the investment based upon the cost of reproduction new, during the years 1908 and 1909, which was available for depreciation and return upon the investment, were as follows: Water pumping, 4.49 per cent; street lighting, 9.66 per cent; commercial lighting, 7.61 per cent; total, 7.64 per cent. These percentages are considerably higher if based upon the present plant value. It was held that this allows a liberal return upon the investment inasmuch as the excessive amount charged by the company to operation and maintenance really included renewals to the plant and would therefore reduce the allowance for depreciation.

The inspections made by the commission did not confirm the claim made by the city that the service rendered was unsatisfactory. Everything considered, the commission did not feel justified in ordering an increase in rates and the case was therefore dismissed.

The commission has authorized the Wisconsin Traction, Light, Heat & Power Company to issue $500,000 par value of 5 per cent thirty-year first-mortgage gold bonds of the denomination of $1,000 each. These bonds are to bear date of July 1, 1901 and to mature July 1, 1931. They are to be issued and sold for the purpose of reimbursing the company for expenditures made for extensions and additions to its railway and lighting system, and to provide funds for future additions to its system; for the increase of its steam power plant, and for the acquisition of additional water power. The bonds are to be sold for money only, and for not less than 75 per cent of the par value.

The New Gas Light Company of Janesville recently announced a reduction in rates amounting to from 13 to 17.8 per cent of the former charges. This voluntary reduction, which may doubtless end an action which has been before the commission for about a year, was made after conferences were had with the commission. The old rates ranged from $1.50 to $1.20, according to the quantity used per month. The new rates are $1.30 per thousand cu. ft. for the first 2000 cu. ft.; $1.15 per thousand for the next 3000 cu. ft., and $1 per thousand for all over 5000 cu. ft., with a minimum bill of 50 cents per month. This reduction is a rather radical one, but the company was willing to make it rather than to pass through long and expensive litigation with the probability of an unfavorable decision finally. The plant is one of the properties of the United Gas Improvement Company of Philadelphia.

Maryland Commission News.

At the request of the Public Service Commission, Superintendent McCuen, of the Baltimore city lighting department, will send Chief Meter Tester John Marley on a trip through the western part of the State for the purpose of examining gas meters for the commission. He will be gone not less than three or four weeks. As a result of complaints made by the traffic bureau of the Merchants and Manufacturers' Association of Baltimore, concerning the service of the Baltimore, Chesapeake & Atlantic and the Maryland, Delaware & Virginia Railway companies, the commission is conducting an investigation. The complaint says that the companies do not publish, post or distribute their rates between points in Maryland; that they require prepayment of freight on goods shipped to points where regular agents are maintained, and that both the minimum and maximum rates should be prescribed so that all companies would have the same chance of doing business. The report says that these companies keep out competition by means of raising and lowering their rates.

New York Commission News.

After hearings which have lasted over six months, the Public Service Commission of the First District has practically completed its consideration of the Third Avenue Railroad reorganization plan. At a hearing June 29 the last testimony was taken and the case summed up. An adjournment was then provided until July 6 in order that the counsel for the bondholders' reorganization committee, and for the Knickerbocker committee and the stockholders' committee, which opposed the plan, might file briefs. The commission will give immediate consideration to the plan and it is promised that a decision will be reached probably by the middle of July.

At a hearing last week by the commission upon the plan proposed by Brooklyn property holders for the construction of a rapid transit route in Nostrand Avenue, between Eastern Parkway and Sheepshead Bay, upon the assessment plan, quite a number of arguments were made by citizens favoring the project. No one appeared in opposition to the plan, and the commission has taken the matter under consideration.

The Union Railway Company, which operates the surface lines in the Bronx, has applied to the Public Service Commission for permission to extend its lines from Fordham Road and Sedgwick Avenue across the bridge at 207th Street to Amsterdam Avenue and through Emerson Street to Broadway. This extension will connect the Union Railway lines with the Third Avenue Railroad Company, of which it is a subsidiary. It will also give that section of the Bronx in the immediate neighborhood of New York University a direct outlet to the subway system. A hearing will soon be had upon the application.

The Board of Estimate and Apportionment last week adopted resolutions providing for the immediate issue of corporate stock in excess of $32,000,000 to be expended for subways and other permanent improvements in the city of New York. As the Appellate Division of the Supreme Court has already decided that the debt limit can be extended by the exemption of more than $40,000,000 of self-sustaining bonds, this issue of stock can be made available for rapid transit construction.

The Board of Estimate has directed its chief engineer to prepare a plan for the extension of Seventh Avenue, New York City, southwardly to Varick Street, and for the widening of Varick Street and its extension to West Broadway. This improvement is preliminary to the construction of a rapid transit route down Seventh Avenue and Varick Street to the Battery.

A plan was submitted to Mayor Gaynor and the Board of Estimate and Apportionment last week by Louis Stern, a prominent merchant of New York City, providing for the construction of a new avenue to be cut midway between Sixth and Seventh Avenues from Third Street to Fifty-third Street. Mr. Stern's idea is that this new avenue should be used only for the purpose of carrying the elevated railroad tracks that are now upon Sixth Avenue, his theory being that the elimination of these tracks from Sixth Avenue would relieve the north and south traffic congestion from which the city is now suffering.

The Public Service Commission, Second District, has authorized the Dansville Gas & Electric Company to isssue $10,000 in gold bonds, the proceeds to be used in payment of the cost of extensions and improvements to the company's plant at Dansville, Livingston County.

The Canisteo Gas Company, of Canisteo, Steuben County, has been authorized to issue $10,500 in bonds to be sold at not less than 85, the proceeds to be used for the discharge of obligations incurred for proper purposes of capitalization.

The Commission has authorized the Bath Electric and Gas Light Company to execute a first mortage upon all its property securing an issue of $250,000 of thirty-year 5-per cent bonds and to issue at present $150,000 of these bonds. Forty-four thousand five hundred dollars of the bonds are to be sold at not less than 80 and the proceeds used in making extensions betterments and improvements to the plant. The balance of the bonds authorized at this time are to be used to refund $100,000 of outstanding bonds and discharge bills payable in the amount of $31,990.15.

The Commission has denied the application of the Hartwick Power Company for permission to exercise franchises and operate an electric lighting plant in the village of Richfield Springs. At present the Richfield Springs Electric Light and Power Company is engaged in furnishing service to the village and the Commission deems it inadvisable to allow an additional company in that village, the territory to be served being too small to allow of the successful operation of two companies. Before denying the application of the new company, however, the Commission required a stipulation from the existing company that it would put its plant in first-class condition so as to be able to serve properly the public in that locality. The company has agreed to comply with the directions of the Commission, and an order has been made requiring the purchase and installation without delay of an engine and gas producer with necessary auxiliary piping and foundation; a new alternator; to repair and rebuild the street lighting and commercial incandescent lighting system, putting the same in first-class condition; to furnish the village upon contract thirty-six alternating-current enclosed arcs, as now located, at $59.50 per lamp per annum; lighting the village hose house gratis, and other minor necessary improvements.

Further hearings will be given this week on the application of the Niagara & Erie Power Company, Buffalo & Lake Erie Traction Company and Niagara, Lockport & Ontario Power Company for authority to issue stock and bonds by the first named corporation and for consent to transfer franchises by the latter two companies to the Niagara & Erie Company; on the application of the Livingston-Niagara Power Company for permission to begin construction of an electric plant and for the exercise of franchises; and on the application of the New York, Westchester & Boston Railway Company for approval of franchises received by that company from the municipalities through which it passes.

The Public Service Commission, Second District, has prepared and is mailing to all telephone corporations in the State a circular asking for information in relation to these corporations.

Chapter 673 of the Laws of 1910, which became a law June 25 and takes effect September 1, extends the jurisdiction of the Public Service Commission, Second District, to every telephone line which lies wholly within the State of New York and to that part within the State of New York of every telephone line which lies partly within and partly without the State of New York, and to the persons or corporations owning, leasing or operating any such telephone line.

The exception to the jurisdiction are corporations, companies, associations, joint stock associations, partnerships or persons having property actually used for the public service in the State of a value not exceeding $10,000, or which do not operate the business of affording telephonic communication for profit.

Blanks are enclosed with the circular which require an answer to the questions submitted on or before July 15. The questions asked are for the name, address and officers; towns,

villages and cities in which the companies operate; kind of corporation, whether a person, partnership, association or an incorporated corporation; the capital stock issued and outstanding, showing common and preferred stock; a statement of the outstanding bonds of the corporation or association, their date of maturity, security, and rate of interest; if exempt from the provisions of the law statement must be made of the property in the State of New York actually used for public service, including poles, wires, switchboard, office furniture and other property and the value of each; and if the property is not operated for the business of affording telephonic communication for profit, a statement of the conduct of its operation must be shown in detail.

The information which the commission has on hand indicates that there are 1106 telephone corporations in the State of New York. It is probable that considerably less than one-half will come within the jurisdiction of the commission because of the exemptions as to the companies having less than $10,000 in property or those not carrying on business for profit.

The greatest number of telephone corporations is in Steuben County, which has 119; Alleghany follows with 70; Chenango has 62; Delaware, 48; Greene, 39; Broome, 36; Albany, 34; Chautauqua, 32; New York, 31; Columbia, 28; Herkimer, 26; Tioga, 24; Otsego, 24; Wayne, 23; Oneida, 23; Schuyler, 22; Cayuga, 22; Jefferson, 22; and Essex, 20; Chemung, Erie, Madison and Orange, 19; Onondaga and Oswego, 18; Cattaraugus, Rensselaer and Schoharie, 16; Lewis, 14; Tompkins and Yates, 13; St. Lawrence, 12; Ontario, 11; Montgomery, 10; Sullivan and Warren, 9; Franklin, Seneca and Ulster, 8; Clinton, Genesee, Kings, Monroe and Wyoming, 7; Saratoga, Schenectady, and Washington, 6; Livingston, Suffolk and Westchester, 5; Fulton, Hamilton and Orleans, 3, and Putnam, 1.

The Public Service Commission, Second District, completed three years of its existence on June 30. During that time there have been submitted to the commission 4918 applications, complaints, etc. During the first three years of the existence of the Board of Railway Commissioners that body had presented to it 219 matters and during the entire 24 years and 3 months of its existence the number was 4814. The total number of cases handled by the Commission of Gas and Electricity during its existence of 11 months was 145. During the three years the commission has made 255 orders authorizing various kinds of capitalization amounting to $344,262,088. The commission held hearings on 635 days and giving a total number of 1324 public hearings. During the year ended June 30, 1908, 416 hearings were given on 195 days; during the year ended June 30, 1909, 443 hearings were held on 202 days and for the year ended June 30, 1910, 465 hearings were held on 238 days.

Massachusetts' Commission News.

The Massachusetts Railroad Commission has issued an order authorizing the Old Colony Street Railway Company to carry baggage and freight in the city of Quincy. The order specifies that no more than two freight cars shall be run at any one time, and that such service shall not be given on highways between midnight and 5 a. m.

The board has issued a finding approving the terms of purchase of the Berkshire Street Railway Company by the New York, New Haven & Hartford Railroad Company. The latter organization will proceed to extend various trolley lines in western Massachusetts, co-ordinate them with its steam service and improve the transportation conditions in the Berkshire Hills in harmony with the law recently passed by the Legislature of 1910.

The Massachusetts Gas & Electric Light Commission has announced that it will give a public hearing [illegible] at its offices in Boston in connection with a [illegible] by the Legislature of 1910 providing for an [illegible] by the board "of the circumstances affecting the [illegible] tricity for light, heat and power upon, [illegible] the public ways, and across any waters [illegible] wealth, and upon private land, and [illegible] to the transmission of electricity in bulk, and to such lines as must pass through two or more cities or towns in order to connect a source of supply with a suitable market for the electricity generated; to examine the laws relative to the location, construction, maintenance and use of lines for the transmission of electricity and the authority of the local officials and of said board with respect thereto; and to report to the next general court the result of its investigation and examination, with such recommendations as it may deem advisable." It is probable that this investigation will tend to bring out many matters of interest in connection with high-tension energy transmission and distribution in Massachusetts, and that special consideration will be given to existing or desirable relations of the commission with companies dealing in hydroelectric power, whether generated within or outside the State. The announcement of the hearing is being sent to all persons, corporations and municipal governments known to be possible parties to the investigation, and it is the intention of the commission to make a thorough study of the relations of electrical transmission to questions of public policy. Until within a few years electrical distribution in Massachusetts has been distinctly local in character. The centralization of production and service and the entrance into the field of energy transmission comparable in voltage characteristics with practice in the far West have introduced new questions of public and corporation policy for the consideration of the board and the Legislature.

The Massachusetts Railroad Commission gave a hearing on June 28 upon the petition of citizens of Cliftondale for the construction of a double-track line on Malden Street and Broadway, in Revere and Saugus, on the Boston & Northern Street Railway. Judge William E. Ludden represented the petitioners, and Bentley W. Warren, Boston, conducted the case for the company. Mr. Warren argued that the population of Saugus is only 8000 persons, and that the volume of traffic is too small to support the cost of building a double-track line. The company has found that there is no profit in carrying passengers from Saugus to Boston, and that the amount of local traffic originating on the line is too small to be of much value. Figures were submitted to the board showing the volume of traffic at three strategic points on the lines in question. Mr. Warren said that if any double tracking is to be done it would be better for the company to do it in case the so-called Squire's Farm Boulevard is developed. It was estimated that the cost of building a double-track line on the boulevard for a distance of 6000 ft. would be $32,444, while the cost of a corresponding double track on Malden Street, 7380 ft. long, would be $59,673. By the use of the boulevard the running time would be cut down. The company has lately put on an improved service to and from Saugus. The board took the case under advisement.

The board gave a hearing on June 29 upon the petition of citizens of Lawrence for extensions of service in the Prospect Hill district. Mr. P. Lyons conducted the petitioners' case. Interest centered on the desire of the petitioners for an extension of the Boston & Northern Street Railway down Prospect Hill, one side being served by an existing line. For the company, Mr. B. W. Warren pointed out that such an extension would not be in the interests of safety on account of the prohibitive grade, and that the labor, power and maintenance requirements would not be met by the traffic. The hearing was closed.

CURRENT NEWS AND NOTES.

International Association of Municipal Electricians.— The fifteenth annual convention of the International Association of Municipal Electricians will be held in the convention hall, Rochester, N. Y., Sept. 6-9, inclusive. Papers will be presented on "Wireless Telephone and Telegraph Systems," "Lightning Protection," "Mercury Arc and Other Rectifiers," "Relation of the Telephone to the General Organization of Fire Department Service," "Underground Work," and "Modern Police Telegraph System." Mr. Frank P. Foster, of Corning, N. Y., is secretary of the association.

Pennsylvania Electric Association.—The next convention of the Pennsylvania Electric Association (State branch of N. E. L. A.) will be held at Glen Summit Springs, Pa., Sept. 14, 15 and 16. Mr. Vanduzen Rickert, Pottsville, Pa., is secretary of the association.

Summer Joint A. I. E. E. Meeting in Chicago.—A special summer joint meeting of the Western Society of Engineers and the Chicago section of the American Institute of Electrical Engineers will be held at the rooms of the former in Chicago on the evening of July 8. Mr. W. A. Blonck, of the Institute, will deliver an illustrated lecture on "Recent European Progress in Dirigible Balloons."

Electrical Supply Jobbers' Convention.—The Electrical Supply Jobbers' Association will hold its annual convention at the Clifton Hotel, Niagara Falls, Ont., Can., July 19, 20 and 21. As this is an important gathering of men engaged in that branch of the industry and Niagara Falls is a pleasant place in which to spend a few days during July it is expected that there will be a large attendance.

A Simple Air-Cooling System.—A simple air-cooling system—not new, but timely at this season—which was recently resorted to by a Government official in his Washington office, comprises a large cake of ice in a wash-tub, against the surface of which the breeze from an electric fan is directed. The air, chilled by blowing over the frozen surface, rapidly lowers the temperature of the room and provides a simple refrigerating system when other means are not at hand.

Larger Quarters for Electrical Laboratories at Michigan University.—As the result of restricted space following the recent growth of the electrical engineering department at the University of Michigan, Ann Arbor, the motor and power machinery laboratory has been moved to the opposite end of the engineering building, near the mechanical laboratories, making larger quarters available. The telephone laboratories will remain in their former location, expanding into some of the rooms vacated by the motor laboratory. Fifty students received the degree of bachelor of science in electrical engineering at Michigan this year.

Detroit Edison Orders More 14,000-Kw Turbine Generators.—Two 14,000-kw turbine-generator sets have been ordered by the Edison Illuminating Company, of Detroit, for delivery next year to complete its Delray power house No. 2. The Edison company is now supplying 4500 kw to the Detroit United Railways, and will shortly increase this amount to 9500 kw. When the Detroit River tunnels of the Michigan Central Railroad are opened in September the Edison company will also begin the supply of energy to the 2000-kw rotary-converter substation, which will furnish 600-volt direct current for the tunnel locomotives.

Special Lighting at Detroit for Elks' Carnival.—About 30,000 incandescent lamps will be used on arches, pillars and festoons to decorate the principal business streets of Detroit during the B. P. O. E. carnival and convention, July 10 to 16. Features of the electrical display will be two large arches at downtown street intersections, one containing 2500 and the other 1500 lamps. The city of Detroit has appropriated $30,000 to carry out this public illumination, and the number of lamps used in private displays will probably equal that installed in the special street lighting. The use of about 25 powerful electric searchlights directed heavenwards is to be one of the novelties of the night illumination. The Detroit Edison Illuminating Company will co-operate with the local municipal plant by furnishing about three-fourths of the energy for the public special lighting.

Illumination of an 11-Acre Army Tournament Arena.—Considerable attention has been attracted by the illumination by flaming-arc lamps of the great arena in Chicago's lakefront Grant Park, where the United States Army tournament and maneuvers are being held, July 4-14. The inclosure, including the tiers of seats, measures 600 ft. x 800 ft., and is provided with illumination estimated equivalent to 240,000 cp, by 80 flaming-arc lamps hung at 50-ft. intervals. The installation is said to be the largest of the kind ever attempted. The arena in which the meneuvers take place measures 600 ft. x 400 ft. The lamps are suspended at a height of 35 ft., from eight 600-ft. spans, each carrying 10 lamps, between poles set outside the boundaries. Each arc is rated to give 3000 cp, and consumes 550 watts, two lamps being connected in series across the 110-volt, alternating-current mains. Electrodes, impregnated to give a brilliant yellow light, are used. The installation was erected by the construction department of the Commonwealth Edison Company, which furnishes the energy to light the lamps; it cost, complete, about $5,000.

Over a Year of Uninterrupted 110,000-Volt Operation.—The 110,000-volt, 30-cycle transmission line of the Grand Rapids-Muskegon Power Company, from Croton Falls into Grand Rapids, Mich., has now been in continuous operation since April 30, 1909, when service was temporarily interrupted by a severe sleet storm which pulled down and grounded the wires at some points, in spite of the unusually heavy construction of this line. A peculiar circumstance of the trouble at that time was the grounding of several of the jumpers around strain insulators at corner towers, by being rotated over against the cross-arms as a result of the twisting torque developed in the stranded cables by the abnormally heavy strains due to the sleet coating. For more than 14 months, now, the Grand Rapids 110,000-volt line has been operating without interruption of any kind, and although working without lightning arresters in a region where lightning discharges are especially severe, is reported to be giving less trouble than nearby transmissions of lower potentials.

"Wayside" Telephones in Detroit.—There are now over 500 "wayside" telephone stations or connection jacks connected to the lines of the Home Telephone Company, of Detroit, installed at various street corners and public places throughout the city. For use with any of these stations regular telephone subscribers of the company, on payment of 50 cents additional per month, are furnished with a pocket combination receiver and transmitter set weighing but a few ounces. The hand telephone set is fitted with a connection plug and cord, inserting which in any of the station jacks calls central so that any telephone in the city may be reached. It is said that no point within the city limits is more than one-quarter mile from a "wayside" station. As the series alternating-current arc-lamp circuits interfere with some of the police telegraph circuits, it is proposed to have Detroit's patrolmen in outlying districts use the telephone boxes for reporting. The city authorities are also considering equipping all fire apparatus with the hand sets for emergency communication with headquarters.

Court Technical Experts.—The following is quoted from a letter written by a prominent engineer who occasionally acts as a court technical expert: "It is unfortunately true that there is a prejudice against technical experts, but this is entirely the fault of those who are willing to prostitute themselves by deceiving the court. While this may be common practice among medical men, and particularly alienists, no self-respecting technical man of good standing should be guilty of such practice; or if found guilty, he should be ousted from the profession. In many technical cases it is generally possible to get at the true facts and thereby determine whether an expert has been deceiving the court or not. I have been engaged in many cases, and in almost every one of them the attorneys expected or asked nothing more of me than to state the exact facts. Most attorneys of good standing, I find, do not care to undertake cases when they do not honestly believe that the facts are on their side. I repeat that it is very unfortunate that technical witnesses are getting the same low reputation as doctors and alienists."

IRRIGATION AND ELECTRIC ENERGY.

Hydroelectric Features of Some of the Projects of the Reclamation Service.

AMONG the large number of projects undertaken by the Reclamation Service of the United States Government, organized about eight years ago for the construction of irrigation works for the reclamation of arid lands under the direction of the Secretary of the Interior, several are characterized by incidental water-power development. In these plants electricity is generated and often transmitted considerable distances for use in lighting or in the operation of motors, these motors being used for pumping, for driving machinery used during construction or for other purposes. In a few cases, however, steam generating stations have been built, under favorable circumstances, to furnish electrical energy for the operation of motors driving pumps used in irrigating works.

SALT RIVER PROJECT, ARIZONA

One of the most interesting of the numerous large engineering projects on which the Reclamation Service is engaged is the Salt River project in Arizona. The source of water supply here is the Salt and Verve Rivers and wells. The irrigable area of the whole project is 240,000 acres. A large storage reservoir has been constructed on Salt River at Roosevelt, Ariz., about 70 miles northeast of Phoenix. This reservoir is controlled by the Roosevelt dam, which is one of the largest in the world, having a maximum height of 280 ft., with a length of crest of 1080 ft. A power plant has been constructed at the storage dam for generating electric energy from the stored water in the reservoir and from water delivered from a power canal heading at a diversion dam on Salt River about 18½ miles above the storage dam. Fig. 1 shows the Roosevelt dam and power house, also the transformer house and the transmission line. The output of the generating plant will be used partly for pumping water from underground sources to high lands in the Gila River Indian reservation and in Salt River Valley, while the remainder will be sold for industrial purposes.

Fig. 1—Transmission Line Leaving Transformer House at Roosevelt Dam. Salt River Project, Arizona.

The work of the Reclamation Service extends into nearly all the States and Territories in the western half of the country and is of the greatest value and interest. Its main purpose is the construction and maintenance of irrigation works for the storage, diversion and development of waters for the reclamation of arid and semi-arid lands in Western States and Territories. The lands so reclaimed are subject to homestead entry. There is no charge for the land itself, but the settler must repay the Government in not more than 10 annual installments his share of the amount expended in reclaiming the land. Incidental to this work there has been considerable electrical development, carried out under the technical direction of Mr. O. H. Ensign, of Los Angeles, chief electrical engineer for the Reclamation Service. The accompanying pictures show some of the interesting electrical features of the work and brief outline descriptions of some of the reclamation projects are given herewith.

When completed the power development will amount to 4400 hp from the power canal and 3000 hp from the Roosevelt reservoir. The transmission line has been completed from Roosevelt to Phoenix, a distance of 75 miles. There are two circuits, each made up of three wires. A branch line 19 miles long, consisting of a single three-wire circuit, is taken off at a switching station located 1½ miles northeast of Mesa, and leads to the Gila River Indian reservation. Fig. 2 is a rear view of the Mesa switching station. The sub-tropical character of the vegetation will be noticed. The transmission line east of the irrigated lands is supported by towers of the four-leg type, standing on a concrete pier. In the settled portion of the valley the line is supported by tripartite poles imbedded in concrete. The three conduc-

tors of each circuit are arranged with the base of the triangle inverted.

The transformer house near the Roosevelt power house has been completed and is equipped with the necessary transformers and other apparatus to deliver the electrical energy to the transmission line at 45,000 volts. One substation is placed about eight miles south of Mesa and another one will be located on the Gila reservation. About 10 miles of distributing circuits will be supplied from each substation. A large proportion of the electrical energy is transmitted to Phoenix and distributed by the Pacific Gas & Electric Company of that city.

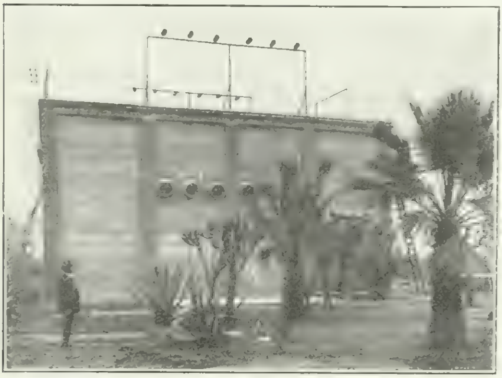


Fig. 2—Rear of Switching Station Near Mesa. Salt River Project. Arizona.

Among contractors for the power plant were S. Morgan Smith Company, water-wheels; General Electric Company, electrical apparatus; U. S. Wind Engine & Pump Company, transmission line supports; B. F. Kierulff, Jr., & Company, transmission line poles, and John A. Roebling's Sons Company, copper wire.

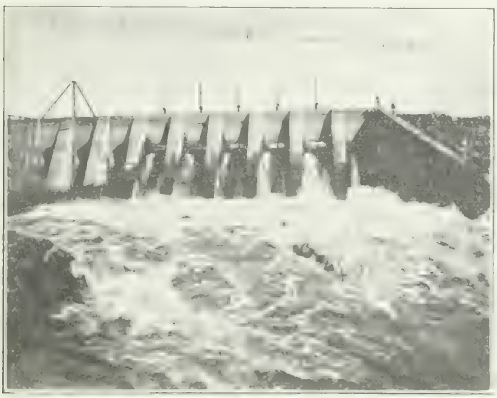


Fig. 4—Downstream View of Dam in Diversion Channel, Minidoka Dam. Minidoka Project, Idaho.

UNCOMPAHGRE VALLEY PROJECT, COLORADO.

Another large project is the Uncompahgre Valley project in the State of Colorado, utilizing the waters of the Gunnison and Uncompahgre rivers. [illegible] water power may be developed. The plan is to divert the water from the canyon of Gunnison River by means of a 6-mile tunnel to supplement the flow of Uncompahgre River in the irrigation of lands in the Uncompahgre Valley. The building of [illegible] roads is included in the plan. Work is under way on this great project and a large water power will be available, the plans for the utilization of which, however, have not been completed. A temporary electric power plant has been installed.

MINIDOKA PROJECT, IDAHO.

Of a different character is the Minidoka project, utilizing the water of the Snake River, supplemented by storage, in the State of Idaho. Briefly, the irrigation plan of this project provides for the diversion of the waters of Snake River for the irrigation, by gravity and pumping, of lands lying north and south of the river in Lincoln and Cassia counties. A combined storage, diversion and power dam has been constructed across Snake River about 6 miles south of Minidoka, Idaho. Electrical energy developed at the dam is utilized in pumping from the canal on the south side of the river for the irrigation of high lands, but the power and pumping plants and the canals for distributing pumped water have not been completed.

Fig. 3—Minidoka Dam. Minidoka Project, Idaho.

Fig. 5—Diversion Channel Dam, Upstream Face, Taken from Bottom of Channel. Minidoka Project, Idaho.

The developed water power amounts to 1800 hp, while the estimated total is 7200 hp. The reservoir is Lake Walcott. Fig. 3 shows the Minidoka dam, looking from the spillway toward the power house. Fig. 4 is a downstream view of the unfinished dam in the diversion channel, showing the water passing through penstock openings. At the time this photograph was taken about [illegible] ft. of water a second were passing through the gates. Fig. 6 is a near view of the uncompleted power house at the Minidoka project, while Fig. 5 is an interior view of the unfinished Minidoka power house, showing the [illegible] gates and penstock openings.

Early last year an 1800-hp turbine water-wheel and generator, a 140-hp water-wheel turbine with exciter, and a transformer were installed in the power house. About 16 miles of transmission line was built and at various pumping stations 300-hp and 600-hp motors driving centrifugal pumps were installed. Temporary wooden structures were built over the machinery. A duplication of this equipment is now under construction.

Fig. 6—Power House. Minidoka Project, Idaho.

For this project the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Company supplied the electrical apparatus, while the latter company also furnished the turbines and pumps. The Niles-Bement-Pond Company furnished the cranes, the Weber Gas Engine Company gas engines, and the Standard Underground Cable Company copper wire.

GARDEN CITY PROJECT, KANSAS.

The Garden City Project, in the counties of Finney and Kearny, in the State of Kansas, is radically different in character. It was constructed to utilize by pumping the underground flow of the Arkansas River Valley. A steam power house having a rating of 600 hp in steam turbines, Fig. 8, was constructed on the main line of the Atchison, Topeka & Santa Fé Railroad at Deerfield, Kan. The building is constructed of pressed brick and concrete and contains two 300-hp steam turbines, direct connected to 6600-volt generators. The electrical energy is transmitted to 23 pumping stations which are located along a concrete-lined canal 20,000 ft. long. The pumped water is discharged into this canal. At each of three of the pumping stations the pumps are connected to 12 15-in. wells from 30 to 50 ft. deep. At the other 20 stations the pumps are connected to nine wells each. The pumps are 9 and 10-in. vertical centrifugal machines, each direct connected to a 25-hp three-phase induction motor. All of the pumping units are installed and are now in operation. Fig. 7 gives an exterior view of one of these pumping stations and also of the transmission line.

Fig. 7—Substation No. 1, Main Canal and Transmission Line. Garden City Project, Kansas.

A soft-water well 247 ft. deep was drilled at the power plant for boiler feed purposes. Oil is burned for fuel and a 55,000-gal. concrete oil-storage tank was constructed. A very marked saving in the cost of fuel resulted in the change from coal to oil.

WILLISTON PROJECT, NORTH DAKOTA

The source of water supply for the Williston Project, in Williams County, N. D., is the Missouri River. The irrigation plan of the first unit of this project provides for a central steam-turbine power plant, operating pumps and generating electricity for the operation of pumping plants. Fig. 10 shows this generating station, which was not quite completed at the time the picture was taken. A series of motor-driven centrifugal pumps is operated on a barge in the Missouri River. A settling basin receives water from the barge pumping plant, and a main canal extends from the settling basin along Little Muddy Creek to the power plant. At the power plant there

is a pumping station having electrically-driven pumps which lift water from the main canal to a high-line canal. This pumping station No. 1, as well as the power house, is shown in Fig. 10. A second pumping station with electrically driven pumps lifts water from the high-line canal to a higher canal. In the central power house there are also two sets of steam-driven pumps which lift water from the end of the main canal to a high-line canal.

The power station is conveniently located adjacent to a vein of lignite coal, from which fuel is obtained. This station also generates electrical energy which is delivered over a transmission line to the Buford-Trenton project in Williams County, N. D., where water is obtained by means of pumps on a barge in the Missouri River, in much the same manner as in the Williston project. The transmission line connecting the two projects is 28 miles long. Fig. 9 shows the Missouri River barge supporting electrically-operated pumps with discharge pipes in position. The power and pumping system for the Williston project was supplied by the D'Olier Engineering Company.

OTHER PROJECTS.

At the Klamath Project, in Oregon and California, the power development has not been determined, but electrical energy for irrigating about 15,000 acres of land which lie above the gravity canals of the project may be obtained from

Fig. 8—Pumping Plant Power House. Garden City Project, Kansas.

the Klamath River, utilizing a drop from the main canal to the south branch canal of the project. On this project, up to June 30, 1909, a total of 64 miles of telephone line had been constructed.

The Strawberry Valley Project in Utah presents an estimated total of 3000 hp in water-power capable of development. Here the first unit of the power plant has been completed, together with a power transmission line 26½ miles long, extending to a substation at Strawberry tunnel, where all tramming and hoisting is done by electric motors. The power house contains two 450-kw generators and two 600-hp turbine water-wheels, with the necessary exciters, switchboards and accessories. Here the water-wheel apparatus comes from the Dayton Globe Iron Works Company and the electrical apparatus from the General Electric Company.

The Sunnyside unit of the Yakima Project in the State of

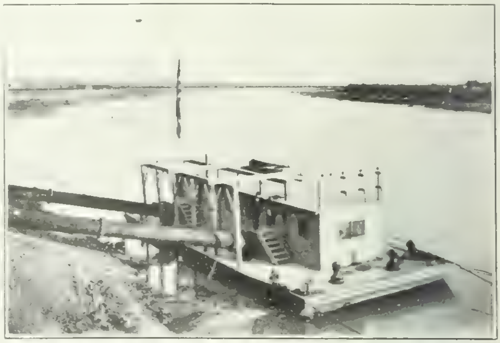


Fig. 9—Barge Bearing Pumps, Station No. 3. Williston Project, North Dakota.

Washington involves a possible power development of about 2000 hp. Power plants may be built at various drops on the canal and laterals. The water supply is that of the Yakima

Fig. 10—Power and Pumping Station No. 1. Williston Project, North Dakota.

River near Parker, Wash., but the power development remains to be undertaken.

The Tieton unit and the Wapato unit of the Yakima Project also involve water-power possibilities, estimated at 4000 hp in the case of the former and 9000 hp for the latter, but the plans for power development have not been worked out as yet.

The Truckee-Carson Project, resulting from a dam at the outlet of Lake Tahoe, in Nevada, and the Shoshone Project, utilizing the water of the Shoshone River in Big Horn County, Wyoming, also present water-power possibilities.

ELECTRICITY IN A MODERN GAS MANUFACTURING PLANT.

ONE of the latest applications of the electric motor to novel industrial service is found in the field of illuminating gas manufacture. It is noteworthy that in the two or three most recently completed gas installations in America electricity is demonstrating its economy and effectiveness in a manner which presages a rapid extension of such service in the gas industry. At Worcester, Mass., New Haven, Conn., and Astoria, N. Y., electric motors are employed in connection with coal-handling equipment of the most advanced design, with resulting savings in labor and operating cost, which look decidedly attractive to the gas engineer. While it is too much to claim that the high rates of gas production enjoyed by the Worcester Gas Light Company per pound of coal are immediately dependent upon the mechanical driving of the equipment, there is no question that the cost of production is lowered by the apparatus now in service, which depends in the most intimate degree upon electricity for its operation. In the following article some particulars are given of the electrical installation at Worcester, which has already created a reputation among gas engineers as one of the most efficient plants in the country.

The plant of the Worcester Gas Light Company occupies a tract of land about 17 acres between Southbridge Street and Quinsigamond Avenue, and substantially one mile from the center of distribution in the city. The company naturally generates its own electricity, having ample generating facilities. The installation consists of one 150-kw, 250-volt, General Electric, direct-current generator direct-driven at 285 r.p.m. by an American-Ball angle-compound engine, and two General Electric, 150-amp, 600-volt, three-phase alternators, each direct-driven at 225 r.p.m. by an American-Ball duplex-compound engine. The alternating-current and direct-current sides of the station are tied together by a 150-kw motor-generator set, consisting of a 200-hp induction motor driving a 250-volt generator at 600 r.p.m. Two 9-kw, 125-volt, belt-driven exciters are in service on the alternating side of the plant. Steam is supplied to the engines by a plant of three 400-hp horizontal return tubular boilers, manufactured by the Stewart Boiler Works, of Worcester. An 11-panel switchboard is installed in the engine-room for the control and measurement of the electrical energy. All the alternating-current machinery operates at a frequency of 60 cycles.

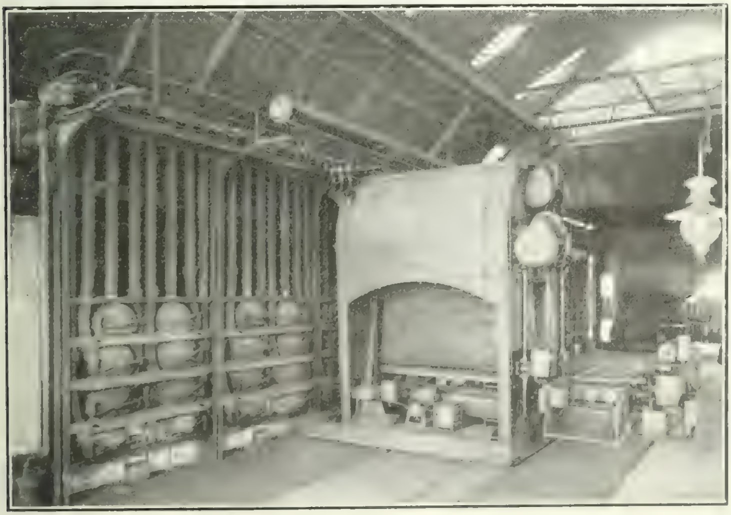


Fig. 1—Electrically-Driven Retort Charging Machine.

About 50 electric motors are in service on the property, and as a result the company is saved the losses and inconvenience which ordinarily attend the transmission of energy for varied uses over such an area by steam piping. The farthest point from the power house at which electricity is employed is about 1000 ft. distant. The demands are somewhat scattered, and include the driving of hoists and cranes, conveyor operation, running of blowers, pumps, crushers and charging equipment. The extensive use of the electric motor in these works has resulted in minimizing the labor requirements to the lowest degree consistent with reliable service to a city of about 150,000 inhabitants. The local lighting service is handled on 110-volt lines through appropriate transformers. Part of the service in the plant is operated by direct-current lines, including certain of the larger electric cranes and telphers, while the three-phase motors in the retort house are supplied with energy from the alternating generators, the potential being stepped down from about 600 volts to 220 volts.

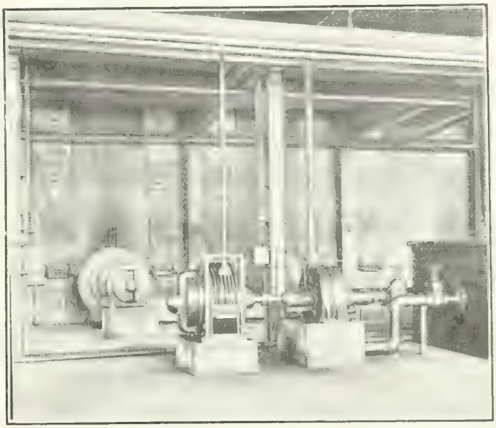


Fig. 2—Electrically-Driven Pump and Blower.

The new retort house of the company has been in operation about 20 months, and in its general design and equipment is the work of the Riter-Conley Manufacturing Company, of Pittsburgh, Pa. The house is designed for two retort stacks of 10 benches each. Coal is stored on the premises in a pocket having a capacity of 25,000 tons, the pocket being served from cars on a siding by a 1-ton Brown hoist electric crane. From the pocket, coal is passed through a crusher on its way to the retort house bunker, all the handling being by electricity. The coal bunker in the roof space of the retort house has a capacity 600 tons, and is filled from the coal-storage house by means of a trolley and electric grab bucket of the Brownhoist type which passes over a covered bridge from the coal-storage house to the retort building. The coal is crushed by apparatus driven by a 20-hp induction motor, the largest lumps being cubes of not over 1¼-in. sides. Two 40-hp motors are employed to drive the second Brown-hoist crane, which is of 2 tons' capacity.

The present installation of retorts consists of 10 benches of eight retorts each. The retorts are 15 ft. long and are built of "Ricon" material. Double tracks are provided through the center of the retort house for the use of the charging equipment, which is of novel design, being provided with electric automatic machinery throughout. In the middle of the retort house tracks, there is installed an electrically operated turntable, with a large platform scale built into it. There are duplicate charging machines of Riter-Conley special design, Mr. Hilliard, of the above-named company, being responsible for the details of the mechanism.

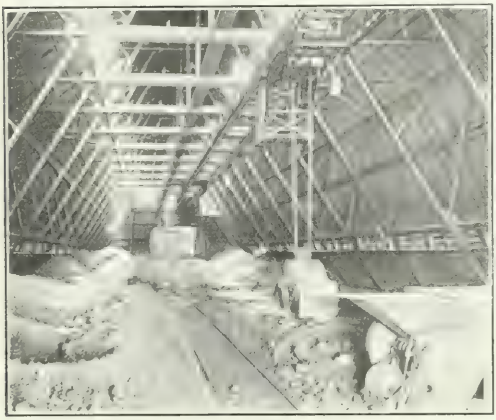


Fig. 3—Coal Handling Electric Telpher.

All the motors in the retort house are of General Electric manufacture, and of the induction type, totally enclosed, and automatically controlled by solenoid switches. The charging machines each consist of a car mounted on four wheels and having a height of about 8 ft., length of about 7 ft., and width of about 5 ft. The machine has a pocket of 20,000 lb. coal capacity, and fuel is drawn into this pocket from the overhead bin by means of easily handled valves. A motor-operated hopper in the top of the machine carries approximately 1 ton of coal, which is dropped into a pair of scoops at such times and in such quantities as the service demands. A charge of coal of from 900 lb. to 950 lb. is ordinarily used per retort.

The scoops, loaded with coal, are pushed into the retort by electricity, the coke of the former charge being pushed out by the entering scoops. The scoops are then turned over by a motor and are withdrawn, leaving the charge very evenly distributed over the floor of the retort and also leaving it quite full of fuel. A motor is provided to elevate or depress the scoops according to the height of the retort in relation to the floor, and in addition, the charging machine, weighing about 50 tons complete, is given a traverse motion. The scoops are withdrawn by the motor used to insert them in the retort.

Each retort is charged with from 900 lb. to 950 lb. of coal every seven hours, and the time of charging and discharging an individual retort is very small. One of the charging machines is held as a reserve, and each has five induction motors ranging in size from 2 hp to 20 hp. The controllers are of the automatic type, on the charging machines. The work done by the motor-driven charging machine has enabled the company to handle its retorts with three men, an additional man being required to run the machine itself, whereas under the former conditions of hand charging 15 men were required to do the work. With the electric charging machine the retorts are filled in the minimum time and the spreading of the coal is done far more evenly than was possible by hand. It is unnecessary to make allowances in the retort for discrepancies in the level of the fuel bed, which with some plants reach a total of 2 in., even with belt-driven charging equipment. The yield of gas per pound of Westmoreland coal averages from 5.9 cu. ft. to 6 cu. ft. of 17-cp gas, compared with 4.95 cu. ft. of 14-cp gas in the old retort house of the Worcester Gas Light Company.

When the coke is pushed from the retort it is dropped upon an electrically driven conveyor and carried out of the house. The conveyor is simple in form and practically carries the coke instead of drawing or pushing it. After the coke is thoroughly drained and dried it is taken to a storage pile by an electric grab bucket, passing through a crusher equipment driven by a 10-hp motor. Telpher connections are also made with the boiler-room, water-gas house, and other parts of the plant.

There are two producers for each bench of retorts in the plant. The fuel is coke, and the producers are furnished with rocking grates kept in slow motion by an electric motor. The blower equipment is motor-driven, and constant speed has helped to make possible a uniform and constant amount of producer gas of a constant heating value. Two men during the day and two men at night not only take care of the rear end retort lids, but they attend to all the work on the producers of seven benches, so that each man takes care of 3½ fires.

With the electric telpher system installed at the plant there is no teaming or shoveling of coke around the works. Purifying material is handled by an electrically driven conveyor, and it has been determined that the coke conveyor on the discharge side of the retorts saves the labor of three men, only two being required at present. Mechanical difficulties and various friction losses in the plant are avoided by the use of electric motors. Mr. D. D. Barnum is superintendent of the plant. An exhaustive discussion of the chemical results of the plant's first 11 months' service was given by President Charles D. Lamson, of the Worcester Gas Light Company, before the October, 1909, meeting of the American Gas Institute. President Lamson referred several times in his paper to the successful applications of the electric drive in the charging and conveying equipment, and from the interest which has been aroused in gas circles in the performance of the plant it is certain that many other in-

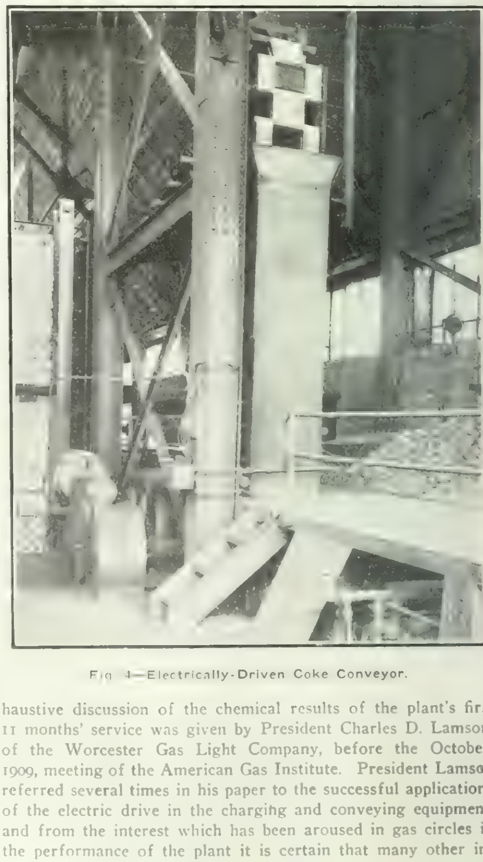


Fig. 4—Electrically-Driven Coke Conveyor.

stallations of the electrically driven type will follow the work being done at Worcester. The savings in labor are conspicuous even upon a short visit to the establishment.

MECHANICAL TESTS OF INSULATOR PORCELAIN AND GLASS.

By Ralph P. Clarkson

Recently it was found desirable to investigate high-voltage insulators for lines carrying upward of 125,000 volts and it was necessary to know something of the mechanical strength of those materials most commonly used for insulating purposes. Recent engineering literature and such reference books as could be obtained were searched for information as to mechanical tests of porcelain and glass, and for the methods of making such tests; but no illustrated article was found, and only the very slightest information that such tests were ever published. The writer, therefore, conducted the following experimental tests in the well-equipped laboratory of the Worcester Polytechnic Institute and offers them, not as exhaustive, but simply to show in general what users of insulators may expect.

The requirements of a good insulator are many, but the chief one is that it must be of low price. This limits the material of which the insulator may be made, and glass and porcelain seem to be the best because of their mechanical as well as dielectric strength. Of these two substances, glass is the better in a great many ways, but it has not been made into as good an insulator as the porcelain except at a much greater expense. Glass appears to be more homogeneous and flaws are easily detected by the eye. There are no dark corners where insects can build their nests. It is also less hygroscopic than porcelain, but does not possess the mechanical strength. The subject of making an electrically and mechanically strong glass has not received the attention it deserves from a chemical standpoint. It is known that glass made for other purposes by the famous Jena glass works has been found to possess electrical properties superior to any usually found and that that glass is very free from any tendency toward surface disintegration.

Because of the above facts, which were known to the writer, and because of the difficulty in obtaining fair glass cubes, only tension tests of glass were made. The glass used was obtained from a prominent manufacturer and the samples were taken from a batch of ordinary insulator glass, having been made about three years before the tests on them were conducted.

Both glazed and unglazed porcelain samples were tested in tension and compression, and the results investigated. All the porcelain was made from a standard formula and was identical with that from which a high-class line of high-voltage insulators are made and the glaze was the standard glaze used on that line of insulators.

It was desired that the tests should be made on standard shapes of materials in order that the results should be easily understood and comparable with other experiments. The shape of the samples of porcelain tested in tension was the standard briquette recommended by the American Society of Civil Engineers for tension tests of cement: It was impossible to get the glass in exactly that shape, but Fig. 1 shows the form used, this differing in no essential point from the shape recommended. The porcelain was, however, obtained very near the standard form, shrinkage causing some variation from the dimensions. The samples of glazed and unglazed porcelain were in the shape of a cube for the compression tests. Their size varied, but a large number of 1 in. on an edge were tested. The porcelain used was not in any sense special, and the flaws found in all insulators were found in these samples. Fig. 2 gives an idea of what those flaws were—a large, round, very hard piece of porcelain imbedded or an open crack where the clay did not stick together.

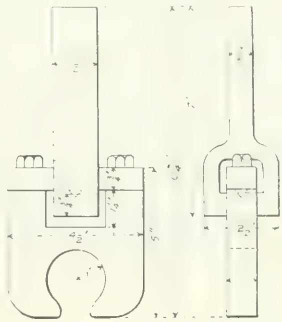


Fig. 4—Design for Cast-Iron Holding Clip.

The testing machines used were standard instruments. For tension tests of glass the Fairbanks briquette testing machine was used, but this has a capacity of only 1000 lb. so that a Wicksteed 20,000-lb. testing machine was used for the porcelain tests, both in compression and tension, except in a very few cases, which were not recorded, when an Emory hydraulic testing machine having a capacity of 100,000 lb. was used, simply to investigate the peculiar fracture and to see if it was due to the method of applying the load.

The Fairbanks machine is shown in Fig. 3. The briquette is held in brass clips at A and the weight applied uniformly by a stream of shot which runs from a reservoir through the tube B into the pail C suspended at the end of the steel yardarm upon which the weight D slides. When the briquette breaks, the arm falls, automatically cutting off the flow of shot. The shot is then weighed by means of the balance at E. The rate of applying the weight or load was about 475 lb. per minute.

The Wicksteed machine is merely a system of levers by means of which the load is applied by hand, or otherwise, and then balanced by the sliding weight so that readings may be taken directly.

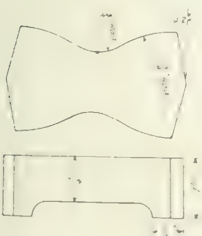


Fig. 1—Shape of Glass Briquettes

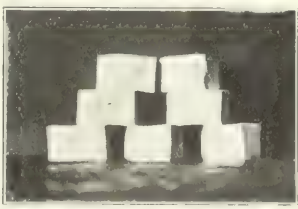


Fig. 2—Flaws in Porcelain.

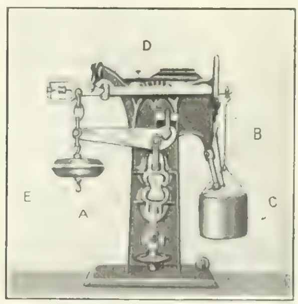


Fig. 3—Fairbanks Concrete Testing Machine.

The clips by means of which the briquette is held and the stress applied are the most important part of a testing machine. Brass clips were used for the glass samples, and were satisfactory, but in order to test the porcelain it was necessary to make very heavy clips so that they would not spread when the load

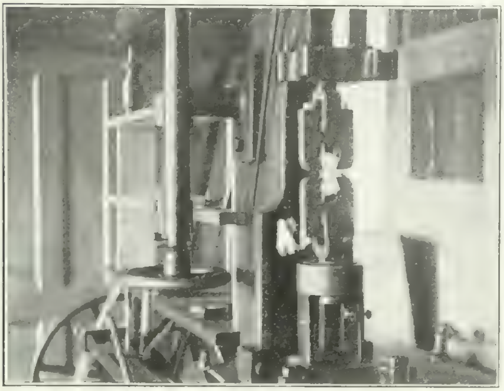


Fig. 5—Porcelain Briquette Under Test.

was applied to the briquettes. Cast-iron clips were obtained in accordance with the design shown in Fig. 4 and were found to work very satisfactorily. Fig. 5 shows the clips in use on the Wicksteed machine, an unglazed porcelain briquette being in place.

To a great extent the methods used in testing cement were followed. Care was taken to center the briquettes carefully in the clips and then a slight initial load was applied and the zero reading taken. For the tension tests of the porcelain the load was applied by steps of 100 lb. up to 1000 lb. and then in steps of 50 lb. until the sample broke. Each load was carefully balanced by means of the sliding weight so that the results are very accurate.

Considerable difficulty was encountered in getting the porcelain to break at the smallest cross-section, but finally by using pillows of cardboard between the clips and the briquettes the break occurred, in most cases, very near to the smallest section. It is not to be expected, however, that the smallest section is necessarily always the weakest when porcelain is used. This is due to two causes, and these are the factors which make porcelain so uncertain in its action. First, the smallest section is, of course, more thoroughly baked than a large section of the same piece. Secondly, the flaws shown in Fig. 2 are very frequently found in all large pieces of porcelain and, many times, they are the determining factor in finding the strength. The lack of homogeneity in porcelain is a serious drawback.

Fig. 6—Standard Form of Briquette.

Fig 6 shows the shape of briquette recommended by the American Society of Civil Engineers, and the dotted line shows how the majority of fractures ran. The breaks were all clean and even, and the samples showed no signs of being crushed at the sides or of splintering.

It may be of interest to note the method of computing the section where the break occurred. It seemed very much of a problem to do this accurately, but the plan finally adopted seemed to give as close results as any. The specimen was placed upon sensitized paper, such as will be turned black by contact with brass (ordinary steam-engine indicator cards were used), and a sharp brass needle point was used to mark around the section. Both halves of the sample were used in each case, and each was traced around a number of times. The area thus obtained was integrated with a planimeter.

Fig. 7 gives a curve sheet showing the results of the tension

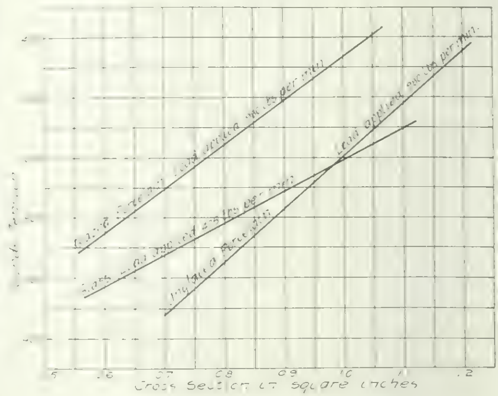


Fig. 7—Tests of Tensile Strength.

tests using glass, glazed porcelain and unglazed porcelain. The cubes used for the compression tests did not have perfectly flat faces and so it was necessary to provide even bearing surfaces for them that the breaks might be in compression and not in tension or shear. It was found that it is possible to grind the unglazed porcelain with a coarse emery or corundum wheel, but the grinding must be done very slowly and carefully or the surface becomes all glazed over. The plan decided upon in this case was to bed the cubes on lead sheets about 1/16 in. thick. When the load was applied the lead flowed slightly and

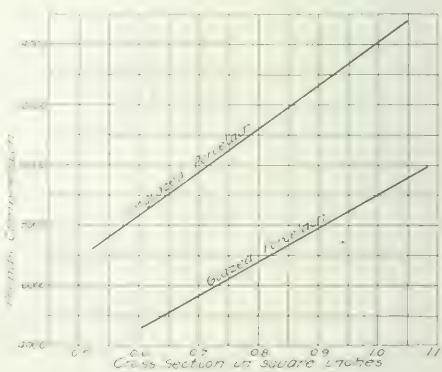


Fig. 8—Tests of Compressive Strength.

very thinly around the edges and curled up, thus possibly giving some very slight additional strength to the cubes.

The porcelain fiber showed up better in these tests than in any other tests of the substance. The fracture took place in lines at right angles to the face of the jaws so that the specimens, instead of crushing as many substances do, splintered into a number of pieces. Different beddings, different rates of applying the load and different methods of applying the load were all tried, but the fracture was always the same. The curve sheet, Fig. 8, shows the results of the compression tests on both the glazed and unglazed samples.

The conclusions which might be drawn from these tests are

very many. In tension glass and unglazed porcelain have about the same strength. Glazed porcelain is about 25 per cent stronger than either. This is to be expected as glaze would probably have the same effect as the scale does on cast iron. In compression unglazed porcelain seems to be stronger than glazed, but the strength of porcelain in compression is from 10 to 12 times its strength in tension. It is rare that such a proportion is found with the more common substances used in construction, cast iron being a fair sample of the proportion usually found, five to one.

The writer believes that tests of porcelain beams would be of great value in the study of that substance, especially cantilever beams, as that is usually the way that insulators are strained. Such tests would assist materially in the study of the work outlined above.

THE TUNGSTEN LAMP SITUATION IN FRANCE.

Rapid Introduction of Tungsten Lamps in Paris.

By Warren H. Miller.

It may seem incredible, but there are practically only two kinds of store lamps in Paris to-day, namely, the gas mantle and the tungsten lamp. To these may be added the arc lamp which is used in large establishments, but the average store is almost invariably lighted either by gas mantles or by tungsten lamps. It seems curious that one must actually hunt in order to find an installation of carbon lamps; the writer traversed the whole circle of the Grand Boulevards, from the Madeleine to the Chatelet, and noted only one carbon-lamp outfit, and that was in the artificial flower decoration of a theater front, where the steel network of leaves and flower lamps was much shaken by the wind.

One passes store after store, mile after mile of boulevards, and never sees a carbon lamp. All of the stores are brilliantly lit with from 25 to 50 lamps, the 25-cp and 50-cp sizes predominating. The brittleness of the filament, which is a great stumbling block in America, has been entirely overcome in European lamps. A sure indication of brittle lamps is the discovery here and there of dead lamps in clusters and the like, for such lamps are not quickly replaced unless used in some important store window, but the writer was not able to find any such, except in rare cases. In a large concert hall, with grand organ making considerable vibration, out of 75 50-cp tungsten lamps only two were dead. Pursuing the investigation further, the year's average of breakages for last year was returned as 2.7 per cent, for large companies such as the French Westinghouse, the lamps of which are made in its own Austrian and Swiss factories. Of those failing, 1.5 per cent was debited to shipment, 0.4 per cent to defective sockets, and the rest to broken filaments, most of which parted at the weld with the metal spider, where the joint is stiff and inflexible.

Aside from the use of improved methods of obtaining the oxide as rich as possible, the freedom from breakage is mostly ascribed by foreign manufacturers to the use of a fine, springy filament, which is drawn down to 0.027 mm in diameter through diamond dies. They consider the 16-cp size on 135 volts as the best of the lot, but the people prefer the 25-cp lamp because of its better light. The principal operating difficulty at the factories at present seems to be to make the diamond dies last longer, as they soon draw large. Another cause of freedom from breakage is the use of a platinum spider to hold the loops of filament at the lower end. This spider is bent back in tension like a bow, so as always to follow the expansions and contractions of the loop and always keep it taut, and yet never be bound by anything stiff and unyielding, such as a stiff spider at both ends. The latter design is often found in American lamps, the filament being permitted to sag on heating and thus be particularly subject to rupture; it also introduces flexure while hot, which probably distorts the fiber of the metal. However this may be, the writer's experience with over 5000 American tungsten lamps showed that while they withstood shipment and placing in sockets very well, after they had been in service for several nights they became very brittle indeed, so that one could not shift the lamps from one department to another, in case of lamp famines, without losing more than half of the lamps transferred.

It might be mentioned here that a state of famine in lamps was chronic, so long as tungstens were used, because they broke much faster than they could be ordered and shipped. The French experience has been exactly the opposite of this as regards the lamps becoming brittle when in service. Their lamps become harder and tougher, and it is standard practice at the factories to heat each lamp for four hours before shipping in order "to toughen the filament."

There are more than 500,000 tungsten lamps in use in the Paris stores, public buildings and private houses at present, something like 200,000 being supplied by the "Osram" Company, 150,000 by the French Westinghouse, and 150,000 by the "Z" Company, and others. This means that the householders and shopkeepers of Paris are saving about $8,000 a night by the use of tungsten instead of carbon lamps. They are operated in all sorts of positions, vertical, horizontal, at all angles, and upside down. No attempt of any sort has been made to introduce spring sockets and fixtures, such as are extensively advertised in America. The Frenchman is nothing if not logical, and he instinctively realizes that if the tungsten lamp is worthless because of brittle filaments, it is better to toughen the filament or else to have no tungsten lamp at all. The idea of treating the lamp as a delicate and evanescent soap-bubble, and hanging it with extreme care in canary-bird spring cradles, appears to him highly illogical. He believes that if the lamp filament is brittle, the lamp is not yet ready for the market, and it is a crime to sell it. Logical thought further drives him to invest considerable of his meager capital in expensive arc lamps, 25-cp tungsten lamps at 60 cents each, and gas mantles at 20 cents each. He realizes that these things pay more in economy of light bills than the same money would return from the best kind of securities, and, therefore, he invests. He also realizes the value of light in attracting customers, and is not sparing with either tungsten lamps or gas mantles inside, or with flaming arcs on the street outside. American store managers, on the other hand, waste their gross profits in light bills for carbon lamps and plain gas burners, and get depressingly lighted floors in order to save a little capital, which lies moldering in the bank at 3 per cent, or is tied up in goods that no one can see to buy.

The tungsten invasion began with the private houses, where there is no such business-killing scheme as a "minimum rate" to make any saving by the use of tungsten lamps impossible. In France the companies are glad to make every dollar they can, and they install meters even if the customer uses far below any arbitrary minimum.

Having proved to the people in their own homes that the tungsten did save much in electric light bills, it was quickly extended to the stores. During the last year the companies tried to introduce the 16-cp, 135-volt lamps, and the people took gladly to them at first, because of the lower first cost of the lamp, but they soon returned to the 25-cp size to obtain more light.

The tungsten lamps are sold in France on a 1000-hour guarantee. Two years ago the companies stood ready to make good 5 per cent in returned and broken lamps, because the storekeepers never miss an opportunity to return any and all broken lamps to the meter-man. However, the breakage did not reach that total, and last year it was only 2.7 per cent, so that 3 per cent is now figured in in gross selling price to take care of broken and returned lamps.

The next places to introduce tungsten lamps were the large central stations. Later the municipalities adopted them, not only for public buildings, but for street lighting. In Bordeaux and Lucerne use is made of street clusters of three and four lamps in multiple, while in Zürich the scheme of using flaming arcs with an auxiliary 50-cp tungsten below it on the same pole is employed. After midnight the arc lamps are extinguished and the tungsten lamps lighted.

Meanwhile the short-filament, 25-volt, series tungsten lamp was coming into its own in the field of railway car lighting, where use is made of a storage battery feeding energy for lighting the entire train. Over 40,000 23-volt tungsten lamps, in 5-cp, 10-cp and 20-cp sizes, were sold to the Italian State Railways, 5000 to the Belgian State Railways, and 10,000 to the Orleans-Paris Railway by one lamp company alone.

At present the field of industrial establishments is being gone into extensively. The big gun works at Creusot are equipped with 3000 tungsten lamps furnished by two separate companies, while there are thousands already installed in the big cotton and silk mills in the south of France. In Paris, the Metropolitan (the subway of the city) has ordered a trial lot of 1000 lamps from several companies, after a test of 50, along the line of track where the vibration is heaviest. These were run in series

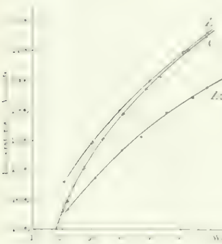


Fig. 1—Luminous Intensity Curves for Carbon Lamps.

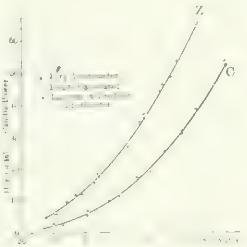


Fig. 2—Luminous Intensity Curves for Tungsten Lamps.

on 600 volts, five in a group—a pretty severe condition. The test of the 50 lamps was stopped at 1200 hours with only one broken.

It may be that the failure of certain American lamps was not due to the filament itself, but to the trivial cause of lack of proper support for the filament. In foreign lamps a small springy spider holds the ends of the loops in tension, in one form or another. There is also some attempt to hold the filament loosely in the middle, but the general tendency in 25-cp lamps is toward the use of short and many loops.

LAWS OF LUMINOUS RADIATION.

Some attempt to formulate the relations between the power consumed in metallic-filament lamps and the voltage, and between the temperature of the filament and the watts dissipated and between the luminous intensity and the specific consumption of the lamps has been published in *La Revue Electrique* for Jan. 15, by Messrs. Cheneveaux and Féry, as was noted in the Digest of the *Electrical World* on Feb. 10. The researches are divided into two groups: First, those aiming to find the relation between either the power consumed or luminous intensity and the voltage; and second, those endeavoring to find a law for calculating the luminous intensity, given the absolute temperature of the filament, or the wattage. The authors first review the various empirical formulas for the curve of luminous intensity in terms of the voltage. Expressed in simple form they are:

Laporte: Intensity $= KE^n$, where $n = 5.8$ for carbon and $n = 3.6$ for tungsten.

Steinmetz: Intensity $= KW^x$, where $K = I \times 5.10^{-3}$ and $x = 3$ for carbon and $K = I \times 1.10^{-5}$ with $x = 2.58$ for tungsten.

Jolley:

Intensity $= 3{,}20.10^{-10}\ E^{5.4}$ for carbon.

Intensity $= 4{,}79.10^{-7}\ E^{3.92}$ for tungsten.

[illegible]

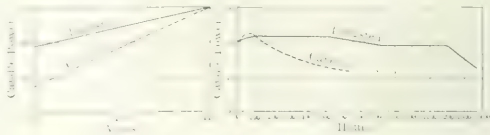
Intensity $= E^{6.6}$ for carbon.

[illegible]

The authors do not consider any of the above values sufficiently precise for a theoretical basis and evolve the general formula:

$$\text{Intensity} = [\text{illegible}]$$

giving the law of the luminous intensity as a function of the watts dissipated, no matter what the character of the filament. A and B are constants characteristic of the particular lamp and x has the value of 4 for carbon and 4.6 for tungsten. This



Figs. 3 and 4—Candlepower Curves.

formula is based on a simple expression of the law of Stefan, which, reduced to watts in terms of the absolute temperature, would be $W = aT^4$ for carbon lamps with black filament, and results calculated from it are given in Table I. To get the formula in practical shape for tungsten filaments Messrs. Cheneveaux and Féry point out that it would introduce an error to

TABLE I.—CARBON LAMPS.

Volts	Amperes	Watts (W)	Temperature Absolute T	$a = \left(\frac{W}{T^4}\right) \cdot 10^{12}$
			°C.	
14.2	1.18	16.8	1543	3.06
16.0	1.34	21.4	1638	2.97
18.0	1.51	27.0	1753	2.84
20.0	1 685	33.7	1848	2.87
22.0	1.86	40.8	193[illegible]	2 92
24.0	2.04	48.9	2013	2.97
25.0	2.12	53.0	[illegible]	2.98
27.0	2.29	61.8	2133	3.00
29.0	2.46	71.4	2203	3.01

W (watts)	$\sqrt[4]{W}$	Candle-power Calculated	Candle-power Observed	Difference in Per Cent
26	2.25	1.4	1.4	0.0
30	2.34	2.3	2.3	0.0
40	2.51	5.97	6.0	0.5
50	2.66	12.3	11.9	3.1
60	2.78	20.7	20.3	2.0
[illegible]	[illegible]	32.2	31.8	1.2
80	2.99	46.3	46.0	0.7
84	3.02	52.4	52.4	0.0

consider the radiation from a highly polished filament equal to that of plain black carbon. They, therefore, conducted experi-

TABLE II.—TUNGSTEN LAMPS.

W	T	$a = \left(\frac{W}{T^4}\right) \cdot 10^{14}$
[illegible]	[illegible]	2.77
[illegible]	1831	2.94
[illegible]	[illegible]	3.00
[illegible]	[illegible]	2.98
60	2125	2.96
70	2201	2.95

[illegible]	$\sqrt[4]{W}$	Candle-power [illegible]	Candle-power Calculated	Difference in Per Cent
28	2 063	4 8	[illegible]	0 0
30	2.094	6.0	[illegible]	+2.5
40	2.229	13.2	[illegible]	+1.5
50	2.340	23.6	23[illegible]	+1.3
60	[illegible]	37.4	[illegible]	+0.8
[illegible]	2.518	54.0	[illegible]	+0.6
[illegible]	2 563	[illegible]	[illegible]	[illegible]

ments with polished platinum, whose temperature was measured with an accurate optical pyrometer, and the total radiation was taken at the same time with a Féry pyrometric telescope. The law was thus found to be $W = aT^{4.6}$ for highly polished surfaces under extreme heat; Table II shows the results obtained with tungsten lamps.

To ascertain the luminous intensity for carbon and tungsten

in terms of the watts, the authors first sum up the empirical formulas and results obtained to date by various experimenters. Tables III and IV give observations on record and the calculated temperatures derived from the formulas of Stefan, Rasch, Petavel and Nernst.

TABLE III.—TEMPERATURES

	Watts per Candle	Temperature in Degrees Centigrade			
		Stefan	Petavel	Rasch	Nernst
Carbon	3.5[illegible]	1557	1607	1647	1657
Graphitized carbon	3.13	1632	1667	1687	1717
Tantalum..................	1.645	1427	1707	1717	1737
Tungsten..................	1.25	1517	1[illegible]27	1777	1[illegible]7

Combining the law of Wein: $P = C\lambda^{-5}\epsilon^{-\frac{c}{\lambda T}}$, where P is the power radiated at wave-length λ, with the law of displacement of Wein; $\lambda_m T =$ constant, and substituting the values of T^4 in terms of W, the authors get:

TABLE IV.—TEMPERATURES.

Authors	Year	Type of Filament	Temperature Absolute
H.-F. Weber..................	1892	Carbon	1838°–1853°
P. Janet.	1898	"	1[illegible]° 1[illegible]
Lummer and Pringsheim	1899	"	1875°–2100°
Le Chatelier and Boudouard	1900	"	2073°
Waidner and Burgess	1906	"	1950°
" " "	1906	Tantalum	2000°
" " "	1906	Tungsten	2300°
Clerici........................	1907	Carbon	1950°
"	1907	Tantalum.........	2000°
"	1907	Tungsten......	2300°
Grau	1907	Carbon...........	19[illegible]
"	1907	Tungsten.........	2123°
Morris, Stroud and Ell[illegible]	1907	Tantalum.	18[illegible]
" " " "	1907	Tungsten ...	2000°
W.-W. Coblentz...............	1909	Graphitized carbon	1843°
" "	1909	Tantalum.	19[illegible]
" "	1909	Tungsten	2083°

$$\text{Intensity} = 2{,}08.10^6\, E^{-\frac{3[illegible].05}{\sqrt[4]{W}}} \text{ for carbon, as shown in Table I.}$$

$$\text{Intensity} = 3{,}08.10^6\, E^{-\frac{27.63}{\sqrt[4.6]{W}}} \text{ for tungsten, as in Table II.}$$

In Figs 1, 2, 3 and 4 are shown all of the results of these investigations, both calculated and observed.

THE DESIGN OF A QUICK-ACTING WHEATSTONE BRIDGE.

By Charles R. Underhill.

In the electrical departments of factories where thousands of coils must be tested daily it is imperative that the testing operation be performed with exactitude and dispatch. Where the ordinary Wheatstone bridge is used much time is lost in adjusting plugs or switch levers or closely observing the deflection of the galvanometer needle, in order that the resistance shall be within the prescribed limits.

While the maximum and minimum resistances may be easily calculated from the permissible variation in resistance, and the galvanometer deflection noted, changes due to temperature variation complicate the problem for ordinary shop testing and very often lead to error in the hands of semi-experienced testers. Again, when the resistance is outside of the prescribed limits, "guessing" adjustments and more calculating are necessary in order to determine the actual percentages of error.

Slide-wire bridges, designed to read directly in per cent, have proved to be even slower to operate than a good Wheatstone bridge equipped with a D'Arsonval galvanometer.

The writer has made numerous devices of this class, but the instrument illustrated in Fig. 1 and described below has given the greatest satisfaction of all, and possesses the decided advantage of being "foolproof" and, therefore, suitable for accurate use in the hands of an otherwise, inexperienced tester.

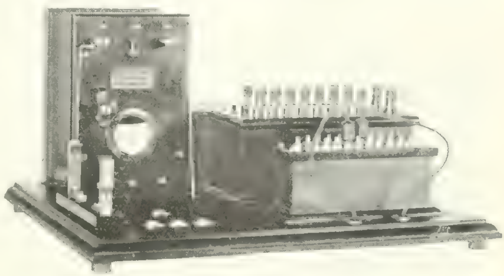


Fig. 1—Quick-Acting Wheatstone Bridge.

In this apparatus, as in the usual form of slide-wire percentage bridge, the battery and galvanometer circuits are transposed in respect to the familiar schematic diagram of the Wheatstone bridge.

In percentage bridges, the galvanometer circuit connection at a, Fig. 2, is adjustable for making A greater or less than B, the scale in the case of the slide-wire percentage bridge or the contacts in the present instrument indicating percentages of variation between R and X. Hence, if r represent the resistance taken from B and added to A to make $A > B$, the familiar equation

$$\frac{A}{B} = \frac{R}{X} \qquad (1)$$

will become

$$\frac{A+r}{B-r} = \frac{R}{X} \qquad (2)$$

or, when $A < B$,

$$\frac{A-r}{B+r} = \frac{R}{X} \qquad (3)$$

When $A = B$, $r = 0$, and

$$\frac{A}{B} = \frac{R}{X}$$

Therefore, equation (2) represents the adjustment necessary to obtain a balance when $R > X$, while (3) is for the condition $R < X$, and when $r = 0$, $R = X$.

On this basis, the instrument shown in Fig. 1 was designed. It consists of a rheostat, adjustable from 1 to 11,110 ohms, a D'Arsonval galvanometer, a single cell of dry battery (enclosed in the box back of the rheostat), and the adjustable "A" and "B" coils, shown in front of the rheostat. These latter coils are wound on a grooved wooden spool contained within the box, and are 22 in number, thus providing for adjustment of from 1 to 10 per cent, high or low, and one adjustment for $A = B$. Fig. 3 shows the connections of this detail with the value of

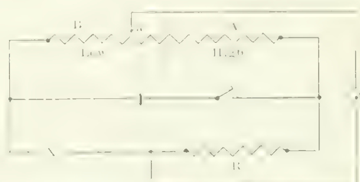


Fig. 2—Connections of Percentage Bridge.

the resistance of each coil. As an aid in calibrating these coils, the following is given: Starting from the center, or 0, the

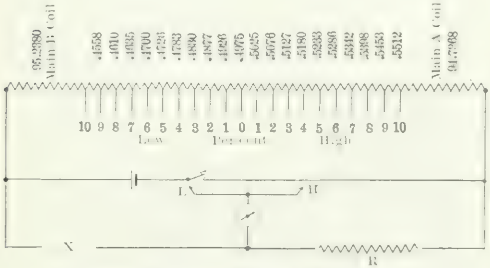


Fig. 3—Resistance Details of Resistors.

sums of the resistances, or the resistance as measured from 0 to the contacts, will be

Low		High		Low		High	
1.	0.4975	1.	0.5025	6.	2.9117	6.	3.0927
2.	[illegible]	2.	1.0101	7.	3.3817	7.	3.6269
3.	1.4778	3.	1.5228	8.	3.8452	8.	4.1667
4.	1.9608	4.	2.0408	9.	4.3062	9.	4.7120
5.	2.4391	5.	2.5641	10.	4.7620	10.	5.2632

The resistance of the main A coil is 94,7368 ohms, and 94,7368 + 5.2632 = 100 ohms. Likewise, 95.2380 + 4.7620 = 100 ohms for the B side.

The equations for calculating the values of the resistances for any values of A and B are

$$r = \frac{(1 + 0.01\, n)\, B - A}{2 + 0.01\, n} \qquad (4)$$

for the "low"side, and

$$r = \frac{A - (1 - 0.01\, n)\, B}{2 - 0.01\, n} \qquad (5)$$

for the "high" side, wherein n is the percentage (1, 2, 3, etc.), r is the resistance between 1, 2, 3, etc., and A and B are equal and represent the total resistance as measured from 0 in either direction (100 ohms in the present case).

Two contacts engage the pegs on the A-and-B box, one marked H being connected to the proper "high" peg, and the other, marked L, to the proper "low" peg. The complete connections are as in Fig. 4.

The operation of this bridge is exceedingly simple. The rheostat is first set for the actual specified resistance of the coil to be tested. The permissible variations in resistance (high

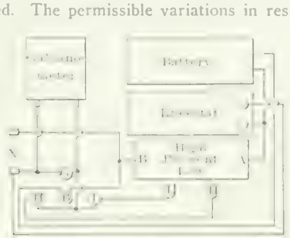


Fig. 4—Assembly of Apparatus.

or low) are then "plugged in" on the A-and-B box, temperature corrections being made from a scale of per cent of resistance due to temperature variation pasted on a thermometer, which is, therefore, direct reading.

The center, or battery, key is first depressed, as usual, and then the galvanometer is connected on the "high" and "low" sides of the A-and-B box by pressing first one and then the other of the keys H and L.

If the needle swings toward "low" when the "high" key is pressed it shows that X is lower than n per cent high. Likewise, if the needle swings toward "high" when the "low" key is pressed it shows that X is higher than n per cent low. Consequently, if the needle swings first one way and then the other it shows that the resistance of the coil to be tested, or X, is higher than the low limit and lower than the high limit.

On the other hand, if the needle swings, both times, toward, say, "high," it indicates that X is higher than the high limits, and is, therefore, too high. The same holds when X is too low, the needle swinging toward "low" when either the H or L key is pressed.

The actual percentage variation may be found by adjustment of either of the contacts on the A-and-B box, or one of these contacts may be placed on the 0 peg and the rheostat adjusted until a balance is obtained in the usual manner. The key marked G is used to short-circuit the galvanometer in order to bring the needle to rest after a violent swing.

The rheostat and galvanometer may be purchased at reasonable prices, and the remainder of the apparatus is not difficult to make. Those in operation have given genuine satisfaction.

ELECTRIC LIFTING MAGNETS IN THE STEEL PLANT.

Around steel plants, for handling the loose scrap and iron used for charging open-hearth furnaces, for breaking up pig iron, skulls, spilled metal, and slag, and for loading rails, plates and other finished products of the rolls, the electric lifting

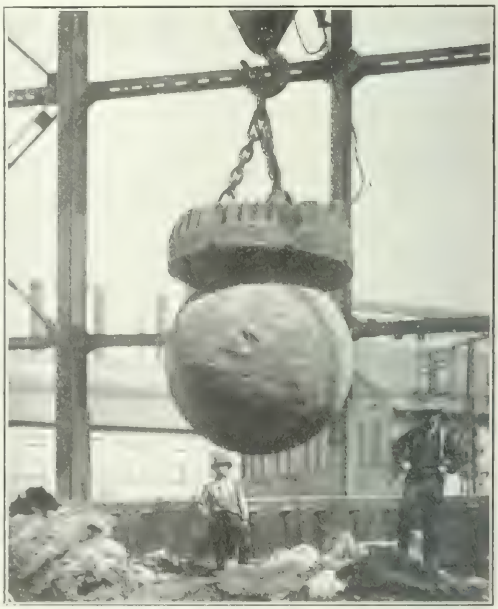


Fig. 1—Scrap-Handling Electromagnet Lifting 12,000-lb. Skull-cracker Ball.

magnet is a relative innovation in conveyance methods that has come to stay.

Continued advances have been made in the design and construction of these magnets, enabling them to lift increasingly greater loads and adapting them to withstand better the severe conditions of temperature change and moisture to which they are subject in service. Whereas the magnets of a few years ago were limited in carrying capacity, especially those used to

lift scrap and small, loose material, the best designs of to-day have no difficulty in "walking off" with 25 tons of slabs or billets, or a ton or more of pig or scrap. Confidently expecting the same progress in design and construction as in the past, we may look to see the future field of application of this interesting class of apparatus tremendously enlarged.

By the use of electric lifting magnets, the cost of handling many classes of magnetic material is cut in half or even a greater saving is accomplished. Many operations can be performed, too, which would be impossible without the magnets. Finished material, pigs, billets, etc., can be piled to a height far above that reached before, effecting valuable saving in space. The magnet also renders comparatively easy the handling of the nondescript and inextricably tangled scrap, usually consisting of coils, springs, twisted wire, pipe and rods, machine-tool chips, casting parts, broken machinery, and ladle-spillings, which is added to the blast furnace charges. Hitherto, this material could be moved only very slowly and at considerable expense by hand or by crane buckets.

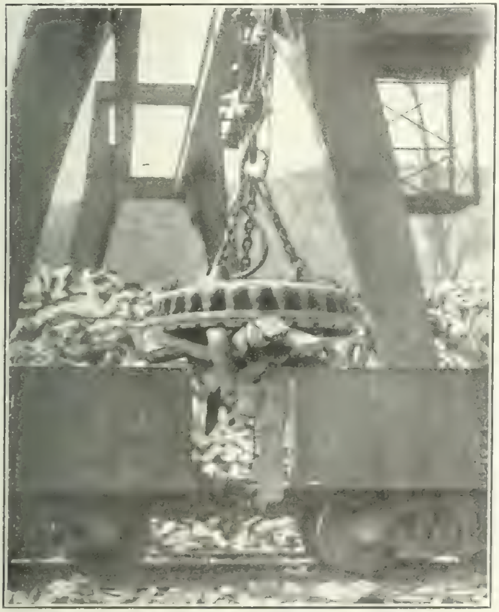


Fig. 2—Loading Pig Iron Into Cars by Electromagnet.

The magnets by which plates and slabs are handled are usually lighter in construction and weight, and consume less energy than those required for picking up the small loose and rough material. Where the pieces lifted are relatively smooth and regular in shape, such as the commercial sizes of steel slabs and plates, a magnet of the rectangular form illustrated, with narrow pole-pieces widely separated, is used. This magnet requires about 12 amp at 220 volts, and will lift three or four plates at a time, aggregating four or five tons. It is controlled by a simple single-pole knife switch.

Considerable dexterity in handling difficult loads of plates and slabs is attained by the operators who manipulate the cranes and magnets. The plates coming from the live rolls are usually piled on an intermediate floor, from which they are picked up by the magnets for loading onto the cars. Some of the more skillful of the operators will raise two or three plates adhering together like the leaves of a book, and then, carrying magnet and all to the point where the bottom plate is to be dropped, are able, by snapping the magnet-switch momentarily open, to release the lowest plate and allow it to fall into position, before the contracting magnetic field has released the upper plates. In this way, three or four plates picked up in a pile by the magnet, can be dropped with accuracy one at a time in as many different positions.

Besides the crane operator, usually one or two ground men are required for loading duty, depending on the amount of work necessary in trimming the car after the material has been deposited by the magnet. This crew, however, replaces the former loading gang of eight men. Counting the maintenance of the magnet and crane as equaling something less than the wage of one man, the use of the magnet is seen to effect a labor saving of about one-half. Indeed, the statement is sometimes made that an electric lifting magnet will pay for itself within three months or less.

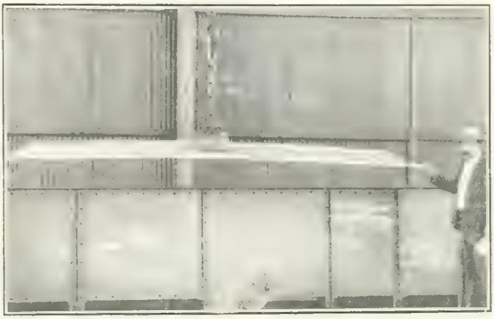


Fig. 3—Electric Lifting Magnet Loading Steel Plate Into Car.

The electromagnets employed for handling scrap and pig iron, and for raising the skullcracker balls used to break up iron and slag masses, are a great deal heavier in both weight and structure than those for lifting plates. They differ in magnetic design, also, usually employing an outer annular pole-piece, concentric with the middle round pole-shoe, and being arranged with a comparatively short air gap, which renders the pole-to-pole flux more nearly independent of the magnetic conductivity and of the density of the loose material lifted. These magnets require currents of from 40 to 60 amp at 220 volts. They will handle several million pounds of pig

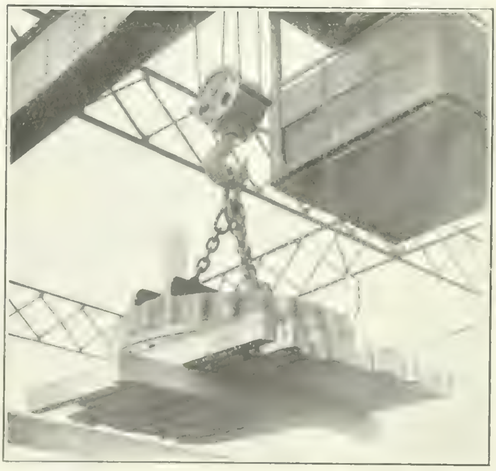


Fig. 4—Electromagnet Lifting 1[illegible],200 lb. Steel Billets.

iron, scrap, or "noodles," as the punchings from the rivet shop are called, and are also able to lift easily a compact 10-ton load, such as a 2-ton ingot mold with its 8-ton ingot. By actual record in one steel plant where electromagnets have been in extensive use for the longest time of any in this country, one magnet handled 3500 tons of scrap in a week of seven working days of 24 hours each.

The control of the larger magnets is effected by mill-type contactors operated from a hand-lever. On account of the considerable inductive reaction when the 60-amp exciting current of one of the scrap magnets is broken, provision is made for automatically inserting a resistor in a discharge circuit to receive the inductive kick and so prevent a high potential on the windings. Another method for rapidly releasing the load by overcoming whatever residual magnetization remains after the exciting current has been shut off, provides for momentarily sending a reverse current through the magnet winding in series with a resistor so designed as to just neutralize the remaining field. Thus in dropping the load, the operator throws his controller over into a reverse position for an instant before bringing it back to the middle "off" position.

Another important use of the electromagnet is in raising and dropping skullcrackers—hugh iron balls, weighing from 6 to 10 tons—which are allowed to fall from a height of 50 to 70 ft. onto iron or slag masses that have to be broken up for better handling. Here the magnet takes the place of the former trip-latch and rope, by which the skullcracker was released by a groundman. This man had to look to his own protection against flying pieces, by getting behind a convenient runway column, and in this way the aim of the falling ball was often spoiled by the side-pull of the trip-rope. With the magnet controlled from the crane operator's station, much greater accuracy is attained in delivering the blow just where it is required. The magnet can also be used to put into position the iron to be broken, and afterward to collect the broken pieces.

A set of very large magnets of the horseshoe type, with flaring pole-pieces, designed to handle steel rails, was recently installed at Gary, Ind. These magnets, which have been frequently described of late, are capable of handling 20 60-ft. rails, aggregating a weight of over 30,000 lb.

The electromagnet used about the steel plant is a particularly sturdy and substantial piece of apparatus, but the service it undergoes in such a place is obviously of the hardest nature. The magnet is frequently dropped onto or allowed to crash against the solid skullcracker ball, an ingot mold, or a pile of plates and slabs waiting to be lifted. Unless its contact pole-pieces are made of the hardest material, they become worn off by attrition at a rapid rate. Manganese steel is used in some types of magnets for a sheathing between the poles, as this material is non-magnetic and one of the hardest steels known. Sometimes the magnet is called upon to lift hot metal—at a temperature just below dull red—and frequently it must work under a water spray used to cool the finished billets.

The most frequent source of trouble with magnets under these severe conditions is the grounding of the coils, due to deterioration of the insulation caused by the entrance of moisture. With the changes in temperature undergone by the magnet interior, when in use and when shut off, it is evident, despite the most careful measures to construct air-tight joints in the case, that the expansion and contraction of the internal interstitial air will cause a "breaking" action, which permits the entrance of moisture. This ultimately spoils the insulation, and a ground occurs between the coil and the case, putting the magnet on the hospital list for repairs.

The electrical superintendent of one large steel plant reports that repairs of this kind are required on his magnets on an average of about once a year. As is characteristic of steel-mill machinery, the electrical apparatus is worked continuously until it completely fails, when it is then laid aside for repairs. Important machinery, an accident to which might cause a critical interruption, is of course regularly inspected for the development of possible trouble, but such appliances as the cranes, magnets, etc., are usually worked without heed at top-rate production until failure occurs in some part. Then the whole is thoroughly overhauled, as it is found that this practice keeps the device out of use the shortest proportion of time.

The magnet coils are usually impregnated by a vacuum treatment by the manufacturer, but after the first rewinding and repairs in the mill shop, where only a filling compound is inserted, they, of course, lack the protection of the complete impregnation, and are more subject to the grounds above mentioned.

In the experience of the company above cited the upkeep of a crane and electromagnet equipment, including all repairs and renewals, should not exceed $500 per year.

THE UTILIZATION OF EXHAUST STEAM.

By Herman Niemetz.

The central station being concerned exclusively with the transformation and sale of energy has done much to develop economy of such transformations in order to obtain a maximum return from a given investment. One of the most serious losses has been the heat energy exhausted from the engine and absorbed by the condenser cooling water. This loss appears at sight to be unnecessary and many ingenious schemes have been devised to reduce it to a minimum.

The binary engine developed by Professor Josse, of the Berlin Royal Technical Institute, was a very successful attempt. This engine consisted of two units, one using steam and the other sulphur dioxide; the exhaust steam being utilized to vaporize the sulphur dioxide. The use of two working substances introduced complications which made this engine impracticable for central-station work, so that it has never come into more than very limited use.

A more practical expedient in reducing these losses is the exhaust-steam turbine operating at very high vacuum. This method is especially successful in large plants, or in low and medium pressure plants equipped with reciprocating engines operating at rather poor economy. The turbine is particularly well suited to the utilization of low-pressure steam because of the ease with which it can be made to take care of large volumes of vapor that could never be utilized in a cylinder with a reciprocating piston.

The steam turbine has introduced many new possibilities in the way of economy and there is reason to believe that many

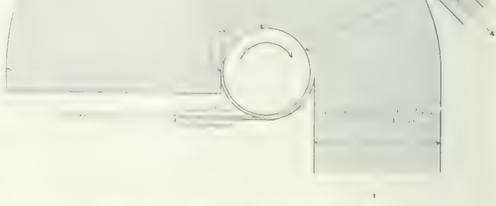


Fig. 1—Heat Balance, Condensing Unit.

more will be discovered as the art develops. The steam turbine does not introduce oil into the steam, therefore, the exhaust steam can be used to advantage in heating systems or discharged into the boiler feed. In addition to this advantage in heating

plants is the fact that steam of any desired pressure can be taken from the turbine by tapping into an intermediate stage, the turbine serving as a reducing valve. Two classes of turbine unit are adapted to use in connection with the generation of electric energy and the supply of steam to a heating system. One, the back-pressure turbine, and the other, the reducing turbine.

In order to make clear the advantages to be gained by these methods of operation, concrete examples will be chosen and the energy losses investigated with different methods of operation. Assume a high-pressure turbine unit having an output of 1000 kw with steam at 170 lb. per square inch and 572 deg. Fahr. (about 200 deg. superheat), and exhausting into a surface condenser at 28.5 in vacuum, cooling water at 60 deg. Fahr. The full-load steam consumption of this unit is taken as 15,850 lb. per hour.

The energy transformations from the coal to the exhaust are clearly shown in the diagram, Fig. 1, which represents the energy in pound-Fahrenheit heat units at different stages in the process. The power output of 1000 kw corresponds to 3,420,000 heat units per hour and the calorific value of the entering steam is 1323 heat units per pound, therefore the total hourly input to the turbine is $15{,}850 \times 1323 = 20{,}900{,}000$ heat units. The difference between the input and the electrical output is 17,480,000 heat units per hour and represents two groups of losses, namely: the machine losses and the exhaust losses. The machine losses include radiation, bearing friction, ventilation and electrical losses, and in this analysis this group of losses is assumed to be 379,000 heat units, while the remainder, 17,101,000 heat units per hour, is delivered to the exhaust. If the condensed steam is assumed to have a temperature of 86 deg. and that this temperature drops 9 deg., due to radiation, before the water reaches the boiler, then, radiation loss $= 15{,}850 \times 9 =$ 142,600 heat units; heat returned to boiler $= 15{,}850 \times 45 = 713{,}250$ heat units; total heat carried from condenser by steam $= 15{,}850 \times 54 = 855{,}850$ heat units. Therefore, the loss in the condensing water is $17{,}100{,}000 - 855{,}850 = 16{,}245{,}150$ heat units.

Next, working backward from the engine to the boiler, a loss of 7 lb. per square inch in pressure and 45 deg. in temperature is assumed. This corresponds to 22.5 heat units per pound of steam, or 363,400 heat units per hour. Summing the losses and assuming a boiler efficiency of 75 per cent the total calorific value of the fuel is found as below:

Item	Heat Units	Per Cent
Condensed steam pipe	142,600	0.52
Condenser cooling water	16,245,000	59.31
Electrical output	3,420,000	12.47
Machine loss	379,300	1.39
Steam pipe loss	363,400	1.31
Boiler loss	6,850,000	25.00
Total or fuel value	27,400,000	100.00

If the calorific value of the coal is taken at 12,600 heat units per pound, there will be required 2175 lb. of coal per hour to generate the 1000 kw.

If this 1000 kw were generated in a turbine unit carrying 28.5 lb. per square inch back pressure, the full-load steam consumption might have been 47 lb. per kw-hour, and the exhaust steam would have been available for heating purposes. Assuming a unit of this kind, the following heat balance is given:

Item	Heat Units	Per Cent
Cooling loss, condensed steam	856,000	1.10
Available for heating	[illegible]	67.62
Electrical output	3,420,000	4.38
Machine loss	400,000	0.53
Steam pipe loss	[illegible]	1.37
Boiler loss	19,462,500	25.00
Total or fuel value	77,850,000	100.00

Therefore, the amount of coal required per hour to produce 1000 kw and 52,644,000 heat units for heating is 6180 lb., assuming the thermal value of the coal to be the same as in the first example.

In order to compare this back-pressure turbine plant with a low-pressure heating plant it will be assumed that the 52,644,000 heat units are generated in low-pressure boilers and that the 1000 kw are produced by the high-pressure condensing turbo unit analyzed in the first case. The heat balance of the low-pressure heating plant, assuming condenser water to be at a temperature of 70 deg. and to lose 10 deg. on its return to the boiler, the following heat balance may be written:

Item	Heat Units	Per Cent
Cooling loss of condensed water	[illegible]	[illegible]
Available for heating (including pipe loss)	[illegible]	[illegible]
Boiler loss	[illegible]	[illegible]
Total or fuel value	71,300,000	100.00

The coal required by this heating plant is 5700 lb. per hour, which, added to that required by the condensing turbine as found above, makes a total of 7875 lb. per hour as compared to 6180 lb. used in the back-pressure plant. Therefore, the back-pressure plant shows a saving of 1685 lb. of coal per hour. Furthermore, the first cost and maintenance of the back-pressure plant is less than that of a plant having both high and low-pressure boilers.

Looking at it from another direction, the back-pressure plant required 6180 lb. of coal per hour, 5700 lb. can be considered as used to produce steam for heating, then 480 lb. is all that is required to produce 1000 kw-hours, or 0.48 lb. per kw-hour. This coal consumption, when taking the condensing unit at 15.85 lb. of steam and 2175 lb. of coal per hour as a basis, corresponds to a steam consumption of

$$15.85 \frac{480}{2175} = 3.5 \text{ lb. per kw-hour.}$$

The use of back-pressure turbines in connection with central-station heating plants is being tried out on a large scale by some

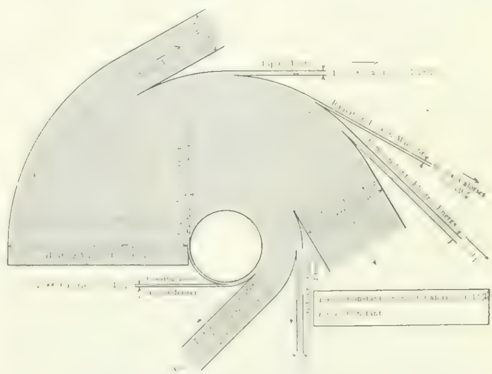


Fig. 2—Heat Balance, Pressure Reducing Unit.

central-station companies in the United States. Turbine stations are located at different points on the system and the exhausts connected directly to the steam-heating mains. One of the great advantages of this system is the low cost of the station equipment and the great saving in feeder copper.

The bleeding of condensing turbines at an intermediate stage offers greater flexibility of operation than the use of back-pressure turbines, although it involves a slightly greater first cost. The analysis of a concrete example along the lines employed above will bring out the various points involved.

Assume a 1000-kw condensing turbine arranged for bleeding, the steam required for heating amounting to 22,000 lb. per hour at a pressure of 28.5 lb. per square inch. Basing the calculations on the assumptions used in the previous examples the heat balance (Fig. 2), shown in the table following, is obtained.

The coal consumption, assuming the same heat value as before (12,600 heat units), is 4400 lb. per hour. With the high-pressure condensing turbine unit alone, the coal consumption was found to be 2175 lb. per hour. The previous calculation for low-pressure steam generation showed that it required 5700 lb. of coal to produce 47,000 lb. of steam; that is, 1 lb. of coal generated 8.25 lb. of steam at 28.5 lb. per square inch. Therefore, in this case, 22,000 lb. of steam would require 2670 lb. of coal if generated in low-pressure boilers, the total being 4845 as against 4400 with the turbine.

[illegible]	[illegible]	[illegible]
Cooling loss, condensed steam	83,600	[illegible]
Condenser cooling water	[illegible]	[illegible]
Available for heating	[illegible]	[illegible]
Electrical output (total)	3,420,000	[illegible]
Machine loss	[illegible]	0.69
Steam pipe loss	[illegible]	1.28
Boiler loss	13,862,500	25.00
Total or fuel value	55,450,000	100.00

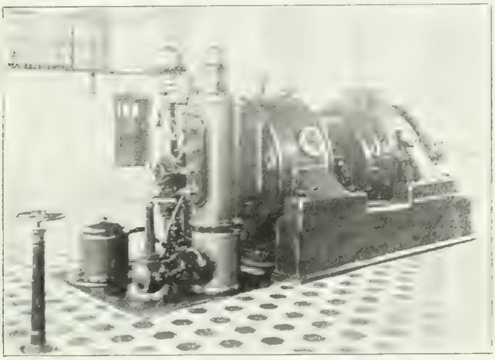


Fig. 3—Back-Pressure Turbine Unit.

The advantage of this method is the ability to always get full power at maximum turbine economy independent of the heating load. When using all the steam for heating the machine runs as a pure back-pressure unit with the low-pressure stage in a vacuum. Enough steam must be let through the low-pressure stage to keep the condenser in operative condition. On the other hand, if no steam is used for heating, then the unit runs as a straight condensing machine, and at maximum steam economy. At any intermediate load condition the heating steam will be supplied in the amount required and the power required above that developed in the high-pressure stage will be developed by steam taken through the low-pressure stage.

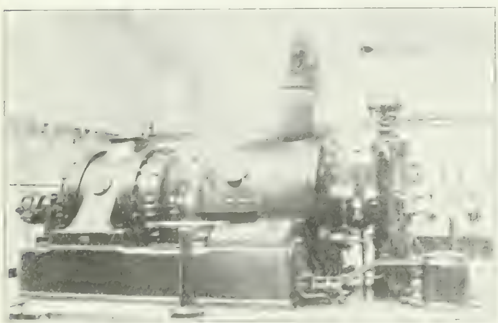


Fig. 4—Reducing Turbine Unit.

Figs. 3 and 4 show actual installations of the back-pressure and reducing turbine, respectively. These turbines are of the Allgemeine Elektricitäts Gesellschaft make, and are used in manufacturing plants where large quantities of steam are required for heating purposes. In this type of turbine the regulation is accomplished solely by automatic adjustment of the admission, independent of the amount of steam required for heating.

BOILER AND ENGINE ROOM PRACTICE OF THE BROOKLYN EDISON COMPANY.

In a portion of a paper on "Electric Power-Plant Operation" read at the convention of the Brooklyn Company Section of the National Electric Light Association at Manhattan Beach, N. Y., June 24, Mr. C. H. Courser gives some interesting facts on the boiler room practice in the Gold Street station of the Edison Electric Illuminating Company, of Brooklyn. In this station there are 14,600 boiler hp., made up of 650-hp and 750-hp Babcock & Wilcox units. The boilers are equipped with what are known as Webster furnaces, a kind of Dutch-oven arrangement for immediately igniting the fuel when it is thrown on the fire. Each boiler is fitted with superheater and shaking grates. The latter are divided into eight sections to enable the firemen to shake any portion of the fire requiring it, and also to enable fires to be carried at any desired thickness. The number of boilers in use varies with the load During the day each boiler supplies 1000 kw of turbo-generators and during maximum load each boiler is forced to feed 1500 kw of generating apparatus.

The boilers when not in use are banked. The fire is first cleaned, spread over the grate and then covered heavily with coal. The dampers are closed, cutting off all draught. During this process, the steam pressure in the boiler drops below the pressure in the mains. This causes the automatic stop valve on the top to close, the valve remaining closed while the boiler is banked. When the boiler is needed for service the dampers are opened and the fire shaken. When the steam pressure has been brought up to 1 lb. in excess of that of the mains, the automatic stop valve opens and the boiler is then in service.

After a boiler has been out for repairs or internal cleaning the process of starting is as follows: First, it is filled with water to the lower gage cock and the superheater flooded. The grates are then covered to a depth of 3 in. with bituminous coal and fire from another furnace is thrown in on top. This is carefully covered with a little bituminous coal and a small amount of draught put on. As the fire builds up and the water in the boiler begins to steam, the tube caps at both front and rear are examined for leaks; the joints around the stop valves, cross-over pipes and superheater connections are examined. If found tight, the fire is gradually increased until the boiler has about 40 lb. steam pressure. The flooding valve on the superheater is then closed and the water blown out. The drip on the boiler bend connecting the automatic stop valve with the header is opened, and then the gate valve on the header end of the bend This allows the steam pressure from the other boilers to come to the upper side of the automatic stop valve. The hand-operated stem on this valve is opened, and the steam pressure on the boiler carefully watched, until the pressure has become 1 lb. or 2 lb. more than the line pressure. At this point the stop valve will open and the boiler is then in service.

The water-tender is responsible for the condition of the fires, the height of the water in the boilers, and the steam pressure during his watch. He reports directly to the boiler-room engineer, who is responsible for the entire boiler house and all men connected with it during his eight hours on duty.

A daily logsheet is kept showing the hours steaming and the hours banked for each boiler, and when closed; also an hourly record of steam pressure, steam temperature and feed-water temperature. The feed water is supplied to the boilers by two four-stage centrifugal pumps, each driven by a 225-hp steam turbine.

The water of condensation from the condenser hot wells is pumped by 5-in. centrifugal pumps driven by 35-hp steam turbines, either into the heater or into the river. The water necessary to replace that lost by blowing-down boilers is taken from the city mains into the heater and controlled by a float valve. From here the water drops into the feed pumps, and is pumped through the feed mains under 225-lb. pressure to the boilers; each boiler being controlled individually by a feed valve operated by the water-tender.

The Gold Street station is strictly a turbine plant containing one 9000-kw Curtis turbine, one 6000-kw and one 5000-kw Allis-Chalmers turbines and one 7000-kw Westinghouse unit. Each turbine is fitted with a surface condenser outfit, the circulating water for which is taken from the East River through a concrete tunnel extending the length of the turbine room. The discharge is returned to the river by a tunnel located directly over the top of the intake tunnel. The circulating pump has only to overcome the resistance in the condenser tubes. Each condenser has a dry-vacuum pump for removing the air and on the bottom of each condenser is a hot well for collecting the water of condensation. An hourly record is kept of the steam pressure, the inlet steam pressure, the vacuum and temperatures, and the number of hours each turbine is in service.

The method in starting one of the main generator units is as follows: First, the air siphon on the circulating pump and the condenser is started. This creates a vacuum in the circulating pump and the water space of the condenser, allowing the water to flow from the intake tunnel through the circulating pump and into the condenser. The circulating pump is then started, which forces the water through the condenser. The auxiliary oil pump is now started, causing a circulation of oil through the main bearings and to the governor of the turbine. The next step is to open the throttle on the turbine enough to allow a small amount of steam to flow through and heat it up. This process is continued from 30 to 45 minutes, after which the turbine is given steam enough to revolve from 50 to 75 turns per minute for a period of five minutes. This is done so that the spindle and casing of the turbine may be heated up evenly and expanded alike around the entire circumference. The throttle is then shut, allowing the turbine to come to rest. When it is required for service, the switchboard attendant on the gallery notifies the engineer by proper signals. The engineer then starts the turbine and allows it to come rapidly up to speed. At the same time the pump oiler starts the dry vacuum and hot-well pumps, so that when the turbine is up to speed it has its full vacuum. The water is then turned on to the glands and the oil cooler, through which the oil from the bearings circulate.

The turbine generator is then ready to be synchronized with the system, which is done by the switchboard operator. As soon as the generator is synchronized and the switch closed, the engineer is given the "O. K." signal whereupon he opens the throttle wide. The turbine is then on the system. From this time on, the attention required is that the bearings be examined every 15 minues for heat, and the temperature of the discharge oil from the bearings noted, and at the same time the pump oiler makes an inspection of the bearings on the auxiliaries and the height of the water in the hot well. The assistant watch engineer looks after the turbines and the auxiliaries to make sure that the oilers attend to their duties. This leaves the watch engineer free to look after the plant, and he is directly in charge of all steam operating men. When the load is such that it requires two turbines, the third unit is kept hot and the auxiliaries running, so that it may be put on the line in from one to three minutes.

The operation of the three-phase transmission system is controlled by a system operator who directs its general operation and keeps a load curve showing the output of the generating apparatus, noting all changes in operating conditions both in the generating and substations. He has before him a dummy board of the system, with switches and buses, and his miniature switches agree in position with the actual connections to the various apparatus.

A. I E. E. PAPERS AND DISCUSSIONS

Following are abstracts of some of the papers presented last week at the Jefferson convention of the American Institute of Electrical Engineers, together with brief summaries of the discussions to which they gave rise. The papers here given were among the more practical ones read, and are not printed in the order of their presentation; those bearing on the same general subject follow each other. An account of the proceedings of the convention in detail is printed elsewhere in this issue.

OIL SW TCHES.

In a paper entitled "The Modern Oil Switch, with Special Reference to Systems of Moderate Voltage and Large Ampere Capacity," Mr. A. R. Cheyney, of the Philadelphia Electric Company, related experience with oil switches designed for e.m.fs. not exceeding 13,000 volts and currents up to 3000 amp. The author stated that experience has frequently demonstrated that no modern circuit-opening switch operating under short-circuit conditions is entirely safe to be used again without a thorough overhauling of the contacts, cleaning up of the switch and its compartments, on account of the large amount of oil which has been blown out by the explosive pressure of the arc, and also the refiling of the switch cylinders. It is frequently necessary to insert an entirely new set of contacts and to file down the rod tips. This whole operation involves a period of at least two hours, and if spare feeders are not available may lead to considerable annoyance, while, in any case, it may involve a temporary disablement of a large and important investment in apparatus.

Changes, such as the substitution of steel for brass pots, the addition in some instances of insulating dashers to assist in keeping the oil within the pot and also to facilitate the breaking of an arc, and improved operating mechanism and contacts, cover practically all the main points that have been improved upon since the introduction of the 8-in. cylinder 8 or 10 years ago, notwithstanding the enormous increase in maximum short-circuit output of the turbo-generator over that of the engine-driven alternator of equal rating and the fact that the size of units has increased from 5000 kw to 20,000 kw. The substitution of boiler-iron tanks for wooden tanks and the gravity opening, with a means of obtaining a certain forced oil flow across the contacts on opening the switch, are a few of the changes in another type.

As a matter of record, with 15,000 kw of turbines in service, the latest type of oil switch has been quite recently practically emptied of its oil, the remaining oil being reduced to a state of absolute blackness and the contacts and rods so badly burned that they were unfit for further use without renewing, makes it evident that some change is needed in our present switchboard or switch design.

Although there has not been a great deal written upon the exact nature of what takes place when a heavy arc is broken, experimental evidence has shown that the quality of the switch oil will without doubt play a very important part in the switch of the future. The electrostatic stress set up between two charged conductors in a light mineral oil such as is used in switches and transformers will, under proper conditions, even though there is no appreciable current, release considerable quantities of gas without appreciable change in the oil itself, and as this gas is naturally rich in hydrogen, it may be that the explosive violence of some of the short-circuits is due to the combination of this gas and the gas driven off by the heat of the arc with oxygen, possibly of the air. The carbonization which took place when a heavy short-circuit was broken in a certain case was sufficient to make a deposit on settling of 0.38 in. in a 4-in. column of oil, or a total volumetric proportion of 10 per cent between the amorphous carbon and the clear oil above.

Whether or not the changes in an oil produced by carboniza-

tion under heavy arcing improves or reduces the values of the remaining filtered oil for use in oil switches, it seems quite urgent that oil for switch purposes be chosen with great care, and manufacturers should make public satisfactory specifications to cover such oils and the testing of the same. It is by no means certain, as is frequently claimed, that a good transformer oil will make a good switch oil. Carbonization under heavy arcing is undeniably unavoidable.

There has been developed, although apparently it has never yet been introduced as a commercial article, an oil switch in which the oil is at all times under pressure which is maintained by a compressed air system—a pressure line at perhaps 150 lb. to 200 lb. caring for a number of switches, and a gravity or return line returning the discharged oil to the system. This principle seems to be exceedingly promising insofar as breaking the arc is concerned. In some cases the switch cylinders are always full of oil under pressure, the opening of the contacts allowing a heavy stream of oil to be forced directly across the arc and through the hollow contact to atmospheric pressure. In another case, the tripping coil opens an oil valve which admits large quantities of fresh oil under pressure to come into direct contact with the heated terminal directly at the base of the arc. It is undeniable that the mechanical squeezing out of the arc is what is needed.

The author stated that experience has demonstrated that constant vigilance is necessary with regard to every part of a generating system if service conditions are to be maintained at the highest point of reliability. Especially is this true of the oil switch in large systems. Certain defects can be noticed by visual inspection; others require the operation of the switch one or more times, while the inspector closely watches the mechanism and tanks. Still others can only be found by actually taking the switch apart and reassembling it. The inspection necessary, therefore, covers the knife switches, the insulators and contacts, oil-switch mechanism, tanks, rods, base insulators and compartment. In order best to accomplish this work the switches should be inspected daily, weekly and yearly.

The daily inspection of mechanism covers the tightening up of possible loose nuts, etc., general cleaning of switch, and all that can be observed with a reasonable amount of attention while the switch is in service, and should be given to every switch whether carrying current or "dead."

The weekly inspection covers the operation of the switch from four to six times to observe clutch conditions, tripping coils or contacts, open-circuits in wiring, loose parts, bolts, nuts, etc. This test also insures the switch being securely bolted down to its compartment.

Once a year every switch should be completely taken down, each part cleaned and oiled, contacts brightened, supplied with fresh oil, and any minor defects that may have crept in should be remedied as far as possible.

The daily inspection eliminates the minor troubles apparent to a trained observer; the weekly inspection makes it possible practically to eliminate all external troubles in the switch compartments and in the mechanism, and especially failures to operate when called upon, whether due to open tripping coils, defective clutch coils or otherwise, and practically insures the switch against trouble due to pumping; while the yearly inspection cleans up the switch as a whole, making it possible to start a new year with switches fresh and complete from top to bottom.

In conclusion the author said that the present state of oil-switch development with especial regard to its continued use in the large installations of the future has not given the operating man quite the same vision of perfect security and unlimited capacity as he would desire. There is need for a more powerful switch which will stand up in continuous service for at least a year without the necessity for overhauling every time a short-circuit is opened.

DISCUSSION.

Mr. William I. Donshea, of the New York Edison Company, said that 450 oil switches in regular service have been found to open the circuit without failure and without causing damage to the apparatus to be tested. The switches are kept in as nearly perfect condition as possible, even the oil being renewed after each opening under load.

Mr. P. Junkersfeld, of the Commonwealth Edison Company, of Chicago, related his experience with more than 200 oil switches, showing the switches do not give entirely satisfactory service on account of their inability to withstand the treatment to which they are subjected under short-circuit conditions. In order to obtain reliability in performance it is necessary to expend a large amount of money in an elaborate array of switches and emergency devices. When present types of switches are installed use should be made of reactors to cushion the blow on the switches. What is urgently demanded is a new design of switch for the severe service conditions now encountered.

Mr. F. W. Harris, of Pittsburgh, admitted that switches intended for controlling as much power as 10,000 kw in a single unit are not reliable; they never fail to open the circuit when kept in proper condition, but often are damaged during the period of opening a short-circuit. A difficulty which the manufacturer has met resides in the impossibility of testing such switches under short-circuit conditions, as no manufacturer is willing to produce deliberately a direct short-circuit on a 10,000-kw generator. For the operation of such a switch a solenoid is preferable to a motor.

Mr. C. W. Stone, of Schenectady, said that a switch cannot be designed to open a circuit instantaneously with absolute accuracy, even if it were desired to obtain one for doing so, and hence some damage may always be expected. For the purpose of minimizing the current on short-circuit use should always be made of reactors when the concentrated power exceeds safe limits. He claimed that the motor-operated type of switch is preferable to the solenoid type by reason of the greater certainty of opening; it can be so arranged as to open positively even when the source of supply to the motor is interrupted.

Mr. D. B. Rushmore, of Schenectady, called attention to the fact that the performance of oil switches in regular service is highly satisfactory, while even under extreme emergency conditions there have been almost no failures. The damage produced has been to the switch itself, rather than to the apparatus which the switch is supposed to protect.

Dr. C. P. Steinmetz stated that oscillographic observations of oil switches shows that the circuit is always opened at the zero value of current, at which time the voltage is usually quite high. The arc produced in the oil as the switch is opened generates an enormous local gas pressure by reason of the relative slowness of the oil-mass to take on motion. This pressure has been known to exceed 2000 lb. per square inch.

PHOTOMETRIC STANDARDS.

Dr. E. B. Rosa and Mr. G. W. Middlekauff, of the Bureau of Standards, discussed the properties of carbon-filament incandescent lamps which render them advantageous as photometric standards.

The authors stated that there are two kinds of primary standards employed in physical measurements, namely, those which can be described in such terms that they can be accurately verified or reproduced from their specifications, and those which are more or less arbitrary and which cannot be reproduced except by copying other standards of the same kind. Primary photometric standards may be of the first kind or of the second kind. Although primary standards of the first kind are to be preferred, *other things being equal,* obviously a reliable, convenient and permanent standard of the second kind is better than an unreliable, inconvenient and ephemeral standard of the first kind. Many primary photometric standards of the first kind have been proposed and a considerable number have been used. The flame standards are not permanent, but ephemeral, and the greatest difficulty in the use of such standards is not the lamp, which is merely the instrument in which combustion takes place. The greatest difficulty is to secure uniform fuel and uniform atmospheric conditions, and as considerable fluctuations in both are inevitable, one is driven to taking many observations and averag-

ing out the errors as far as possible by taking the mean. The other reproducible standards that have been proposed are even less satisfactory than the flame standards.

The most successful photometric standards of the second kind are carbon-filament incandescent lamps, which have been employed for many years as convenient working standards, and in recent years have been employed in making careful comparisons of the photometric standards of different countries. Such lamps cannot, of course, be made accurately to specifications, but if they are sufficiently permanent they may be employed to maintain the unit of light for an indefinite period. Work done at the Bureau of Standards tends to show that carbon-filament lamps when properly made and carefully seasoned are remarkably permanent and reliable, and that a single group of lamps might serve to maintain the units of light for a century, provided they are protected from violence and used with ordinary care as primary reference standards, even though burned as much as half an hour at a time every six months for the entire 100 years.

The above conclusions have been based on refined measurements made with potentiometers having a sensibility of 0.01 volt when using 100 volts and ammeters capable of measuring current to the fifth significant figure.

As to the precision of photometering carbon-filament lamps, photometers are now available with such a precision that the mean error of the determination of candle-power on any lamp at one time need not exceed 0.2 per cent, whereas the mean error of the average value of six lamps photometered at one time may be less than 0.1 per cent. If a group of six lamps be photometered by four different experienced observers, the mean of the four will, of course, be still less in error. These figures are the results of a large number of experiments with rotating standards, of the same color, and stationary standards may be measured with substantially the same accuracy.

With such precision of measurement and a life performance of standards such as is readily obtainable, it would seem as though the unit of candle-power not only of a commercial laboratory, but also of a national standardizing laboratory, or even of a group of national standardizing laboratories, could be maintained for a long period of years by carbon-filament incandescent lamps far more constant than could possibly be done with flame standards or any other form of primary standard as yet proposed.

DISCUSSION.

Dr. C. P. Steinmetz outlined the history of the development of the standards of length, resistance, current, etc., and showed that similar history relating to the standard of candle-power is now being made. It is essential to obtain as the final standard one that can be described in such terms that it can be accurately reproduced at any time. Incandescent lamps as standards, although very convenient, possess the undesirable feature of drifting or changing slightly in candle-power with time. The drifting tendency should be absent in a reliable standard.

Dr. A. E. Kennelly, of Harvard University, stated that even with their imperfections, the incandescent electric lamp standards are far more precise than any flame standard of candle-power.

AUTOMATIC TELEPHONY.

In a paper entitled "Telephone Engineering Around the Golden Gate," Mr. Arthur B. Smith, of the Automatic Electric Company, described the automatic telephone exchanges installed in Oakland and San Francisco, Cal. In Oakland there are five offices, designated as A, B, F, and district stations 1 and 2, while in San Francisco there are four offices, C, J, M and S. The offices are designated by letters instead of figures, the numbers relating to subscribers' stations served from the various offices. The manipulation of the dial on the calling subscriber's instrument for an average call number takes about five seconds, after which the bell of the called station begins to ring without further action on the part of the calling subscriber. The ring is intermittent and ceases when the called subscriber answers. Instantaneous release of the switches is effected by hanging the receiver on the hook. This is of interest chiefly to those who have two or more calls to make in succession.

The author described in detail the methods for handling interoffice trunk calls, suburban and long-distance calls and for collecting the charges for each call. The Oakland exchange is operated on the flat-rate basis for all calls originating and terminating within the exchange, which includes the suburb of Berkeley. In San Francisco measured service is required, use being made of an automatic two-coil meter attached to the line switch, so arranged that when the called station answers, the current supplied to the latter operates a relay which reverses the current supplied to the calling line. This causes the meter to record one call. Neither coil alone will cause registration, and the apparatus has a range from 0 to 1500 ohms line resistance. Its line coil is of low resistance and is short-circuited during conversation. The reversal of current for operating the meter is accomplished in such a manner as not to cause inconveniences to the calling subscriber.

The larger proportion of the calls between the two cities are handled on the credit basis. From the records of the toll tickets statements are made out at regular intervals and sent to the subscribers for payment. For such public places at which it is desirable to collect cash for suburban and long-distance service, a regular coin box is attached to the telephone. The dropping of the coin gives a signal which reveals its denomination to the operator.

There was no discussion on this paper.

AMERICAN TELEGRAPH ENGINEERING.

A paper by Mr. William Maver, Jr., of New York, and Mr. Donald McNicol, of Salt Lake City, recorded some of the salient features of present telegraph engineering practice in America. The authors stated that as a source of e.m.f. for telegraph service gravity batteries have been almost entirely displaced by direct-current generators, operating either alone or in connection with storage batteries. Some use is also being made of electrolytic rectifiers for charging the batteries from alternating-current circuits.

In many cases Morse duplex circuits, or portions of them are used simultaneously as telephone circuits, the wires of two such duplex telegraph circuits being employed as one metallic circuit for telephonic purposes. The Wheatstone bridge method of rendering the polar relays irresponsive to the home pole changers is used, the arms of the bridge being formed of a double retardation coil, which is found to be an efficient, practical device. Composite circuits are employed in this country and Canada very extensively, notably by the American Telephone & Telegraph Company, also by the telegraph department of large railway systems. Between New York and Boston alone at least 50 leased telegraph wires are in daily operation on long-distance telephone circuits, and this dual use of circuits is being rapidly extended in telegraph practice, all new line constructions [illegible] being designed with this end in view, the increased earning capacity of the wires gained thereby being the obvious incentive thereto.

At the present time the tendency of American practice is to the employment of lower e.m.fs. at the terminals of the circuit and to lower resistances in the relays for multiplex working. During the period when No. 9 iron wire was the standard for telegraph purposes, and when the insulation resistance of the lines was far below present-day standards, a high e.m.f. was necessary in order to maintain proper current values, but by the substitution of low-resistance copper conductors in place of iron wire and with improved line construction, the way has been paved for the employment of lower voltages, and relays of much reduced resistance in multiplex operation. Thus some very satisfactory results have been obtained recently in different parts of the country on quadruplex circuits using e.m.fs. as low as 200 volts on well-insulated lines of comparatively low resistance (2 ohms per mile) and with polar relays wound to 100 ohms and neutral relays to 50 ohms. The length of the cores of these relays has been somewhat increased. The "potential" resistance of 600 ohms (usually inserted between the current generators and the multiplex apparatus) in

these instances has also been reduced to 300 ohms, and the "proportion" resistance and "leak" shunt in the field key system from 1200 ohms to 600 ohms, and from 900 ohms to 450 ohms, respectively. The objective in these modifications of the prevailing practice is to reduce the inductive effects upon parallel circuits and to render the relay less sensitive to inductive disturbances from any source.

DISCUSSION.

Mr. R. W. Pope, of New York, called attention to the noteworthy fact that, although numerous rapid telegraph systems have been devised and installed, the manual Morse sender and receiver have survived all attempts to overthrow and remain the accepted standards for service. Manual sending with the old-type key corresponded in speed with the ability of the receiving operator to write out the message by pen. With the adoption of the typewriter for transcribing a higher sending speed is possible, and for this purpose the Martin mecograph, which makes all dots automatically, but requires manual operation for the dashes, has proved well suited. However, high-speed machine telegraphy may prove excellent for transmitting "night lettergrams."

Mr. J. B. Taylor, of Schenectady, remarked that telegraphic service means much more than the mere sending of a message at the greatest rapidity between two telegraph offices. The message must be delivered to the proper person in a form suitable for conveying to him the desired information. The necessity for writing out the received message and delivering it at any one of many thousand out-of-the-way places has been the prime reason for the retention of manual telegraphy. All of the disturbance to telegraphic circuits caused by neighboring transmission lines could be effectively eliminated by substituting metallic circuits for the ground-return circuits now universally employed.

Mr. W. B. Hale, of Mexico City, outlined the telegraphic methods employed by the Mexican governmental system. This system is operated without any attempt to obtain a profit on the investment, but rather as a service for the people. The consequence has been that messages of congratulation and those of a social nature are usually sent by telegrams in Mexico. The Government has placed on sale telegram-cards costing 5 cents upon which a message of 10 words may be written for transmittal anywhere within Mexico City. These cards are deposited in boxes and collected at one-half-hour intervals for transmittal by Government employees.

BALL BEARINGS FOR STREET CARS.

Mr. Cyril J. Hopkins, of the Hess-Bright Manufacturing Company, presented a paper calling attention to the saving in energy consumption that may be obtained by equipping cars with ball bearings and operating them on a schedule allowing considerable coasting.

The author stated that in the case of a plain bearing car making a run of 2900 ft. in 82 seconds without coasting the car consumes 110 watt-hours per ton-mile. By allowing 83 seconds for the run, a 16-second coast is admissible and the energy consumption is reduced to 94 watt-hours per ton-mile. By allowing 84 seconds for the running time the energy consumption is reduced to 88 watt-hours, which can be further reduced to 75 watt-hours by equipping the car with ball bearings, the coasting period being extended thereby from 24 to 35 seconds.

In addition to the saving in energy obtained by using the ball bearings, the author claimed for them increased comfort to passengers and decreased maintenance charges on brakes and motors.

DISCUSSION.

Mr. A. H. Armstrong maintained that when the bearings on a car are changed from the usual cylindrical to the ball type there should be a corresponding change made in the gear ratio if the results obtained with the older arrangement is to be compared with that obtained with the newer one.

Mr. N. W. Storer remarked that not all of the energy saving reported by Mr. Hopkins should be attributed to the ball bearings, because much of it was due to the change in the coasting conditions.

Mr. H. S. Putnam said that the mere substitution of ball bearings for bearings of the ordinary type could not produce so great a saving as claimed by Mr. Hopkins since he had claimed a possible reduction in the tractive resistance of 8 lb. per ton, since bearing friction alone is not so great as this amount.

Mr. F. J. Sprague ventured the prediction that within a few years ball bearings will be quite generally adopted for railway cars.

ENERGY FOR OPERATING RAILWAYS.

Mr. H. St. Clair Putnam presented a paper describing some tests made on the Manhattan Elevated Division of the Interborough Rapid Transit Company, New York, in which a clock was used to record the amount of coasting employed in the operation of trains, the object of this device being to obtain from the motormen a better manipulation of the trains with the resulting economy in the consumption of energy.

The clock used in the tests consisted of a mechanism manufactured for factory and office use for recording the time of employees. To the balance-wheel escapement there was added a braking device which is lifted free from the balance wheel by an electromagnet which is energized only during the coasting of the train. This permits the clock to record the coasting time only. Each motorman's service is rated according to the percentage that the coasting time is of the total time of the run.

The object in employing the clock is to encourage the motorman to accelerate the trains at a high rate and lose less energy during the braking period. It was estimated that under the Manhattan Elevated conditions, providing other factors of train operation remain the same (that is, the braking, running time and time of stop), an increase in the rate of acceleration from 0.9 mile to 1.47 miles per hour per second will result in an increase in the percentage of coasting time from 0 per cent to 40.5 per cent of the total time, and a saving of 36 per cent in energy consumption.

As a result of operation with the coasting time clock it was found that an increase in the percentage of coasting from 12 to 37.5 effected a saving in energy consumption of 24 per cent. The author claimed that it is preferable to measure the time of coasting rather than the amount of energy actually consumed, since coasting represents the recovery of energy already used and is the key to the whole problem of economical operation. At the same time it concentrates the motorman's attention on that element of operation which is the direct reason for the saving in power which results from changes in the methods employed as to the other factors of operation.

DISCUSSION.

Mr. A. H. Armstrong, of Schenectady, called attention to the increase in power involved in saving energy by coasting, and stated that an increase can be made in the acceleration without increasing the maximum power demanded from the station by accelerating at a more rapid rate with the motors in series while maintaining the former rate of acceleration during parallel running. Thus a 100 per cent increase in the current per motor, while in series, would be needed in order even to equal the power demand with the motors in parallel.

Mr. N. W. Storer, of Pittsburgh, remarked that the coasting time clock insures the proper manipulation of the controller to a much greater degree than is possible when the motormen are merely instructed as to the methods to be employed for saving energy.

President L. B. Stillwell pointed to the absurdity of demanding from the manufacturers machines giving efficiences of almost 100 per cent and then carelessly losing 24 per cent of the generated power by improper operation of the cars. He estimated that the saving produced by the adoption of the coasting-time clocks on the Second Avenue division of the New York elevated roads is equivalent to $1,000 per day.

Mr. Frank J. Sprague said that for the purpose of insuring uniform accuracy in acceleration the automatic equipment,

which renders the rate of acceleration independent of the motorman, is far preferable to the manually controlled equipment.

Mr. G. H. Hill, of Schenectady, discussed the habit of many motormen of applying the brakes long before reaching a station, thereby necessitating extra energy for bringing the train to the platform. He said that much energy could be saved by equipping the cars with automatic devices for controlling the retardation during the braking period.

In answer to a question by Mr. J. B. Taylor, Mr. Putnam stated that the coasting-time clocks are so installed and operated that a motorman is unable to obtain a false record, assuming that he wished to do so.

MECHANICAL FEATURES OF ELECTRIC LOCOMOTIVES.

Messrs. N. W. Storer and G. M. Eaton, of the Westinghouse Electric & Manufacturing Company, presented a paper containing a discussion of the essential features of an electric locomotive. Among these are: (1) Mechanical parts of strength sufficient for the required service; (2) motors of sufficient size to develop the required power; (3) a reliable transmission system between the motors and the driving wheels; (4) weight on driving wheels sufficient for adhesion; (5) a complete control system; (6) riding qualities enabling the locomotive to negotiate the rails without undue damage. More or less closely associated with these essentials there is an endless variety of detail concerning which no two men will hold identical opinions. The electric locomotive designer must act as a clearing house for the opinions and ideals of all the men associated with railroad electrification. To prepare himself for this position, he must view the locomotive through the eyes of men connected with every branch of the service.

The authors outlined the conflicting requirements for switching service, slow-freight service, fast-freight service, and high-speed passenger service, and stated that while it is commercially practicable to cover a considerable range of speed and weight of trailing load with one locomotive, and any passenger locomotive may be used to handle on its lower speeds freight trains within its range of tractive effort, yet where the weights of trains to be handled and the speeds at which they operate vary as widely as they do on most trunk lines, an absolutely interchangeable locomotive is impracticable.

The electric locomotive is not so well suited for interchangeable service as is the steam locomotive because of the fact that its continuous tractive effort is practically constant regardless of the speed at which it is operated. A steam locomotive, on the other hand, can develop its maximum horsepower at almost any speed, and its continuous tractive effort may be anything from its maximum, which is developed at starting, down to that necessary to give its maximum horsepower at its maximum speed. It may be contended that where gearless motors are used it is simply a matter of winding the motor to develop a given tractive effort at its maximum speed, and it will then be suitable for any service requiring this tractive effort at lower speeds. This is true, but for mechanical reasons the converse is not true; namely, that a freight locomotive can be operated in passenger service by winding the motors for a higher speed. An economical mechanical design for a locomotive, which is thoroughly satisfactory for freight service, will not be at all suitable for the high-speed passenger service. Steam locomotives have been used interchangeably to some extent in railway service, but in general this has been found impracticable.

In discussing transmission through gears, the authors remarked that gears can be obtained to perform satisfactorily in any class of railway service. They said that while it is too early in the use of gears for large locomotives to make an absolute statement of fact in regard to the allowable pressure, experience thus far indicates a pressure of 1000 lb. per inch width of gear face as a perfectly practicable value for continous rating of large gear. With special steel pinions and high-grade gears it is probably safe to exceed this figure. It is well known that for short hauls pressures far above 1000 lb. per inch are now in daily successful operation. In the locomotives for the St. Clair tunnel, for instance, the pressure is carried on a single gear having a 6-in. width of face. The normal loads at which the locomotive operates on the up-grade give a pressure of from 1500 lb. to 2000 lb. per inch width of face on the gears. With this pressure the pinions have a life of from 40,000 miles to 50,000 miles, and none of the gears has yet worn out, although the locomotives have been in continuous operation for over two years. With twin gears there is a possibility of further increase in unit pressure as the absence of relative skewing of pinion and gear shafts produces a better application of the tooth load.

Transmission by side-rods possesses some very distinct advantages. It permits the use of a single powerful motor to drive two axles. The motor is mounted in the cab instead of under it, so that all parts are readily accessible and are thoroughly protected from dust, dirt and water from the roadbed. The location of the heavy motor so high in the cab raises the center of gravity of the locomotive to a height corresponding to that of high-speed steam locomotives. The side-rods form a transmission system that is familiar to all steam-locomotive operators. It apparently has all the good points of the steam locomotive rods and is, in addition, susceptible to perfect mechanical balance and gives a uniform tractive effort.

The side-rod type of locomotive is at a disadvantage when compared with the high-speed geared type, because of the fact that the mechanical parts of the locomotive and also the motor frames must necessarily be much heavier to withstand the reciprocating stresses imposed on them. They will also require much more careful work in assembling, and will, therefore, be more expensive. On the other hand, it would seem that after the side-rod locomotive is once completed the mechanical parts should be very cheap to maintain.

DISCUSSION.

In introducing the discussion on Mr. William McClelland, the chairman of the railway committee of the Institute, outlined the fundamental difference between the problems encountered in designing steam and electrical locomotives. The most prominent difference relates to the thermal problems. With the steam locomotive it is desirable to maintain a high temperature, while with the electric locomotive it is best to keep the apparatus as cool as possible.

Mr. A. F. Batchelder, of the General Electric Company, claimed that in the design of switching locomotives it is not essential to obtain the minimum possible dead weight per axle, this feature being of relatively minor importance. Moreover, the necessity for high center of gravity has been much exaggerated. The desired results can be obtained by placing the supporting springs near together rather than far apart. The permissible weight per axle is not set by the whim of the operating men, but is determined by the condition of the track and the strength of the bridges. An excellent design consists in placing the weight near the center of the locomotive and employing such an arrangement as most readily to steer the mass in the direction of travel. Mr. Batchelder showed a recent proposal for embodying all of the desirable features in an articulated symmetrical electrical locomotive in which use is made of both gears and side rods, the center of gravity being only moderately high.

Mr. Frank J. Sprague, of New York, argued that the prime requisite is a locomotive having good riding qualities which can be produced at the minimum expense. Of the three principal types, exemplified in the gearless directly mounted New York Central locomotive, the gearless spring-mounted New Haven locomotive, and the side-rod Pennsylvania locomotive, the first named is much the simplest. There is no absolute necessity for a high center of gravity, the chief desideratum being obtained by making each wheel independently movable in the required directions. Mr. Sprague stated his positive conviction that the New York Central accident was not caused by the low center of gravity of the locomotives, as shown by the fact that the locomotives have been rendered thoroughly safe without changing the center of gravity by merely adding guiding trucks.

Mr. A. H. Armstrong, of Schenectady, claimed that service requirements under steam railroad conditions may render it necessary to use electric locomotives interchangeably for freight and passenger haulage over grades. A solution of such a problem might be found in employing, say, three locomotive units for hauling a freight train at moderate speed and one unit for a passenger train running at higher speed.

In closing the discussion, Mr. G. M. Eaton stated that he had made close personal observations of the riding qualities of the various electric locomotives placed in service around New York, and had found that, although the New York Central locomotive operates with a high degree of satisfaction at low speeds, it possesses a decided tendency to "nose" when running at high speed; that is, it tends to spread the rails under this condition.

LOCOMOTIVE HEAD-LAMP TESTS

A paper by Profs. C. Francis Harding and A. N. Topping, of Purdue University, contained reports of results of road and laboratory tests on the effect of powerful locomotive head-lamps upon the interpretation of signals and upon the ability of the engineer to see and recognize obstacles upon the track in front of the locomotive. The road tests were carried out on the St. Louis division of the Big Four Railroad for the purpose of comparing effects noted above of oil and electric head-lamps under actual operating conditions.

The laboratory and out-of-door tests were carried on to determine the photometric and spectrophotometric values of the above head-lamps as well as corresponding values for reflected light from signal roundels.

The road tests showed: (1) That a powerful head-lamp on a locomotive has one marked disadvantage, namely, that it causes reflections from glass roundels and lenses, thereby producing false or phantom signals. It seems likely that these are partly due to the intensity and partly to the spectral composition of the light. (2) That a powerful opposing head-lamp adjacent to block signals so obscures the latter as to make it difficult to read them correctly at distances exceeding 1000 ft. (3) That an opposing oil head-lamp of ordinary intensity allows such signals to be read correctly at 4000 ft. or less. (4) That even with no opposing head-lamp, the distance in which the signal can be read correctly is slightly reduced by the use of a powerful head-lamp. (5) That a more powerful head-lamp on an approaching engine obscures the classification signals on that engine to a marked degree. This is particularly true of green signals in the glare of a powerful head-lamp whose spectral intensity is high in green. (6) That an opposing oil head-lamp of ordinary intensity allows either white or green signals to be read at a distance of 400 ft. or even more. (7) That obstructions on the track cannot ordinarily be seen with a powerful electric head-lamp at a sufficient distance to prevent accidents, since a train traveling at a high rate of speed cannot be stopped in the distance at which obstacles sufficiently large to cause a wreck were first detected.

The laboratory tests were made on seven different lamps of various types, as follows: (1) Luminous arc, upper electrode copper, lower electrode presumably magnetite composition. (2) Carbon arc, carbons inclined 45 deg. to the horizontal. (3) Luminous arc, similar to No. 1. (4) Electric arc, upper electrode carbon, lower electrode copper. (5) Kerosene oil lamp. (6) Acetylene lamp. (7) Luminous arc, same as No. 1, but, instead of being fitted with a reflector, supplied with a lens. These tests showed: (1) That the magnitude of the illumination is a function not only of the total light flux emitted from the lamp, but also its distribution. (2) That the reflector in which the largest proportion of total light flux falls in the vertex will have the highest multiplying factor. (3) That the lens type of projector has a higher multiplying factor than has the reflector type, other things being equal. (4) That the spectral intensities of the luminous arc head-lamps are not noticeably different from those of the carbon arc, although the former are slightly lower in the red portion of the spectrum than are the latter. (5) That the head-lamp [illegible] having a lower electrode of copper may [illegible] operate in practice as to produce relatively high intensities in the yellow-green portion of the spectrum. This is also true of head-lamp No. 3 with terminals reversed. (6) That head-lamp No. 5 gives intensities higher in the red and lower in the green than all other head-lamps tested. (7) That the reflected light from green roundels has a higher intensity in the green than that from red roundels and that this intensity is greatly augmented when a signal lamp is placed behind the signal roundel as in practice.

DISCUSSION.

Mr. G. H. Stickney, of Schnectady, remarked that a locomotive head-lamp performs a double function in providing a warning of the approach of the locomotive and in enabling the driver to see objects on the tracks. In order to ocercome the objections of glare and reflection, the beam of light could be directed below the signals and out of the range of the driver on an oppositely running locomotive.

Dr. C. P. Steinmetz, of Schenectady, stated that since the head-lamp is intended either to be seen or to enable one to see, the more light it produces the better are the results. When it becomes too powerful for the signal lamps, the proper method is to increase the light from the latter lamps.

Mr. J. C. Lincoln, of Cleveland, Ohio, maintained that the best solution of the problem is to place the head-lamp in the proper position and then so direct the light that it does not fall on the signals.

In reply to questions by Prof. H. P. Wood and Messrs. J. B. Taylor and Harry Barker, Professor Harding said that the head-lamps give better results when placed on top of the locomotive than when placed lower down on account of the inability of yardmen to distinguish the number on the lamp when in the latter position. Although no specific tests were made with the object of determining the ability of the 11 observers to distinguish colors, the tests of the lamps furnished sufficient evidence to show that no observer was color blind. The Indiana Railroad Commission has adopted candle-power rating for head-lamps falling between the oil lamps and the electric arc lamps, namely, 1500 cp, but has not specified how the candle-power is to be measured or defined.

ELECTRIC RAILWAY SERVICE.

In a paper by Mr. R. W. Harris, of the Wisconsin State Board of Assessment, a description was given of an investigation into the adequacy of the service rendered by the Milwaukee street railway system. A study of the movement of the people showed that there are four distinct periods in each day during which the majority of people travel, namely, from 6 a. m. to 9 a. m.; 11 a. m. to 2 p. m.; 5 p. m. to 8 p. m., and 10 p. m. to 11 p. m. Observation showed that independent of the amount of available seating room, about one person out of each five is willing to stand by preference, so that a car designed for seating 42 passengers can be considered as suitable for conveying 50 passengers with the desired amount of comfort. The investigation indicated that the minimum practicable headway in Milwaukee is 20 seconds, corresponding to 180 cars per hour passing a chosen point in one direction. In cases where the number of passengers to be carried exceeded the carrying capacity of this number of cars it was necessary to re-route certain of the cars and thereby reduce the congestion over the heavily loaded sections.

The author remarked that the routing of the cars that serves the largest number of people by the most direct route, at times when the traffic requires it, free from delay and with a sufficient number of sanitary cars so the average amount of traffic will be comfortably cared for, is highly desirable. A failure to provide any one of these accommodations will result in an attack, sooner or later, on the company for giving poor service.

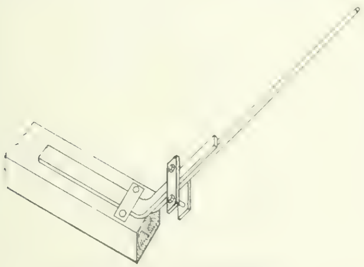
DISCUSSION.

Mr. W. E. Reed expressed the opinion that the number of passengers standing by preference in a car depends largely upon the distance to be traveled, and hence values observed in one place are not applicable in other places where the lengths of haul are different.

LETTERS ON PRACTICAL SUBJECTS

A METHOD FOR BENDING BUSBARS.

The writer has had considerable work to do on various sizes of copper busbars. As far as possible, lengths of approximately 20 ft. were used as, of course, the longer the individual bars the smaller the percentage will be that is wasted in the laps. Copper busbars of this length are quite difficult to handle and to bend with any degree of accuracy without special apparatus. In doing this work the writer has found a comparatively easy and simple way to bend the busbars. This consists in using a piece of timber about 6 in. or 8 in. and perhaps 16 ft. long, and arranging a clamp at one end made up of a piece of flat iron and a couple of bolts passing through the timber. The busbar is secured under this clamp within about 2 in. of where the bend is desired, and a pinch bar is clamped to it as shown in the accompanying illustration. With this



Method of Bending Busbar.

apparatus the busbar can be bent with a fair degree of accuracy to any angle desired. Before making a bend a wire can be bent to the correct angle and then used as a templet in bending the busbar. To put a quarter twist in a busbar, the latter is clamped and a pinch bar is clamped to it at right angles to the length of the busbar and the busbar twisted. In a 2½-in. x ½-in. copper busbar a quarter twist can be made in about 6 in. of length without forging. A short bar can probably be handled to better advantage in a vise. To bend a bar on its edge it is generally necessary to send it to a forge shop and to make the bend while the bar is hot, since it is difficult to make the busbars stay flat otherwise.

Niagara Falls, N. Y. J. Cloyd Downs.

REMARKABLE ELEVATOR ACCIDENT.

Two electricians were at work recently in the shaft of an electric elevator in a State Street building in Chicago. They were standing on the top of the car and were installing conduit for new mains for the elevator motor and for lamps. The foreman on the job was inside the car, and with him was the colored elevator operator. In some manner, unexplained at the time, there was a short-circuit in the shaft, followed by a flash of fire and the dropping of sparks down into the car. The foreman hurriedly left the elevator, and he was followed by the elevator man. In the excitement, apparently, the controller handle was pulled over, so that the car shot up toward the top of the shaft. One of the electricians on the roof of the car jumped for an open gate as the car was passing an upper floor, but his attempt was unsuccessful, and he was caught between the car and the opening in the shaft, receiving injuries from which he afterward died. The other man was rescued without injury, as the car stopped when the first man became jammed in the opening.

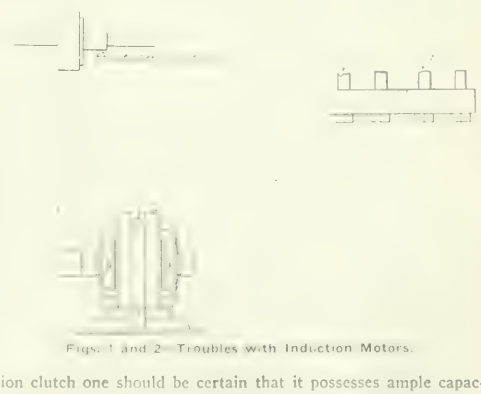
On investigating the accident later, inspectors from the city Department of Electricity were for a considerable time unable to locate the cause of the accident. It was finally discovered, however, that the direct cause of the trouble was a short-circuit between the steel elevator control cables and the grounded metal enclosure on the main floor. The more remote cause of the accident, however, was of quite unusual interest. A breakdown of the fiber insulation of the reversing switch in the penthouse, containing the electric elevator motor and controlling mechanism, caused a connection with the metal parts of the machinery, and also the large I-beam to which the motor is bolted. This I-beam also supports the penthouse. This made all metallic parts of the elevator car and cables, as well as the machinery on the roof, "alive," exhibiting a difference of potential to ground of nearly 120 volts. The metal sheaves of the controlling cables are mounted on wood. The penthouse is wood, covered with metal sheeting outside. No part of the metal sheeting was in contact with the I-beams. The controlling cables show burns caused by the short-circuit, and they are fastened, but not securely, to an angle-iron at the bottom of the shaft. It was found that all metal work here was covered with rust.

Voltmeter readings showing that the metallic parts and the elevator mechanism were grounded in the manner indicated were taken from the motor base to a radiator ground while the motor was in operation. With the car ascending, the reading was 119 volts, and with the car descending, it was 94 volts.

Chicago, Ill. Jas. L. Cuthbert.

TROUBLES WITH INDUCTION MOTORS.

Motors are very frequently installed in manufacturing plants in such a manner as to cause considerable trouble and annoyance, not to mention frequent shut-downs. One not infrequently finds an induction type of motor having a squirrel-cage rotor coupled so that it will be necessary for it to start under heavy load. Aside from the injurious action of the excessive current upon the motor itself, this method of running an induction motor is detrimental to the life of the belt and the starting box, and causes much annoyance by the opening of circuit-breakers and the blowing of fuses. For instance, in the case of motors driving heavy shearing machinery, punches or devices carrying heavy balance wheels, these should first be placed into operation without load, so that the stored energy in the flywheels may be utilized when the load is thrown on. To start such machinery on the jump requires an excessive amount of energy and current oftentimes greater than that permitted by the insurance authorities for the size of wire used in feeding the motor. Many of these installations can be made to operate more satisfactorily, and require less energy at starting, by arranging the motor drive as shown in Fig. 1. Here a friction clutch is employed on the main lineshaft so that the motor may be brought up to speed before it is connected to the load. The friction clutch permits the load to be picked up gradually while the motor is running at full speed. In selecting a fric-



Figs. 1 and 2—Troubles with Induction Motors.

tion clutch one should be certain that it possesses ample capacity. Not infrequently a clutch which has ample capacity at first will not carry its connected load after long service, so that it is best to purchase one slightly larger than would be abso-

lutely necessary. It will then be found to require very little attention and give much better service than one operating up to its limit. The main feature which a friction clutch used in connection with an electric motor should possesses is ample sleeve bearing, so that it will remain true and give a good contact without slippage. It is felt that if the suggestions above are heeded burn-outs at contact points in the starting box, such as shown in Fig. 2 at C and E, will be entirely avoided. The extra current which is required in a motor of the induction type starting under full load from standstill is exceedingly detrimental to the life of contact points, regardless of the oil, and it is not long before trouble is experienced with the starting box. Unfortunately, owing to the simplicity of the induction motor they are very frequently run under unfair conditions, the most prevalent of which is that of throwing the motor on the line under load.

Sheffield, Ala. C. R. McGAHEY.

THE SIMPLICITY OF THE B. & S. GAGE FOR COPPER WIRE.

At first sight it would appear a hopeless task to try to remember the whole of the B. & S. wire gage, together with the resistances and weights of the various sizes. The task proves, however, to be a very simple one if approximate accuracy suffices. The numbers 2 and 5 serve, by strange coincidence, as key both to the wire table and to the constants for copper. The following table, for instance, gives, almost at a glance, the approximate resistance per 1000 ft. of any wire from No. 4-0 to No. 29. This table involves only the numbers 2 and 5, or simple combinations of them or their reciprocals:

	$\frac{1}{[illegible]}$	$\frac{1}{200}$	$\frac{1}{100}$	$\frac{1}{50}$	$\frac{1}{25}$	$\frac{1}{20}$	$\frac{1}{10}$	$\frac{1}{[illegible]}$	$\frac{1}{[illegible]}$	$\frac{1}{2}$	$\frac{1}{1}$	$\frac{1}{[illegible]5}$	$\frac{1}{0.25}$
20....	4-0	0	3	6	9	10	13	16	19	20	23	26	[illegible]
25....	[illegible]	1	4	7		11	14	17		21	24	27	
25....	2-0	2	5	8		12	[illegible]	18		22		28	..

To find the resistance per 1000 ft. at about 20 deg. C. of any size of wire, in ohms, multiply together the fraction at the head of the column and the number at the end of the row, in which the gage number occurs. Thus, for instance:

No. 21 wire has a resistance of about $(\frac{1}{2} \times 25) = 12.5$ ohms per 1000 ft. No. 8 wire has about $(1/50 \times 2^5) = 0.64$ ohms per 1000 ft.

The following well-known rule aids in writing out the table: *"The resistance of B. & S. gage copper wire becomes doubled every third size and multiplied by ten every tenth size."*

In order, now, to determine the diameter and other useful constants for the various sizes it is well to use No. 10 wire as a starting point.

No. $10 = (5 \times 2)$ B. & S. copper wire.
$100 = (5 \times 20)$ mils in diameter.
$10{,}000 = (5 \times 2000)$ circular mils cross-section
$1 = (0.5 \times 2)$ ohms resistance per 1000 ft.
$32 = (2^5)$ lb. weight per 1000 ft.
500 lb. breaking weight (hard drawn).
250 lb. breaking weight (annealed.)
5 mils thickness of single cotton covering.

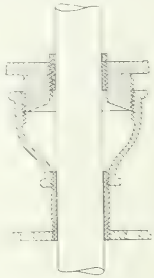
The numbers 2 and 5 help also in remembering the following constants for copper:

The atomic weight is 64 $(= 2 \times 2^5)$.
The valency is usually 2.
The specific gravity is 555 lb. per cubic foot.
The specific heat is 0.1 $(= \frac{1}{2} \times \frac{1}{5})$.
The melting point is 1100 $(= 550 \times 2)$ deg. C.
The temperature coefficient is 0.0022 per degree Fahrenheit.
The tensile strength is $40{,}000 = [(200)^2]$ lb. per square inch.
In [illegible] the [illegible] given by the Aluminium Company of America.

Pittsburgh, Pa. F. M. DENTON.

HOME MADE STUFFING BOX.

A short time ago the writer had occasion to use a couple of stuffing boxes for a 1-in. shaft, and as there did not happen to be anything on the premises that would answer, and the requirements of the job did not warrant making them up according to standard pattern, the arrangement of pipe fittings shown herewith was devised and found to work very satisfactorily. The stuffing box is very easily made up, owing to the fact that



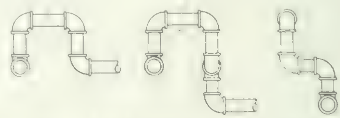
Stuffing Box Made of Pipe Fittings.

standard 1-in. pipe makes a nice working fit for a 1-in. shaft. Standard pipe fittings will do equally well on a number of other sizes of small shafting. As shown in the illustration, the articles necessary to put together such a stuffing box are: a floor flange, two nipples, one reducing coupling and one bushing. It makes a better job to use a bushing a size smaller than the shaft, and then to drill it to fit, if the proper drill is procurable.

Buffalo, N. Y. D. C. JONES.

BENDS VERSUS EXPANSION JOINTS.

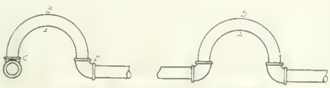
The build-up bends shown in Figs. 1, 2 and 3 have an advantage over the continuous bends shown in Figs. 4 and 5 owing to the fact that they automatically compensate for expansion and contraction by either screwing up or unscrewing in the fittings as the strain or stress is brought to bear on them, thus arranging themselves to suit the different stresses imposed. The stresses are of three kinds, namely, torsional, tensile and compressive. The torsional stress is imposed in a direction calculated to twist the pipe apart: the tensile stress is imposed on the pipe or bend in a direction the effect of which is to pull the pipe apart, while the compressive stress is calculated to crush the pipe or bend. In the bends in Figs. 1 and 4 a tensile



Figs. 1, 2 and 3—Built-Up Pipe Bends

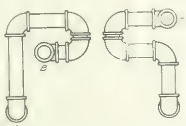
stress would tend to increase the distance between the legs of those bends, and hence the under part of the pipe shown at A would be under a tensile or pulling stress, while the upper portion of the pipe, shown at B, would be subjected to a crushing stress. The one great objection to build-up bends is the number of fittings employed and consequently the increased number of joints, with their liability to leakage. In a large number of cases the use of continuous bends tends to rupture the pipe owing to the way they are connected or inserted in the line, for the reason that the strain imposed by either expansion or contraction would tend to shear or break the bolts in the flanges when these are used as the connecting medium. This is particularly true when the flanges are permanently fitted to the bends. If the flanges were screwed on the continuous bends, as with the built-up bends, then they could swivel, thus compensating for strains. Of course, in this case the direction of strain would have to be known before the bends were connected up, and then they should be erected to allow for swivelling.

The flexibility of the bends in Figs. 1, 2 and 3 is, upon inspection, immediately apparent. The side view with the form of built-up bend, shown in Fig. 3, makes no difference how the strain is imposed; this bend will automatically arrange itself to suit the varying stresses of expansion and contraction. Two different strains could be applied at right angles to each other at the same moment and still this bend would compensate for both directions of strain, while the bend shown in Fig. 1 can only compensate in one direction. The bend shown in Fig. 1 has an advantage over those shown in Figs. 4 and 5 because it can swivel at four points, as shown at *C, D, E* and *F*, while the bend shown in Fig. 4 can only swivel at two points. It is



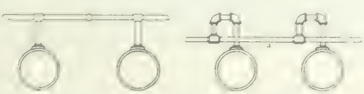
Figs. 4 and 5—Pipe Bends.

understood that the strain applied to those bends is perpendicular to the paper, and under such a stress the bend shown in Fig. 5 would not be capable of compensation, as the strain could not be applied in that direction. When the strain is applied so as to force the pipes closer together or to pull them further apart, then the bends shown in Figs. 4 and 5 are equal in efficiency to that shown in Fig. 1 in compensating for expansion and contraction. If the elbows shown on the bends in Figs. 1 and 4 pointed in the same direction as shown in the bend illustrated in Fig. 5, then there would no difference, as the tendency would be to close or open the space existing between the sides of the bends. Whenever such a stress exists in the bend shown in Fig. 2 there can be no opening or closing of this space, as the strain is compensated for by reason of the swivel-



Figs. 6 and 7—Pipe Bends.

ling of the extra joint, hence the importance of the bend shown in Fig. 2 in compensating for the push and pull incident to long lines of piping is apparent. Fig. 6 shows also a very important built-up bend used principally in places where the pipe extending from elbow *A* is rigidly situated. In this case the line of pipe connected to *B* can push or pull without doing any harm to the main line at *A*. There are so many points offered for swivelling purposes with this style of bend that the movement of the ell *B* is hardly perceptible unless the pine line is of considerable length. This bend can be employed for taking care of expansion and contraction on three main lines of piping with good results. Fig. 7 illustrates a bend used where the service main is situated above the main steampipe, as shown at *B*. It will be noticed that the bends shown in Figs. 6 and 7 are somewhat



Figs. 8 and 9—Boiler Connections.

similar in structure with the exception noted. The swivelling and compensating action of these two bends are similar and takes care of the lengthening and shortening of the supply steam lines, while the opposite bends are only used to allow for the passing of the pipe over and under obstructions. Thus in the case of the bend shown in Fig. 6, which was used in a certain place, the engineer was forced to carry the supply line under a line of water mains and in the case of the bend shown in Fig. 7 had to run under a heavy stone arch and return over the same arch. In both cases the object was to have the bends act as compensators for expansion and contraction and at the same time to permit of bringing the connections where they were wanted. Fig. 8 shows a battery of boilers connected up without due consideration for expansion and contraction. With this style of pipe fitting the strain on the bolts and flanges is multiplied whenever one of the boilers is shut down for cleaning or repairs. The rigid connection between the boilers causes trouble from leakage and difficulty is experienced in fitting gaskets to the various connections. Fig. 9 shows a much better arrangement than that shown in Fig. 8 for fitting up a battery of boilers and at the same time for allowing for expansion and contraction. The main pipe *A* is free to move from right to left or vice versa, the connections swivelling to compensate for whatever movement may occur. But in the arrangement shown in Fig. 8 there is no such movement of the steam main possible. Any expansion or contraction of the connections imparts the same stress to the boilers, causing them to recede or approach each other and hence the great difficulty in maintaining the flanges and connections steam tight. In many cases this method of connection cracks the sustaining wall around the boilers, and such cracks being usually in the outer brickwork, admit cold air, thereby causing a loss. In general, cracked walls are blamed on the furnace, there being no effort made to discover if any other cause exists.

Philadelphia, Pa. KINGSLEY WILLIAMS.

STARTING TORQUE OF INDUCTION MOTORS.

Probably the most common mistake in the installation of induction motors is the selection of a motor that is too small to start the load. Most machinery manufacturers can now give us fairly reliable data as to the power required to drive their machinery under running conditions, but few of them know what starting torque is required to start the load from rest and bring it up to speed. Some classes of machinery, such as fans and centrifugal pumps, require little effort at starting, but the load accumulates as the speed increases—other classes of machinery require practically the same effort at starting that they do to maintain their speed after in motion and some even more than this. In the latter class are pumps and air compressors starting under pressure. Elevators and hoists or other machinery that move a dead weight or pull against a fixed constant resistance and often a line shaft with many idle belts will be found to belong to the class that requires more effort at starting than after it is in motion and driving full load.

This is often the controlling feature in selecting a suitable

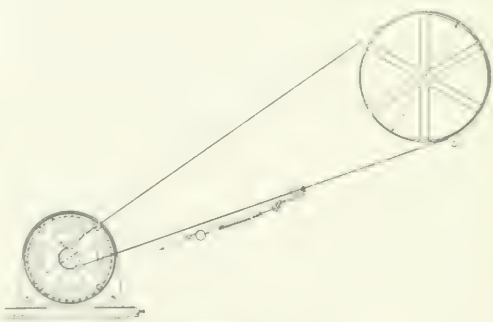


Fig. 1—Determining Belt Pull.

induction motor, for while modern motors will exert starting effort considerably greater than that corresponding to their rated horse-power, they are often found connected to loads that they will run easily after starting, but will fail to start without assistance. Very often this is due to a drop in voltage at the motor terminals on account of insufficient transformer equipment or a long supply circuit of insufficient size. This condition is readily discovered by a voltmeter, but even then the question often arises as to whether the motor is large enough if the voltage were properly maintained or how large a motor should be used. The positive determination of this

matter is so simple that it is surprising the subject is so often a matter of controversy and the method of procedure in typical cases given below is presented in the hope that resort to these simple and convincing tests will in a measure eliminate the fruitless argument that often results in such cases. Suppose an induction motor is belted to a line shaft which may drive a group of machines or a single machine through other belts, as shown in Fig. 1. It is found that the motor fails to start this load and the question arises whether the load is greater than the motor should be expected to start or whether the motor is at fault. The driven machinery may be connected or not, but with this we are not concerned, as it is the actual torque that the motor has to exert under starting conditions that is to be the subject of test. There is always some slack in the connecting belts and when the motor is started it first turns the line shaft slightly, taking up this slack, and then the full starting effort necessary to overcome the resistance of the belts and the idle pulleys will be required.

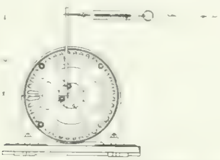


Fig. 2—Testing Motor Driving a Machine Through Coupling.

If the pounds pull the driving belt has to exert to start this shaft and machinery can be found this can easily be translated into horse-power by considering it in connection with the belt speed after the motor is running, and to find this pull one can proceed as indicated in Fig. 1. A clamp which may be made of two pieces of hard wood slightly wider than the belt, with bolts passing through each end, is fastened to the pulling side of the belt and by means of a rope fastened in a loop around the belt back of this clamp or otherwise attached to the clamp an ordinary spring balance is fastened to the belt, as shown in Fig. 1. In the case of a small motor, the clamp may often be omitted and the rope simply tied around the belt. Now, holding this balance parallel to the belt and pulling in the direction that the belt runs, we first take up the slack of the driving belts and then a further pull will start the shaft and the maximum reading of the scale will indicate the number of pounds of useful belt pull required to start the load. From the number of revolutions and the size of the pulleys we find the belt speed in feet per minute and multiplying this by the pounds pull, we have the number of foot pounds per minute, which, divided by 33,000, gives us the horse-power of the motor which will exert this starting effort without overload. For example: Suppose a pull of 60 lb. is registered on the spring balance and the driven pulley on the line shaft is 36 in., or 3 ft., in diameter, and runs at 200 r.p.m., the horse-power would be: Hp = 60 × 3 × 3.14 × 200 ÷ 33,000 = 3.12.

Most modern motors will exert a starting torque about 50 per cent greater than the torque corresponding to their full rated load when full voltage is impressed at their terminals, but it is often undesirable to apply full voltage on account of the heavy current that will be drawn from the line so that this excess should only be used as a margin for emergencies and with large motors it is better practice to arrange the load so that it may be disconnected at the start and not over 30 per cent to 50 per cent of full-load synchronous torque required.

In Fig. 2 is shown the method for testing a motor directly connected to an elevator or other machine that may be driven by a coupling. A bar of iron or wood of convenient length is clamped beneath the heads of the coupling bolts or may be simply hooked in place between the bolts and shaft in such a way that it serves to move the motor and driven machine in the normal direction. The motor is turned until all the backlash is taken out and it actually begins to raise the load, then a spring balance is applied at a fixed distance "L" from the center of the shaft and the pull on the balance would indicate the effort required to start the load as in the case of the belt. Care must be taken to pull in a direction at right angles to the line from the center of the shaft to the point where the balance is attached to the lever and to measure the distance from the center of the shaft to that point, then the horse-power is obtained by the formula: Hp = 6.28 N. L. P. ÷ 33,000 in which P equals number of pounds pull shown by the balance, L the distance from the center of shaft to the balance, in feet, and N, the number of revolutions of the motor per minute. In the case of a pump or other machine driven by gearing, the spring balance may be attached to the rim of the gear and pulled in a tangential direction, and the horse-power obtained by multiplying the pull by the speed of the gear in feet per minute and dividing by 33,000. This test may also be used to determine in advance the horse-power required to drive an elevator or similar machine before the installation of a motor. It is, of course, not applicable for this purpose when the load is of such character that the torque increases with the speed, but is perfectly reliable and accurate in all cases for determining the starting effort.

Chicago, Ill. M. O. SOUTHWORTH.

OVERHANGING RETAINING WALL FOR COAL STORAGE.

The writer is watching with a great deal of interest the engineering operations pertaining to the rebuilding of the power house of the Indiana & Michigan Electric Company, at South Bend, Ind. The portion of the building which is to be reconstructed will be kept in use all the time, the steel and brick structure being built around and over the old building, which will be removed after the new roof has been completed, without stopping the motor-generator sets for a single hour. The accompanying illustration gives an excellent idea of the manner in which more room is being obtained in the rear of the station along a canal which supplies water for generating and manufacturing purposes. The body of the wall along the canal was constructed with sufficient width of base to enable it to retain the bank of the canal and also to carry some load, which, as the engraving shows, is made up of sundry motor parts and steam fittings, while in the distance may be seen a large pile of coal. The extension was built, however, for coal storage. The greater part of the output of this station is converted energy transmitted from a hydroelectric station at 25,000 volts. There

Overhanging Retaining Wall.

is, however, considerable steam-generating equipment in the station at South Bend for reserve use and for peak loads; hence the necessity for a large coal-storage space. The steel reinforcing of the concrete wall is ample, both horizontally and vertically, and in that portion of the retaining wall next the earth filling. By means of this arrangement the body of the wall was not necessarily as heavy as would be supposed, for when the extension over the canal is not loaded, the weight of the retaining wall is more than ample to sustain the overhanging concrete. When the overhang is loaded with coal, the main wall is also loaded with many tons weight and the additional weight thus placed upon the wall serves to aid in carrying the load on the overhang.

JAMES F. HOBART.

QUESTIONS AND ANSWERS

Can an induction-type watt-hour meter [illegible] on a circuit having rectified current? L. T. R.

Not satisfactorily. Induction type watt-hour meters connected to circuits having certain types of rectifiers simply vibrate and do not register at all.

Are rotating standards used for testing large meters on direct-current circuits? K. O.

Rotating standards are seldom used for testing meters of over 200-amp rating due to the troubles from stray fields caused by the leads running into the standard. A water pail rheostat and voltmeter and ammeter are used instead.

In what city or town were series tungsten lamps [illegible] S. I.

From what we can learn the Hartford Electric Light Company, of Hartford, Conn., was the first to try out the series tungsten lamp. In May, 1907, this company installed 96 6¼-amp and about 350 5.5-amp lamps on its street lighting circuits.

I would like to know the weight and resistance of the No. 36 wire used in making the primary of the small transformer described in the May issue; also the weight and resistance of the secondary? F. W. Q.

The primary winding of the transformer mentioned consists of 1½ oz. of No. 36 double silk-covered magnet wire having a resistance of 400 ohms, while the secondary consists of 1½ oz. of No. 25 double cotton-covered wire having a resistance of 2.65 ohms.

Has water any damaging effect on babbitt metal in bearings? G. E. B.

We do not see how water can damage babbitt bearings unless it is substituted for oil, in which case, of course, lack of lubrication might cause damage. Genuine babbitt metal is composed of pure tin with a small quantity of antimony (about 2 per cent) added in order to make the molten metal to flow freely and to harden the bearing somewhat. Water would thus have no deleterious action on the metal itself.

Is it necessary to make any modifications or changes in a single-phase [illegible] through the usual spark coil? I. P.

Ordinarily single-phase current is not satisfactory for ignition purposes, due to the fact that the break in the circuit is apt to occur when the voltage is zero. To use alternating current for ignition purposes, it is necessary to synchronize the engine with the current in order to have the spark occur at the "peak" of the wave. In actual operation a high-speed gas engine ignited by an alternating current has an irregular spark supplied to it, which causes continual skipping.

Why are not fire-tube boilers used more frequently in central-station practice? H. E.

Fire-tube boilers are cheaper in first cost than water-tube boilers, and are efficient steam generators. They cannot be used in large sizes or on high pressures, 200 hp and 120 lb. pressure are about the respective limits for this class of boiler. Where high-pressure steam is required, as in modern central-station practice, water-tube boilers are generally best suited to meet all the conditions in respect to safety, operation and general adaptability.

Kindly explain why, when measuring power in a three-phase circuit with two wattmeters, one meter will read negatively when the angle of lag is greater than 60 deg. H. K. R.

On account of the method used in connecting two wattmeters for measuring power in a three-phase circuit, the voltage across one wattmeter shunt coil is 30 deg. ahead of the current in its series coil, while the voltage across the shunt coil of the other meter is 30 deg. behind the current in its shunt coil when the power factor is unity, that is, when the real circuit angle of lag of the current behind the e.m.f. is 0 deg. When the circuit angle of lag is 60 deg. the current in the series coil of one wattmeter lags by $(60 - 30) = 30$ deg. behind the voltage across its shunt coil, while the current in the series coil of the other wattmeter will lag by $(60 + 30) = 90$ deg. behind the voltage across its shunt coil. When the wattmeter angle of lag is 90 deg. its reading is zero.

Can induction regulators be connected inside and outside of the delta on the low-tension side of the transformer? E. F.

Induction regulators have been designed for both methods of connection. In either case the regulators have the same rating and weight for a given range of voltage regulation on synchronous converters of the same output. The only difference is in the winding of the secondary. When connected inside the delta, the secondary voltage is higher and the current lower than when connected outside the delta. In the latter case the secondary has fewer turns which are of greater cross section than those of the inside connected regulator. The complicated wiring necessary in the inside-the-delta connection owing to the limited space beneath the regulator has militated against the wide use of this type. The outside-the-delta regulator is the type most generally used.

Are there any objections to operating motion picture machines by means of electric motors? Such a scheme would be far preferable to manual operation; but no use seems to be made of motors for this purpose. A. I. B.

Objection has been made to the use of motors for operating motion picture machines because if the film should break the film in the top magazine would continue to come down in front of the lamp and, becoming wedged there, would take fire. If for any reason the motor should stop the intense heat from the lamp would also ignite the picture film. The latter is composed of pyroxylin, nitro-cellulose of low nitration, and is readily inflammable; combustion taking place after a few seconds if subjected to a temperature of 150 deg. C. or more. The pictures move through the lantern at the rate of 1060 per minute; but the photographic exposure is only 1.85 cm long and 2.5 cm wide.

Are direct and alternating currents sent commercially or otherwise over the same wires? If so, are they separated again for use on separate circuits? I mean, of course, in a manner somewhat similar to the quadruple telegraph, so that each current will do its separate work afterward. I understand that an alternating current can be impressed upon a direct-current circuit—as, for instance, in the telharmonium, where alternating-current music can be heard with a direct-current arc lamp as a receiver. How would difference of voltage affect the result? W. C. P.

The simultaneous transmission over the same circuits of two currents of different frequencies or of a direct current and an alternating current has been tested under practical conditions and found to be operative. Neglecting the telegraph and telephone fields, however, the system is not in commercial use. Various engineering relations of numerous composite transmission systems were disclosed in publications by Dr. Frederick Bedell in 1903 and 1904.

Of what use are st[illegible] formation of smoke? [illegible]

There are many forms of application of the steam jet to boilers. Sometimes the steam is applied below and sometimes above the grate. Below the grate the effect is perhaps slightly to increase the draft, but chiefly to soften the clinkers. Above the grate the steam jet is essentially for the purpose of inducing a draft of air over the fire and to mix the air with the gases from the coal. The steam itself is not a source of any heat. A number of smoke preventers employing steam jets are in successful use and when properly applied will reduce the tendency of boiler furnaces to smoke.

Central Station

Management, Policies and Commercial Methods

HELPING FIND TENANTS FOR HOUSES THAT ARE WIRED.

Houses that are wired for electric service rent more easily than the old-fashioned kind. A progressive Indiana central-station company impresses this fact upon property owners by maintaining an electrically lighted bulletin board on its outside wall at one of the most prominent corners of the little city, on which it enters the address and a brief description of all houses equipped for electric service which are for rent. The property owners, too, have come to realize the value of this kind of advertising, for the houses offered on the board are usually snapped up quickly. On the one extreme this fact has resulted in having old houses wired about as rapidly as they become vacant. Then they are not vacant much longer.

CENTRAL-STATION ELECTROMETALLURGICAL LOAD.

The manager of the Sheffield, England, municipal electrical plant has asked for a grant of $400,000 to extend the capacity of the newest of its several generating stations. This station—that at Neepsend—was opened in 1904 with a capacity of 3000 kw; in 1908 this was increased to 7000 kw, and the station is now overloaded. In an interview the manager stated that the great increase is not so much due to lighting load as to demand for power and heating. A large demand has developed in the form of heating for electric smelting furnaces in the East End Works, and indications point to very considerable extensions in this direction. Already two furnaces have been connected to the supply mains, and others are awaiting connection.

ONLY ELECTRIC SIGNS MAY EXCEED THREE-FOOT LIMIT AT FORT WAYNE, IND.

The enforcement of the building ordinance recently adopted in Fort Wayne, Ind., which allows electric signs to project 10 ft. over the sidewalk while non-illuminated signs are permitted to extend only 3 ft. from buildings, is resulting in the installation of a number of more or less pretentious electric displays to take advantage of the freedom given the favored class. Little attention had been paid to the existing ordinance until recently, when the city authorities decided to repair their omission and demand the removal of all offending signs on certain streets. The result has been a marked boom in the electric sign business. When the ordinance was originally passed, its sponsors took the viewpoint that electric signs add to the illumination of the street and thus aid the city lighting, so they should be favored and their installation encouraged.

VACATION-TIME IRON CAMPAIGNS.

The conjunction of hot weather and school vacations makes a time which is especially favorable for the central-station man endeavoring to stock up his lines with electric irons or other heating appliances. One electric company in a small Indiana city, which has been especially successful in putting out this class of domestic apparatus, reports that its best results in placing irons are secured with the co-operation of the school children. An advertisement among the small "want" notices in the local paper brings 50 to 100 boys and girls to the office. Each of these is given an iron to sell or place, being offered a commission of 50 cents for each iron sold in this manner.

The young folks frequently gain an audience, especially among their neighbors, which a regular solicitor would be unable to obtain, and as an indulgence, often get some older objecting friend to try an electric iron, to her delight and ultimate purchase. It is the experience of the company cited that electric irons put out in this way invariably "stick" to the satisfaction of both customer and company. As the transaction with the youthful agent is, of course, entirely on a commission basis, the actual charge for selling the iron is small, compared with that of keeping a regular solicitor on the road, with indifferent success. The company keeps a record of the destination of each iron.

ORNAMENTAL POST LIGHTING AT GRINNELL, IOWA.

The Grinnell Electric & Heating Company has entered into a contract with the Grinnell Commercial Club for a system of lighting the business district with lamps on iron posts supplied from conduits run under the sidewalk along the curb line. There will be 128 posts in all, spaced 100 ft., for which $129 per month, or $4.60 per post per month, will be paid. Each post will have two 60-watt lamps and one 100-watt tungsten lamp. The 100-watt lamp, which is on the top of the post, will be burned all night every night, while the two 60-watt lamps will burn until 11 p. m. every night except Saturday, when they are to burn until 12 p. m. At the end of seven years the Commercial Club will become the owner of the entire system, including conduits, posts and electrical equipment for which the only costs will be for electricity or operation. Grinnell has a population of about 5000.

WHAT AN ELECTRIC WASHING MACHINE SAVED ONE BARBER SHOP.

Up to nine months ago the Randall five-chair barber shop of Fort Wayne, Ind., was paying ½ cent apiece for having 1200 to 1500 towels laundered each week. The laundry bill accordingly averaged $27 per month; added to which was a charge of about $3 per month for replacing, at 5½ cents each, the towels which were lost and torn in the laundry operation. A chance remark by the barber on the subject of this $30 monthly tax, to Mr. J. B. Weidgenant, contract agent of the light and power department of the local electric company, as he was being shaved one day, led the central-station man to suggest that something might be done to alleviate the situation by having a motor-driven washing machine installed.

The washing machine was accordingly installed on a 30-day trial proposition, and did its work so excellently and economically that it was immediately purchased at the end of the trial period. After several months' subsequent experience, the manager of the barber shop reports the following success: The entire shop laundry, including that of the barber's family, is now done by the shop porter in two hours' work three days a week, at a total expense of $5 a month for electricity and gas. As first installed, gas-heating elements were employed, although electric heat will probably be substituted later. The electric bill probably represents $2.75, of which the largest item is undoubtedly for lighting the barber's house, as no separate meters have been installed. The porter works two hours every second morning washing, and another hour for ironing the pieces. He is thus engaged about nine hours a week in laundering 1200 or more pieces, practically all of the physical work being performed by the machine. The electric washer does not rip or tear, and no towels are lost, so that the renewal item of $3 monthly is at once abolished. As the porter's time is otherwise lost, no labor charge is attributable to the washer.

The washing and ironing outfit complete cost $135. Figuring a monthly saving of $25, or even $20, this barber shop is

deriving a return of $240, or almost 200 per cent, on its electric washing machine investment. The barber is enthusiastic over his results, and this fortunate installation has been the direct means of selling a dozen other washers besides affording many of the shop's customers eloquent and first-hand testimony of the satisfaction of electric devices.

TO REMIND THE NEW TENANT.

As a reminder to the new occupant of a house or dwelling wired for electricity, in which the meter has been taken out at the removal of the last tenant, the Marion (Ind.) Light & Heating Company is experimenting with a post-card scheme for revealing to the succeeding occupant how easy is the matter of re-establishing electric service.

When a house is vacated, and the company's man goes to take out the meter, he leaves tied to the hallway chandeliers, usually, a printed return postcard, carrying the following suggestion:

"NOTICE.

"The last occupant of this house used electricity with entire satisfaction.

"Fill in blank space with your name and address, mail to us, and our representative will call promptly and arrange to install meter for you.

"Name ....

"Address ...."

The reverse side of the card is already stamped and addressed to the electric company, involving a strong invitation to the new householder to learn something about the company's viewpoint and rates. This plan has been tried only for several weeks in Marion, but in spite of the obvious lag in its operation a number of cards and inquiries traceable directly to these timely suggestions have already been received at the office. Mr. H. E. Gant, of the new-business department of the company, is very much interested in the experiment with these cards, and predicts that the results of the scheme will prove it well worth the meter man's additional trouble taken to affix the card.

"ELECTRICAL WONDERS" AT WHITE CITY

A show attraction for the advertising of central-station service has been created recently by the Comonwealth Edison Company of Chicago, at the White City Amusement Park, by means of an exhibit of household electrical appliances and two sets of moving pictures, one showing the use of electrical conveniences in the home, and the other illustrating the operation of the Fisk Street and Quarry Street power houses. This display gives an instructive and entertaining half-hour to many of the thousands of amusement seekers who nightly throng this park.

Exhibit Pavilion of Commonwealth Edison Company at White City, Chicago.

The company has leased for the entire season one of the large concession buildings, which it has fitted up as an auditorium and exhibit room for electrical cooking and heating appliances. Outside of the building, a clothesline full of washing and a motor-driven washing machine, with an attendant, comprise the "ballyhoo" act which attracts the casual visitor into the exhibit room. Attendants are on hand to explain the uses of the various electric heating and cooking devices shown, and once hourly an exhibit of the moving-picture films is given. The first of these illustrates the many uses of electrical conveniences for the home, and is one of the films formerly exhibited at the 1910 Chicago Electrical Show and already described in these columns.

Following several comedy pictures and a number of really handsome slides showing the interior of the beautiful Electric Shop of the Commonwealth Edison Company at Jackson and Michigan Boulevards, a new film, made only a month ago, takes the audience for a promenade through the great power houses of the Chicago central-station company, the Fisk Street and the Quarry Street stations. These views include a panorama of the Chicago River, showing both stations, and detailed views of the coal handling apparatus and hoisting conveyors, the automatic furnaces and the turbo-generator rooms of each station. The closing feature of the power-house pictures, which lends itself especially to the purpose of an interesting film, is a run by the plant fire department in response to an alarm. The men, drawing hose-reels, are shown dashing down the river bank, and within less than one minute from the time the first company appears, a dozen streams are in operation playing on the imaginary fire.

This moving-picture exhibit of the Commonwealth Edison Company will be operated every night, seven days a week, during the present White City season. The auditorium seats 200 people, and the staff comprises two demonstrators, two doormen and one moving-picture machine operator. Mr. Charles F. Stark, of the advertising department of the Commonwealth Edison Company, is in immediate charge of the White City exhibit.

DECISIONS ON INJURY FROM NEGLIGENCE.

The Kentucky Court of Appeals has decided that damages cannot be awarded for electric shock as a result of a lineman's failure to use appliances furnished. Two employees of a telephone company were commissioned to remove a telephone from the home of a subscriber. They took out the instrument and disconnected the wire from the house at the point where it entered the dining room, but had not taken it off the front corner of the house. One of the men then picked up the wire where it had dropped down after it was disconnected from the house at the dining room, and began to wind it up in a coil, in doing which he gave the wire a pull to get it off the front corner of the house. The other man had cut it off at the pole in the street; and either from its being cut off, or the pull given, it so came in contact with a trolley wire, the latter received a shock and was so burned that he narrowly escaped death. The wire was not insulated, and it was a custom to insulate the wires which passed above the trolley of the railway company. The man knew the wire was not insulated at the point where he picked it up, but he did not know what its condition was between the house and the pole. He brought suit to recover for his injuries against the telephone company, in which proof showed that wires like this, when adjacent to high-voltage wires like trolley wires, should be removed either by the men using insulated pinchers or by making a coil in the wire, tying a rope in this and pulling the wire down with the rope. It was also shown that the men had with them a rope for this purpose. If this method of getting the wire down had been followed, there would have been no danger in handling it.

It was held that the company was not liable. The rule that the master must use ordinary care to furnish the servant a reasonable safe place to work is subject to the exception that the servant takes the risks resulting from changes made by the servant himself in the ordinary progress of the work. Servants who pull down or dismantle houses or other structures acting under a general direction to do the thing, but taking their own course in doing it, assume risks not assumed by

servants in putting up new work under the direction of the master. The reason is obvious. The material is old, and the servant may reasonably anticipate it is not in good condition. He must keep his eyes open, and use ordinary care. The insulation on a wire is subject to atmospheric action, and like other things, in time decays; and though this wire when put up had been insulated, the plaintiff had no right to assume that it was still in such condition that it could be safely dragged across the trolley. He had been furnished a rope with which to take the wire down, and, if he had used it instead of taking the wire in his bare hands, there would have been no danger. The injury was due, not to any fault of the master, but to his own way of doing the work.

In another case the same court held that an electric light company is not liable for death of electrician caused by negligent operation of a switchboard. An electrician, in sole charge of the defendant's light and power plant, had been working in that capacity for about six weeks, and had previously had several years experience in other, but smaller, plants. One of his duties was to turn off the street arc lamps, which was done by pulling two plugs out of the switchboard. These plugs were about 10 in. in length, and ran into sockets in the switchboard, and each of them had a rubber handle about 5 in. long and perfectly insulated. The evidence very clearly established that the proper way in which to turn the lamps off was to pull out one of these plugs at a time, and that if this method was observed there was no danger. The evidence also established that even if both of them were pulled out at the same time, as they might be by taking hold of the insulated handle of each, there would be no danger, unless some part of the hand came in contact with the plugs before they were entirely pulled out, and beyond the point at which they were insulated. It is also clearly shown that the electrician knew that the proper method of cutting off the lamps was to pull one of these plugs out at a time, and that he also knew that it was dangerous to attempt to pull both of them out at the same time; and, being the electrician in charge, he knew that if his hand or fingers touched the uninsulated part of these plugs before they were pulled out that death might result. There was no serious contradiction in the evidence that the method of pulling these plugs out was very simple and entirely safe if the slightest care were exercised by the operator to prevent his fingers or hands coming in contact with the uninsulated part of the plug, which it was not necessary in any state of case to touch in order to pull the plugs out. The electrician, in attempting to shut off the lamps, pulled both plugs out at the same time, and in some manner permitted one finger on each hand to come in contact with the uninsulated plugs. The result was instant death. It was held that the negligence of the electrician barred a recovery of damages against the company. In cases like this all that the master is required to do is to furnish reasonably safe places and appliances, and that this degree of care does not demand that he should furnish the very latest and best improvements. It will be sufficient if those furnished are in general use.

ELECTRIC COMPANY ADVERTISES A CITY'S MOTTO AT OWN EXPENSE.

Some months ago the city of Fort Wayne, Ind., adopted as its municipal slogan the words "Fort Wayne with Might and Main." Shortly afterward, with the idea of presenting this motto in brightly illuminated letters to the chance stranger, as well as impressing its significance on the citizens themselves (without, of course, losing an opportunity to popularize and demonstrate the use of electric signs), the lighting department of the Fort Wayne & Wabash Valley Traction Company, which supplies the local commercial lighting, erected the large ornamental motto sign illustrated herewith, at one of the most prominent corners in the city. This sign measures 20 ft. x 30 ft., is mounted on the roof of a four-story building, and contains about 500 4-cp carbon lamps. The upper figure of the design is to represent in idealized form the spirit of the city.

The sign was erected and has been operated for several months, entirely at the expense of the electric company, which has looked to no one for the cost of the sign or its energy supply. However, the public's appreciation of this evidence of the company's spirit and co-operation has made the sign

Fort Wayne Electric Sign.

and the energy taken to light it a good investment. Strangers inquire about this unusual manifestation of a city's spirit, and the handsome appearance of the sign has aided in the introduction of other illuminated displays of which Fort Wayne is just beginning to get its share. The city has recently discussed the matter of purchasing this sign for installation in a position facing the tracks of the principal railroads passing through Fort Wayne.

TUNGSTEN LAMP PRACTICE IN NEBRASKA.

Mr. Joel Roberts, of York, Neb., wrote a report for presentation at the convention of the Nebraska Electrical Association, May 3, in which he gave answers compiled from a number of Nebraska central stations on their practice as to handling tungsten lamps.

In answer to the first question, "Do you furnish free installations of tungsten lamps?" all answered "No." Six companies reported that the use of these lamps has not caused a noticeable increase in load; one noted an increase of from 10 per cent to 15 per cent; one noted a temporary falling off of load; six reported an increase in earnings; two no noticeable effect, and one a reduction. As to sizes of lamps used, two companies are introducing lamps ranging from 40-watt to 250-watt sizes; three make a practice of installing 100-watt single units as far as possible; one installs five-lamp chandeliers with prismatic glass reflectors; five have some series tungsten lamps on the streets and four have not. For street work seven companies prefer suspension of the lamp from a span wire; one prefers supporting from a bracket, and one prefers brackets unless the lamps are of the series type.

As to his experience at York, Mr. Roberts said that the load was not growing as fast as formerly, but the number of consumers has increased very much. The tungsten lamp has proved

a formidable rival of gasoline lighting systems. In stores it is the practice to use 60-watt or 100-watt sizes in single units scattered over the area to be lighted.

Mr. H. A. Holdrege, of the Omaha Electric Light & Power Company, said that the tungsten lamp had caused a great increase in the number of customers, especially among those formerly using other illuminants. Mr. Frank McMaster, of Beatrice, said that tungsten lamps had brought his company a lot of small consumers, many of whom were of the "kicker" class. Some consumers who were not profitable from the company's standpoint had been changed to better consumers, because of the greater number of hours' use of the installation each month.

Mr. J. R. Cravath expressed gratification at the reports furnished to Mr. Roberts because none of the companies advocated the use of the cheap open clusters with flat porcelain shades, which have been introduced extensively in some places where there is little regard to obtaining the best illuminating results. The questions indicated good illuminating engineering practice among the stations answering.

Mr. McMaster inquired what could be done to induce customers to accept the more modern types of chandeliers for tungsten lamps in which the lamps are placed close to the ceiling. He said his customers insisted on having old-style, long chandeliers with the lamps low. Mr. Cravath said that this is somewhat a matter of psychology and salesmanship. No man likes to think that he is purchasing something which is not modern or which is likely to go out of fashion soon. If it is explained to the customer that the old-style long chandeliers are going out of use and are now out of date, it will have fully as much weight with him as the more important reason for using short chandeliers, namely, that of getting better and more comfortable illuminating results.

Mr. W. J. Scoutt, of Kearney, told of a business man from his town who had a $13 monthly bill for his residence and complained bitterly. Mr. Scoutt put 556 cp in tungsten lamps to replace 348 cp in carbon lamps. The bill was reduced over one-half. The consumer then called him a fool and asked him why he had done it. The answer was to make a satisfied consumer. He had not been using the 250-watt lamps until recently. He had used the 100-watt lamp extensively for displacing gasoline plants. Twenty-five lamps of the 250-watt size had recently been installed with great success.

Mr. McMaster told of a case where one of the first stores in Beatrice to install tungsten lamps had recently complained of insufficient light. He had told them at the time of installation that they were not putting in enough, as they were providing only 0.416 watt per square foot. After this installation was put in another store in town had asked him to plan as good a lighting installation as possible, leaving the matter to him. He had made this latter installation with 1.25 watts per square foot.

Mr. Seabury, of the General Electric Company, said that not over 25 per cent of the carbon-filament lamps are now being sold which were sold two years ago, this, of course, being the result of the tungsten lamp introduction. The tantalum lamp is now in better shape than two years ago and has a good life, even on alternating-current circuits. As a moderate-priced lamp which will stand hard usage it has a field.

President B. C. Adams, of Lincoln, pointed out that there is a field for the tantalum lamp where energy is being obtained at very low rates. Mr. Bell, of David City, said that his company had pushed tungsten lamps probably as hard as any in the State. The load had increased from 7 to 10 per cent.

Mr. Norton, of the Lincoln, Omaha & Beatrice Railway, which operates electric lighting service in Bethany, reported that the tungsten lamp had stimulated residence business. This company gets a deposit of $12 from the consumer for each meter installed. This takes care of the meter investment. It is explained to the consumer that this deposit is necessary on account of the low rate which is being given. Mr. Bell, of David City, told of the use of a small transformer made by the Butler Electric Company, of David City, which is being used by some consumers to reduce the voltage from 110 to 19, so the low-voltage tungsten lamps can be used. Mr. Seabury said that it is unnecessary at the present time to change over to low-voltage lamps in order to get good life for residence use. Low-voltage transformers are being used for sign lamps. In Wichita, Kan., signs of 6000 lamps aggregate capacity are being operated on a flat rate from low-voltage transformers.

The question of handling consumers requiring only one or two lamps was brought up for discussion at this point. Mr. Bell, of David City, said that it is his custom to charge each consumer 75 cents per month per 50-watt lamp. Some others reported putting all consumers on flat rates, no matter how small. Mr. D. L. Bender, of Fairmount, reported getting a $5 meter deposit from each customer.

Wiring and Illumination

ELECTRIC LIGHTING OF A SAILING YACHT.

The trim schooner-rigged sailing yacht *Nomad*, a 50-footer of the Chicago pleasure fleet, has the distinction of being equipped with electric light throughout, including an electric search-lantern, the entire equipment being supplied with energy from storage cells carried aboard. The cabin has accommodations for seven persons and is lighted by three 6-cp, 6-volt tungsten lamps mounted on the ceiling behind bull's-eye reflectors, which aid in the effective and economical distribution of the light. In each of the two staterooms is a 4-cp, 6-volt tungsten lamp, while the sixth unit of the interior illuminating system is a 1-cp, low-voltage tungsten used as the binnacle lamp to light the compass card. The lighting equipment is supplied with energy from a three-cell storage battery, capable of furnishing 135 amp-hours at 6 volts. A 6-volt storage battery of the portable type used for ignition purposes is also employed to light a deck-lamp which is enclosed in a strong parabolic reflector. This lamp is used as a head lantern and also as a torch for signaling, when necessary. The storage batteries are charged on shore between trips; as the vessel is ordinarily used, one battery charge frequently supplies energy for the lamps for a month.

SPECIAL MULTIPLE-TUNGSTEN STREET LIGHTING FOR FORT WAYNE, IND.

The 10 principal business blocks of Calhoun Street, Fort Wayne, Ind., are to be lighted by tungsten groups carried on ornamental iron pillars, eight to the block. The standards will have cast-iron bases with wrought-iron tapered poles, which carry the ornamental brackets at a height of 14 ft. above the sidewalk. Each pillar will carry four 60-watt multiple tungsten lamps on its side brackets, and a 100-watt tungsten in the top fixture at the center of the pole. All lamps will be enclosed in opal globes.

The expense of furnishing and installing the pillars will be borne by the adjacent property owners, the City Council having approved an ordinance which requires each owner along the streets on which the special lighting will be installed to pay an assessment proportional to his front foot space. The general city government will pay for laying the conduit and making connections to the pillars, and afterwards will furnish the energy for lighting the lamps from the Fort Wayne municipal generating plant. The 60-watt lamps on the side arms are to burn from dusk to 11 o'clock, and the 100-watt lamps on the peaks of the posts all night.

After the first installation has been started it is planned to extend the special illumination by the addition of 200 more pedestals, around the court house and on Columbia and Bary Streets. The estimated cost per standard is $40. Much of the conduit for the first installation is now laid, and the contract for the posts will be let shortly.

BATTERY LAMPS FOR EMERGENCY USE ON SHIPBOARD.

A night-lamp circuit, containing 25 4-cp, 110-volt carbon lamps, supplied with energy from a storage battery, has been installed on the steamship *Alabama* of the Goodrich Line, plying on Lake Michigan between Chicago and Muskegon, Mich. The battery is mounted at the highest point of one of the upper decks, so that in case of emergency or accident, as in the event of the vessel's foundering, the corridors will continue to be illuminated to aid in the escape of passengers, even after the engine-room becomes submerged and useless. The battery of 56 cells has a rated output of 4.5 amp for eight hours, and will supply energy to the 25 lamps above noted for 10 hours at a charge. At night, after the regular generator circuit has been turned off, the deck and corridor lamps always receive energy from the battery exclusively, so that in case of any accident, sufficient light is assured, without the manipulation of switches or automatic devices, to assist in passengers' escape. The battery is charged during the day from the ship's generators.

AMENDMENTS TO MUNICIPAL WIRING RULES IN CHICAGO.

In Chicago the rules and regulations of the Department of Electricity of the city government relating to the installation of electrical wires and apparatus are incorporated in a city ordinance and have the force and effect of law. This plan has obvious advantages in enforcing the rules, but it also has some disadvantages, because, with the rapid development of the art it becomes necessary at rather frequent intervals to modify the rules, and to do this, it is necessary to introduce a new ordinance in the City Council, have it referred to the proper committee, and in due time reported on, published and passed. This procedure, which takes considerable time, was followed in the case of some amendments to the rules covered by the ordinance to that effect reported by the committee on gas, oil and electric light, and passed by the City Council at its meeting of June 6 last.

By the new ordinance the rules and regulations contained in the familiar little blue-covered book, edition of 1909, are modified in a few particulars. The amendatory ordinance contains ten sections, and omitting the enacting clause constituting Section 1 and the final section, which says that the ordinance shall be in full force after its passage, approval and due publication, the remaining eight sections may be summarized as follows, the paragraph numbers relating to the printed code containing the "Rules and Regulations" of the Department of Electricity of the City of Chicago:

Section 2 covers an amendment to Paragraph 5, by striking out clauses (a) and (b), which required the use of lightning arresters on all outside lines over 100 ft. long. It has been found in practice in Chicago that where lightning arresters are not maintained under expert supervision they are liable to do more harm than good, and it has been thought best to waive the requirement.

Section 3 amends clause (f) of Paragraph 12, by which the requirement for soldering joints on all overhead pole-lines construction is repealed.

Section 4 amends clause (c) of Paragraph 14 in such a manner as to allow the use of patent splicing devices where they make a joint as good as the regular soldered joint. This paragraph comes under the rules relating to inside work.

Section 5 amends clause (c) of Paragraph 19, so as to repeal the requirement of a wire mesh around arc lamp globes. This is now considered an obsolete requirement.

Section 6 amends Paragraph 64, which has to do with the wiring for signaling systems, telephones, telegraphs, district messenger circuits, fire and burglar alarms, etc. Here in clause (a) the requirement of a brick partition in manholes separating signaling wires from electric service wires is repealed; provided, however, that the low-potential and high-potential wires are properly installed on opposite sides of the manhole.

Section 7, amending clauses (c) and (d) of Paragraph 65-A, has changed the requirements for moving-picture machines, making these requirements a little more strict than heretofore. This amendment also allows the use of a steel receiving tank on moving-picture machines, but requires that this tank be so arranged that it shall be practically impossible for a lighted film or a spark to enter the tank. In the past the ordinance allowed only the use of the take-up reel.

Section 8 amends clause (c) of Paragraph 68 to require the use of larger bolts for the support of electric signs. This amendment also requires the use of two turnbuckles on such signs as are required to have two supporting chains. It has been found that the chains or cables stretch, and where only one turnbuckle is used the whole weight of the sign is put on the one cable in making it straight.

Section 9 also amends Paragraph 68, relating to electric signs, but the present amendment does not in any way alter the previous requirements. Various clauses of the paragraph have been rewritten to shorten and simplify it.

CENTRAL-STATION ELECTRIC SIGN ON NEW YORK BAY.

Approaching New York from the sea one sails through two magnificent bodies of water, Lower and Upper New York Bay. These are joined by The Narrows, a strait between Brooklyn and Staten Island. Skirting the bluff on the Brooklyn shore is one of the finest driveways in the world, known as the Shore Road, extending from Fort Hamilton on the south to Owl's Head on the north, where it turns in and becomes a part of the boulevard system of the city. Owl's Head has a commanding position, overlooking both bays, and here it is that the Bay Ridge station of the Edison Electric Illuminating

Fig. 1—Day and Night Views of Brooklyn Edison Sign at Bay Ridge Station.

Company of Brooklyn is located. The company has just completed an electric sign 200 ft. long on the dock in front of the station; the large letters on the sign being 18 ft. high and the other letters 12 ft. high, the framework being 33 ft. tall. Exactly 1962 5-watt, 10-volt tungsten lamps are used to illuminate the sign, which is the biggest in Brooklyn and is visible all along the bay and its shores from The Narrows to the Battery. Alternating current is used and the potential is first stepped-down to 120 volts from 2300 volts by two transformers and then to 10 volts in 16 transformers, one on the back of each letter.

Fig. 2—Side View of Edison Sign at Owl's Head.

There is a double row of lamps near the edges of each letter and the latter is made with a 3-in. wall projecting forward from its face. This wall confines the light, giving to each letter a clean-cut appearance. In order to withstand the tremendous wind pressure sometimes exerted on the Lower Bay a specially constructed angle-iron framework is used, the design of which is clearly shown in Fig. 2. The sign can be read easily from the Staten Island and Jersey shores.

MANHOLE PROTECTION FOR HIGH-TENSION UNDERGROUND CABLE SYSTEMS.

By S. D. Levings.

Of the operations involved in installing and making ready for service high-tension underground cable systems, that of affording protection to the portion of the system which passes through manholes is one of the most difficult. In the earlier installations of such systems, when 2200 volts was considered the allowable maximum for underground cable transmission, manhole protection was not considered a necessity; but as the number of cables increased, making it necessary to rack two or more of them on the same support and hence in very close proximity to each other, and as voltages were gradually being raised, manhole protection became not only an apparent necessity, but an imperative one. As the voltage of these systems was gradually increased to such tensions as 9000, which is standard with the Commonwealth Edison Company of Chicago, "blow-outs" became more frequent. If this form of trouble, which is feared by lighting companies possibly more than any other, would confine itself to the destruction of the cable which originates it, conditions would not be so bad; but quite to the contrary, it is safe to say that no unprotected cable within the confines of the ordinary manhole is safe when the high tension "lets loose."

As to the cables themselves, there is no good reason why it should be assumed that the portions which pass through the manholes are not possessed of the same integrity as those in the ducts of the conduit system, unless some may consider the splice the weakest point in the cable. As a matter in fact, it is generally conceded that a splice, properly constructed, is as perfect electrically and mechanically as the continuous portions of the cable. Therefore, there is no reason why "blow-outs" should occur in manholes more frequently than in the ducts, and this deduction is borne out in practice.

On the other hand, as such accidents are liable to occur in manholes, and as the cable, unprotected, is in danger of mechanical damage, to which the portions in the ducts are not subjected to the same degree, it seems a logical conclusion that manhole sections should be provided with the same protection as that afforded by the ducts. The prime object of this form of protection is the safeguarding of each cable against the results of internally caused accidents to other cables in the manhole, and from external mechanical injury.

Lead fuses at about 330 deg. Fahr. There is no record of the temperature of the arc caused by a high-tension "blow-out" nor of the surrounding atmosphere, but it is known that such discharges are measured in many hundreds of degrees, and that a large heat field is instituted. In any event, practice has shown that in some instances the sheaths of cables several feet away from a "blow-out" have been melted away from the cores, while the cables adjacent to the "erupting one" have not only suffered the removal of the sheath, but the complete disintegration of the insulation and sometimes the copper conductors themselves. It can readily be seen then, that unprotected cables are subject to injury from accidents to others, and when all are unprotected, the trouble generally becomes a cumulative one until finally all of the cables of the system in a particular location are put out of service at the same time.

When a "blow-out" occurs in the ducts, the heat generated is not of sufficient duration, despite its intensity, to penetrate adjacent ducts and cause injury to cables therein contained. The insulation resistance of the combined thicknesses of duct walls is generally sufficient to withstand the strain of the breakdown, or else the discharging current does not have an opportunity to concentrate and puncture the walls separating adjacent cables. If the same protection is given the cables in passing through the manholes as is afforded by the ducts, it is safe to assume—and the fact is assured by practice—that an accident to any one of the cables will be confined to that cable.

There are two commonly used methods for providing this protection. One adopts asbestos in the form of pipe covering for the protecting medium, the materials being secured around the cable by means of brass or copper bands. Moisture is excluded by giving the finished covering a coat of moisture-proof compound. The asbestos covering may be purchased split, so that it may be slipped around the cable, and bends are made with standard asbestos bends, the cable being made to fit the best combination of coverings between the ducts through which it enters and leaves. This protection has the marked advantage of being easily worked and handled, but it possesses the pronounced disadvantage of offering a poor mechanical protection. The other method employs split vitrified tile ducts, similar in construction to the main ducts of the conduit system.

This latter method is in use by the Commonwealth-Edison Company of Chicago, and the interior views presented in Figs. 1 and 2 are of interiors of manholes containing cables so protected. Like the asbestos covering, these split tile ducts are manufactured with standard radii of curvature, and may be obtained in several diameters and thicknesses of wall. It is of course, obvious that a duct of sufficient diameter to clear

the sleeve of the splice must be used. In planning protection with tile ducts, the duct line through the manhole with its support is first laid out. The method of supporting the ducts depends upon the characteristics of the manhole, and where the duct lines enter close to the floor and right angle turns in the cable are necessary, the method shown in Fig. 1 is employed. A channel or angle iron, the latter being the cheaper, may be employed as the main supporting medium, the ducts being laid on a plank to fit the iron, thus obtaining a broad surface of support. The angle, or channel, as the case may be, can be either let into the manhole wall, or can be supported on brick or concrete piers at its extremities. It is always advisable to provide piers under the duct line where it emerges and enters the main duct system. Such a pier is plainly shown in Fig. 1.

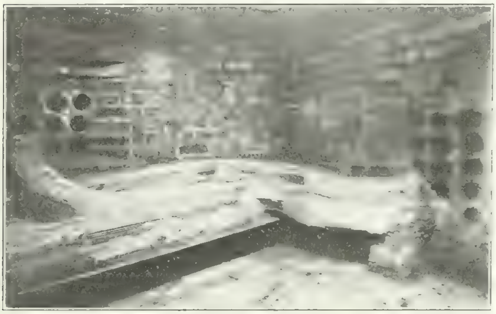


Fig 1—Method of Supporting Ducts in Manhole.

As previously stated, the tiles are split, and it is necessary to apply cement mortar freely. Owing to this fact the work generally possesses an untidy and unworkmanlike appearance. No protection from cement is necessary when covering the horizontal joints, unless the two portions of the tile are not in line, or unless the edges are badly broken. Where vertical joints cannot be well closed, owing to bends, a strip of muslin or burlap may be placed around the ducts to guard against the entrance of mortar. The application of cement is the saving operation in this work, as many times the duct lines are required to be self-supporting for short distances, as indicated in Fig. 2. While the ducts to a greater or less extent rest upon the cable, and pressure is to be avoided when possible by properly aligning and bonding.

Fig. 2—Self-Supporting Ducts In Manhole.

Where the cables pass from one end of the vault through to the other, the duct lines may be supported on channels or angles laid across the arms of the cable supports, as illustrated in Fig. 2. The plank is provided as previously described. As it is not desired to raise the ducts in the vault any higher than necessary, as many ducts should be placed on the lower arms of the supports as possible. It is often advisable to plan for high-tension cables many years in advance of their installation. For this reason, and also because it is common practice in all underground systems, the lower ducts should be reserved for high-tension cables.

The segregation of conduit systems into high and low-tension portions, each independent of the other, is advocated by many engineers, and the chief cause for such opinion is the fear for the low-tension system, should a "blow-out" occur in one of the high-tension cables. By adopting the manhole protection, as outlined, no fear of this nature need be entertained, and a large portion of the two-system conduit investment may be eliminated. Aside from investment features, the loss of revenue during time needed for repairs to broken down cables represents a considerable item, and the advantages of manhole protection can best be determined by calculating the loss of revenue occasioned by a "blow-out" on a single cable where protection is installed, against the loss on two or more cables where protection is not afforded.

Last but not least, the employees of the company are protected to the maximum extent by this method. While accidents resulting fatally are more frequent among the aerial men than the underground workers, cases have been known where life has been lost due to the inability of some poor fellow to get out of a manhole when a cable has broken down. From the standpoint of investment, the pecuniary cost of one life, say nothing about the moral responsibility, is more than enough to offset the protection necessary for the average system. The actual cost of this work is not large. The amount varies according to the characteristics of the manhole and it is not possible to give a unit of cost or one near enough to base an estimate upon.

A PECULIAR UNDERWRITERS' RULING.

By G. S. Kemery.

In the *National Electrical Code* for 1909 approval for the use of Edison plug cut-outs is given only for voltages not exceeding 125 for 0 amp to 30 amp cut-outs and not at all for 31 amp to 60 amp cut-outs. A ruling to this effect could not be found by the writer in the handbook of "Installation Rules," but in the handbook of "Construction Rules," which indicates how the apparatus is to be constructed, are clauses which, although expressed in a different way, have essentially the above meaning. In effect manufacturers are directed to cease making Edison plug cut-outs for 31-60 amp fuses and not to equip apparatus operating at voltages in excess of 125 with those of 0-30 amp capacity. There is nothing to prevent the manufacturer from making this contraband equipment; but work in which it is used will not be approved. Under such conditions it is likely that the demand for it will shortly end.

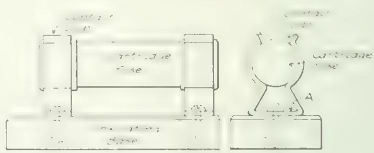


Fig. 1—National Code Cut-out and Fuse.

It is not the manufacturer that will suffer, however, as he can furnish other appliances that from his and the Underwriters' viewpoint will supersede the Edison plug cut-outs satisfactorily. It is the user that suffers, the industrial plant maintenance man and the men higher up that own the plant.

If the writer's understanding of the ruling is correct the type of cut-out, fitted with a National Electrical Standard fuse (see Fig. 2), indicated in Fig. 1, must be used for 0-30 amp if the voltage exceeds 125 and does not exceed 250, and it must be used for all voltages below 250 for 31-60 amp. This type of cut-out has three inherent disadvantages, which are: (1)

It is frequently difficult to remove the fuses from the cut-out without introducing a tool of some sort. (2) The contact clips get bent intentionally and unintentionally and this results in loose connections. Sometimes the contact fingers are broken off entirely. (3) It is difficult to remove or replace fuses, particularly in the 0-30-amp size, without danger of shock.

Probably none of the above detriments is of much consequence where cut-outs are used in residence and office-building illuminating installations, where fuses are very seldom blown.

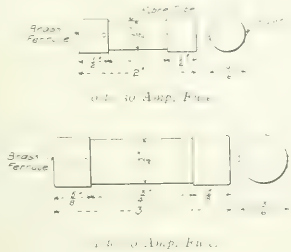


Fig. 2—National Electrical Code Standard Fuses.

But in industrial-plant work, particularly where the fuses are used for the protection of small motors, and blow often, and where every minute has its value, they become important.

Referring to disadvantage No. 1, it is necessary, if a good contact is to be provided, that the spring clip fit the fuse ferrule snugly and it usually does when the cut-out is first installed. Some of the metal used by manufacturers, doubtless in an effort to provide a good contact pressure, is exceedingly stiff. It requires considerable pressure to force the fuse into such clips, as shown in Fig. 3, and it is often impossible to remove the fuse with the fingers. From Fig. 3 it is apparent that to remove or replace a Code fuse of less than 60 amp. capacity the clips must be forced considerably from their normal positions, and the little clips sometimes resist displacement stubbornly. This gives more trouble with the 0-30-amp fuse (see Fig. 2) than it does with the 31-60-amp size because the smaller diameter of the fuse of less capacity makes it difficult to grasp The condition becomes aggravated when one's hand is oily, as it frequently is when motor repairs are being made. The 31-60-amp fuses are not at all easy to remove when the contact springs are of stiff metal.

Obviously either size of fuse can be pried out easily, but the repair man uses the tool most convenient, which is usually either a metal screwdriver or a pair of pliers. If the tool slips then, as sometimes happens, two legs of the circuit may

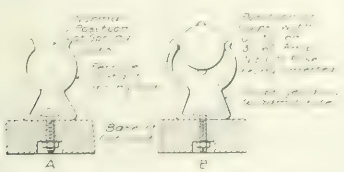


Fig. 3—Showing How Clips Must Yield.

be short-circuited and a larger main fuse, the one that protects the panel box, disrupted. It is certainly unwise to use equipment which encourages the introduction of metallic tools into "live" panel or switchboxes.

Disadvantage No. 2 follows directly from disadvantage No. 1. A repair man in replacing a blown fuse has difficulty in removing the old one. It may be that he [illegible] with [illegible] and has to pry out the old fuse with [illegible]. He thinks that the clips fit too tightly. He corrects the trouble by prying he clips apart. Doubtless he pries too hard the first time—he is not a watchmaker—and then must bend the clips back again. After a trial or so he adjusts them to his satisfaction and inserts a new fuse. The motor or other apparatus is tested. It operates and the repair man leaves. Shortly after the motor gives trouble and another repair man, after some delay, locates the fault. It is a loose connection in one of the fuse clips. The new man endeavors to adjust the clips according to his ideas and in doing so one of the clips is broken off at the point *A*, Fig. 1. This does not happen very often, but it does happen often enough to be a very disagreeable characteristic of the National Code standard 0-30-amp and 31-60-amp cut-outs. Contact fingers in these cut-outs formed from very soft metal are occasionally bent sufficiently out of shape by merely inserting and removing fuses that loose connections result.

Disadvantage No. 3 also is probably not of much consequence in residence, store or office-building installations because one in replacing a fuse in such installations seldom stands on a

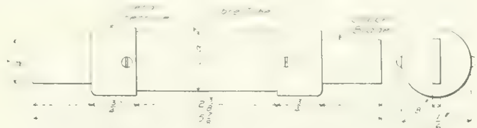


Fig. 4—National Fuse Code 61—100 amp.

grounded cement floor, cast-iron floor plate or steel roof truss. But the repair man in an industrial plant often does. From Fig. 2 it will be noted that there is but 1 in. clearance between the "live" end ferrules on a 0-30-amp fuse. This is not sufficient for the fingers of a burly electrical repair man or for the fingers of one that is not burly as many can testify. In replacing or removing one of these small fuses the fingers are apt to touch one or the other of the ferrules, and if the manipulator is "grounded" he gets a shock. He would not if the system were free from grounds, but it seldom is. If not grounded through faults, it is usually permanently grounded through the ground detector.

Such a shock is not fatal, but the one that a 250-volt alternating-current circuit gives is not at all pleasant. It is sufficient to cause the arms and body to twitch and to cause the man to loose his balance and fall if he stands in an awkward position. Such an accident might, with the man working on a roof truss 30 ft. above the floor line, result seriously. Some types of Code 0-30-amp cut-outs have their porcelain bases so molded that it is difficult for fingers to touch line metal parts,

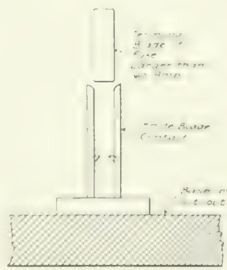


Fig. 5—Fuse Clip for National Code Fuse Larger Than 60 amp.

but in other designs, that for instance shown in Fig. 1, no protection is afforded.

None of these disadvantages outlined above holds for National Code fuses of capacities above 60 amp (see Fig. 4 for typical design), nor for their fuse holders, of which a typical end view is shown in Fig. 5. Such fuses have knife-blade contacts. They can be removed and replaced easily because their diameters are such that the fingers can grip them. No trouble due to loose connections or broken contact fingers is experienced. Because of the knife-contact blades (see Fig. 5) the fuses can be inserted and removed with comparative ease. The blades move but slightly when a fuse is taken out or re-

placed. Wiremen and repair men do not endeavor to alter the adjustment of the knife-blade contacts because they can readily manipulate the fuses in them without such adjustment. Shocks are not liable to be received through the knife-blade contact fuses because the ferrules have ample distance between them. In the smallest size, 61-100 amp, shown in Fig. 4, this distance is 2⅜ in. For capacities exceeding 60 amp the situation is well taken care of.

Where a fusible cut-out having a capacity of less than 60 amp is required on a circuit having a voltage of less than 250, the combination of an Edison plug cut-out (see Fig. 6), a National Code fuse (see Fig. 2) and an Edison fuse-plug casing (see Figs. 7 and 8) provides an equipment having none of the three disadvantages tabulated above. But the Underwriters approve this combination only for 0-30 amp not exceeding 125 volts. What their reasons are for withholding approval on the combination for 0-60 amp not exceeding 250 volts, the writer does not know.

Edison plug cut-outs like that shown in Fig. 6 have, in the past, been made in two sizes, as were the Edison fuse-plug casings. The smaller cut-outs accommodated the smaller casing, which in turn fitted a 0-30-amp National Code fuse. The larger combination took a 31-60-amp National Code fuse. Both of these fuses are approved for service at 250 volts or less.

Fig. 8 shows clearly the construction of the casing, and Fig. 9 the manner in which a fuse rests in it. The casing consists essentially—the actual construction is different in different makes—of a porcelain hollow cylinder, to enclose the fuse, having at its bottom a screw-thread formed from sheet metal, which meshes into the corresponding thread in one of the sockets of the cut-out. The screw-thread at the bottom of the casing connects electrically with a metallic lining at the top, on the inside of the casing. The casing screwing, as it does, into the cut-out socket effects excellent pressure contacts between the lower ferrule of the fuse and the brass contact button

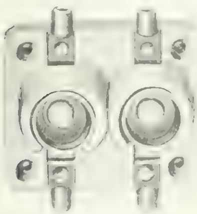


Fig. 6—Double-pole Edison Plug Cut-out.

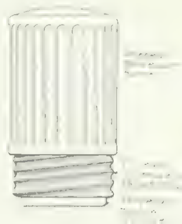


Fig. 7—Edison Fuse Plug Casing.

(shown in Fig. 6 at the bottom of each of the sockets) and between the metallic top lining of the plug and the top ferrule of the casing of the fuse. When the casing is screwed into position the thread and the button in the socket of the cut-out, and consequently the top and bottom ferrules of the fuse in the casing, connect to the two cut-out binding posts located on the same center line as the socket. "Live" parts of the fuse are not exposed when the casing is screwed into its position. The outer surfaces of the better casings are corrugated, as shown in Fig. 7, so that they can be easily removed from the cut-out with the hand, although it may be oily or enclosed in a greasy glove.

Disadvantage No. 1 does not obtain with the Edison plug cut-out fuse-plug casing-fuse combination because a tool is never required nor can one, so far as the writer knows, be used in removing the fuse-plug casing from the cut-out. There is no occasion for introducing a metallic tool into the panel box. To remove the fuse from the casing a nail, a piece of wire or a stick is inserted through the hole in the top of the casing to start it. This operation is performed, after the casing is removed from the panel box, where there is no danger of short-circuiting.

Disadvantage No. 2 does not obtain as there is no member that can be bent. The pressure contact effected by screwing the casing into the socket is excellent.

Disadvantage No. 3 is out of the question where the cut-out casing-fuse combination is used because the fuse is wholly encased in porcelain. Clearances are ample and accidental contacts between the hand and "live" portions are inexcusable. When an Edison plug cut-out of the form shown in Fig. 11, which has a porcelain protecting cover, is used accidental contact and shock are practically impossible.

The device shown in Fig. 9, which is known as the "Edison plug fuse," is approved for 0-30 amp at not exceeding 125

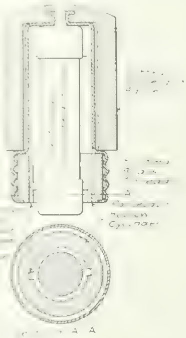


Fig. 8—Sections of Fuse-Plug Casing.

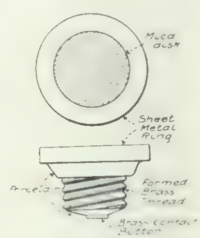


Fig. 9—Edison Fuse Plug.

volts. This places it, although it is decidedly inferior, in the same class with casing-fuse combinations, where it does not seem to belong. The same enclosed fuse used in the casing-fuse combination is rated and with approval used in a cut-out like that of Fig. 1 at 250 volts, but its use is not permitted at that pressure when it is further enclosed in a porcelain container which permits the fuse to be used in a cut-out that provides good contacts and lessens liability to shock.

The plug fuse of Fig. 9 is certainly not to be recommended

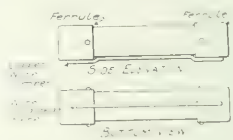


Fig. 10—Copper Jumper Soldered on Fuse.

for use at 250 volts. The break distance is too short for that pressure. It may be that this device, although for some time it has been approved for only 125 volts, found its way into 250-volt cut-outs and the Underwriters to guard against this limited all Edison plug cut-outs to 125 volts. But this does not account for the elimination of the 31-60-amp Edison plug cut-out.

It might be argued that fuse-plug casings are dangerous be-

Fig. 11—Protected Edison Plug Cut-out.

cause pieces of metal—dummy fuses—having carrying capacities much in excess of the rating of the cut-out might be concealed in them. Dummy fuses can be and are thus used in fuse-plug casings. But they are also used in the National Electrical Code cut-out shown in Fig. 1. A jumper of copper wire of ample diameter is soldered, as shown in Fig. 10, from ferrule to ferrule of a blown fuse. The dummy fuse is inserted, with the copper wire toward the base of the cut-out, so that its presence is not easily detected. It is not really necessary to solder the wire to the fuse. An expert can so wedge

it between the ferrules of the fuse and the contact clips that it will carry the load and not be readily discerned.

It is a fact that the Edison plug fuse of Fig. 9 is not capable of safely operating at pressures in excess of 125 volts. But if this has been taken as a reason for limiting all Edison plug cut-out combinations to that pressure it does not seem fair. In the opinion of many the Edison plug cut-out casing-fuse combination is, for capacities below 60 amp, a much better equipment than is the standard cut-out fuse combination for either 125 volts or 250 volts.

Letter to the Editor.

The Fallacy of Using Too Large a Centrifugal Pump.

To the Editor of Electrical World:

Sir:—The fallacy of using a thing too big for the purpose just for the sake of having it large enough on the assumption that it is better to have it too big than too small is well illustrated in the case of an engineer who selected a centrifugal pump for a higher head than was actually required with the idea in mind that if the pump was built to deliver water against a high head, it would surely be large enough to use on any head lower than that at a corresponding saving in power.

A centrifugal pump is in some respects like a shunt-wound generator; it generates constant pressure which must be entirely consumed by friction of water in the pipes and counter-pressure due to static head. If the latter is decreased the friction in the pipes must increase by an amount sufficient to compensate therefor; that is, the flow of water will increase until the friction developed is great enough to absorb the excess pressure. To carry the analogy further, the pressure developed by a pump is essentially a function of the speed, and wherever the head is varied, it should be done by varying the speed of the pump. However, if this is impracticable a valve should be inserted in the pressure pipe and adjusted until the proper reading is obtained upon a pressure gage in the delivery pipe of the pump.

The overloading of centrifugal pumps due to application under too low a head is similar to the operation of a generator on too large a current, and in extreme cases its effect is similar to a short-circuit. For instance, a centrifugal pump delivering into a long pipe will stall the motor and probably blow the fuses if the pipe is suddenly broken off close to the delivery. A centrifugal pump will operate efficiently over a considerable range of head, providing the flow of water is maintained near the rated capacity of the pump, either by the use of a valve or by changing the speed of the pump. Therefore, where a mistake has been made or where it is desired to operate a pump at a head different from that for which it was designed, efficient operation can be obtained by the use of a valve or by changing the speed. Ignorance of these simple facts has often caused the rejection of a pump, and in some cases necessitated doubling the horse-power of the driving motor in order to carry the excess load due to reduction of head. It is not an easy matter to measure the flow of water and a pump is liable to considerable overload without any one being any the wiser, except that the motor takes an abnormal amount of energy to operate it.

Buffalo, N. Y. David Morris.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Cascade Converter.—H. S. Hallo.—The conclusion of his long illustrated article on the cascade converter. In the present installment the author deals with its use for the supply of energy to three-wire networks. The arrangement is similar to the old three-wire dynamo of Dolivo-Dobrowolsky, but is simpler and without any complications. The slip rings which are needed for starting may be used for the current of the neutral wire. If the balancing current is not very large, the neutral wire may be connected with a single switch to one of the slip rings. If the balancing current is large, however, it is preferable to subdivide it over the brushes of all the slip rings. This may be done with the aid of a three-pole switch as indicated in Fig. 1,

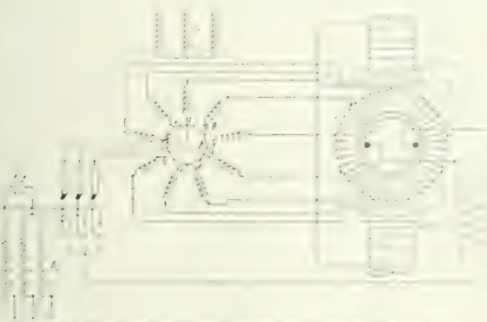


Fig. 1—Diagram of Connections of Cascade Converter.

which shows all the connections. In this case the balancing current does not pass through the contacts of the starter. Moreover, there is no voltage impressed on the starter during operation. There are a large number of cascade converters in operation on three-wire systems, and it has been found that the voltage difference between the two halves of the network is about 0.5 per cent of the voltage between the outers if the balancing current is 20 per cent of the full-load current. If the balancing current is 50 per cent of the full-load current, the voltage difference between the two halves is 1 per cent of the voltage between the outers. Sometimes it is desirable to increase the voltage of the half which is overloaded to compensate for the voltage drop in the feeders. In this case it is necessary to use a series-wound booster, which may be directly driven from the axle of the cascade converter.—*Elek. Zeit.*, June 16.

Efficiency Tests.—J. F. Forrest.—The author recommends the methods of analysis of results of the Hopkinson efficiency test given in a paper by Drysdale, which was recently abstracted in the Digest. As to the differences in the efficiency between motor and generator action he emphasizes that it is a real one, and is an inherent feature of the efficiency curves of any machine. For any given output, the armature current of a generator can be divided into useful current and exciting current, while that of a motor consists of useful or working current and "losses" current. The "losses" current when running as a motor will generally be greater at the same output, thus the motor armature current and I^2R loss will be slightly higher than those of the generator. He finds that this agrees with the figures of about 1 per cent in Drysdale's numerical example. Drysdale replies that Forrest's remarks about the armature losses are correct in principle, but they do not exhaust the problem, since the error introduced by wrong apportionment of the iron losses is not insignificant.—Lond. *Electrician*, June 17.

Lamps and Lighting.

Indirect Illumination.—Bloch.—The author claims that indirect arc-lamp illumination is not as uneconomical as is often alleged. Indirect arc-lamp illumination is far more economical than illumination with carbon incandescent lamps, and if the arc lamps with reversed position of the carbons are used, indirect arc-lamp illumination is also more economical than metallic-filament lamp illumination. If arc lamps are used with the usual position of the carbons, indirect arc-lamp illumina-

tion is about as economical as metallic-filament lamp illumination. Indirect arc-lamp illumination with reversed carbon position requires from 14 to 18, on the average 16 watts per lux of average illumination and 100 sq. m area of the ground. If arc lamps are used with the usual position of the carbons the power consumption is 22 to 28, and in the average 25 watts. Large rooms lighted by indirect illumination may look cold on account of the absence of shadows. For this reason a semi-indirect illumination system may be used. Another way is to use indirect illumination of the walls by means of specially constructed arc lamps. The light is thrown onto the walls between the windows and reflected from them and illumination of this kind is almost exactly the same as the illumination obtained by daylight through the windows. The quartz mercury-vapor lamp is specially suitable for indirect illumination. The power consumption is about the same as with arc lamps with reversed carbon position, but the quartz lamp has the advantage that the length of its life is 1000 hours and that the light is absolutely quiet. Such an illumination is specially good for draughting-rooms.—*Allgem. Elek. Ges. Zeit.*, Vol. 12, 1910, page 12; abstracted in *Elek. Zeit.*, June 16.

Street Lighting.—J. Abady.—A paper read before the Institution of Gas Engineers in London, reviewing the question of municipal street lighting, both by electricity and gas. He did not touch upon the controversy between the two systems, but confined his remarks to a discussion of forms of contract and the size, spacing and arrangement of lamps to obtain good illumination. He favors charging for the actual light rather than for the energy supplied and points out the advantages of small units close together.—Lond. *Elec. Eng'ing,* June 16.

Tungsten Filament.—A note on a recent British patent of C. H. Weber (18,808, 1909; June 9, 1910): In order to render tungsten filaments less brittle, a small percentage of tellurium (a brittle metal vaporizing at 1400 deg. C.) is added to the tungsten mixture before squirting. After the usual baking process, the filaments are heated in a reducing atmosphere at a red heat for a considerable time in order that the tellurium may melt and alloy with the tungsten. Firstly, the filament is raised to a bright red heat and most of the tellurium is vaporized. About 0.05 per cent tellurium is present in the finished filament, however, and this is about the amount which gives the toughest alloy. Selenium can be used instead of tellurium. Two other processes for obtaining the required alloy are described in the specification. It is stated that blackening is not accelerated, as the tellurium is retained by the filament, and the carbon content of such filaments is less than that of ordinary tungsten filaments.—Lond. *Eng'ing,* June 16.

Metallic Filaments.—A note on a recent British patent (15,193, 1909; June 9, 1910) of Société Française d'Incandescence par le Gaz (System Auer). Filaments of vanadium, niobium or titanium are prepared by reduction from the oxides of these metals. The filaments are squirted from a paste of the oxides mixed with powdered metal and lampblack and, after being heated to make them conduct, are raised to a red heat in a suitable atmosphere to decarbonize them. Finally, the decarbonized filaments are reduced at a white heat (about 1800 deg. C.) in an atmosphere of hydrogen and ammonia to the metallic state. The decarbonizing and the final reduction can be performed in one treatment by the addition of a small percentage of an oxidizing gas to the hydrogen and ammonia.—Lond. *Elec. Eng'ing,* June 16.

Resistance Meter for Filament Lamps.—An illustrated description of a new ohmmeter specially designed for the use of incandescent lamp factories. The current is kept constant and the e.m.f. is measured with a precision voltmeter, which is directly calibrated in ohms. One of the special and carefully worked-out details of this instrument is the manner of mounting the filament to be tested.—*Zeit. f. Beleucht.*, June 10.

Generation, Transmission and Distribution.

Vacuum in Steam Turbines.—R. M. Neilson.—A paper in which the author deals with the question of the effect of variation in the terminal pressure on the economy of steam turbines, and, from a consideration of the available heat energy in steam and the constructional requirements in steam turbines, explains why the efficiency of a turbine is affected as it is by change in the terminal pressure. A curve is given from which the effect of such changes on the steam consumption of any turbine may be estimated.—Lond. *Electrician,* June 17.

Exhaust-Steam Turbines at Edinburgh.—F. A. Newington.—A (Brit.) Municipal Elec. Ass'n paper on the exhaust-steam turbines and condensing plant recently installed at Edinburgh. The most interesting feature is the use of sewage for condensing purposes. The capital cost of the installation and the reduction in the costs per unit generated are tabulated. The first row of figures refers to the year 1908, when only reciprocating engines were used without condensation. The second row of figures refers to the year 1910, with exhaust-steam turbines and condensation. In 1908 the price of coal was considerably lower than in 1910, but for the purpose of comparison the 1910 prices has been taken for both periods.

COSTS PER KW-HOUR GENERATED.

	1908	1910	Saving per cent
Fuel	[illegible] cent	[illegible] cent	33.4
Oil and stores	0.018	0.008	50.0
Water	0.054	0.012	78.0
Salaries and wages	0.168	0.04	
Repairs estimated	0.114	0.114	
Total	[illegible] cent	0.562 cent	30.0

In the costs per unit generated for the 1910 figures the units used by the condensing plant have been deducted.—Lond. *Electrician,* June 17.

Mixed-Pressure Turbines.—A. Bremner.—An illustrated paper read before the (Brit.) Municipal Elec. Ass'n. The author describes the mixed-pressure turbines installed at Burslem, and gives particulars of the saving in works costs thereby obtained. He also mentions the saving obtained in other installations of mixed-pressure turbines, which latter he considers are an economical method of extending existing supply stations. For the mixed-pressure turbine installed at Burslem the following figures of works costs per kw-hour generated are tabulated to show the gain (32 per cent) due to installing the turbine.

	Reciprocating Sets only, April, 1909.	Combination of turbine and reciprocating sets. April, 1910.
Coal	0.488 cent	0.368 cent
Water	0.142	0.056
	0.630 cent	0.424 cent

The calorific value of the coal is 12,700 lb-Fahr. units per pound and its cost per ton $1.81 into bunkers.—Lond. *Electrician,* June 17.

Air Pump for Exhaust Turbines.—In the discussion on mixed-pressure turbines before the (Brit.) Municipal Elec. Ass'n, I. V. Robinson described a kinetic air pump of a new type. One of these pumps had been in operation for some eight months and was able to maintain a steady vacuum of 29 in. on a 750-kw turbo-plant. The air and vapor were drawn from the condenser under the action of a steam jet, and, together with the steam, were met by a water spray, which condensed the added steam of the jet. The ejector water was then encountered and the combined flow delivered to the discharge pipe. Fig. 2 shows a sectional arrangement and assembly plan of the kinetic pump. The left-hand diagram is a section of the kinetic air ejector. 1 is the steam inlet; 2 a steam nozzle; 3 air and vapor condenser; 4 steam jet, air and vapor combining tube; 5 non-return valve; 6 spray-water inlet; 7 spray-water holes; 8 spray-water driver; 9 spray-water combining tube; 10 water jet inlet; 11 water jet adjustable nozzle; 12 water jet combining tube; 13 main discharge to tank. The right-hand diagram shows the general arrangement of the kinetic air pump. The letters in it have the following meaning: Condenser water: *B* head pump section; *C* head pump dis

charge; *D* equilibrium pipe to condenser; *E* pressure pump suction; *F* pressure pump discharge to tank. Air from condenser: *G* steam jet air suction; *H* steam jet; *J* steam jet discharge to water ejector; *K* kinetic pump suction from tank; *L* kinetic pump discharge to spray; *M* kinetic pump discharge to jet. The complete arrangement included a circulating pump for the spray and ejector water and a two-stage centrifugal pump. With the latter the first stage is connected to the condenser from which the condensed steam water, over and above the air and vapor, which are removed by the steam jet, is

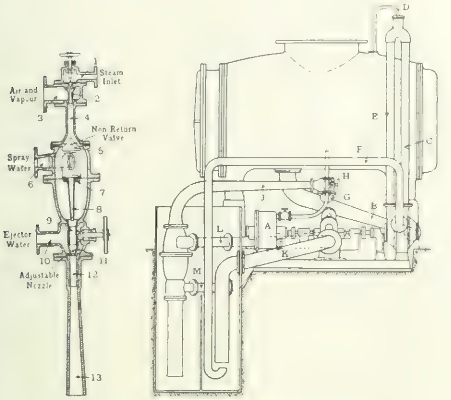


Fig. 2—Air Pump for Exhaust Turbines.

withdrawn and delivered against a static head of 8 ft. into a pipe, the top of which is connected to the condenser barrel. The connection ensures that the first stage of the pump (known as the head and pressure pump) shall discharge only against this head. Further a positive head is thus secured for the suction side of the suction stage of the same pump. This second stage discharges the condensed steam water to the pump surrounding the ejector, whence the boiler feed is drawn. In the right-hand drawing the two pumps are shown driven by a small Curtis turbine. The pump dealing with the water spray and jet keeps this water constantly circulating from the pump. The advantage of the arrangement was that the latent heat in the steam jet was not given up to the circulating water as in the case of a vacuum augmenter, but to the hot well, which was raised to a temperature 10 deg. or 15 deg. above the temperature corresponding to the vacuum. The apparatus ran with the minimum of attention, being entirely rotary with ring-oiled bearings; there was but a single pumping unit, and the space occupied was extremely small.—Lond. *Electrician*, June 17.

Transmission Plants for Agricultural Districts.—R. Meier.—A paper read before the Verband deutscher Elektrotechniker. The results so far obtained in Germany with electric transmission systems in agricultural districts show that only those are economical which supply industrial works requiring a large amount of power, or which supply both industrial works and agricultural plants. On the other hand, transmission plants in a purely agricultural district are not able to make a good profit on account of the very high first cost per useful kw-hour sold. Statistical data are given to prove these facts.—*Elek. Zeit.*, June 16.

Belgium.—J. Izart.—In the first installment of an article on electricity in Belgium, the author discusses electric installation in coal mines, and deals especially with the different systems for electric winding so as to overcome the troubles of the large fluctuations of load.—*L'Industrie* [illegible], June [illegible].

Traction.

Reduction of the Weight of Traction Motors.—An editorial emphasizing that more attention should be paid to the reduction of the weight of traction motors. For example, it is said that by using oxidized aluminum instead of fiber insulated copper for field coils, the Hamburg (Germany) Street Railway saves about 100 lb. per 40-hp motor and incidentally eliminates those short-circuits arising from charred insulation. Another place for reduction is in the gear case. The possibilities of using special steel like vanadium steel are also mentioned.—*[illegible]*, June [illegible].

Installations, Systems and Appliances.

Voltage Regulator.—J. Reyval.—In an article on the recent exhibition of instruments and apparatus of the French Physical Society, the author describes the voltage regulator of Routin. The object is to maintain constant the voltage supplied by a generator by varying the exciting current. Fig. 3 shows the connections. 1 is the beam of a balance, suspended on a point 2. The movable coil 3 is suspended from one arm of the balance and is acted upon by the magnetic field created by the coils 4 and 5. The coils 3, 4 and 5 are in series with an auxiliary resistor 6, and this circuit is connected to the terminals of the generator the voltage of which is to be regulated. 7 is a counterweight, and further adjustment may be made by means of the spring 9 and the screw 8. A silver-plated iron rod 10 is mounted on the beam of the balance, and is electrically insulated from it. When the arm of the balance sinks or rises, the rod 10 comes in contact with one or the other of two silver-plated steel wires 11 or 11'. The rod 10 can move freely in the interior of the fixed coil 12, which maintains it constantly magnetized for the object of sure and quick contact making and breaking. When the voltage of the generator is too high the force exerted by the two coils 4 and 5 on 3 causes the right arm of the balance to drop and contact is made between 10 and 11. Through the circuit of the electro-

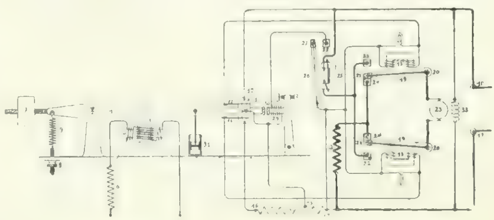


Fig 3—Diagram of Voltage Regulator and Connections.

magnet 13 a current will then pass which is taken off between the points 14 and 15 of a resistor 14, 15 and 16, used as potentiometer and connected at 17 and 18 to a source of direct current. The electromagnet 13 attracts the armature 19, which revolves around 20. Contact is thereby made between the movable carbon piece 21 and the fixed carbon piece 22. The armature 23 of the motor, which operates the rheostat (motor with constant excitation, is then caused to revolve in such a direction as to diminish the excitation. As soon as the contact is broken between 10 and 11 the armature 19 is drawn back by means of a spring, not shown in the diagram, so that contact is made again between 21 and 24. The brushes of the armature are thereby short-circuited and the motor is stopped suddenly by means of electromagnetic braking action. When the voltage is too low the apparatus operates in an analogous way, the rod 10 now making contact with 11'. Other details of the apparatus, and especially the method of keeping the contacts intact, are described.—*La Lumière Elec.*, June 11.

High-Tension Switchgear.—A. C. Eborall.—While the oil circuit-breaker constitutes to-day a highly important factor in the successful operation of large power plants, one is inclined to wonder whether finality has already been reached in this direction. The author thinks that for power plants of 100,000 kw or more it is doubtful whether we can rely solely upon the oil circuit-breaker—or upon any circuit-breaker—to deal satisfactorily with the enormous surges of energy that may arise from time to time. For such very large power plants the capital cost of protective gear which would give the same security

as is obtained in present stations would turn out to be prohibitively high. It is possible that the solution will be found to lie in the adoption (or partial adoption) of a type of generator that will have different characteristics from those of the present-day synchronous machine rather than in further improvements to oil circuit-breakers. Thus, if it were not for its high exciting current and inability to carry a wattless current, the asynchronous generator might well come into consideration in this connection, for, running in parallel with synchronous units, it ceases to generate under short-circuit, which in reality is what is wanted. Although at present this type of machine is nearly uncommercial (at any rate, in large sizes) it may be that it will undergo development before long.—Lond. *Elec. Eng'ing*, June 16.

Electricity Supply.—W. W. Lacke.—His presidential address to the (Brit.) Municipal Elec. Ass'n. He emphasized that municipalities have done much to advance the central-station industry. He then discussed the question of depreciation and made the following points: (1) Depreciation of value is met by the sums set aside for sinking fund, if such sinking fund be properly calculated upon the probable life of the plant. (2) Decreased efficiency should be met by depreciation if the ordinary maintenance chargeable to revenue is not sufficient to keep the plant in its first state of efficiency. (3) Obsolescence does not mean, nor does it involve, depreciation. It is not true depreciation, but it is quite possible that a prudent manager might look to the advantage which would be gained by installing present-day plant, and so getting greater efficiency than would be obtained from antiquated plant. Such a manager would annually lay aside a sum for this purpose and might be found dispensing with old plant in favor of something more up to date, even although the latter might not have reached the end of its usefulness. As to the supply of lamps, he thought that much could be said in favor of the manager providing the consumers with lamps. Frequently bad lighting is found to be entirely due to defective lamps. In the end it would be for the best welfare, not only of the central-station company, but of the wiring contractors, if the lamps (which, after all, are the means of transforming electrical energy into light) were left to the manager, either to be supplied and the price included in the charge per unit or sold direct to the consumer. If the former method were adopted one lamp might be given for every 100 or 200 units used, and if the latter, the price would be, at most, net cost. Finally, the question of rates was taken up and the author emphasized that in his opinion any flat rate adopted must be based on the maximum-demand system, or, in other words, on the load factor of each consumer, and where classification is possible, on the average load factor of any one class. The maximum demand would still be taken during the year, and the average rate worked out. This would mean that there should be different flat rates for different consumers or for various kinds of consumers, ranging from 7 cents to 1 cent per kw-hour, decreasing from the former to the latter by tenths or even hundredths of a penny; but each rate would be the result of fair and just computation. A rate committee might be appointed and sit once or twice a year to hear and settle cases in dispute.—Lond. *Electrician*, June 17.

Commercial Advancement of Electrical Supply.—A. C. Cramb.—A paper read before the (Brit.) Municipal Elec. Ass'n. The author urges the necessity of a vigorous campaign for developing the use of electrical apparatus, and indicates on general lines how this campaign should be organized.—Lond. *Electrician*, June 17.

Commercial Progress of Central Stations.—H. C. Bishop.—A paper read before the (Brit.) Municipal Elec. Ass'n. The author describes the commercial development of the Newport electric supply company during the past three years, discussing installation work, arc-lamp rental, rental purchase schemes, charges, gas competition, free wiring, installment plan wiring, etc.—Lond. *Electrician*, June 17.

Pushing the Sale of Electricity.—In the discussion of the two papers of Cramb and Bishop at the recent meeting of the (Brit.) Municipal Elec. Ass'n, F. Ayton expressed his intention of training lady-canvassers in order to push the sale of domestic electrical apparatus. Some strong remarks were made in support of municipal wiring, and C. H. Wordingham was alone in advocating that electric supply companies should not do this work. Cramb and Ayton both advocated the policy of leaving the contractor out of the question altogether, the former saying that the present position was that the central-station manager should sell the apparatus and the contractor take the discount. Other speakers referred to the fact that while the wiring contractors had had the field to themselves for years, the sale of heating and cooking apparatus had never been pushed.—Lond. *Elec. Eng'ing*, June 16.

Earthing in Three-Phase Plants.—M. Vogelsang.—An article in which the author recommends the earthing of one outer lead (not the neutral point) to prevent dangerous rises of voltage and the advantages of this arrangement are briefly discussed.—*Elek. Zeit.*, June 16.

Aerial, Underground and Interior Circuits.

Conservation of Wooden Poles.—R. Nowotny. The author gives the results obtained in practice during a series of years with wooden poles impregnated with zinc fluoride. This is far more effective than copper sulphate or zinc chloride. Zinc fluoride containing free acid ($ZnF_2 . 2HF$) is used. The method of impregnation and the time necessary are discussed; also the effect of concentration of liquid, the effect of temperature, etc. More recently experiments have also been made with "bellit," which contains mainly sodium fluoride and also some dinitrophenol and aniline oil.—*Elek. und Masch.* (Vienna), June 12.

Causes of Faults in Cables.—F. Fernie.—In a continuation of his long illustrated serial on electric cables, the author takes up the causes of faults and methods for preventing them. Faults may be classified into those of manufacture, those caused during laying, and those developed after the cables are laid. The last class is due to a number of causes, such as mechanical injuries, electrolysis and electric osmosis, chemical action, overloading and eccentricity, high temperature, abnormal pressures and static discharges. These causes are separately discussed.—Lond. *Electrician*, June 17.

Electrophysics and Magnetism.

Wave Detectors.—W. H. Eccles.—A paper read before the Physical Society of London on an oscillation detector actuated solely by resistance temperature variations. The experiments described are offered as additional support for the author's hypothesis of the mode of action of certain types of electrical oscillation detectors. This hypothesis suggests that in detectors constituted of a loose contact the energy of the oscillatory current through the contact is transformed into heat at the contact and warms the matter there sufficiently to change its electrical resistance and, consequently, the steady current through the indicating instrument. The principal deductions from this hypothesis were worked out and were illustrated by experiments on iron-oxide coherers in a former paper. The present experiments are on a detector of the so-called "crystal rectifier" type, from which, however, the possibility of thermoelectric effects have been eliminated. This detector consists merely of a loose contact between two pieces of galena—a substance which, according to the author's theory, ought, by virtue of its large negative coefficient of change of resistance with temperature, to be a very efficient detector of electrical vibrations. The experimental curves obtained from a galena-galena detector are: the steady current curve, the sensitiveness curve, and the power curve. The first has steadily applied e.m.f. as abscissas, and current through the detector circuit as ordinates. It proves to be a curve which in general rises slowly at first, then quickly, and then slowly again; but if the circuit be arranged to have but little resistance other than that at the contact, the curve may possess a negative gradient at the point of inflection. The chief difficulty met in obtaining these steady-current curves arose from the slow movements of heat through the mass of crystals—which have, of course,

small thermal conductivity. This difficulty was overcome, and the true character of the curves brought to light, by allowing a proper time interval for thermal equilibrium to be established before each galvanometer reading was taken. The sensitiveness curve had the e.m.f. applied to the detector as abscissas, and the power passed to the indicating instrument as ordinates, the intensity of the electrical vibrations being of fixed amount. It is a curve which rises to a maximum near the point of greatest slope of the former curve ,and thereafter descends slowly. The power curve has the power supplied to the detector in the form of electrical oscillations as abscissas, with the power passed by the detector to the indicating instrument as ordinates, the steady e.m.f. applied to the detector being the best value. This curve is a straight line. The properties of this "crystal rectifier" are, therefore, just such as are logically deducible from the fundamental fact that the contact possesses a negative resistance temperature coefficient.—Lond. *Electrician*, June 17.

Brownian Movements and Molecules.—J. PERRIN.—The conclusion of his paper in which the author reviews the different methods for calculating the number of molecules in a "molecular volume." The author's investigations of the Brownian movements have furnished him with three methods for determining the constant of Avogadro's law and the results agree among themselves and with the values obtained by other methods. The author concludes that molecules are real things. —*La Lumière Elec.*, June 11.

Electrochemistry and Batteries.

Carbon Cells.—I. TAITELBAUM.—An investigation of various carbon cells of the Jacques type. The author used fused caustic soda for electrolyte in his first experiments and later on concentrated sulphuric acid.—*Zeit. f. Electrochemie*, May 1.

Ozone.—HENRY.—An illustrated article discussing briefly the present methods of producing ozone by electric discharges and the applications of ozone for water sterilization and air purification.—*L'Industrie Elec.*, June 10.

Units, Measurements and Instruments.

Units.—The report, signed by Strecker, of the committee on units of the Verband deutscher Elektrotechniker. Communicated discussion is requested till the middle of January, 1911. Besides some general rules and recommendations, the following specific notation is recommended: Multiples and fractions M = 10^6, k = 10^3, h = 10^2, d = 10^{-1}, c = [illegible], m = 10^{-3}, μ X 10^{-6}. Lengths: m (meter), km (1000 meters), etc., $\mu = 0.001$ millimeter. Volumes: l (liter), hl (100 liters), $\lambda = 0.000001$ liter, m^3 (cubic meter), etc. Weights: t (ton), g (gram), kg (kilogram), dg (0.1 gram), etc., $\gamma = 0.000001$ gram. Units of time: hour, st; minute, mn; second, sk. Work: m kg (kilogram meter), PS st (horse-power-hour, also P st or Stundenpferd), W st (watt-hour), k W st (kilowatt-hour). Power: PS or P (horse-power), W (watt), k W, not kw (kilowatt). Photometric units: HK (hefner candle), Lm (lumen), Lx (lux). Electric and electromagnetic units: A ampere, V volt, Θ ohm, S siemens, C coulomb, J joule, W watt, F farad, H henry, VC volt-coulomb, Wst watt-hour, VA volt-ampere, Ast ampere-hour, mA milliampere, k W kilowatt, μF microfarad, MΘ megohm. The report is accompanied by explanatory notes by K. Scheel and K. Strecker. *Elek. Zeit.*, June 16.

Weston Standard Cell.—S. W. J. SMITH.—An abstract of a paper read before the Physical Society in London. In this paper the recent experiments of F. E. Smith on cadmium amalgams are discussed from the point of view of the modern theory of alloys. Theory and experiment alike suggest that there is no range at any temperature over which the e.m.f. of a Weston cell is absolutely [illegible] Cd in the amalgam [illegible] existence of surface energy must cause some variation. Within the range over which the e.m.f. is usually taken as constant the e.m.f. appears to rise very slowly with increase in the cadmium content. The rate varies, but is never more than a few millionth of a volt for 1 per cent C. From the data it seems possible also to discover the precise way in which the use of the richer two-phase amalgams may lead to variability of the e.m.f. of the Weston cell. The interpretation advocated is that the irregularities are due to electrolytic skin effects arising out of want of uniformity of composition of the surface grains. The probable reason why the temperature coefficient of e.m.f. of a Weston cell, always small, actually vanishes near zero Centigrade is indicated. An outline of the way in which the phase rule can be used to exhibit the nature of the incomplete equilibrium of the Weston cell is also given.—Lond. *Electrician*, June 17.

Electric Resistance Thermometer.—An illustrated description of an electric resistance thermometer specially designed for use in cold-storage houses. Its construction is shown in Fig. 4. Being enclosed in a brass tube, it is readily responsive to changes of temperatures and practically unbreakable. This instrument works on the Wheatstone bridge principle, the indicator being a combination of a galvanometer with a bridge of the Callendar and Griffiths type.—Supplement to Lond. *Electrician*, June 10.

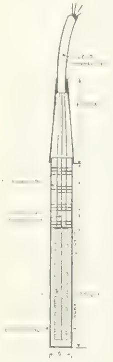


Fig. 4—Electric Resistance Thermometer.

Electric Thermometry.—A system of electric thermometry designed by an English firm for use in cold-storage houses, in magazines and in coal bunkers. Electric resistance thermometers are used mounted in a hollow metal tube. From each of these tubes a lead-covered cable is run to a distributing switch and the indicating instrument. The indicator is constructed upon the principle of the differential galvanometer with an electrical control. One of the differential windings (X, in Fig. 5) is shunted with a platinum thermometer, the other winding S being shunted with a resistor s, which is made variable so as to equal the resistance of the thermometer at certain fixed temperatures. The control coil of the ohmmeter system is also shunted with the resistor d, the resistance of which is determined by the degree of sensitiveness required and may be made variable with s. These shunted windings are connected in series, and the circuit is completed through a battery and switch. By using a differential winding (the currents in which are respectively due to the resistance of the thermometer and s) in conjunction with a control coil (in which the current is proportional to a selected difference unit d) the advantage is gained of making the indicator read on both sides of what would be the zero point in an ohmmeter of the usual construction, thus increasing the open length of the scale from about 45 deg. of arc to more than a right angle.

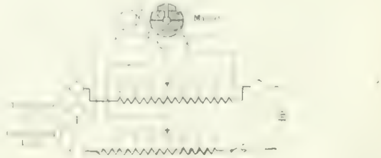


Fig. 5—Electric Thermometry.

Moreover, as the deflection is proportional to the ratio of difference of the currents in the differential windings to the current in the control coil, the sensitiveness for a given variation in the temperature of the thermometer may be made as large as desired by giving a suitable value to d, and is only limited by practical considerations.—Supplement to Lond. *Electrician*, June [illegible].

Electricity Meters for Double Tariff.—In recent years electricity meters have found favor in Germany which indicate on the same dial the consumption of energy for lamps at one tariff

and the consumption of energy for motors at another tariff. Of course, these meters do not indicate kw-hours or amp-hours, but directly the amount to be paid. This simplifies the matter for the consumer, but does not permit control by the station. Nevertheless, such meters have found use, especially in small installations. With the aid of diagrams various methods are described by means of which different types of meters may be arranged for the purpose indicated.—*Elek. Anz.*, June 12.

Pyrometers.—J. A. Fleming.—His second lecture before the Royal Institution on electric heating and pyrometery. The author briefly discusses the definition of temperature, and then describes resistance pyrometers, thermoelectric pyrometers and radiation pyrometers.—Lond. *Engineer*, June 17.

Exhibition of Instruments.—J. Reyval.—The conclusion of his illustrated article of various physical and electrical instruments for laboratory and industrial purposes exhibited at the recent exposition of the French Physical Society.—*La Lumière Elec.*, June 11.

Telegraphy, Telephony and Signals.

Wireless Telegraphy for Marine Intercommunication.—W. W. Bradfield.—A fully illustrated article. After discussing the advantages and progress of wireless telegraphy for marine purposes, the author describes in detail the Marconi plant used on board ship. This may be classified as transmitting, receiving and emergency apparatus. In conclusion, particulars are given of the number of naval and mercantile marine stations in operation in the various countries.—Supplement to Lond. *Electrician*, June 10.

Ships' Telephones.—H. S. Thompson.—An illustrated article in which he describes the general scheme adopted on board a ship, which from the telephone point of view may be looked upon as a large hotel. The instruments and other details, such as wiring and protection from stray currents, are next considered. Owing to the special conditions, at sea, such installations differ materially from those on land. For connecting a ship to a shore exchange a special flexible cable, with connecting boxes, is used.—Supplement to Lond. *Electrician*, June 10.

Miscellaneous.

British Municipal Electrical Association.—A very full account of the recent fifteenth annual convention of the (Brit.) Municipal Elec. Ass'n, held in Glasgow. The proceedings included a day trip to Edinburgh. The association now numbers 416 members.—Lond. *Electrician*, June 17, and other London electrical papers of the week.

Book Review

Pipes and Piping. By Herbert E. Collins. New York: McGraw-Hill Book Company. 140 pages, 75 illus. Price, $1.

This book is made up of articles taken from *Power* and forms one of the Power Series of handbooks. The scope of the work includes the calculation of strains and stresses and design of pipe circuits to resist the forces due to temperature changes; the installation and operation of piping; the arrangement of piping for complete power plants; the testing and selection of fittings and other information useful to the power-plant engineer. The book is just as valuable to operating engineers as to those who design and install the piping.

New Apparatus and Appliances

MOTSINGER ROTARY ENGINE.

The accompanying cuts illustrate a 5-hp rotary engine of a new type, made by the Motsinger Rotary Engine Company, Greensburg, Pa. The advantages claimed for this engine over the steam turbine are that it uses steam by expansion instead of by impact, operates economically non-condensing, is reversible and will start and carry a full load at low speed. With respect to the reciprocating engine, the claims are that as the rotors receive steam but once a revolution, it has a double expansion ratio; that it has a greater speed capacity and less vibration, is more compact, simpler to install and requires less attention running; and having no dead-points a flywheel is not required unless the cut-off is very short, while there is less friction owing to the absence of sliding surfaces, connecting and eccentric rods. The engine is easily reversed, responding to the movement of the reversing lever almost instantly.

Fig. 1 shows the engine direct-connected to a 3-kw generator, and the parts disassembled are shown in Fig. 2. There are three rotors, two of which are male and have vanes running the full length of the cylinders; the third is female and is grooved to receive the vanes of the male rotors. The rotors are 2¼ in. in diameter and 7 1/16 in. long. The vanes are 9/16 in. in height and fit exactly in the female rotor. The vanes of the male rotors are set 180 deg. apart, which allows them to run alternately in the female rotor. Balance is maintained by taking out metal from the male rotor on the vane side and from the opposite side of the groove on the other rotor, which equalizes the centers and eliminates vibration.

The rotors are fitted in a cylinder which has three bores, all of which are made 0.001 in. larger in diameter than the rotors. The two outside bores are made to fit the vane rotors, the middle bore being for the grooved rotor. The rotors are held in exact position by bearings placed in the cylinder heads, which cover the ends of the cylinders and hold the rotors in close contact with each other. These bearings, which are made of bronze, are 3⅛ in. in length and 1¼ in. outside diameter; 9/16 in. from each end are cut slots 1/16 in. wide and extending half way around the bearing. A connecting slot 1/16 in. wide joins these vertical slots at each end, making a flexible tongue of metal that can be pressed in by means of a spring gib and set screw to take up any play that might be caused by wear. The spring gib fits in a cored hole in the cylinder head and rests against the tongue of the bearings.

The vane and grooved rotors are geared together, the gears

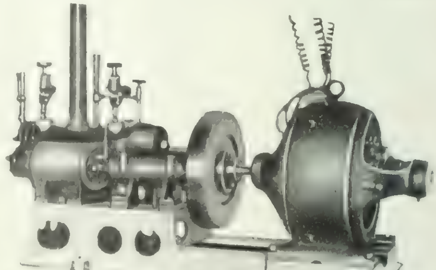


Fig. 1—Rotary Engine Direct-Connected to Generator.

being immersed in an oil bath. The female rotor shaft extends beyond the casing and carries a flywheel.

On the top of the vanes, and set 90 deg. apart on the female rotor, are T-shaped grooves running the full length, which are fitted with T-shaped strips of metallic packing. Springs are inserted under the strips and hold the packing in close contact with the cylinder bore. The ends of the rotors are packed with rings inserted in the ends, into which packing strips are

inserted. Both rings and packing strips are held outward by springs. The steam enters the engine at the bottom of the cylinder and passes around the cylinder in cored spaces, which also act as a steam jacket, and then enters the middle of the reversing valve, which is immediately over the rotors. From this valve it passes into the cylinder heads, and then to the rotors. The cut-off valves are made 90 deg. to 185 deg. long, as desired, and the steam expands until the rotor vanes reach the exhaust ports in the cylinder heads at the opposite end of the cylinder, whence the steam enters the rotor chamber. From

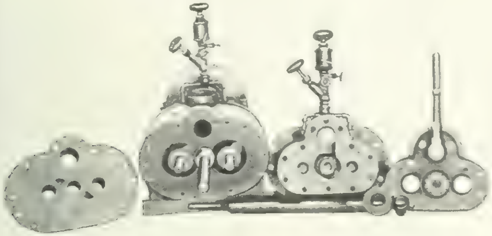


Fig. 2—Dissembled Parts of Rotary Engine.

this cylinder head it passes back to the reversing valve and goes to the atmosphere or condenser.

The reversing valve runs past the exhaust chambers of the two cylinder heads, and then is reduced for the governor and the reversing lever. The valve is cored with the exception of a partition between the two live-steam entrance ports at the middle of the valve. These two ports are directly opposite each other, and the partition makes one port communicate with one cylinder head to carry off live steam, while the other port communicates with the other cylinder head to receive the exhaust steam, and vice versa. The inlet and exhaust ports for one rotor are on the same side but at opposite ends of the valve. The exhaust ports are back of the cut-off plates, there thus being very little back pressure. The cut-offs to each engine are separate and distinct. The longest cut-off possible is 270 deg. for either engine. This allows no expansion. A cut-off of 90 deg. is the most economic.

The live steam is governed by an automatic cut-off governor formed by attaching centrifugal balls to two double-ported sleeves surrounding a port in the reversing valve, which sleeves are geared to the main shaft of the engine or female shaft by gears that open and close ports in the reversing valve, and with the centrifugal balls control the size of the steam ports of the reversing valve in accordance with the load.

In a test recently made at the U. S. Naval Academy, Annapolis, Md., a 5-hp engine was worked to a load of 7.3 hp. Five sizes of the engine are now being built, namely, 5 hp, 10 hp, 20 hp, 40 hp and 80 hp, the speed being respectively 1200 r.p.m., 1000 r.p.m., 900 r.p.m., 750 r.p.m. and 600 r.p.m., with a steam pressure of 100 lb. The steam consumption is claimed to be as low as that of any simple engine of the same speed and power. The engine has also been applied to centrifugal pumps with the highest satisfaction.

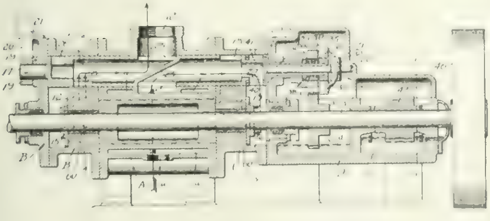


Fig. 3—Longitudinal Section of Engine.

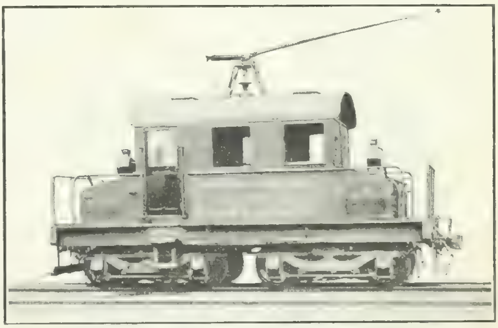
ELECTRIC SWITCHING LOCOMOTIVE.

The Hoboken Railroad, Warehouse & Steamship Company has had in operation since May, 1906, a 60-ton electric switching locomotive the continuous and economical performance of which under varying and severe load conditions has caused many very favorable comments in railroad circles. This locomotive has not only supplied the demand made most urgently by operating men that the service be perfectly reliable, but has been operated continuously at a maintenance cost that is exceedingly low.

Since the electric locomotive was placed in operation four years ago there has not been replaced a single contact on the switch group or a contact on the master switches or reverser. On the control apparatus nothing other than two tips on the live switch has been replaced. The brushes that are in the motors at the present time have been operating 14 months, and the master mechanic believes they will operate at least six months longer without replacement. No trouble has been experienced with broken brushes. Except that there has been replaced one pinion which was broken when a lock washer dropped into the gears, no repairs on the motor have been necessary.

The cost of inspection and cleaning has been practically nothing. Every Saturday morning the man operating the locomotive makes an inspection of the equipment. With compressed air he blows out the motor and the various parts of the control apparatus, and cleans any part that may need it with a piece of cloth. This work is not charged to maintenance, as the operator in doing it is simply filling in his time. No extra time is needed for maintenance or inspection.

The locomotive has a running and a starting drawbar pull of 14,500 lb. and 30,000 lb. respectively, and has a normal speed of 12 miles an hour. It has four 100-hp, slow-speed motors, a hand-operated unit switch control, and Westinghouse air brakes and compressor. The electrical equipment was furnished by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; the mechanical parts, the steel cab and the trucks were built by the Baldwin Locomotive Works. The Hoboken Company stated that there never has been a time when the locomotive refused to work or would not do the work required of it. It averages 12 hours a day of shunting service very nearly every day in the year.



Electric Switching Locomotive.

REMARKABLE PERFORMANCE OF INDUCTION MOTOR.

The performance of apparatus under exceptional circumstances reveals the weak or strong points in its design, and its suitability for the service for which it has been installed. Due to the fact that many manufacturers design their apparatus with a large factor of safety, remarkable records are sometimes made. A 20-hp, three-phase, 220-volt standard induction motor made by the General Electric Company recently demonstrated the ability of the standard motors manufactured by this company to operate successfully under the trying conditions met

with in mines, where the air is very damp, without their being totally enclosed. This is of great importance, as thorough ventilation of the motor is absolutely necessary due to the high temperatures which prevail in mines. This motor is geared to a mine pump located at the bottom of the shaft at the mines of the Richmond Iron Works, Richmond Furnace, Mass., and is installed in a chamber where the air is always very damp and moisture is continually dripping from the roof timbers. It is protected from this water by a piece of tarred paper tacked above it, so as to conduct the water away. During a heavy thaw last January, the surface water broke in on one of the upper levels and flooded the mine. The water rose so rapidly that the electric pump was soon under water, the top of the motor being 2 ft. below the surface. Under such circumstances it was imperative that the pump should continue in operation as long as possible, and so it was not shut down. It continued to operate and at the end of two hours, during the whole of which time the motor was submerged in water, it had pumped itself clear of water. It was then stopped only long enough to clean the dirt and chips from around the rotor and put oil on the bearings, and then was started up again. This pump has been running about 20 hours a day ever since and the motor has apparently suffered no injury from its unusual experience.

TUNGSTEN GROUP REFLECTOR.

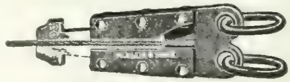
The "Deflectolier" tungsten fixture shown in the accompanying illustration comprises a highly reflecting and diffusing enamel deposited on the surface of a metal disk of such theoretically correct curvature that the light from the units mounted in its receptacles will be distributed uniformly in all directions. The fixture is arranged for five 60-watt tungsten lamps, four in the curved surface and one pendent from the stalactite at the center of the reflector. Its arrangement secures the maximum useful distribution of the light from these units, making

Tungsten Group Reflector.

the fixture a valuable ally in replacing Welsbach incandescent gas arcs and other competitive fixtures. The makers state that for replacing an arc lamp the Deflectolier unit will benefit both the consumer and the central-station company, for although the tungsten group itself requires less energy, the superior quality and distribution of its light will result in the installation of more units, bringing the total up to an amount in excess of the original consumption. The Deflectolier is manufactured by Edward J. O'Beirne & Company, Elgin, Ill.

STRAND MESSENGER WIRE GRIP.

The grip shown herewith has been designed by Mathias Klein & Sons, Chicago, Ill., to handle strand or messenger wire without injury to the strands. The grip consists of a body or retaining piece, in which two steel wedge-shaped jaws move longitudinally. These jaws are arranged to move in either direction simultaneously, so that they open or close in unison. The gripping surface of the jaws is concave, and is provided with a series of milled teeth. These grip into the spirals of the strand, and being uniformly distributed over the entire length of the jaw, grip the wire at many points, so that no undue strain is brought to bear at any one point. The tackle is attached to the two oblong rings in the body piece, which being arranged centrally insure a straight pull. The proportions of



Strand Messenger Wire Clip.

the various parts are calculated to carry any strain that is necessary to tighten the wire, and the jaws are self-adjusting. The device is made in three sizes for messenger wire, and in two sizes for trolley wire. In the latter grip the jaws are not serrated, but only roughened.

DETROIT INDUSTRIAL EXHIBITION.

A successful industrial exhibition is being held in Detroit in special buildings erected for the purpose adjoining the Wayne Garden, a large part of the latter being also used for exhibits. The show is being given under the auspices of the Detroit Board of Commerce, principally with a view to booming the interests of the city in a business way, and only Detroit manufacturers are allowed to exhibit their products. The buildings are illuminated by the Elblight system in multiple series, placed 15 in. apart, 18,000 lamps being used in the installation. The electrical installation was installed in 14 days, which is considered a record for the amount of work necessary. There is ample current for power and lighting purposes. There are altogether about 200 exhibits, which include a considerable number of automobile exhibits, among these being two electric automobiles. A partial list of exhibits in the electrical and allied fields follow:

Anderson Carriage Company (electric vehicles); Knop Battery Company ("Wizard" house-lighting plant, igniters and battery chargers); Hovey & Falk (electric vehicles); Michigan Copper & Brass Company; Kerr Machinery & Supply Company (automatic electrically driven water systems); Palm Vacuum Cleaner Company (vacuum cleaner); Northern Engineering Works (cranes); Detroit Insulated Wire Company (wire-insulating machinery in operation); Edison Illuminating Company (current-using devices); Detroit Copper & Brass Rolling Mills (bare copper and brass wire, rods and tubing); Hoskins Manufacturing Company (electric furnaces, soldering irons and heating appliances); Detroit Twist Drill Company (drills and reamers); Wright Manufacturing Company; American Blower Company (Sirocco fans, ventilating furnace, cupola, forge and blower, engine-generator set); Austin Separator Company; Chicago Pneumatic Tool Company, Chicago; Osburn Electric Company (electric gas-stove lighter, spark coils, magnetos and ignition specialties); Eureka Vacuum Cleaner Company (portable vacuum cleaner).

SUPPLY MEN AT OSHKOSH CONVENTION.

At the Oshkosh convention of the Wisconsin Electrical Association, on June 28 and 29, no exhibits of apparatus were made, but the following-named representatives of electrical manufacturers and dealers were in attendance: Messrs. F. T. Andrae and J. C. Schmidtbauer, Julius Andrae & Sons Company, Milwaukee; Glen L. Johnson and Donald H. Wyre, Buckeye Electric Company, Chicago; A. W. Dunham, Central Electric Company, Chicago; P. R. Boole and J. B. McMullin, Electric Appliance Company, Chicago; M. L. Demming and T. W. Jackson, General Electric Company, Chicago; E. A. Quarfot, Illinois Electric Company, Chicago; E. F. Berger, Midvale Steel Company, Chicago; W. H. Talkes, Pittsburgh Meter Company, East Pittsburgh, Pa.; W. R. Patton, Wagner Electric Manufacturing Company, Chicago; O. O. Tucker, Western Electric Company, Madison, Wis.

Industrial and Commercial News

The Week in Trade.

Trade reports continue to show that business is very irregular, and in many sections unsatisfactory. Retailers are not disposing of the stocks with anything like the rapidity that was anticipated, and there is a general disposition in the direction of conservatism in almost all quarters. Weather conditions, while they have been somewhat improved, are as yet not thoroughly encouraging. In the Northwest there has been entirely too much dry weather, and in the central Gulf States there has been an excess of moisture. There is still considerable uncertainty felt as to the outcome of the spring wheat crop, and this has a deterring influence upon all classes of trade throughout the section of the country where spring wheat is the main production. Cotton has in a measure improved, especially in Texas. The iron and steel industries continue to be moderately active, but it is claimed that the mills are kept busy in many instances by making concessions in prices that will reduce profits. The production of pig iron is still in excess of the demand, and prices are inclined to be weak. The textile trade, which has not been in good shape for many months, shows no improvement. In both cotton and woolen goods there is general curtailment. Prices for manufactured products in these lines are gradually being lowered, and only the uncertainty as to the cost of raw material prevents material cuts. The unsettled condition of the securities market has had some effect upon commercial business. It has also had a decided effect in the matter of collections, and these are far from satisfactory. Failures for the week ended June 30, as reported by *Bradstreet*, were 197, as compared with 187 for the previous week; 213, for the same week in 1909; 236, in 1908; 135, in 1907, and 134 in 1906.

The Copper Market.

During the last few days of June there was quite an increase in the exports of copper, which if it did not have the effect of strengthening prices locally, at least had the effect of putting some heart in the discouraged traders in the copper market. The total exports for the month amounted to 22,688 tons or approximately 51,000,000 lb. It is not likely that the unexpected increase in exports will produce any very favorable results in the figures of the Copper Producers Association, for at the same time that exports were expanding imports were growing to an unprecedented figure. It now seems probable that the total receipts from abroad during the month will amount to about 18,000 tons, breaking all previous records. The domestic market during the week that preceded the holidays was extremely dull. But few sales were made to domestic consumers and practically all of these few were small lots to minor concerns which bought only from immediate necessity. Prices during the week were lower both at home and abroad

Standard Copper	Bid	Asked	Settling
Spot	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]

The London market July 2 was as follows:

	Noon.	Close.
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest	Lowest
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
Best selected	[illegible]	[illegible]

and there were reports in the local market that offers were made even below the quoted scale. The condition of the copper trade in Europe shows no improvement. A London authority on the copper situation, who visited New York last week, says that no one knows the exact amount of surplus metal now carried in England and the Continent. The optimists, he says, are willing to admit that it will reach 140,000 tons and the pessimists declare that it will considerably exceed 200,000 tons. This authority also believes that the mines in Africa which are now being promoted and developed will soon turn out a large amount of copper which can be produced at something like seven cents a pound. One of the reports which was widely circulated in the market last week was to the effect that quite a number of representative American copper producers and sellers were now in London arranging a deal whereby the sale of about 100,000,000 lb. to foreign buyers would shortly be put through and the domestic situation thereby relieved. This may be a dream or it may be true, but it is difficult to understand how it will ultimately benefit the situation. As long as the mines of the world continue to produce every month 25 per cent more copper than the melters can use, prices can only be maintained by artificial methods. There can be no satisfactory market condition where production persistently exceeds demand. The daily call on the Metal Exchange July 2 quoted standard copper as per accompanying table.

Industrial and Commercial Notes.

Foreign Filaments in This Country.—Frank Greenhalgh, manager of the Electric Manufacturers' Agency Company, and representative in this country of the International Filaments Company, Ltd., and Stewart & Company, of London, says that the sale of foreign tungsten filaments in this country has been very satisfactory. The smaller lamp manufacturers all over the country have been purchasers, and more are buying as the filaments become better known. The special safety cartons in which the lamps are packed is also receiving recognition in this country. This carton, which is a patented article, is handled in the United Kingdom by Johns, Son & Watt, Ltd., London, and in this country by the Manufacturers' Agency Company, 1269 Broadway, New York. The carton not only protects the lamp from breakage, but it also permits the lamp to be lighted and tested before the seal of the package is broken. Mr. Greenhalgh says that the 45 per cent. duty makes the cartons more expensive than they should be, and that probably arrangements will be made to manufacture them in this country.

Westinghouse Business for Six Months.—The business of the Westinghouse Electric & Manufacturing Company for the first six months of 1910 has been the largest in the history of that corporation. May was an especially large month, and the plants of the company are reported as working at present at full capacity. One of the officials of the company says that orders taken during April and May amounted to $7,083,038, and that the unfilled orders on hand May 31 were approximately $13,000,000. Like the other electric manufacturing companies, the business done by Westinghouse has been largely in the line of small apparatus. Very little heavy machinery is being ordered, but there is a large quantity of business in a small way. Motors for traction companies have furnished no inconsiderable part of the business of the company.

Postal Company's Telephone Alliance.—It is announced in St. Louis that the Kinloch Telephone Company has formed a traffic alliance with the Postal Telegraph Company covering Illinois, Indiana, Iowa, Missouri, Kansas, Kentucky and Ohio. This alliance is similar to the Western Union-American Telephone & Telegraph traffic agreement. The Kinloch Telephone Company operates in St. Louis and East St. Louis, and is a subsidiary of the Kinloch Long Distance Telephone Company which operates in portions of all of the States above named. There will be no financial connection between the telephone company and the Postal Telegraph Company.

Edison Electric Illuminating Company of Brooklyn.—W. W. Freeman, general manager of the Edison Electric Illuminating Company, of Brooklyn, announces that he is formulating plans whereby the employees of the company will be invited to share in its profits. He states that these plans are still in embryo, and have not as yet been definitely decided upon. The company, he says, intends to adopt a new system, and it will probably take six months to get the ideas worked out in a practical shape. The plans will probably embrace some system for pensioning old employees.

Marseilles (Ill.) Hydraulic Company.—The Marseilles Hydraulic Company, of Ottawa, Ill., which was recently incorporated, has prepared plans for the construction of a hydroelectric plant on the south side of the Illinois River at Marseilles, where a lease for 99 years has been secured. Work upon this new plant will be commenced about Sept. 1.

Lower Prices for Rubber.—The excessively high prices for crude rubber which prevailed early in the spring have been to some extent modified. Para, which sold up to almost $3 per lb., is now selling at about $2.40; Centrals, which formely sold at $1.50, are now selling at about $1.30, and Africans, which were as high as $1.95, are now selling at about $1.60. In discussing the effect of the high price of crude rubber upon the insulated wire trade, one of the best-known rubber authorities in the United States said: "Of course, higher prices for rubber must make the cost of insulated wire higher. It is a mistake, however, to think that insulated wire manufacturers are restricted to the use of Para, or even the better grades of African, for their insulation. Many years ago it was the generally accepted theory that nothing but the best rubber could be used for insulated wire. That theory has been very largely modified. It was a long time before wire manufacturers could be induced to use any reclaimed rubber, but now it is found that this material can be very successfully employed in connection with high-grade rubbers for insulating purposes. Of course, I am speaking only of the honest manufacturers who use rubber insulation, and who do not use substitutes and pitch. Reclaimed rubbers, Guayule and other brands of cheaper rubber, are now used quite extensively, and very sucessfully. Of course, there is no rubber in the world that has the elasticity of 'Islands fine Para,' but elasticity is not such an important factor when it comes to insulation. As to the price of rubber, I am of the opinion that it will gradually decline until we reach a reasonable basis. I have recently made an extended trip up the Amazon, and I am persuaded that there need be no fear of a scarcity of rubber. There is plenty of rubber in that vast territory to supply all of the needs of the world for many years to come. The trouble has been heretofore that there was not sufficient labor, nor a sufficiently systematized method in rubber gathering. The business men of Manaos, however, have now taken up this problem, and I believe that in the future the forests of the upper Amazon will be worked so as to develop very much larger quantities of rubber than they have heretofore. Whether it will be possible to import foreign labor into that country or not I am not certain, but the people who have the matter now in hand are progressive, and will work out some solution to the problem. The rubber excitement in London has been purely speculative, and I see no reason why the craze to buy shares in rubber-growing companies should work a permanent advance in rubber itself. In fact, the London speculative mania has almost spent itself. I believe that next year will see the rubber market on a steady and legitimate basis, and that after that we will have few of these speculative excitements." The speculative nature of the present London rubber situation is confirmed by an English financial expert now in New York, who has made a study of rubber production. One result of the recent and present inflated situation is, he says, a tremendous stimulation in planting rubber-producing trees, thereby promising a great future overproduction.

Allis-Chalmers Business for the Half Year.—An official of the Allis-Chalmers Company says that the business for the first six months of 1910 has been the best the company has ever had in a similar period. "There was a gradual improvement," said he, "from the beginning of the year. Every month was better than the one preceding it, and every month was better than the corresponding month last year. The month of May was one of the largest the company has ever experienced. Sales during that month were at the rate of $25,000,000 per year. Only two months since the company began have exceeded the past May. Quite a large portion of our business has been for small apparatus, which in itself is an advantage to the company. This sort of business means early delivery and quick collections. It might also be said that there is a better profit in small apparatus than heavy stuff. Our factories are running full time, and we are employing quite a large force, but we are not running up to capacity. During the last few years we have added new buildings and increased our capacity quite materially, and we have not yet reached this new limit."

Telephones on Lehigh Valley Trains.—Portable telephones are soon to be installed on passenger trains of the Lehigh Valley Railroad, which will make it possible for the train crew or any passenger to get into communication with the rest of the world at any isolated point along the road. A series of experiments have recently been carried on, which, it is claimed, have demonstrated the practicability of such a service. By means of an extension pole, which can be hooked over the telephone wires running parallel to the track, it will be possible to make connection at any point. It is thought that this system will be especially valuable in presenting delays in freight service. The equipment for this service, as well as the telephone equipment for train dispatching, has been furnished by the Western Electric Company. The Lehigh road has been adopting telephones for dispatching for a number of years, and many of its branches are now equipped with this service. It is the intention of the officials to equip the entire line as soon as possible.

New Telephone Line in Arkansas.—Plans have been practically completed whereby 60 miles of telephone line will be placed in service along the St. Francis levee, in eastern Arkansas. The system will cost about $12,000, of which $6,000 will be paid by the L. C. Going Telephone Company, of Marion, Ark.; $3,000 by the land owners who will use the service, and $3,000 by the St. Francis Levee Board. The telephone line will extend from Marion to the south end of the levee. Wires are to be strung on cedar poles erected on top of the levee. The service will be inaugurated with 50 telephones at Marion, and connections will be made with the lines of the Southwestern Telephone & Telegraph Company, which has connections to all of the principal points in the United States.

Ft. Wayne Electric Works Adds New Factory.—The foundations have been completed for the new factory and office buildings to be erected by the Ft. Wayne Electric Works adjacent to its present plant on Broadway, Ft. Wayne, Ind. This improvement was described in our issue of March 17. The new four-story factory building, 229 x 140 ft., and 76 ft. high, will practically double the company's present manufacturing floor space. Its construction embodies some of the most approved features of factory building. Excellent interior daylight illumination will be afforded by about 500 windows. The new office building adjoining will be five stories high, and occupies a space 60 x 140 ft. Part of these structures will be ready for occupancy by September.

Long Island Railroad Company.—The Long Island Railroad Company has received 16 new steel motor cars on its order of 140, and expects to receive four per week during the summer. The tardiness of these deliveries is attributed to the long-continued strike in the shops of the Pressed Steel Car Company. Four hundred of these cars have been ordered, and they will be delivered as rapidly as completed. The East River tunnel of the Pennsylvania Railroad is ready to be put in operation. It is expected that the date for this opening will be in August, 1910, and that by that time the railroad will be fully equipped. The new steel cars contain the latest devices in the way of electrical heating and lighting, and will cost when completed about $20,000 per car.

Southern Railway Orders Gas Electric Cars.—The fact that the Southern Railway Company was experimenting with gas-electric cars for use in suburban traffic was referred to in the issue of June 9. It is now stated that the officials of the road are satisfied with the success of the experiments and that three cars have been ordered from the General Electric Company, which is building them in connection with the McKeen Motor Car Company, of Omaha. These cars will be used to supplement the steam train service in the congested district in the neighborhood of Greenville, S. C. While these cars are being built, the car belonging to the General Electric Company, which was used experimentally, will be put into service.

Big Four Mill Equipment.—The Maple Leaf Milling Company, Ltd., of Port Colbourne, Ontario, which possesses one of the largest and most complete flour mills in America, has just placed an order with the Allis-Chalmers-Bullock Company, of Montreal, for a complete outfit of machinery. The buildings are now being erected and the mill is expected to be in operation when the fall grain movement begins. The installation includes transformers of 2,400 kw capacity, with switchboards and a large number of individual motors. The contractors will turn the mill over ready to run.

To Place Wires Underground.—The Metropolitan Electric Company, Reading, Pa., will place its wires throughout the business section of the city underground. Plans and specifications are now being prepared by a corps of engineers engaged for this work. Legislation granting the company the required permission to do this will shortly be introduced in the city council. The conduits will carry the heavy feed wires from the new plant to a distributing station in the central portion of the city.

Increased Business in Flaming Arc Lamps.—There is a constantly increasing demand for flaming arc lamps, according to Theodore Stave, president of the Stave Electrical Company. Mr. Stave has but recently returned from a lengthy Western trip, and he says that he finds all over the country a growing interest in flaming arcs for the illumination of factories and public concourses. The Stave company has recently made quite a number of important installations, and has under negotiation several more. This company has supplied the equipment for the largest installation in the country, that of the Weston-Mott Company and the Buick Automobile Company, which are practically the same concern, at Flint, Mich. In this plant the Stave Company has placed about 900 lamps. The service has been entirely satisfactory, and a letter from the superintendent of the factory, recently received, says that the bill for repairs for the lamps for an entire year has been less than $15. Mr. Stave has also recently placed 26 lamps in the terminal station of the Central Railroad of New Jersey, at Jersey City. Of this number 20 are in the train shed, and the illumination furnished there has been pronounced thoroughly satisfactory by the officials of the road. Before the installation of these lamps the shed was lighted by 36 arcs and 75 incandescents. These furnished less than 20,000 cp, and cost for current about $5,500, while the new lights are guaranteed to furnish 60,000 cp, and not to cost more than $4,161 for the year. The new lamps consume about 11 kw per hour, while the old lamps consumed about 25 kw per hour. This installation shows, according to Mr. Stave, that three times as much illumination can be furnished at less cost by the use of flame arcs. The Stave company has within the past few months furnished the city of Cincinnati with 30 lamps for park lighting, and is now figuring on increasing this installation many fold. It has also furnished to business men's associations in Davenport, Iowa, and Perth Amboy, N. J., quite a number of lamps for street lighting. The municipalities are slow to take up the flaming arc, largely, as Mr. Stave thinks, because it requires a daily trim, but in many places the merchants have been willing to pay for the illumination of the business centers. The Stave lamp has recently been selected by the officers in charge of the government arsenal at Rock Island, Ill. This selection was made after long and exhaustive tests. The arsenal will eventually use between 300 and 400 lamps.

Pennsylvania Railroad and Steinway Tunnel.—Plans are being perfected by the Pennsylvania Railroad Company to make a connecting link between its terminal in Long Island City and the Steinway Tunnel under the East River, and to provide for a transfer station near the Hunter's Point Avenue viaduct. By this arrangement the Long Island Railroad will have direct communication with the subway system in Manhattan. The charter of the Pennsylvania Railroad prohibits its carrying local traffic through these tunnels between Manhattan and Long Island City, and the nearest station where passengers can board a Pennsylvania train for transportation through these tunnels is at Winfield, three miles outside of Long Island City. This transfer arrangement will give passengers from Long Island who prefer to use the New York Subway a chance to leave the trains of the Long Island Railroad and go to Manhattan through the Steinway Tunnel.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions of present plants at Stamford, Tex.; Foraker, Okla.; Danville, Ind.; Ansonia, Conn.; Reedville, Va.; England, Ark.; Salem, Mass.; Elkins, W. Va.; Indianapolis, Ind.; Crosby, Minn.; Strawberry Point, Ia.; Omaha, Neb.; Maricopa, Cal.; Farmington, Utah; Salem, Wash.; Vancouver, B. C., Can.; Worcester, Mass.; Creston, Ohio; West Falls, Wis.; La Crosse, Wis.; Anamosa, Ia.; Ephraim, Utah; Lakeview, Ore.; Marseilles, Ill., and Carrollton, Ill.

Central Colorado Power Company.—It is stated in Denver that negotiations have been practically completed whereby the Denver City Tramway Company will be supplied with energy from the Central Colorado Power Company. If this deal is consummated it is understood that rotary transformers will be installed by the power company. The tramway company is now enlarging its steam plant in Denver, at a cost of about $375,000, for the purpose of using it as an auxiliary when the deal with the Central Colorado Company goes through.

Northern California Power Company.—The Inskip plant of the Northern California Power Company, at Red Bluff, Cal., was placed in operation June 12. [illegible] 8000 hp, making the total development of the company 27,000 hp. Work has also been commenced on a new plant at Horseshoe Bend, on Battle Creek, three miles above its junction with the Sacramento River. At this plant the water is delivered under a 480-ft. head, and it is estimated that 20,000 hp can be developed.

Pittsfield (Mass.) Electric Company.—Work has been begun on the new plant of the Pittsfield Electric Company, at Silver Lake, Mass. The cost will be about $225,000. It is expected to have the plant ready for operation by October 1. The present plant in Pittsfield will eventually be abandoned. The Stone & Webster Corporation, of Boston, will have charge of the construction work.

Belknap (Utah) Power Company.—Work has been commenced by the Belknap Power Company on a new plant in Sevier County. It is estimated that the plant will develop about 9000 hp. A tunnel 1400 ft. in length is being driven through the neck of a horseshoe bend, which will save the construction of flumes and canals. The cost of this development is estimated at $32,000.

Southern Power Company Franchise.—The Board of Aldermen of Durham, N. C., has granted a 60-year franchise to the Southern Power Company to furnish light and power to Durham and West Durham. It is understood that the company will build a 10,000-hp auxiliary steam plant in Durham.

Financial.

The Week in Wall Street.

Mystified by the course of the Wall Street market last week, the professional traders and old-time observers are offering diverse explanations and many contradictory prophecies for the future. No one seems to be able to explain exactly what is the matter with the securities market. Everyone agrees that it is so heavy that it sinks with its own weight. At the present moment, the anomalous condition is presented of severe declines in prices whenever the market shows activity and of firmness in tone whenever the market is stagnant and dull. During the few days that preceded the holiday there was a sharp fall of prices throughout almost the entire list. Railroad shares were especially weak, but many of the most active industrials also recorded heavy reductions. During these declines the market was active and several days the transactions amounted to more than a million shares. The story of the week can be told in the fact that almost one hundred issues made new low records for the year. The liquidation was continuous and insistent. There seemed to be oceans of stock for sale and few buyers ready to purchase. For several days subsequent to the first sharp break the course of the market was identical; heavy sales during the forenoon session, light trading from noon until about an hour

NEW YORK

	June 27.	July 1.	Shares sold.		June 27.	July 1.	Shares sold.
[illegible]	[illegible]	8½*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All.-Ch., pfd.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Amal. Cop...	[illegible]	[illegible]	291,850	Mackay C.,pf.	75*	[illegible]	[illegible]
Am. D. T....	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	6,300	Met. St. Ry..	15*	[illegible]	——
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——
Am. Tel. & C.	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T..	[illegible]	[illegible]	11,630	Steel, pfd....	115½	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gen. Elec....	143	[illegible]	3,800	West'h., com.	62	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	23,450	West'h., pfd..	123*	[illegible]	[illegible]

PHILADELPHIA.

	June 27.	July 1.		June 27.	July 1.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elec Co. of A.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elec. St. B'ty	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E. S. B'ty, pfd.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CHICAGO.

	June 27.	July 1.		June 27.	July 1.
Chi. City Ry.	[illegible]	[illegible]	Chi. Tel. Co.	[illegible]	[illegible]
Chi. Rs., Ser.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chi. Rs., Ser.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Com. Edison..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chi. Subways.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BOSTON.

	June 27.	July 1.		June 27.	July 1.
Am. T. & T.	[illegible]	[illegible]	Mex. Tel.	6	[illegible]
Cum. Tel.	[illegible]	[illegible]	Mex. Tel., pfd.	6½	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	133¼
Gen. Elec.	[illegible]	[illegible]	W. T. & T.	15¼*	[illegible]
[illegible]	[illegible]	14¾	W. T. & T., pfd.	87*	[illegible]
Mass. E. Ry., pfd...		76			

* Last price quoted.
Shares sold for four days, June 27 to July [illegible]

before the close, then a few purchasing orders which were sufficient as a rule to partially recover the morning's losses. For the most part, however, each of these days recorded a net loss on every active issue. There was very little substantial support offered by those heavy financial interests which have for several years been back of the upward movement. It is the general opinion in the street that this market condition is not to be explained by the recent railroad legislation or by any other decided influence. This opinion has brought about a condition in Wall Street where only the reckless trader is willing to hazard an opinion as to the future, or to make for himself any heavy investment on either side of the market. One feature that makes the market past the understanding of financial experts is the fact that scores of good dividend-paying stocks are selling at figures which would net the invester from 5 per cent to 7 per cent, while the banks are filled with money that can be borrowed at less than 4 per cent. Such a situation can only be possible through an utter lack of confidence as to the future earning capacity of railroads and industrials. The money market during all this turmoil has continued to be easy and rates are cheap. Rates July 1, the last day the financial markets transacted business before the holiday, were: Call, 2½@3¼; 90 days 4 per cent. The quotations in the table are those of the close July 1.

Financial Notes.

Red River Power Company.—H. M. Byllesby & Company, of Chicago, have purchased the property of the Grand Forks Gas & Electric Company, which operates in Grand Forks, N. D., and East Grand Forks, Minn. The electric property at Red Lake Falls, Minnesota, and certain other smaller properties, were acquired, also. All were formerly owned by Minneapolis interests, headed by W. J. Murphy, publisher of the Minneapolis *Tribune*. A new company, which will operate the properties acquired in and near Grand Forks, has been organized. It is called the Red River Power Company. Thomas Roycraft has been retained as local manager. The Red River Power Company proposes at once to make extensive additions and improvements to the gas and electric systems at Grand Forks and East Grand Forks, including the extension of many miles of distributing mains and transmission lines into sections not now served.

International Traction Company.— Another bondholders' committee has been formed in an effort to straighten out the affairs of the International Traction Company, of Buffalo. The committee referred to in our last week's issue represents the majority of the 5 per cent collateral trust bonds, but the new committee, it is said, will also have a number of bonds deposited with it. The members of this second committee are: Hardin H. Littell and George R. Teller, of Buffalo, and John W. Green, of Louisville. In the announcement of this new committee it is stated that the terms of the reorganization as proposed by the first committee, of which Robert L. Fryer is chairman, will work to the prejudice of the bondholders and in favor of the stockholders. Mr. Littell was formerly actively connected with traction enterprises in Buffalo.

United Railways of Baltimore.—The United Railways & Electric Company of Baltimore have made an increase of about $40,000 in May over the earnings of the same month last year, or a percentage increase of 6 per cent. From the record of earnings which the United is now earning it is practically certain that it will close the first half of 1910 with an increase in net earnings of not less than $200,000, and it is probable that an even better showing will be made provided June revenues meet expectations. The company is also planning to extend the Washington street line to Orangeville, Md., and the right of way is now being procured. It is expected that this extension will be a profitable source of revenue to the company.

Cambridge Electric Light Company.—The Board of Gas & Electric Light Commissioners of Massachusetts has approved the issue of $50,000 additional stock by the Cambridge Electric Light Company. The stock is to be offered at $200 per share. The proceeds of the new issue are to be used for making additions to the plant.

Interstate Light & Power Company.—H. M. Byllesby & Company of Chicago have purchased the generating and distributing properties owned by the Interstate Light & Power Company with headquarters at Galena, Ill. This company serves a territory of 200 square miles in area in the lead and zinc mining fields of southwestern Wisconsin and northwestern Illinois. Power is produced at a modern steam generating station near Galena recently completed. All the energy used in Galena, Ill., and Platteville, Cuba City, Benton and Hazel Green, Wis., is supplied by the Interstate company. These cities and towns comprise a population of 18,000. Power business received from the lead and zinc mines has created a large day load. Byllesby & Company propose to make additions and improvements.

New York Air Brake Company.—At a special meeting of the directors of the New York Air Brake Company, last week, a quarterly dividend of 1½ per cent was declared on the stock. This is the first dividend which the company has declared since October, 1907. Prior to that time, for quite a number of years, the company had been declaring 8 per cent dividends. It was given out after the meeting that, while the operations of the company were hardly up to the level which obtained prior to 1907, the output has been large enough to warrant the resumption of dividends. The company has $10,000,000 of capital stock outstanding, and $3,000,000 of 6 per cent bonds.

Berkshire Street Railway Purchase Approved.—The Massachusetts Railroad Commission has approved the purchase of 1923 shares of the Berkshire Street Railway Company, of Pittsfield, Mass., by the New York, New Haven & Hartford Railroad Company. The railroad company pays $149.90 per share for the stock. This purchase was recently authorized by special enactment of the Legislature. This purchase gives the New Haven railroad control of the entire traction system in the Pittsfield district, the Pittsfield Electric Street Railway Company having been taken over last February.

Consolidation in Colorado.—As has been anticipated for some time the Colorado Springs Electric Company, Colorado Springs Light & Power Company and Pike's Peak Hydroelectric Company have been merged into the Colorado Springs Light, Heat & Power Company, with a capitalization of $2,000,000. Greater efficiency in service and economy in administration are the principal reasons for the consolidation. George Bullock, the president, and George B. Tripp, the general manager of the three companies, will be re-elected to the same positions.

Norfolk & Portsmouth Traction Company.—The stockholders of the Norfolk & Portsmouth Traction Company voted last week to change the capitalization of the company from $6,000,000 common stock, to $3,000,000 common and $3,000,000 5 per cent cumulative preferred. Each holder of two shares of the old common stock will receive one share of the new common stock, and the privilege of subscribing to one share of the preferred at $60, par being $100. It is estimated that the new plan will bring to the company about $1,800,000 new capital.

Federal Light & Traction Company.—The Federal Light & Traction Company, which was recently incorporated under the laws of New York, has filed a certificate with the Secretary of State increasing its capitalization from $2,000 to $11,000,000. This company was referred to in the issue of June 9. It embraces properties controlled by Sanderson & Porter, Harrison Williams, J. B. Colgate and certain financiers identified with the National City Bank. The properties are located in the far Northwest, and in the Southwest.

Northern Indiana Gas & Electric Company.—It is stated in Philadelphia that the United Gas Improvement Company has acquired a majority of the stock in the Northern Indiana Gas & Electric Company, which company recently took over the property of the South Bend & Mishawaka Gas Company and of the Plymouth Lighting Company. This company, of which C. H. Geist is president, also controls the other properties in which Mr. Geist is interested in northern Indiana.

Hornell & Bath Interurban Railway Company.—The Public Service Commission of the Second District of New York has authorized the Hornell & Bath Interurban Railway Company to issue $195,000 of bonds. The proceeds of this issue are to be used for the construction of the company's line from Hornell to Bath. This issue is in addition to the previous issue which was authorized, amounting to $450,000 of bonds.

Greenville-Carolina Power Company.—The plant of the Greenville-Carolina Power Company, of Greenville, S. C., which was recently purchased by the Southern Power Company, will be greatly enlarged and equipped with modern machinery. The price paid for this property was about $250,000. The company is capitalized at $200,000, and has $300,000 in bonds.

Commonwealth Power Company.—John C. Weadock, of New York City, attorney for the Commonwealth Power Company, the holding corporation for the public utility properties owned by Hodenpyl, Walbridge & Company, and E. W. Clark & Company, in Michigan and Wisconsin, says that the merger is operative at the present time, and that the business is being conducted under the holding corporation. The Commonwealth Power Company holds the stock of the Michigan Gas Company, which controls the gas properties; it also holds the stock of the Consumers' Power Company, which controls the electric light properties, and the stock of the railway companies. Owing to the objection of the Michigan Railroad Commission, the Commonwealth Power Company has issued no bonds, but the needs of the underlying companies are being provided for by separate bond issues, each company taking care of its own affairs. Mr. Weadock says that the earnings of all of these properties have increased and are now entirely satisfactory.

Denver Irrigation and Reservoir Company.—The receiver recently appointed for the Denver Irrigation & Reservoir Company has been granted authority by the United States Court, at Denver, to issue receiver's certificates amounting to $650,000. This amount, it is thought, will be sufficient for the completion of the Standly dam, and the establishment of an irrigation system that will reclaim 250,000 acres of land. A representative of the Trowbridge & Niver Company, of Chicago, which firm undertook to finance the proposition, says that the issuance of these certificates will relieve the company of all present embarrassment. This is the concern which Henry L. Doherty recently undertook to carry through after the failure of the financiers to place the securities. Mr. Doherty will remain in control of the company.

Montgomery, Ala., Lighting Muddle.—Contempt proceedings were begun June 30 in the Federal Court at Montgomery, Ala., against Alex. Rice, formerly president of the Citizens Light and Power Company, and F. S. Ball, his attorney. The accusation is that the defendants violated an injunction, procured by Henry L. Doherty, prohibiting them from selling their stock in the Citizens company, Doherty claiming that the stock had been already sold to him. It is claimed that after the injunction was issued Rice and Ball sold their shares to Richard Tillis. Mr. Rice was on the stand throughout the day and testified that when he sold to Tillis on June 16 he had not been notified that an injunction had been issued. He explained that the transaction with Tillis was completed outside of Montgomery and that he was not in Montgomery until late in the afternoon June 16 subsequent to the deal with Tillis. The hearing has not yet been completed.

Funds for Chicago Subway Development.—The Supreme Court of Illinois has rendered a decision holding that the money which the City of Chicago has received from the traction companies as its share of the net receipts, under the present law, can be used by the city for the construction of a subway system. This fund now amounts to over $4,000,000.

Birmingham Railway, Light & Power Company.—Both the gross and net earnings of the Birmingham (Ala.) Railway, Light & Power Company for May show large increases over last year. In fact, the company has shown a very substantial growth in earnings since the beginning of the year. The increase in gross for the five months ending May 31 amounted to $151,133, or 16.42 per cent; and the increase in net was $79,715, or 23.01 per cent.

Pennsylvania Gas and Electric Merger.—Emmet Quinn, a Pittsburg capitalist, has purchased the Harrisburg Heat, Light & Power Company and the Paxtang Electric Company, of Harrisburg. The price paid for these two properties is said to be about $3,000,000. The companies are to be consolidated with the Citizens' Heat, Light & Power Company, of Johnstown. It is said that negotiations are now being conducted for the purchase of a number of other gas and electric plants in Pennsylvania, which are to be included in this merger.

DIVIDENDS.

American Gas & Electric Company, quarterly, 1 per cent, payable July 12.

Bell Telephone Company of Pennsylvania, quarterly, 1½ per cent, payable July 15.

Boston & Northern Street Railway Company, common, 2 per cent, payable June 30; preferred, semi-annual, 3 per cent, payable Aug. 1.

Boston Suburban Electric Companies, preferred, quarterly, 1 per cent, payable July 15.

Chicago Pneumatic Tool Company, quarterly, 1 per cent, payable July 15.

Colorado Telephone Company, quarterly, 1¾ per cent, payable July 15.

Columbus (Ohio) Gas & Fuel Company, 1 per cent, payable Aug. 1.

Electric Utilities Corporation, preferred, semi-annual, 2½ per cent, payable July 1.

Fonda, Johnstown & Gloversville Railway Company, 2 per cent, payable July 20.

Fort Smith (Ark.) Light & Traction Company, preferred, quarterly, 1½ per cent, payable July 15.

New York Air Brake Company, quarterly, 1½ per cent, payable July 29.

North States Power Company, quarterly, preferred, 1¾ per cent, payable July 15.

Oklahoma Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable July 15.

Old Colony Street Railway Company, common, 3 per cent, payable July 15; preferred, semi-annual, 3 per cent, payable Aug. 1.

Ottumwa (Iowa) Railway & Light Company, quarterly, preferred, 1¾ per cent, payable July 15.

San Diego (Cal.) Consolidated Gas & Electric Company, quarterly, 1¾ per cent, payable July 15.

Southern New England Telephone Company, quarterly, 1¼ per cent, payable July 15.

Standard Underground Cable Company, quarterly, 3 per cent, payable July 11.

United Metals Selling Company, quarterly, 5 per cent, payable July 15.

United States Light & Heat Company, preferred, semi-annual, 3½ per cent, payable July 15.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Baton Rouge (La.) Electric Company					
April, 1910	$8,302	$5,162	$3,140	$1,959	$1,181
April, 1909	7,343	6,053	1,290	661	629
Cape Breton Electric Company, Ltd.:					
April, 1910	20,729	11,659	9,070	5,050	4,020
April, 1909	16,511	11,209	5,302	5,056	246
Columbus (Ga.) Electric Company:					
April, 1910	40,695	15,943	24,752	19,981	4,771
April, 1909	29,778	15,478	14,300	12,862	1,438
Detroit United Railroad Company:					
May, 1910	795,380	476,300	319,080	163,368	167,908
May, 1909	664,507	389,179	275,328	154,932	133,065
Lake Shore Electric Company:					
May, 1910	100,424	52,983	47,441	35,035	12,405
May, 1909	89,534	47,111	42,423	34,581	7,842
Northern Ohio Traction & Light Company:					
May, 1910	207,323	111,250	96,073	43,375	52,698
May, 1909	188,749	103,832	84,917	43,809	41,107
Paducah (Ky.) Traction & Light Company:					
April, 1910	20,358	12,342	8,016	7,017	999
April, 1909	18,351	11,136	7,215	7,034	181
Rio Janiero Tramway, Light & Power Company:					
May, 1910	916,476	466,125	450,351	.....	......
May, 1909	646,118	391,736	254,382	.....	......
Sao Paulo Tramway, Light & Power Company:					
May, 1910	237,698	87,245	150,453	.....	......
May, 1909	190,277	75,570	114,707	.....	......
Tampa (Fla.) Electric Company:					
April, 1910	48,362	31,209	17,153	4,590	12,563
April, 1909	46,431	28,634	17,797	4,797	13,000
Twin City Rapid Transit Company:					
May, 1910	627,945	289,381	338,564	.....	......
May, 1909	569,217	260,970	308,247	.....	......

General News

Construction News.

ANNISTON, ALA.—The City Council has awarded the contract for [illegible] & Ga[illegible] Company for a period of 10 years. Under the terms of the contract the city is to have the privilege to purchase the plant at every five-year period.

ENGLAND, ARK.—The Richwoods Gin Company is reported to be contemplating the installation of an electric light plant and water-works system. The capital stock of the company has been increased from $10,000 to $25,000.

MARION, ARK.—Plans are being considered for the erection of a telephone line beginning at Marion and extending to the end of the St. Francis levee, 200 miles in length, at a cost of $12,000. It is proposed to connect it with the system of the Cumberland Telephone & Telegraph Company, at Memphis, Tenn. President Going of the Going Telephone Company is reported to be interested in the project.

MONTENE, ARK.—The Clubhouse, Hotel & Cottage Company is reported to be preparing plans for the installation of an electric light plant. It is understood that contract for construction of the plant has been awarded.

OLA, ARK.—The City Council is considering the question of the installation of an electric light plant to be owned by the municipality or operated under a franchise granted by the city. M. L. Martin is Mayor.

ALAMEDA, CAL.—Negotiations [illegible] way between the property owners and the electric light commission of the City Council for erecting street electroliers in the residence districts on San Antonio Avenue and Horton Street, Alameda.

LOS ANGELES, CAL.—The lighting system in Central Park will be improved by the installation of ornamental electroliers, of which 72 will be erected.

LOS ANGELES, CAL.—Failure on the part of the electric companies to submit bids for supplying electricity for the ornamental lamps on West Pico Street, may compel the property owners on that thoroughfare to install meters on every post in order to secure electric lighting service. The post-meter plan has been suggested as a solution, because the companies can then be compelled to supply electricity.

MARICOPA, CAL.—Preparations are being made to enlarge the plant of the West Side Electric Company, of Maricopa, for the purpose of extending its system to adjacent oil fields and also to the towns of Taft and Moron. The plant will furnish a 24-hour service covering a territory of about 10 miles square. H. G. Shippe is president and general manager of the company.

MONTEREY, CAL.—Preliminary plans have been completed by the Monterey & Del Monto Heights Electric Railway Company for the construction of an electric railway to connect Monterey and Del Monte Heights, 4 miles in length. F. M. Fairchild, 1707½ Oak Street, San Francisco, Cal., is general manager.

NOVATO, CAL.—Bids will be received by the Board of Supervisors of Marin County for the sale of a franchise to erect transmission lines along the public streets and public highways of the Township of Novato, Cal., for which application has been made to the board by J. W. Cain.

OAKLAND, CAL.—The City Council has granted the Southern Pacific Railroad Company permission to equip its Webster Street-Alameda mole line for electrical operation. The grant provides for the lighting of the thoroughfare in a manner similar to the lamps to be installed by the company on its new line from Fourteenth Street to the bay.

RED BLUFF, CAL.—The Inskip power plant of the Northern California Power Company was placed in operation June 12 for the first time. The plant has an output of 8000 hp, making the total electrical output of the company 27,000 hp. The company has commenced work on the construction of another power plant in the Horseshoe Bend, of Battle Creek, at the Coleman place, three miles from the junction of the creek with the Sacramento River. At Coleman the water will be used for the fourth time; the water will be delivered under 480-ft. head, and it is estimated that 20,000 hp can be developed. Electricity from the Inskip plant will be transmitted to Chico. A second transmission line will be erected from Inskip by the way of the Coleman power plant to Hamilton City and thence to Chico.

SAN FRANCISCO, CAL.—It is reported that negotiations are under way by the United Railways Investment Company by which it will secure control of the Sierra & San Francisco Power Company. The new com-[illegible]

SEBASTOPOL, [illegible]nance granting a franchise for the erection and operation of electric transmission lines and telegraph and telephone lines on certain streets and highways in Sebastopol to John E. Bennett, the highest bidder.

DENVER, COL.—Negotiations are reported to be under way between the Denver City Tramway Company and the Central Colorado Power Company, by which the last named company will supply electricity to operate the street car system in this city. If the deal is consummated, it is understood that rotary transformers will be installed. The tramway company is now enlarging its Platte Street power plant, at a cost of about $375,000, which will be used as an auxiliary plant in case the deal goes through.

ANSONIA, CONN.—The Ansonia O. & C. Company, of Ansonia, Conn., manufacturers of corsets, shoes and suspender webbing, has commenced work on the erection of a new generator plant.

BRIDGEPORT, CONN.—A franchise has been granted to the Bridgeport & Danbury Electric Railway Company by the Supreme Court to construct an electric railway between Bridgeport and Danbury. The proposed railway is to operate from the terminus of the present North Main Street line of the Connecticut Company in Bridgeport through Trumbull, and over the Newton Turnpike through Stepney, Monroe, Botsford, Hattertown, Newton, Dodgingtown, and thence to connect with the system of the Danbury & Bethel Street Railway Company, which owns and will operate the new railway.

MIDDLETOWN, CONN.—The Middletown Electric Light Company has decided to supply alternating current from its new plant at the foot of College Street when completed. At present it is furnishing direct current, which will necessitate a change of motors. The company has submitted two propositions to its patrons using electricity for motors: One to furnish them with second-hand alternating-current motors to replace the motors now in use and the other to pay for half of the expense of installing new motors. The change will not be made until next fall.

NORWICH, CONN.—Preliminary arrangements have been completed by the Norwich, Colchester & Hartford Traction Company for the construction of its proposed electric railway. Construction on the Hartford end of the line will commence in about a month. It is expected to have 10 miles completed before the winter sets in.

WILMINGTON, DEL.—Negotiations have been consummated whereby the Philadelphia & Wilmington Traction Company, recently incorporated with a capital stock of $6,500,000, will be the holding company for all of the Interstate Railways Company's properties south of Philadelphia, which, it is stated, have been merged with the Wilmington Light & Power Company. The properties have all been acquired by leases of 999 years. O. T. Crosby, of New York, N. Y., will be president.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 20 for furnishing and installing lighting fixtures in the United States buildings at Boulder, Col.; Clarinda, Ia.; Fayetteville, Ark.; Kearney, Neb.; Logan, Utah.; Marion, Ohio; Mayfield, Ky.; Pittsburg, Kan.; Shenandoah, Ia., and Newark, N. J., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

COLUMBUS, GA.—The contract for the construction of the Meritas Mills has been awarded to T. C. Thompson & Brother, of Birmingham, Ala., and Charlotte, N. C., including the erection of mill building, weave shed, power house, seven warehouses and village. The equipment will include 10,000 spindles and 170 looms, which will be equipped for electrical operation. Alvin Hunsicker, 320 Broadway, New York, N. Y., is president of the company; Fred S. Hinds, 19 Milk Street, Boston, Mass., is architect and engineer in charge.

FAIRBURN, GA.—The Fairburn & Atlanta Railway & Electric Company, which is constructing an electric interurban railway between Atlanta and Fairburn, a distance of 20 miles, is said to be contemplating using the Edison storage battery system to operate its cars. W. T. Roberts, of Fairburn, Ga., is president of the company.

IDAHO FALLS, IDAHO.—The City Council has awarded contracts for construction of a hydroelectric power plant in connection with the municipal electric plant as follows: For construction work to the Chatfield-Cutler Construction Company, of Salt Lake City, Utah, at $63,500, and for equipment and machinery to the Minneapolis Steel & Machinery Com-[illegible] plant will commence at once.

LEWISTON, IDAHO.—Surveys are being made by the Lewiston-Clarkston Improvement Company on the Grand Ronde River in connection with the construction of a large power plant. The company has acquired a location for powe. site and all necessary holdings for same. The present power plants of the company are unable to meet the increasing demands for electrical service.

SWEETWATER, IDAHO.—Preparations are being made by the Webb Ridge Telephone Company, recently incorporated, for the construction of a rural telephone from Sweetwater into the Craig Mountain country, 25 miles in length, work on which will commence at once. J. A. Ferris is reported to be interested in the project.

CARROLLTON, ILL.—It is reported that the Harman Engineering Company, of Peoria, Ill., is receiving estimates on two centrifugal pumps driven by steam engines, two return tubular boilers, a small vertical boiler, feed water heater and an electric lighting unit for a drainage plant at Carrollton, Ill.

KEWANEE, ILL.—The City Council has rejected the ordinance providing for a new 30-year franchise for the Kewanee Light & Power Company.

MARSEILLES, ILL.—The Marseilles Hydraulic Company, of Ottawa, Ill., recently incorporated, is reported to be contemplating the construction of a hydroelectric power plant on the south side of the Illinois River at Marseilles, where it has secured a 99-year lease. It is understood that work on construction of the plant will begin about Sept. 1. Duncan McDougal is president of the company.

MONMOUTH, ILL.—The question of substituting electric motors for steam power for operating the pumps in the water works system in Monmouth, Ill., is under consideration. Electricity for operating the pumps will be secured from the plant of the Monmouth Public Service Company.

DANVILLE, IND.—Plans are being made by the Danville Light, Heat & Power Company for extending its service to the towns of Coatsville, Clayton, Mooresville and other towns to furnish electricity for street and commercial lighting and also to furnish electrical service to farmers along the line. The company now supplies energy in Danville, Plainfield and Brownsburg and farmers along its lines between those cities. James F. Lynch, manager of the Danville company has secured a franchise to construct and operate an electric light and power plant in Shoals, work on which will commence in the near future.

ELKHART, IND.—The Home Telephone Company is asking for a new franchise under the terms of which it promises extensive improvements and extensions of its lines in the country districts.

EVANSVILLE, IND.—The Schroeder Headlight Company, of Evansville, Ind., is reported to be considering the installation of a 75-kw direct-current generator.

FORT WAYNE, IND.—The Commissioners of Allen County have granted the Fort Wayne & Winona Traction Company a franchise to construct an electric railway through the county, with the provision that it complete the railway projected by J. A. Barry and associates by January, 1912.

FOWLER, IND.—The date of the sale of the property of the Fowler Utilities Company has been extended from July 2 to Oct. 15 at the request of the bondholders. The bondholders represented to the court that they did not learn of the approaching sale until a few days ago and that they had been unable to perfect an organization to buy in the plant in case there should be no other bidders.

GREENFIELD, IND.—The City Council has amended the electric light ordinance fixing a minimum charge of 65 cents a month, with a meter rate of 12 cents per kw-hour.

HAMMOND, IND.—The City Council has granted the Indiana Northwestern Traction Company a 50-year franchise to construct a railway in Hammond. The proposed railway will connect Cedar Lake, Hammond, Crown Point and Chicago. Eugene Purtelle, 222 La Salle Street, Chicago, Ill., is president.

HANOVER, IND.—Work has commenced on the construction of the proposed Cincinnati, Madison and Louisville electric railway of the Southern Indiana Traction Company. The power house at Scottsburg is being enlarged.

INDIANAPOLIS, IND.—Bids will be received by the Commission of the Indiana State School for the Deaf, Room 54, State House, Indianapolis, Ind., until July 13 for material and labor for a number of improvements, including the erection of an outside lighting system at the institution, located at the corner of the Monon Railroad and Forty-second Street, Indianapolis, Ind.

MUNCIE, IND.—The Muncie Heat, Light & Power Company has filed a certificate with the Secretary of State showing an increase in its capital stock from $30,000 to $500,000 and an authorization of preferred stock to the amount of $35,000. James C. Markley is president.

ANAMOSA, IA.—The installation of a new Corliss engine, generator, transformers, etc., is reported to be under consideration by the Anamosa-Oxford Junction Light & Railway Company.

CALMAR, IA.—It is reported that an election will be held July 7 to vote on the question of granting a franchise to C. Miller & Sons, of Clermont, Ia., to construct and operate an electric light plant.

FAIRPORT, IA.—Sealed proposals will be received by the Commissioner of Fisheries, Department of Commerce and Labor, Washington, D. C., until July 26 for construction of boiler and pump house for the biological station on government reservation at Fairport, Ia.

NEWTON, IA.—It is reported that the Newton & Northwestern Railroad will be equipped for electrical operation from Newton to Colfax. The railroad is owned and controlled by the Fort Dodge, Des Moines & Southern Railroad Company, of Fort Dodge.

OSSIAN, IA.—C. Miller & Son, of Clermont, Ia., is reported to have been granted a franchise to construct and operate an electric light and power plant in Ossian.

STRAWBERRY POINT, IA.—Bids will be received by the Town of Strawberry Point, Ia., until July 1[illegible], for [illegible] a 50-kw, three-wire generator, pole line, wiring and brick building. A. R. Cole is town clerk. Oscar Claussen, German-American Bank Building, St. Paul, Minn., is consulting engineer.

ISLAND, KY.—Contracts have been awarded to the Charleston Electrical Supply Company, of Charleston, W. Va., by the Memphis Mining Company, of Memphis, Tenn., for equipment for its power plant at Island, Ky., including an engine [illegible] Ridgway [illegible] Engine Company, of Ridgway, Pa., connected to a 300 kw direct-current generator, with switchboard and auxiliary apparatus. The plant will furnish electricity for operating the machinery in the mines, for hauling, surface work and for lamps.

McHENRY, KY.—The Farmers' Mutual Telephone Company is reported to be making arrangements to construct a telephone line to Beaver Dam, Ky.

SERGENT, KY.—Preparations are being made by the Letcher County Home Telephone Company for the construction of a telephone line to connect Whitesburg, Mayking, Sergent and Baker, Ky., a distance of 25 miles. It is understood that bids for construction of the line will be asked at once. W. B. Webb, of Colly, Ky., is manager.

WATERLOO, KAN.—It is reported that work has commenced on the construction of the power house of the Waterloo, Cedar Falls & Northern Railway. The plant will have an output of about 8000 kw and will cost $300,000.

WHITESBURG, KY.—The construction of an electric light system in Whitesburg is under consideration. Jesse L. Cannon, of the Whitesburg Telephone Company, is reported to be interested in the project.

CATAHOULA PARISH, LA.—The Southern Telephone Company, of Stamps, Ark., is reported to be contemplating extensive improvements to the telephone system in Catahoula Parish, Ia., which will involve an expenditure of about $150,000.

BALTIMORE, MD.—It is reported that the Baltimore & Pennsylvania Railway Company will soon commence work on the construction of its proposed electric railway along the Reistertown and Hanover Turnpike. The proposed road will connect with the Emery Grove line of the United Railways and with the Hanover and York systems at their intersection above Melrose. The cost of the road is estimated at $600.000.

BOSTON, MASS.—The State Board of Gas and Electric Light Commissioners has instructed the Charlestown Gas & Electric Company to reduce its price for gas from 90 cents to not more than 85 cents per 1000 cu. ft., the new rate to take effect not later than Aug. 1.

CAMBRIDGE, MASS.—The State Board of Gas and Electric Light Commissioners has granted the Cambridge Electric Light Company permission to issue 500 shares of additional capital stock at $200 per share, the proceeds to be used for extensions to plant.

LOWELL, MASS.—The Wamesit Power Company is contemplating building an addition to its power plant on Lawrence Street, Lowell.

MILLBURY, MASS.—Announcement has been made by the Millbury Electric Light Company that the rate for electricity for lamps will be reduced from 20 cents to 19 cents per kw-hour, with a minimum charge of $1 per month. Free lamp renewals will be given in all cases, in accordance to the lamp rules issued July 1. T. R. Robinson, of Uxbridge, Mass., is superintendent.

PITTSFIELD, MASS.—The State Railroad Commissioners has approved of the purchase of the controlling interest of the Berkshire Street Railway Company, of Pittsfield, Mass., by the New York, New Haven & Hartford Railroad Company.

PITTSFIELD, MASS.—Work has commenced on the construction of the new plant of the Pittsfield Electric Company at Silver Lake, to cost about $225,000. It is expected to have the plant completed by Oct. 1. The present power plant on Renne Avenue will eventually be abandoned. The Stone & Webster Corporation, of Boston, Mass., has the contract for the work.

SALEM, MASS.—The Salem Electric Light Company has awarded the contract for extensive improvements to its power plant on Peabody Street to J. N. and V. S. Peterson.

UPTON, MASS.—Announcement has been made by the Upton Electric Light Company of a reduction in the price of electricity for lamps from 20 cents to 19 cents per kw-hour, the new rate to take effect from Aug. 1.

WORCESTER, MASS.—Plans have been completed by the Worcester Consolidated Street Railway Company for the construction of a new power station at Millbury. It is proposed to build an extension to the present plant in Millbury, on the Blackstone River, increasing the present output from 3000 hp to 5000 hp, which will be transmitted to Worcester. It is expected that plans will be carried out as soon as permission is obtained from the New York, New Haven & Hartford Railroad to erect high-tension transmission lines along its right-of-way from Millbury to Worcester.

IRON MOUNTAIN, MICH.—It is reported that the property of the Iron Mountain Electric Light & Power Company has been sold to a new corporation, which, it is said, proposes to develop what is known as Twin Falls, on the Menominee River, at a cost of about $800,000.

IRONWOOD, MICH.—The City Council has awarded the Ashland Power Company a franchise for an electric light, heat and power plant in Ironwood, Mich. A franchise was also granted to the company to construct an electric railway from Ironwood to Bessemer. A street lighting contract was also awarded to the company.

CROSBY, MINN.—A franchise has been granted to H. [illegible] Pearce and associates for the construction and operation of an electric plant and water-works in Crosby. It is understood that work will commence on the building of the plants at once. The plant will furnish electricity in the towns of Deerwood and Cuyana, Minn.

DELANO, MINN.—It is reported that George [illegible] is contemplating [illegible] of a [illegible] at the Rockford dam to supply electricity for lamps in Delano.

FORT SNELLING, MINN.—The contract for [illegible] the electric light system at Fort Snelling, Minn., has been awarded to W. I. Gray & Company, of Minneapolis, Minn.

GRANITE FALLS, MINN.—At an election to be held July 12 the proposition to issue $40,000 in bonds, the proceeds to be used for the construction of an electric light plant, water power plant and water works system, will be submitted to the people.

RED LAKE, MINN.—Dr. N. J. Pinault, of New Orleans, La., is reported to be considering making improvements to the Healy water power owned by him.

NIXON, MO.—H. M. Wilson, of Nixon, Mo., is interested in a project to construct an electric railway from Nixon to Springfield. The land owners agree to give the right of way provided the railway is built and in operation by Jan. 1, 1912. W. H. Schrieber is engineer.

LINCOLN, NEB.—The capital stock of the Lincoln Telephone & Telegraph Company has been increased to $2,500,000.

OMAHA, NEB.—Extensive improvements and additions costing approximately $1,000,000 are contemplated by the Omaha Electric Light & Power Company, of which $350,000 will be expended this year. The immediate work will include the installation of new condensing machinery, a turbine engine and the erection of a new transformer station, contracts for which have already been placed. Plans for next year include extension of boiler facilities, new coal storage building and warehouse. F. A. Nash is president of the company.

ATLANTIC CITY, N. J.—The contract for construction of a new pumping station at Absecon, bids for which were opened June 28, was awarded to Edward L. Baden, Bartlett Building, Atlantic City, N. J., for $48,200. F. A. Chapman, of Atlantic City, N. J., has secured the contract for wiring the station at $2,240. Contracts for electric equipment for the station have already been placed. L. Van Gilder is superintendent and engineer of Water Department.

BURLINGTON, N. J.—The City Council has passed an ordinance [illegible] for municipal service. To become effective the ordinance must be signed by the Mayor, which has heretofore opposed long-term franchises without proper return to the city. The town has been agitating municipal ownership of electric plant.

RIVERSIDE, N. J.—The contract for the construction of a brick power house at Riverside, N. J., for the Philadelphia Watch Case Company has been awarded to the William Steele & Sons Company.

BELEN, N. M.—The County Commissioners have granted a franchise to M. W. Flournoy, of Albuquerque, N. M., to construct and operate an electric light plant in Belen.

LAS VEGAS, N. M.—It is reported that the lighting and traction systems of the Las Vegas Light & Power Company, which were recently taken over by the Federal Light & Traction Company, recently incorporated to take over and control several light and power companies in Colorado, New Mexico, Arizona and Wyoming, will be enlarged and improved and the service extended to Hot Springs.

ALBANY, N. Y.—The Federal Light & Traction Company of New York has filed a certificate with the Secretary of State showing an increase in capital stock from $2,000 to $11,000,000. The document is signed by M. Gregg Latimer, Emerson Stringham and W. Henry Hoyt.

BUFFALO, N. Y.—Extensive additions are being made to the plant of the United States Rubber Reclaiming Works at Babcock and Hannah streets and the Erie Railroad. The plant is operated by electricity generated at Niagara Falls and when the extension is completed between 2500 and 3000 hp will be used. One 1000-hp motor, one 200-hp and several motors will be installed. Frank H. Brewster, 724 Babcock Street, Buffalo, N. Y., is general superintendent.

DANSVILLE, N. Y.—The Public Service Commission, Second District, has granted the Dansville Gas & Electric Company permission to issue $10,000 in bonds, the proceeds to be used in payment of extensions and improvements to its plant in Dansville.

NEW YORK, N. Y.—The Independent Telephone Company has filed an application with the Board of Estimate for a franchise to construct and operate telephone wires through the low-tension subways and to lay wires throughout the streets of the city and to erect and maintain pole lines throughout the several boroughs.

NEW YORK, N. Y.—Contracts have been awarded by C. B. J. Snyder, superintendent school buildings, for repairs, alterations and additions to the electric equipment in public schools in the Borough of Manhattan to T. Frederick Jackson, 94 John Street, New York, N. Y., as follows: Public School [illegible], for $[illegible]; [illegible], for $[illegible]; [illegible], for $4,983, and [illegible], for $[illegible].

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until July 11 for completing and finishing the electric equipment in Public School 101, located on East One Hundred and Eleventh Street, near Lexington Avenue, Borough of Manhattan. Blank forms, original plans and specifications may be seen at the above office.

NEW YORK, N. Y.—Sealed bids will be received by the Board of Park Commissioners, Department of Parks, Arsenal Building, Fifth Avenue and Sixty-fourth Street, New York, N. Y., until July 21: (1) For furnishing material and installing electric lighting fixtures in the Metropolitan Museum of Art. (2) For furnishing and installing electric lighting fixtures in new addition (F) of the Metropolitan Museum of Art. (3) For furnishing material and labor required for changes in old electric feeder system and rearrangement of night light control for the Metropolitan Museum of Art. (4) For furnishing material and installing system of ventilation in the attic story of the east wing of the Metropolitan Museum of Art. Plans may be seen and blank forms obtained at the above office. Charles B. Stover is president of the Park Board.

SYRACUSE, N. Y.—Steps are being taken to secure the removal of all overhead wires of the Syracuse Lighting Company, the Bell Telephone Company and the Independent Telephone Company from the campus of the Syracuse University and the streets and avenues which surround the campus. It is understood that an informal agreement has been reached with the executive heads of the three companies by which the poles and wires shall be removed from the campus and its immediate environs and the lighting and telephone wires placed in conduits.

CANTON, OHIO.—Announcement has been made by the Canton Electric Company that extensive improvements will be made to its power plant located on East Seventh Street, which will involve an expenditure of about $400,000.

CINCINNATI, OHIO.—The Lunkenheimer Company, of Cincinnati, Ohio, is reported to be in the market for two gas engines with a rating of 200 hp each, to be used in connection with natural gas and producer gas, and which are to be direct connected to alternating-current motors to supply heat and power for the plant for the company at North Fairmont. The new equipment is to be installed in connection with the present power plant.

COLUMBUS, OHIO.—Sealed proposals will be received at the office of the Board of Trustees of the Ohio State University, Columbus, Ohio, until July 18 for the installation of a coal-handling and storage plant, including locomotive crane, at the power house at the Ohio State University, in accordance with plans and specifications prepared by David Gaehr, of Cleveland, Ohio, which are on file in the office of the State Auditor. Proposals will also be received at the same time and place for the installation of a hot-water heating and ventilating system in University Hall, at the Ohio State University, in accordance with plans and specifications prepared by J. A. Almirall, of New York, N. Y., which are on file in the office of the State Auditor.

CRESTON, OHIO.—Sealed proposals will be received by Charles A. Tenny, village clerk, until July 14 to supply electricity for an electric light system; also for the installation of an electric street lighting system.

HAMILTON, OHIO.—At a special election held June 25 the proposition to issue $260,000 in bonds, the proceeds to be used for extensions to gas, water and electric light systems, was carried.

SANDUSKY, OHIO.—Preparations are being made by the Auto Parts & Motor Truck Company for the construction of a new plant in Sandusky, Ohio, to be in operation by next fall. The plant, it is said, will be equipped for electric motor drive.

TOLEDO, OHIO.—It is reported that the City Council has instructed the Director of Public Service to purchase an auxiliary pump and motor for the municipal filtration plant.

FORAKER, OKLA.—It is reported that the proposition to issue $5,000 in bonds, the proceeds to be used for the construction of an electric light plant, was carried at an election held recently.

LAWTON, OKLA.—Plans are being prepared by the Pioneer Telephone Company for the construction of a new telephone exchange building in Lawton, to cost $80,000.

SAPULPA, OKLA.—The Oklahoma Union Traction Company, it is reported, will commence work at once on the construction of its proposed interurban railway between Sapulpa and Tulsa. The line will traverse the Glenn Pool oil fields.

KLAMATH FALLS, ORE.—Extensive improvements are contemplated by the Klamath Development Company, which will involve an expenditure of about $150,000, and will include the construction of an electric street railway system to take the place of the old horse car line which was recently acquired by the company. A subsidiary company, known as the Klamath Falls Land & Traction Company, has been formed to operate the street railway and the Buena Vista properties recently purchased by S. O. Johnson, president of the Klamath Development Company, and associates. Mr. Johnson is also president of the traction company.

LAKEVIEW, ORE.—Arrangements are being made for the erection of a power plant on Deer Creek, 22 miles east of Lakeview. Surveys of the falls are now being made for location of the plant. It is estimated that about 7000 hp can be developed. Work on construction of the plant will commence this summer. J. Lewis and G. McDonald, of Spokane, Wash., are reported to be interested in the project.

FORD CITY, PA.—Contracts have been awarded by the Pittsburgh Plate Glass Company for structural steel for its new plant to be erected at Ford City, Pa. The plant will be operated by electricity, which will be supplied by gas engine-driven units.

PHILADELPHIA, PA.—Preparations are being made by the Philadelphia Rubber Company for the erection of a warehouse at its plant at Thirty-seventh and Reed streets. An electric elevator will be installed.

PHILADELPHIA, PA.—The Philadelphia Electric Company is reported to have awarded the contract for the construction of a storage plant, 90x150 ft., on Randolph and Twenty-first Streets, to John R. Wiggins & Company, 1215 Filbert Street, Philadelphia, Pa. John T. Windrim is architect.

PITTSBURGH, PA.—Heyle & Paterson, Inc., of Pittsburgh, Pa., are reported to be in the market for a second-hand traveling crane of from 5 to 10 tons' capacity, and 40 to 60 ft. span.

READING, PA.—Plans are being prepared by the Metropolitan Electric Company for placing its wires underground throughout the business section of the city.

SOMERSET, PA.—Charles Griffith and associates, of Johnstown, Pa., have purchased the controlling interest in Somerset County Telephone Company of Frank John, of Philadelphia, Pa.

WESCOSVILLE, PA.—The contract for constructing an electric light and power plant and sewerage system and fire service at the Lehigh County Home, located near Wescosville, Whitehall Township, has been awarded to George H. Hardner, of Allentown, Pa., for $49,000. J. S. Troxell is clerk Board of Commissioners.

NEWPORT, R. I.—A project has been started by a number of the merchants on Thames Street, Newport, to light the street by electricity during the summer evenings. The business men propose to bear the cost of the illumination.

PROVIDENCE, R. I.—The E. K. Watson Company, of Warren, R. I., has been awarded the contract for the construction of an addition to the electric power station of the Browne & Sharpe machine shops in Providence, R. I.

GREENVILLE, S. C.—Application has been made to the City Council by J. Thomas Arnold, representing a power company, for a franchise in this city.

GREENVILLE, S. C.—The directors of the Pelzer Cotton Mills have subscribed $33,000 to the capital stock of the Greenville-Spartanburg-Anderson electric railway, and the Belton Mills have subscribed to $14,000 of the capital stock of the company.

GREENVILLE, S. C.—It is reported that the power plant of the Greenville Carolina Power Company, which was recently purchased by the Southern Power Company, of Charlotte, N. C., will be greatly enlarged by the new owners. The purchase price of the plant is said to be about $250,000. W. S. Lee, of Charlotte, N. C., is vice-president and chief engineer of the Southern Power Company.

CENTER, TEX.—The Center Electric Light & Power Company has filed an amendment to its charter, changing its name to the Center Ice, Light & Power Company, and increasing the capital stock from $15,000 to $20,000.

KARNES CITY, TEX.—It is reported that R. L. Spillar, of Manor, Tex., is contemplating the construction of an electric light plant in Karnes City, Tex.

MISSION, TEX.—The Minneapolis Steel Company, of Minneapolis, Minn., has submitted a proposition to the City Council to install an electric light and ice plant in Mission. The cost of the plant is estimated at about $13,000.

NACOGDOCHES, TEX.—The City Council has instructed the fire committee to secure estimates of the cost of installing an electric light plant in connection with the water-works system.

STAMFORD, TEX.—J. E. Johnson, of Stamford, Tex., is planning to install an electric light plant in Spur, Tex.

TERLINQUA, TEX.—The Chinos Mining Company is reported to be contemplating the installation of an electric light plant, and ice plant at its mines.

TYLER, TEX.—Arrangements are being made by the Banner Telephone Company for extending and improving its telephone lines both in and out of the city. H. E. Scovern, of St. Joseph, Mo., electrical engineer, will have charge of the work.

WACO, TEX.—The Waco Gas Company is reported to be contemplating increasing the output of its plant. The company has recently awarded a contract for a new steel gas holder.

EPHRAIM, UTAH.—Work has commenced by the Belknap Power Company on the construction of its power plant at Belknap, Sevier County. The proposed plant will have an ultimate output of about 9000 hp. The initial installation will furnish 150 hp, which will be transmitted to Joseph, Elsinore and Richfield. A tunnel 1400 ft. in length is now being driven through the neck of Horseshoe Bend, which will save the expensive construction of flumes and canals. William Seegmiller, of Richfield, Utah, is president; William Johnston, treasurer, and J. B. Weimer, manager of the company.

FARMINGTON, UTAH.—The Home Telephone Company has purchased the plant and holdings of the Davis County Light & Power Company. It is understood that the price paid for the plant was $50,000. The plant now furnishes electricity in the towns of Clearfield, Hooper and Lagoon. The new owners propose to extend the transmission lines all over Davis County and into Weber County, where franchises have recently been secured. John Ford, of Centerville, is president of the light company, and S. S. Howard, of Woods Cross, is president of the telephone company.

SALINA, UTAH.—The local electric light plant has been purchased by a company headed by John Monson, Hugh [illegible] and Milan Packard, which will take possession July 15. A new power [illegible] has been secured at Rattlesnake Hill, 4 miles above the present plant on the Salina Canyon.

RUTLAND, VT.—The Rutland Railway Light & Power Company has placed a contract with the Risdon-Alcott Turbine Company, of Mount Holly, N. J., for a pair of 30-in. water wheels with a rating of 1800 hp, to be installed at the Carvers Falls plant.

LEW, VA.—It is reported that L. Jackson, agent, is in the market for equipment for a vinegar plant, including electric generators, hydraulic press, etc.

LURAY, VA.—The contract for lighting the streets of the towns has been awarded to the Shenandoah River Light & Power Company, of Luray, Va., for $600 per annum.

NORFOLK, VA.—The Portsmouth & Norfolk Traction Company, through its failure to execute a contract for lighting the streets of Portsmouth has forfeited a certified check for $5,000, which it deposited as a guarantee to carry out the contract. It is said that negotiation may be reopened with the corporation.

REEDVILLE, VA.—The Coast Fishing Corporation, recently incorporated, with a capital stock of $200,000 to establish a menhaden fertilizer plant, is reported to be contemplating the construction of several buildings to cost about $25,000. An electric light plant of sufficient output to supply 500 lamps will be installed; also conveyors, elevators, etc. The company, it is said, would like to receive estimates on two 60-hp, three 20-hp and five 35-hp engines.

RICHMOND, VA.—The Richmond & Henrico Railway Company has awarded the contract for boilers for its proposed new power plant to be erected on Louisiana Street, in Fulton, to the Babcock & Wilcox Company. The cost of the work is estimated at $10,000.

STAUNTON, Va.—The contract for lighting the streets of the city has been awarded by the Common Council to the Staunton Lighting Company, at a cost of $6,000 per year. It is estimated that the city will save about $1,000 a year. The city has a municipal electric light plant, which it has operated for 25 years.

BELLINGHAM, WASH.—The power plant on York Street of the Whatcom County Railway & Light Company is being torn down to make way for the new plant.

BLAINE, WASH.—Farmers of the Birch Bay district, Pleasant Valley and Mountain View are contemplating the construction of an electric railway from Ferndale to Blaine, via Lake Terrell and Birch Bay, for which five miles of right of way has already been donated.

CENTRALIA, WASH.—It is reported that contracts have been awarded by the Twin City Light & Traction Company for the construction of a new power plant, to be located on Coal Creek, about four miles from Centralia. The cost of the plant is estimated at $150,000.

ELLENSBURG, WASH.—The City Council has granted A. Olson, C. O. Eidel, A. F. Currier and F. Wippel a franchise to supply electricity in Ellensburg for lamps and motors.

MEDICAL LAKE, WASH.—A franchise has been granted the Medical Lake Telephone Company for the construction of a telephone system in Medical Lake.

NEWPORT, WASH.—The Northern Idaho & Montana Power Company has entered into a contract with the Washington Power Company, of Spokane, Wash., to provide electricity for lamps and motors for the cities of Sandpoint, Newport and intervening points for a period of 10 years. In order to supply the service the Washington Power Company will erect a high-tension transmission line from its power plant at Little Falls, on the Spokane River, to Newport, Wash., 70 miles in length. The Northern Idaho & Montana Power Company controls and operates electric light and power plants between Kalispel, Mont., and Newport, Wash.

ODESSA, WASH.—The City Council has accepted the bid of the Washington Water Power Company for materials and supplies for equipping the city water pumping plant to be operated by electricity, the cost not to exceed $1,376.

SALEM, WASH.—Extensive improvements are contemplated by the Salem Electric Company, which will involve an expenditure of about $200,000. It is proposed to build an addition to its plant and install new generating machinery and also improvements to its distributing system in Salem. It will also build a conduit system at a cost of $100,000. The company is also planning to improve its plant on Peabody Street at a cost of $75,000.

SPOKANE, WASH.—The Star Telephone Company is reported to have been granted a franchise to operate a telephone system in Ochlare, a new town on the Inland Empire system, about two miles south of Spokane.

VANCOUVER, WASH.—The Vancouver, Camas & Washougal Traction Company is reported to be contemplating the construction of an electric railway across the lands of the Vancouver Barracks military reservation, for which right of way has been applied for.

ELKINS, W. VA.—The Elkins Electric Railway Company is planning to construct a new power plant during the summer and also expects to build 7 or 8 miles of tracks within the next three months. F. B. Bloomfield, is general manager.

MILBOURNE, W. VA.—Surveys are being made by the Middle Railroad Company for the construction of its proposed electric railway to connect Sistersville, Kidwell, Middlebourne, Shirley and Clarkesburg, 60 miles in length. The company also proposes to furnish electricity for lighting. T. Moore Jackson, of Clarkesburg, W. Va., is president of the company.

CUBA CITY, WIS.—The new ore reduction plant of the Campbell Magnetic Separating Company now under construction, near Cuba City,

Wis., will be equipped for electric motor drive throughout. Electricity for operating the plant will be supplied by the Interstate Light & Power Company, of Galena, Ill.

EDGERTON, WIS.—Arrangements are being made by the Edgerton Wagon Manufacturing Company, of Edgerton, Wis., for the construction of a new plant, which will be equipped for electric motor drive throughout.

FOND DU LAC, WIS.—Preparations are being made by the Northern Casket Company, of Fond du Lac, Wis., for the construction of two new buildings, for which power equipment will be required, including boilers, electric motors and other machinery. Contracts for part of the machinery, it is said, have been placed.

JANESVILLE, WIS.—An addition is being erected to the foundry of the Janesville Machine Company, of Janesville, Wis. The equipment will include a 10-ton cupola, monorail crane and hoist, and motor-driven blower. It is understood that orders have been placed for most of the apparatus.

LA CROSSE, WIS.—Negotiations are reported to have been closed between the La Crosse City Railway Company, of La Crosse, Wis., and the La Crosse Gas & Electric Company, whereby the latter company will furnish electricity to operate the electric railway system. It is understood that it will be necessary for the La Crosse Gas & Electric Company to increase the output of its plant, which will require the installation of additional equipment, plans for which have not yet been completed.

WEST ALLIS, WIS.—It is reported that estimates have been taken for the construction of a new plant for the Kempsmith Manufacturing Company, of Milwaukee, Wis., to be located at West Allis. A power house will be erected, 50x100 ft., in which a steam electric generating plant will be installed. The machinery will be equipped for electric motor drive.

NEW WESTMINSTER, B. C., CAN.—The British Columbia Electric Railway Company is reported to be contemplating extending its railway system to Millside in the near future. Work on the construction on the Lulu Island section, it is said, will commence soon.

VANCOUVER, B. C., CAN.—The Vancouver Power Company, a subsidiary of the British Columbia Electric Railway Company, is reported to have announced plans for development of 100,000 hp, which will involve an expenditure of about $10,000 000.

LONDON, ONT., CAN.—Announcement has been made of rates for electricity furnished by the system of the Hydro-Electric Power Commission. For motors for manufacturing purposes the rate will be from $40 to $50 per horse-power per year; for lamps for residences 6½ cents per kw-hour with 20 per cent discount, making the rate about 50 per cent less than the rates now charged by the London Electric Company.

New Industrial Companies.

THE ALPHA CONTRACTING & ENGINEERING COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Thompson W. Miller, of Flushing, N. Y.; Robert T. Rasmussen and Henry Hetkin, both of 896 Park Avenue, Brooklyn, N. Y. The company proposes to do a general construction business.

THE ATLAS WATER TUBE BOILER COMPANY, of Westmont, N. J., has been chartered with a capital stock of $300,000 by P. J. Dougherty, J. B. Rettew, of Philadelphia, Pa., and J. Q. Adams, of Westmont, N. J. The company proposes to manufacture water-tube boilers, etc

THE AUTOMOBILE ENUNCIATOR COMPANY, of Chicago, Ill., has been chartered with a capital stock of $500,000 by S. F. Harris, W. I. Patton and A. E. Wilson, of Chicago, Ill. The company proposes to manufacture electrical supplies and apparatus.

THE AUTOMATIC FEED REGULATOR & SPECIALTY COMPANY, of Kittery, Maine, has been incorporated with a capital stock of $200,000 to manufacture and deal in apparatus relating to water, steam, gas, etc. E. J. Burnham, of Kittery, Maine, is president, and H. P. Knowlson, of Malden, Mass., treasurer.

THE BALANCE GEAR LIGHT VEHICLE COMPANY, of New York, N. Y., has been chartered with a capital stock of $30,000 by Walter E. McDonnell, of New York, N. Y.; Thomas Spaulding, of Long Island City, N. Y., and Michael J. McDonnell, of Far Rockaway, N. Y. The company proposes to manufacture vehicles, motors, engines of all kinds.

THE BOULEVARD ENGINE COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $10,000 by Howard B. Gentry, N. S. Brown, B. C. Winston and others.

THE COMO ELECTRICAL COMPANY, of Como, N. J. (not a post office), has been incorporated by W. W. Rowan, of Asbury Park, N. J.; T. Hickley, Spring Lake, N. J., and W. E. Anderson, of Englishtown, N. J. The company is capitalized at $50,000 and proposes to manufacture electrical and mechanical devices.

THE COMET ELECTRIC STOVE COMPANY, of Detroit, Mich., has been incorporated with a capital stock of $50,000 by James D. Lamont, Ellsworth S. Bryant and Franklin S. Prussia. The company proposes to manufacture electric stoves and heaters.

THE CROUCH CONSTRUCTION COMPANY, of Jersey City, N. J. has been chartered with a capital stock of $100,000 by H. O. Coughlan, L. H. Gunther and H. A. Black, of Jersey City, N. J.

THE GOTHAM MOTOR CAR COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 by W. Schuette, R. W. Schuette, of Douglas Manor, and D. W. Gluck, of New York, N. Y. The company proposes to manufacture and deal in motors, engines, motor cars, etc.

THE GUNN MOTOR COMPANY, of Utica, N. Y., has been incorporated with a capital stock of $300,000 to manufacture and deal in motors, engines, etc., by J. K. Dunn, W. T. Baker and W. I. Taber, of Utica, N. Y.

THE HAMPSHIRE MANUFACTURING COMPANY, of New York, N. Y., has been incorporated by C. J. Kleber, of New York, N. Y.; J. MacGregor, of Springfield, Mass., and J. H. Kaesen, of New York, N. Y. The company is capitalized at $125,000 to manufacture and deal in machinery, tools and appliances.

THE KERBEAUX COMPANY, of New York, N. Y., has been chartered with a capital stock of $1,000 to manufacture packings, power and mill supplies. The incorporators are: Irving D. Lyon, 715 West Eightieth Street, New York, N. Y.; August Voelker, New York, N. Y., and Charles P. Hull, Metuchen, N. J.

THE LEHIGH ENGINEERING CONTRACTING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $250,000. The incorporators are: E. L. Brooks, of Kyserine, N. Y.; T. E. Ryan, Eddystone, Pa., and M. Shapiro, of Brooklyn, N. Y.

MASON, HILTON & COMPANY, of New York, N. Y., has been incorporated by F. Mason, of Brooklyn, N. Y.; J. C. Hilton, of Hackensack, N. J., and A. L. Mason, of New York, N. Y. The company is capitalized at $50,000 and proposes to do a general engineering, contracting and building business.

THE MAXIMILIAN TOOL & MACHINE COMPANY, of Buffalo, N. Y., has been incorporated by Max Maximillian, Fred A. Meyer and John B. Porter, of Buffalo, N. Y. The company is capitalized at $500,000 and proposes to manufacture and deal in machinery, tools, etc.

THE McMAHON CONSTRUCTION COMPANY, of Newark, N. J., has filed articles of incorporation with a capital stock of $50,000 for the purpose of doing a general contracting and construction business. The incorporators are: J. McMahon, P. J. McGuinness and L. W. McMahon, all of Newark, N. J.

THE MIDDLE WEST ENGINEERING COMPANY, of Cincinnati, Ohio, has been chartered by James E. Hewes, F. C. Busch, C. B. Matthews and Randolph Matthews. The company is capitalized at $100,000 and proposes to do a general engineering and construction business. James E. Hewes will be president of the company.

THE MONTROSE MANUFACTURING COMPANY, of Brooklyn, N. Y., has filed articles of incorporation with a capital stock of $100,000. The company proposes to manufacture and sell electrose products. The incorporators are: L. Steinberger, of Brooklyn, N. Y.; J. H. Poppenburg and F. [illegible], of New York, N. Y.

THE NIAGARA LEAD & BATTERY COMPANY has filed articles of incorporation with the Secretary of State with a capital stock of $5,000,000. The incorporators are: G. O. Parkman and William W. Hepburn, of Philadelphia, Pa., and Edward C. Waddington, of Woodtown, N. J. The company proposes to manufacture electrical supplies.

THE NORTH AMERICAN RAILWAY SPECIALTY COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000 to manufacture railway supplies and rolling stock. The incorporators are: S. J. Cotsworth, S. P. Gough and E. M. Fry, of Chicago, Ill.

THE OLD COLONY CONSTRUCTION COMPANY, of Boston, Mass., has been chartered with a capital stock of $50,000 to do a general contracting and building business. R. E. Davis, of Brookline, Mass., is president and treasurer.

THE O-SIGN ELECTRIC COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 by J. L. Cockle, F. L. Phillips, J. P. Patterson, of New York, N. Y. The company proposes to do a general advertising business, constructing electrical advertising devices.

THE EDMUND T. PERKINS ENGINEERING COMPANY, of Augusta, Maine, has been chartered with a capital stock of $100,000 to do a general engineering, construction and contracting business. R. S. Buzzell is president and A. F. Jones, treasurer, both of Augusta, Maine.

THE ST. MARKS BUILDING COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $5,000 for the purpose of manufacturing and dealing in pumps, dynamos and machinery; also conducting a real estate agency. The incorporators are: Archibald K. Meserole, 784 Manhattan Avenue, New York, N. Y.; N. Marsila and James J. Murray, both of New York, N. Y.

THE UNITED ELECTRICAL CONSTRUCTION COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 by Loyal L. Smith, Austin J. Rooney and John J. Rooney. The company proposes to do a general electrical construction business.

THE WIRT ELECTRIC SPECIALTY COMPANY, of Portland, Maine, has been incorporated with a capital stock of $50,000 for the purpose of manufacturing and dealing in all kinds of electrical and other apparatus, machinery, etc. T. L. Croteau is president of the company and A. F. Jones, treasurer, both of Portland, Maine.

New Incorporations.

ABBEVILLE, ALA.—Articles of incorporation have been filed for the Abbe Light & Power Company with a capital stock of $6,000. The officers of the company are: J. S. Pollard, president; J. L. Bodiford, vice-president, and C. J. Owens, secretary and treasurer.

BAY MINETTE, ALA.—The Alabama Telephone & Telegraph Company has been incorporated with a capital stock of $5,000 and proposes to operate telephone lines in Baldwin, Conecuh, Escanabia, Monroe and Washington Counties. The officers are: Ellis L. Munna, president; Spaulding Peck, secretary and treasurer, and J. H. Haswell, general manager.

OROVILLE, CAL.—The Butte & Plumas Railway Company has applied for a charter to construct an electric railway to connect Oroville and Standwood, a distance of 30 miles, surveys for which are now being made. The capital stock of the company is placed at $500,000. The incorporators are: O. C. Hasslett, E. S. Dunbar and J. L. Smith.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company has been incorporated with a capital stock of $6,500 000 by W. T. Spring, F. J. Hensel and J. M. Lindsay, of Wilmington, Del.

FOREST CITY, IA.—Articles of incorporation have been filed for the Forest City & Mason City Railway Company by P. O. Koto, C. N. Christopherson, C. S. Isaacs, of Forest City, Ia.; A. M. Sheimo, of Baldwin, Wis.; A. L. Sherin and M. J. Hawley, of Watertown, S. D The company is capitalized at $400,000 and proposes to construct a railway in South Dakota from Forest City, via Fertile to Mason City, a distance of 30 miles

VANDALIA, ILL.—The Fayette County Telephone & Telegraph Company has been incorporated with a capital stock of $48,500 by William M. Crouch, John U. Metzger, Charles M. Ratterjohn.

MAQUOKETA, IA.—The Washington Farmers' Mutual Telephone Company has been chartered with a capital stock of $2,000 by E. W. Burnett, W. E. Roe and others.

PORTLAND, MAINE.—Articles of incorporation have been filed for the Pacific Power & Light Company with a capital stock of $7,500,000. The company is a subsidiary of the American Power & Light Company and has taken over the following properties: Gas properties in Walla Walla and North Yakima, Wash.; Lewiston, Idaho, and Astoria and Pendleton, Ore.; also electric properties in Walla Walla, Astoria, Pendleton and Athena and the local electric railway systems in Astoria and in Walla Walla and interurban railway extending from Walla Walla to Milton; the Strahorn properties, consisting of electric light, power and water systems in North Yakima and along the valleys of the Columbia and Yakima rivers.

ASH GROVE, MO.—The Ash Grove Telephone Company has been chartered with a capital stock of $15,000 and the following directors: J. T. Kirkland, A. K. Kirkland and J. Francis Kirkland.

FAIRFAX, MO.—The Fairfax Light, Heat & Power Company has been chartered with a capital stock of $5,000 by William F. Ranken, William F. Marshall and E. C. Whitford.

ILLMO, MO.—The Illmo Light & Power Company has been incorporated with a capital stock of $4,000 by J. H. Beisswingert, John S. Norman, D. T. Doty and others.

NEVADA, MO.—The Nevada Water, Light & Traction Company has been chartered with a capital stock of $350,000 by Henry C. Barker, William W. Seibert, Edward Willard and others.

SAVANNAH, MO.—The Savannah Electric Light & Power Company has filed articles of incorporation with a capital stock of $15,000 by F. C. Barrington, William A. Evans and Z. L. Zwick.

OMAHA, NEB.—The Niobrara Investment Company has applied for a charter for the purpose of constructing an interurban railway extending between Niobrara River and Sioux City. A power plant will be built on Niobrara River. The company is capitalized at $1,200,000. F. Jaeggi is interested in the project.

STONE HARBOR, N. J.—Articles of incorporation have been filed for the Stone Harbor Electric Light & Power Company by H. S. Risley, D. R. Risley, R. P. Risley, of Stone Harbor, N. J.; C. A. Farnum, of Philadelphia, Pa., and E. C. Waddington, of Woodstrom, N. J. The company is capitalized at $100,000 and proposes to operate electric light, heating and power plants in Stone Harbor and the lower portion of Seven Mile Beach.

TRENTON, N. J.—The Riverside Traction Company has been incorporated with a capital stock of $1,500,000 to take over the property of the Camden & Trenton Railway Company. The officers of the company are: Thomas Haydock, of Philadelphia, Pa., president; Dietrich Debuys, of Camden, N. J., secretary, and Robert Long, of Philadelphia, Pa., treasurer.

BELEN, N. M.—The Belen Light & Power Company has been incorporated by W. M. Berger, Oscar Goebel, Mary E. Berger, of Belen, N. M., and Charles H. Scholl, of Los Angeles, Cal. The company is capitalized at $25,000 and has secured a franchise to furnish electricity in Belen. It is expected to have the plant in operation within three months.

ALBANY, N. Y.—The Maples Telephone Company has been incorporated by A. N. Pruner, A. W. Kressler and L. W. Kester, all of Salamanca, N. Y. The capitalization is $5,000.

OVERLY, N. D.—Articles of incorporation have been filed for the Overly Farmers' Telephone Company with a capital stock of $25,000 by Fred E. Sims, John Schuchard, C. Foss, Peter Boardman, T. E. Morgan and others.

STANLEY, N. D.—The Sunny Center Telephone Company has been chartered with a capital stock of $5,000 by Peter Ilson, Amos E. Lande, of Belden, N. D., Dayton H. Dody, Martin Holter and G. J. Gilbertson, of Stanley, N. D.

NELSONVILLE, OHIO.—Articles of incorporation have been filed for the Hocking Light & Power Company by H. H. Long, G. M. Murray, C. H. Davis, L. S. Madden and G. H. Sweetland. The company is capitalized at $10,000 and proposes to acquire and operate transmission lines for the distribution of electricity for lamps and motors in Nelsonville and vicinity.

KENNARD, PA.—The Kennard Telephone Company has been chartered with a capital stock of $5,000.

LAKE SIDE, R. F. D. SUSQUEHANNA, PA.—The Lake Side Telephone Company has been organized with a capital stock of $10,000.

TAYLORSTOWN, PA.—The Taylorstown Farmers' Telephone Company has been incorporated with a capital stock of $5,000 by J. G. Snodgrass, R. W. Wolfe, W. G. Cundell, W. H. Phillips, J. F. Kerr and G. R. Conger, of Taylorstown, Pa., and N. O. Braundell, of Carothers, Pa.

NASHVILLE, TENN.—A charter has been granted to the Overton branch of the Home Telephone system with a capital stock of $5,000. The incorporators are: B. L. Speck, J. A. Hargrave, W. J. Chilton, A. G. Keisling, W. A. Reed, Jesse S. Fleming and A. J. Mofield.

CLINT, TEX.—The Clint Telephone Company has been incorporated with a capital stock of $2,500 by C. M. McKinney, R. H. Davidson and C. D. Bubble.

VIENNA, VA.—Articles of incorporation have been filed for the Washington-Virginia Railway Company with a capital stock of $1,000,000 to construct an electric railway from Vienna to Belmont, 50 miles in length. The officers are: M. E. Church, president; G. B. Fadsley, vice-president; F. B. Parker, secretary, and L. L. Northrop, treasurer, all of Falls Church, Va.

ONTARIO, WIS.—The Ontario & Northern Railway Company has been granted a charter to construct an electric railway from Ontario to Wilton, a distance of 8 miles. The company is capitalized at $75,000, and the directors are: V. A. Stoddard, C. W. Lord, A. T. Saunders, L. R. Abbott, F. G. Bredlow and Levi Wallace, all of Ontario, Ont.

Personal.

MR. JOHN C. PARKER, electrical engineer of the Rochester (N. Y.) Railway & Light Company, was married June 21 to Miss Elizabeth Brooks at Rochester.

MR. L. W. JACQUES, master mechanic of the Fort Wayne & Wabash Valley Traction Company, with offices at Fort Wayne, Ind., was married June 22 to Miss Jennie Schroyer, of Zanesville, Ohio.

MR. JOHN E. ROBERTS has been appointed a member of the electric lighting board of Jamestown, N. Y., which operates a municipal plant. Mr. Roberts was at one time employed by the plant as electrician, and recently has been an alderman.

MR. W. R. WILSON has been appointed director of industrial enquiries and industrial education in the United Provinces of Agra and Oudh, India, with headquarters at Allahabad. Mr. Wilson was formerly engineer of the Simla hydroelectric plant.

PROF. D. C. JACKSON, of the Massachusetts Institute of Technology, president-elect of the American Institute of Engineers, was the guest of honor at a dinner of Cornell alumni held at Jefferson, N. H., on June 30 during the convention of the A. I. E. E.

MR. HAROLD D. LARRABEE, manager of the Green Mountain Electric Company, Montpelier, Vt., has been appointed superintendent of the Consolidated Lighting Company, of that city, to succeed Mr. E. O. Wedge. Mr. Larrabee is a graduate of the Massachusetts Institute of Technology.

MR. E. O. WEDGE, who has been with the Consolidated Lighting Company, Montpelier, Vt., for the past 18 years, and is now its superintendent, has resigned his position to become general manager of the Astoria Electric Company, which controls the electric railway, electric lighting and gas lighting properties at Astoria, Ore.

MR. GEORGE R. WEBB, of Baltimore, Md., will become vice-president of the new merger of the Philadelphia & Wilmington Traction Company and the Wilmington Light & Power Company. Before the merger Mr. Webb was a large holder in the latter company.

PROF. MIKIL A. DE CHATELAIN, of the department of electrical engineering, Wasily Ostow, St. Petersburg, Russia, is in this country visiting points of interest to electrical engineers. He attended the recent convention of the A. I. E. E., of which he is a member.

MR. SILAS E. WEIR has accepted a position with the Triumph Electric Company, of Cincinnati, as shop superintendent. Mr. Weir, who was formerly connected with the Western Electric Company, of Chicago, has had a long and varied experience in the manufacture of direct and alternating-current machinery.

MR. M. J. KEHOE, superintendent of power in charge of operation of the main plant of the Fort Wayne & Wabash Valley Traction Com-

pany, at Fort Wayne, Ind., has been promoted to be also superintendent of the light and power department of the company, which does the commercial lighting in Fort Wayne. Mr. John B. Weidgenant is assistant superintendent.

Trade Publications.

WATER METERS.—Water meters, [illegible] of services known as fire services in distinction to those known as manufacturing or commercial services, are illustrated, described and listed in bulletin issued by the Hersey Manufacturing Company, South Boston, Mass.

PANEL BOARDS.—The J. Lang Electric Company, Cleveland, Ohio, is distributing an attractive poster, printed in three colors, showing its panel board designed particularly for use in office buildings and similar localities. Tables are given of the sizes of wires for use with motors or for carrying a known value of current.

INTERCOMMUNICATING TELEPHONES.—Telephone systems for interior use, as in hotels, factories, apartment houses, etc., form the subject of catalog 21 of the Connecticut Telephone & Electric Company, Meriden, Conn. Different types of instruments and switchboards are described and connection diagrams given.

IGNITION DEVICES.—The Eisemann Magneto Company, 225 West 57th St., New York, has issued a well-arranged folder giving instructions for the installation and maintenance of high-tension magnetos with separate transformer coils. A description of the Eisemann magneto is given in bulletins Nos. 20 and 21 of the company.

LINE DROP COMPENSATORS.—In bulletin No. 4740, issued by the General Electric Company, there is described a line-drop compensator for alternating-current circuits, which can be applied to switchboards already installed without any radical changes in the existing panels and can be mounted at any convenient place behind the panel or on the wall, the small leads only being brought to the instrument on the panel.

HEMMING INSULATION.—A handsome booklet issued by the Hemming Manufacturing Company, 2 Rector Street, New York, describes "Hemit," an insulating composition molded under high pressure into various forms and shapes, illustrations of a number of which are shown. It is stated that all electrical insulators, or insulated parts of electrical machinery or apparatus, may advantageously be made of "Hemit."

ENAMELED MAGNET WIRE.—With the title "Enameled Magnet Coil and Electromagnetic Windings," the American Electric Fuse Company, Muskegon, Mich., has issued a handsome pamphlet, which will be found of much interest by users of small wire and of electromagnets. An account is given of the development of the enameled type of wire insulation, and comparisons made with cotton and other fiber coverings as to winding space occupied and break-down voltage. In an appendix sample formulas are given for calculating coil windings. Numerous halftones are given illustrating coils, their winding, etc.

SERIES TUNGSTEN LIGHTING SYSTEM.—The Western Electric Company has issued bulletin No. 5533, describing series incandescent lighting system with tungsten lamps. The bulletin gives details of and operating data for lamps and constant-current transformers suitable for use on series lighting circuits. It lists standard switchboard panels for controlling lighting circuits, and pole brackets, hoods and reflectors for use in the construction of these circuits. A new device brought to notice is the safety automatic cut-out, a device for protecting series street lighting circuits in case any portion becomes ruptured.

BUSINESS NOTES.

ATLANTIC INSULATED WIRE & CABLE COMPANY, 120 Liberty Street, New York, has appointed Mr. Samuel D. Gloss, formerly with the Simplex Electrical Company, sales manager, to succeed the late Mr. George F. Porter.

THE LORD MANUFACTURING, The Lord Electric and the Lord Construction companies are taking contracts for lighting installations for parks, municipalities, factories and mills. In these contracts they are supplying their "Luminator" flaming arc lamps. It is claimed that these lamps give a wonderfully brilliant light and when hung at a sufficient height above the ground make an even, pleasing glow. Moreover, in rolling mills and factories the light is of such a character as to improve working conditions to a degree whereby the operating expenses in many instances have been considerably decreased.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Lloyd Lyon, Mobile, Ala. Next meeting, Anniston, Ala., 1910.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, 29 West 39th St., New York.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, 158 West 76th St., New York City.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

American Street & Interurban Railway Accountants' Association. Secretary, H. E. Weeks, Davenport, Ia.

American Street & Interurban Railway Engineering Association. Secretary, John W. Corning, Boston Elevated Railway Company, Boston, Mass.

American Street & Interurban Railway Association. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

Arkansas Association of Public Utility Operators. Secretary, J. E. Cowles, Little Rock, Ark.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 509 Perry-Payne Building, Cleveland, O.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 135 Adams St., Chicago.

Association of Railway Electrical Engineers. Secretary, George B. Colegrove, 960 Monadnock Building, Chicago. Next annual meeting, Chicago, Oct. 4, [illegible], 1910.

Association of Edison Illuminating Companies. Secretary, D. I. Huntington, Spokane, Wash.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allen H. Royce, 48 King St., W., Toronto, Ont.

[illegible] Railway Association. Secretary, A. L. [illegible], [illegible], Ind.

Colorado Electric Light, Power & Railway Association. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, Glenwood Springs, [illegible].

[illegible]

Electric Vehicle and Central Station Association. Secretary [illegible]

[illegible]

Electric Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electric Trades Association of Philadelphia. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Contractors' Association of State of Missouri. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next annual meeting, Chicago, Nov. 3, 1910.

Electrical Supply Jobbers' Association. Next meeting Niagara Falls, Canada, July 19, [illegible] and 21, [illegible].

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

Engineering Society of Wisconsin. Secretary, W. G. Kirchoffer, 31 Vroman Building, Madison, Wis.

Engine Builders' Association of the United States. Secretary, C. H. Lembower, Reading, Pa.

Florida Electric Light & Power Association. Secretary, H. C. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., 1911.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, [illegible], Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Light Association. Secretary, Fred Leslie, Muncie, Ind.

Internal Combustion Engine Association. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Rochester, N. Y., Sept. [illegible].

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Annual meeting, second Wednesday in March, each year.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Kansas City, Kan., Sept. 27 and 28, 1910.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October, each year.

MAINE ELECTRICAL ASSOCIATION. Secretary, Fred D. Gordon, Auburn, Maine.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. P. Biggs, Detroit, Mich. Next meeting, Port Huron, Mich., Aug. 16, 17 and 18.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, B. W. Cowperthwait, Faribault, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W Schweer, Windsor, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRIC CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Atlantic City, N. J., July 20, 1910.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next meeting, San Francisco, Cal., June 9, 1910.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, C. H. Hodskinson, 89 Lafayette St., Boston, Mass.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, on board steamer *Queen*, leaving Seattle Aug. 26, 1910.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next meeting, Cedar Point, Sandusky Bay, Ohio, July 26, 27 and 28, 1910.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OKLAHOMA PUBLIC UTILITIES ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla. Next meeting, Oklahoma City, Sept. 30 and Oct. 1, 1910.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal.

PACIFIC COAST ELECTRICAL SHOW, San Francisco, Cal., week beginning Aug. [illegible], 19[illegible].

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa. Next meeting, Glen Summit Springs, Pa., Sept. 14, 15 and 16, 1910.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

PITTSBURG ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEGRAPH ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1911.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Lena M. Owen, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester Center, Vt.

WASHINGTON ELECTRICAL SHOW, October or November, 1910.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill. Next meeting, Omaha, Neb., October, 191[illegible].

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WINNIPEG ELECTRICAL SHOW, Winnipeg, Manitoba, July 13 to 23, 1910.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRICAL ASSOCIATION. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association. Secretary, John S. Allen, Lake Geneva, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 28, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

962,417. ELECTRICAL RECEIVING APPARATUS; J. M. Boyle, New York, N. Y. App. filed July 28, 1905. For high frequency oscillations in which the receiver consists of a two fluid primary battery, the conductive fluid connection of the fluids being of extremely small cross-section.

962,431. TYPE CARRIAGE PROPELLING MECHANISM FOR PRINTING TELEGRAPH RECEIVERS; G. S. Hiltz, Brooklyn, N. Y. App. filed Nov. 16, 1908. For effecting the return of the carriage from any point to its initial position.

962,435. INCANDESCENT LAMP SYSTEM; Y. Kawasaki, Vancouver, B. C., Can. App. filed July [illegible], 19[illegible]. [illegible] filaments and a common terminal which may be connected to the several wires of a controlling circuit.

962,455. SERVICE CUT-OUT AND METERING APPARATUS; T. E. Murray, New York, N. Y. App. filed Dec. 21, 1909. For connecting any number of local circuits to their several meters independently with a protecting fuse, by means of a panel of blocks of insulating material in which the connections are embedded.

962,473. SWITCHBOARD CONSTRUCTION; W. M. Scott, Philadelphia, Pa. App. filed Nov. 9, 19[illegible]. [illegible] switchboard, circuit leads, and a plurality of electric switches on the board and disposed vertically above each other with a movable contact member connecting a lead with a busbar.

962,497. VAPOR ELECTRIC APPARATUS; J. T. H. Dempster, Schenectady, N. Y. App. filed Apr. 4, 1904. A vapor electric apparatus having a vaporizable electrode and a solid electrode in the same space as the vaporizable electrode and cooled by contact with fluid of the same character as the electrode.

962,499. ELECTRIC HAMMER; B. M. Dutton, Richmond, Va. App. filed Feb. 16, 1909. Electric reciprocating motor having two solenoids which alternately influence a plunger.

962,532. ELECTRIC FURNACE FOR METALLURGICAL PURPOSES; H. F. D. Schwahn, Belleville, Ill. App. filed March 24, 1909. For aluminum consisting of a annular furnace around a transformer having electrodes of carbon and refractory material.

962,533. TROLLEY SWITCH; F. L. Sessions, Columbus, Ohio. App. filed May 5, 1908. For crossing devices for trolley wires consisting of a plate carrying a wire with a threaded binding device and wire clamps.

962,536. LIGHTNING-ARRESTING APPARATUS; T. M. Stevens, Watertown, Mass. App. filed Jan. 3, 1910. For protecting oil tanks from lightning by means of spaced masts, a cable between, and a plurality of lightning arresters at intervals along the cable.

962,552. FIRE-ALARM; M. V. Crawford, Blaine, Wash. App. filed Feb. 4, 1909. Thermo fire alarm including a strand of horsehair for holding the elastic terminal away from the fixed terminal.

962,589. RECEPTACLE OR SOCKET FOR ELECTRIC LAMPS; W. S. Ryan, New York, N. Y. App. filed Aug. 21, 1909. Diagonally disposed holes for receiving a holding device and connecting and disconnecting the electrical conductors at will without severing them.

962,[illegible]. TELEPHONE SYSTEM; R. [illegible] Livingston, [illegible], N. Y. App. filed May 21, 1908. Party line telephone system with a signal connected to the main line which is broken at two points, a separate bridge, normally closing the brakes, and a telephone under [illegible] of a separate bridge.

962,655. APPARATUS FOR ELECTROPLATING PIPES, ETC.; D. H. Murphy, New Castle, Pa. App. filed June 1, 1908. A tank with plating solution in which a carrier supports the pipes and gives them a reciprocating rotary motion.

962,683. DYNAMO-ELECTRIC MACHINE; M. Walker, Manchester, England. App. filed June 5, 1905. Turbo-generator in which the slotted core carries bar conductors projecting beyond the end secured thereto by a plurality of connecting rings.

962,687. SIGNALING DEVICE; M. J. Wohl, New York, N. Y., and H. Hertzberg, Brooklyn, N. Y. App. filed March 16, 1908. Telephone receiver with diaphragm giving an audible signal by the vibration of the diaphragm through the expansion and contraction of a thermo conductor.

962,689. ELECTRICAL APPARATUS; C. Aalborg, Wilkinsburg, Pa. App. filed July 8, 1909. A tank or casing with a base having projecting teeth to co-operate with toothed sections or corrugated portions of a transformer placed within the tank so as to center it.

962,692. ARC-LAMP; T. J. Anderson, Houston, Tex. App. filed Nov. 30, 1908. Carbon holder with guiding tube supported by vertically [illegible] bar and clamp with a plate.

962,694. PRINTING TELEGRAPH RECEIVER; Marie Burry, N. Y. Executrix John Burry, Deceased. App. filed Aug. 27, 1908. Type carrier setting mechanism including an electromagnet and a printing mechanism with actuating magnet, with a third magnet for causing the first two to actuate their mechanisms in the order named.

962,709. TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed July 9, 1906. For telegraphing on lines such as submarine cables with great capacity, by means of an alphabet having heavy lines above an imaginary zero line, the space consisting of a heavy line below and above the zero line.

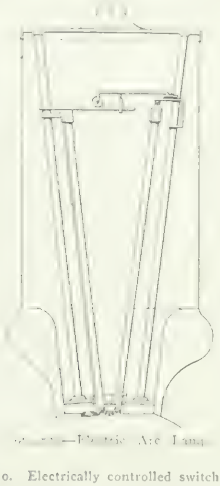
962,713. ELECTROPNEUMATICALLY OPERATED CONTROLLER; J. N. Mahoney, Wilkinsburg, Pa. App. filed Sept. 3, 1907. A series of independently operated switches with an elastic fluid interlocking means and electro-responsive means for initiating the action of the switches.

962,726. INSULATING BUSHING; C. H. Thordarson, Chicago, Ill. App. filed Jan. 29, 1910. An insulating bushing for electric wiring having a contractable spring screw threaded sleeve removably fitted thereto and arranged to be locked on the body when screwed into a screw threaded shell.

962,732. ELECTRIC ARC LAMP; H. Beck, Frankfort-on-the-Main, Germany. App. filed Nov. 15, 1906. For keeping a substantially uniform distance between the arcing ends of the electrode by means of a roller carried by one member with means carried by one of the members for preventing lateral displacement.

962,739. AUTOMATIC RAILWAY SWITCH; C. E. Brandfass, Wheel-

962,[illegible]—[illegible]



[illegible]—Electric Arc Lamp.

ing, W. Va. App. filed Jan. 20, 1910. Electrically controlled switch operated by the motorman. Details.

962,759. ELECTRIC MEASURING INSTRUMENT; R. H. Hickok, Atlanta, Ga. App. filed June 4, 1909. Wattmeter of the galvanometer type, having a fixed coil and a movable coil moving in opposition to the tension of a spring.

962,768. ELECTRIC SAD IRON; H. G. Levy, San Francisco, Cal. [illegible] removable handle [illegible] and an electrically heating unit in the body of the iron, the handle engaging contacts when applied to the body to make the circuit and [illegible]

962,[illegible]. FLEXIBLE CONDUIT; G. A. Lutz, Plainfield, N. J. App. filed June 6, 1908. Inner and outer strips suitably corrugated. the joint of one strip being out of line with the joint of the other strip.

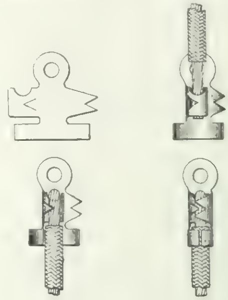
962,773. ELBOW FOR CONDUITS; G. A. Lutz, Plainfield, N. J. App. [illegible] One piece of [illegible] metal bent in channel form with open sides at right angles to each other.

962,774. ELBOW FOR CONDUITS; G. A. Lutz, Plainfield, N. J. App. filed Aug. 13, 1908. Open side members at an angle to each other, the open sides facing in different directions away from each other.

962,793. ELECTRIC HEATING UNIT; H. M. Smith, Pittsfield, Mass. App. filed March 29, 1909. The resistance conductor is enclosed in a metallic casing, the casing being bent around the unit without injury either to the unit or to the casing.

962,795. INCANDESCENT ELECTRIC LAMP; A. F. F. Stodd, Paterson, N. J. App. filed June 23, 1909. For throwing the light downwardly, the neck within the lamp having a plurality of annular enlargements carrying an incandescent filament.

962,800. TELEPHONE SYSTEM; J. B. Taylor, Schenectady, N. Y. App. filed May 3, 1909. Transmission circuit and switch, a transformer with one winding connected to the receiving and transmitting apparatus and a second winding connected through the switch to the



962,921—Terminal for Electric Conductors.

transmission circuit and a bell connected across the circuit between it and the switch.

962,816. ELECTRICAL RECEPTACLE AND ROSETTE; L. J. Castonguay, Bridgeport, Conn. App. filed Dec. 17, 1908. A body with terminals and having a flange for securing it to the mouth of the conduit.

962,817. TIME LIMIT PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; H. W. Cheney, Norwood, Ohio. App. filed May 27, 1907. A thermo device heated by abnormal currents, the volume of thermal body varying under rising temperature and controlling an electric circuit whose conditions as regards opening and closing is reversed when the volume of the body reaches a predetermined value.

962,823. DEVICE FOR SINGEING TEXTILE FABRICS; G. Gin, Paris, France. App. filed March 30, 1908. The fabric is moved in contact with metallic surfaces heated to red heat by electric current, the surfaces forming the secondary circuit of a static transformer.

962,835. MOTOR CONTROL; H. Heymann, Berlin, Germany. App. filed Feb. 26, 1910. A separately excited generator supplies current to a motor, with means for varying the field of the generator and an auxiliary speed regulator for the motor normally locked in full field position and means for releasing the regulator when the motor reaches a predetermined position.

962,847. SPRING JACK STRUCTURE; H. J. Kuesl, Chicago, Ill. App. filed Nov. 20, 1905. Unitary spring jack for holding together the contact strips and jack thimble. Details.

962,856. STARTING DEVICE FOR ELECTRIC MOTORS; D. H. Plank and A. C. Finney, Schenectady, N. Y. App. filed March 1, 1910. Alternating-current motor with supply circuit transformer, and a plurality of switches for connecting the motor to the supply circuit through the transformer and then directly to the supply circuit after a predetermined interval.

962,870. STORAGE BATTERY; C. F. Washburn, New London, Conn. App. filed Aug. 12, 1909. For lessening the weight by using a strip of lead forming hollow poles and an aluminum plate bent and extending into said poles.

962,884. THERMO-ELECTRIC FURNACE REGULATOR; J. H. Bobbitt, Harvard, Neb. App. filed Oct. 7, 1908. For controlling the damper and check by means of a motor mechanism controlled by a thermostat. Also gives an audible signal and has an index.

962,894. SHOE FOR PRESSING IRON STANDS; F. E. Emery, New York, N. Y. App. filed Dec. 3, 1908. A shoe with guards preventing lateral movement of the iron while on the stand, so as to avoid accidental engagement of the iron with the switch mechanism.

962,921. TERMINAL FOR ELECTRIC CONDUCTORS; E. Schneider, New York, N. Y. App. filed Feb. 2, 1909. For securing a terminal to a conductor without solder by means of a pair of wings, one of which has a tongue and a notch.

962,923. PENDANT ELECTRIC SWITCH; F. E. Seeley, Bridgeport, Conn. App. filed Sept. 4, 1908. An inverted insulating cup carrying a push-button switch actuating a ratchet wheel and contacts.

962,936. SWITCH LOCK; P. F. Augenbraun, Stamford, Conn. App. filed Sept. 9, 1909. For locking a switch arm against movement by means of a fixed keeper and a lock carried by the arm and having a bolt to enter the keeper.

962,958. SOLENOID OPERATING MECHANISM; E. M. Hewlett, Schenectady, N. Y. App. filed Nov. 17, 1906. For operating switches in which the power is furnished by solenoids and the switches are operated by motors, the switch member having an actuating toggle with a movable abutment and locking means for holding the abutment immovable to enable the toggle when straightened to close the switch.

962,960. SEMAPHORE MECHANISM; W. K. Howe, Rochester, N. Y. App. filed May 19, 1909. A round signal mast, a semaphore support clamped around it and vertically and angularly adjustable thereon.

962,966. ELECTRIC RAILROAD BONDING SYSTEM; G. H. Lindsey, Austen, W. Va. App. filed May 26, 1909. A spliced bar with grooves between the bolt openings and a U-shaped bond with its connecting member in the groove, the arms of the bond being threaded.

962,980. ELECTRICALLY HEATED FLATIRON; G. E. Stevens, Lynn, Mass. App. filed May 8, 1909. The handle, when grasped, throws the current on and when released cuts it off, by means of a spring-[illegible] connected to the handle and actuating the switch.

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NEW YORK, THURSDAY, JULY 14, 1910.

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ELECTRICAL GOODS IN DEMAND.

We were able to comment optimistically on the figures of electrical export for April, but might be forgiven for being quite enthusiastic about those for May, which have just come to hand. The upward trend is not only maintained, but is marked very decisively; and we can only hope and believe that the process will continue until the line is crossed of the previous "highest record" of three or four years ago. This achievement begins to look like a possibility. The export of heavy electrical machinery for May, 1910, was $684,938 as compared with $479,951, a noteworthy gain in a department where even as late as April there had been retrocession. But in electrical instruments and apparatus the increase is most cheering. In May, 1910, the amount of value was $1,025,549 as compared with $539,424 in 1909, a gain of practically 100 per cent. When the two items are put together, May, 1910, shows a total of $1,710,487 as compared with $1,019,375, a gain of about $700,000. Nor is this all. The figures of the 11 months for the two items, put us back near the high line of 1907-8. The gross showing is as follows: 1908 a total for 11 months of $14,168,207; for 1909 a total of $11,261,894; and for 1910 a total of $13,253,600. The reversal to "good form" is so apparent we might almost be justified in expecting the full 12-month period to see the gap closed between 1908 and 1910 figures; but perhaps that is hoping for too much. It would certainly seem that 1911 would see the figures advanced to new high standards, and meantime we can take new courage from such a showing as the above.

One significant fact seems to emerge from all these data, namely, that the prosperity or magnitude of our electrical export trade depends now upon a greater variety being given to it. Thus the export of electrical instruments in 1910 for the 11 months was $7,791,539 as compared with $6,332,485 in 1908—a gain of nearly $1,500,000; whereas the export of heavy goods is nearly $2,500,000 below what it was in 1908. Here is an evident shift; and one wonders a little bit what it means. The great gain in miscellaneous goods is, however, full of encouragement; and while we have no means of checking off the nature of the goods, it can only be inferred that there is a growing heterogeneity of product in demand abroad. When we say "abroad," perhaps a little qualification is needed, as when British North America, Mexico and Brazil are taken out, what is left is not remarkably large, as they represent over $4,500,000 out of the $7,791,539 and are steadily increasing their purchases. Europe is hardly worth noting, and even a good customer like Japan seems to have little money to spend on American apparatus, just at the moment. Should large orders begin to come in from Africa, Australasia and the Far East our electrical export trade would go a-booming.

RATES BASED ON AREA LIGHTED.

Within the past two months considerable interest has been awakened in the question of changing systems of central-station rates so as to make the consumer, and especially the residence consumer, pay higher fixed or readiness-to-serve charges than

formerly, and at the same time reduce the kw-hour charge. Such, in effect, was the general trend of the paper by Mr. S. E. Doane before the National Electric Light Association, upon which we have already commented. Last month Mr. W. H. Winslow, of Superior, Wis., outlined before the Wisconsin convention a proposed system of rates for residence lighting designed to protect the central-station company from loss on this class of business when the use of the tungsten lamp becomes general. It appears that coincidently Mr. S. Bingham Hood, of Toronto, worked out what he calls the R. C. M. service-rate system which, in many respects, is similar to Mr. Winslow's, and which formed the subject of a paper, abstracted elsewhere, which was presented at the Canadian convention last week. The new departure in these systems is that the consumer is required to pay a certain fixed charge per month for a given amount of area lighted, the area being determined according to certain prescribed rules. Under these systems the consumer pays a comparatively high fixed rate per month and gets his electrical energy at a very low cost as compared to present practice. The systems devised by Mr. Winslow and Mr. Hood have taken certain important features from two well-known and extensively used systems of residence rates. One of these is the Doherty readiness-to-serve system, based on the Wright maximum demand system, which charges a fixed readiness-to-serve rate based on connected load. The other is the Detroit system, the distinguishing feature of which is that it virtually figures connected load as proportional to the number of occupied rooms in a house. Under the Detroit system a large discount from the basic rate is given after the consumer has used a given number of kw-hours, which number is dependent on the number of occupied rooms without regard to the connected load. By combining these two systems we have the systems proposed by Messrs. Winslow and Hood, which make a fixed rate based on the area or the number of rooms counted. The object of using area or number of rooms as a base rather than connected load is, of course, to avoid charging the consumer for a lot of connected lamps very infrequently used and which are put in as electrical conveniences and do not really increase the consumer's maximum demand. The results of experiments with the systems outlined will be watched with much interest.

REPORT OF GERMAN COMMITTEE ON UNITS AND SYMBOLS.

The annual report of the Ausschuss für Einheiten und Formelgrossen of the Verband Deutscher Elektroteckniker has recently been published in the *Elektrotechnischer Zeitschrift*, and contains some particulars of international interest. There are two main propositions, namely, one on the value of thermo-mechanical equivalents, and the other on the units of conductance and conductivity. In regard to thermo-mechanical equivalents, the value of the gram-calorie at 15 deg. C. is recommended as 4.189 joules, or 427.2 kgm. This numerical value is likely to meet with very general recognition. It is pointed out, however, that certain recent researches have indicated the joule and watt to be short of their theoretical C.G.S. value by 0.03 per cent, or 1 part in 3300. This discrepancy, if it is confirmed, applies to the practical ampere-volt-ohm system as a whole, and is a physicist's question rather than an engineer's question. In the days of the B.A. ohm, this discrepancy was admitedly much greater. The second proposition is the substitution of the name Siemens for the mho, as the unit of conductance

The electrical unit names thus far officially adopted at international electrical congresses are nine in all—ohm, ampere, volt, watt, joule, coulomb, henry, gauss and maxwell. Two of these are German, two French, three English, one Italian and one American. It is desirable that both Siemens and Kelvin should be added to this list, in recognition of the great services of both these eminent workers in electricity. It is, however, a pity to apply these names where they are not needed when there exists a demand that is likely to increase for names of other electrical units now nameless. The Germans desire to use Siemens for what is already generally known as the mho, and to replace by an effort of memory what takes no effort at present. The British also desire to use Kelvin for what is already generally known as the kw-hour, and to replace something that does not require to be learned—something self-understood—by something to be learned with an effort. This may be magnificent, but it is not war, in applied science. On the other hand, we need names for units of electrostatic flux, flux-density, and other quantities in electrostatics that at present are neglected for want of christening. These quantities will probably insist upon being recognized and talked about in the future when new burdens on memory must be imposed.

A valuable contribution on symbology is appended by the committee in which a systematic development of decimal multiples and sub-multiples is propounded. In particular we applaud the openly expressed proposition that, as far as possible, symbols for units should be chosen with a view to subsequent international adoption. This contribution to symbology is worthy of careful study by electrical engineers in all countries. A useful distinction is offered between the symbol for a gram, or any of its multiples, as a unit mass, and as a unit gravitational force, by appending an asterisk in the latter significance. As a minor criticism it may be pointed out that two atmospheres are defined, namely, the technical atmosphere of 1 kg* per square centimeter and the so-called physical atmosphere of 76 cm mercury at 0 deg. C. We think the latter should be referred to as the standard barometric atmosphere. The standard physical atmosphere should be 1 megadyne per square centimeter, as already used internationally in many physical books and pamphlets, and as recommended by the International Bureau of Weights and Measures.

PORTABLE STANDARD OF LIGHT.

Despite all the work that has been done on primary and secondary standards of light, it is an unfortunate fact that nothing of the sort really suitable for a working standard for photometry in the field has yet been devised. Incandescent lamps are beautifully adapted to permanent work in the laboratory, yet when it comes to street photometry, which is daily assuming greater and greater commercial importance, they are exceedingly inconvenient. Most of the weight, which is considerable, of every portable photometer, is in the reference lamp and its equipment, battery, measuring instrument, rheostat and so forth. Yet so far these things are indispensable, since without a well-controlled standard lamp precision is quite out of the question. Indeed, without this, one is almost driven to photometers of the reading or extinction type, so uncertain and subject to personal equation that their use would be a practical joke were it less frequently employed to deceive. No matter whether an incandescent lamp is used by regulating the voltage, the current or the watts, it still requires too much attention, if

reasonable precision be desired, by reason of the very great variation of light with any one of these quantities—a variation of the order of 5 per cent at the lamp and 1 per cent at the instrument. If there were only such a thing as a battery of sensibly constant voltage and moderate weight, one would take some chances with small variations, for in street work the highest precision is not required; but unless one carried about a storage battery of most inconvenient weight and handled it as gently as a case of eggs, the chance of getting down to a constancy of 1 per cent or so is small. In the original Weber photometer-progenitor of most of the portable type, a benzine lamp was employed, and it may be an open question yet whether, when carefully used, it was not nearly as reliable as the later members of its tribe.

We are by no means disposed to deny that very good photometric work can be and is being done in the field with portable instruments using incandescent standards, but it is at the cost of a very considerable amount of trouble and time. A relatively simple instrument conveniently worked by a single man is greatly to be desired, even if it should lack the highest degree of precision. In testing street lamps, for example, it is highly desirable to work through a considerable territory in an evening without attracting the attention of a large and inquisitive crowd by the profuse display of instruments. The present tendency toward depending much upon field measurements in electric lighting contracts gives this matter large importance. We have more than once showed the practical futility of such determinations as a measure of price, but they are of value in showing whether a contract is or is not being in general lived up to. A reference lamp trustworthy for an evening's work within 2 or 3 per cent, or even 4 or 5 per cent, would be a boon to all who undertake field photometry. It need not even be constant within these limits if its variations are fairly regular and determinable. The choice seems to lie between using a battery giving nearly constant voltage or small decrement, and some form of flame illuminant possessing similar qualities of steadiness. Automatic voltage regulators may be left out of the question as involving such an increase of weight and complication as is sought to be avoided. Incandescent lamp schemes are handicapped by the extreme probability that the shaking up of the battery during transportation will cause irregular variations of voltage, and against the lamps is to be charged the trouble due to draughts and to temperature variations. It is, of course, easy to meet the requirements if weight, bulk and number of operators be left out of consideration, but this is not the thing at issue. It is not precision to ½ per cent, with a half-hundred weight of apparatus and three or four operators that is needed, so much as quick readings to 4 or 5 per cent with an equipment that one man can carry and use. And within these limitations the apparatus should be a measuring device and not a mere adjunct to guessing not always disinterested.

DISRUPTIVE STRENGTH WITH TRANSIENT VOLTAGES.

Several valuable papers on subjects related to dielectric strength were read at the recent Jefferson convention of the American Institute of Electrical Engineers. Dielectric strength is becoming of increasing concern to the electrical engineer, in view of the steadily rising tensions employed in energy transmission. It is necessary to employ ample dielectric strength in order that the electric stresses may be safely sustained, while, on the other hand, an excessive amount of dielectric strength is necessarily very expensive. In the study of dielectric strengths great complexity is revealed. Take, for example, the atmospheric air, the most commonly used dielectric. The strength of air depends upon the distribution of the electric stress, the duration of its application, the chemical state of the air, its temperature and hydrostatic pressure. At very high pressures, or many atmospheres, the dielectric strength is relatively high, and at very low pressures it is relatively low, until a certain critical low pressure, or approach to vacuum, is reached, below which the dielectric strength rises again rapidly.

Very little is yet known concerning the effect of time application in electric stress upon dielectric strengths. It has been recognized that a certain small amount of time is necessary to attain the full sparking distance corresponding to a given tension. A paper on this subject was presented by Messrs. J. L. R. Hayden and C. P. Steinmetz. The method they employed consisted in applying a direct-current pressure to the primary terminals of a step-up transformer, through an adjustable non-inductive resistance, and computing, from the constants of the primary circuit, the amount and the equivalent time application of the corresponding wave of high tension in the secondary circuit. It appears from the experimental results given in the paper that when the time of applying the tension to opposed needlepoints in air is a fraction of a millisecond, the striking distance may be only a small percentage of the full striking distance for that tension when sustained. The lowest percentage of full striking distance was 3.3 per cent, for the case of 105 kilovolts with 0.14 millisecond. This percentage, increased to 97 per cent, at the other extreme, with 15 kilovolts and 15.8 milliseconds. It is manifestly difficult to define the precise electric conditions at the needlepoints when the impulse only lasts a fraction of a millisecond. The whole mass of surrounding air is yielding electrically, in condenser fashion, and the voltage actually developed during this time may be markedly less than that generated within the transformer, owing to this elastic displacement. A very evident result of the research was that air disrupts much more speedily than oil.

The existing theory concerning the rupture of a gas under electric stress is that at or above a certain critical electric intensity, in volts per centimeter, the gas molecules become electrically decomposed into positive and negative constituents; or becomes ionized. The ions, or electrified particles, are then, like ordinary electrified pith balls, subject to attractive and repulsive forces, in obedience to which they generate velocities considerably in excess of those corresponding to air molecules at the environing temperature, according to the kinetic gas theory. The ionic projectiles, flying like cannon balls, impact upon neighboring undecomposed molecules, and smash them into decomposition. Consequently, ionization spreads rapidly, by contagion, through the mass of air, once the critical disruptive intensity has been reached. A certain time must be allowed, however, for these kinetic actions to be effected, so that a very brief electric intensity can be withstood by air without rupture, far in excess of what would be sufficient to disrupt it if continued for a single second of time. Moreover, the larger and slower the molecules, as in a liquid like oil, the longer the process of ionization, and we may readily conceive of a gaseous dielectric disrupting more quickly than a liquid dielectric.

Ohio Electric Light Convention.

The following program has been prepared for the sixteenth annual convention of the Ohio Electric Light Association, to be held at Hotel Breakers, Cedar Point, July 26 to 28. Every effort will be made to bring forth discussion of the papers presented.

"Low-Pressure Turbines and Their Operation," by Mr. W. C. Anderson, Canton; "Turbine Troubles," by Mr. Frank Brosius, Columbus; "Motors for Single-Phase Circuits," by Prof. F. C. Caldwell, Columbus; "Introduction of Electric Vehicles in Ohio," by Mr. J. T. Kermode, Cleveland; "Getting New Business in Cities of 15,000 or Less," by Mr. L. A. Petit, Jr., Middletown; "Experience with Tungsten Lamps for Street Lighting," by Messrs. Claude Smith, C. C. Custer and Frank Jackley; "Tungsten Lamps vs. Central-Station Earnings," by Mr. E. L. Booth; "Central-Station Facts and Factors," by Mr. J. R. Cravath, Chicago; "Methods of Maintaining Electric Meter Accuracy," by Mr. John Gilmartin, Toledo; "Methods to Be Followed in Purchasing Station Apparatus," by Mr. R. J. Feathers.

There will be entertainments as follows: Musicale on Tuesday afternoon for the ladies and the association dinner in the evening. Launch ride for the ladies on Wednesday, banquet and ball in the evening. Musicale for the ladies on Thursday afternoon, and association theater party in the evening.

Rapid Examination-and-Report Work.

In no department of effort connected with the electric service industry has there been more marked advancement during the last few years than in the work of making engineering examinations and reports of properties where the aid of financiers is sought to make extensions, or where the property is offered for sale or a consolidation is proposed. A recent instance of work of this kind, involving a $40,000,000 deal, in which an Eastern syndicate was interested, constitutes a record, possibly, for this class of work, and is of much interest. The syndicate in question obtained a 30-day option on the property involved, and H. M. Byllesby & Company, of Chicago, were instructed to examine the entire plant and make a comprehensive report. These properties consist of no less than 28 street-railway, gas and electric light companies and a holding company, there being 29 distinct organizations in all.

The option expired on June 25 and owing to some delays in getting the work started, it was June 1 before two experts and a stenographer from the engineer firm left Chicago for the scene of operations. On June 3 Mr. Harold Almert, the head of the Byllesby & Company's department of examinations and reports, followed. An assistant stenographer was employed at the scene of operations, and the elaborate report which was compiled was the work of these three engineers and two stenographers. The Chicago members of the party came back with the report completed and bound on June 21. This report consists of 286 typewritten pages of the ordinary letter-paper size, accompanied by 28 photographs and four maps and diagrams. It was completed four days before the expiration of the option, giving the bankers who were interested in the proposed deal time to reach their decision. To make such a very thorough report as was made on these 29 distinct companies in the space of 21 days was an achievement worthy of note.

The report was most thoroughly and carefully made. It included, first, an examination of the books of each of the 29 companies. The examiners drew off a statement of earnings, showing receipts and disbursements for each year from 1906, including the first five months of 1910. A trial balance was then struck for each company showing the assets and liabilities. In addition an analysis of the profit-and-loss account of each company was made, going back to the time that each company was taken over by the holding company. Furthermore, there was a very complete analysis of the construction account of each company, reviewing all the vouchers to determine whether they had been distributed to the proper account and to show whether any of the items should be charged to operation or maintenance rather than to construction. It may be mentioned that a number of such items were found.

With this information the examiners then made up a sheet of statistics for each company, giving a comparative statement of operation, and going into details of cost of generation and distribution, general expense, etc. These figures were given very carefully for each department of the business, as street railway, electric light and gas. In the electric light department, for instance, the figures showed, for each company, the total kw-hours delivered at the switchboard, the average cost per kilowatt generated, details of cost of generation, details of cost of distribution, and an analysis of the general expense, all reduced to a kw-hour basis. Similar figures were given in the case of each company for the gas and street railway departments. Then the figures for all the companies were summarized, and a similar sheet was made out for the entire system.

The next step in the report was the making of replacement values for each company separately, and also a summary for the whole system. Then estimates for depreciation were made for each property in detail and summarized for the whole system by departments. In figuring depreciation renewals were relied upon to keep the various properties to a 100 per cent value. However, no matter how faithfully the parts of a piece of apparatus or a system are renewed as they wear out, there will come a time ultimately when the whole will be used up or so antiquated as to have survived its usefulness. Therefore, with the most careful system of renewals there must still be a further allowance for depreciation, and in the case of the system under examination this final figure for depreciation was figured out to amount to 2.58 per cent. This, it should be explained, was after all ordinary replacements chargeable to operation had been made, and, in addition, after an allowance of 3.42 per cent had been made for maintenance. These figures were arrived at by going into all the constituent parts of each property and fixing the life of each by itself.

After determining what the physical property of the system was worth, the examiners made a survey of the territory served, going back 20 years, studying statistics of population, the growth of the territory, etc. Next, a forecast of the probable growth of population for the next five years was made. This was done to estimate the requirements necessary to serve the territory in 1915 and in intervening years, presupposing proper, up-to-date management. In doing this the examiners made a complete forecast of the financial requirements of the system for each year, estimating the gross income, the operating expenses and the net income. Then, the next step was the estimating of what proportion of the increased capital requirements would be needed each year, and what the equivalent would be in bonds at the probable price at which the bonds could be marketed. This, in turn, gave the increased amount of bond interest to be met. With these figures available a new valuation of the property was figured, and then the depreciation was calculated on this new valuation. This enabled the experts to arrive at a total of the interest and sinking fund required for each year in the future period under consideration—that is, up to and including 1915. Deducting this total from the net income gave a statement showing what the probable surplus or loss would be for each year of the future period. These, of course, were very important figures to the prospective investors.

Furthermore, the experts made a careful study of the scope of the business, the nature of the territory served, the character of population, and the class of industries; also actual or possible competition, as from steam railroads in the railway end of the business, and the like. It also was considered whether the territory was largely dependent on one industry, so that it would be unduly affected in case of a period of business depression. A study of the postal receipts also was made to indicate the character of the territory served. Then a careful

examination was made of the franchises of the various companies to determine exactly their life and whether they contained any burdensome restrictions; also how they would fit into a possible reorganization. From studies of this character final conclusions were drawn as to the general management of the properties and their future prospects.

The report included a drawing of every piece of real estate owned by any of the companies. At the bottom of the page containing each drawing of this character was a photograph of any building or portion of plant equipment on the particular piece of real estate shown by the drawing above.

The whole task of preparing this large and elaborate report in such a short time was executed something after the manner of a rush newspaper job. All the necessary equipment was moved on the ground from the Chicago office, and while the experts were preparing one sheet of copy the stenographers were typewriting and making five copies of the previous sheet. Every night the stenographers caught up with the work of the experts for that day. The last task undertaken by the makers of the report was the drawing of conclusions from the mass of material previously prepared. Then the sheets of the report were ready for assembling, and a table of contents was made. Finally the 286 typewritten pages were bound in leather covers with photographs, maps and drawings and the report was complete.

The Los Angeles Rate Situation.

Following the action of the city administration of Los Angeles in adopting an ordinance decreasing the basic rate for electricity from 9 cents a kw-hour to 7 cents, the question was voted on at a special election held in that city on June 30. Between the date of the Council's action and the election there was an exciting campaign in which the proposed reduction was discussed from many angles. The companies strenuously opposed the change, asserting that they could not make a fair return to their stockholders at the proposed price. However, the Southern California Edison Company announced by circular that if the "7-cent ordinance" was defeated an 8-cent basic rate for electric service, with a monthly minimum of 75 cents instead of $1, would be put into effect; furthermore, that contemplated additions and extensions would be made as originally planned. When the ordinance was first passed the company announced that all extensions and improvements would necessarily be abandoned if the reduced rate was made mandatory.

At the election of June 30 the vote stood 18,488 for the 7-cent ordinance and 8961 against it. The electric-service companies were naturally disappointed, although they hardly expected, of course, that the users of electricity would vote money out of their own pockets by rejecting the ordinance. They had hoped, however, that perhaps the majority of citizens might be influenced by their arguments and accept the 8-cent compromise.

It is altogether probable that litigation will follow before the companies submit to the new rate. The Southern California Edison Company, by Mr. R. H. Ballard, its secretary, made this announcement after the election:

"We are agreeably surprised by the very large vote cast against the unfair lighting rate ordinance, and we firmly believe that had we been allowed a reasonable time to continue the campaign of education and publicity, which was only started a short time ago, the ordinance would have been defeated.

"As the rates provided by the ordinance will not afford a reasonable return on the capital actually invested, we are forced to take such steps to protect ourselves as may be properly taken under the law.

"We greatly appreciate the splendid assistance rendered us by our employees and friends, and a portion of the press, and regret that their efforts were unsuccessful."

Mr. A. C. Balch, general manager of the Pacific Light & Power Company, is credited with the statement that his company will take the matter into the courts in an endeavor to protect what the company considers its stockholders' rights. Very likely similar action will be taken by the Los Angeles Gas & Electric Company.

Much of the electricity used in southern California is obtained by the development of water-power, and the position of the Los Angeles authorities seems to be that the companies are charging too high a price to the small consumers. The city officials appear to be very much exercised because the electric-service companies sell electrical energy to railway corporations for ¾ cent per kw-hour and are skeptical when the companies say they can make more selling at wholesale to the railway companies at ¾ cent than by delivering the current to small, short-hour consumers at 9 cents. The companies contend that they did not have sufficient time to make a campaign of education for the purpose of making this point clear to the lay mind.

Some of the newspapers are active in favoring a municipal electric plant for Los Angeles.

An interesting feature of the Los Angeles campaign was a dinner tendered to the officers of the Southern California Edison Company a few days before the election by about 300 employees of the company. The sentiments that animated the occasion may be judged by the following list of the toasts of the evening: "A Soulless Corporation," by Mr. S. M. Kennedy; "One Good Turn Deserves Another," by Mr. W. E. Boden; "A Happy Family," by Mr. S. Darnell; "A Square Deal," by Mr. J. H. Peiper; "Squad Ready," by Mr. C. S. Walton; "Publican and Pharisee," by Mr. P. Ducker; "How I Am Going to Vote and Why," by Mr. W. A. Raymaker; "From the Ground Up," by Mr. W. L. Frost; "Liberty," by Mr. H. D. Thaxter; "Between the Devil and the Deep, Deep Sea," by Mr. R. H. Ballard; "Lest We Forget," by Mr. Frank Balfour; "Play Ball," by Mr. Charley Sherrart; "The First Law of Nature," by Mr. E. H. Mulligan.

The following communication on the Los Angeles situation, dated July 2, has been received from Mr. Le Roy Allison, of that city:

"While to a great degree of local interest, the question of lighting rates, which has engaged the attention of Los Angeles lately, is one which may arise in any city. The determination on the part of the average consumer is to obtain current at the lowest rate possible, whether it be consistent with the territory in which he resides or otherwise; for the former, embodied in its single sense, he cannot be reproved—this is human nature; but, coupled with the latter, the citizen should contemplate the effect of what borders on the confiscation of property. To take away a fair rate of income on an investment in a public commodity may insure the saving of a few cents to the small consumer, but entails the transaction of business by a service company at a profit so trifling as to forbid seeking for new business where expenditure for construction is necessary.

"The rates for electric service, both for lighting and power, are always subjects for controversy. Even though a rate is just, not only from the utility company's point of view, but from the discreet consumer's conclusions drawn from his own premises, the critical resident is always in evidence. Basic rates for service founded upon the investment, depreciation and cost of maintenance have been established. In some cases they are under the control of State Commissions and in others are regulated by municipal authority; a perusal of the appended table will prove an assertion that in the majority of cases they are illustrative of equitable treatment and are not delusions of visionary minds or corrupt power.

"A Public Utilities Commission at Los Angeles recommended to the City Council a reduction in service rates of 2 cents per kw-hour; acting upon such suggestion this latter body drafted an ordinance on May 28 enforcing a rate of 7 cents in place of the former 9-cent rate, with a minimum of $1 as heretofore. This made a direct cut of 22 per cent. The investigation of the Board of Public Utilities was expedited to an extent that left no doubt as to its inaccuracy. The appraisal of the capital invested, the details and expense of operation were passed over lightly. Its recommendation was based on a comparison with the rates for supplying railways at ¾ cent, and the current rate at Pasadena, namely, 4 cents per kw-hour. The

latter is the price at which the Edison Company is forced to sell that city in competition with a municipal plant, to derive such revenue from its property as it can; it is in no wise a business proposition; it is a question of salvage. Furnishing railways 10,000 times as much energy at ¾ cent at the switchboard is far more profitable than supplying the average residence consumer a few hours at 9 cents, where the investment in distributing systems and meters, the cost of care and maintenance, billing and collecting is vast.

"Where it may be claimed that public-utility companies rule a city, it is also true that they assist greatly in building one and adding to its prosperity. The peculiar conditions surrounding the growth of a Western city, such as Los Angeles, where new tracts of land are being continually improved and opened to public sale, make it imperative, in this enlightened period, that public commodities—railroads, gas, electricity—be in the vicinity. In extensions of this character the lighting companies have invested millions of money obtained from the Eastern market upon their securities. If proper returns are not forthcoming to the Eastern investor and his capital is placed in jeopardy, he will seek other fields.

LIGHTING RATES EFFECTIVE IN 58 AMERICAN CITIES.

	Population	Base Rate
Atlanta, Ga.	[illegible]	[illegible] W.P.
Albuquerque, N. M.	10,000	[illegible]
Baltimore, Md.	650,000	[illegible] C.F.
Birmingham, Ala...	60,000	10.4
Boise City, Idaho...	20,000	15
Boston, Mass......	630,000	11
Brooklyn, N. Y.....	1,600,000	12
Buffalo, N. Y......	41[illegible]	.09* W.P.
Burlington, Vt.....	22,000	10
Butte, Mont.......	65,000	11.8 W.P.
Chicago, Ill......	2,600,000	12 C.F.
Cheyenne, Wyo..	20,000	12
Cincinnati, Ohio.	460,000	10*
Cleveland, Ohio..	550,000	12.5
Denver, Col.........	230,000	8 W.P., C.F.
Des Moines, Iowa....	100,000	12*
Detroit, Mich........	450,000	12.6
Fargo, N. D.........	15,000	10
Grand Rapids, Mich..	110,000	8** W.P.
Guthrie, Okla.......	23,000	15
Hartford, Conn......	100,000	11*
Houston, Tex......	100,000	13*
Indianapolis, Ind.	250,000	10 C.F.
Kansas City, Mo...	375,000	10 C.F.
Little Rock, Ark..	60,000	13.5
Los Angeles, Cal...	350,000	.07 C.F.
Louisville, Ky....	290,000	8.4
Madison, Wis.......	26,000	14.5
Manchester, N. H....	70,000	12*
Memphis, Tenn....	200,000	10
Milwaukee, Wis......	375,000	12*
Minneapolis, Minn...	310,000	10 W.P.
Natchez, Miss.....	18,000	13.5
Newark, N. J........	350,000	10
New Orleans, La.....	375,000	17.1
New York, N. Y.	3,000,000	10
Oakland, Cal.........	200,000	9 W.P.
Omaha, Neb......	150,000	14*
Philadelphia, Pa....	1,500,000	13.5 C.F.
Pittsburg, Pa.......	600,000	10 C.F.
Portland, Me...	65,000	9
Portland, Ore...	275,000	15* W.P.
Providence, R. I.	215,000	12
Raleigh, N. C...	18,000	13.5
Richmond, Va.	116,000	10 W.P.
Rochester, N. Y...	200,000	8* W.P.
St. Louis, Mo.....	750,000	12
St. Paul, Minn....	235,000	13.5
Sacramento, Cal..	55,000	[illegible] W.P.
San Antonio, Tex.	125,000	14.5
San Francisco, Cal.	500,000	.09 W.P.
Salt Lake, Utah...	100,000	10 W.P.
Spokane, Wash....	85,000	10 W.P., C.F.
Seattle, Wash.....	200,000	.09** W.P.
Sioux Falls, S. D...	15,000	15
Topeka, Kan......	50,000	.09 C.F.
Washington, D. C..	350,000	[illegible]
Wheeling, W. Va.	50,000	13.5 C.F.

W.P., Water Power; C.F., Cheap Fuel; *, 5% discount allowed for cash; **, 10% added to bills where not paid promptly.
The average rate for above (omitting Los Angeles) is 11.4c per kw. hr.

"This is the situation in Los Angeles, and the case was submitted to public vote on June 30, with the populace in favor of the low rate, as was to be expected; the leading industrial institutions, however, voted for a compromise of 8 cents per kw-hour, which was offered by the companies affected in their efforts to continue extensions and services, which interpretate prosperity to the city.

"The three companies interested are the Southern California Edison Company, the Pacific Light & Power Company and the Los Angeles Gas & Electric Company. With their offer for compromise rejected they turn to the only alternative—the courts—where the just rate will be argued along technical lines. Meantime, further extensions of systems come to a standstill; solicitors, linemen, clerks are taken from the payroll, realty interests are jeopardized and prosperity, which is dependent, will be stunted.

Decision Against Exclusive Telephone Service Contract.

The New York State Court of Appeals in an opinion handed down June 14, and reported in the *New York Law Journal* of June 25, considers the case of a contract for a term of nine years between a telephone company and the proprietor of a hotel, under which the former installed at a considerable expense a private exchange in the hotel subject to the provision that the lines of no other company should be permitted in the house or connections made therewith. The hotel in question is the Yates Hotel, of Syracuse, and the telephone installation was made by the Central New York Telephone & Telegraph Company, at an expense of $2,700. The court held that such a contract, although only in partial restraint of trade, involved to that extent an injury to the public interests and is therefore void. On the other hand, the contract being divisible with respect to its valid and invalid parts, the company may lawfully insist that its system be retained in the hotel, without preventing other telephone systems being introduced therein.

The court held that the public franchises which telephone corporations enjoy are granted to promote the transmission of vocal messages between the largest numbers of persons who can be brought into communication with one another under satisfactory economic conditions. This purpose is frustrated by any agreement which operates to prevent the rendition of telephone service where otherwise it could be obtained. A contract between a telephone corporation and one of its subscribers whereby the latter excludes all other telephone service from his premises deprives all the patrons of that other telephone service from telephonic communication with such subscriber and all the occupants of his premises. Though the number affected by one such exclusive contract may not be large, if exclusion may be exacted from one customer it may be exacted from all, and so a corporation first in the field might establish a monopoly to the detriment of a large proportion of the community and their deprivation of telephonic intercommunication.

The court also held that the invalid part of the contract could be separated from the valid part, and, therefore, while the plaintiff was not entitled to enjoin the defendant from introducing into the Yates Hotel other telephone systems than those which the plaintiff had furnished under his contract; on the other hand, inasmuch as the defendants admitted that they proposed to discontinue and abandon the use of the private hotel exchange with which the plaintiff had equipped the Yates Hotel, the plaintiff was entitled to prevent such discontinuance and abandonment. In other words, the plaintiff was entitled to a part of the relief which it claimed, but not all. It could lawfully insist that the defendants should retain and continue to employ its telephone exchange and telephone system, but it could not lawfully prevent the defendants from admitting other telephone systems or placing other telephone exchanges in their premises. Under these circumstances the only remaining inquiry is what relief can be afforded upon the present appeal to the defendants, who are under a legal obligation to comply with every portion of their contract with the plaintiff except that portion which relates to the exclusion of other telephones.

Municipal Lighting Competition in Pasadena.

Pasadena, Cal., has a municipal electric lighting plant, and an active controversy is in progress between the city authorities and the Southern California Edison Company in relation to electric service and lighting rates. The rate has been cut in Pasadena to 5 cents per kw-hour, and the competition between the central-station company and the municipality appears to be keen. At a recent mass meeting in that city the Pasadena Municipal Lighting League was organized to assure the permanency and success of the municipal plant. It is said that this organization is the only one of its kind in existence. This body declares that the municipal plant has been the direct means of securing to the people of Pasadena fair service at reasonable rates and affirms that the permanency of the municipal plant is a matter of the greatest importance, not only to the people financially as individual users of electricity, but also as a matter of civic progress and integrity.

There has been considerable discussion of the possibility of the Edison Company selling electricity to the municipal plant in Pasadena at wholesale rates. Mayor Earley of that city says that before the last $150,000 of bonds was voted to enlarge the municipal plant he endeavored to secure electricity from the Edison Company at wholesale rates. The company would not sell, however, unless the municipal authorities would agree not to go into the commercial lighting business, and this stipulation was refused. Mr. C. W. Koiner, manager of the Pasadena municipal plant, was recently reported as declaring that the city is connecting up from 15 to 20 new consumers daily. He is thus quoted: "If there is any advance at all on the part of the Edison Company to sell the city wholesale electrical energy, it will no doubt be received candidly by the city, and if it is possible profitably to enter into such an agreement with the Edison Company the city will undoubtedly do so. The matter will be considered on a purely business basis, however." On July 1 the municipal plant reported over 3000 customers, while the number aimed at by Sept. 1 is 4000.

Fence Wire as High-Tension Transmission Line.

A curious combination of circumstances proved that even a lowly barbed-wire fence may serve efficiently as a 25,000-volt transmission line in the experience of a Michigan hydroelectric company some time ago. The men in charge of a substation from which the street railway and lighting of several considerable towns beyond receive energy, had been given no intimation that the 25,000-volt, three-phase line between them and the generating station was in trouble until some farmers working in a field several miles away telephoned in and reported that one of their number had received a severe shock from a barbed-wire fence on his place, near the high-tension line. The attendants were incredulous that this fence could become charged without some indication at the station, as they reasoned that had a line wire broken and fallen on the fence service would certainly have been interrupted. Word of the trouble came in just before noon, and a gang was dispatched to investigate the cause of the electrified fence.

Coming near the charged section they found that the 110-ft. span of one of the lower wires of the 25,000-volt, three-phase circuit had broken at a point about one-third the distance from one pole and had fallen so that it hung against the top wire of the fence. The other end of the span had also fallen across the fence further along, its loose end lying in the grass. The result, of course, was a through circuit completed by the fence wire.

The transmission line at this time was carrying about 100 amp per phase, at 25,000 volts, but the loose contacts gave no evidence of distress except for a few faint sparks from time to time. As the transmission was needed for delivering the full load of two towns whose service it was not desirable to interrupt, and as the fence wire which acted as part of the high-tension circuit was fortunately dead-ended at two posts about 1/4 mile apart, it was decided to patrol this section and warn persons away until midnight, when the circuit could be cut out and the break repaired. This was accordingly done, and the barbed-wire fence carried its share of the evening peak without any indication of the unusual jumper's existence ever coming to the consumer's attention. From the leakage down the posts while in this condition all of the wires of the fence became dangerously charged for the quarter-mile distance, as an inquisitive neighbor's dog discovered while investigating the unusual excitement on his master's "east forty."

Extensions for Salt Lake City.

Work has been begun on a large steam reserve power plant for the Utah Light & Railway Company, of Salt Lake City. The station, which, with its equipment, will cost possibly $600,000, will be placed on the Jordan River near the present steam plant and transformer station of the company. This plant is under construction for the purpose of insuring a continuous supply of electricity for lighting and motor service and for street-railway operation in Salt Lake City and Ogden. The company has sufficient generating capacity in its water-power plants to handle its regular demands for electrical energy, and the new steam plant will be held in reserve to carry a portion of the load at times of unusual peak or to be used in case of an emergency.

The first unit of this reserve steam plant will consist of a turbo-generator capable of delivering continuously 13,500 electrical horse-power. This unit is said to be the largest piece of electrical generating apparatus between the Mississippi River and the Pacific Coast. Six boiler units of sufficient capacity to provide the necessary steam for this generator will be installed in a boiler-room separated from the turbine-room of the station by a fire wall. Elaborate coal and ash-handling equipment is provided, as is also a full condensing equipment.

The contract for the construction of the plant has been let to Westinghouse, Church, Kerr & Company, of New York. The resident engineer for the contractor is Mr. H. A. Brinkerhoff, while Mr. O. A. Honnold, electrical engineer of the Utah Light & Railway Company, will supervise the erection of the plant for his company.

Schenectady Sectional Meeting of Empire State Gas and Electric Association.

The third of the sectional meetings of the Empire State Gas and Electric Association for the present year was held in Schenectady on Friday, July 8. Through the courtesy of Mr. M. W. Offutt, general manager of the Mohawk Gas Company and the Schenectady Illuminating Company, and of some of the officers of the General Electric Company, the meeting was held at the Mohawk Golf Club. The session started at 10 o'clock and adjourned at 1 o'clock. The delegates, about 60 in number, were then entertained at luncheon in the Golf Club, following which they visited the works of the General Electric Company and the gas plant of the Mohawk Gas Company.

At the session in the morning, Mr. C. D. Haskins, of the General Electric Company, presented a short paper on the use of electricity in gas works, which provoked some little discussion, as there seemed to be a slight difference of opinion in regard to the advantages and disadvantages. Among other things it was pointed out that extreme care should be used in the wiring in case electric motors or electric lamps were used in gas works. The question of 25-cycle lighting was next taken up, and Mr. E. W. Allen, of the General Electric Company, discussed the subject informally, after which numerous questions were asked him and the discussion became general.

In preparation for the meeting, the members had been asked to suggest subjects which could be taken up informally, but it was found impossible to take up many of the questions suggested. There were four matters in regard to the use of electric fans and the discussion on this subject was quite general. It was pointed out that there were so many wrinkles in the

use of electric fans that it would be advisable if somebody would prepare a pamphlet which could be distributed to the users of fans which would suggest to them not only the proper method of use for ventilation, but also many other ways in which the fans could be employed during other seasons of the year.

Canadian Electrical Association Convention.

One of the most notable gatherings in the history of the Canadian Electrical Association was the twentieth annual convention held at the Royal Muskoka Hotel, Muskoka Lakes, Ontario, from July 6 to 8. Delegates to the number of about 200 gathered, not only from Canadian points, but from the United States also. There were present representatives from the two important American sister societies, the National Electric Light Association and the American Institute of Electrical Engineers. From the first-mentioned came President W. W. Freeman and Secretary T. C. Martin; representing the latter was ex-President Chas. F. Scott. After an absence of several years Mr. Frederic Nicholls, of Toronto, an ex-president of the National Electric Light Association, was present and took an active interest and part in the proceedings, while Mr. Leonard Andrews, of London, England, was also in attendance. A consideration of the question of affiliation with the National Electric Light Association was an important feature of the convention, and while no definite action was taken towards bringing this matter to a climax, it is not unlikely that it will claim a share of the attention of the Canadian Association's members at an early date.

The business sessions during the meeting were well attended, and while this was, perhaps, to a great extent due to the absence of many of the distractions which usually claim the delegate's attention in urban centers, yet to the papers read this must be attributed in no small measure. The papers were exceptionally well prepared and reflected great credit on the authors and also upon the papers committee, composed of Messrs. A. L. Mudge and R. G. Black, of Toronto.

The social and entertainment features of the convention were most enjoyable. Situated 100 ft. above the sea-level, the "Royal Muskoka" air was most exhilarating. Bathing, boating, fishing, tennis and golfing gave the visitors a wide assortment of amusements, and the splendid attendance of the lady members lent additional charm to the occasion. During the convention a series of festivities were carried out, including the annual banquet, a canoeing regatta, golf tournament, fishing competition and a base ball match between the manufacturers and central station operators. Perfect weather conditions prevailed throughout the entire meeting.

ELECTION OF OFFICERS.

The executive section of the convention elected officers as follows: President, Mr. P. S. Coate, manager of the Chatham Gas Company, Chatham, Ont.; first vice-president, Mr. E. A. Evans, Quebec Railway, Light & Power Company; second vice-president, Mr. W. L. Adams, Ontario Power Company, Niagara Falls, Ontario; secretary-treasurer, Mr. T. S. Young, Toronto, re-elected. Management committee: Messrs, J. J. Wright, R. G. Black, R. F. Pack, L. V. Webber, A. L. Mudge, D. H. McDougal, Toronto; W. N. Ryerson, A. A. Dion, Ottawa, F. A. Chisholm, St. Johns, Que.; W. L. Bird, Fort William.

Mr. P. S. Coate, the newly elected president of the association, has been long identified with electrical interests in Canada. He is a man of particularly affable disposition and notice of his new honor is received with little surprise by his friends.

Born in Chatham, Ontario, he has been constantly engaged with the Chatham Gas Company for 26 years; rising to the position of accountant and from that to secretary of the company, until to-day he is the general manager. Besides being a large operating gas company, his Chatham plant also extensively generates and distributes electrical energy.

ANNUAL BANQUET.

The association's annual banquet held on Thursday evening was a decided success, and never, perhaps, has an assemblage of electrical engineers gathered under more happy circumstances. Mr. Frederic Nicholls replied to the toast of "Canada, Our Country," in a stirring speech; in his belief Canada is destined to become one of the greatest nations of the earth. Mr. C. A. Littlefield replied on behalf of the "Central Stations," reviewing in an excellent manner the progress made since the first central energy was supplied. "Sister Societies" was responded to by Mr. W. W. Freeman, president of the National Electric Light Association; Mr. T. C. Martin, secretary of the same association, and Mr. Charles F. Scott, ex-president American Institute of Electrical Engineers. Their remarks were enthusiastically received. All of the speakers dealt with the question of amalgamation of the Canadian Association with the larger American body. With union would come strength was the keynote running throughout their remarks. Mr. Martin spoke in flattering terms of Mr. Nicholl's work in the past in the interests of the National Electric Light Association when at its head. The toast to the ladies was replied to by Mr. W. A. Bucke, Toronto, and Mr. A. A. Dion, Ottawa. President Coate made an admirable chairman and master of ceremonies.

ASSOCIATION AFFAIRS.

On the first day the attendance was exceptionally good when the first vice-president, Mr. P. S. Coate, called the convention to order. President W. N. Ryerson, of the Great Northern

Pres. P. S. Coate.

Power Company, Duluth, Minn., sent a message expressing his regrets at his inability to be present. An interesting paper prepared by Mr. Ryerson was read later, taking the place of the usual presidential address.

After the minutes of the association had been read and approved, Secretary-Treasurer T. S. Young made his annual report. It was extensive and showed that the Canadian Electrical Association has been steadily gaining ground during the past year. The financial standing of the association is also excellent.

The chairman next read President Ryerson's paper, "Some Practical Considerations Concerning Contracts for Lighting and Motor Service." Considerable discussion followed. Mr. R. F. Pach, Toronto, considered that the enforcement of a penalty for non-payment of accounts when due, as urged by Mr. Ryerson, would antagonize the customer and advocated rather the adoption of a discount system for payments made in advance. He also took exception to the insertion of a "mutual liability" clause in motor service contracts as being of too dangerous a character.

THE COMMERCIAL AGENT AND THE COMMUNITY.

Mr. C. A. Littlefield, of the New York Edison Company, gave a brief description of the commercial department of his

company. He stated that during the year 1909 348 buildings were erected in New York City requiring electric service, and of this number 96.7 per cent adopted the central-station service. During 1909 40 isolated plants were shut down and central-station service substituted therefor. The company delivers energy to a total of 233,400 hp in motors. The commercial department work is carried on by eight bureaus known as the wholesale and new-business, private plant, motor service, sign, automobile, heating, follow-up and engineering. The company maintains five district offices, and a contract and inspection department by which all relations with the public are conducted. It has no wiring department, but co-operates with wiring contractors.

Referring briefly to the subject of rates, the author expressed the opinion that a simple, easily understood rate system devoid of "minimum," "stand-by" or "readiness-to-serve" charges is one that strongly appeals to the public. Gild the charge as one wishes with descriptive phrases, the customer is convinced when he gets a bill of this nature that he is paying for something he has not received, and no amount of argument can dispel the dissatisfaction that the bill has created. The theory upon which rates are based, sustained by precedent and a wealth of eminent authority, amply justifies the use of "stand-by" charges, but from the viewpoint of the great buying public there are most convincing arguments in opposition to these requirements in a rate, thereby placing the theory and application of rates at variance.

In response to the wishes of the association of merchants and property owners along Fifth Avenue the company has agreed not to canvass for signs along this thoroughfare and to discourage their use in that locality. As a means of attracting night crowds to the avenue the company made a trial display of window lighting on several blocks, furnishing at its own expense both the lighting equipment and the electrical energy. By this means the company has gained the good-will of the merchants and property owners.

In the discussion Mr. Littlefield was called on to answer several questions regarding the plans outlined therein. Mr. A. A. Dion expressed appreciation of the paper. He took exception to a statement made regarding "stand-by" or "readiness-to-serve" charges. He expressed the belief that the introduction of tungsten and other high-efficiency lamps renders necessary the establishment of such charges by all central stations. A general discussion followed and it was decided to give Mr. Littlefield's paper consideration when discussing rates.

THE THREE-ELEMENT RATE SYSTEM.

Mr. S. Bingham Hood, of the Toronto Electric Light Company, was the author of a paper entitled "The R. C. M. Electric Service Rate System." The system described is based on three elements of the rate, namely, the "readiness-to-serve" charge, the "consumer" charge and the "meter" charge. The first charge includes the items necessary to maintain and operate the entire generating equipment without load or actual delivery of energy to the consumer. The second charge includes all those expenses which vary directly with the number of consumers on the system. The third charge varies directly with the kw-hour output; in general, it would be divided into two parts covering the actual energy supplied and the lamp renewals, respectively.

The advantages claimed for the three-element rate system are as follows: (1) Unprofitable short-hour business is discouraged. (2) A fair and uniform profit is assured from all consumers. (3) The small consumer is given the same advantage as the large one, having equal load conditions. (4) Each consumer is given the lowest possible rate which his load conditions will warrant, irrespective of the size of his maximum peak demand. (5) Any benefit to be derived from improvements in efficiency of lighting units is shared between the consumer and the company, thereby enabling the company to adopt and push the introduction of these improved units without suffering a destructive decrease in revenue.

In the absence of Mr. Hood this paper was read by Mr. S. E. Doane, of the National Electric Lamp Association. This paper, on account of the principle of rates advocated by the author, was regarded as essentially the most important of the convention; and a spirited and energetic discussion was largely participated in by the members present. Mr. R. G. Black, general superintendent of the Toronto Electric Light Company, spoke at length. Different contracts and schedules are necessary, he said, if the central station desires to reach all classes of customers. He pointed out both advantages and disadvantages in the new system as outlined. Mr. R. F. Pack, of Toronto, feared that the advent of such a system would cause agitation. This speaker suggested that both private and municipal companies would find it advantageous to submit rates to a public-service commission for adjustment. These commissions could also assist in educating the public to an understanding of scientific lighting rates.

Mr. A. T. Holbrook, of New York, spoke to this question discussing the system proposed in city application to residential lighting. He stated that no commission would allow any lighting company to enforce the rate stipulated by Mr. Hood on the basis of carbon-lamp installation where tungsten lamps were really installed without giving the customer the benefit in connected load. On the other hand it is unfair to the company for the customer to add cooking and heating utensils without increasing the demand rates. He considered the measuring of floor area as a basis of charging quite unfair,

Mr. C. A. Littlefield, of New York, also contributed to the discussion and an interesting criticism from Mr. Peck, of Rochester, was read by the secretary.

Mr. Leonard Andrews, of London, England, criticized the paper's stand in regard to "readiness-to-serve" on the basis of floor space. He said that the light required per square foot varies with condition of room. The idea is not new, but has been tried in England. The consideration of the small customer is very necessary; he is a most valuable adjunct to the central station's prosperity. Mr. C. A. Littlefield concurred with this last remark.

RESIDENTIAL LIGHTING.

The profitable cultivation of the residential lighting field formed the subject of a paper by Mr. A. T. Holbrook, of New York, in which was given a description of the residence lighting campaign inaugurated by the Hartford Electric Light Company, which obtained 781 contracts for new installations between Sept. 1, 1909, and Feb. 1, 1910. This business was secured by means of a rate for energy based on a straight kilowatt-controlled demand charge. Careful checking in Hartford has shown that the minimum return on a kw-hour basis is 6 cents. Mr. Holbrook advocated a rate for residence lighting based on a fixed charge of not less than $120 per year per kilowatt of actual station demand. The demand should be defined by means of an excess indicator installed for the purpose. The indicator serves notice on the customer when he has exceeded his demand, and thus safeguards the lighting company against any unfair treatment on the part of the customer. This method of charging appeals especially to that class of customers whose bills average about $1.50 per month.

Under the plan here proposed the solicitor will experience no difficulty in closing contracts with owners or lessees of unwired houses. The author remarked that the lighting field can be profitably worked by co-operation with the wiring contractor and the public journals. The central station should make a rate under which results are possible. The wiring contractor should establish fixed and definite charges which can be understood by the lighting solicitor. The public journals should publish notices of general interest on lighting subjects.

In discussing Mr. Holbrook's paper, Mr. R. G. Black said that his company has for many years realized that it is not reaching the poorer class of possible customers because it did not provide a special rate that would appeal to them. It should be possible to increase largely the central-station revenue along such lines as those mentioned by Mr. Holbrook.

Mr. A. A. Dion, of Ottawa, and others contributed to the

discussion. Mr. C. A. Littlefield took issue with a statement that less than ten per cent of residences in central station centers are using electric light; he agreed, however, that a large proportion remain still unreached by the lighting companies.

Mr. I. H. Wright, of North Bay, Ont., asked the opinion of the meeting regarding the standing or rating of the small customer. It was the unanimous opinion that representing, as he generally does, the mechanic, his account is of the best nature.

The committee on central station statistics, of which Mr. W. A. Bucke was chairman, next reported. The committee was handicapped by the lack of co-operation from central station managers, who generally paid little attention to their requests for information. The committee's work during the year was commended and it will be prosecuted still further. Mr. Leonard Andrews said that information collected over a period of fifteen years in his country is now considered invaluable.

UNIFORM ACCOUNTING SYSTEM.

A committee, of which the chairman was Mr. R. F. Pack, of the Toronto Electric Light Company, presented a report endorsing the classification of accounts adopted by the National Electric Light Association. The committee said that since the Railroad and Municipal Board of Ontario has power to superintend the system of bookkeeping and keeping of accounts of all public utilities operated by municipal corporations, and, since many municipalities in Ontario will shortly be distributing energy supplied by the Hydroelectric Commission, it recommends that the Canadian Electrical Association petition the Ontario Railway and Municipal Board to adopt, and to order, a classification of accounts, for municipalities, similar to that adopted by the association.

Considerable interest was manifested in the methods outlined for adoption by central station managers.

PROTECTION OF SYSTEMS.

A paper entitled "Protection of Service in Large Electric Systems," prepared by Mr. A. S. Loizeaux, of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., was read by Mr. A. A. Dion. Emphasis was laid upon the reference in this paper to the public's appreciation of the assurance of continuity of service. In the discussion following, Mr. A. L. Mudge, of Toronto, reviewed the paper, expressing his appreciation. He said that it applies perhaps more to the larger and more complicated systems than those generally existent in Canada. Mr. Leonard Andrews discussed relays and their successful application in England.

CALCULATION OF THE REGULATION OF TRANSMISSION LINES.

A method for calculating the voltage regulation of a transmission line involving the use of certain tables of constants was described in a paper by Mr. Paul M. Lincoln, of the Westinghouse Electric & Manufacturing Company. The method ignores the effects of leakage and capacity, but takes into account the resistance and reactance of the line and the current and power-factor of the load. In applying the method the line resistance "drop" is determined by multiplying the load current by the resistance. Tables are given for showing the ratio of the reactance to the resistance at 25 cycles and 60 cycles for various sizes of wires at different spacings, and by means of this ratio the total drop is found in a third table giving a factor by which the ohmic drop must be multiplied according to the power-factor of the load and the ratio of the line reactance to the line resistance.

Mr. Lincoln not being present, Mr. C. F. Scott presented the paper and gave practical illustrations of the ease with which Mr. Lincoln's tables can be applied, by those not conversant with higher mathematics, to ascertain the size of wire required for different circuits. Mr. Scott's remarks were well received.

[illegible] AFFILIATION.

The committee appointed to investigate the question of affiliation with the National Electric Light Association reported. They were not prepared to make any decisive recommendation. Mr. Frederic Nicholls opposed the whole scheme of affiliation if they wished to remain a Canadian organization. He believed that with union would come a loss of identity and a rapid disintegration. No action was taken in the matter.

Mr. A. A. Dion, Ottawa Electric Company, as chairman of the committee on grounding of secondaries, reported. His committee was not yet prepared to make definite statements. He expressed his personal belief in grounding circuits up to the 150-volt point; beyond that, however, it should be left to the discretion of the individual as determined by local conditions. In this he disagreed with the recommendation of Dr. Steinmetz to the National Electric Light Association, who advised the grounding of all secondaries irrespective of the voltage carried.

INCREASING THE STATION LOAD.

Mr. S. G. Redway, of the Toronto Electric Light Company, presented a paper outlining certain methods for increasing the station load. The author remarked that the "take-it-or-leave-it" policy is highly disadvantageous, and the keynote of success is satisfied customers. He claimed that the central-station company, through its commercial department, should endeavor to boom the town, interest the municipal authorities to better illuminate the streets, parks and public buildings; work in harmony with the wiring and fixture contractors; try to induce electric sign makers to open factories in the territory, endeavor to get motor manufacturers to come into the cities and towns, and call upon the leading manufacturers with a view to substituting steam and gas-engine plants with up-to-date electric drive. The company should interview prospective incoming manufacturers and take an active interest in any exhibitions or fairs that may be held with the end in view of handling as much of the lighting and small motor-service business as possible.

The author described the various duties which should be performed by the members of a well-organized sales department of a progressive central-station company.

In a lively discussion following the presentation of this paper by its author, all of the speakers concurred with the suggested methods of increasing the station load.

ELECTRIC HEATING.

In his paper, "Electric Heating and Cooking Appliances," Mr. Harold S. Brown, of the Canadian General Electric Company, treated modern electrical cooking and heating appliances and gave the results of a series of experiments in which a comparison had been made with similar machines operated by gas. The economy and efficiency of the former apparatus over the others was demonstrated most fully.

WATT-HOUR METERS.

The committee on the installation, care and testing of meters, of which Mr. L. V. Webber, of the Toronto Electric Light Company, was chairman, submitted a report in which much stress was laid on the necessity for maintaining the accuracy of watt-hour meters. The opinion was expressed that it is imperative that all meters be tested systematically and regularly. Induction meters in residential districts should be tested at intervals of from 12 to 18 months; in business districts they should be tested at six-month or 12-month intervals. Commutator-type watt-hour meters in residential districts should be tested at intervals of from 6 to 12 months; in business districts the meters should be tested at intervals of from 3 to 12 months; in 500-volt industrial service the meters should be tested from three to six times per year.

Concerning the reading of meters, it was suggested that each meter be read on the same day of each month. When this plan is not followed the bills vary from month to month and the customers are displeased thereby.

ILLUMINATION AND THE CENTRAL STATION.

In a paper entitled "The Attitude of the Central-Station Manager Towards Illuminating Engineering," Mr. Roscoe Scott, of the National Electric Lamp Association, outlined some plans for the manager who wishes to introduce illuminating engineering methods into his lighting work. The author dis-

cussed the desired intensity of illumination, the diffusion, distribution and quality of light, the economical production of light and the artistic features of the lighting installation. He called attention to the value of the Illuminating Engineering Society and its *Transactions* to the central-station manager. He said that the central-station manager who takes all possible steps to have the illumination layouts on his circuits correctly designed from the standpoints of intensity, distribution, diffusion, quality, economy and artistic effect, will not need a very large complaint department. Users of other illuminants than electricity will be quick to appreciate the service which their neighbors are receiving and orders for new connections will multiply.

STREET LIGHTING WITH TUNGSTEN LAMPS.

Mr. C. E. Stephens, of the Westinghouse Electric & Manufacturing Company, read a paper entitled "The Tungsten Lamp as a Factor in Modern Street Lighting," containing a description of a constant-current regulating transformer especially designed for use with series tungsten lamps. The regulator differs from the constant-current transformer used with arc lamps in being much more sensitive and suitable for use with a circuit of constant resistance rather than one of rapidly varying resistance.

The regulating transformer is of the repulsion-coil type, there being two movable coils suspended by steel cables in such a manner that they just balance each other when the normal current exists in the secondary coil. It is said that the regulator will maintain the lamp current within 1 per cent of the normal for any load.

The paper by Mr. Stephens was read by Mr. C. F. Scott, who also contributed some useful information on the subject.

Maryland Commission News.

Messrs. Cumberland, Dugan & Son, subscribers of the Maryland Telephone Company, have preferred the charge that the Maryland Company is owned by the Chesapeake & Potomac Telephone Company, and that the latter company is operating the Maryland Company in such a manner as to compel the subscribers of the latter to become subscribers of its company. The letter containing these assertions was submitted to Mr. Charles H. Weber, division superintendent of the Chesapeake & Potomac Telephone Company. In response to various inquiries, Mr. Weber said that his company did not operate the Maryland Company, but it did guarantee the bonds of the Maryland Telephone Company and that the two companies were under separate management. The complaint was also made to the commission that the Maryland Telephone Company had not issued a directory since 1909, but this was denied at the office of the Chesapeake Company. The Public Service Commission referred this complaint to the Chesapeake & Potomac Telephone Company with a request that it be adjusted within 10 days. Messrs. Cumberland, Dugan & Son addressed their complaint to the Governor under the impression that he was a member of the Public Utilities Commission. They say that their object in making the complaint is to save the life of the Maryland Telephone Company.

Wisconsin Commission News.

The Wisconsin Rate Commission has authorized the Berlin Public Service Company, a reorganized company, to issue stock and bonds as follows:

1. Seven hundred and fifty shares of common stock of the par value of $100 per share. 2. Seventy thousand dollars par value of bonds, of denominations of $100 and $500 each. These bonds are to be issued under and pursuant to a mortgage or trust deed executed and delivered by the applicant to the Fidelity Trust Company as trustee, and are to bear interest at the rate of 5 per cent per annum.

Five shares of the capital stock are to be sold for money only, the same being a reissue of the $500 par value of stock, previously issued without the consent of the commission, which was sold for the purpose of paying the expenses of incorporation. The balance of the stock is to be issued and exchanged for an outstanding bonded indebtedness against the property purchased by the applicant company. The bonds are to be issued and exchanged to take up, pay and compromise all accounts and debts against the property and against O. C. Irwin, receiver of the Berlin Lighting, Heating & Power Company, and are to be used in connection with the bills and accounts receivable purchased with the property.

The applicant company was incorporated on May 19, 1910, for the purpose of acquiring the equity of the Berlin Lighting, Heating & Power Company, and of the receiver of said company, in and to the plant and all the property of the said company. The value of the physical property, as determined by the commission, is $127,500.

Part 3 of the third annual report of the commission, which contains the statistics of the steam and electric railroads for the year ending June 30, 1909, is ready for distribution. Because of the disparity in the size of the electric railway systems in the state it was found advisable to group them into three classes, as follows: Class A, companies whose gross earnings exceed $500,000 per year; Class B, companies whose gross earnings are between $80,000 and $500,000 per year; Class C, companies whose gross earnings are less than $80,000 per year.

A condensed summary of the income accounts for that part of the traffic lying wholly in the state is given below. There were 6 Class A, 9 Class B, and 10 Class C companies reporting.

The following average values were obtained from the statistics as reported by the various electric railway companies in the state:

Average cost of coal per ton at the plant	$[illegible]
Average lbs. of coal consumed per switchboard, kw-hrs.	6.14
With a maximum of 11.[illegible] and a minimum of [illegible] (Milwaukee)	
Average watts per lb. of coal consumed	179.72
Average pound-Fahrenheit units per lb. of coal	12,606
Average operating expense per mile of single track, exclusive of taxes and depreciation	$[illegible]
Total number of passengers carried (in State)	142,761,892

Of the above total, 77.7 per cent were classed as revenue passengers, 21.8 per cent as transfer passengers, and 0.5 per cent as free passengers.

The report shows a total of 43 persons killed in the state by electric railways, and a total of 852 injured. Thirty-one of those killed were struck by the cars, while 33.9 per cent of the total injured received the injury in alighting from the cars, 21 per cent in getting on the cars and 13.5 per cent by collisions between cars.

New York Commission News.

The Interborough Rapid Transit Company, last week, submitted an offer to the city of New York for the operation and equipment of new subways and extensions to the existing lines, to be constructed on the city's credit at a cost of about $70,000,000. The proposal was sent to Mayor Gaynor instead of to the Public Service Commission, and it was by the Mayor forwarded to the commission. There is very little difference between the present proposal and those heretofore made by the Interborough company, with the exception that it is proposed to use Lexington Avenue instead of Madison Avenue for a north and south line. It is proposed to construct a four-track line from Times Square under Seventh Avenue and West Broadway to Liberty Street with a two-track extension to the Battery and a two-track branch from the intersection of Liberty Street and West Broadway under Liberty Street and under the East River to Pineapple Street, Brooklyn, from there to a junction with the existing Brooklyn subway on Fulton Street and a four-track extension from the terminus of the present subway at Atlantic Avenue under Atlantic Avenue and Eastern Parkway as far as Nostrand Avenue. It is proposed also to construct a four-track line from the present subway at about Thirty-fifth Street and Park Avenue under private property to Lexington Avenue, under Lexington Avenue and under the Harlem River to 149th Street in the Bronx, thence a two-track extension connecting with the present West Farms branch of the subway system and another two-track extension, principally an elevated

structure running up River and Jerome Avenues to 194th Street. The Interborough suggests that the operating lease of this proposed new line, if built, be made at least coterminous with the unexpired portion of the present subway contract. The chairman of the Public Service Commission has expressed his disapproval of the proposed plan, and declares that he does not think it is as advantageous to the city as former offers made by the Interborough Company. The plan also contains as a portion of it, as have all the other proposals of the Interborough, the right to third-track the elevated structures. The proposal to use Lexington Avenue, according to the commission's view, would effectually prevent the construction of the comprehensive tri-borough system, plans for which have already been drawn, and would practically give the Interborough Company a monopoly in rapid transit in Manhattan and the Bronx.

The commission finally completed its hearings last week upon the Third Avenue reorganization plan. These hearings have been going on for six months. Vast quantities of statistics and figures have been filed with the commission, prepared by experts employed both by the commission and the bondholders reorganization committee. The opinions of these experts as to the present physical value of the property and its replacement cost vary widely. It is not believed that a decision in this case will be reached for some weeks, and it is probable that the refinancing plan offered by the bondholders' committee will be scaled down.

It was announced last week by a member of the Public Service Commission that during the present month advertisements would probable be published asking for bids for the construction of the Broadway-Lexington Avenue subway system. The engineers are now preparing the final details of these contracts and as soon as this work is completed they will be sent to the corporation counsel for approval.

The commission has formally approved the terms of the franchise recently granted by the Board of Estimate and Apportionment to the Union Railway Company for the construction of a trolley extension from the intersection of Sedgwick Avenue and Fordham Road in the Bronx across the Harlem River Bridge at 207th Street to connect with the Third Avenue Railroad line at Emerson Street and Broadway.

The commission has ordered an inquiry to be made into the service provided and the equipment employed by the New York & Queens County Railway Company. The line complained of runs from the terminus of the Fulton Street Elevated line in Queens County to Freeport and other points in Nassau County. Charges of inefficient equipment and insufficient accommodation have been made by the patrons of the line.

Fire Commissioner Rhinelander Waldo, of New York, has sent a report to the committee of the Board of Estimate and Apportionment which is investigating the condition of the fire-alarm service in the city, recommending the abolition of the private fire-alarm companies. Mr. Waldo urges that these private alarm concerns be taken over by the city and expresses the opinion that the city would get enough rentals from them to run the entire fire-alarm telegraph system. He also says that one-half of the alarms sent in by some of these companies are unnecessary. The majority of these private concerns operate in lower Manhattan and in the dry goods district, but there are also about 1500 subscribers in Brooklyn. Mr. Waldo gives the list of companies and subscribers as follows: Automatic Fire-Alarm Company, 1233 subscribers; Consolidated Fire-Alarm Company, 346; Manhattan Fire-Alarm Company, 3322; National District Telegraph Company, 241, and Fire-Alarm Electric Signal Company, 519. These companies install alarm boxes in buildings and then run a wire connecting with the nearest city fire department line. Their fees are from $50 to $60 per year for the first box installed, with additional boxes in the same establishment at reduced cost. According to Mr. Waldo, the companies admit that they derive a revenue of about $212,000 a year in rentals, but the commissioner thinks their total receipts are in the neighborhood of $500,000.

The Public Service Commission, Second District, has received an application from the Livonia Light & Heat Company for permission and approval of the commencement of construction and the exercise of rights and privileges under a franchise granted to it by the Town Board and Highway Commissioners of the towns of Livonia, Lima and Avon, all located in Livingston County. Also, a petition from the Lima-Honeoye Electric Light & Railroad Company and the Lima-Honeoye Light Company for consent to transfer and lease property and franchises of the Lima-Honeoye Electric Light & Railroad Company to the Lima-Honeoye Light Company; and a petition from the Lima-Honeoye Light Company for an order authorizing the issue of $5,000 par value of its capital stock for the improvement and maintenance of the electrical plant, distributing system and railroad leased to it by the Lima-Honeoye Electric Light & Railroad Company.

During the present week the Public Service Commission, Second District, will give hearings on the complaint of residents of the villages of White Plains, Portchester, Eastchester and Irvington and the Public Welfare Association of the villages of Tarrytown and North Tarrytown against the Westchester Lighting Company relative to quality and price of gas and electricity, and on the application of the Suffolk Gas & Electric Light Company for authority to acquire all of the outstanding capital stock of the East Islip Electric Company and to merge said company with itself.

Massachusetts Commission News.

The Massachusetts Railroad Commission gave an important hearing on July 6 upon the petition of the Boston & Eastern Electric Railroad Company for a certificate of public convenience and necessity in connection with its plans for building a high-speed interurban railroad between Post Office Square, Boston, and the North Shore cities of Lynn and Salem, with branches to Beverly and Danvers. At the recent session of the Legislature the company was granted the right to build a tunnel under Boston Harbor and a subway in Boston to a terminus and by a route to be fixed by the Railroad and Transit Commissions. Mr. Charles Baxter requested on the ground of the board's previous intimation that there is a necessity for the construction of the line, combined with the recent legislative enactment regarding tunnel construction, that the commission issue the certificate of exigency to the railroad company. This request was vigorously opposed by Mr. Frederic E. Snow, counsel for the Boston Elevated Railway Company; Mr. Bentley W. Warren, counsel for the Boston & Northern Street Railway Company, and Mr. William H. Coolidge, counsel for the Boston & Maine Railroad. Company. Other objections were voiced by Mr. Woodward Hudson, counsel for the New York Central & Hudson River Railroad Company, whose property in East Boston is crossed by the proposed road. President Melvin O. Adams, of the Boston, Revere Beach & Lynn Railroad, was also present in opposition. Mr. Snow said that the Boston Elevated Railway Company desires to handle the incoming traffic from the suburban districts of Boston, distributing it by means of its extensive elevated, subway and tunnel systems. He suggested that the transportation conditions of 1908, when the board first found that the Boston & Eastern road would be desirable, are not to-day in evidence. Since that time the Boston Elevated has rearranged its large terminal at Sullivan Square and has secured a location for its elevated extension to Malden and Everett. The Boston Elevated opposes any separate transportation lines into Boston on the ground of its present unified service and capabilities of expansion, together with its heavy investments in subways and tunnels, which must be supported by large suburban patronage no less than by city traffic.

For the Boston & Northern Street Railway Company, Mr. Warren emphasized the fact that the board had rejected the first plan of the petitioners to enter the city by Sullivan Square. He stated that the question of necessity is still open and that the conditions in the transportation field at Boston are different from those which obtained when the board gave its tentative approval to the project in 1908, and argued that the question of exigency must be determined afresh. He felt that if the road is built it will tend to delay electrification of the steam railroads on the north of Boston, and contended that the extent

of control to be exercised in the future by the Boston Elevated Railway Company in the handling of electric transportation in eastern Massachusetts is bound up with this problem of new lines. Concluding, Mr. Warren said that the Boston & Maine Railroad could not in fairness be asked to electrify its lines if the Boston & Eastern should be permitted to build an electric high-speed road in its territory.

Chairman Hall, of the commission, said that he did not see, as a practical matter, that the Boston & Eastern law of 1910 in any way requires the question of necessity to be redetermined. Speaking for himself, he implied that the necessity of the enterprise has now been shown and that the procedure henceforth should be merely routine.

Mr. William H. Coolidge, for the Boston & Maine Railroad, stated that all the existing transportation companies stand ready to electrify or otherwise improve their services, as the commission and the Legislature may require. If the Boston & Maine Railroad is required to electrify its suburban lines, the public will get exactly the same kind of a railroad as the Boston & Eastern proposes to build, including a tunnel between the two union stations at Boston, which will facilitate distribution of traffic in the city. If the Boston & Maine should be electrified and the Boston & Eastern built, there would be two electrified roads in the same territory, with duplication of facilities and investment. Mr. Coolidge cited the recent address by Mr. George Westinghouse on steam-railroad electrification and contended that this is bound to come in the near future. Since the finding of the board in 1908 the Boston & Maine and New York, New Haven & Hartford railroads have become substantially a unified transportation system for New England and the proper handling of the Boston traffic is one of the important problems before the management. The proposed inter-station tunnel will cost $15,000,000, and if this cannot be used to handle the suburban traffic electrically, and particularly the traffic originating outside the immediate metropolitan district in which the Boston Elevated operates, there will be no incentive to build it. Mr. Coolidge argued that the times have changed greatly since the first finding of the board, and that the existing companies are the ones to do new work if such is necessary.

At a continued hearing, on July 11, arguments in opposition to the project were presented by F. E. Snow, counsel for the Boston Elevated Railway Company. Mr. Snow stated that the Boston Elevated Railway Company is firmly opposed to the entrance of any competitive system of transportation into the heart of Boston, and that the company would not for a moment have considered building new rapid transit elevated and subway lines and paying charges upon them if it did not feel assured that the policy of the commission is to permit no rival agency to establish a line and central terminus in the center of distribution of the Boston territory. All the company's agreements and financing have been carried forward on the basis of a single unified electric transportation system in Boston, and a line like that of the Boston & Eastern would injure existing subway and tunnel lines, since it is competitive. If the certificate is to be issued, however, the Boston Elevated Railway Company should be the one to handle the traffic inside the city, and two plans by which this could be done were outlined by Mr. Snow. For the Boston & Eastern Company, Counsel C. S. Baxter urged that the evidence has conclusively indicated that the East Boston tunnel cannot be used by Boston Elevated surface cars and Boston & Eastern interurban trains together. Corporation Counsel T. A. Babson, of the city of Boston, urged the use of the East Boston tunnel by the new road on the ground that the present rental received from the Boston Elevated Railway Company is insufficient to meet the annual charges on the tunnel, which in large part have to be met in the form of a 1-cent toll charge for each passenger carried through the tube or riding in it. Woodward Hudson, counsel, and J. H. Heustis, general manager of the Boston and Albany division of the New York Central lines, opposed the construction of the new road in East Boston. The board continued the hearing until July 20, to permit further technical discussion to be held

The Massachusetts Railroad Commission has issued an order granting a certificate of public convenience and necessity to the Boston & Western Electric Railroad Company, which desires to construct a high-speed interurban line between the cities of Waltham and Marlboro, with a branch line to the town of Maynard. The road will also pass through Weston, Wayland and Sudbury. The estimated cost of the line, which would be a double-track road, is $1,552,000, the larger items being: Grading, $565,070; bridges, culverts and trestles, $100,254; rails, $161,760; electric-power transmission, $124,595; power station and car house, $116,110. The promoters of the line contemplate establishing through service between Boston and Worcester by this route, including the use of the facilities to be offered by the Cambridge subway of the Boston Elevated Railway Company, and the Marlboro-Worcester connections of the Worcester Consolidated Street Railway Company. One of the most vigorous opponents of the proposed line was the Boston & Worcester Street Railway Company, which maintained that it is giving a true interurban service between the cities named in its charter and that any competitive route established would be injurious. On account of the large proportion of highway running which would be required between Boston and Worcester by the Boston & Western and its connections it is probable that the through traffic of the former will not suffer materially in case the new line is built as planned, since the running time via the Boston & Western between Boston and Worcester could only with much difficulty be made equal to that already in force on the existing system. If the Boston & Western line is constructed under the authority now granted that road new rapid transit facilities will be accorded to a large area in north-central Massachusetts.

The Massachusetts Gas & Electric Light Commission has issued an order approving the issue by the Cambridge Electric Light Company of 500 shares of new capital stock of the par value of $100 each. The board approves the issue at a price of $200 per share, as fixed by the directors of the company. The proceeds of the issue are to be applied to an enlargement of the company's generating station in Cambridge, including the purchase of a low-pressure turbine, the relocation of the switchboard, installation of a condensing plant suitable to low-pressure service, and the inauguration of special power service by underground lines to a number of large manufacturing plants in the Cambridgeport district.

CURRENT NEWS AND NOTES.

Incandescent Lamps for the Government.—The United States Treasury Department has authorized the expenditure of about $170,000 for incandescent electric lamps for the next 12 months. The prices established for the lamps are as follows, being based on 110-volt, 16-cp units: Carbon filament, 12.92 cents; graphitized filament, 14.86 cents; tantalum filament, 29.70 cents; tungsten filament, 40.68 cents. Prof. E. B. Rosa, of the Bureau of Standards, who conducted experiments for the department, reported the average life of the lamps as follows: Carbon, 400 hours; graphitized, 600 hours; tungsten and tantalum, each 800 hours. He found that the average carbon lamp consumed 3.3 watts and the tungsten 1.3 watt per candle.

Coal Land Withdrawals.—On July 7 President Taft announced that under the recent act of Congress providing for the Executive validation of withdrawals of public lands he had affirmed the withdrawal of 35,073,164 acres of coal land in Washington, Arizona, Utah, Colorado, North and South Dakota. Of this total 20,688,469 acres, comprising the withdrawals in North and South Dakota, had not previously been authorized and are new. The remainder, 14,374,695 acres, were withdrawn under the previous administration, but were considered of doubtful title. The act of President Taft merely makes the previous withdrawals legal and will prevent any question being raised in the future. Of the lands already withdrawn by President Taft the water power sites cover a total of 1,454,499 acres. The phosphate lands withdrawn total 2,594,113 acres and the petroleum lands 4,447,119 acres.

Tungsten in Washington.—Reports from Spokane state that valuable deposits of tungsten manganese ore containing 70 per cent of tungsten have been found in the Blue Grouse, six miles from Loon Lake.

Italian Hydroelectric Installation.—The Italian Electrochemical Company, of Rome, is planning to erect a 27,000-hp generating station near Torre dei Passeri (Teramo) in order to utilize two falls on the Pescara. The equipment will consist of 9000-hp Riva turbines driving Brown-Boveri generators.

A Good Day's Work in Conduit Laying.—According to the *Edison Round Table,* the largest amount of conduit construction ever done by the Commonwealth Edison Company in a single day was on June 1, 1910, when 22,005 duct-feet of conduit was installed. The number of men employed by the conduit department of the company on this day was 447.

Convention of Municipal Electricians.—The fifteenth annual convention of the International Association of Municipal Electricians will be held at Rochester Sept. 6 to 9, at which the following papers will be presented: *The Wireless Telephone and Telegraph; Lightning Protection; Mercury-Arc and Other Rectifiers; Telephone in the Fire Department; Underground Work; Marine Wireless Telegraph System.* Mr. Frank P. Foster, Corning, N. Y., is secretary of the association.

Proposed Telephone Regulation in Denver.—A resolution which has for its object the reduction of telephone rates in Denver has been introduced in the Board of Supervisors of that city. It requests the city attorney to submit not later than Aug. 1 an opinion setting forth the rights of the city in the premises. If the resolution prevails the city attorney will also inquire into the claim of the Colorado Telephone Company for a perpetual franchise. The resolution was referred to the committee on streets and alleys.

Swedish Waterpower Development.—According to United States Consul-General Winslow, of Stockholm, the power that can be developed from the waterfalls of Sweden is about 7,500,000 kw. Three-fourths of the larger falls are in Norrland. The State at present owns 277 falls. The largest fall now managed by the State is Trollhättan, the water of which is expected to produce 60,000 kw, but at present is producing only one-half of that amount. At the Porjis Falls, in northern Sweden, 37,500 kw is expected to be realized.

Modern Lighting of an Ancient City.—The ancient city of Tarsus, in Asia Minor, has recently been lighted by electricity, the power being obtained from the Cydnus River over a transmission line 1.5 miles in length. The hydroelectric equipment is designed for 1000 16-cp lamps; 450 are now used to light the streets of the city and the remainder will be furnished to private consumers. It is proposed to extend the electric lighting system to Adana and Mersine, the energy to be furnished by the Cydnus River and transmitted to these places.

Ban on Ugly Signs.—Numerous New York organizations, including the Fifth Avenue Association, Municipal Art Society, the Women's Municipal League, the City Club, the Manhattan Central Improvement Association, the Thirty-fourth Street Association, the Twenty-third Street Association, the Forty-second Street Association and the American Civic Association, have started a movement having as its object the removal of ugly signs along certain thoroughfares, especially Fifth Avenue. All of the reform organizations have been invited to join with the Fifth Avenue Association in drafting and obtaining suitable legislation against all unsightly signs on Fifth Avenue. The association has passed a resolution disapproving "of the construction and maintenance of unsightly electric or gas advertising signs, or signs of any other character, on the roofs, or against the walls, or affixed to any part of the premises of buildings on Fifth Avenue, or immediately adjacent thereto."

Telephone Improvements on Isthmus of Panama.—The telephone exchanges at Culebra and Paraiso, in the Canal Zone, are to be consolidated with the Empire exchange as soon as the work of installing new equipment at Empire is completed. The "central" at Paraiso has been abolished, and the stations served by it were temporarily connected with the Culebra exchange. The consolidation is designed to increase the efficiency of the service by centering operations at a point where they can be given closer supervision. A saving in operating expenses will also be effected. The new equipment at Empire will include a modern common-battery, two-section switchboard to serve 400 stations.

Chicago Subway Project.—At the meeting of the Chicago City Council on July 5 action was taken in relation to the construction of the proposed subway under downtown streets for passenger traffic and the accommodation of underground utilities, by referring the status of the subway proposition to the local transportation committee. The chairman of the committee announced that the report of Mr. Bion J. Arnold, the city's subway engineer, would not be ready before fall. A resolution expressing the sense of the Council in opposition to the Union Elevated Loop, particularly against an enlargement of the Loop district and the renewal of Loop franchises, was also referred to the local transportation committee. Mr. George W. Jackson, Inc., has submitted to the city authorities its patented plan for building a subway without interfering with the traffic on the streets.

New Jersey Public Utilities Commission.—In accordance with an act passed at the last session of the New Jersey Legislature, the State Railroad Board has passed out of existence, its three members becoming a new Public Utilities Commission. As previously noted (March 31) the commission has jurisdiction over every public-service corporation in the State, including telegraph and telephone companies, pipe lines and water companies. While very limited in its powers as compared with other State public service commissions, it can require every public utility corporation to comply with the laws of the State, to furnish safe and adequate service, to adopt a uniform system of accounting, and direct any utility corporation granting any rebates or unjust or unfair or unreasonable discriminations to cease immediately. There is right of appeal from any order of the commission. All issues of stocks and bonds must first be approved by the commission, and no lease, merger or consolidation of public utility corporations will be valid until approved by it. The expenses of the commission are limited to $50,000 per year.

Chicago Agitation of Railroad Terminal Electrification.—While there has been a lull in the agitation in Chicago for the electrification of the suburban service of the Illinois Central Railroad, there are indications that the protests from press and people are about to be revived. The Chicago *Daily Tribune* of July 7 published a strong editorial in which it declares that Chicago should no longer endure the public nuisance maintained under the title and authority of the Illinois Central Railroad. The fouling of the air with soot, gas and cinders should be stopped and electrification should be compelled. Even if it were true, which it is not, that electrification is an experiment, why has Chicago not as much right to demand progressive experimentation by its public utilities as New York? The *Tribune* announced that two weeks from the date of its editorial it will review the situation again and that twice a month or oftener the subject will be brought emphatically to the attention of its readers. No newspaper alone can win such a struggle, it is said, and the people are appealed to to win their own fight. In another column Mr. Burt L. Taylor, the clever "Line-o-Type" man of the *Tribune,* contributes caustic comment by saying: "The I. C. is all ready to electrify; all that's needed is a club." Meantime the project of compelling the electrification of the steam railroad terminals in Chicago by municipal action rests peacefully in the custody of the local transportation committee of the City Council.

Argentine-European Cable.—The direct telegraph cable from Argentina to Europe by way of Ascension Island has been opened to the public.

Large Mileage for an Electric Vehicle.—Dr. A. E. Evans, of Columbus, Ohio, has made the statement that he has used an electric vehicle (Studebaker) from April, 1905, to the present year, during which period it made a speedometer record of 87,715 miles.

Meter Tests.—Public Service Commission tests of meters in New York City during the month of June showed that 41.6 per cent of gas meters tested ran too fast and 15 per cent too slow. The corresponding figures for electric meters are 17 per cent and 12.8 per cent.

Extension of Wireless on Vessels.—It is estimated at the United States Bureau of Navigation that about 60 per cent of all steamers which will come under the law requiring them to be equipped with wireless telegraph apparatus before July 1, 1911, are already supplied with the necessary equipment.

Belgian Telegraph and Telephone Service.—Statistics show that the number of telegrams sent in Belgium in 1908 was 3,576,539, the recipts from which were $397,110; also 3,325,856 international telegrams, the receipts from which were $512,-587. The telephone service gave a revenue of $1,847,590 from 34,027 telephone subscribers and 199 public telephone stations.

Ungrounded Wireless.—Experiments with a Wright aeroplane are being conducted at Fort Sam Houston, Tex., on behalf of the Government by Lieut. Ben D. Foulois. The aeroplane has been equipped with wireless telegraphy outfit and will carry on its long-distance flights an operator who will keep the local wireless station advised of the progress of the trip.

Everybody Busy at Hastings.—The enterprising Thornapple Gas & Electric Company, of Hastings, Mich., of which Mr. L. W. Heath is manager, is busy with improvements. It is just finishing a new steam-generating station to be used as a reserve to its hydroelectric plants. A new gas plant has also just been completed, and about 21 miles of aluminum transmission line is to be replaced with copper at once.

Montreal Street Lighting.—The City Council of Montreal, Quebec, Canada, acting on a report of the board of control, has decided to terminate further street-lighting arrangements with the Montreal Light, Heat & Power Company on Oct. 31 next. It will now be absolutely necessary for the City Council to make arrangements with other companies for the lighting of the streets after that date, or the city will be in darkness.

Conservation Publicity in California.—Mr. John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, of San Francisco, has recently been delivering illustrated lectures to irrigation water consumers in Placer County, California, his object being to come to a better understanding with the people, and to show consumers that it is to their interests as well as that of the corporation to conserve the water supply from now until the rainy season starts in.

Proposed Baltimore Sewage-Electric Plant.—Chief Engineer Hendrick, of the Baltimore Sewerage Commission, has submitted a plan whereby, it is claimed, the public buildings of Baltimore can be lighted from an electric plant forming part of the sewage-disposal plant to be erected at Back River. The power would be generated by turbines operated by the flow of the sewage. After the sewage passes through the various tanks the water will flow off an elevation of 18 ft. into Back River, and Chief Engineer Hendrick recommends that the energy from this drop be utilized for the generation of electrical energy. The commission has directed that the plan be incorporated into the general plans of the sewage work.

Convention of Smoke Inspectors.—The fifth annual convention of the International Association for the Prevention of Smoke, an organization of the smoke inspectors of American and Canadian cities, was held at Minneapolis June 29 to July 1, inclusive. About 15 cities were represented by officials of their inspection departments. Special appliances and methods of furnace construction for avoiding smoke received the major part of the attention at the sessions. A discussion advocating the electrification of railroad terminals as a preventive of much of the smoke in large cities and railroad centers was led by the smoke inspectors of Chicago and Milwaukee. Following the technical sessions of the association, Mr. Paul P. Bird, smoke inspector of the city of Chicago, was elected president and Mr. R. C. Harris, commissioner of properties, of Toronto, Canada, was chosen secretary and treasurer.

Telephone Rate Regulation in Chicago.—Under the direction of a subcommittee of the committee on gas, oil and electric light of the City Council of Chicago, the staff of experts retained to analyze the Jackson-Young report on the telephone-rate situation in Chicago has begun its work. As previously mentioned in this journal, the chief investigator is Mr. William J. Hagenah, statistician for the Wisconsin Railroad Commission. Assisting him are Mr. Charles A. Honecker, accountant, Chicago; Mr. Peter H. Schram, accountant, Milwaukee, of the Wisconsin Railroad Commission staff, and Mr. William Sloan, engineer, of Madison, Wis., also on leave of absence from the same organization. These experts will not only analyze the Jackson-Young report, but will make a careful examination of the books of the Chicago Telephone Company and also investigate the cost of the company's plant used in furnishing telephone service in Chicago. The cost of furnishing service from this plant will be obtained from an analysis of the company's operating expenses for a reasonable period of time, probably two years. No doubt, also, allowance will be made for depreciation, and it will be interesting to observe whether the conclusions of the Jackson-Young report are followed in this particular. When the subcommittee's experts have made their report the aldermen will take up the actual question of revising the rates for telephone service as required by the ordinance under which the company is operating.

Toronto Central Station Situation.—The offer of the Toronto Electric Light Company to the corporation of the city of Toronto, looking to the elimination of competition between the company and the new civic electrical system which will soon be receiving and distributing Niagara energy from the Hydroelectric Power Commission, was considered by the board of control for the municipality on June 30, and rejected. The board suggested that the only basis on which negotiations could be entered into by the city corporation was the sale of the company's plant to the city at a reasonable figure. The counsel for the company stated that his instructions from the company had not anticipated negotiations with the city on this line, but he promised to confer with the company and see if some offer could be made by the company which would form a basis of negotiations. The offer of the Toronto Electric Light Company, made on June 8, was given in these columns in the issue of June 16. Briefly, the company proposed that the corporation should utilize the Hydroelectric Power Commission's energy to the extent of 6000 hp, but to do so only for the purposes of water-works pumping, street lighting and lighting of municipal buildings; the city and company to have the joint use of the poles and conduits throughout the city; the rates to be fixed by the city and company and the dividends to be 10 per cent on the capital stock, the Mayor being an ex-officio member of the board of directors. It was claimed by the company that the city would be saved an expenditure of about $5,000,000 as a result of the abandonment of the duplicate plant.

Wires from Reno Carried 800,000 Words.—Officers of both the Western Union and the Postal Telegraph companies have stated that the sending of fight news out of Reno broke all telegraph records for a single day. More than 800,000 words were sent at an average cost of 2 cents a word.

British Decision Against Municipal Trading.—A British court has decided that municipal lighting plants, in the absence of parliamentary authority, have not the right to wire houses and supply fittings and electrical appliances to consumers. The installation of electric fittings was held to be a separate business incidental to the use, but not the supply, of electricity.

Telephone Company Fined $175,000.—Judge Blount, in the Chancery Court at Water Valley, Miss., imposed a fine of $175,000 for violation of the State anti-trust law upon the Cumberland Telephone & Telegraph Company. The company was charged with entering into a contract with the Oxford Telephone Company in Marshall County for the purpose of shutting off competition.

Telephone Regulation in Mississippi. — The Cumberland Telephone & Telegraph Company has been found guilty of violating the Mississippi State anti-trust law by Judge I. T. Blount in the Chancery Court and a fine of $175,000 has been imposed. The company was charged with entering into a contract with the Oxford Telephone Company in Marshall County for the purpose of shutting off competition. The case will be appealed.

Texas Telephone Regulation.—The Texas State Court of Civil Appeals has upheld the city of Dallas in a case appealed by the Southwestern Telephone Company, attacking the constitutionality of the initiative and referendum ordinance, passed at the city election last April. The ordinance fixes the rates of charges, prohibits the telephone company from collecting in advance for rentals, and gives subscribers 10 per cent discount on bills if paid by the 10th day of the month following service.

Railway Regulation in Illinois.—The Supreme Court of Illinois has decided in favor of Mr. Clarence H. Venner, in his mandamus proceedings against the Chicago City Railway Company for inspection of its books of account and records, and reversed the decision of the Appellate Court, which was in favor of the railway company. The company contended that it was not subject to the general corporation law entitling stockholders to such inspection, because it was incorporated by special charter before the corporation law was passed. This contention the Supreme Court has overruled.

Turkey Wants Electric Railways.—Following close on the concession granted to the telephone syndicate for the exclusive operation of telephones in Constantinople, as announced in these columns a few weeks ago, comes the invitation to Americans from the Ottoman Government, through its consul-general in New York, to build electric railways in the capital. There is to be a network in the city itself and besides this the Government has laid out five possible routes outside Constantinople. The Turks are also asking for bids on a system of trolley roads in the city of Salonica. The bids close on Nov. 1.

Northern California 27,000-HP Plant.—On June 19 the Northern California Power Company began the operation of its Inskip generating station near Redding, thereby adding 8000 hp to its generating capacity, which now has a total of 27,000 hp, as follows: Volta power house, 9000 hp; Kilarc power house, 4000 hp; South power house, 6000 hp; Inskip power house, 8000 hp. The company has commenced to build a power house on Battle Creek at Coleman, three miles from the junction of the creek with the Sacramento River, at which point [illegible] hp will be developed [illegible]

Increasing Use of Electricity on Passenger Trains.—All the through trains of the Burlington system are now lighted by electricity from the locomotive to the observation platform. No such extensive and costly improvement of coach lighting has been attempted before. These electric-lighted trains run between Chicago, St. Louis, St. Paul, Omaha, Kansas City, Denver, Billings, Spokane, Seattle, Tacoma and Portland. The generator is located in the baggage car and an electrician is on duty on each train.

Cable Letters.—As a result of closer business relations between the Western Union Telegraph Company, the Anglo-American Telegraph Company and the Direct United States Cable Company, it is expected that a plan will be put in force for sending cable messages between certain hours at greatly reduced rates. The plan is said to be similar to the "night letter" telegram idea recently adopted by the land telegraph companies. It is thought that by establishing a lower rate between certain hours for messages sent in ordinary words rather than in code a great increase will result in the service by encouraging the sending of messages of a social or domestic nature from continent to continent, which are now seldom sent, owing to the high tolls.

Chicago Subway Plans.—Mr. Bion J. Arnold has taken charge of the plans of the proposed State Street passenger subway system and will report his recommendations to the City Council some time in the fall. The line will be a four-track road under State Street from Chicago Avenue to Twenty-third Street, the estimated cost being about $5,000,000. It is said that Mr. Arnold will also advise that the conduits of the public service corporations be removed from the streets entirely and placed in the alleys back of the buildings that are supplied. It will be suggested that the subway extend from building line to building line and that there be underground sidewalks with store entrances and shop windows. A storage yard for cars under Grant Park, in the downtown district, is one feature of the plan. This would do away with the dead haul of empty cars back to the yards after the morning rush and again down town before the evening rush. It is now believed that work on this subway can be started early next year and that it can be completed within three years.

Denver Gas and Electric Banquet.—The third annual banquet of the Denver Gas & Electric Company, at which the guests were 100 office employees, was given June 18. Mr. F. M. Willoughby was toastmaster, and responses were made by Messrs. T. L. Curtan, L. A. Ramsey, C. C. Van Vlaack, George Creel, of the Denver *Post*, and Charles H. Elliott. The Denver *Post* of June 20 contained a leading editorial by Mr. Creel in which he referred in high terms to the policy of the company towards its employees and the public. "Speech after speech was made—all of them splendid, too," he said, "amply recognizing the right of the consumer to every courtesy and consideration; and from conversation it was learned that the banquet was really a sort of 'commencement,' marking the end of a lecture and study course that has for its sole object the education of the corporation employees with regard to their public relations and right and proper dealing with the people. In this course that the company provides for its men, the textbooks are individuals, and the lectures do not deal with abstractions, but center about the consumer, his rights, his treatment and his point of view. And the result was apparent in the high class of the hundred-odd men about the table, their intelligence, poise and general likability. And a further result is evidenced by the company's freedom from the perpetual turmoil that involves tramway, water and railway companies." In conclusion Mr. Creel recommends that the company shall, in order to allay remaining friction, demand that the city appoint meter inspectors. The Denver city government has not followed the lead of other municipalities in having a bureau of meter inspectors, and he thinks the company can do no more popular thing than to make such a demand.

A LONDON MUNICIPAL CENTRAL STATION.

Generating Station of the Westminster Electric Supply Corporation.

BY the London County Council Act, 1[illegible]0, the council was empowered to obtain possession of the site of the Millbank Street station of the Westminster Electric Supply Corporation in connection with proposed improvements, including the construction of an embankment. By the terms of the act the London County Council had to provide a new station site, and after lengthy negotiations a plot on Horseferry Road was offered to the company. This site, although much larger than the Millbank Street site, had the disadvantages that it was no longer possible to obtain coal by water, or to dispose of ashes except by means of carting, while water for condensing purposes was not so easily obtained as on the former site, which was close to the Thames River.

The London County Council, therefore, agreed to pay the Westminster Electric Supply Corporation a sum representing the difference between the cost of coal delivered at Horseferry Road and of coal brought by barges to the Millbank Street site. This agreement remains in force until 1931, when the electricity undertaking becomes purchasable by the Council. The Council also arranged to construct a subway, and to lay four 20-in. pipes from the new generating station to the river so that water for condensing purposes would be available from that source.

The arrangements in connection with this supply of water are probably the most interesting feature of the new station. There are no grids at the intake on the bed of the river, all the strainers being situated in the power house. The four pipes are of slightly different lengths, so that the hot discharge from any pipe is not liable to enter other pipes through which cold water is flowing. Grids, comprising bars spaced about 7/8 in. apart, are fixed at the station on each of the four pipes, and a very ingenious system has been adopted for minimizing trouble due to the choking of the grids and pipes. All the discharge from the condensers is passed through one tube, while the other three can, if necessary, be used for the intake. This results in the discharge pipe and grid being well scoured out due to the high velocity of the discharge water. When the pressure gages show that any intake pipe is becoming choked, that pipe is used for the discharge from the condensers and the pipe previously used for the discharge, and which has become cleared from deposit, is utilized for the intake. By changing over in this way it is possible to keep the pipes in a satisfactory condition, and to prevent a great deal of the trouble likely to arise where river water containing foreign matter is used for condensing purposes.

The water is drawn from the river by three electrically driven pumps, and after passing through the grids and through these pumps, the water flows through a rotary strainer, of which there are two installed. The unstrained water passes through a slowly revolving grid on its way to the condensers, while the discharge flows through a grid in the opposite direction, thus washing away any deposit clinging to the strainer surface. The grid is rotated at a speed of about 1/2 r.p.m. Each strainer is capable of dealing with 335,000 gal. of water per hour normally, and not less than about 500,000 gal. per hour in an emergency. The strainer consists of a cast-iron casing in four parts, the casing being mounted upon a sub-

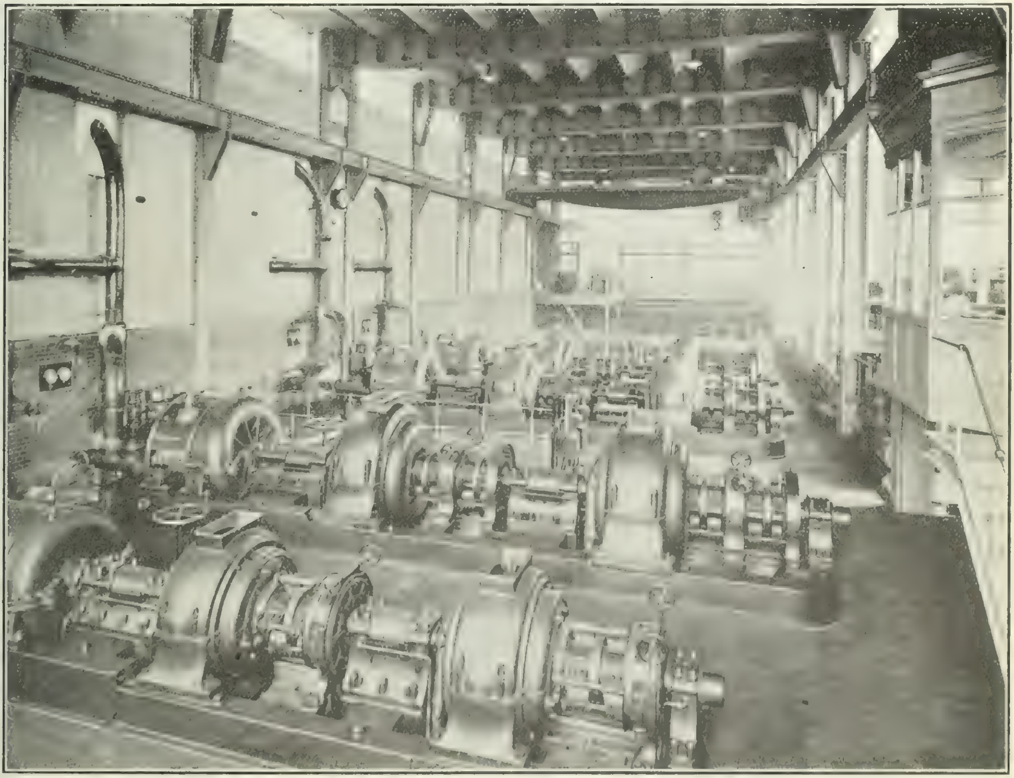


Fig. 1—Horseferry Road Station of Westminster Electric Supply Corporation.

stantial cast-iron base and provided with 18-in. inlets and outlets. Internally it is fitted with two rubbing strips faced together back and front. An inspection cover is located on the outside circumference of the top casing, while side inspection is provided for by four inspection blank covers. The cast-iron rotor, about 60 in. in diameter, is fitted with specially constructed brass grids, and is mounted upon a main shaft 5 in. in diameter, with gun-metal and leather packing rings arranged to prevent the by-passing of water as far as possible, and also to allow of easy access for overhauling and repairs. A 1-in. water service for maintaining the water seal is provided, and the quantity of sealing water for each strainer amounts to about 400 gal. per hour.

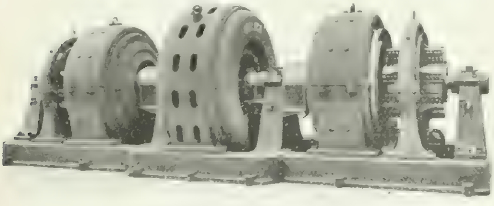


Fig. 2—Motor-Generator.

Since at low tide the pumps are from 8 ft. to 10 ft. above the level of the Thames, it is evident that great care must be taken to obviate trouble due to air accumulating at the highest points in the pipes, thus causing the pumps to lose their suction. For preventing air pockets in condensing-water pipes separate 1½-in. vacuum pipes are led from all high points into a vacuum tank on the roof of the station and at a height of 70 ft. above the condensers. To this tank a vacuum pump is connected. Each vacuum pipe thus forms a barometric leg in which the water rises, and all air is collected in the vacuum tank. To prevent any water from accumulating in the latter a barometric drain pipe is provided.

Coal and ashes are brought to and removed from the station in carts. The coal is tipped from carts at the roadway into a hopper on the basement floor. From this hopper a continuous conveyor of the swinging-bucket type raises the fuel and conveys it into bunkers over the boiler house; measuring hoppers and chutes being provided for each boiler. The conveyor is capable of disposing of about 25 tons of coal per hour, and is driven by an enclosed motor. The parts of the conveyer system outside the building are covered in and protected by a frame work of steel plates. The ash conveyer lifts, at a rate of about 50 ft. per minute, a skip containing 40 cu. ft. of wet ashes from the basement outside the boiler house to an ash bunker overhead, whence the ashes are discharged through chutes to carts. The ash conveyer is driven by a series-wound, direct-current enclosed motor. Each ash skip is brought out on a trolley, which runs on rails on the boiler-room basement floor.

As in the case of the Millbank Street station, which was shut down and handed over to the Council on May 1, the Horseferry Road station houses a low-tension direct-current system only, although several motor-generator sets are installed in which high-tension, three-phase current supplied from the Grove Road station of the Central Electric Supply Company is converted into direct current, the motor-generator sets operating in parallel with the main generators.

The boiler room houses four B. & W. boilers, each of which is fitted with a superheater and operated in connection with an economizer. Each boiler fitted as above is capable of evaporating normally 20,000 lb. of water per hour from a temperature of 75 deg. Fahr. into steam at a pressure of 200 lb. and superheated 150 deg. If necessary, each boiler can be forced to evaporate 25,000 lb. of water per hour. The superheaters are of the usual B. & W. type, consisting of solid-drawn mild-steel tubes, 1½ in. external diameter, bent to shape and expanded at the ends with wrought-steel boxes. The boiler furnaces are equipped with B. & W. mechanical chain grate stokers. These are of the latest pattern, in which the movement of the grate is continuous, differing in this respect from earlier patterns, where a ratchet and pawl drive was adopted. The links are also placed closer together, which fact, together with a steady movement, allows a cheaper grade of coal to be burned. The speed of the grate is variable to suit different classes of fuel and conditions of firing, while the hopper is so arranged that the fuel is spread over the width of the grate, the thickness of the fire being regulated by a vertical movement of the fire. Shafting for driving the stokers extends the length of the boiler house, and an electric motor is installed at each end, a clutch disconnecting either motor as required.

Water for the boilers is supplied by two feed pumps and an electrically driven centrifugal pump, each capable of delivering 60,000 lb. of water per hour against a boiler pressure of 210 lb. The electrically driven centrifugal pump is found to be the more economical, but the steam pumps will generally be employed, since the exhaust steam from these pumps is taken to a feed-water heater, so that the feed water may be raised in temperature before it enters the economizer.

The vertical-spindle electrically driven turbine pump affords an interesting example of the advance made in recent years in the application of this class of pump to power-station work. From considerations of practical utility, the arrangement of the pump and motor with the axis of rotation vertical and direct coupled is one that obviously has much to commend it, as it enables the pump to be placed at as low a level as may be desired, thus avoiding the troubles so often encountered when a centrifugal pump has to work with a considerable lift on the suction side. The motor can also be placed on the engine or pump-room floor level in an easily accessible position, and well away from all danger from water. In the early days of electrical driving this arrangement was attempted, but met with little success owing chiefly to the difficulties experienced with the balancing of the vertical forces and from objectionable shaft vibrations, not to mention difficulties in connection with bearings. A water-treating and filtering plant has been installed for softening the make-up water for the boilers, and water recorders, one measuring the hot-water discharge and the other the make-up water, are also installed. A CO_2 recorder is installed in connection with the boilers.

The plant has three vertical pumps with motors and switchgear. The smallest of these is a hot-water pump capable of delivering 100 gal. per minute against a head of 45 ft., with an efficiency of 60 per cent when running at 1600 r.p.m. It is placed in the basement of the building below the water level of the hot-water sump, and is direct-coupled through a length of shaft of about 12 ft. to an electric motor of 2.8-kw rating located on the engine-room floor. The armature runs entirely in ball bearings, the topmost bearing being of the ball-thrust type and carrying the weight of the armature. At about the floor level, and within the motor casing, is a flexible shaft coupling capable of transmitting rotational forces only. Situated immediately below this coupling in an extension of the

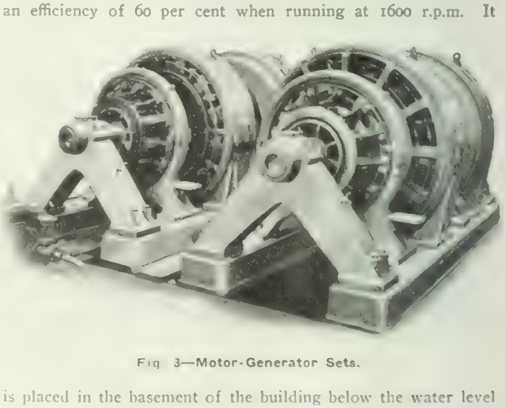


Fig. 3—Motor-Generator Sets.

motor housing is a ball-thrust bearing designed to carry the weight of the shafting and the pump impeller. The various lengths of shafting are connected by ordinary flange couplings, and supported laterally by ordinary white-metal bearings in halves. The pump is of the turbine type, having one impeller and one set of diffuser blades, both of special bronze. An automatic hydraulic balancing device is employed to carry the weight of the rotating parts of the pump and part of the weight of the vertical shafting.

The second pump, which is of the two-stage turbine pump type, is driven by a 5.6-kw motor located on the boiler-room floor and is designed to deliver 100 gal. of water per minute against a head of 100 ft., with an efficiency of 61 per cent when running at 1600 r.p.m. The third, and most interesting pump of the series, is the centrifugal boiler-feed pump, which is of the six-stage type, the general design and arrangement being very similar to the pumps just described. It is designed to deliver 100 gal. of water a minute against a head of 485 ft., when running at 2200 r.p.m., and with an efficiency of 61 per cent. The pump, which is illustrated in Fig. 6, is direct-connected to a 22.8-kw shunt-wound motor through a length of 8-ft. shafting. This set on test gave an efficiency of 63 per cent under the specified conditions.

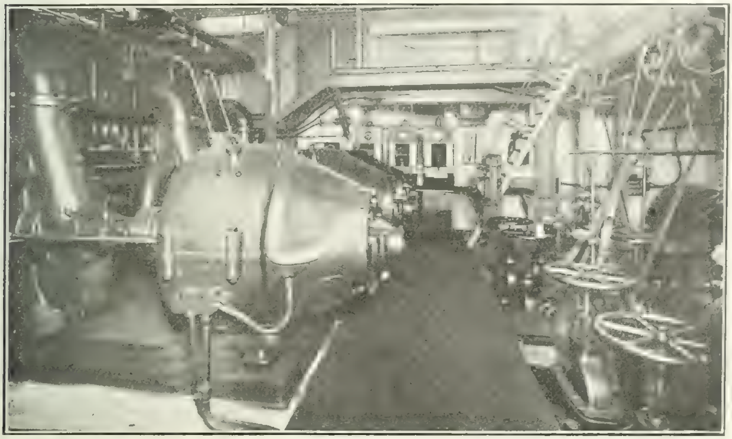


Fig. 4—Strainers and Pumps.

The main generating plant comprises three 1000-kw turbines, built by Messrs. Howden Brothers, each of which is coupled to two 500-kw direct-current generators wound for 410-460 volts, and built by Siemens Brothers Dynamo Works. In addition there are two 300-kw steam balancers of the same type as the main set, each driving two 150-kw, 200-230-volt generators. A view of the engine room, with one of the balancers in the foreground, is shown in Fig. 1.

The turbines are of the Zoelly impulse type, the larger set running at 1850 r.p.m. and the steam consumption being guaranteed with 150-deg. superheat and 28.5 in. vacuum as follows: Full load, 17.1 lb.; three-quarter load, 18.4 lb.; one-half load, 20.8 lb.; one-quarter load, 27.4 lb. per kw-hour. The corresponding figures for the 300-kw set are: 19.50 lb., 21.75 lb., 25.75 lb. and 36.75 lb. per kw-hour. In each case the plant can take an overload of 25 per cent for half an hour and 40 per cent for three minutes. The turbines are also specified to give normal full load when running non-condensing and exhausting direct to atmosphere. As indicated above, each turbine is direct-connected to two dynamos in tandem, this arrangement being considered by the engineers to be more reliable at the present time than single generators of double output. Particular attention has been paid by the manufacturers to compensating armature reaction, two commutating poles, as well as a distributed compensating winding on the main poles, being provided. As will be seen by reference to Fig. 1 each commutator is divided into two distinct parts, and the connections between the two parts are arranged to act as a fan for ventilating the interior of the commutators. The machines themselves are ventilated by fans on the armature shafting, the hot air being discharged through an opening at the top of the frame. The machines are self-excited and the pressure is regulated by hand, an adjustable rheostat being inserted in the field circuits.

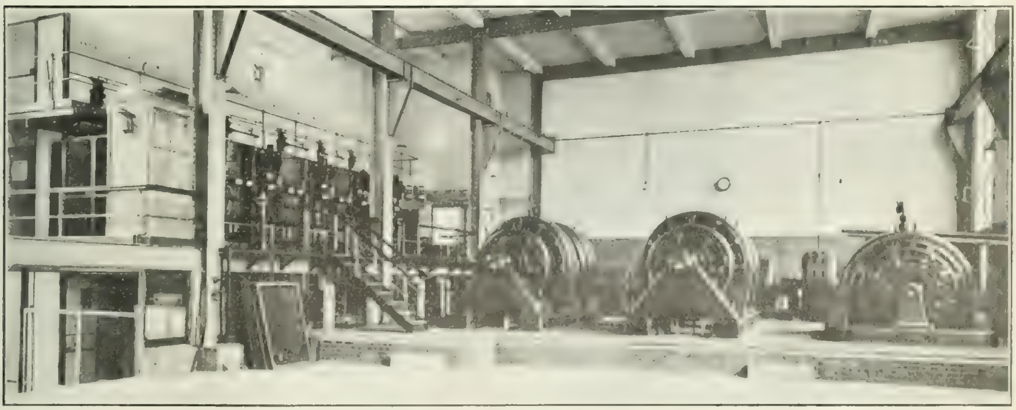


Fig. 5—Motor-Generator Room and High and Low-Tension Switchboards.

The condensers, which are situated beneath the turbines, are of the "Contraflo" type. The air pumps are electrically driven. Careful provision has been made for keeping account of all water used, and for ascertaining the cause of any undue consumption. Lea recorders are employed for the air-pump dis-

charge and for the make-up water; a Kennedy meter measures the feed water, and a Venturi meter enables the amount of condensing water to be ascertained. Three "Aero" recorders indicate the level of the water in the storage tank on the roof, in the treated-water tank and in the hot well. The make-up water is obtained from a well in the station, the city water supply being used only as a standby. A 25-ton electric crane spans the engine room, and one of smaller size is installed in the motor-generator room. An electrically driven air compressor has been found convenient for cleaning the generators, economizer tubes, etc.

Two storage batteries, each containing 100 cells, are installed in a room adjacent to the motor-generator room. The normal capacity of the batteries, which have been supplied by the Tudor Accumulator Company, is 2100 amp-hours on the one-hour rate, and they are capable of discharging at 1200 amp for two hours, or 950 amp for three hours. For charging and discharging the cells in each battery two boosters have been installed in the motor-generator room. The pressure of these boosters is regulated by hand from the main switchboard gallery in the engine room. The five end cells of each battery can also be used for regulating purposes.

As direct current is supplied from the Horseferry Road station on the three-wire system at a declared pressure of 400 volts across the outers, it is evident that the batteries act as a stand-by; but, of course, it would usually only be capable of dealing with a small part of the load. In this connection it may be mentioned that the Houses of Parliament are supplied from this station, a special panel on the switchboard controlling the supply. The batteries also serve as a standby for the various motors driving the auxiliary plant in the station.

Fig. 6—Centrifugal Boiler Feed Pump and Motor.

Undoubtedly one of the most interesting features of the new station of the Westminster Electric Supply Corporation is the large motor-generator room, which is situated above the main engine room, and is of about the same size as the latter. Whereas, however, provision has been made for installing steam plant to a total capacity of 6600 kw, the motor-generator room can accommodate, if ever required, transforming plant to the extent of 15,000 kw.

At present two 1000-kw Oerlikon motor-generators and a 500-kw machine of the same type for balancing purposes have been installed, together with a 500-kw British Thomson-Houston motor-generator which was used at the Millbank Street station and has been transferred to the new site. Electrical energy is supplied to this plant at 6000 volts, 50 cycles, from the Grove Road station of the Central Electric Supply Company. The motor-generators are operated in parallel with the main steam plant installed on the ground floor, so as to obtain the most economical results.

The motor-generators can withstand an overload of 25 per cent for half an hour and a 40 per cent overload for three minutes, while they run sparkless from no load to 40 per cent overload without shifting the brushes. They are also so built that when running at normal speed they can be switched onto a short-circuited system (due to failure of the supply or defective cables). This they have to do with a current equal to 40 per cent overload and about [illegible] volts to start with, the pressure to be raised by regulation (separate excitation) from this level up to the normal. Even under these conditions the machines have to remain practically sparkless.

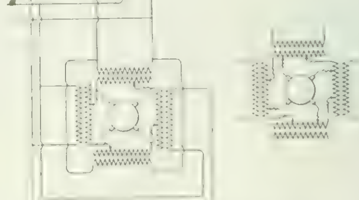
In the view of the motor-generator room given in Fig. 5 the two 1000-kw Oerlikon generators will be noticed, while the machine on the right-hand side of the illustration is the 500-kw British Thomson-Houston motor generator. In the background the balancer is just discernible, while Figs. 2 and 3 show further views of the Oerlikon machines.

The direct-current Oerlikon generators are of the auxiliary-pole type, and the commutator is equipped with shrink rings of a design similar to that adopted with most Oerlikon turbo-generators. The A-shaped spread bearings have been adopted to obtain the greatest possible stability of the machine and also to give easy and comfortable access to the commutator.

The switchgear comprises a low-tension, three-wire, direct-current switchboard in the engine room and a high-tension and low-tension switchboard in the motor-generator room. Practically the whole of the control, however, is carried out from the switch gallery in the engine room, the switches and instruments for the main generators, balancers, batteries, boosters and low-tension feeders being located on this switchboard. The arrangement of this board is on standard lines, but attention may be called to the fact that aluminum rod has been largely used for the connections behind the panels; the leads to the generators being also of aluminum rod. This allows of a very neat arrangement, and minimizes the risk of fire. Duplicate busbars are provided so that the voltage on individual feeders can be varied, while section switches allow of each busbar being divided into two independent halves. From this switchboard, which is on a gallery at one side of the engine room, as will be seen from Fig. 1, connections are run to the low-tension switchboard in the motor-generator room, a view of the high-tension and low-tension boards installed in that room being given in Fig. 5. The high-tension gear is of the standard British Thomson-Houston type, the British Thomson-Houston Company being the contractors for the whole of the switchgear. Provision is made for the necessary switching in connection with the high-tension feeders from Grove Road station and the three-phase induction motors of the motor-generators. The switches are enclosed in fire and arc-proof cells of the usual construction. Mr. G. Horley is the engineer in charge of the Horseferry Road station.

POLYPHASE COMMUTATING MOTOR.

A polyphase commutator motor, in which the value and phase of the e.m.f. across the brushes can be adjusted independently of the field circuit is the subject of a patent granted to Mr. Harris Alexander. The invention consists in so arranging the commutator brushes and their connections (Fig. 1) that they form with the rotor winding polyphase circuits, each of which comprises a set of rotor conductors lying opposite the conductors of one of the phases of the stator winding—that is, the distribution of the conductors is such that the m.m.fs. of stator and rotor are of the same shape, and leakage fields are avoided. The connections shown in Fig. 2, in addition to the above advantage, also permit the adjustment of the phase of the e.m.f.



Figs. 1 and 2—Polyphase Commutator Motors.

COLORADO HYDROELECTRIC INSTALLATION.

The Boulder Generating Station of the Central Colorado Power Company.

IN the present article will be given a description of the Boulder hydroelectric station of the Central Colorado Power Company, the other features of whose system have already been described in articles in these columns as follows: Transmission line, Jan. 27, 1910; Glenwood station, June 23, 1910; substations, June 30, 1910.

For an intelligent understanding of the Boulder development it will be necessary to repeat briefly the relation of this plant to the other stations of the company. The Glenwood or Shoshone plant on the Grand River, near Glenwood, 153.4 miles from Denver, is designed to carry a continuous load up to 5000 kw, with very little water storage for peak-load purposes. The Boulder plant on the other hand is designed primarily as a peak-load and emergency plant, and has a very large water storage. In fact, this Boulder plant will depend almost entirely on stored water for its operation, as the minimum flow of Middle Boulder Creek, from which the supply is obtained, is as low as 5 cu. ft. per second in dry seasons. A general plan of this development is given in Fig. 1.

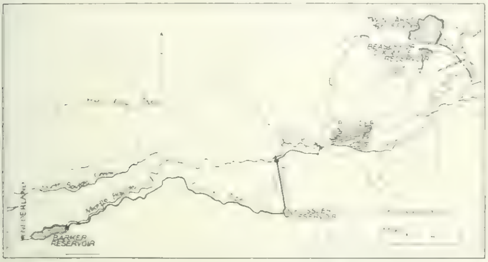


Fig. 1—Map of Colorado Hydroelectric Development.

The Barker reservoir has a holding capacity of 520,000,000 cu. ft. It will be possible to regulate the stream with this to a continuous flow of 37 cu. ft. per second. The reservoir is provided with a concrete dam 177 ft. high. A 36-in. concrete pipe line leads from the reservoir 12 miles to a second reservoir at the head of the pressure pipe line above the power house. The plant operates under 1830 ft. static head. The power plant is rated at 10,000 kw. Below the power house on the plains is a secondary storage reservoir, in which water discharged from the plant during the winter can be stored and supplied to those having irrigation rights along the creek at such times as the primary reservoir (Barber) is storing water during the irrigation season.

The Kossler reservoir at the head of the pipe line has a present holding capacity of between 5,000,000 cu. ft. and 6,000,000 cu. ft., and when the dam contemplated is completed at this reservoir, its holding capacity will be about 9,000,000 cu. ft.

With the aid of the Kossler terminal reservoir it is estimated that the power plant can develop 15,500 hp for 100 hours, assuming the gravity pipe line between the Barker reservoir and the Kossler reservoir to be running full. Thus, in case the Glenwood power plant or the transmission line from Glenwood to Denver should fail, the Boulder plant would constitute a valuable reserve. The reservoirs also make it possible to carry high peak loads.

The Bolder plant is 29 miles from Denver, and the transmission line is erected on the plains and among the foot hills along the east side of the main range of mountains. It will not, therefore, be subject to as severe climatic conditions as will the line from Glenwood which crosses the continental divide at three different points.

Fig. 2 is a plan of the power station and Fig. 3 an elevation showing the arrangement of apparatus. Fig. 4 shows the arrangement of high-tension apparatus in this station. The station building is a brick structure with steel frame and concrete-slab roof. The reinforcing used on the roof is known as "Hy-Rib." The roof slab is 2.5 in. thick. The roof trusses are 15 ft. 4 in. apart and the purlins 5 ft. 8 in. apart. A slope of 5/8 in. to 1 ft. is given to the roof. The pressure pipe line leading into the plant is supposed to be the heaviest ever constructed. The diameter of the pipe at the lower end where the pressure is highest is 44 in. and the plates of which the pipe is constructed are 1.75 in. thick. The pipe is double-butt strap-riveted with a joint efficiency of 80 per cent. Rivets 2 in. in diameter are used. The rivet heads inside the pipe are of the flat or gas-holder type, and thus afford a smooth surface for the flow of water. The pressure pipe is laid in a trench, which averages 7 ft. wide by 11 ft. deep, and is back filled as a protection for the pipe.

Fig. 2—Arrangement of Apparatus, Boulder Power House.

The water-wheels in the power house are of the impulse type, each of the two wheels being rated at 10,500 hp. They were furnished by the I. P. Morris Company, of Philadelphia. The governing is by deflection of the nozzles away from the wheel bucket with needle adjustment in the nozzle for different constant loads.

The electrical arrangements of the station are very simple. There are two 500-kw, three-phase generators giving 4000 volts,

60 cycles. Each generator is connected to the busbars by a 1200-amp motor-operated oil switch. The leads are in single-conductor varnished-cambric cables with waterproof braid. These are laid in fiber ducts in the concrete floor. The busbars lead through a totalizing oil switch to the transformer busbars. The oil switches are arranged along one side of the station, as seen from the plan. The transformers, which increase the e.m.f. from 4000 volts to 100,000 volts for the transmission of energy to Denver and other points on the system, are located in one end of the power house. At the other end are transformers which step up to 13,000 volts for the distribution of energy to the mining districts in the vicinity of the Boulder plant. A motor-operated oil switch is inserted in the busbars between the latter bank of transformers and the main busbars. Series instrument transformers are located under the oil switches. The shunt instrument transformers are on the wall of the station above the switches. There are three 4000-to-100,000-volt transformers connected delta. Each has a rating of 3330 kw. and a guaranteed full-load efficiency of 98.5 per cent. The voltage regulation is 1.2 per cent on non-inductive load between no-load and full-load. The transformers are rated for 24-hour run at full load with 35 deg. C. rise in temperature. For handling machinery a 35-ton Whiting motor-operated crane is installed.

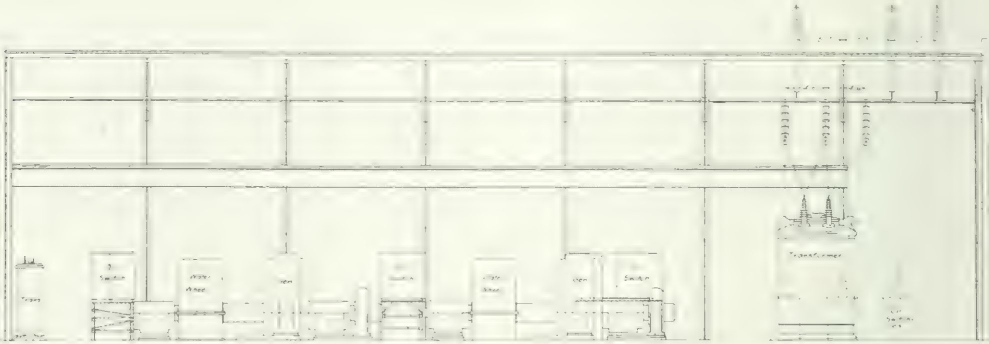


Fig. 3—Arrangement of Apparatus, Boulder Power House.

Fig. 4—High-Tension Arrangement.

The exit of the 100,000-volt lines from the building is through roof bushings such as were described in the previous articles on the Glenwood generating station and the Denver substation. The 100,000-volt bus lines inside of the building between the transformer terminals and the roof bushings consist of brass pipe of the same size as 1-in. extra-heavy iron pipe. In general, the apparatus in this station is almost a duplicate of that in the Glenwood plant already described. The essential differences between these plants are, first, the Boulder station building is a permanent and not a temporary structure; second, the Boulder plant supplies 13,000-volt energy for local distribution; third, the water-wheels are of the high-head impulse type, instead of the reaction turbine type.

CONSTRUCTION OF 135,000-VOLT TRANSMISSION INTO FLINT AND BATTLE CREEK, MICH.

The 9000-kw Cook Falls development on the Au Sable River, which is now under construction 15 miles above Au Sable, Mich., will go into operation during the coming year as the head of a 135,000-volt transmission line 125 miles to Flint, and later 65 miles further to Battle Creek, tying in at other points to the 44,000-volt network which covers south and central Michigan.

This station is the first of a series of four or five planned to develop water-power sites on the Au Sable River. It will utilize a 40-ft. fall in a wild and sparsely populated part of Iasco County. The Au Sable River has an uncommonly uniform flow, averaging 1100 cu. ft. per second. The records of 10 years show that at no season has the flood flow exceeded four times the minimum. This regularity of flow is attributable to the springs emerging from the clay strata underlying the sandy surface of the northern part of the peninsula, which supply the river, there being but two insignificant tributaries to the stream in its whole length above the water-power site.

The generating equipment will comprise three 3000-kw, 60-cycle alternators mounted on horizontal shafts driven by water-wheels, with eight runners to each shaft. The electrical output of these generators will be stepped up to 135,000 volts by delta-connected transformers installed at one end of the generator room. The dam and power-house foundation will be of solid concrete with molded water passages and draft tubes. The power house will be of brick above the water levels, and will have a floor space 40 ft. x 110 ft. The spillway section of the dam will have a total clear opening of 72 ft., given by three 24-ft. x 13-ft. Tainter gates controlled from the gate-house above the power station. The 40-ft. dam will impound a lake covering 2000 acres, which will be of use for the storage of water against daily variations in the station load. Construction work on the dam and power house has been going forward several months, and part of the concrete is already in

place. The electrical apparatus has not yet been contracted for, but all haste is being made to get the development ready for operation early next year.

The transmission line will comprise a single three-phase circuit of three No. 0 copper wires carried on suspension-type insulators hung from the cross-arms of 55-ft. tripod steel towers. These towers are generally similar to those of the 110,000-volt transmission into Grand Rapids. Two braced bracket-arms extend from one side, and one arm from the other, carrying the wires at the apices of a tipped isosceles triangle with a 12-ft. base and 17-ft. sides. The lowest wire is 40 ft. above the ground. The suspension insulators to be used will have eight disks linked in series, each disk having been tested to withstand continuously 75,000 volts, and subjected to 100,000 volts for a brief period. Each complete eight-disk insulator measures 52 in. from the tower hook to the line conductor.

The decision to employ 135,000 volts on the Cook-Flint transmission was reached only after careful study and consideration of the successful performance of the Grand Rapids 110,000-volt line. In preliminary experiments the pressure of this line has been raised to 125,000 volts, in order to determine the corona and leakage losses at pressures in excess of those commercially used. Taking the results obtained with this 50-mile line of No. 2 copper conductors, the engineers have computed that the 135,000-volt line with No. 0 conductors should show a corona loss of about 1 kw per mile. The brush display from the larger conductors at 135,000 volts should not exceed, they believe, that noticed with the No. 2 wires at 110,000 volts. The apparent power of the 135,000-volt line is expected to be between 10,000 kva and 12,000 kva for the first 125-mile section.

About 40 miles of the second section of the transmission line, from Owosso to Charlotte, is already under construction, and will be operated as part of the 44,000-volt system until the hydroelectric plant is completed. The main transmission will be tapped into substations at Flint and Saginaw. That at Flint will occupy a part of the building for the new 9000-kw steam-turbine station, which has been hastily erected to supply the demand for energy in this section. The Saginaw substation will also distribute to Bay City. Large factory installations of motors will be supplied in these vicinities. Clear rights-of-way into each substation have been purchased for the 135,000-volt lines. Rather elaborate entries are also afforded into the station transforming apparatus. The end wall of the building is apparently cut away, leaving only a hanging pediment which serves as a rain-shield to protect the vertically-downward entries of the wires through bushings in a horizontal shell carried by a second wall several feet inside the building line. The high-tension lines will be delta-connected to the transformers, subjecting the insulation to the entire 135,000-volt stress. The use of lightning arresters on this line is yet problematical, as it appears that a line of such high insulation is little injured by lightning strokes. In fact, the 110,000-volt Grand Rapids line gives less trouble than many others of much lower potential in the system, and, although afforded no lightning protection, has operated through the most severe storms without interruption. Some kind of switching apparatus will be required for handling the 135,000-volt energy at the substations, but the design of this apparatus has not been settled upon. It is understood that the large manufacurers stand ready, however, to offer switching appliances for handling this extreme voltage.

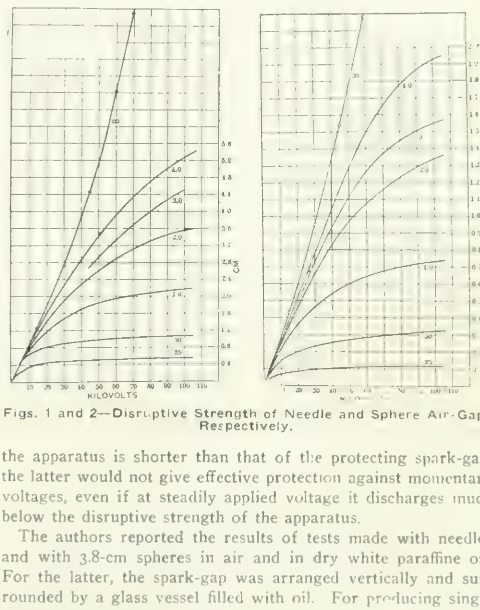
The Cook Falls development and 110,000-volt transmission line is being built by a syndicate headed by interests identified with the Commonwealth Power Company, of Jackson, Mich. Mr. J. B. Foote is electrical engineer for the undertaking. It is especially significant that under the same direction the first 60,000-volt line in this country was built, into Grand Rapids, Mich., and afterward raised to 72,000 volts, then the highest operating pressure of any system. The 110,000-volt transmission from Croton Dam to Grand Rapids, another of Mr. Foote's achievements, was also designed and put into operation almost two years before any of the present plants operating under this pressure.

A. I. E. E. PAPERS AND DISCUSSIONS

In last week's issue were printed abstracts of some of the papers read at the recent annual convention of the A. I. E. E. at Jefferson, N. H., together with summaries of the discussions. The remainder of the papers and the discussions thereon are abstracted below.

DISRUPTION STRENGTH WITH TRANSIENT VOLTAGES.

In a paper by Messrs. J. L. R. Hayden and C. P. Steinmetz, of the General Electric Company, much information was given concerning the time-lag of the disruptive discharge following the application of an electromotive force upon air and oil. This phenomenon is of industrial importance in the protection of electric circuits against over voltages of short duration, since a spark-gap of small time-lag may protect the insulation of apparatus against momentary voltages, even if set for a discharge e.m.f. higher than the voltage which the apparatus could withstand when continuously applied, if the time-lag of disruptive strength of the insulation of the apparatus is much greater than that of the protecting spark-gap. On the other hand, if the time-lag of disruptive strength of the insulation of



Figs. 1 and 2—Disruptive Strength of Needle and Sphere Air-Gaps Respectively.

the apparatus is shorter than that of the protecting spark-gap, the latter would not give effective protection against momentary voltages, even if at steadily applied voltage it discharges much below the disruptive strength of the apparatus.

The authors reported the results of tests made with needles and with 3.8-cm spheres in air and in dry white paraffine oil. For the latter, the spark-gap was arranged vertically and surrounded by a glass vessel filled with oil. For producing single high-voltage impulses of very short duration a continuous voltage was impressed upon the primary coil of a high-voltage transformer through a non-inductive resistor. During the rise of the continuous current in the transformer primary, a voltage impulse was induced in the (high-potential) secondary of the transformer. The height of the voltage impulse and its duration were determined by calculations based on the continuous voltage of the supply circuit, and the total resistance of the circuit.

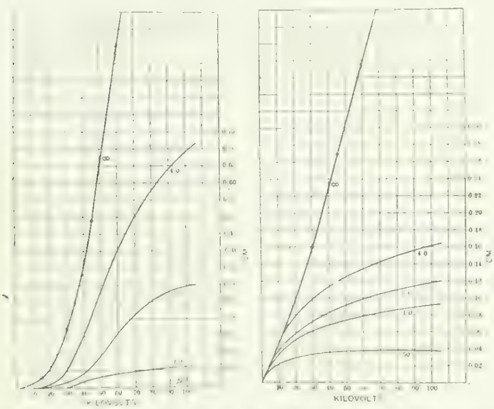
In Figs. 1 and 2 are shown the striking distances with transient voltages between needles and 3.8-cm spheres in air; each curve corresponds to a definite current input into the transformer—that is, to a definite energy value. The energy is the lower the smaller the current and the curve for unlimited energy input, as given by a steadily applied alternating voltage is marked by ∞.

It seems from this that the curves of striking distance with

transient voltages start from the curve of unlimited energy (∞) at low voltages, but drop below this curve the earlier and the more rapidly the smaller is the amount of available energy. All of the curves of constant-energy striking distance seems to approach a finite limit of striking distance at the higher voltages. With transient voltages, the striking distance seems to approach a finite limit with increasing voltage, and this limit is higher the greater is the available energy, which is behind the voltage. For sufficiently high voltage, the striking distance at limited energy becomes independent of the voltage, and is merely a function of the energy back of the voltage. Thus the usual curve of striking distance, derived by tests with unlimited energy, does not apply at all when the voltage lasts so short time that the energy back of the voltage is limited. At transient voltages of very limited energy, the striking distance is a function of the energy, but not of the voltage: it increases with increasing energy, but not with increasing voltage.

Between spheres in air, the effect of limited energy back of the voltage in decreasing the striking distance is similar to that between needle points, but is greater with low values and slightly less with higher values of energy. Thus, when a needle-gap and a sphere-gap are set to discharge at the same alternating voltage, at transient voltage the discharges would pass over the needle-gap if the energy is very small, and usually over the sphere-gap if the energy is large.

With spheres in oil, the behavior at transient voltages is similar as that with spheres in air, as seen from Figs. 3 and 4,



Figs. 3 and 4—Disruptive Strength of Needle and Sphere Oil-Gaps Respectively.

except that the decrease of striking distance with limited energy is very much greater with oil than with air, and at the lower values of energy no discharges at all could be observed—that is, the energy apparently was not sufficient to break down even the smallest oil film. This means that the "time-lag of disruptive strength" of oil is much greater than that of air, and an oil-gap requires a greater amount of energy, for puncture, than does an air-gap set for the same alternating voltage.

Although an air-gap, set for such distance as to protect oil insulation against voltages of unlimited energy, also protects against transient voltages, yet an oil-gap, even if set to discharge at an alternating voltage much lower than that which air insulation would safely withstand, would not protect against transient voltages if of sufficiently limited power.

To some extent similar relations exist between the needle-gap and sphere-gap in air. For low values of energy an air needle-gap would protect a sphere-gap against transient voltages, but not inversely; while for higher values of energy, a sphere-gap would protect a needle-gap against transient voltage, but not inversely. The differences for higher values of transient energy are relatively small compared with those for lower values and in general, therefore, it seems that the needle-gap in air is safer than the sphere-gap in protecting against transient voltages. It follows, therefore, that spark-gap terminals are preferably corrugated or knurled.

From calculations of the energy involved, the authors concluded that an air-gap requires only 3 per cent of the energy required by the same oil-gap to start a discharge; or inversely, that it takes 33 times as much energy to disrupt oil electrostatically as it takes with air. A spark-gap between 3.8-cm spheres in air requires about five times as much energy as does a spark-gap of the same length in air between needle points.

THE ELECTRIC STRENGTH OF AIR.

Prof. J. B. Whitehead, of Johns Hopkins University, presented a paper dealing with the breakdown voltage of air as affected by temperature, moisture and the condition of the conductors. He remarked in opening that as a result of the increase in values of transmission voltage and of improvements in high-voltage apparatus and line insulators, the electric strength of air has become a limiting factor in the long distance transmission of energy.

The author described a method recently developed which permits a determination of the critical intensity or electric strength of air in the neighborhood of round wires to an accuracy within 0.5 per cent. It also permits accurate control of the temperature and moisture content of the air under observation. It makes use of the fact that electrical rupture is invariably accompanied by ionization, and that extremely minute traces of ionization may be detected by the gold-leaf electroscope, one of the most sensitive instruments known.

The wire is stretched along the axis of an outer metallic cylinder, and the voltage is applied between them. Air is drawn from the neighborhood of the wire under investigation and over a suitable discharge terminal connected to the gold-leaf system of the electroscope *G*, Fig. 1. As soon as the ionization accompanying electrical breakdown occurs the electroscope discharges.

Near each end of the outer cylinder is drilled a series of small holes permitting air to be drawn through the cylinder.

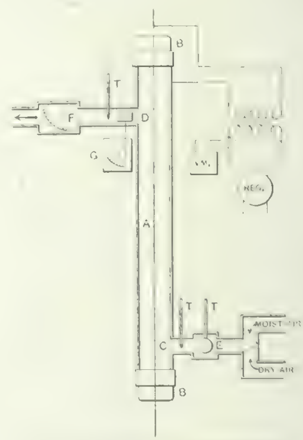


Fig. 1—Arrangement of Apparatus.

The electroscope terminal is placed close to the openings by which the air leaves. The electroscope retains its charge until the critical voltage is reached and then discharges rapidly. A diagram of the apparatus and auxiliaries is shown in Fig. 1. *A* is the wire accurately centered in the outer cylinder; it is supported under tension by dry threads well beyond the ends of the cylinder which are closed by the wood and glass caps *BB*. Air is drawn through the cylinder by an exhaust fan, entering at *C* and leaving at *D;* the velocity of the air is measured at *F*. Any degree of moisture is obtained by bubbling the air through water at various temperatures, and the driest state by drawing through a large column of calcium chloride. The

temperature of the air was controlled by passing it through a large coil of lead pipe immersed in a tank filled with ice or water of any desired temperature.

In taking observations, the electroscope was charged and a slow current of air drawn through the apparatus. With eye on the electroscope leaf the voltage was gradually raised to a value at which the electroscope just began to discharge as detected by the eye, and its rate of leak was then measured. The voltage was increased by small steps, corresponding rates of leak being taken several times for each value. The temperature and pressure were also noted. The time for discharge was found to drop from practically an infinite value to very low values (from two to four seconds) within a very small change of voltage, as shown in Fig. 2.

It was found that the point of initial breakdown was not affected by the velocity of the air through the test cylinder. Concerning the influence of the temperature, it was found that at an atmospheric pressure of 760 mm of mercury there is a drop or rise of 0.22 per cent in the critical voltage for each degree centigrade rise or fall from 21 deg. C.

The author reported observations made on copper, aluminum and steel wires of diameters between 0.089 cm and 0.5 cm centered in tubes 4.9 cm, 6.35 cm and 9.82 cm in internal diameter, and 100 cm in length. The steel wires were taken from rods of tool steel; they were perfectly straight and readily polished and handled without danger of kinks. The copper and aluminium wires were heated by electric current to dull red and at the same time subjected to tension; they were then

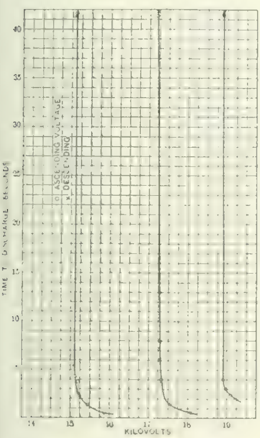


Fig 2—Typical Curves Showing Critical Voltage for Wires 0.205, 0.276 and 0.347 cm in Diameter in 6.35-cm Tube.

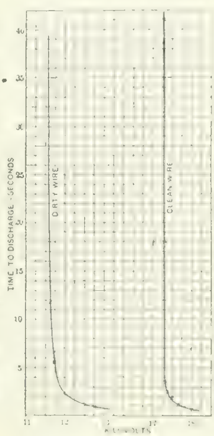


Fig. 3—Discharge Curves—Clean and Dirty Wires 0.276-cm wires in 6.35-cm Tubes.

carefully polished and placed in the outer tube without bending or contact with other objects. The two larger tubes were placed in the vertical position and the wire held under tension in accurately centered insulating bushings on the ends. The air was strained through cotton wool and a cambric screen at the entrance to the tube. On raising the voltage the charged electroscope is unaffected until the critical voltage is reached when a sharply marked rapid rate of leak sets in. Fig. 2 gives curves relating to wires 0.205 cm, 0.276 cm and 0.347 cm in diameter in a 6.35-cm tube. From these it may be seen that at the critical point an increase of 1 per cent in the voltage is sufficient to cause the electroscope to discharge in three or four seconds although it was unaffected at the lower value. With increasing values of voltage, the electroscope discharges still more rapidly, although owing to its sensibility a point is soon reached when the discharge is so rapid that its time cannot be read. The visible corona appears faintly at the beginning of the break in the curve and brightens rapidly with increasing voltage. Since the corona and power loss begin together there is no ionization before power loss sets in. The nature of the power loss has been the subject of much speculation, and the above fact is one leading to the conclusion that a part if not all of the loss is in the process of ionization—that is, the separation of the two opposite charges on the molecules of the gas. The shape of the curve beyond the critical point depends on the air velocity, distance to the electroscope, size of its terminal, etc. A further fact of interest in connection with these curves is that for decreasing voltage the curve is retraced, and ionization or breakdown ceases at the same voltage at which it began. There is thus no apparent aftereffect of foregoing ionization.

Throughout the experiments on clean wires it was found that the least dust, dirt, or other inequality of surface was accompanied by a lowering of the critical voltage. On viewing such a wire through the end of a tube a discharging point could usually be detected. On raising the voltage, other points appear on a dirty wire, and the amount of lowering of critical voltage depends on the size and number of surface irregularities and their location with reference to the electroscope. Thus, for copper wire 0.122 cm in diameter taken from a fairly clean coil and not polished, the drop in critical voltage below that for clean wire was only 1 per cent. On the other hand, when a 0.277-cm polished copper wire, giving a critical surface intensity of 56,500 volts per centimeter, was heated by current until it took on a flaky coat of oxide, its critical intensity was reduced to 37,850, or by 33 per cent. Repeated observations show this point to be very constant and sharply marked. On comparing the discharge curves for clean and dirty wires (see Fig. 3), however, it will be seen that the break in the curve is less sharply marked for the dirty wire and the bend is more gradual. This indicates a lesser supply of ions, but a supply amply sufficient to cause a rapid discharge of the sensitive electroscope. It is thus apparent that the figure 37,850 has no significance, only representing the value at which the first surface irregularities begin to discharge. These discharges represent energy loss, and in sufficient quantity may cause the voltage at which appreciable loss begins to fall far below the value for clean wires.

Basing his conclusion on many experiments, the author stated that moisture in the air has no influence on the surface intensity at which ionization and loss begin. In not a single test was it possible to detect any influence of the moisture content on the critical voltage.

By means of a stroboscopic device, observations were made of the corona effect throughout each portion of a cycle. The tests showed that the corona corresponding to a given voltage will persist on the decreasing side of the wave to a value below that at which it starts on the side of rising voltage. After the intensity drops below the value at which ionization begins the foregoing plentiful ionization is able to preserve luminosity for a certain interval. This interval is extremely short and of the order of magnitude of one or two thousandths of a second. As a result of the stroboscopic tests the author expressed the belief: First, that the edge of the corona marks the limit of ionization or rupture; and second, that the corona has high conductivity, the greater part of the potential difference, and hence loss, occurring beyond its boundary. On this assumption the loss would be due to the forced passage under the electric gradient of molecular ions through the air. It is to be noted, however, that these figures do not indicate that the intensity at the edge of the corona is 40,000 volts per centimeter, the suggested constant electric strength of air, but that it is higher and its value related to the corona diameter in the same way that the critical surface intensity for a solid wire is related to the diameter of the wire.

In speculating as to the nature of the corona, the author remarked that the most conspicuous fact is that the breakdown of the air which is invariably accompanied by a more or less visible corona is attended by copious ionization. The present knowledge of ionization of gases reveals three possible sources of ions or charged particles: (a) the ions may be drawn from

the substance of the wire or terminal itself under the electric intensity; (*b*) the molecule of the gas may be disrupted by a separation of its two component charges by the intensity of electric field in which it finds itself; (*c*) a molecule of a gas may be ionized or separated into its component charges as a result of a collision between itself and another molecule or charged particle.

Regarding the possibility of drawing free charges from the metal of the terminals, there is the experimental evidence that the generation of ions in the neighborhood of wires is independent of the material of the wires and one should expect different figures for different materials if initial ionization started in this way. [illegible] it has been calculated that the electric intensity necessary to draw electrons from metal is of a very much higher value than that at which corona begins. With reference to the second possible source (*b*), it has also been shown that the intensity necessary to separate the component charges of a molecule is higher considerably than the intensity at which corona begins at atmospheric pressure.

There is considerable evidence that the third source of ionization mentioned above—that is, ionization by collision, or secondary ionization as it is called, is that which leads to the starting of corona. There are always a certain number of free electrons or negative charges and of ions of molecular size present in the air at atmospheric pressure. These free charges have their origin in the frequent collisions between molecules and are extremely few in number. A single charge does not have a long independent existence, but when it combines with a molecule of opposite charge its place is taken by other charges, so that the average condition is that of a constant number of free charged particles. These charged particles account for the conductivity of the air which may be observed by sensitive instruments.

DIELECTRIC STRENGTH OF OIL.

Mr. H. W. Tobey, of the General Electric Company, presented a paper outlining some of the more important characteristics of oil having particular reference to dielectric strength. The characteristics were exemplified by means of curves and data obtained from systematic investigations.

The dependence of the disruptive strength of oil upon the shape of the terminals between which it is tested is indicated in Fig. 1. It will be seen that the shapes of terminals which cause the lowest breakdown values are those which allow the greatest concentration of electric stress at both terminals. In other words, the terminal is surrounded by a zone of oil across which the stress is greater than in the next succeeding zone. The oil in the former is strained beyond its strength and breaks down. As soon as this occurs the stress is transferred to the next zone and this breaks, and so on across the entire gap. In actual practice, of course, these ruptures occur in such rapid succession that they are virtually simultaneous.

When the distribution of flux is perfectly uniform, as for example, between large disks placed near together, the average and maximum densities are the same. This no longer holds where the field is distorted, for in this case the stress across one section of the gap, as already indicated, may be very much greater than across the remainder. The distances between terminals may have been exactly the same, yet the second gap will break down at lower voltage because the oil in one section of it was strained beyond its breakdown point.

Concerning the effect of temperature upon the dielectric strength of oil, the author cited the case of a certain test in which a sample withstood an e.m.f. of 52,000 volts between two 0.5-in. brass disks separated by 0.2 in. when the temperature was 60 deg. C., and 45,500 volts at 20 deg. C. and 44,000 volts at zero. Upon congealing, however, as the temperature drops below the freezing point of the oil, the dielectric strength increases with great rapidity, in some cases reaching a value from 60 per cent to 80 per cent higher than that just before the freezing point was passed. In the example just referred to, the dielectric strength rose to approximately 77,000 volts, or an increase above 44,000 of 75 per cent. On heating, the strength drops to the value it had just before freezing, although it is usually necessary to raise the temperature considerably above the freezing point before this occurs. In other words, changes in strength lag behind changes in temperature. Continued heating will finally restore the dielectric strength to its initial value. The curve of Fig. 2 indicates the cycles through which these changes take place. This may be considered typical for one kind of oil. The values for other kinds are quite likely to vary considerably from those shown by this curve, but the manner in which the changes occur are much the same.

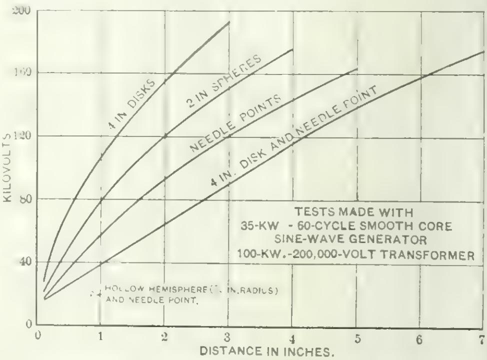


Fig. 1—Disruptive Voltage of Dry Oil Measured Between Variously Shaped Terminals.

Oil, as far as dielectric strength is concerned, is extremely sensitive to moisture, even the slightest amount being detrimental. It is, therefore, of the greatest importance not only to remove every trace before putting the oil into service, but also to maintain this condition of dryness under continued operation.

The accompanying curves, Figs. 3 and 4, emphasize these

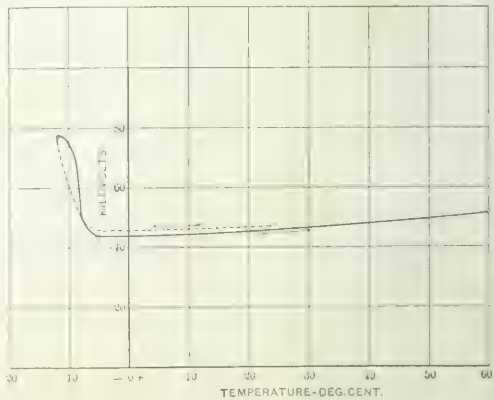


Fig. 2—Effect of Temperature on Dielectric Strength.

facts, indicating, as they do, the reduction in dielectric strength for gradually increasing percentages of moisture. The first was plotted from results of tests on a medium grade and the second from tests on a light grade oil.

It is often difficult to determine how moisture can be taken up by oil contained in apparatus having fairly tight covers, yet this frequently happens, nevertheless. Some of the moisture may settle to the bottom, where it can be gotten rid of by simply drawing off a limited quantity of oil. A certain per-

centage, on the other hand, will be retained and kept in circulation. The percentage which may be safely allowed naturally depends to some extent on the voltage of the apparatus, but that this amount must be extremely small is apparent from the curves just mentioned. Even 0.03 per cent reduces the dielectric strength to three-quarters. (This means only five or six drops of water per quart of oil.) With the addition of 0.01 per cent of moisture, the strength is reduced to one-half.

It is evident from the above that the importance of dry oil cannot be overestimated. The apparatus into which it is to be placed, including the interior surface of the tanks, should be thoroughly dried, and not only should the oil be tested for dielectric strength before it is put into service, but at stated

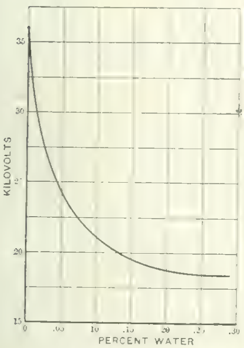


Fig. 3—Influence of Moisture on Dielectric Strength of Oil of Medium Viscosity.

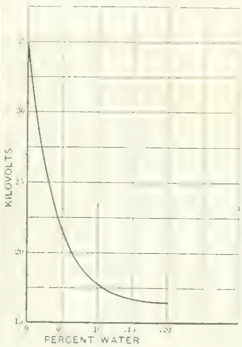


Fig. 4—Influence of Moisture on Dielectric Strength of Light Oil.

periods afterwards as well. Oil found below the desired value should be dried or replaced with new.

Of the various methods which have been used for detecting moisture, the following were mentioned by the author: A quantity of oil may be placed in a tank and allowed to settle for a week or 10 days, at the end of which time a sample may be taken from the bottom with a glass tube, or a thief. If much water is present, the eye will readily detect it. A piece of cold glass plate may be held over a sample and the latter heated to the boiling point of water. Any moisture driven off will be condensed on the plate. Anhydrous copper sulphate is sometimes used, a small quantity being shaken with the oil to be tested. If it contains moisture in any considerable quantity a slightly bluish color will result.

Still another method is to thrust a red-hot nail or piece of wire into a sample of oil. A crackling noise will be heard if moisture is present. If dry, there will simply be a puff of smoke. A similar test can be made by placing a sample of oil in a small porcelain dish, and heating it over a flame. If moisture is present a sharp, crackling noise will result, much the same as with the hot nail or wire just referred to.

Of all the methods which have been used the dielectric strength test is the most satisfactory and reliable. Moreover, it is extremely sensitive so that even the smallest percentage of moisure may be detected. This last method is the only one which can be recommended as being absolutely sure. The one mentioned just before this, that is, heating the oil in a porcelain dish, is the next most reliable, but even this is not certain. The hot-wire method would come in the same class. The other tests mentioned are only of service when large quantities of moisture are present. Otherwise, they are not reliable.

The author discussed various methods for drying and filtering oil, including the use of chemicals, heat and vacuum, heat and air, settling, centrifugal separators, and paper filters. He remarked that of the various chemicals used for dehydrating oil, calcium chloride has given the most satisfactory results, although calcium oxide (unslacked lime) is also used extensively and gives good results. Calcium carbide and metallic sodium, as well as other agents, have been tried with varying degrees of success.

When heat is used for removing moisture it is sometimes applied to the outside of the receptacle containing the oil, and in other cases is introduced by means of steam coils or an electric heater. The last-mentioned arrangement is preferable, and is usually more convenient. In all cases the temperature maintained is about 105 deg., or, in other words, slightly above the boiling point of water. This process at best is slow. It must be watched with great care, and there is always the danger of injuring the oil from overheating. Long-continued overheating will cause a deposit to be thrown down and is also liable to change the nature of the oil by driving off some of the lighter hydrocarbons. The danger of the overheating may be practically overcome by removing the air pressure from the drying receptacle and employing heat as before. The reason for this is that water boils at much lower temperature at vacuum pressure than at ordinary air pressure.

Air rendered perfectly dry by passing it through calcium chloride or other drying agents can advantageously be forced through numerous openings at the bottom of the tank and allowed to bubble up to the surface. The oil in the tank may or may not be heated, although heating naturally facilitates the operation.

The water in oil may be gotten rid of almost entirely by allowing it to stand for some time undisturbed. The water, as well as some of the impurities, gradually settle to the bottom, leaving a dry oil to be drawn off from the top. The process usually requires a number of days and herein lies the greatest difficulty in its use.

The different specific gravities of oil and water make it possible to separate the two by centrifugal action. It is extremely difficult to remove all of the moisture by this means, but it serves a good purpose in taking out a considerable portion of the water when the oil is extremely damp. The remainder, however, may be removed by means of a filter within the upper part of the machine, so that virtually both steps in the process take place at the same time. The operation may be accomplished by a standard cream separator.

A method for removing moisture from oil which has recently been introduced on a large scale consists in passing the oil through ordinary filter paper, which will not allow water to pass. The apparatus employed consists of a press for holding the paper, a pressure pump and an operating motor, together with necessary piping, valves, gages, etc. The most interesting part of the outfit is made up of a number of alternate grids and chambers arranged in such a way that square sheets of blotting paper may be placed between them and the entire device bolted together. By means of suitable channels the oil from the pressure pump is led into the chambers, forced through the blotting paper and finally discharged into the receiving tank. The blotting paper allows the oil to pass, but retains all moisture and impurities, thus raising the dielectric strength to values as high as 60,000 volts to 70,000 volts (measured between 0.5-in. disks placed 0.2 in. apart). With a moderate-sized press 600 gal. of medium grade oil may be treated per hour, and twice this amount of light oil, it merely being necessary to replace the blotting paper occasionally, once every half-hour to an hour is sufficient with oil in fair condition.

The oils now most commonly used for insulating purposes are obtained from crude petroleum by "fractional" distillation this being entirely distinct from the method known as "cracking" distillation, used for obtaining the greatest yield for burn- [illegible] to yield a sweet, unburned residual oil, while distillates of higher boiling points, after being subjected to various other manipulations, become what may be called insulating oils. The process is carried on in such a manner as to preserve the hydrocarbons in their natural form. The characteristics, such as flashing and burning points, viscosity, etc., depend, of course, upon the limits worked to during the process of distillation and

refining. The data in the accompanying table indicate what may be expected from a medium and from a light grade oil:

	Medium	Light
Flashing temperature	180 to 190 deg. C.	130 to 140 deg. C.
Burning temperature	[illegible]	[illegible]
Cold test	−10 to −15	−15 to −20
Specific gravity at 13.5 deg. Cent.	0.865 to 0.870	0.845 to 0.850
Viscosity at 40 deg. Cent (Saybolt test)	100 to 110 sec.	40 to 50 sec
Acid, alkali, sulphur, moisture	None	[illegible]

When free from moisture both have the same dielectric strength (45,000 volts to 50,000 volts, sine wave, between 0.5-in. disks placed 0.2 in apart). The two most noticeable differences are in the fire and viscosity tests. The medium grade has a flashing temperature about 50 deg. above that of the lighter oil and a burning temperature about 60 deg. above. As to viscosity, a given quantity of the medium-grade oil requires about 2.5 times as long to pass through a given orifice as does the light grade, conditions as to temperature, etc., of course, being the same.

It is usually customary for reasons of design to use the medium grade in apparatus, such as self-cooled transformers, in which the temperature of the oil at the top, due to overloads, etc., may reach fairly high values, the lighter grade being employed in apparatus, such as water-cooled transformers, where the temperature may be more readily controlled.

DISCUSSION.

The papers by Messrs. Hayden, Steinmetz, Whitehead and Tobey were presented in succession and discussed together. The discussion was opened by Mr. D. B. Rushmore, who remarked that the limit in transmission e.m.f. around 60,000 volts previously set by the line insulator has been removed by the substitution of the suspension type for the pin-type insulator. At the present time the limit is set by the dielectric strength of the air between the line conductors or the corona loss around the conductors at high voltages. The voltage may be increased without exceeding a specified loss by enlarging the conductors, but there is a limit beyond which the conductors cannot be enlarged. In any event it is of importance to study the laws relating to the formation of corona and the bearing of the surroundings on the loss occasioned by the corona.

Prof. V. Karapetoff, of Cornell University, discussed the analogue to electric stress in dielectrics as found in the mechanical stress in materials and expressed his surprise at the results indicated by the investigation of Mr. Hayden and Dr. Steinmetz, which are contrary to what one would expect from the mechanical analogue. He questioned the accuracy of the estimation made by the authors relative to the e.m.f. applied because the inductance of the testing circuits and the condenser storage effect of the air dielectric had been neglected.

Dr. A. E. Kennelly expressed the opinion that certain of the results obtained by Professor Whitehead on wires of small diameter can be accounted for by assuming a compression of air in the immediate neighborhood of the wire. Such a compression could be attributed to the unequal attraction and repulsion of polarized particles of air in the alternating electrostatic field of non-uniform density surrounding the wire, the non-uniformity being relatively greater with the smaller wires.

Mr. W. H. Pratt said that one should not assume that specially prepared air, such as that used by Professor Whitehead, possesses the same electrical properties as external air such as surrounded the lines tested by Mr. Mershon at Niagara Falls in 1907. Possibly the difference in conductivity of the air in the two cases accounts for the seeming discrepancy in the results reported by Professor Whitehead and Mr. Mershon.

Prof. E. E. F. Creighton, of Schenectady, reported observations with alternating voltage and unidirectional voltage which showed conclusive evidence of a time lag in the electric disruption of air. For example, a steadily applied direct voltage is able to arc across a spark-gap which is not broken down by an alternating voltage of much greater maximum value, the conclusion being that the maximum value is applied for too short a time in each cycle to cause disruption. Tests show that the time-lag when plotted along the x axis with the disruptive voltage along the y axis traces a hyperbole having the equation $x\,(y-23) = 1780$, the y values being in kilovolts and the x values in milliseconds. In regard to the effect of "dirt" in lowering the discharge e.m.f., it is noteworthy that the effect cannot be attributed solely to the roughening of the surface. When the disruptive voltage between two terminals has been decreased by the formation of a coat of oxide on the terminals it may be restored to almost its former value by chemically removing the oxide without altering the degree of roughness of the surfaces.

Mr. C. F. Scott, of Pittsburgh, remarked that the lack of agreement between the results obtained by Professor Whitehead and Mr. Mershon, respectively, points to the necessity of checking the results obtained from laboratory tests before assuming them as being directly applicable in practice. Laboratory tests allow one to determine the laws relating to interconnected phenomena, but the constants must be ascertained under actual operating conditions.

Mr. R. D. Mershon, of New York, outlined the conditions under which the Niagara tests were conducted and expressed the conviction that the results reported were accurate within 10 per cent, the consistency of observations made at various times throughout more than one year was such as to preclude the possibility of inaccuracy in observation as to the effect of moisture upon the atmospheric loss between wires. He questioned the accuracy of the methods used by Messrs. Hayden and Steinmetz in determining both the energy of the discharge and the e.m.f. at discharge.

Dr. Steinmetz explained that the energy values given in the paper relate to the primary circuit of the testing transformer and are greater than the values actually reaching the dielectric. They represent the amounts of energy which will surely break down the dielectric, being somewhat beyond the upper limit in this respect. He claimed that the features of inductance and capacity neglected by him in calculating the e.m.f. are of no great importance and can safely be ignored. He expressed the belief that a thin layer of highly compressed air surrounds a conductor and this must be punctured before break-down occurs. As the voltage is raised a layer of corona forms around the wire, thereby increasing the size of the conductor and altering the electrostatic capacity of the circuit. The corona may be in contact with the wire or may be separated therefrom by an extremely thin layer of compressed air. It is not correct to assume that ionization, the formation of visible corona, the production of measurable loss, etc., occur at the same voltage; it is more than probable that these changes represent definite stages through which the dielectric passes as the e.m.f. is slowly increased in value.

In reply to questions by Messrs. J. C. Lincoln and P. H. Thomas, Professor Whitehead said that so far as he was able to determine the positive and the negative ions were present in equal quantities, there being no evidence of preponderance of one over the other. The test tube was provided with insulating end-caps made of wood and glass, which effectively shielded the inside of the tube from any ions that might have been formed at the abrupt end of the tube. He called attention to the fact that the investigations made by Messrs. Hayden and Seinmetz were not so conducted as to provide conclusive evidence of any time-lag in the disruptive discharge.

In reply to a question by Mr. R. D. Mershon, Mr. Tobey said that the freezing point of transformer oil is at about — 10 deg. C. Below this temperature the oil congeals to a density about equal to that of vaseline at ordinary temperature, and its dielectric strength is even greater than when at higher temperatures, so that nothing is to be feared from the freezing of the oil in transformers.

ROTATIVE ENERGY OF INDUCTION MOTORS.

In a paper entitled "Interactions of Flywheels and Motors when Driving Roll Trains by Induction Motors," Mr. F. G. Gasche gave a mathematical analysis of the energy stored in and the power consumed by induction motors in rolling-mill

service. He attributed to the use of energy-storing flywheels with the induction motor the following advantageous characteristics: (*a*) Providing reservoirs of energy exterior to the power plant in excess of the structural and commercial possibilities of flywheels on the prime movers, or of storage batteries; (*b*) equipment of the roll trains with an independent means of freeing the rolls of the bars, in case the motor becomes suddenly inoperative; (*c*) raising the load-factor on the power plant; (*d*) reduction of size and costs of installation of motors, particularly with variable roll-train loads.

DISCUSSION.

Dr. C. P. Steinmetz remarked that the mechanical problems involved in the supply of energy to roll-trains are similar to the electrical problems in transmission circuits where transient phenomena are encountered. In fact, many of the solutions in the one case are applicable by analogy in the other case.

Mr. C. F. Scott stated that the substitution of the electric motor for steam engines in rolling mills has revolutionized the design of such mills and the methods employed in their operation. Moreover, the use of flywheels with electric motors has enabled rolling mills, which represent the most violently fluctuating loads, to be equipped with gas engines as prime movers, although these engines are of all types of prime movers least adapted to fluctuating loads.

Mr. Gano S. Dunn expressed the opinion that the highest equipment efficiency and the most satisfactory service can be obtained by using very heavy flywheels with low-slip motors rather than lighter flywheels with motors giving a larger range in speed. In either case the flywheel will store and return the desired amount of energy in each operating cycle, but the low-slip motor is more efficient and requires less generating equipment than does the machine of higher slip.

VOLTAGE REGULATION OF TRANSFORMERS.

In a paper by Prof. Adolph Shane, of the Iowa State College, a description was given of a method for directly measuring with considerable accuracy the voltage regulation of a stationary transformer. The method involves the use of two similar transformers, one operated at full load and the other at no load, and a third transformer for assisting in determining the difference in the voltages on the secondary circuits of the other two transformers. The primaries of the three transformers are joined in parallel and the secondaries of the two similar transformers are joined in open parallel, so that the resultant e.m.f. between the free leads is the true impedance voltage of the loaded transformer. The secondary of the third transformer is joined in series opposition with the secondary of the unloaded transformer and the number of its secondary turns is varied until the resultant e.m.f. across the three secondary circuits is a minimum as shown by a galvanometer. Under these conditions the secondary e.m.f. of the third, variable voltage transformer is the regulation voltage of the loaded transformer.

The author described also a method for calculating the regulation on the basis of the data obtained from the secondary e.m.fs. and currents of two similar transformers, one being operated at no load and the other at full load. A voltmeter connected across the free leads of the secondary circuits joined in open parallel shows the true impedance voltage of the loaded transformer, as noted above. The resistance component of this impedance is found by means of a wattmeter, the shunt coil of which is subjected to the impedance e.m.f. and the series coil of which carries the secondary current. The calculations of the regulation are based on the resistance and impedance values in the usual manner. Test data given by the author indicate that the two methods outlined above give results that are thoroughly consistent, although differing from results obtained by the familiar short-circuit testing method.

DISCUSSION.

Mr. E. A. Wagner and Mr. L. T. Robinson questioned the accuracy of the results obtainable with the methods described by Professor Shane, while a written communication from Mr. Fortescue also expressed doubt as to the accuracy

Professor Shane showed that under those conditions which might be assumed as causing the greatest error, the instruments are most sensitive and inaccuracies are least likely to appear in the observations.

VECTOR REPRESENTATIONS IN ALTERNATING-CURRENT PROBLEMS.

Dr. A. E. Kennelly, of Harvard University, presented a paper indicating the limitations under which power in an alternating-current circuit may be treated as a stationary vector; extending the technology of vector alternating-current quantities; combatting the use of the terms "wattless power" and "wattless current" by offering more logical terms as substitutes, and presenting a plea for the standardization of phase rotation in the vectors used in alternating-current theory.

After explaining the different methods that may be employed for representing alternating-current quantities by means of vectors, the author designates as "direct representation" that method which, in the direction of positive rotation, makes a leading current lead and a lagging current lag with respect to its e.m.f., while the opposite method he defined as "inverse representation." In a list of standard publications 42 use the direct representation and 24 the inverse representation.

In discussing the quantity sometimes called the "wattless power," the author said that the direct product of the current by the e.m.f. is commonly called volt-amperes. He claimed that although it may be practically advantageous to call the unit of apparent power the volt-ampere in order to distinguish apparent power from effective power in engineering, yet a volt-ampere is essentially a watt, and the apparent power is correctly stated as apparent or resultant watts, the vector sum of effective and reactive watts. The effective component is the average power delivered to the circuit by the generator, and is usually called the "real power." The reactive power is however, when considered from within the circuit, just as the effective power so that the term "real power" is unsuitable. The reactive power is the maximum cyclic power expended in transmitting energy into and out of the magnetic flux linked with the circuit, being alternately plus and minus, or from and to the generator, in successive quarter cycles of current. This energy is kept in the circuit; whereas the effective power transmits energy out of the circuit. The maximum reactive cyclic power is all internal. The effective power is the average of that delivered externally, is the cyclic average of the instantaneous total internal power, and is also the maximum cyclic value of the externally delivered power.

The author showed that it is readily possible to compute and discuss the power in an alternating-current circuit as a stationary-vector quantity, without reference to the double-frequency or rotative-vector power. He showed also that the energy in a single-frequency alternating-current circuit follows the projection, upon the rail, of a flange-point on a wheel rolling along the rail with uniform angular velocity. The path of the flange-point is an oblate trochoid for reactive circuits, but is a cycloid for a non-reactive circuit. He said that in any alternating-current circuit, or portion of the same, there are four non-rotating vectors, Z, E, P, W to standard current phase, and also four Y, I, P, W, to standard potential-difference phase, all connected by ordinary vector arithmetic, and not involving double-frequency products. He concluded that the algebra of alternating currents may be regarded as the same as the algebra of continuous currents for power as well as for other quantities, so that any formula relating to direct-current circuits is also a formula relating to single-frequency alternating-current circuits, when complex numbers are substituted for real numbers.

DISCUSSION.

The discussion of Dr. Kennelly's paper assumed the form of the presentation of arguments for and against the author's so-called direct representations, Prof. D. C. Jackson and Mr. W. W. Crawford siding with the author and Dr. C. P. Steinmetz, Mr. J. B. Taylor and Mr. L. T. Robinson taking the opposite view. At the suggestion of Mr. Gano S. Dunn it was voted to

refer the matter for consideration to the International Electrotechnical Commission through the channels of the American committee of that commission.

ALTERNATING-CURRENT MEASUREMENTS.

In a paper entitled "Some Recent Developments in Exact Alternating-Current Measurements," Dr. C. H. Sharp and Mr. William W. Crawford, of the Electrical Testing Laboratories, described certain new methods and apparatus which have been designed for rendering alternating-current measurements as accurate as direct-current measurements.

The authors remarked that in precise direct-current work zero methods are used to the exclusion of all others, but in alternating-current measurements zero methods have not been used to so great an extent, largely because of the lack of proper facilities for applying them when using currents of commercial frequencies. The difficulty of applying zero methods to alternating currents lie chiefly in the instrument used as a detector in obtaining a balance. By rectifying the alternating current and passing the rectified current through a direct-current galvanometer used as a zero detector excellent results have recently been obtained. The apparatus developed for this purpose places alternating-current measurements on the same basis as direct-current measurements with respect to the sensibility of the galvanometer. Using the galvanometer as a deflection instrument, such quantities as the drop in a short length of iron rail or in a bond carrying alternating current, the measurement of the leakage and charging current of a few insulators, or of a short length of cable, etc., may be easily measured. The mechanical imperfections of the rectifiers thus far constructed are such that the calibration as a deflection instrument is not accurate, due to the reversal not taking place exactly at the zero of the wave, but when the calibration is made under the conditions of use it will be sufficiently accurate for the class of measurements involved.

The authors described a method of determining the current ratio in a transformer by introducing resistors of low resistances in the primary and secondary circuits and balancing the drops against each other by means of a zero detector, has been tried by various experimenters. The ratio of transformation is the inverse ratio of the resistances. Due to the slight phase difference between the two currents there will remain, when the drops are adjusted to equality, a slight voltage, practically 90 deg. in time-phase from the resistance drops. The effect of this voltage is eliminated by introducing a proper "mutual inductance," which adds to the drop in one resistance a small voltage in time-quadrature with it, thus balancing the phase displacement. Tests have shown that the transformation ratio can be determined within 0.1 per cent and the angle of time-phase displacement within a few minutes.

The paper contained descriptions of the resistors and mutual inductors used in measuring transformation ratios. In the mutual inductor use is made of four coils so arranged that the effect of stray fields is small. The coefficient of mutual inductance of the coils is variable at will by changing the overlap of the several coils.

A description is also given of heavy-current resistors to be used as non-inductive shunts for current-measuring instruments. The terminals of the resistor consists of two heavy copper blocks which lie horizontally on the top of the containing case. A series of bars are silver soldered to the terminal blocks, alternate bars being attached to the positive and negative terminals, respectively. These bars extend directly downward into an oil bath. Each sheet of resistance metal is folded double and its ends attached to two adjacent bars of opposite polarity. By this arrangement each sheet is made non-inductive and any desired number of sheets may be connected in parallel. The resistors are immersed in oil and cooled by a water jacket.

DISCUSSION.

Prof. V. Karapetoff, of Cornell University, outlined the various types of instruments developed for measuring alternating-current quantities and stated that two types are well suited for precision work, namely, the hot wire and the thermo-elecric, both of which can be directly calibrated with direct current and are equally as accurate when measuring alternating as direct current.

Mr. L. T. Robinson, of the General Electric Company, claimed that an electro-dynamometer arranged for use with a separately excited field is equally as accurate for use with alternating current as are the constant-field direct-current instruments of precision.

Mr. W. H. Pratt, of the General Electric Company, called attention to the fact that a very satisfactory non-inductive shunt resistor for measuring heavy alternating currents can be made of a pipe with which the water flowing therein is used as a cooling medium. A non-inductive resistor free from eddy-current effects can be made up of a copper cable in which each strand is individually insulated by a braiding.

Dr. C. P. Steinmetz showed that by means of two constantly excited mercury-arc rectifiers one can obtain direct current from an alternating-current source for use in delicate testing instruments.

Central Station
Management, Policies and Commercial Methods

ELECTRIC VEHICLE PROMOTION AT DENVER, COL.

During the St. Louis N. E. L. A. convention, Mr. Frank W. Frueauff, general manager of the Denver Gas & Electric Company, decided that it might be advisable and profitable for that company to inaugurate in connection with its commercial work a new department for promoting the sale of electric vehicles and trucks in Denver. Dr. M. Ekstromer, of Cambridge, Mass., was employed and is now in Denver actively promoting this work. The company does not intend to handle electric vehicles. Dr. Ekstromer's work will be to advise and assist automobile dealers, garage owners, and possible purchasers and users. He is at the present time visiting all the automobile dealers and garage owners, tendering his services to them in an endeavor to assist their salesmen in selling electric vehicles, and doing all in his power to help consummate sales. He is also following up the Denver Gas & Electric Company's many consumers who have electric vehicles and who own private garages, offering them assistance whenever they are in need of technical aid. After this department had been in operation for a month, the company found a large need for the work undertaken, and Mr. C. N. Stannard, secretary and commercial manager, believes from present indications that it has inaugurated a very profitable department. Dr. Ekstromer's arrival in the city was duly heralded with a portrait and interview in one of the Denver papers. In this interview Dr. Ekstromer states that he knows of a large dry goods house in Denver whose deliveries last year cost $48,000. This house will replace its present method of transportation with electrically operated vehicles, which means 30 per cent cut in this portion of its expenditures.

The Denver Gas & Electric Company is also seriously considering the organization of a refrigeration department to to work along similar lines.

A "PROSPECT" BOOK FOR THE CONTRACTORS.

Enterprising electrical contractors are frequently the central-station's company's best solicitors. Through the energies and

efforts of these constructive men, the electric company frequently obtains much valuable business. The company can in part reciprocate these favors, earning the co-operation of the contractors, as one wide-awake central-station in the Middle West does, by maintaining in its office a "prospect" book containing the name and address and character of job proposed of every probable customer or inquirer who calls at the company's office to discuss electric service. This book is kept open to all the contractors, and the information it contains is common property. A contractor's impetus frequently assists in hastening a slow connection, and the scheme is especially valuable to the electric company in getting the contractors to visit its office at frequent intervals and keep in touch with its efforts to install electric service.

RE-POWERING MACHINE TOOLS.

One of the greatest advantages of the electric drive is the facility with which the power requirements of different tools and machine combinations can be tested from time to time for the purpose of securing the most positive and efficient operation of the plant. By means of a few electrical measurements data may readily be secured to determine the power necessary to operate the machine. In the following paragraphs are given the results of a number of tests of this kind in a large foundry, with the changes determined by simple voltmeter and ammeter readings. The data illustrates the need of going over machine-tool installations from time to time to find out whether the conditions of power supply and utilization require a readjustment of the motors in relation to the tools, a substitution of group for individual driving, or vice versa.

All motors in service were of the direct-current type, wound for 500 volts, and were replaced by 550-volt, three-phase motors.

One 30-hp motor, running at 650 r.p.m., driving a line shaft and three rattlers, light took 2.2 kw; driving one rattler loaded it took 3.5 kw. The motor was replaced by a 7.5-hp motor running at 1200 r.p.m.

One 7-hp motor, running at 950 r.p.m., driving a suction fan for rattlers, with usual load, took 2.86 kw. The motor was replaced by a 5-hp motor running at 1800 r.p.m.

One 3-hp motor, rated speed 1700 r.p.m., driving a sand conveyor when running unloaded took 0.9 kw. A 3-hp, alternating-current motor, running at 1800 r.p.m., was substituted for this motor.

One 2.5-hp motor, rated speed 1620 r.p.m., driving a double grinder, with grinder idle took 0.68 kw, with the motor driving grinders, two men grinding light castings, it took from 1.1 kw to 1.8 kw. A 2-hp, 1800-r.p.m. motor was substituted.

One 2-hp motor, running at 1280 r.p.m., driving a 36-in. exhaust fan, removing gases from the core room and ovens, with normal load, took 1.8 kw. It was replaced by a 3-hp motor running at 1800 r.p.m.

One 5-hp, 1200-r.p.m. motor, driving a sand mixer, when running light took 0.92 kw; and when running loaded it took 1.84 kw. This motor was replaced by a 4-hp, 1200-r.p.m., alternating-current motor.

One 2.5-hp, 1700-r.p.m. motor, driving a rattler, when running light took 2.2 kw. A 3-hp, 1800-r.p.m. motor was substituted for this motor.

One 40-hp, six-pole motor, rated at 975 r.p.m. light and 840 r.p.m. loaded, driving a Root blower, one hour after starting took .26 kw. A 35-hp, 900-r.p.m. motor was substituted for this motor.

One 2.5, 1800-r.p.m. motor, driving a 36-in. band-saw, a 14-in. bench-saw and a 7-in. lathe showed the following conditions: Motor driving shaft light took 0.66 kw; motor driving band-saw, 2-in. pine stock, took 1.1 kw; motor driving band-saw, with 2-in. plank on bench saw, took 3.3 kw. This load was so excessive that motor speed was reduced to 70 per cent of normal speed. The motor was replaced by a 5-hp, 1800-r.p.m. motor.

One 2-hp, 2000-r.p.m. motor was connected to a 3-in. x 24-in. planer. This motor was unable to plane wide stock at desired speed. It was replaced by a 5-hp, 1800-r.p.m. motor.

A SILENT FLATIRON CAMPAIGN.

By William H. Stuart.

A silent flatiron campaign has recently been started in Jersey City, N. J., and has so far proven much more of a success than any other method heretofore used. Jersey City for a city of its size has always been a peculiar field of central-station endeavor and is not as a rule responsive to the general run of selling campaigns, no matter what the article or product may be.

About a month ago the Public Service Corporation launched what they call a "silent" flatiron campaign, and of every 100 irons put out, but four or five were returned. The method of conducting the campaign was very simple. A list of residential consumers was compiled from the consumers' ledgers and carefully gone over so as to get a list that would prove as fertile for the sale of irons as possible. To each name on this list there was sent a flatiron in a sealed package, prepaid, by express. In the package a letter was enclosed which stated briefly the fact that the iron was sent out for approval and use and that an employee of the company would call and demonstrate the iron in a day or so. As full and complete directions as to the actual use of the iron were enclosed in the package, the call of the demonstrator was more to learn from a personal interview the exact feeling toward the iron than to demonstrate; yet a demonstration was given in every case and a number of "wrinkles" displayed that easily proved the iron's worth over the old-style flatiron. If there was any doubt as to whether the iron was to be purchased or not expressed by the consumer, the iron was left for a free trial for a period of 30 days, at the end of which time it was to be returned or charged to the consumer. As has been stated above but a very small percentage of the irons were returned, and this method has certainly proved a success in this territory.

An official of the company in speaking of this campaign said: "The main idea of this campaign in sending the flatiron in a sealed package prepaid by express was to get the iron in the house. We have our doubts as to whether a demonstrator going from one consumer to another with an iron in hand would gain admittance and be granted an interview in many houses; then, again, a demonstration given in our showrooms would be a big gamble in so far as the actual sale of irons was concerned. In this case we succeeded in actually getting the iron in the house and also in attracting to it particular attention. The way was paved for the demonstrator and in a great measure half the work was accomplished and the sale practically closed. Of course there were a few things about the iron that the demonstrator showed which helped to establish the iron in the good graces of the household. We think from the results obtained so far that this scheme has been a big success in Jersey City, and the fact that but four or five irons out of every 100 were returned proves so. We may in the future attempt to put in operation a similar scheme to secure the sale of other appliances and we expect in a great measure something like the success obtained with the irons."

Wiring and Illumination

HOUSE WIRING AT $2 PER ROOM.

The average non-consumer of electricity needs to have his mind disabused of the notion that electric wiring or electric service is so outrageously expensive as to be the luxury of the rich rather than a necessity and convenience for all classes. Perhaps he has gotten into his head some vague notion from somewhere that the electric wiring for any ordinary house, even of the simplest construction, costs $100 or more. With this uncomfortable idea firmly fixed, he is, of course, an unresponsive subject to the emulation of his neighbors who use electricity.

The best way to correct the impressions of those good folk who are yet too conservative to use electricity or install service

is by showing them some simple concrete figure, so low as to be impressive, which they can apply to the case of their own houses.

The Marion Light & Heating Company, of Marion, Ind., after securing the co-operation of local contractors, recently blazoned forth in signs and advertisement the good news that during June only any contractor in Marion would wire any house, at $2 per room, furnishing cord drop and socket in each.

Seventy per cent of the houses are already wired in this middle-aged Indiana town of 20,000, but the proposal had the effect of stampeding those balancing on the fence, and more than 40 new houses were wired this month compared with any preceding period.

RESIDENCE LIGHTING.

In a paper read by Mr. H. J. Gille before the St. Louis convention of the National Electric Light Association it was stated that the development of residence lighting presents many interesting problems that are materially different from those of commercial lighting. Convenience and economy depend largely upon the proper location of switches. It is, therefore, important that the wiring be properly laid out before the work is done. The outlets, the style of fixture, the kind and size of lamps are all more or less controlled by decorations and furnishings. In the past, when combustible illuminants were used, it was necessary to place these far enough from the ceiling to avoid danger from fire and damage to decorations. This has been entirely changed through the introduction of electric lamps, especially since the introduction of high-efficiency units and artistic fixtures for their use.

It should be recognized that there are many considerations outside of the immediate field are factors in residence installation. Interior decoration should be the consistent relationship between light, color, form, proportion and dimension. In music it is an established fact that certain notes used in pleasing combination produce sounds called harmony; unless the right notes are struck our sensibilities are jarred. In the use of light and color the same immutable law applies. No more delightful harmony of color can be imagined than that provided by nature; it starts in with the brown of the earth and runs into several shades of green, and from that touches upon yellow and from yellow to orange, from orange to red, and red to violet, and from violet to the blue of the sky. Learned scientific men have put forth remarkable statements concerning the physiological influence of color. An eminent London physician spoke highly of the beneficial effect upon the nerves and the eye of soft-toned greens; vivid yellow produces exhilaration and confidence; violet tones have a tendency to depress: softened or broken white is quieting to the brain of the busy man; quiet tones in the sleeping-room are soothing and delightful. The effect upon the brain where a color treatment has been carried out not consonant with the personality of the occupant is more serious than is generally realized, as it extends to the entire system. The constant dropping of water wearing a stone illustrates this action of color upon the nerves of the brain. The constant presence of irritating color is so real as to produce physical distress, and medical aid is often called in when what is really needed is a change of wall paper.

In many houses the walls are left white for a year or more until the new plaster settles. In this condition a small unit of light is sufficient; but when the decorator completes his work, adding fabrics and wall-paper which absorb and diminish the light, the consumer does not always comprehend why his lighting bills increase, being unaware that the cause is his taste for dark-colored furnishings. These facts must be understood to be remedied, and it remains for the illuminating engineer to learn by experiment the value of light as it affects or influences color, as well as the value of color as it affects light, in order to determine the amount of light required to produce the best results.

The development of residence lighting, therefore, depends not on the economic question only, but upon the character of the light, its color influence and the structural character of its introduction. Any plan to develop residence lighting must include the co-operation of architect, contractor, fixture dealer and decorator. They are important agents in the proper installation and arrangement of the electrical equipment, and are in a position to assist materially in bringing to the attention of the public the value of electric service in the home.

The public uses electric service, not from compulsion, but from choice. The desire for it may in a general way exist, but through some misunderstanding, fear of danger, high cost of energy, cost of installation, lack of information regarding proper methods of wiring or use of the energy, or numerous other reasons, the choice may be delayed. It is, therefore, necessary to prosecute a vigorous campaign of well-planned publicity in addition to energetic and enthusiastic personal solicitation to correct erroneous impressions and properly place the true merit of electric lighting service before the public.

HOME-MADE CHANDELIER HOOK AND LOOPS.

By E. B. WATSON.

Chandelier loops and hooks are often used in connection with conduit wiring installations. Examples of their application are shown in Figs. 1 and 2. Fig. 1 represents an arc lamp

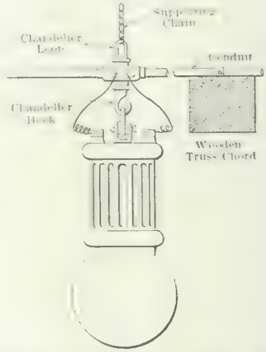


Fig. 1—Chandelier Loop and Hook Supporting Arc Lamp

suspended at the middle of a bay, in a building of wooden mill construction, by a chandelier loop and hook. From the loop a chain is carried to the roof above and secured in a screw-eye turning into the roof timbers. Through this arrangement the stress, due to the weight of the lamp, is taken

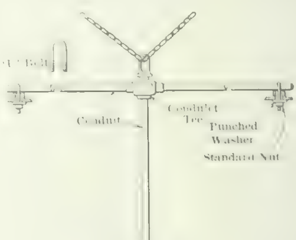


Fig. 2—Tungsten Fixture Supported by Chandelier Loop.

almost wholly by the chain and there is practically no tendency for the conduit to break, in the threads, where it turns into the condulet tee. If a chain or some auxiliary support is not used ½-in. conduit will not support, without excessive deflection, an arc lamp at the center of a 20-ft. bay. The lamp hangs on a chandelier hook turned into the bottom outlet of the condulet.

Fig. 2 illustrates a method, often utilized, for supporting a

tungsten lamp fixture at some point between trusses. The example is taken from an installation in a steel factory building. The main conduit is clamped, with U-bolts, against the upper edges of the two angles forming the bottom chords of the roof trusses. Two chains are necessary here. Each chain is made fast, at its upper end, to one of the truss members near the roof. It would not be practicable to use only one vertical chain, because the roof is a concrete slab to which attachment would be difficult. It is cheaper and better to use two chains than to drill and plug the concrete roof in order to effect an attachment.

In both of the cases cited (Figs. 1 and 2) the chandelier loop is of the ordinary commercial pattern, which can usually be obtained at any plumbing or electrical supply house. It will be usually cheaper to buy chandelier loops and hooks ready made than to make them. If it is not practicable to buy them, or if some are needed immediately and there is not enough time to send to the dealer, they may be made as suggested in Figs. 3 and 4.

In the method shown in Fig. 3 an ordinary commercial pipe-cap is drilled and tapped, and a piece of wrought-iron rod, say

Fig. 3—Chandelier Loop Made from Pipe Cap.

Fig. 4—Chandelier Loop Made From Pipe Plug.

of a diameter of ¼ in., is threaded on one end and has a ring formed at its other end. Whether the ring is left open or closed depends on whether the resulting appliance is to be a loop or a hook. The threaded end of the loop or hook is turned into the hole tapped in the cap and the device is complete. To prevent any possibility of the loop turning out of the hole it is a good plan to "bead-over" its end on the inside of the pipe cap. The wrought-iron rod shown in Fig. 3 is so bent as to form a hook rather than a loop.

A "home-made" loop is illustrated in Fig. 4. In this, a pipe plug, a readily obtainable fitting, is drilled and tapped to receive the threaded end of the loop. The construction outlined in Fig. 3 is neater than that of Fig. 4, but usually either is installed where it cannot be seen, so appearance is of little consequence. The plug-loop (Fig. 4) can be turned directly into a condulet fitting while an additional nipple is required where the cap-loop (Fig. 3) is used. Because of this the plug construction is usually preferred.

NEW TELEPHONE PATENTS.

TRANSMISSION CIRCUIT.

While the attenuation of telephone currents in their passage through a telephone line has been recognized in a general way for a long time, it is only within the last few years that there has been any real understanding of what takes place in a line. This knowledge has naturally led to a considerable number of suggestions and plans for improving transmission by doing away with the line wastes.

Messrs. W. F. Gradolph, of St. Louis, and W. C. Hahne, of Chicago, have looked upon these wastes largely as wattless currents expending themselves as I^2R losses, and they have conceived the idea that if the currents in the two limbs of a line can be kept equal and opposite in their instantaneous values then there will exist no reactance either of inductance or capacity between the conductors and, therefore, no reaction or wattless currents.

To approximate this result, they have arranged a circuit at the transmitting end with a split induction coil. One end of the coil is connected to one limb of the line and the other coil terminal is connected to an impedance coil, which in turn is connected to the second line limb. Thus far we have a single-phase system. To overcome this a third wire is connected to the middle point of the induction coil which is made of a length at least as great as one wave length of the telephone currents. This third wire is associated with the line limb opposite from the impedance coil.

It is claimed that the result is a phase distortion, the currents in one line limb being retarded and those of the other advanced. The receiving coils having inductance serve to bring back the currents toward conjunction. It is, of course, recognized by the inventors that opposition cannot be attained, but they contend that an advantage of transmission is gained which increases with the approach to opposition of phases in the line and with the approach toward conjunction in the receiving coil. The inventors show a complete system with automatic means for converting a station from a receiving to a transmitting station.

LETTERS TO THE EDITOR.

Electrical Shows.

To the Editor of Electrical World:

SIR:—The article on page 1692 of the issue of June 30, under the heading of "Electrical Shows," which contains figures relating to the recent Electrical Show in St. Louis, and states that 60 per cent of the payments for floor space by the exhibitors was rebated to them at the end of the Show, has just come to my attention.

The article is very misleading in that it does not point out the unusual circumstances which made possible this very large return to the exhibitors. The receipts—$12,301.25—are very carefully itemized, while the disbursements—$7,033.25—are not shown in detail, giving the impression that this latter amount included all items of expense incidental to this electrical show.

I am informed upon good authority that the St. Louis Electrical Show paid absolutely nothing for its booths and decorations. All of this material, used by the exhibitors at the last convention of the National Electric Light Association, was allowed to remain without cost to the Electrical Show. The amount paid for rent, I understand, was nominal and included the services of those connected with the Coliseum. Current was supplied to exhibitors to a liberal extent without charge, through the courtesy of the Union Electric Light & Power Company; and as the Show was administered under the auspices of the League of Electrical Interests, salary expenses were entirely eliminated. Considering the absence of these items of expense and possibly others, it would not seem that the Show referred to is a fair example for comparison.

We trust that it will be possible for you to publish a more detailed statement of the expenses incidental to the Show referred to in your article, that any false impressions deducted therefrom may be corrected.

New York. GEO. F. PARKER,
General Manager New York Electrical Show.

[The figures showing in detail the expenses of the St. Louis Show are not available for publication. We believe, however, that our correspondent is correct in his surmise that the total disbursement reported is much less than would be incident to a similar enterprise which has to bear in full every expense entailed in equipment and conduct. In New York City, for example, the item of rent for the annual Electrical Show is alone much greater than the total disbursement at St. Louis. [ED.]

Illumination from Window Light.

To the Editor of Electrical World:

SIR:—In your issue of June 30, page 1722, Mr. Joseph Thompson recommends the more general use of calculations of the illumination produced in a room by the light from such a surface source as a window. In this I agree with him. The reason why it is not done more frequently is presumably be-

cause such calculations are not generally understood, as very little, if any, useful information about them is found in text-books, and probably few illuminating engineers could say offhand how to make calculations of the candle-power, flux and illumination when the source is the sky, clouds or buildings outside of a window.

Mr. Thompson gives the rule that the illumination at any point in a room lit by a window "depends solely upon" or "varies exclusively with the product of" the "surface brilliancy of the window and the solid angle subtended by the window when viewed from that point," which he claims would "render unnecessary the many involved equations based on 'inverse squares' . . . always resorted to at present . . ."

Anyone attempting to make this calculation from his statement will not get far and will also find that Mr. Thompson is mistaken in believing this gets rid of the "inverse square" factor, for it merely transfers it to the calculation of the solid angle.

Moreover, his statement of that law is of the so-called "bobtail" kind of solutions so common in books on physics—that is, it is just short of being of use in practice because it fails to state what the numerical units are and merely describes how the illumination "varies," but not what it really is equal to numerically. It is, therefore, of little or no use to the practical man who wants actual results. The term "surface brilliancy" is, in my opinion, an unfortunate and very indefinite one, especially when the units in terms of which it is expressed are omitted. Nor does Mr. Thompson call attention to the fact that the inaccuracies in this law become quite great for points near the window.

The numerical solution is as follows: Let it be found by measurement that each square foot of the window illuminates a point on a line perpendicular to it, just as much as *n* candles would if they replaced that square foot; this is readily measured with a photometer or an illuminometer. This figure takes the place of his "surface brilliancy." Multiply this by the number of square feet of the window. Then on any plane sufficiently far distant and parallel to the window the illumination in foot-candles will be equal to that product divided by the square of the distance in feet. Or, to use the method advocated by Mr. Thompson, multiply this *n* by the solid angle; but as this solid angle is the window area in square feet divided by the square of the distance from the illuminated plane to the window in feet, it will be seen that the numerical calculation is exactly the same and that nothing is gained. On the contrary, as the calculations of solid angles are not so generally understood as the inverse square law, the first method is, in my opinion, the one to be preferred.

It may be of interest to add here that the light flux passing through each square foot of such a window when expressed in spherical candle units of flux is equal numerically to one-fourth of this *n*, or when expressed in lumens it is equal to 3.14 times *n*. Each square foot of this window is, as a light-giving source, exactly equivalent to 1 sq. ft. of the sky, clouds, buildings, etc., from which the light comes, if that original surface is imagined to take the place of the window.

These and many other results concerning the less usual calculations of light flux, illumination, etc., were fully described in a paper by the writer entitled "Calculating and Comparing Lights from Various Sources," read before the Illuminating Engineering Society Oct. 5, 1908, in which all the results are expressed in such a form and in such units that they may be directly applied in actual cases.

Philadelphia, Pa. CARL HERING.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Single-Phase Alternators.—C. PICHELMAYER.—An English translation of his recent German paper, which has already been noticed in the Digest. Means are described whereby the dangerous pressures, induced in the rotors of single-phase alternators by the inverse rotary field, can be avoided and the factor of safety of working of these machines made equal to that of polyphase machines.—Lond. *Electrician,* June 24.

Lamps and Lighting.

Physical Production of Light.—E. P. HYDE.—The first part of a paper read before the Franklin Institute in which the author considers briefly certain questions in physiological optics which determine the light-giving properties of radiant energy and then discusses the laws of radiation and the radiating properties of metals. Particular attention is given to various new methods for determining selective radiation, and data obtained by these new methods are presented.—*Journal Franklin Inst.,* June.

Metallic Filament.—A note on a recent British patent of R. Jahoda (15,496, 1909; June 16, 1910). Powdered tungsten is mixed with an organic binding agent and a small quantity of powdered copper or silver, or oxides or hydroxides of these metals. After squirting, the filaments are decarbonized at a high temperature in an atmosphere of hydrogen, and, although practically all the carbon is removed, the presence of the copper or silver gives the filaments the required strength, thereby enabling them to be handled with ease. During the sintering treatment the copper or silver is evaporated, thus leaving a pure tungsten filament.—Lond. *Elec. Eng'ing,* June 23.

Sockets for Incandescent Lamps.—M. [illegible].—The first part of an article in which the author states that some commercial lamp sockets are of such a construction that they may lead to accidents. He shows how the design can be improved upon. The article, which is illustrated by diagrams, is to be concluded.—[illegible], June [illegible].

Testing the Vacuum of Incandescent Lamps.—LOUIS TIERSOT.—A description of a method of testing the vacuum of an incandescent lamp by means of high-frequency currents. It is common practice to test the vacuum by placing the lamp in a high-tension alternating field whereby fluorescence effects are obtained within the lamp. This method has the disadvantage that the globe is liable to be perforated by a spark and physiological effects may be produced on the man who holds the lamp. These disadvantages are overcome when high-frequency currents are employed, as they produce no physiological effects and it is possible to choose for the voltage a value so that fluorescence is produced in all cases and the lamp assumes a different color according to its degree of vacuum.—*Revue Polytechn. de Geneve,* May 10; abstracted in *L'Industrie Elec.,* June 25.

Generation, Transmission and Distribution.

Transformation of the Energy of Coal Into Electrical Energy.—E. J. BERG.—The author discusses the magnitude of the losses incidental to the transformation of the energy in coal into electrical energy. He discusses the specific losses of a 1000-kw steam-turbine station and gives the heat balance sheet as follows:

Heat Balance	Thermal Units	Per Cent
Boiler plant loss	4,390,500	20 0
High pressure steam pipe loss.	352,500	1 6
Rotation losses, general.......	204,600	9
Electrical output, genera	3,410,000	15 6
Cooling water loss............	13,489,600	61 1
Heat lost in feed water.......	105,800	[illegible]
Total.	[illegible]	100 0

Notes are added on the relative economy of steam heating from an independent low-pressure steam boiler and from the exhaust of the steam turbine. His calculations emphasize the desirability of heating by means of exhaust steam.—*Gen. Elec. Rev.,* July.

Exhaust-Steam Feed-Water Heater.—An illustrated description of a simple and inexpensive means by which the exhaust steam from auxiliary or other plant can be utilized to heat the feed water, and at the same time there can be recovered the pure water which might otherwise be wasted. To use this form of heater it is necessary merely to place it at the top of the hot-well tank or other reservoir generally used for the storage of feed-water, the top part of which should be closed to prevent radiation. The chief feature of the heater is that, although the exhaust steam is entirely surrounded by water, it is not under water-level at the outlet, so that there is no possibility of creating a back-pressure on the plant from which the exhaust is derived. This is accomplished by changing the form of the water, as it passes through the heater, from a solid bore at the inlet to a hollow "umbrella-shaped" film, having its base at the water-level in the tank. The exhaust steam, on entering the inner casing, is met by a few jets of water, which help to reduce the temperature of the steam, and then passes out of the heater into the space which is made by the water "umbrella." In trying to break through this film, which can be made of any desired thickness, it is completely condensed. The description applies to both types of heater illustrated in Fig. 1. The ordinary type is shown at the left. The automatic type shown at the right provides a means of regulating the water in the tank, when necessary, without interfering with the free discharge of exhaust steam. By removing the cap *A* the spring *B* can readily be adjusted. In most cases when the feed water has been checked the amount of exhaust steam is less than when the former was "full on," so that the whole arrangement with an automatic type of heater would be automatic.—Lond. *Elec. Rev.*, June 24.

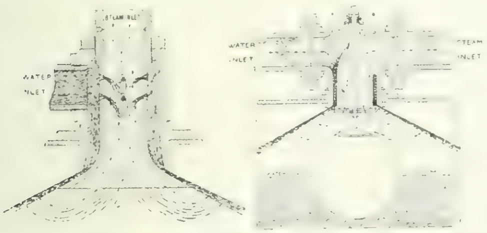


Fig. 1—Ordinary and Automatic Types of Feed-Water Heaters.

Load Regulator for Water-Power Stations.—F. Simmerding.—An illustrated description of the Wolff load-regulating system for water-power stations. The load is kept constant in such a way that the regulator adds load according to the variation of the speed. A centrifugal regulator acts on a lever by means of which the electrodes of a water resistor are more or less raised or lowered in the water so as to change the resistance. This water resistor is within the circuit of the generator driven by the turbine and the effect of the regulating system is that the load of the generator and of the turbine is maintained constant.—*Elek. und Masch.* (Vienna), June 12.

Turbo-Generators.—E. Brunswick.—In a continuation of his long review of the present situation of the design of turbo-generators, the author discusses the design of direct-current generators directly driven by steam turbines, the special difficulties of their design, the relation of cost to speed, etc. The article is to be continued.—*L'Industrie Elec.*, June 25.

Control of Electrically Driven Machine Tools.—A note on a recent British patent (27,026, 1909; June 16, 1910) of A. J. Boult and the Felten & Guilleaume-Lahmeyerwerke. In large high-speed reversing machine tools, such as planing and mortising machines, the driving motor is reversed at the end of the travel by gradually reducing the speed of the motor by means of stops attached to the table of the machine. These stops can work switches to increase the field magnetism of the motor by short-circuiting resistors in the field circuit. The gear is arranged so that the slightest movement in the opposite direction opens all the switches, thereby making the control of the motor when speeding up dependent solely on the starting gear.—Lond. *Elec. Eng'ing*, June 23.

Equalizing the Fluctuations of Load.—A. Reisset.—With reference to a recent review of the different methods of equalizing the fluctuations of load in main-shaft winding in mines and in the electric drive of rolling mills the author describes two new systems of the Brown-Boveri Company.—*La Lumière Elec.*, June 25.

Hydroelectric Stations.—F. Koester.—In a continuation of his serial on hydroelectric practice the author now takes up the discussion of the electrical machinery, generators, switchboard, and general electric-station equipment.—*Eng. Mag.*, July.

Electric Energy Supply in Great Britain.—A statistical table of electric energy supply stations in Great Britain, giving the principal data of equipment, rates, etc., for 118 different stations.—Supplement to Lond. *Electrician*, June 24.

British Central Stations.—A large table giving statistical data on the electric central stations of the United Kingdom. Data are given on the history, equipment, etc., of 457 stations.—Supplement to Lond. *Elec. Review*, June 24.

Traction.

Multiple-Unit Control.—C. Renshaw.—A paper read before the Street Railway Association of the State of New York on recent developments in multiple-unit control and other electric apparatus, especially the application of the acetylene welding process to the manufacture of sheet-steel gear cases, and the application of forced ventilation for railway motors.—*Elec. Rail. Jour.*, July 2.

Brake-Shoe Standardization.—J. A. Panton.—An abstract of a paper read before the Tramways and Light Railways Association at the Dublin Congress. Attention is first called to the large amount of waste in connection with brake-heads and blocks. The author then discusses the properties of the various types of brake blocks, and finally suggests a standard design which, he claims, will show a saving of over 100 per cent in material.—Lond. *Electrician*, June 24.

Electric Propulsion of Ships.—A note on a recent British patent (19,872, 1909; June 16, 1910) of the British Thomson-Houston Company (General Electric Company of this country). High-speed turbo-alternator sets supply three-phase currents to induction motors, the rotors of which are mounted on the propeller shafts. On each shaft is also a low-pressure, low-speed turbine. For high speeds of the ship, the turbines of the generating sets exhaust into the low-pressure turbines, and both these and the motors drive the ship. For cruising speeds, the low-pressure turbines are run in a vacuum or are disconnected from the shaft, and the ship is driven by the motors only, the turbo sets exhausting directly into the condensers. Arrangements for pole-changing the motor windings permit of speed variation.—Lond. *Elec. Eng'ing*, June 23.

Installations, Systems and Appliances.

Calculating the Cost of Electric Energy.—W. Wunder.—A paper read before the Association of German Electricity Stations in Nurnberg. The author compares two methods of calculating the cost of electric energy. The common feature of both methods is that the expenses are divided into two classes, namely, first, those which are proportional to the kw-hours (direct cost, variable cost), and second, the costs which increase with the maximum load in kilowatts (indirect cost, fixed cost). The two methods discussed differ in so far as in the first method the items of management, interest, amortization, etc., are taken from the books to calculate the indirect cost and the items of cost of materials of operation, wages, and maintenance, are also taken from the books and summed up to give the direct cost. In the second method, that of Wright, the separation into fixed and variable costs is made by an empirical method. The second method is employed by the Upper Silesia Electricity Works and has proven very successful. The author claims that the second method is more accurate. A plant which calculates the cost according to the first method is liable to sell energy to offices at too low a cost and will not be able, on the other hand, to reach the very large consumers. As to the tariff the author thinks that for residence

lighting the greatest profit can be obtained if the price of energy is taken so low that even the residence of the less well-to-do people can be served. It is recommended to supply groups of consumers at unit rates and to sell energy to large consumers according to the Wright maximum-demand system with switches which disconnect the consumer at certain hours. For small industrial consumers a double tariff is recommended. —*Elek. Zeit.*, June 23.

Central-Station Economy.—An account of a discussion at the recent meeting of the (British) Municipal Electrical Association, on the advantages of continuous records of costs and of steam consumption. It was opened by G. Silkinson, who insisted particularly on the undesirability of feeding into the economizers at too high a temperature and explained that he obtained greater efficiency by returning the condensed water from the steam traps, etc., directly to the boiler instead of taking it to the feed tank. Shawfield, who followed, gave an instance to show the practical value of continuous tests. He was not in favor of returning the condensed water directly to the boiler, as he preferred to measure it, and thus obtain an indication as to defects in the lagging or arrangement of the steam pipes. He had, however, not had good experience with CO_2 recorders. Ayton, Wordingham and Ruddle all thought that there is danger of the taking of records in stations being overdone. Ayton's experience with CO_2 recorders coincided with that of Shawfield, and he explained the probable cause of the trouble and the remedy he is trying. He also described the methods he uses to prevent air leakages into the furnaces and flues, a point which had also been raised by Wilkinson. Newington described some tests he had made on the moisture in coal; Lea related some interesting experiences which had led him to evolve his water recorder, and complained that plant running is not taught at engineering colleges; and, finally, Rowland expressed a high opinion of the CO_2 recorder, which instrument, he said, has led to economies at Stretford.—Lond. *Elec. Eng'ing*, June 23.

Trient.—E. Rudolph.—The first part of a paper read before the Electrical Society in Vienna on the electricity works of the city of Trient in Austria. The first station was opened in 1890, the Fersina water-power being utilized. There were six 140-hp, 550-volt, direct-current generators supplying energy to a 4 x 115-volt 5-wire lighting system of 5500 incandescent lamps. When the load increased, a 150-hp, steam-driven, direct-current generator was installed as reserve in the municipal gas plant. Later on the network was modified in so far as the outers of the five-wire system with an e.m.f. of 500 volts were used for motor service, while the three middle wires with 2 x 220 volts were used for the lighting system. As soon as the load further increased an entirely new hydroelectric station was erected at the Sarca River. This was opened last year. It contains three 1500-hp turbines, each driving a 1250-kva, three-phase generator, the e.m.f. being 5250 volts and the frequency 50 cycles. The article is to be continued.—*Elek. und Masch.* (Vienna), June 26.

Determination of Resistance Steps.—E. R. Carichoff and H. Pender.—A mathematical article discussing the following problem. Given the speed-current curve of a motor corresponding to line the voltage; the current at which the controller is to be advanced, and the number of steps in the starting resistor, to find the proper resistances of the resistors such that the current is taken by the motor at the instant of advance of controller from one step to the next shall be the same for each point of the controller. The exact mathematical theory is given and the analytical solution is applied to various special cases.—*Gen. Elec. Rev.*, July.

Switchboard.—F. [illegible].—An illustrated description of the switchboard of the high-tension, three-phase system of the Chorzow station of the Upper Silesia Electricity Works generating three-phase currents at 3 x 6000 volts, the total generating rating being 23,000 kw. The switchboard is of the most modern design. It is in a building separate from the machine house and is subdivided into three stories. Great care has been taken to insure as much as possible its reliability under all conditions of service and the safety of the attendants.—*Elek. Zeit.*, June 23.

Synchronizing Alternators.—J. Teichmueller.—An English translation of his recent German article on the relative sensitiveness of the different methods of lamp connections used in synchronizing alternators.—Lond. *Electrician*, June 24.

Aerial, Underground and Interior Circuits.

Costs of Mains and Services.—An account of the discussion before the (British) Municipal Electrical Association on cheapening the costs of mains and services which was opened by S. J. Watson and Ayton. Some valuable figures were given as to the cost of service connections. In Glasgow they average $21.60, but a few years ago they were actually $35. Some speakers explained why they had been successful in reducing the cost of services. An extended use of looping-in was also advocated, and one suggested that it would be worth while in some cases to lay the services at the same time as the mains.—Lond. *Elec. Eng'ing*, June 23.

Electrophysics and Magnetism.

Magnetostriction.—H. G. Dorsey.—An account of an experimental investigation of magnetostriction in iron-carbon alloys in which the carbon varied from 0.058 per cent to 1.37 per cent, while the amount of phosphorus, silicon, manganese and silver was low and approximately constant. The maximum elongation decreases with the carbon content to 0.9 per cent carbon and then increases. In a somewhat similar manner, but not so definitely, the value of H at which the rods retract to their original length drops to a minimum value at about 0.9 per cent carbon. Up to field strength of about 1600 the rods were still contracting at individual uniform rates. However, for a field strength of 1500 it may be said in a general way that the greater the carbon content the less the retraction. The modulus of elasticity decreases with carbon, or, the amount of shortening in strong fields varies directly as the modulus. Steels slowly cooled have greater elongations and susceptibilities than when quenched. Accidental exceptions are found in soft iron. Magnetostriction depends upon the previous history of the specimen. The percentage elongation in the middle of a 40-cm rod of soft iron is nearly three times as much as for the entire rod. Rods of different lengths of the same quality of iron give different values, and hence absolute values of magnetostriction as determined by different workers are not comparable with each other unless experiments are made with rings or else some method of correction is devised.—*Phys. Rev.*, June.

Luminescence.—C. A. Pierce.—An account of an experimental investigation of the distribution of energy in the luminescence spectrum of sidot blende. The results of the experiments show that the energy curve of the fluorescence light of Sidot blende consists of a band extending from about $\mu = 0.46$ to $\mu = 0.60$, having a maximum at $\mu = 0.55$. There may be another band situated in the region of longer wave lengths. Furthermore, the energy distribution in the fluorescence light and in the phosphorescence light immediately after excitation is the same. Further experiments are now being carried on by the writer to find whether any change in the energy curve takes place during decay, or is brought about by the influence of infra-red rays or by other means.—*Phys. Rev.*, June.

Elementary Quantum of Electricity.—A. E. Haes.—A paper on the new theoretical method for calculating the elementary quantum of electricity and the radius of the hydrogen atom. The former is found to be 3.18×10^{-10} electrostatic units and the latter is 1.88×10^{-8} cm.—*Phys. Zeit.*, June 15.

Inductance of Metal Tube.—F. W. Grover.—An abstract of an American Physical Society paper in which the author gave several more accurate formulas than had heretofore been developed for the inductance of a metal tube bent into the form of a circular ring.—*Phys. Rev.*, June.

Electrochemistry and Batteries.

Refining Bismuth.—F. Foerster and E. Schwabe.—In the electrolytic refining of lead by the Betts process the anode slime contains silver and bismuth. The present authors pro-

pose to subject this silver-bismuth to a further refining process in a silico-fluoride solution of bismuth as electrolyte. Pure bismuth is deposited on the cathode. The lead contained in the anode passes into the electrolyte. The silver remains back at the anode. The bismuth deposited on the cathode is free from lead.—*Zeit. f. Electrochemie,* April 15; abstracted in *Met. and Chem. Eng'ing,* July.

Units, Measurements and Instruments.

Measurement of Magnetic Fluxes.—W. Peukert.—The property of bismuth of changing its electric conductivity in a magnetic field has already been used for measuring magnetic fluxes. The author proposes to utilize another property of bismuth, namely, the Hall phenomenon. The principle is shown in Fig. 2. The current i passes from the battery E through a

Fig. 2—Measurement of Magnetic Fluxes

bismuth plate, *abcd,* the connections of the wire of the bismuth plate being made at the points a and b. Two other points, c and d, are so chosen that when they are connected by a wire to the galvanometer g_1 no current passes through g_1—that is, the two points c and d have the same potential. If, now, the electromagnet NS is excited so that the bismuth plate is within a magnetic field a current passes from c to d through g_1 and the potential difference between c and d is approximately proportional to the current i and the flux H, and inversely proportional to the thickness of the plate. In the experiments of the author a bismuth plate of the dimensions 68 mm x 28 mm x 1 mm was used. Since the thickness is constant the potential difference between c and d should be directly proportional to the magnetic flux H when the current i is kept constant, assuming that the above rule will hold strictly true. In reality, however, the relation between magnetic flux and e.m.f. between c and d differs somewhat from a straight line. The exact error may be determined experimentally and then used in the calibration of the instrument. By changing the current i the calibration curve is not changed, since there is an exact straight-line relation between the primary current i and the e.m.f. between c and d. By changing the current i the scale of the instrument can be widely varied.—*Elek. Zeit.,* June 23.

Surface Bolometer.—E. F. Northrup.—An abstract of a paper read before the American Physical Society on a special type of surface bolometer for total radiation experiments. The apparatus consists essentially of two flat spirals of very fine insulated wire which form two arms of a Wheatstone bridge. The flat spirals used are each 4.5 cm in diameter. They are wound with 2-mil silk-insulated nickel wire and cemented to very thin sheets of mica. These flat-disk spirals are mounted with their faces opposed in a box which replaces a Lummer-Brodhun screen on a photometer bench. When equal radiation from two incandescent lamps falls on the two disks, the Wheatstone bridge is balanced. If one lamp gives more total radiation than the other the balance of the bridge is restored by moving the bolometer along the photometer bench to obtain the balance in precisely the same way as a Lummer-Brodhun is moved to obtain a balance for equal luminosity. Thus the device enables the total radiation to two sources to be compared with great sensitiveness in the same manner as a photometer screen allows the luminous radiation of two sources to be compared. The surface bolometer has the advantages over the thermopile in being more sensitive, in being able to have the sensitiveness adjusted by varying the current through the bridge, in permitting a balance to be obtained (giving a null method) by varying the resistance along a slide wire, and in having an exceedingly small thermal-capacity and time-lag as compared with a thermopile. The instrument may be modified to read radiation in absolute measure and hence become a pyrheliometer. It may be adapted for use as a sensitive and accurate recorder, and gives promise of being adapted for use as a radiation pyrometer.—*Phys. Rev.,* June.

Measuring the Speed of Rotation.—E. B. Brown.—A description of an accurate electrical method of measuring the speeds of rotation by means of a modification of the condenser method. The main feature is the use of a special type of differential galvanometer. By means of a rotating commutator a condenser is alternately charged by a battery and discharged through one coil of a differential galvanometer. The steady deflection which would exist due to the rapid succession of discharges is opposed and prevented by a steady current from the same battery passing through the second coil of the differential galvanometer. This steady current is adjusted by variable resistance in series until the galvanometer is restored to its zero position. The ratio of the steady current to the mean value of the pulsating current will be a constant for the instrument, but the steady current is equal to the potential difference of the battery terminals divided by the total resistance exterior to the battery, while the mean value of the pulsating current is equal to the product of the potential difference of the battery terminals, the capacity of the condenser and the number of discharges per second. If the capacity of the condenser may be regarded as constant, the reciprocal of the total resistance in the steady current circuit must be proportional to the speed of rotation when the galvanometer shows no deflection, the battery potential difference being eliminated. The speed of rotation may then be calculated by dividing a constant by the resistance in circuit. The special feature of the galvanometer employed is the large ratio between the number of turns in the two windings. This enables series resistance of moderate value to be used instead of the very large and expensive resistances which would be necessary with an ordinary differential galvanometer. The connections are shown in Fig. 3, where the two coils of the differential galvanometer are represented by M and C, and the commutator by the arrowheads D and A and E. Of these A, attached to one terminal of the condenser K, alternately makes contact with D and E, thereby charging and discharging the condenser. B is the battery and T the series resistor. If F be connected to H the condenser discharges pass through the coil C, but if F be disconnected from H and connected to L, the charging currents pass through C. Both methods of connection give the same value of the capacity within the limits of errors of observation. The experiments of the author show that, corresponding to every value of the speed, there is a definite value of the series

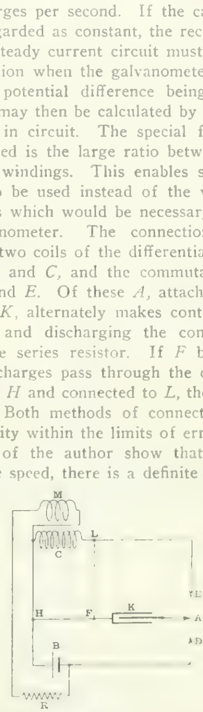


Fig. 3—Diagram of Connections.

resistor which will bring the galvanometer to zero. As far as the adjustment is concerned the value of the battery e.m.f. is immaterial, except that increasing it increases the sensitiveness of the arrangement.—Lond. *Electrician,* June 24.

Measurement of Thermal Conductivity.—J. K. Clement and W. L. Egy.—A method of measuring the thermal conductivity of fireclay in which a known quantity of heat is generated by means of an electric heating circuit in such a manner that all the heat generated must flow through the substance tested. If a constant quantity of heat is generated until conditions have reached an equilibrium then the quantity of heat conducted through the material per second must be equal to the quantity generated per second. This method may be used with a heating coil either in a hollow sphere or in a long cylinder. The latter form was chosen for the tests because of the ex-

perimental difficulties arising in the former. From the electrical measurement of this heat and from temperature measurements by means of thermo-couples the thermal conductivity is determined.—*Met. and Chem. Eng'ing*, July.

Boiler Tests.—C. E. Larard.—A very full discussion of a proper boiler test installation and the economical combustion of fuel. In the concluding instalment various types of pyrometers and recording instruments are described.—Lond. *Engineering*, June 3, 17 and 24.

Induction Coil.—J. K. A. Wertheim-Salomonson.—An account of an experimental and theoretical investigation of the oscillations observed in the oscillographic study of the primary current wave of an induction coil.—*Phys. Zeit.*, June 15.

Telegraphy, Telephony and Signals.

Telephone Disturbances from Earthen Three-Phase Systems. —E. Von Holstein-Rathlou.—At one of the central stations of Copenhagen a large new three-phase cable network, operated at 60,000 volts, was recently opened to supply part of the suburbs with electricity. The station contains two 2500-kw turbo-generators wound for 6000 volts and 50 cycles and two synchronous motor generators each of 250 kw at 6000 volts. The neutral point of one of the large generators was earthed. It was found that considerable disturbances occurred in the telephone lines in the suburbs, and it became necessary to remove the earth connections. The telephone company in Copenhagen uses a double conductor within the center of the town, but in the suburbs operates at present with only one conductor and with the earth as return. The causes of the disturbances were investigated in detail and it was found that currents of considerable magnitude (5 amp) passed through the earthing conductor into the earth. Due to the three capacities between the three phases of the cable with respect to earth currents representing harmonics of triple frequencies and multiples thereof enter into the earth. These pass back through the earth to the earth connection at the generating station and may thus cause trouble.—*Elek. Zeit.*, June 23.

Miscellaneous.

British Municipal Electrical Association.—The annual report of the council shows that the membership of the association now stands at 416, made up as follows: Municipal electrical committees (members), 170; chief electrical engineers (members), 191; honorary members, 3; chief assistants (associate members), 11; assistants (associates), 41. There is an increase of 26 on last year's total. The sub-committee on physical standards of the engineering standards committee, upon which the association is represented, has in hand at the present moment standard specifications for bayonet-socket electric lampholders, and a specification for metal-filament lamps. J. Christie, chief electrical engineer to the Brighton Corporation, is the new president.—Lond. *Electrician* and *Elec. Rev.*, June 24.

Free Trade and Protection.—The speeches made in the recent debate in London on the effects of free trade and protection upon the electrical industry are given in full in Lond. *Elec. Rev.*, May 27 and June 3.

Book Reviews

Exporters' Encyclopaedia, 1910. Complete Export Shipping Guide. New York: Exporters' Encyclopædia Company. 800 pages. Price, $5.

This book is a useful guide for those who ship goods to foreign countries. It contains detailed information on shipping routes, customs regulations, and all special information necessary for all foreign countries. General directions for making foreign shipments are also given. The general information, which includes shipping directions, foreign weight and money conversion tables, postage rates, etc., is followed by a section on specific shipping directions classified under countries, which are arranged alphabetically. The subscription price includes monthly correction sheets, which keep the guide up to date.

Erecting Work. Herbert E. Collins. New York: McGraw-Hill Book Company. 140 pages, 110 illustrations. Price, $1.

The present volume is one of the Power Handbooks and is based upon articles that have appeared in *Power*. The work is intended for millwrights, erecting engineers and others which have to install machinery. The laying of foundations, unloading, handling and erecting of heavy machinery and directions for building home-made hoists, tieing knots and making hitches are among the things treated. The book is exceedingly practical and should be of use to men in small and medium-sized stations where the operatives are occasionally called upon to move heavy machinery and no special appliances for such work, such as overhead cranes, are at hand.

The Electrician Electrical Trades Directory and Handbook. 2 vols. London: The Electrician Printing & Publishing Company, Limited. 2000 pages. 18s. 6d.

The present is the twenty-eighth edition of the "Blue Book," as it is familiarly called. As usual, it contains a record of the year's progress in the electrical industry, the laws and regulations of different countries which are of interest to the electrical industry are brought up to date, and financial details and organization of electrical corporations given. In the directory division is listed practically every person engaged in the electrical business in the United Kingdom. Sections of the directory are devoted to the British Colonies, the Continent of Europe, Asia and Africa, Central and South America, and the United States. In addition to the usual alphabetical and classified trades divisions, there are sections giving particulars of all the chief officials engaged in the electrical, telegraph, railway and works departments of the governments of the world. A biographical section gives sketches of leading men in matters electrical, and obituary notices of those who died during 1909. A tabulated central-station directory for the United Kingdom is printed in a separate pamphlet, which is folded and inserted in a pocket in the directory volume. One of the central-station tables is devoted to Colonial and foreign enterprises.

Universal Electrical Directory, 1910. A complete record of all the industries directly or indirectly connected with electricity and magnetism. London: H. Alabaster, Gatehouse & Company. 1538 pages. Price, 18s.

The present is the twenty-ninth edition of the "Red Book," which is too well known to require more than an announcement. The present edition contains 33,095 selected names, unimportant ones being omitted. These names are divided as follows: Great Britain, 13,192; Colonies, 5400; Continental, 8037, and the United States, 6466. The four sections are arranged both alphabetically and topically. In addition to this the British firms are arranged geographically, this being done this year for the first time. The topical arrangement of the British section is more detailed than in the other sections, and it is to be hoped that this subdivision of topics will be carried still further in the next edition. There are many specialties made nowadays under trade names which are completely lost in a general classification. This directory, in common with all the others, fails more or less when it is desired to look up the manufacturers of some specialty, such as, for instance, a particular brand of insulating material. The topics could with advantage be further subdivided and under the name of the manufacturer any specialties which are generally known under a trade name might be mentioned.

Messungen an Maschinen und Motoren für Wechselstrom. By Fritz Hoppe. Leipzig: Johann Ambrosius Barth. 166 pages, 190 ills. Price, 5.80 marks.

The present volume is No. 9 in the series of electrotechnical text books issued by the same publisher. Like all the books in the series it is written for the practical man and mathematical demonstrations are used as little as possible. Enough of the theory of the machines is given to explain in each case the meaning of the tests which are described. The work is limited

to alternators, synchronous and induction motors, and synchronous converters. Single-phase commutator motors are not treated as they are seldom used except in traction work. The work necessarily contains some mathematics, but most of the explanations are made with the aid of vector diagrams, the Behrend-Heyland diagram being used with the polyphase induction motor.

Auto-Transformer Design. A practical handbook for manufacturers, contractors and wiremen. By Alfred H. Avery. New York: Spon & Chamberlain. 60 pages. 24 ills. Price, $1.50.

Metallic-filament lamps, on account of the comparatively low resistance of the filaments, are well adapted for voltages lower than those commonly used with carbon filaments, and it is often desirable to install low-voltage lamps for use with a small transformer. The present book discusses briefly the lamp problem and gives directions for designing and building a line of auto-transformers of small size for use in connection with metallic-filament lamps.

New Apparatus and Appliances

MAKING HARD RUBBER FOR TELEPHONE PURPOSES.

By F. S. Malm.

The Western Electric Company has found that it is able to save a considerable profit that formerly went to middlemen by making its own hard rubber for telephone purposes and at the same time is enabled to assure its customers as to the quality of this portion of its manufactured product. Para rubber, which the Western Electric Company uses, comes in the form of large biscuits which possess an odor similar to smoked ham, and it has a strength and elasticity which is unapproached by any other grade of rubber. It contains approximately 20 per cent of water, as well as a small amount of dirt and other impurities which must be entirely eliminated before it can be used in hard rubber manufacture. The crude rubber is first softened in hot water, this being done in a large steel tank with a capacity of several tons. The washing equipment consists of washing mills, provided with corrugated rolls, and a water pipe carrying wash water running parallel to the rolls along their whole length. The pipes are perforated and thus allow a constant stream of water to play upon the rubber while it is being passed between the rolls. The time required to wash crude rubber properly will depend upon its condition, as in every instance all contamination of hard rubber with such injurious substances as sand and bark must be removed. After the rubber has been thoroughly washed it is passed between the rolls of a finishing mill where it is rolled down to a thickness of ⅛ in., after which the sheets are dried in a large drying room in which the temperature may be controlled.

Fig. 1—Part of Vulcanizing Room.

Fig. 2—Rubber Inspection Department

Hard or soft rubber can be made by varying the percentage of sulphur, but the proportion 40 per cent of sulphur and 60 per cent of rubber, vulcanized at the proper temperature, will produce the best hard rubber. The combination of sulphur and rubber is brought about mainly by heat, and no vulcanizing action takes place below the melting point of sulphur (238 deg.), and this action proceeds very slowly at temperatures under 250 deg. Fahr. When a piece of rubber is vulcanized properly with sulphur, no evidence of sulphur can be seen in the piece. When hard rubber contains more than 33 per cent of sulphur the balance will remain in the free state.

In making hard rubber at the Western Electric plant, the requisite kinds of rubber and the required percentage of sulphur are weighed out and thoroughly mixed in mills. The resulting mixture is cut from the mills, rolled into convenient sized lots and is taken to the various departments where it is to be made into hard-rubber parts. Hard-rubber sheets are made by warming up on the mill and calendering the rubber to size. Calenders are shown in the background of Fig. 1. The equipment consists of a large calender, which is a machine used for rolling the rubber out into a definite sized sheet. The sheets of rubber are in turn placed in cars and put into large vulcanizers. These vulcanizers are heated by steam, the heat being increased very carefully and gradually. The length of vulcanization depends, of course, upon the size and quality of the sheets to be made. The product of vulcanization now becomes a sheet which is hard and elastic and which possesses a beautifully polished surface. Upon cooling sheets are trimmed, if necessary, and sometimes buffed and polished. As a final operation these sheets are inspected and carefully gaged for size. A view of the inspection department is given in Fig. 2.

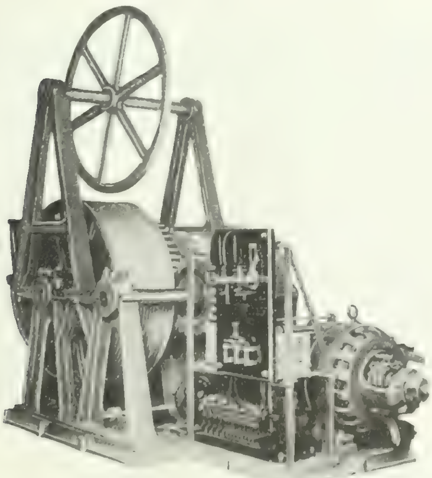
Rods and tubes are made from rubber mixtures on regular tube machines, which consist of a steam-jacketed cylinder in which a forcing screw is revolved, causing the rubber which is fed into the cylinder to be squirted out through a sizing die. After this operation they are vulcanized in similar vulcanizers to those in which sheets are made. The tubes are made similar to rods with the exception that the central hole is formed by

the aid of a pin in the tubing machine. After leaving the tubing machine the tubes are placed on steel rods on which they are vulcanized to obtain a tube with a hole of definite size. The rods and tubes after vulcanizing are finished to size and if necessary buffed and polished. The finishing is done on special polishing and buffing wheels, using different kinds of polishing agents to obtain the desired finish on the various grades of rubber.

Hard-rubber receiver parts are made from rubber mixtures which are milled and calendered as for sheets. These sheets are then cut into blank pieces which are placed into metal dies, pressed into the required shape and vulcanized. The dies in which these parts are vulcanized are placed in a steel form so arranged that a certain number of dies can be heated at the same time. The mixtures of rubber used are, of course, adapted to the particular use to which the parts are put. These dies are held to the most exacting dimensions of the modern tool room, to eliminate the possibilities of any defective workmanship which might result in the making of hard-rubber parts from these. After the parts have been vulcanized they are removed from the dies and put through the finishing operation, which consists in bringing them down to size with the assistance of every possible labor-saving machinery.

AN ALTERNATING-CURRENT ELECTRIC FREIGHT ELEVATOR INSTALLATION.

The accompanying illustration shows the simplicity and compactness of the motor equipment necessary to operate an electric elevator. The cable drum, the controller, and the motor can all be so placed together as to occupy very little space, and the entire plant requires practically no attention. Two of these freight elevators were recently installed at the Charleston Navy Yard by Mr. John B. Adt, Baltimore, Md. Each machine has a lifting capacity of 5000 lb. and weighs 12,000 lb. net. The hoisting machine is of the tandem worm-gear construction. The bronze worm wheels engage each other and right and left worms placed tandem on one shaft in a double housing. As the thrust is absorbed in the right and left worms, thrust bearings are not necessary. The worms are submerged in oil.



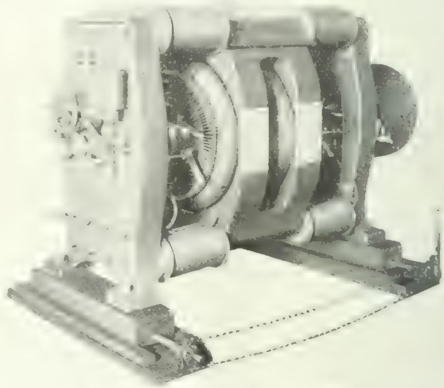
Alternating-Current Motor Equipment for Freight Elevator.

Heavy spur gears transmit the power to the winding drum. An effective brake, quick-acting, with two parallel-moving, leather-lined shoes, is attached to the work shaft. Automatic terminal stop appliances, as well as a slack-cable device, are attached to the front of the worm-gear housing, where they are all readily accessible for adjustment.

A Westinghouse 15-hp reversing induction motor, designed to operate on a three-phase, 220-volt, 60-cycle circuit, is direct-connected to the worm shaft and runs at 860 r.p.m. This type of induction motor is suited for applications where a strong starting effort is needed, and where induction motors of the squirrel-cage type would take so much starting current as seriously to disturb the line voltage. The motor is started by throwing the full-line voltage upon the primary; the speed is then increased by reducing the resistance in series with the secondary. The starting, reversing and acceleration are accomplished through the automatic controller shown in the illustration. The hoist frame, the motor, and the controller are all bolted to a substantial, one-piece bed plate.

MODERN ARC GENERATOR EMBODIES EARLY DESIGN.

One hundred of the new type of magnetite arc lamps being brought out by the Ft. Wayne Electric Works will be added to the present magnetite-arc street lighting of Ft. Wayne, Ind. These lamps are of the 4-amp type, and for supplying them



Modern Generator of Old Design.

with energy it is interesting to note that the Ft. Wayne Electric Works have recently completed the construction of a series-arc generator, all the essential features of which follow a design made in June, 1880, by Mr. J. J. Wood, who also designed the new magnetite lamps. The generator is of the double-circuit type, producing 7500 volts on each side.

ELECTRIC LIGHTING SYSTEM FOR AUTOMOBILES.

The use of electricity in side and tail lamps on practically all new high-priced cars is becoming quite common. Even among lower-priced cars some makers are furnishing electric lamps as standard equipment. Tungsten lamps and the production of

Fig. 1—Parts of Lamp.

suitable batteries made electric lighting a practical proposition. The fact that lamps fitted with Edison base would shake loose in sockets caused much unreliability and annoyance, however. The Willard Storage Battery Company, of Cleveland, Ohio, has given a new impetus to electric lighting by designing a socket in which the lamp does not depend on friction to hold it in

position. This socket requires lamps fitted with Edi-Swan base. The pins on this style of base engage a bayonet catch on the socket, the lamp being firmly locked in place by substantial plungers which also carry energy to the lamp. For headlamps a socket is used which slips into a sleeve at the apex of the parabolic reflector. The socket may be moved forward or

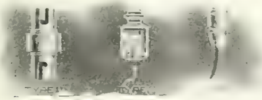


Fig. 2—Socket and Attachment Plug.

backward for adjustment of focus and securely locked in place by means of a compression clamp. In side and tail lamps a double-end socket is placed in a vertical position, one end carrying the lamp and the other engaging an attachment plug also fitted with pins similar to those on the lamp base. Manufacturers of tungsten lamps now make them also with the Edi-Swan base.

METER PROTECTIVE DEVICES.

The Metropolitan Engineering Company, of Brooklyn, N. Y., in an effort to prevent the theft of unmetered energy has

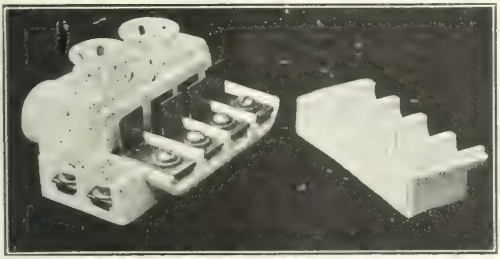


Fig. 1—Two-Wire Sealable Combination Service and Meter Testing Block.

developed a sealable service cut-out equipped with a superior type of approved fuse so constructed that it may be refilled indefinitely at low cost. This service cut-out is used in con-

Fig. 2—Three-Wire Sealable Combination Service and Meter Testing Block.

junction with flexible or rigid metallic conduit and wiring frames adaptable to all types of meters. This makes an excellent tamper-proof service installation. The fuse is placed in an hermetically-sealed porcelain enclosure possessing several distinctive features. It has been approved by the National Board of Fire Underwriters and will withstand disruptive effects to a high degree. The receptacle for the fuse is also a departure from ordinary practice in that the barrier scheme of protection between opposite polarities is incorporated and with the U-form of fuse makes a service cut-out admirably adapted for low-tension work. The service switch lends itself to installations of all characters and it has been modified for other uses, and in combination with panel boards for local distribution on building risers and for meter testing devices both

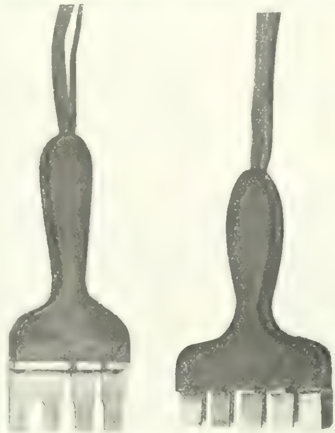


Fig. 3—Two and Three Wire Meter Test Plugs

separately and in combination as the controlling switch of the installation. The company has also devoted considerable time during the past 18 months to the development of several other devices intended not only to prevent theft of energy, but to combine the facilities of a meter testing cut-out in the same device; thus greatly simplifying meter testing by saving time in making connections for such tests. They also make possible an increase of at least 40 per cent in the number of meters tested in a given time and at the same time obviate the usual annoyance to the consumer due to interruption of service while the test is in progress. Another advantage of this device is that

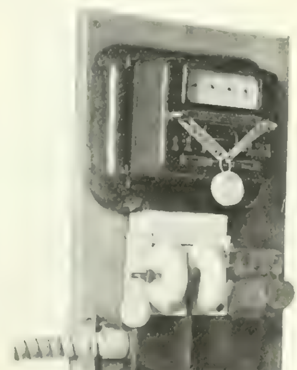


Fig. 4—Application of Meter Protective Devices.

the meter and device may be wired in advance and sent to the job ready for immediate connection. This also saves time and expense as the lineman can make the connections himself without the assistance of an expert meter man. Fig. 3 shows two-wire and three-wire testing plugs already wired and used

in connection with the testing block forming part of the service installation. When the test is to be made, it is only necessary to insert the testing plug and then remove the strap which is in use under service conditions. It is impossible to insert the plugs incorrectly in the cut-out. This is of value particularly where polyphase currents are metered, and precludes the possibility of a test under any other than approved methods. Here again greatly increased efficiency is possible in the tester's work. It is also impossible to make a short circuit, the device being practically foolproof. The line of porcelain protective devices was designed by Mr. Thomas E. Murray.

AMMUNITION HOIST CONTROLLER.

An ammunition-hoist controller built for Government purposes by the Ward Leonard Electric Company, of Bronxville,

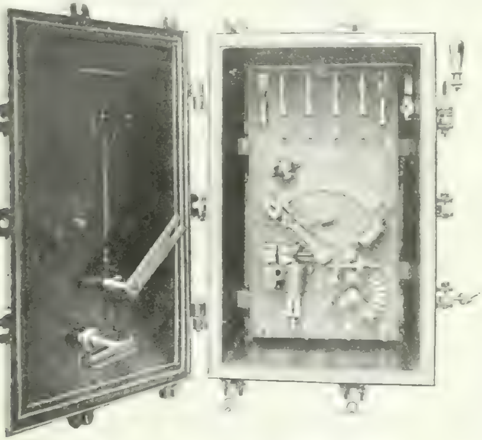


Fig. 1—Ammunition Hoist Controller, Open.

N. Y., is illustrated in Figs. 1 and 2. The apparatus consists of a four-pole reversing switch, a no-voltage and overload release starter with field controller and a dynamic brake attachment.

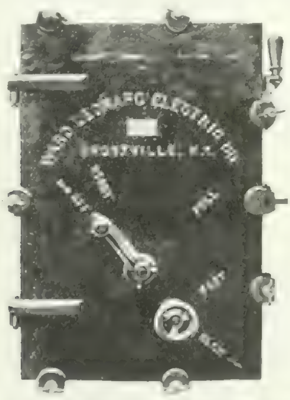
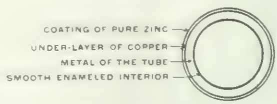


Fig. 2—Ammunition Hoist Controller, Closed

A movement of the lever on the outside of the enclosing case in the up position causes hoisting of the ammunition and throwing the lever in the downward position causes a lowering of the load. All parts on the face of the panel are renewable, and the resistor is made up of Ward Leonard enameled units. The panel is mounted in an entirely waterproof enclosing case, and before shipment a test of the case is made by placing it and the controller within under water for 24 hours to see if there is any leakage. Although built to Government specifications, the apparatus is applicable in places where its waterproof features would be of advantage. Needless to state, Government specifications are very rigid so that reliability is one of the features of the controller.

ELECTRO-GALVANIZED RIGID CONDUIT.

The American Circular Loom Company, of Boston, Mass., has brought out a copper-plated rigid conduit for electric wiring with exterior coating of zinc and smooth enameled interior. The conduit, which is known as "Xduct," is a steel tube which has received first an electro-deposited layer of copper and then on top of the copper an electro-deposited coating of zinc. It is furnished in 10-ft. lengths, threaded both ends, with coupling. The layer of copper is even and continuous and forms an impervious covering for resisting corrosion even should the zinc coating be entirely removed. The copper coating also makes practical the preliminary plating of the tube in a definitely alkaline medium and insures uniform surface resistance while the zinc is being deposited. In coating the conduit with zinc there is no possibility of the presence of an alloy, since the zinc is deposited on copper and not on iron. The primary reason for applying the zinc to the tube is to prevent corrosion. The con-



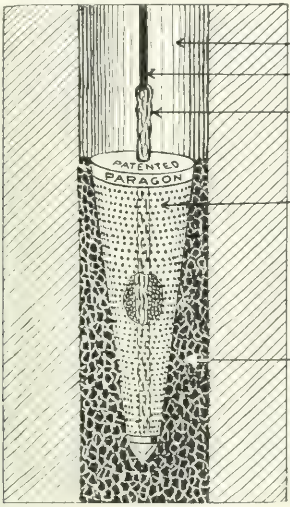
Cross Section of Conduit.

duit can be used to advantage with concrete, as the exterior surface being smooth and clean the concrete mixture wets it throughout its length and subsequently bonds with it. The formation of pockets in which corrosive elements might accumulate is thereby avoided. The interior of the tube has a lining of alkali-and-acid-resisting enamel and is free from blisters, burrs or other obstructions; presenting a smooth and glossy surface to facilitate the insertion of wires and their ready withdrawal. The tube itself is made of mild steel and bends easily without danger of fracture. It is, of course, thoroughly cleaned before being placed in the plating bath and the threads being zinc coated save labor of rethreading and provide good contact at every joint. The conduit embodies the suggestion made at the last meeting of the National Board of Fire Underwriters that fittings have conductive coatings in order to secure better electrical contact at all points throughout the conduit system.

GROUND CONE.

It is often difficult to obtain a satisfactory "ground," and the grounding device illustrated herewith has been designed on common-sense principles with the idea of making an appliance that will meet all the requirements demanded of it. The accompanying illustration shows the cone placed in position in the ground. The cone is made of pure sheet copper, perforated with 75 openings to the square inch. It is filled with pea-sized charcoal, and a hollow copper cable runs through its entire length. This cable is soldered securely at the bottom, and extends about 3 in. or 4 in. above the top of the cone. The perforations not only allow the charcoal to absorb moisture, thus keeping the soil around the cone permanently damp, but they also furnish a much larger discharge area than the surface of the cone itself, taking into account not only the lateral surfaces, but the superficial area of each perforation. The sharp edges of the perforations act as discharge points, reducing the cone's electrostatic capacity to a minimum.

The hollow copper cable is furnished so that the ground wire may be run into it and slipped to the very bottom of the cone. A pull on the ground wire makes the cable lace itself tightly around the wire, on the same principle as the action of



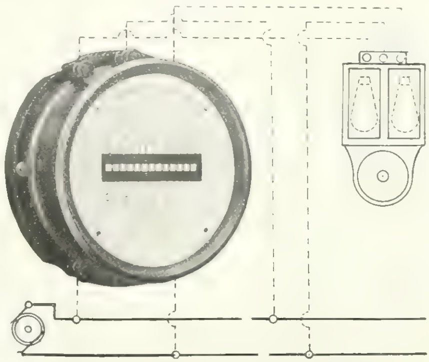
Ground Cone.

the ordinary cable "come-along." A little solder around the top of the cable keeps the wires together and insures perfect contact between the ground wire and the cone. The cone is tipped with a solid point of copper. The copper cable is 61,968 circ. mil in area. The cone can be buried to any depth by simply boring a hole with an ordinary post-hole auger and dropping the device in it.

It is recommended that charcoal or coke be tamped around the cone, as shown in the illustration, partly to protect it from possible chemical action of the soil, and partly to increase the moisture in the soil directly surrounding the cone. Two or more cones may be installed and connected together, if it is desired to obtain a greater grounding surface than that afforded by one cone. These cones are made in two sizes by the Paragon Sellers Company, 56 Fifth Avenue, Chicago. Each size is made in two gages of metal—a light gage for use with telephone and telegraph systems, and a heavier gage for grounding lighting or power systems.

FREQUENCY VARIATION ALARM.

The accompanying illustration shows a Hartmann & Braun standard, resonance type, frequency meter, within whose case is mounted a pair of relays which are likewise operated on the resonance principle. In the particular range which is shown, the normal frequency of the station is 60 cycles, and the two relays are adjusted one to operate at 59 cycles and the other at 61 cycles. With the wiring connections, as indicated by the dotted lines, a combination optic and acoustic alarm is operated whenever these limits are exceeded. The optical alarm consists of lamps behind differently colored glass screens, so that the attendant can tell at a glance whether the trouble is due to excessive speed or to insufficient speed. The operation of the frequency indicating reeds themselves is not interfered with by the presence of the relays, so that the instrument serves the same indicating purpose as does the ordinary model. Apparatus is supplied to indicate at one cycle above and one cycle below normal for 40-cycle and 60-cycle apparatus, and at ½ cycle below and ½ cycle above for 25-cycle apparatus. The standard finish of the instruments is dead black. The diameter of the case is about 9 in. In addition to the combination of indicator and alarm, separate relays of the resonance type are made for various purposes. One use of the relays is to protect alternators when these tend to race; for under such condition the frequency

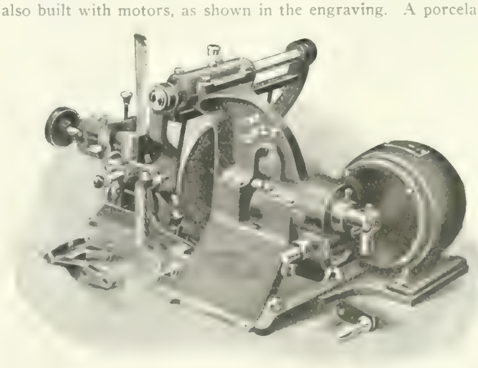


Frequency Variation Alarm and Connections.

rises, of course, putting the relay into operation. By the use of auxiliary apparatus the machine can be shut down before damaging itself. Machado & Roller, New York City, are the United States agents for the apparatus.

MOTOR-DRIVEN MACHINE FOR FILING AND SETTING BAND SAWS.

The accompanying illustration shows a machine for filing and setting band saws which requires only 16 in. by 22 in. of bench space. The saw hangs from a peg overhead and passes through the machine vertically, and it is claimed that the machine feeds the finished tooth away from the file, a feature that insures a uniform size and shape of tooth. The belt carriage possesses a positive motion, and cannot file deeper in brazes or other soft spots. The regular slim taper or taper files are employed, but machine files may be used if preferred. All the working parts are made of tempered tool steel and are interchangeable. The machines are made with belt drive, but are also built with motors, as shown in the engraving. A porcelain



Machine for Filing and Setting Band Saws.

plug and length of cord are part of the outfit, making it easy to attach it to any lamp socket. The motors are of the "Standard" type built by the Robbins & Myers Company, of Springfield, Ohio, and are of sufficient size to drive the machine under all conditions. The machine itself is built in three sizes to accommodate saws from 1/16 in. to 4½ in. wide, and is manufactured by the Black Diamond Saw & Machine Works, Natick, Mass.

Industrial and Commercial News

THE WEEK IN TRADE.

RETAIL trade reports from the western section of the country were a trifle better last week than they have been since the beginning of the summer. Some increase in activity had been brought about by clearance sales and by more favorable weather. In spite of this betterment, however, the volume of distribution is not up to expectations and is far below the same period last year. Wholesale trade is unusually quiet even for midsummer. Although there are a fair number of buyers in the central markets, the orders placed are extremely conservative. There is a general disposition to wait a more definite knowledge of the crop situation and to make only very limited purchases at the present time. In many lines of industry there are midsummer shut-downs for repairs and overhaulings. This is especially noticeable in the iron and steel industry, where, in many instances, the prices at which business is being taken are not sufficiently attractive to engender any unusual activity. Pig iron has again been reduced in price and many of the furnaces have gone out of blast. Iron statistics for July 1 show a drop of 15 per cent in production as compared with February. The textile manufacturers are still curtailing output, and prices are more or less demoralized. The six months failure report as prepared by *Bradstreet's* is fairly encouraging. It shows a reduction of 3 per cent in the number of failures from 1909 and 23 per cent from 1908. Liabilities are heavier than they were during the first six months of 1909, but this was caused by two or three large suspensions. Collections last week showed the effect of the inactivity of retail trade and payments were reported as only fair. The disturbance in the security market was also responsible, in a measure, for this condition. Failures for the week, which ended July 7, as reported by *Bradstreet's*, were 172 against 196 the previous week, 182 in the same week of 1909, 246 in 1908, 185 in 1907, and 143 in 1906.

THE COPPER MARKET.

JUNE figures furnished by the Copper Producers' Association did very little to help along the condition of the copper market. While they showed that there had been quite an increase in the exports during June, and that the total delivery had been 119,259,144 lb., they also showed that the daily rate of production for the month was 4,240,636 lb. This is the heaviest rate of production ever known, and is little short of startling. The rate for May was 3,975,563 lb. If the present daily rate continues, and there is no reason to believe that it will decline, the total production for the month of June will be in the neighborhood of 131,500,000. While there has been some increase in the consumption of American copper in Europe, it is estimated that it does not average more than 40,000,000 lb. per month. It is also figured that the total consumption requirements of American copper, including domestic

Standard Copper	Bid.	Asked.	Settling price.
Spot	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	11.75
August	[illegible]	[illegible]	11.75
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]

The London market July 12 was as follows:

	Noon. £ s. d.	Close. £ s. d.
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
Best selected	[illegible]	[illegible]

melting, will not be more than 100,000,000 lb. per month. It is, therefore, very evident that large quantities of copper are being produced which are not being melted. Whether these surplus stocks are being carried by speculators, by the producers or in the warehouses of actual consumers makes little difference so long as they are in existence. The figures of the June report of the Copper Producers Association were: Production, 127,219,188 lb.; deliveries, 119,259,144 lb.; and stocks on hand at the end of the month, 168,386,017 lb. This is an increase of 7,961,000 lb. during the month. The exports for June were 65,895,948 lb. and the domestic takings 53,363,196 lb. The imports continue to be unusually large. Exports for the month, including July 11, have been 6162 tons. The daily call on the metal exchange July 11 quoted standard copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Acheson Plant Extensions.—The International Acheson Graphite Company, of Niagara Falls, N. Y., has arranged to erect an addition to its works on the lands of the Niagara Falls Power Company in that city. The addition will be in the nature of a furnace room, which will afford capacity for 10 or 12 new furnaces. The buildings will be of brick and steel construction and erected to the west of its present works, where there is ample room for still further enlargement. The additional furnaces will make possible a very large increase in the output of graphite in the form of electrodes for electrochemical, metallurgical and electrical purposes, powdered graphite for dry-cell filler, paint pigment, powder glazing, lead pencils, firearms lubrication, general lubrication, electrotypers' molding and polishing leads, etc. The Acheson Oildag Company has purchased recently a factory site of 30 acres at Port Huron, Mich., and will erect there a large plant. Port Huron was selected as the site because of its comparatively pure water and excellent shipping facilities. On July 1 the Acheson Oildag Company reduced the selling price of Oildag to approximately 60 per cent of that previously quoted, thereby bringing it down to a price, when bought in quantity, of considerably less per gallon than that of the oil with which it is mixed. The presence of the deflocculated graphite in the oil is claimed to make each gallon equal to from two gallons to four gallons of plain oil.

General Electric Company's Business.—An official of the General Electric Company states that the orders taken during the first six months of 1910 are at an annual rate of between $70,000,000 and $71,000,000. The business for June was better than it was for May, and the total for the six months was slightly in excess of $35,000,000. Business for 1909 (11 months), as shown in our issue of Jan. 6, was about $55,000,000. The company is now employing almost as large a number of men as at any time in its history. Its aggregate number at the various plants is in the neighborhood of 30,000. As a rule, the majority of the business is for the smaller classes of apparatus. There has been a particular activity in the line of street-car motors and equipment. There has also been a very large development in the manufacture of household and other similar appliances.

Commercial Cable Company.—A representative of the Commercial Cable Company says that the completion of the new submarine cable between Waterville, Ireland, and Weston-super-Mare, England, which was accomplished last week, will add materially to the transatlantic cable service. This makes three cable lines between these points. The new cable which the Commercial Cable Company has planned to build by way of Newfoundland is being held up pending the settlement of the difficulties with the Newfoundland government. The representative above referred to believes that this matter will shortly be settled, and says that as soon as it is the new cable will be laid and another transatlantic cable line opened.

C. W. Hunt Slope Business.—Arrangements have been made by the C. W. Hunt Company, New York, builders of coal-handling, conveying and hoisting machinery, by which its business on the Pacific Coast will be handled by the San Francisco Bridge Company, with offices at 865 Monadnock Building, San Francisco. The company has just completed a naval coaling station in San Francisco Bay for the government.

Chattanooga & Tennessee River Power Company.—A contract has been made by the Chattanooga & Tennessee River Power Company with Jacobs & Davies, of 30 Church Street, New York, for the completion of the hydroelectric plant at Hale's Bar, on the Tennessee River. About 50 per cent of the work on this plant has already been done. When completed, it is expected to develop 50,000 hp.

Great Eastern Telephone Company.—Mandamus proceedings were commenced last week in the Supreme Court of New York City by the New York Electric Lines Company against the Empire City Subway Company, Ltd., praying for a peremptory writ to compel the Subway company to give space to the wires of the Electric Lines company in its conduits. The New York Electric Lines Company is a wire-leasing concern holding a perpetual franchise dated 1883. It is controlled by the same interests that organized and own the Great Eastern Telephone Company, and its wires, if they are permitted in the conduits, will be leased to the Great Eastern Telephone Company for the operation of an independent system in New York City. The present demand for space covers only about 30,000 ft., and is intended to supply the initial exchange of the Great Eastern company, which will be in the financial district of lower Manhattan. A decision has already been rendered by the Court of Appeals of New York, practically establishing the right of the Electric Lines company to space in the conduits. Speaking of this enterprise, D. A. Reynolds, president of the Great Eastern company, said: "After having had our rights established in the conduits, we made a tender, on June 7, of $5,000 to the Empire City company to pay for space in the conduits. This tender was declined and on that account we have brought the mandamus suit. We hope to have the matter definitely settled by the highest court in the State within the next three months, and as soon as it is, if settled in our favor, we will begin placing our wires. The Great Eastern Telephone Company was organized with an authorized capital of $1,000,000, but since then the stockholders have voted to increase this amount to $50,000,000. Only a few shares of this stock, however, have been issued, the balance being held until the rights of our affiliated wire-leasing company are established. The Great Eastern company has contracts in the Wall Street section for 107,000 telephones ready to be installed as soon as it is prepared to operate. It controls the State Line Company operating in Columbia, Dutchess and Westchester counties, which will give it a long-distance outlet to the North. It also controls the Coast Line Telephone Company and the Hudson & Middlesex Telephone & Telegraph Company, in New Jersey. This will give it long-distance connections to the West. We claim that we will be able to furnish a telephone service at about 48 per cent of the charge now made in New York City."

Oil Engine Industry.—There is a very satisfactory increase in the oil engine industry in connection with electric generation, according to statements made by Mietz & Weiss, manufacturers, of 128-138 Mott Street, New York. C. W. Weiss says that there is a constantly growing demand for this class of engine for small central stations, for farm plants, for isolated plants in stores and residences, and for small pumping stations. The company has also taken quite a large number of orders from the government for oil engines to be used in connection with wireless equipment on battleships. These orders have for the most part been delivered to the Brooklyn Navy Yard, and the engines thoroughly tested there before being placed on the ships. As a rule these engines run from 7 to 12 hp. Mr. Weiss says that the economy of operation of the oil engine is recommending it to a great many people who never before have understood its merits. Among the recent sales which this firm has made are: One 100-hp and two 25-hp engines to the Andover (Mass.) Water Company; one 100-hp to the Gregory (S. D.) Light & Power Company; one 50-hp to the Ireton (Iowa) Electric Light & Power Company; one 80-hp to the Huron (S. Dak.) Milling Company, to generate energy for driving individual mill motors; one 35-hp to the Bridgewater (S. Dak.) Electric Power Company; one 50-hp. to the Leaksville (N. C.) Light & Power Company; one 50-hp to the Faulkton (S. Dak.) Light, Heat & Power Company; one 50-hp to the Sheldon (Iowa) Electric Station, and two 80-hp to the Holmes Machine Company, Sparta, Mich., to generate energy for individual machine motors. Mr. Weiss says that the economy shown in a small water works plant in New England, where oil engines have been used for several years, has induced a number of towns in that section to take up the matter of using this class of engine. The initial cost of these engines is, as a rule, more than that of gas engines, but the manufacturers claim that the economy in operation is sufficient to offset any additional cost.

Plans of the New Illinois Valley Company.—The first step in the development of the system of the new Illinois Valley Gas & Electric Company, of Streator, Ill., the formation of which was mentioned in these columns June 16, will probably be the construction of a 33,000-volt transmission line connecting Joliet, Wilmington, Dwight, Streator and intermediate towns. The new company will be closely affiliated with the Economy Light & Power Company, of Joliet, Samuel Insull, of Chicago, being president of both. The Economy company has a water-power plant on the Des Plaines River at Joliet, and electrical energy from this plant will be utilized. From the principal transmission line mentioned branch lines will be constructed to Coal City and other adjoining towns on the Santa Fé Railroad. There will also be two other 33,000-volt transmission lines, one connecting Joliet and Ottawa and the intermediate towns, and another running from Ottawa to Streator. The aggregate length of these 33,000-volt lines will be 128 miles. The branch lines, operating at 11,000 volts and 4000 volts, will be 27¾ miles long. The plans involve the erection of a 10,000-hp auxiliary steam station in Streator. Plans are under way for the erection of five substations, which will be located at Wilmington, Braidwood, Dwight, Gardner and Odell, through each of which the 33,000-volt line will be looped and transformers installed, stepping down to 2300-4000 volts. As soon as the transmission line has been constructed it is planned to transfer the load of the least economical plants to those showing better economy, and this weeding-out process will ultimately result in the concentration of the generation of the entire system in not more than two or three thoroughly modern steam and water-power plants.

American "Z" Electric Lamp Company.—The American "Z" Electric Lamp Company, 149 Broadway, New York, has printed in the newspapers an open letter addressed to the president of the International Tungsten Lamp Company, in which a protest is made against a statement that a connection exists between these two companies. In the letter it is stated that a contract was made March 20, 1910, between the America "Z" Electric Lamp Company and A. J. Clark, of Detroit, Mich., granting the latter the sole right to manufacture for the company metallic filament lamps under the American license for the use of the Herman Zerning processes and inventions, and notice is given that the transfer of this contract to the International Tungsten Lamp Company is not approved and will be contested. Among the grounds given for this position are that the name of the company is objectionable; that as only about $50,000 is needed to begin manufacturing, the proposed issue of $5,000,000 in stock is a gross overcapitalization; and that making the shares of a manufacturing company of this nature of a par value of $1 per share is objectionable.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions of present plants at Pittsburg, Pa.; Browntown, Wis.; Streator, Ill.; Appleton, Wis.; Ingersoll, Ont., Can.; Auburn, Cal.; Livonia, N. Y.; Minneapolis, Minn.; Princeton, Ind.; Wallace, N. C.; Vancouver, B. C., Can.; Fort Missoula, Mont.; York Springs, Pa.; Wilson, Kan.; San Francisco, Cal.; Fresno, Cal.; New Hamburg, Ont., Can.; Moose Jaw, Sask., Can.; Rapid City, S. D.; Abbeville, Ala.; Tampa, Fla.; Sylvania, Ga.; Osage, Okla.; Hudson, Ohio; Wheatland, Wyo.; Foraker, Okla.; San Augustine, Tex., and Goshen, Ind.

New Steam-Reserve Plant for Goshen, Ind.—The Hawks Electric Company, which does the central-station business of Goshen, Ind., is about to build a new steam generating plant. The company produces its principal supply of electricity by a 300-kw hydroelectric plant on the Elkhart River. It also has a steam-reserve plant in a flour mill. The new plant will be erected as an addition to the water-power plant and will take the place of the old reserve plant. It will contain two water-tube boilers and a 500-kw turbo-generator producing 2300-volt, 3-phase, alternating current. F. J. Postel & Company, of Chicago, are the designing engineers for the Hawks Electric Company.

Consolidated Traction Company's Rehabilitation in Chicago.—Plans for the absorption of the Consolidated Traction Company, of Chicago, by the Chicago Railways Company appear to be proceeding smoothly. Under foreclosure proceedings it is thought that a decree will be entered on or about July 15, allowing 30 days thereafter for the sale of the properties to the Chicago Railways Company. No doubt an ordinance will be introduced in the City Council of Chicago providing for the rehabilitation of the Consolidated company's physical property, which is badly needed.

Tunnel Service to Long Island in September.—Ralph Peters, president of the Long Island Railroad, announced last week that the opening of through service between Long Island points and the new Pennsylvania Railroad terminal in Manhattan had been postponed until Sept. 8, when the fall train schedule goes into effect. The tracks and platforms of the station are all ready for service now, but the fixtures have not yet all been placed and there is a great amount of cleaning up and instructing station employees to be done. When the new service is commenced through electric trains will be run from the station to Far Rockaway, Long Beach, Hempstead and Jamaica. Enough of these trains will stop at Winfield Junction to connect with the trains from the Port Washington and College Point branches. The railroad has been somewhat delayed by the failure to get deliveries of the new steel cars ordered more than a year ago, but it is now claimed that the road will have ample equipment by Sept. 1 for all purposes.

General Electric's Copper Mine.—An official of the Bully Hill Copper Mining & Smelting Company, which is owned by the General Electric Company and which has recently been closed down, as was stated in the issue of June 23, has explained the reason for the shut-down. It seems that the government authorities, according to this official, ordered the smelter to eliminate the smoke nuisance. While the official says that this is the only complaint ever made on this score, it was thought best to suspend operations rather than go to the expense of making changes that would do away with the fumes of the smelter. "Our company," he said, "is not large enough to justify this expense, and we can well afford, with copper at the present price, to discontinue mining operations."

Storage Cars for Third Avenue Railroad Company.—The Third Avenue Railroad Company has ordered thirty storage battery cars for use on some of its small subsidiary lines, which have heretofore been operated by horse cars. This course was adopted after quite a number of months of experimentation with both storage battery and gasoline cars. The batteries for equipping these cars were ordered from the Gould Storage Battery Company, and the motors will be furnished by the General Electric Company. The Third Avenue company will build the cars in its shops.

Financial.

The Week in Wall Street.

ALTHOUGH the condition of the market in Wall Street was extremely irregular last week, and many stocks made new low records for the year, the tone at the end of the week was stronger than at the beginning and prices were about the same on most of the active issues. In the opinion of many, the low points of last week were about the culmination of the long decline that has been affecting the market since the early spring. The average price of the 20 active railroad stocks, which are usually taken as a barometer for the purpose of comparison, reached 110.63 at the low point last week. The average on the first day of the year of these same stocks was 130.41. This comparison probably gives as lucid an idea of the decline that has taken place in securities as any that can be offered. For several days there was heavy liquidation, and all efforts of the bulls to support the market seemed to be futile. It is thought that the majority of the shorts covered during this period, and the decline in prices certainly brought into the market a considerable amount of investment buying, a thing that had been absent for many, many weeks. This buying, together with the fact that toward the end of the week there was a break in sterling exchange and a promise that gold imports would soon be inaugurated, caused a strengthening in prices and a vast improvement in tone. The ill reports from the spring wheat crop, which were used as a club to hammer the market, have apparently lost their effect. The condition of other crops is so satisfactory that a reduction in the yield of wheat is not likely to prove disastrous. The money market has continued remarkably easy under the stress of demoralized prices for securities. While the bank statement was not as satisfactory as had been predicted, there was still about it nothing to alarm investors. Quotations for money July 11 were: Call, 2½@3 per cent; 90 days, 4 per cent. The quotations in the table are those of the close July 11.

NEW YORK

	[illegible]	[illegible]	Shares		[illegible]	[illegible]	Shares
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	400
[illegible]	[illegible]	[illegible]	194,025	Mackay C., pf	73*	[illegible]	[illegible]
Am. D. T....	20½*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	830
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	107	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	6,250	Steel, pfd....	115½	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	62⅛	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,600
[illegible]	[illegible]	[illegible]	12,300	West'h., pfd..	115*	[illegible]	[illegible]

PHILADELPHIA.

	July 1.	July 11.		July 1.	July 11.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elec. Co. of A....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CHICAGO.

	July 1.	July 11.		July 1.	July 11.
[illegible]	180*	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	70	Met. Tel. Co........	22*	20*
Chi. Rs., Ser. 2...	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BOSTON

	[illegible]	[illegible]		[illegible]	[illegible]
Am. T. & T.	[illegible]	[illegible]	Mex. Tel.	[illegible]	[illegible]
Cum. Tel...	[illegible]	[illegible]	Mex. Tel., pfd.	[illegible]	6½*
Edison E., Il	252	[illegible]	[illegible]	[illegible]	134*
Gen. Elec...	[illegible]	142	W. T. & T..........	15¼	[illegible]
[illegible]	[illegible]	15¾*	W. T. & T., pfd.....	87*	87*
Mass. E. Ry., pfd...	76	[illegible]			

*[illegible]

Financial Notes.

Sierra & San Francisco Power Company.—It is said that before the end of the month the United Railways Investment Company will probably have acquired through a subsidiary company the delivery of $20,000,000 of common stock of the Sierra & San Francisco Power Company. This company has recently authorized an issue of $6,500,000 of bonds, to be used for taking over the steam-power system of the United Railroads of San Francisco. A contract has been made between the railroad company and the power company for 44 years. It is said that $1,000,000 will be expended at once on the distribution system in San Francisco. The power company will produce approximately 78,000 hp, half of which will be used by the traction lines in San Francisco, the other half to be sold in the city and in the smaller towns through which the distribution lines pass.

Mexican Telephone & Telegraph Company.—Announcement has been made in the city of Mexico that on Jan. 1, 1911, the exchange service of the Mexican Telephone & Telegraph Company in that city will be doubled to meet the rapidly increasing business. The company has now under construction a new central office at Calle de Ezequiel Montes to carry a new switchboard of the same capacity as the old switchboard now in service. When the company installed the present switchboard, in the San Agustin exchange, three years ago, it was thought that it was large enough to handle all of the business for at least 10 years, but the increase of telephones within the three years has made this doubling of capacity necessary.

Mexican Light & Power Company.—The annual report of the Mexican Light & Power Company, which is largely owned in Montreal, says that while the construction work is not yet complete, and ample water power has not yet been secured, the gross earnings for the year amounted to $3,014,325, as compared with $2,938,474 the previous year. A 7 per cent dividend was declared upon the preferred stock and a 4 per cent dividend upon the common stock. During the year extraordinary expenditures were incurred in connection with the steam plant, which had to be operated on account of the noncompletion of the reservoirs.

Denver & Inter-Mountain Railroad Company.—Interests identified with the Denver City Tramway Company have secured control of the Denver & Inter-Mountain Railroad Company. This road has 22 miles of track and connects Denver and Golden. The new owners will practically re-equip the line and will probably spend $100,000 in that direction.

Washington-Virginia Railway Company.—A charter has been issued by the State Corporation Commission of Virginia to the Washington-Virginia Railway Company. The company has an authorized capitalization of $1,000,000, and is empowered to construct and operate an electric road from Vienna to Bluemont, Va.

Pioneer Telephone Company.—The Pioneer Telephone Company, Oklahoma City, has purchased the properties of the Leger & Chickasha Telephone Company and the Mangum & Quanah Telephone Company. The price paid for the two was $00,000. The two systems include five exchanges and 17 toll lines.

American Light & Traction Company.—The earnings of the American Light & Traction Company, both gross and net, continue to show improvement. The gain in the former in May amounted to more than 22.75 per cent, and in the net the gain amounted to 23.75 per cent. For the five months which ended May 31, the gross improvement was better than 15.5 per cent. The officials of the company state that the weekly returns now coming to hand indicate a steady improvement in business. It is confidently expected that 1910 will be the largest year in the company's history as regards the volume of business handled and the revenues derived therefrom. The earnings of the company for the 12 months which ended March 31 last show an amount available for dividends on the common stock equal to 26.02 per cent. The company has already declared several extra dividends, and this policy will probably continue. The directors met last week and declared a quarterly dividend of 2½ per cent on the common stock payable Aug. 1, and an extra dividend of 2½ per cent payable Aug. 15. The regular quarterly dividend of 1½ per cent on the preferred stock was also declared.

Telephone Consolidations.—The New York Telephone Company certified to the Secretary of State at Albany last week that it had absorbed the New York & Pennsylvania Telephone & Telegraph Company. This company was capitalized at $1,000,000, and operated telephones in the southern tier of counties of New York State and some of the northern counties of Pennsylvania. This absorption is in line with several previous mergers and in keeping with the policy of the American Telephone & Telegraph Company to consolidate its operations into large corporations, rather than to hold a number of small companies. In the same general policy, the New England Telephone & Telegraph Company, a subsidiary of the American, last week purchased the People's Telephone Company, operating in Exeter, Hampton and neighboring New Hampshire towns.

Elevated Merger in Chicago.—Henry A. Blair, the New York financier, who is engineering the Chicago elevated merger, says that negotiations will again be taken up this week and that everything is now sufficiently advanced for him to feel assured of the success of the plan. The condition of the securities market in Wall Street had caused the syndicate, represented by Mr. Blair, to pause, but it is now believed that there will be no difficulty in raising all the funds necessary to carry out the project. The temporary check in the deal caused some sharp declines in the prices of elevated stocks on the Chicago Exchange last week.

Pacific Power & Light Company.—The name of the newly incorporated company, subsidiary to the American Power & Light Company, which will control the properties recently collected by H. M. Byllesby & Company, of Chicago, in southeastern Washington and northern Idaho, is the Pacific Power & Light Company. Full details of the deals by which these properties were consolidated were published May 19 and June 16. The new company will have its headquarters in Portland, Ore., and will be capitalized at $7,500,000.

Philadelphia Rapid Transit Company.—The receipts of the Philadelphia Rapid Transit Company for the fiscal year which ended June 30 will be shown to be about $325,000 less than those of the preceding year. According to a statement made by one of the directors, it is estimated that the deficit for the year will be upwards of $600,000.

Hackensack-Paterson-Englewood Electric Railway Sold.—The Public Service Corporation of New Jersey has acquired a controlling interest in the New Jersey & Hudson River Railway Company, consisting of several lines connecting Paterson, Hackensack, Englewood and adjacent cities, with a terminal at Edgewater on the Hudson River, where the power house is situated. The system has 48 miles of track, and includes the Fort Lee ferry. The property was developed by Ford, Bacon & Davis, from whom the control was purchased.

Interborough Sells Notes.—The Interborough-Metropolitan Company, which is the majority stockholder of the Metropolitan Securities Company, has sold $4,000,000 of 5-year 6 per cent notes at par, in order to provide the necessary cash for the payment of its share of the $5,500,000 settlement of the litigation instituted by the receiver of the New York City Railway Company. It is understood that ten directors of the Metropolitan Securities Company contributed the other $1,500,000 necessary.

Berwyn & Laurel Electric Railroad Company.—The United States Court of Baltimore last week appointed Charles F. Gladfelter receiver for the Berwyn & Laurel Electric Railroad Company. This action was brought on account of the failure to pay the $239,621 due on the 5 per cent gold bonds. A foreclosure sale will probably be ordered. The company owns no rolling stock of its own, being operated by the City & Suburban Railway Company, of Washington.

Chicago Edison Bond Redemption.—The Commonwealth Edison Company, of Chicago, has called for redemption the $5,335,000, 5 per cent bonds of the Chicago Edison Company, dated July 1, 1896. These bonds will be redeemed April 1, 1911, through the Merchants' Loan & Trust Company, of Chicago. The Commonwealth company offers to exchange its 5 per cent mortgage bonds for the Chicago Edison bonds at any time prior to Aug. 15, 1910.

DIVIDENDS.

American Light & Traction Company, quarterly, preferred, 1½ per cent; common, quarterly, 2½ per cent., both payable July 16; common, extra 2½ per cent., payable in common stock Aug. 15.

Brooklyn City Railroad Company, quarterly, 2 per cent., payable July 15.

Electric Company of America, semi-annual, 3½ per cent., payable Aug. 3.

Minneapolis General Electric Company, common, quarterly, 1¾ per cent; preferred, semi-annual, 3 per cent, both payable Aug. 1.

National Carbon Company, quarterly, common, 1½ per cent, payable July 15.

Railway & Light Securities Company, of Boston, preferred, semi-annual, 3 per cent; semi-annual, common, 2 per cent, both payable Aug. 1.

Rio de Janeiro Tramway Light & Power Company, quarterly, 1¼ per cent, payable July 15.

San Diego (Cal.) Consolidated Gas & Electric Company, preferred, quarterly, 1¾ per cent, payable July 15.

Union Traction Company of Indiana, semi-annual, 1 per cent, payable July 9.

United Gas & Electric Company of New York, semi-annual, preferred, 2½ per cent, payable July 15.

United States Rubber Company, quarterly, first preferred, 2 per cent; second preferred, 1½ per cent, payable July 30.

United Traction Company, Pittsburgh, semi-annual, preferred, 2½ per cent, payable July 20.

J. G. White & Company, quarterly, preferred, 1½ per cent, payable Aug. [illegible]

REPORTS OF EARNINGS.

	[illegible]	[illegible]	[illegible]	Charges.	Surplus.
[illegible] Light & Power Company:					
[illegible]	[illegible]	[illegible]	67,635	[illegible]	22,637
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Company:					
May, 1910	[illegible]	[illegible]	247,055	[illegible]	[illegible]
May, 1909	[illegible]	[illegible]	227,500	[illegible]	[illegible]
Detroit United Railway Company:					
May, 1910	[illegible] 380	[illegible]	319,080	163,368	167,908
May, 1909	[illegible]	389,179	[illegible]	[illegible]	133,065
Ft. Wayne & Wabash Valley Traction Company:					
May, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Light & Power Company:					
Year 1910	[illegible]	[illegible]	1,889,090	[illegible]	[illegible]
Year 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mexican Telephone & Telegraph Company:					
May, 1910	[illegible]	21,853	[illegible]		
May, 1909	[illegible]	[illegible]	[illegible]		
[illegible] Company:					
May, 1910	[illegible]	[illegible]	[illegible]		
May, 1909	[illegible]	[illegible]	58,940		
Portland (Me.) Electric Company:					
May, 1910	[illegible]	[illegible]	[illegible]		
May, 1909	[illegible]	[illegible]	[illegible]		

General News

Construction News.

ABBEVILLE, ALA.—The Abbe Light & Power Company, recently incorporated, with a capital stock of $60,000, is reported to be contemplating the construction of an electric power plant to generate 1000 hp for transmission. It is understood that bids for construction will be called for in the near future. James R. Hall, of Columbus, Ga., is engineer in charge.

BESSEMER, ALA.—The City Council has granted the Birmingham Water & Light Company, of Birmingham, Ala., a franchise for an electric light plant and water-works system in Bessemer.

BIRMINGHAM, ALA.—The Birmingham Rail & Locomotive Works, of Birmingham, Ala., has recently placed an order for electrical machinery and equipment for its new plant amounting to about $25,000. Haskins Williams is president.

EUFAULA, ALA.—It is reported that the Eufaula Gas, Electric Light & Power Company has applied to the City Council for permission to remove its power house to a more desirable location on Union Street. If granted permission to remove the plant the company agrees to enlarge the plant and purchase additional machinery.

FORT MORGAN, ALA.—The contract for installing the electric lighting system at Fort Morgan, Ala., was awarded to the Babcock & Wilcox Company, of New Orleans, La., for $6 994.

MOBILE, ALA.—The Alabama Canning Company is reported to be contemplating the installation of an electric light plant.

MONTGOMERY, ALA.—Mayor Gaston has asked the City Council to pass an ordinance requiring all overhead wires in the business section of the city to be placed underground.

MONTGOMERY, ALA.—It is reported that the City Council has authorized Mayor Gaston to enter into a contract with the Montgomery Light & Water Company to supply electricity to operate the water works system.

SELMA, ALA.—The Selma Street & Suburban Railway Company is reported to be contemplating extending its railway to Summerfield, work on which will commence at once.

THOMASTON, ALA.—Plans have been prepared for the erection of a telephone system in Thomaston, with branch lines to Prentice, Consul, McKinley and Hugo. It is understood that work on construction of the line will begin in the near future.

THORSBY, ALA.—The Northrup Manufacturing & Supply Company, of Thorsby, Ala., is reported to be in the market for a 20-hp gas engine to operate an electric generator; also for wire, generator with sufficient output to supply 200 lamps, 16-cp lamps and tungsten lamps. C. E. Northrup is president of the company.

IMBODEN, ARK.—The property of the Imboden Power & Development Company, which was recently sold at a receiver's sale to the Peoples' National Bank, has changed hands again, having been purchased by Mrs. J. Nash, of Jonesboro, Ark. It is understood that the new owner will make extensive improvements to the plant and service.

LESLIE, ARK.—J. W. Vaughn and James F. Kiser, of Leslie, have been granted a franchise by the City Council to construct and operate an electric light plant and water works system in Leslie.

AUBURN, CAL.—The Bell Electric Company is reported to have notified the Board of City Trustees that it will make improvements to the street lighting system, at a cost of about $3,000. New lamps will be erected in all parts of the city which will be placed under the direction of the trustees.

FRESNO, CAL.—The property and holdings of the Fresno Traction Company have been taken over by the Southern Pacific Railroad Company. F. W. Webster has succeeded A. G. Wishon as general manager of the Company.

FRESNO, CAL.—It is reported that the Southern Pacific Railroad Company is contemplating the construction of an electric power plant to supply electricity for lighting the depot, yards and freight sheds. At present the service is furnished by the San Joaquin Light & Power Company, of Fresno, Cal.

GEYSERVILLE, CAL.—The Cloverdale Light & Power Company, of Cloverdale, Cal., is contemplating making improvements to its local service, including the installation of a regulator.

LOS ANGELES, CAL.—It is reported that the Central Oil Company, which has valuable holdings in Whittier field, is contemplating the installation of an electric light plant.

OAKLAND, CAL.—The San Francisco, Oakland & San Jose Railway Company is preparing to install a complete signal system at its terminals, contract for which has already been placed.

OROVILLE, CAL.—Notice of appropriation of 20,000 cu. in. of water has been filed in the office of the county recorder by Charles Swezy, of Sacramento, of which 10,000 cu. in. is to be taken from Mosquito Creek and [illegible] in. from French Creek, to be used for irrigation [illegible] The water [illegible] to be taken from Mosquito Creek at a point one mile from its junction with French Creek. From French Creek the water will be taken at a point above the junction of the two streams. The water from Mosquito Creek will be diverted by means of a concrete dam 15 ft. high and 40 ft. wide. On French Creek it is proposed to build a dam 10 ft. high and 50 ft. wide.

PASADENA, CAL.—The citizens of the northwest section of the city have started a project for municipal ownership of street railways. An effort has been made to have the Pacific Electric Railway Company build a branch up Lincoln Avenue. The company demanded a 10-year franchise and a bonus of $45,000 to make the extension. It is estimated that the railway can be built for about $23,000. It is now proposed that the citizens of the northwest section raise the money to build the road and turn it over to the city to operate when completed. The City Council has not yet taken up the project.

REDDING, CAL.—The Sierra Nevada Power & Irrigation Company has filed three complaints in the superior court of Shasta County against the Central Pacific Railroad Company and others to condemn rights of way for a ditch and power line and to quiet title to riparian rights of land owners on Montgomery Creek, Hatchet Creek and Roaring Creek. The irrigation company was incorporated last April and has acquired water rights of 15,000 cu. in., 5000 cu. in. on each of the creeks mentioned. The three creeks run into Pit River, where the company proposes to construct its power house. The company is trying to secure the rights of way for flumes and ditches in order to bring the water of the three creeks together at the power house. George O. Perry and John J. Dailey are directors of the power company.

ROSEVILLE, CAL.—At an election held June 28 the citizens voted in favor of the proposition to issue $90,000 in bonds, the proceeds to be used for the installation of an electric light and power plant and sewer system.

SANTA ANA, CAL.—It is reported that the Chamber of Commerce has subscribed funds to install an electric light plant and to build houses for the miners at the coal mines in Orange County, located about three miles above Orange County Park.

SAN FRANCISCO, CAL.—The Board of Harbor Commissioners has awarded the contract for lighting the ferry building and the water front for a term of three years to the Mutual Electric Light Company at the rate of $1.25 per week for each arc lamp of 2000 cp, with all-night service, and electricity for incandescent lamps at 2¼ cents per kw-hour. Under the new contract the rate for arc lamps is 5 cents less per week and 19/100 of a cent less for incandescent service than under the previous contract.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company, which supplies electricity for operating the system of the United Railroads of San Francisco, has authorized an issue of $6,500 000 in bonds, the proceeds to be used for the purpose of enlarging its plant and extending its service. The company has purchased the entire power system of the United Railroads and has entered into a contract for a term of 44 years to supply the latter with energy to operate its railways. The Sierra & San Francisco Power Company proposes to expend $1,000,000 during the next three years for the construction of a distributing system in San Francisco and elsewhere. The district now served by the company includes the counties of San Mateo, Santa Clara, Alameda, San Joaquin, Tuolumne, Stanislaus and Calaveras. The principal power station of the company is located on the Stanislaus River, north of Sonora, the transmission line passing through Vallecito, Angels Camp, Copperapolis, Tracy, Mission, San Jose and thence to San Francisco. The company proposes to develop additional water rights on the Stanislaus River, which will more than double its present hydraulic capacity. The output of the auxiliary steam plant is to be increased from 12,500 hp. to 28,500 hp. next year.

SAN MIGUEL, CAL.—The Sunset Mining Company, which is mining coal at La Barranca, Sonora and San Miguel, is reported to be preparing plans to install a large electric power plant to furnish power for its mines and to supply surrounding mines and hamlets with electrical service.

NEDERLAND, COL.—The Wolf Tongue Mining Company has contracted with the Central Colorado Power Company to extend its transmission lines to the Wolf Tongue mill, which will be operated by electricity instead of steam power.

NEW HAVEN, CONN.—Preparations are being made by the United Illuminating Company to remove all wires from the old Green. It is proposed to erect ornamental iron lamp posts and to lay wires leading to them [illegible] underground conduits. The company is now laying underground conduits in Elm Street.

WASHINGTON, D. C.—Bids will be received by the Department of the Interior, Washington, D. C., until July 22 for the installation of two electric passenger elevators for the pension office building, Washington, D. C., in accordance with plans and specifications, copies of which can be obtained on application to the chief clerk of the department.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 19 for furnishing to the navy yards and naval stations the following supplies; Schedule 2612—F. o. b. 40 gun-elevating electrical equipments for vessels, Mare Island, Cal. Newport, R. I., Schedule 2651—Boiler stoker, etc. Portsmouth, N. H., Schedule 2672; 13 compressed air-driven hammers and two drilling machines. Brooklyn, N. Y., Schedule 2673—Two sets gasoline machinery. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—David J. Braun Manufacturing Company, of Chicago, Ill., has been awarded the contract for installing light fixtures in various public buildings as follows: Chippewa Falls, Wis., for $994; Danville, Ky., at $961; Versailles, Ky., for $471; Winchester, Va., at $709; Jackson, Miss., for $2,212; London, Ky., at $1,448; Montgomery, Ala., for $289; Gulfport, Miss., at $994; New Orleans, La., for $2,474; Albuquerque, N. M., at $2,275; Baker City, Ore., at $885; Cheyenne, Wyo., for $640; Kewanee, Ill., for $688; Moline, Ill., at $1,331; Ruston, La., for $567, and Sault Ste. Marie, Mich., at $2,257.

TAMPA, FLA.—Plans are being made by the Tampa Electric Company for the installation of a 750-kw motor generator in the West Jackson Street power house. It is understood that contracts for machinery have been placed.

TAMPA, FLA.—The property and holdings of the Tampa-Sulphur Springs Traction Company is reported to have been purchased by Charles O. Brewster, of New York, N. Y. The officers of the new company are: Walter L. Weston, president and general manager; Peter O. Knight, vice-president; C. Fred Thompson, secretary, and F. Hathaway, treasurer. The company will retain the present name.

AMERICUS, GA.—It is reported that Mr. Rood, of Springfield, Mass., formerly president of the Hamilton Watch Company, has submitted a proposition to the City Council offering to guarantee the construction of an electric light plant and to establish an electric railway system in Americus, providing the city will grant necessary franchise and renew contract made several years ago, but which was not carried out by parties to whom the franchise was granted.

ATLANTA, GA.—The citizens are considering the question of installing a permanent ornamental electric lighting system for the main streets of the city. It is proposed to have the property owners along streets lighted bear the cost of the same. Forrest Adair is interested in the project.

ATLANTA, GA.—On July 7 Judge W. T. Newman of the United States Court confirmed the sale of the properties of the Etowah Power Company, which has extensive holdings along the Etowah River, to S. F. Smith, of the S. Morgan Smith Company, of York, Pa., for $160,000.

ATLANTA, GA.—The City Council has granted the Georgia Power Company a franchise in Atlanta for a term of 50 years. The company recently purchased the property and holdings of the North Georgia Electric Company at a receiver's sale. The power plant is located in Gainesville, Ga., and has its wires erected to the Atlanta city limits. The company is capitalized at $6,000,000 and bonds to the same amount have been issued. E. Elmer Smith, of York, Pa., is president, and L. F. Joerissen, of Atlanta, Ga., is treasurer.

CARTERSVILLE, GA.—It is reported that Hazlehurst & Anderson, of Atlanta, Ga., have been engaged by the Town of Cartersville to make a report on the electric and gas plants, with a view of issuing bonds for municipal improvements. For further information address Mayor Gilreath.

DALTON, GA.—Plans are being considered for the construction of an electric railway from Chattanooga, Tenn., to Dalton, Ga., with an extension to Chatworth, connecting with the Louisville & Nashville Railway.

HARTWELL, GA.—Preparations are being made by the Hart County Telephone Company for the installation of additional switchboard equipment.

MACON, GA—The business men of Cherry Street are forming an association for the purpose of installing a new electric illuminating system for Cherry Street. Plans prepared by J. E. Rood have been adopted. Jo[illegible] N. Neal is president of the [illegible] H. Hyman is secretary and treasurer.

NICHOLS, GA.—The Nichols Telephone Company is reported to be in the market for wire and a complete telephone outfit. For further information address W. R. Frier, of Douglas, Ga.

ROYSTON, GA.—D. H. S. McGrary, chairman Methodist Episcopal Church, South, it is reported, would like to receive prices on an electric lighting plant.

SYLVANIA, GA.—Bids will be received until July 20 by the City of Sylvania for the construction of an electric light plant, the cost of which is estimated at $11,000. The J. B. McCrary Company, of Atlanta, Ga., has charge of the engineering work. [illegible]

CLINTON, ILL.—The question of [illegible] the municipal water works by electric motors, instead of steam power is under consideration.

JOLIET, ILL.—The Illinois Valley Gas & Electric Company, which recently purchased the electric plants at Dwight, Odell, Cornel, Streator, Ottawa and other places north of here, is erecting a high-tension electric line between Dwight and Joliet and intermediate points. As soon as this is completed a line will be erected from Dwight to Odell and Cornell.

LITCHFIELD, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 3, for construction of the United [illegible] piping, heating apparatus, electric conduits and wiring, at Litchfield, Ill., in accordance with plans and specifications, copies of which may be obtained from the custodian of site at Litchfield, Ill., or at the above office. James Knox Taylor is supervising architect.

STREATOR, ILL.—Preparations are being made by the Illinois Valley Gas & Light Company for the construction of a 10,000-hp electric plant in Streator, Ill. Provision will be made to increase the output of the plant to 30,000 hp, as the service requires. The company is a subsidiary of the Economy Light & Power Company, of Joliet, Ill.

EVANSVILLE, IND.—The power house of the electric plant of the new city is completed and was put into operation for the first time July 2. The plant at first will furnish electricity for arc lamps for lighting the river bank and barges, so that work of pumping sand can be carried on at night. The administration building of the new city is nearing completion. The new city is being erected on the Kentucky side of the Ohio River and is to have no governing officials.

GOSHEN, IND.—Arrangements are being made by the Hawks Electric Company for the construction of a new steam generating plant. The company operates a 300-kw hydroelectric plant on the Elkhart River and has a steam auxiliary plant in its flour mill. The equipment of the new plant will include two water-tube boilers and a 500-kw, 2300-volt, three-phase, alternating-current turbo-generator set. It is understood that contracts have been placed for part of the equipment. F. J. Postel & Company, of Chicago, Ill., are consulting engineers.

MONROVIA, IND.—The Monrovia Mutual Telephone Company has increased its capital stock by $5,000. The company is planning to rebuild and extend its telephone lines.

PRINCETON, IND.—The Princeton Light & Power Company has filed an amendment to its charter increasing its capital stock from $75,000 to $100,000. The company is contemplating making extensive improvements and extensions to its plant. Henry C. Barr is president.

SHOALS, IND.—It is reported that work will commence at once on the construction of the new municipal electric light plant.

CALMAR, IA.—The citizens, on July 7, voted to grant a franchise to C. Miller & Sons, of Clermont, Ia., to construct and operate an electric plant in Calmar.

DECORAH, IA.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 10 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office building at Decorah, Ia., in accordance with plans and specifications, copies of which may be obtained from the custodian of site at Decorah or at the above office. James Knox Taylor is supervising architect.

INDIANOLA, IA.—Preparations are being made for the installation of a Corliss engine and a 150-kw generator in the municipal electric light plant, bids for which have already been received. J. H. Clark is city clerk.

PAULLINA, IA.—The contract for the construction of the municipal electric light plant is reported to have been awarded to the Interstate Supply Company, of Sioux City, Ia., for $11,500.

WILSON, KAN.—Bids will be received at the office of N. Coover, city clerk, until Aug. 2 for material and labor for the construction of an electric light plant and water-works system, separate bids will be considered as follows: (1) For furnishing and installing pipe lines, including cast-iron pipe, valves, hydrants and specials. (2) Furnishing and erecting water tank, tower and foundations, 150 ft. to maximum water line, 75,000 gal. capacity. (3) Furnishing and installing internal combustion engines as follows with complete foundations: One 100 hp, one 50 hp and one 25 hp. (4) Furnishing and installing two triplex pumps, single acting, 200 gal. capacity; one for direct connection to motor and the other for direct connection to engine. (5) Furnishing and installing generators and apparatus as follows: One 75-kw and one 35-kw, three-phase, 2300-volt, 60-cycle generator, and switchboard; one 8-kw constant current transformer; one 25-hp, 2300-volt, three-phase motor. (6) Furnishing and erecting transmission lines, including poles, cross-arms, transformers, street lamps, wire, etc. The above to be furnished and work done in accordance with plans and specifications on file at the office of the city clerk or at the office of George P. Taylor, engineer, Stockton, Kan. Extra copies of plans and specifications can be secured of the engineer for $4. D. E. O'Donnell is Mayor.

WHITESBURG, KY.—Preparations are being made by the Whitesburg Light & Power Company for the installation of an electric light plant, at a cost of about $2,500, to be operated by water power. It is understood that contracts have been placed for machinery. J. L. Coleman is manager.

NEW ORLEANS, LA.—It is reported that Penick & Ford, Ltd., of New Orleans, La., are in the market for three generating sets with ratings of 100, 75 and 50 kw, respectively, 250 volts, each to be driven by a direct-connected engine of simple four-valve or Corliss type.

PHILLIPS, [illegible] recently the citizens [illegible] & Electric Company for street lighting [illegible] under which the company is to furnish [illegible] at $13.99 per lamp per year, for up-to-midnight service. If the town corporation votes for an all-night service any time during the life of the agreement [illegible] additional per annum

[illegible] have not been lighted since last April.

BOSTON, MASS.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 23 for extensions to underground conduit system for electrical conductors at the Navy Yard, Boston, Mass. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. R. C. Hollyday is chief of bureau.

MILFORD, MASS.—The Board of Selectmen has entered into a contract with the Milford Electric Light & Power Company for lighting the streets of the town for a period of three years, under the terms of which the company is to supply 17 arc lamps instead of 42 as at present and 134 tungsten lamps instead of 72 furnished under the present contract, for which the town is to pay $5,000 per year. All additional arc lamps furnished will cost $105 each per year and tungsten lamps $24 each per annum.

PITTSFIELD, MASS.—The General Electric Company has awarded the contract for the construction of a large addition to the power house at the Stanley plant to Beckwith & Pike. The cost of the building and equipment is estimated at about $500,000.

WEBSTER, MASS.—The Webster & Southbridge Gas & Electric Company has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for a 1000-kw, three-phase, 2300-volt, 60-cycle, 3600 r. p. m. steam turbo-generator set, which will operate in parallel with the present 500-kw machine.

WOBURN, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 9 for the construction complete, including plumbing, gas fitting, heating apparatus, electric conduits and wiring, of the United States post office at Woburn, Mass., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Woburn, Mass., or at the above office. James Knox Taylor is supervising architect.

WORCESTER, MASS.—The Worcester Electric Light Company has announced a reduction in the price of tungsten lamps from 65 cents to 50 cents on the 25 and 40-watt lamps and will also renew incandescent lamps without charge.

BAY CITY, MICH.—Plans are being prepared by Bradley, Miller & Company, of Bay City, Mich., for the construction of a new box factory, which will probably be equipped for electric motor drive throughout.

DETROIT, MICH.—The Anderson Forge & Machine Company is reported to be contemplating the construction of a new power plant to furnish electricity to operate the machinery of its works.

MUSKEGON, MICH.—The Linderman Machine Company, of Muskegon, Mich., is erecting a new building 66x106 ft., the equipment of which will include a 10-ton traveling crane, electric and pneumatic tools, etc. The company, it is said, will also increase its power and compressor equipment.

AURORA, MINN.—The Village Council is reported to have awarded the contract for the installation of the electrical equipment for the municipal electric light plant to the Marshall-Wells Hardware Company, of Duluth, Minn., for $2,300.

AUSTIN, MINN.—It is reported that an election will be held to vote on the proposition to issue $30,000 in bonds, the proceeds to be used for electric light, power and water extensions.

BIWABIK, MINN.—It is reported that bonds have been voted for the construction of an electric light plant in Biwabik, Minn.

DE SOTO, MINN.—The City Council is considering the question of installing a municipal electric lighting system in connection with the water works plant. Ward Cunningham is Mayor.

EAST GRAND FORKS, MINN.—Preparations are being made by the Tri-State Telephone Company for the installation of a telephone system in East Grand Forks to cost about $20,000.

MINNEAPOLIS, MINN.—Bids will be received until July 29 at the office of Henry N. Knott, city clerk, for furnishing the City of Minneapolis, Minn., electricity to operate a 20,000,000-gal centrifugal pumping engine, according to specifications on file in the office of the supervisor of water-works.

MINNEAPOLIS, MINN.—Sealed bids will be received at the office of Henry N. Knott, city clerk, until July 29 for furnishing the City of Minneapolis, Minn., one 20,000,000-gal. electrically driven centrifugal pumping engine and one vertical triple expansion pumping engine, according to plans and specifications which are on file at the office of the city engineer

WILLMAR, MINN.—The City Council has passed an ordinance authorizing the erection of a local telephone exchange to cost $35,000.

INDEPENDENCE, MO.—The City of Independence has purchased a 500-kw General Electric turbo-generator unit complete for the municipal electric plant from the John A. Stewart Electric Company of Cincinnati, Ohio, to provide for increased demands made upon the plant.

INDEPENDENCE, MO.—The City Council is contemplating an issue of $15,000 in bonds, the proceeds to be used for improvements to the municipal light plant. A new turbine will be installed at a cost of $9,000, [illegible]

LATHROP, MO.—Arrangements are being made by the Clover Leaf Telephone Company to place all its wires in cables in the business section of the town.

ST. LOUIS, MO.—According to the annual report submitted to the Board of Public Works the city hall electric light plant showed a large saving last year. The plant supplies electricity for lamps and motors in the city hall, four courts, police headquarters, first district police court, court house and old city hall. The report shows the total cost of operating the plant, including heat for the city hall, to have been $21,940. Electricity alone furnished by the plant, if secured from the Union Electric Light & Power Company at the rate charged the city, 4.5 cents per kw-hour, would have amounted to $31,293.

FORT MISSOULA, MONT.—Bids will be received by A. B. Shattuck, constructing quartermaster, until July 30 for construction of a reinforced concrete pumping station, furnishing and installation of all boilers, steam pumps, valves, etc. Alternate bids will be received for pumping station using motor-driven pumps, including motors, pumps, etc. In applying for specification bidders should designate whether they wish to bid on steam or electrically driven pumps. A deposit of $5 will be required on each set of plans, which can be secured on application to the constructing quartermaster.

ALLIANCE, NEB.—Plans are being prepared by Grant & Letton, Lincoln, Neb., for the construction of an electric light plant and water works system in Alliance, the cost of which is estimated at $95,000.

BELGRADE, NEB.—At an election held recently bonds to the amount of $18,000 were voted, the proceeds to be used for the construction of an electric light plant and water works system.

SUTTON, NEB.—The Sutton Telephone Company is reported to have purchased a site in Sutton, on which it will erect a new exchange building.

BURLINGTON, N. J.—Mayor Farner on July 5 vetoed the ordinance granting to the syndicate, which recently purchased the property of the Burlington Electric Light & Power Company, a 50-year franchise to furnish electrical service in Burlington. His action blocks the plans of the promoters to secure the franchise before the new Public Utilities Commission becomes operative.

FORT BAYARD, N. M.—The contract for equipment for the cold storage and power plant at Fort Bayard, N. M., has been awarded to J. B. Downey as follows: Boilers and boiler room equipment, $17,000; engines and generators, at $9,400; switchboard, $3,500; remodeling distributing system, $2,450; tungsten street lighting system, $1,400, and meters, $1,000. The refrigerating plant will be installed by the Creamery Package Manufacturing Company.

ALBANY, N. Y.—Bids will be received by the State Commission in Lunacy, Albany, N. Y., until July 27 for work at Central Islip State Hospital, Kings Park State Hospital and Manhattan State Hospital, as follows: For Central Islip State Hospital, Central Islip, N. Y., kitchen and dining room building, conduits, steam mains, feeder cables and outside sewer and water connections for new group, additional boiler capacity, North Colony, construction, including heating, plumbing and electric work. For Kings Park State Hospital, Kings Park, N. Y., kitchen and dining room building, conduits, steam mains, feeder cables, sewer and water connections for new groups, construction including heating, plumbing and electric work. For Manhattan State Hospital, Ward's Island, New York City, kitchen building, steam mains and feeder cables for new cottages, construction including heating, plumbing and electric work. Drawings and specifications may be consulted and blank forms of proposals obtained at the institution for which the work is advertised, or for all the work, at the office of the State Commission in Lunacy, 1 Madison Avenue, New York, N. Y., or at the office of the state architect, Franklin B. Ware, Albany, N. Y. T. E. Garr is secretary of the Commission.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until July 18 for repairs, alterations and additions to the electric equipment in Public Schools 16, 58 and 108, Borough of Brooklyn, N. Y. Blank forms, plans and specifications may be obtained or seen at the above office, also at branch office, 131 Livingston Street, Brooklyn, N. Y.

BUFFALO, N. Y.—The City Council is considering the question of installing two steam turbo-generators with a rating of 500 kw to operate the three electric pumps in the new pumping station.

BUFFALO, N. Y.—The Niagara & Erie Power Company, a new company which has been formed to take over the electrical distributing department of the Buffalo & Lake Erie Traction Company and the Niagara, Lockport & Ontario Company, including the furnishing of electricity for lamps, heat and motors to local communities, has notified the Public Service Commission, Second District, that it will file an agreement with the Commission that the existing rates for electrical service will not be changed upon its assumption of the properties.

LIMA, N. Y.—The Lima-Honeoye Light Company has applied to the Public Service Commission, Second District, for permission to take over the property and franchises of the Lima-Honeoye Electric Light & Railroad Company to be operated under lease. The Lima-Honeoye Light Company has also petitioned for authority to issue $5,000 in capital stock, the proceeds to be used for improvements and maintenance of the electrical plant, distributing system and railway system.

LIVONIA, N. Y.—The Livonia Light & Heat Company, of Livonia, N. Y., has applied to the Public Service Commission, Second District,

for permission and approval of commencement of construction and the exercise of rights under franchises granted by the Town Board and Highway Commissioners of the towns of Livonia, Lima and Avon.

NEW YORK, N. Y.—Bids will be received until July 18 by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., for repairs, alterations and additions to the electric equipment Public School 2, Third Avenue and 169th Street, Borough of Bronx, Public School 157, St. Nicholas Avenue and 127th Street, and Public School 147, Henry, Orchard and Gouverneur Streets, Borough of Manhattan; also for new water main and electric pump, etc., at Public School 62, Hester, Essex and Norfolk Streets, Borough of Manhattan. Plans and specifications can be seen at the office of the superintendent, Park Avenue and Fifty-ninth Street, Borough of Manhattan.

NEW YORK, N. Y.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 30, for furnishing condensers, piping, equipment, etc., for power plant for Navy Yard, New York, N. Y., plans and specifications for which can be obtained on application to the above bureau or to the commandant of the navy yard named. The cost of the work is estimated at $46,000. R. C. Hollyday is chief of bureau.

NEW YORK, N. Y.—The Board of Public Service, Second District, has approved the terms of the franchise recently granted by the Board of Estimate and Apportionment to the Union Railway Company for the construction of an extension of its electric railway from the intersection of Sedgwick Avenue and Fordham Road in the Bronx across the Harlem River Bridge at 207th Street to connect with the Third Avenue Railroad system at Emerson Street and Broadway.

NEW YORK, N. Y.—Announcement has been made that bids will be called for in the near future for the construction of the Broadway-Lexington Avenue subway system. Details of contracts are now being completed by the engineers.

OLEAN, N. Y.—The Olean Electric Light & Power Company has applied to the Public Service Commission for permission to issue $50,000 in capital stock, the proceeds to be used to pay for additions and extensions to its plant already made and the completion of others under way.

OSSINING, N. Y.—The New York, New Haven & Hartford Railroad Company, which recently acquired control of the local electric railway, is reported to be negotiating with F. A. Stratton for the Hudson River & Eastern Traction Company's system. The Hudson River company operates an electric railway in Ossining. Arrangements had been made by the company some years ago to extend the railway to White Plains, passing through Briarcliff and Pleasantville. The New York, New Haven & Hartford Railroad Company, it is said, if it secures control of the system, will extend the lines to White Plains and to Port Chester, thereby completing its control of the electric railway system in the county.

OSWEGO, N. Y.—An order has been placed by the National Starch Company with the Allis-Chalmers Company, of Milwaukee, Wis., for a 937-kva, 480-volt, three-phase, 60-cycle, 1800 r. p. m. steam turbo-alternator. Excitation for this will be supplied by a small generator coupled to an extension of the turbine shaft. A type "C" Allis-Chalmers condenser will be used to maintain the vacuum.

PALMYRA, N. Y.—The Public Service Commission, Second District, has granted permission to the Palmyra Gas & Electric Company, of Palmyra, N. Y., the Newark Gas Light & Fuel Company, the New Light, Heat & Power Company, of Newark, N. Y., the Lyons Gas Light Company, of Lyons, N. Y., and the Wayne County Electric Company, of Lyons, N. Y., to consolidate under the name of the Wayne County Gas & Electric Company. The company is to be capitalized at $200,000, which is $45,000 less than the total of the capital stock of the companies consolidated.

RICHFIELD SPRINGS, N. Y.—The Richfield Springs Electric Light & Power Company has agreed to comply with the directions of the Public Service Commission, Second District, and has undertaken a contract to furnish the village with alternating-current arc lamps at the rate of $59.50 per lamp per year and to furnish electricity for lighting the hose house free of charge. The Public Service Commission, Second District, recently denied the application of the Hartwick Power Company for permission to furnish electrical service in Richfield Springs on the ground that the village is already served by the Richfield Springs Electric Light & Power Company; at the same time instructed the last-named company to make improvements to its plant and improve its service.

GASTONIA, N. C.—The City Council has granted the Isothermal Traction Company a franchise to construct an interurban electric railway through the streets of Gastonia. The company proposes to build an electric railway which will ultimately extend to Asheville, 90 miles distant.

WALLACE, N. C.—The Western Assurance Company, of Wallace, N. C., it is reported, would like [illegible] equipment and also contractors of electric light plants.

CLEVELAND, OHIO.—Bids for [illegible] the county buildings for a period of six years were submitted to the County Buildings Commission as follows: The lowest bid was submitted by the Cleveland Electric Illuminating Company, which offered to supply electricity for lamps at 3¾ cents per kw-hour; 4¾ cents per kw-hour for motors and 35 cents per 1000 lb. pressure for steam heating purposes. The Strong, Carlisle & Hammond Company offered to furnish electricity for lamps and motors at 4 cents per kw-hour and steam for heating purposes at 4[illegible] cents. The bid of the [illegible] Company was 5 cents per kw-hour for energy for lamps; 4¾ cents per kw-hour for power and 35 cents for steam. Bids were also submitted for the construction of a power house and equipment. Only one complete bid was received in this class, which was submitted by John Grant & Son, at $357,000 for plant, with $95,000 additional if a tunnel is constructed. The bid for the building alone was $147,000.

HUDSON, OHIO.—It is reported that plans have been prepared by D. M. Hosford, engineer, Caxton Building, Cleveland, Ohio, for municipal improvements in Hudson, including an electric light plant, contracts for which will be placed in the near future. The specifications call for a 150-hp gas engine, gas producer and a generator with a rating of 100 kw.

YOUNGSTOWN, OHIO.—Plans are being prepared by the Osborn Engineering Company, of Cleveland, Ohio, for enlarging the plant of the Republic Rubber Company, of Youngstown, Ohio, which will include the erection of an addition 80x200 ft., five stories high. Later, it is said, the company will enlarge its power plant.

ALTUS, OKLA.—The City of Altus has awarded contracts for improvements to the municipal electric light plant, water works and sewer systems, amounting to $200,000, to the H. W. Maxey Contracting Company, of Houston, Tex. The work on the electric plant will cost $35,000 and the water works $130,000 and will include bringing the water from a point about seven miles north of the city; the water will be pumped by electricity furnished from the central station.

ALTUS, OKLA.—The Pioneer Telephone Company, of Oklahoma City, Okla., has purchased the properties of the Leger & Chickasha Telephone Company and the Mangum & Quanah Telephone Company, the total consideration being $90,000; $60,000 for the Leger & Chickasha property and $30,000 for the Mangum & Quanah holdings. The systems include three exchanges and nine toll lines of the Leger & Chickasha company and two exchanges and eight toll lines of the Mangum and Quanah property, all having headquarters in Altus. There are also 14 rural lines operated out of Altus in connection with the Altus exchange. It is understood that extensive improvements will be made by the new owners. E. B. Jeffrey, C. C. Henry, J. R. McMahan and C. C. Hightower, all of Altus, Okla., are the principal stockholders.

FORAKER, OKLA.—Preliminary plans have been prepared by F. H. Lancashire, of Dallas, Tex., for the construction of an electric light plant and water works system in Foraker, for which bonds to the amount of $30,000 have recently been voted. It is said that as soon as plans are completed the town will advertise for bids for same. W. L. Leaton is town clerk.

HOBART, OKLA.—The Hobart Light & Power Company is planning to rebuild its overhead distributing system in the residence section.

OSAGE, OKLA.—The Osage Land & Development Company is reported to be contemplating the construction of an electric light plant in Osage, Okla. The office of the company is located at 500 North Broadway, Oklahoma City, Okla.

ASHLAND, ORE.—At an election held June 27 the citizens voted in favor of the proposition to issue $55,000 in bonds, the proceeds of $25,000 to be used to complete the municipal electric plant and $30,000 for paving. M. F. Eggleston is recorder.

KLAMATH, ORE.—Plans have been prepared by the Midway Telephone & Telegraph Company for rebuilding its entire system in Klamath Falls, work on which will begin the latter part of this month. A complete central energy system will be installed and the wires placed underground on Main Street. A 1600-line switchboard will be installed.

PORTLAND, ORE.—The headquarters of the Pacific Power & Light Company, a subsidiary of the American Power & Light Company, of New York, N. Y., will be located in Portland, Ore., with branch offices in the various towns where its properties are located. The properties purchased are as follows: Astoria gas plant, electric plant and street railway system; Pendle gas plant and electric plant; Adams electric plant; Freewater electric plant; Walla Walla gas plant, electric plant, street railway system and interurban railway to Milton and Freewater; Lewiston gas plant; Pasco water-works and electric plant; Kennewick water-works and electric plant; Sunnyside electric plant; Mabton electric plant; Wapato electric plant; North Yakima Gas plant, electric plant and water-works. The company will own steam generating plants at Astoria, Walla Walla and Kennewick, a hydroelectric plant at Walla Walla River, and combined steam and hydroelectric plants at North Yakima and on the Natchez River, 10 miles above North Yakima. The company is capitalized at $7,500,000.

EASTON, PA.—Plans have been prepared by M. H. Treadwell & Company, of Lebanon, Pa., Stoever Foundry & Manufacturing Company, of Myerstown, Pa., and the Lebanon Steel Castings Company, of Lebanon, Pa., for the erection of combined plants on a tract of 28 acres in Easton, Pa., recently acquired. The new plant will be equipped for electrical operation throughout.

NEKODA, PA.—The Pfoutze Valley Telephone Company has increased [illegible] stock from $[illegible] [illegible] of Millerstown, Pa., [illegible].

NEW CUMBERLAND, PA.—[illegible] are being made by the Susquehanna Woolen Mill Company to change its motive power from steam to electricity. It is proposed to erect a new building and install a new boiler and a 150-kw generator, which will supply electricity for lamps and motors [illegible]

PHILADELPHIA, PA.—[illegible] is reported to be estimating on plans and specifications for the construction and completion of the addition to the Passyunk power house, located at Twentieth Street and Oregon Avenue, for the Girard estate.

PITTSBURGH, PA.—W. P. Fraser, of the Highfield Company, owner of Morewood Heights, with other property owners in the vicinity of Morewood Heights, has organized the Squirrel Hill Electric Light Company. It is proposed to erect an electric light plant on Beeler Street some distance from Moorewood Heights to supply electricity for lighting residences in the Shadyside-Squirrel Hill district. The cost of the plant is estimated at about $100,000, and will be operated entirely by gas engines.

YORK SPRINGS, PA.—It is reported that York capitalists have purchased the Deardorffs Mills, near York Springs, and propose to erect an electric plant to furnish electricity in York Springs for lamps and motors.

CHARLESTON, S. C.—The capital stock of the Charleston Consolidated Railway, Gas & Electric Company has been increased from $1 500,000 to $2,000,000. It is reported that the company is contemplating making improvements to its system.

RAPID CITY, S. D.—Announcement has been made by the Dakota Power Company, which is now erecting a power plant on Rapid Creek, near Rapid City, to furnish electricity in this city, that it proposes to construct an auxiliary steam plant and an electric railway in Rapid City. L. A. Richards is president of the company.

CHATTANOOGA, TENN.—The Chattanooga & Tennessee River Power Company has engaged Jacobs & Davies, 30 Church Street, New York, N. Y., to complete its hydroelectric plant at Hale's Bar on the Tennessee River. It is understood that about 50 per cent of the work has been completed. About 50,000 hp will be developed.

CLEVELAND, TENN.—The plant and holdings of the Cleveland Electric Light Company have been purchased by J. W. Adams, of Chattanooga, Tenn., and associates for $25,000. The new owners are reported to be contemplating the construction of a dam 125 ft. high to develop the power of the Oconee River.

CLEVELAND, TENN.—The Union Improvement Company has been granted a franchise for the construction and operation of an electric system in Cleveland. The company has the privilege of building both overhead and underground distributing systems. The franchise is to be forfeited if the system is not in operation within two years.

GEORGETOWN, TENN.—It is reported that a local telephone company has been organized in Georgetown and proposes to erect an exchange system in this place. It is said that a trunk line will be built, connecting with the Cleveland Telephone Company, of Cleveland, Tenn.

BROWNSVILLE, TEX.—The question of making improvements to the municipal electric light plant is reported to be under consideration. It is said that about $15,000 will be expended.

FRIONA, TEX.—Plans are being considered by the Citizens' Coöperative Development Company for the construction of an electric light plant in Friona. C. C. Fredericks, Carson Building, Amarilla, Tex., is president of the company.

PALESTINE, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 19 for the construction, including pumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office in Palestine in accordance with plans and specifications, copies of which may be obtained at the above office or from custodian of site.

SAN AUGUSTINE, TEX.—The property and franchise of the San Augustine Light & Power Company have been purchased by E. E. Jeanes Lumber Company, which, it is said, will rebuild the power house, recently destroyed by fire. At present the town is without electric service.

WOODWARD, TEX.—The townsite of Woodward has been purchased by M. Bargas Company, of San Antonio, Tex., which will be further developed for a resort. Improvements will be made including the installation of electric light, water works, sewerage systems and other public utilities.

SALT LAKE CITY, UTAH.—A letter has been filed with the city recorder by R. J. Robinson, engineer, submitting a proposition relative to in-[illegible] Canyon. Mr. Robinson [illegible] that he has located water rights, which have been approved by the State engineer. He proposes to take water from the creek at a point about 2 miles above [illegible] 4 miles down the canyon through a 30-in. pipe.

ALTAVISTA, VA.—[illegible] Cotton Mill Company, of Altavista, Va., for construction of its plant. The equipment will include 13,000 spindles and 300 looms which will be [illegible]

FORT MONROE, VA.—Sealed bids will be received at the office of the constructing quartermaster, Fort Monroe, Va., until July 18 for construction of addition to hospital at Fort Monroe, including plumbing, heating and electric wiring and fixtures. Plans and specifications are [illegible]

NEWPORT NEWS, VA.—[illegible] for the navy yard power plant at Charleston, S. C., has been awarded to the Newport Contracting & Engineering Company, of Newport News, Va., [illegible]

RICHMOND, VA.—The Council Committee on Electricity has awarded the contract for underground connections for the proposed Broad Street ornamental lamps to the McKay Engineering Company. This is simply an increase of the original contract with the company.

STAUNTON, VA.—The Board of Aldermen on June 27 refused to concur in the action of the Common Council in approving the contract with the Staunton Lighting Company to light the streets of the city for a term of 15 years for $6,000 per year, with additional lamps in proportion. The city owns and operates a municipal electric plant.

MEADOW LAKE, WASH.—The Washington Water Power Company, of Spokane, Wash., is reported to have completed plans for the installation of an electric lighting system in Meadow Lake.

WILSON, WASH.—Arrangements have been completed for the extension of the telephone line of the Pacific Telephone & Telegraph Company from Wilson Creek to Soap Lake and Ephrata.

FAIRMONT, W. VA.—Overhead construction has commenced on the Fairmont & Northern Traction Company's railway at Fairview and will be completed as far as Granttown by September, a distance of six miles. D. L. Evans is superintendent of line construction.

APPLETON, WIS.—Arrangements are being made by the Wisconsin Traction, Light, Heat & Power Company for the construction of a dam on the Wolf River, at Gardner's dam, 35 ft. high. From there water will be carried through two flumes one and one-half miles to the site of the power plant, which will give a fall of 95 ft. Electricity generated at the plant will be utilized to operate an interurban railway in the Fox River Valley, owned by the Wisconsin Traction, Light, Heat & Power Company. John I. Beggs, of Milwaukee, Wis., is president of the company.

BROWNTOWN, WIS.—Bids will be received until Aug. 1 by the Village Clerk, Browntown, Wis., for the construction of an electric light plant to be driven with gasoline engines. C. B. Stewart, of Madison, Wis., is consulting engineer.

HIGHLAND, WIS.—The Wallace Mining Company, of Highland, Wis., is planning to increase the output of its electric plant. The equipment will include an electric generator and other apparatus.

LARSEN, WIS.—The capital stock of the Larsen Telephone Company has been increased from $10,000 to $15,000.

OCONTO FALLS, WIS.—Preparations are being made by the Morgan Telephone Company, recently organized, to erect a telephone system. It is understood that connections will be made with the Little River Telephone Company.

TWO RIVERS, WIS.—Arrangements are being made by the Nelson Lumber Company, of Two Rivers, Wis., for enlarging its mill. It is understood that the company will require woodworking and power machinery and probably electric motors.

WEST ALLIS, WIS.—The Milwaukee Machine Tool Company is reported to be contemplating the purchase of power equipment for its West Allis plant, including an engine, generator, boiler of from 80 to 100 hp and a number of electric motors.

SHERIDAN, WYO.—Representatives of the Ohio syndicate which was recently granted a franchise to construct an electric railway in Sheridan have filed their bond and it is expected that work on construction of the railway will begin soon. Later a railway will be built to Kooi, via Fort MacKenzie, a distance of 14 miles.

WHEATLAND, WYO.—Bids will be received until July 15 by the Town of Wheatland, Wyo., for the construction of an electric light plant, water works and sanitary sewer, plans and specifications for which may be seen at the office of the town clerk, or the office of J. C. Hadsall, engineer, Wheatland, Wyo. Plans may be obtained from the engineer by depositing the sum of five dollars, which will be refunded upon return of the same. Charles G. Buechner is town clerk.

VANCOUVER, B. C.—Arrangements are being made by the British Columbia Electric Railway Company for the construction of its new power plant in the Chilliwack district, work on which will soon commence. Power for operating the plant will be secured from Jones Lake, 18 miles east of Chilliwack, and Chilliwack Lake, 23 miles southeast of Chilliwack. The tunnel from Chilliwack is to be 14 x 16 ft. and 5¼ miles in length, and the tunnel from Jones Lake will be 10,200 ft. long.

INGERSOLL, ONT., CAN.—The City Council has engaged Robert A. Ross, of Montreal, Que., Can., to prepare plans, secure tenders and supervise the work of making the necessary changes for operating the electric plant recently acquired from the Ingersoll Electric Power & Light Company for receiving and distributing Niagara power from the Hydro-Electric Power Commission, work on which will begin at once.

NEW HAMBURG, ONT., CAN.—Sealed proposals will be received by the Municipality of New Hamburg, Ont., until July 18 for 13200-2300-volt transformers, switching apparatus, protective apparatus, street lighting apparatus, distributing transformers and maximum demand apparatus. For further information address William Millar, town clerk, New Hamburg, Ont., or from Edward P. Merrill, engineer, 59 Yonge Street, Toronto, Can., where specifications can be seen, etc.

TORONTO, ONT., CAN.—The offer of the Toronto Electric Light Company submitted to the City Council, details of which were published

[illegible] rejected. The board suggested that the only basis on which negotiations could be entered into by the city was the sale of the company's plant to the city at a reasonable figure.

MONTREAL, QUE., CAN.—The City Council, acting on a report of the Board of Control, has decided to terminate the street lighting contract with the Montreal Light, Heat & Power Company on Oct. 31, 1910.

MOOSE JAW, SASK., CAN.—Sealed tenders will be received by W. F. Heal, city clerk, until July 18 as follows: Contract "A"—Supplying material and constructing sewage disposal plant, complete and laying trunk sewer. Contract "B"—(1) Supplying and installing a complete air-lift system. (2) Supplying and installing one electrically-driven centrifugal pump and auto-starter. Contract "C"—Supplying and delivering 3000 cords of field stone. Plans and specifications may be seen at the office of J. M. Wilson, city engineer, Moose Jaw, Sask., Room B 33, Board of Trade Building, Montreal, Que., Can., and Room 404 Builders' Exchange Building, Winnepeg, Man., Can.

New Industrial Companies.

THE AKRON ROTARY ENGINE COMPANY, of Akron, Ohio, has been incorporated with a capital stock of $10,000 by C. E. Forsyth, Leo G. Fedderman, I. M. Forsyth, A. Fedderman and A. S. Mottinger.

THE ALBANY ELECTRIC SUPPLY COMPANY, of Albany, Ga., has been incorporated with a capital stock of $2,500 by L. Lewenstein, S. Farkas and R. Lewenstein. The company is a reorganization of the Albany Engineering Company, which will handle electric supplies, equipping buildings, etc.

THE AMERICAN ELECTRIC HEADLIGHT COMPANY, of Indianapolis, Ind., has been chartered with a capital stock of $50,000 for the purpose of manufacturing and selling headlights for use on locomotives, engines and other vehicles and conveyances. The directors are: Charles S. Stone, Charles N. Elliott and Harry B. Gates.

THE AUTOMATIC ENUNCIATOR COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $500,000 by S. F. Harris, W. I. Patton and A. E. Wilson, of Chicago, Ill. The company proposes to manufacture electrical supplies and apparatus.

THE AUTO ELECTRIC-LITE COMPANY, of Indianapolis, Ind., has been incorporated with a capital stock of $15,000 for the purpose of manufacturing and selling electric generating machinery and devices. The directors are: E. V. McCloud, O. M. Fish, W. F. McCloud and George L. Fish.

THE BANNER SAFETY LAMP COMPANY, of New York, N. Y., has been incorporated by Henry C. Hepburn, Edwin M. Post and H. C. Hepburn, all of Babylon, N. Y. The company is capitalized at $10,000 and proposes to manufacture electrical apparatus and devices.

THE DOWLING ENGINE WORKS, of Biloxi, Miss., has been organized with a capital stock of $100,000 to manufacture a headless twin cylinder engine. E. J. Dowling is interested in the company.

THE F. & J. AUDITORE COMPANY, of Brooklyn, N. Y., has been chartered with a capital stock of $25,000 by V. Ajello, J. Catanzaro and J. G. Stockman, all of Brooklyn, N. Y. The company proposes to do a general contracting business, building railways, light and power plants, real estate and building, sewers, reservoirs, etc.

THE GARRETSON ENGINEERING COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $100,000 by Albert D. Garretson, H. O. Garretson and William M. Hoffman, all of Buffalo, N. Y. The company proposes to manufacture engines, boilers, dynamos, etc.

THE GEORGE W. MULLER INTERIOR COMPANY, of Rome, Tenn., has been chartered by George W. Muller, of Atlanta, Ga.; John M. Graham, J. L. Bass, C. R. Porter and J. B. Sullivan, Jr., all of Rome, Tenn. The company is capitalized at $300,000 and will manufacture interior fittings, telephone booths, etc.

THE GIFFORD CONSTRUCTION COMPANY, of Borough of Queens, N. Y., has been incorporated with a capital stock of $10,000 by George H. Gifford, 400 Hillside Avenue, Jamaica, N. Y.; Allen B. Gifford, of Valley Falls, N. Y., and Leslie P. Gifford, of Valley Falls, N. Y. The company proposes to do a general contracting and construction business.

[illegible] N. Y., has been chartered by C. J. Kleber, of New York, N. Y.; J. McGregor, of Springfield, Mass., and J. H. Kaesen, of New York, N. Y. The company is capitalized at $125,000 and proposes to manufacture and [illegible]

[illegible] machinery manufacturing business.

[illegible] of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are: D. B. Wynn, J. K. Orvis and H. J. Farmer, of Waukegan, Ill.

[illegible] Martin and Henry J. Martin, all of Brooklyn, N. Y. The company proposes to manufacture and deal in hoisting machinery, elevators and fire escapes; also to do a general electrical and mechanical engineering business.

McGLYNN, HAYS & COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 to manufacture engines, elevator machinery, shafting, etc. The incorporators are: Thomas P. McGlynn, of Montclair, N. J.; Henderson B. Hays, of Montclair, N. J., and Elmer E. Cooley, 223 West 104th Street, New York, N. Y.

THE MUTUAL LAMP MANUFACTURING COMPANY, of New York, N. Y., has been chartered by Sigmund Thau, Louis Zankel, Solomon J. Stadler, all of New York, N. Y. The company is capitalized at $3,000 and proposes to manufacture and deal in oil, gas and electric lamps and shades, etc.

THE SHORES-IRWIN ELECTRIC COMPANY, of Spartansburg, S. C., has been organized for the purpose of doing a general engineering and contracting business. The company is the result of the purchase of a half interest in the Shores Electric Company by W. H. Irwin. J. H. Shores, R. A. Shores and W. H. Irwin are interested in the company.

THE SPENCER AIR PURIFYING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000 for the purpose of manufacturing machinery of all kinds and to deal in railroad equipment. The incorporators are: George M. Spencer, of St. Louis, Mo.; Edward B. McKellar, Sixth Street, Garden City, N. Y.; Charles B. Price, Fifth Avenue, Mt. Vernon, N. Y., and Vernon Terrance, of East Orange, N. J.

THE TREACY IRON WORKS, INC., of Brooklyn, N. Y., has been chartered with a capital stock of $5,000 for the purpose of doing an iron and steel contracting and construction business. The incorporators are: Louis V. P. Treacy, 600 East 164th Street, New York, N. Y.; Henry Wenz, Long Island City, N. Y., and H. M. Hebberd, of Brooklyn, N. Y.

New Incorporations.

HANFORD, CAL.—The Hanford & Summit Lake Railway Company has been chartered with a capital stock of $15,000 to construct an electric railway through Grangeville and Hardwick into the Summit Lake region, returning through Lemoore and Armonia. The railway, including an extension to Laton, will be 15 miles in length. The incorporators are: Charles R. Harwick, J. O. Hickman, George C. Ayedelott, of Hanford, Cal.; Ralph W. Heins, of Santa Cruz, Cal., and Clifford McClellan, San Francisco, Cal.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Bay Cities Home Telephone Company by James Lanagan, Guy Knupp, H. T. Bailey, C. F. Mohler, E. C. McDonough, J. E. O'Brien, N. J. Prendergast and others. The company is capitalized at $20,000,000.

WILMINGTON, DEL.—The Kermont Lighting Company has been chartered with a capital stock of $25,000 by Christian Douch, of Philadelphia; William H. Daart, of Harrisburg, Pa., and Martin E. Smith, of Wilmington, Del.

WILMINGTON, DEL.—Articles of incorporation have been filed with the Secretary of State by the Standard Gas & Electric Company with a capital stock of $24,000,000. The incorporators are: John S. Stubbs, James P. Murray and Edgar E. McWhiney, of Philadelphia, Pa.

WILMINGTON, DEL.—The Standard Light Company has filed articles of incorporation with the Secretary of State. The company is capitalized at $1,000,000 and the incorporators are: Willis A. Burney, Jr., of Savannah, Ga.; Herschel M. Conner, of Chicago, Ill., and Thomas E. Bayard, of Wilmington, Del.

NICHOLS, GA.—The Nicholas Telephone Company has been incorporated with a capital stock of $2,000 by W. R. Frier and others.

EAST ST. LOUIS, ILL.—The Alton & Southern Railroad Company has been granted a charter to construct and operate an electric railway from the right of way of the Southern Railway in East St. Louis to the St. Louis & Belleville Electric Railway, near Louisiana Boulevard. The company is capitalized at $10,000. The incorporators are: Arthur V. Davis, R. B. Mellon, of Pittsburgh, Pa.; Charles M. Hall, of Niagara Falls, N. Y.; C. B. Fox, Filbert McCulloch, Charles Souder and W. H. Hebenstreit, of East St. Louis, Ill.

HOWE, IND.—The Star Milling & Electrical Company has been incorporated with a capital stock of $10,000 for the purpose of generating electricity for distribution throughout La Grange County. The directors are: Oliver P. McKee and Emanuel Ritzer.

SEYMOUR, IND.—The Four Corners Mutual Telephone Company has been incorporated with a capital stock of $4,000 to construct a telephone system throughout Jackson and adjoining counties. O. M. Downs, of Seymour, Ind., R. F. D. No. 6, is secretary.

FRANKFORT, KY.—Articles of incorporation have been filed for the Cincinnati, Lexington & Licking Valley Railroad Company for the purpose of building an electric railway through Fayette, Pendleton, Kenton and Campbell Counties, connecting Newport and Lexington. The capital stock is placed at $30,000. The incorporators are: Don G. McVean, of Covington, Ky.; R. W. Day, of Scranton, Pa.; F. L. Fuller, of New York, N. Y.; T. J. Foster and W. L. Connell, of Scranton, Pa.; R. H. Reese and Wade H. Lain, of Cynthiana, Ky.

[illegible]

YORK, MAINE.—Articles of incorporation have been filed for the Gila Valley Electric Gas & Water Company. The company is capitalized at $200,000 and proposes to develop and distribute electricity, gas and water rights, etc. The incorporators are: John C. Stewart, president; Louis N. Duval, treasurer, and John C. Stewart, clerk.

SOUTH HAVEN, MICH.—The Citizens' Telephone Company, of South Haven, has been organized with a capital stock of $25,000 and the following officers: George C. Monroe, president; J. J. Clement, vice-president; E. J. Berge, secretary, and A. R. More, treasurer.

KERKHOVEN, MINN.—Articles of incorporation have been filed for the Kerkhoven-Louriston Telephone Company with a capital stock of $5,000 by William and Otto Strom, Fred Armstrong and others, of Murdock, Minn.

HERSHEY, NEB.—The Rosedale Telephone Company has been organized with a capital stock of $5,000 by T. A. Roberts, D. E. Martin and W. J. Shinkle.

LIMA, N. Y.—The Lima-Honeoye Light Company has been incorporated with a capital stock of $10,000 by George W. Olmstead, Ludlow, Pa.; Ellis L. Phillips, 50 Church Street, New York, N. Y., and Edward D. Hamlin, of Avon, N. Y. The company proposes to generate and distribute electricity.

MOUND CITY, S. D.—The Mound City Telephone Company has been incorporated by Gaines Falde, H. G. Fenske, of Mound City, S. D.; G. E. Brophy, N. J. Amundson, of Glenham, S. D. The company is capitalized at $25,000 and proposes to erect both local and long-distance telephone lines in the northern part of the State.

PARKSTON, S. D.—The Starr & Crossplains Telephone Company has been organized with a capital stock of $50,000 by J. H. Weber, Hubert Weber, Lawrence Schilmgen, of Parkston, S. D.; G. Hoffman and Henry Kurtenbach, of Ethan, S. D.

VIVIAN, S. D.—The Vivian-Fort Pierce Telephone Company has been chartered by Warren Young, Frank Whalen and Z. Sutley, of Fort Pierre, S. D.; Arthur Morse and R. Wood, of Vivian, S. D. The company is capitalized at $5,000.

VIENNA, VA.—The Washington-Virginia Railway Company has been granted a charter with a capital stock of $1,000,000 to construct and operate an electric railway from Vienna to Bluemont, Va.

Legal.

LAMP SOCKET LITIGATION.—The U. S. Circuit Court of Appeals for the [illegible] circuit has rendered a decision reversing the lower court in a suit for alleged infringement of a lamp socket patent granted June 13, 1899, to Charles G. Perkins. In the lower court the Yost Electric Mfg. Co. had been adjudged guilty of infringing four claims of the Perkins patent, but on appeal it was decided that of four Yost sockets in suit, three did not infringe, while the fourth was an infringement. The manufacture of latter socket, however, was, the court stated, discontinued about a year before the bill was filed, when the later numbered styles were adopted.

APPLICATION FOR RECEIVER FOR THE SIERRA NEVADA WATER & POWER COMPANY.—A lis pendens was filed July 1 by the Union Trust Company, of San Francisco, Cal., against the Sierra Nevada Water & Power Company, covering the entire holdings of the company in Amador and Calveras Counties. The company has just been through court proceedings and it was understood that all legal troubles were ended. Arrangements were being made by the power company to commence work on one of the largest water systems in the State to be used for generating electricity and irrigation purposes. The site of the proposed plant is located near Railroad Flat, in Calveras County. Work was begun on the system several years ago, but operations were suspended after the fire of 1906. The property was recently purchased at a sheriff's sale by Frank Z. Towle. The holdings of the company are extensive and include old water rights on branches of the Mokelumne River of over 30,000 in. and four appropriations on the same stream made since 1908 of 64,000 in., including a 55-mile ditch, numerous rights of way, land, pipe lines and other property. Application was made to Judge McSorley to have a receiver appointed. Frank Z. Towle was placed in charge of the property.

Personal.

DR. CHR. DEETJEN, of Baltimore, Md., has sailed for Europe to attend the International Congress for Medical Electricity. He will return the middle of October.

MR. MEYER BARNET has resigned from the Atlanta office of the General Electric Company to accept a position in the power department of the Empire District Electric Company, of Joplin, Mo.

MR. W. R. SWEENEY, who has been contracting agent for the Toronto, Can., civic electrical department, has been appointed by the Board of Control general manager of the electrical department.

MR. H. W. GOTTFRIED for the past four years connected with the Westinghouse Electric & Manufacturing Company at East Pittsburg, Pa., is now with Messrs. G. & O. Braniff & Company, of Mexico City, Mexico.

MR. E. L. PEARSALL has been appointed general manager of the Susquehanna Light, Heat & Power Company's Gas and electric properties at Bloomington, Ill. Mr. Pearsall was formerly connected with the Altoona (Pa.) Gas Company.

MR. O. B. WILCOX, vice-president of the Central Colorado Power Company, gave an interesting talk at the luncheon last week of the Colorado Electric Club, Denver, on the effect of electrical development on Colorado resources.

MR. BION J. ARNOLD, chairman of the Board of Supervising Engineers, Chicago Traction, has an interesting article on "Rehabilitation of Chicago's Traction Lines," in the July issue of *The Round Table*, of Chicago—a new magazine for the traction men of Chicago and vicinity.

MR. A. B. KRATZ has been appointed superintendent of telegraph and telephones for the Panama Railroad Company, operated by the Isthmian Canal Commission. For some time Mr. Kratz has been acting superintendent of telegraph and telephones for the Panama Railroad Company.

MR. FRANCIS RAYMOND, well known to electrical men in Chicago and vicinity, has accepted a position with the Duntley Manufacturing Company of Chicago. Mr. Raymond has lately given much attention to the introduction of electrically operated pneumatic cleaners, and his work for the Duntley Company will be largely along the same line.

MR. WILLIAM H. BRYAN, of St. Louis, has been certified by the Civil Service Commission of Chicago for the position of chief engineer of the Board of Education of that city. The salary for this position is $8,000 a year. Mr. Bryan is well known to electrical men as a consulting engineer of long standing, and in recent years has made the subject of plant depreciation a specialty.

MR. J. M. BARR, who has been connected with the testing and engineering departments of the Westinghouse Electric & Manufacturing Company, and more recently has been manager of the industrial motor department, has resigned to become manager of the Indianapolis factory of Fairbanks, Morse & Company. Mr. Barr is a graduate of the University of Wisconsin in the class of 1894.

MR. H. H. WESTINGHOUSE has been elected president of Westinghouse, Church, Kerr & Company to succeed Mr. Walter C. Kerr, a notice of whose death appeared in these columns recently. Mr. Westinghouse is president of the American Brake Company, president of the Westinghouse Traction Brake Company, first vice-president of the Canadian Westinghouse Company, second vice-president of the East Pittsburg Improvement Company, vice-president of the Pittsburg Meter Company, vice-president of the Westinghouse Air Brake Company, vice-president of the Westinghouse Machine Company, director of the Westinghouse Brake Company, Ltd. (London), director of the Westinghouse Foundry Company, and director of the Nernst Lamp Company.

Obituary.

MR. W. A. STADELMAN died on July 6 at his home in Rye, N. Y., at the age of 46 years. Mr. Stadelman was at one time a member of the firm of Chadbourne, Hazleton & Company, of Philadelphia, which was quite active in the electric railway and electric motor fields. For several years Mr. Stadelman was identified with the Brown Hoisting Machinery Company, of Cleveland, and the Wellman-Seaver-Morgan Company, of the same city, residing for a time in Cleveland, and later in New York. For the past two or three years Mr. Stadelman was at the head of the Darley Engineering Company, of New York. The funeral services were held in Rye on July 8, and the body was interred in Philadelphia, the former home of the deceased. He leaves a wife and two daughters.

MR. F. H. LINCOLN, vice-president of the Pay-Within Car Company, Philadelphia, was instantly killed Monday morning, July 11, while trying to board a train at the West Philadelphia P. R. R. station. Mr. Lincoln was returning from a visit at Atlantic City to his family, and the fatal accident occurred while endeavoring to catch a Washington train which was pulling out when the Atlantic City train arrived. Mr. Lincoln was born in Boston, May 28, 1867. His first work was in the machine shop of the Walworth Manufacturing Company, and in 1884 he entered the employ of the Thomson-Houston Electric Company, with which he remained until 1891. In the latter year he became connected with the Toledo Consolidated Street Railway, and in 1893 went to Philadelphia to become electrical inspector of the Peoples' Traction Company. This company at the time was changing from horse to electric power, and after a brief service as inspector Mr. Lincoln was given full charge of all the power stations of the company. Upon the consolidation of all of the surface roads in Philadelphia in 1895 he was made superintendent of lines and cables, in which capacity he had entire charge of redesigning and rebuilding the company's electrical distribution system, and was also superintendent of the Willow Grove Line, owned and operated by the Rapid Transit Company. In August, 1895, he was made assistant general manager of the Rapid Transit Company, and in that position had special charge of the Market Street elevated and subway division, as well as the maintenance of equipment of the entire system. Mr. Lincoln patented a number of inventions relating to electric traction, and was one of the co-inventors of the method for converting old-style cars into pay-within cars. Mr. Lincoln resigned in January from the Philadelphia Rapid Transit Company to become vice-president and general manager of the Pay-Within Car Company, which controls the pay-within car patents and is allied with the Electric Service Supplies Company. He always took

an active part in the work of the American Street and Interurban Railway Engineering Association, and last year at the Denver meeting was elected president of that association. He was also a member of the American Institute of Electrical Engineers.

Trade Publications.

FOUNDRY BLOWERS.—Belt type blower equipments for foundry service are illustrated and described in bulletin No. 286, of the American Blower Company, Detroit, Mich.

RHEOSTATS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a well-executed booklet devoted to battery charging rheostats intended particularly for electric vehicle service. The booklet contains numerous illustrations, full descriptions and complete price lists.

INSULATION ELECTRIC MACHINES.—In a bulletin of the Lincoln Electric Company, Cleveland, Ohio, the process of insulating an induction motor and rendering it waterproof is described and backed up by an illustration showing an induction motor operating under water.

ELECTRIC RAILWAY MATERIAL.—Catalogue No. 8 of the Ohio Brass Company, Mansfield, Ohio, is a well-illustrated 297-page publication dealing with appliances used in the construction, maintenance and operation of electric railways, mine haulage systems and transmission lines.

COUNTERS, REGISTERS AND INDICATORS.—This is the title of a catalog published by the Schaeffer & Budenberg Manufacturing Company, of New York, in which are illustrated and described the various revolution counters, engine registers and tachoscopes manufactured by the company.

FIBRE CONDUIT.—The H. W. Johns-Manville Company, of New York, manufactures a molded indurated fibre conduit for underground work which possesses many advantages. A description of this material was published in our issue of May 19. Other details and prices are contained in a small catalog just issued by the company.

VALVES AND STEAM SPECIALTIES.—The Ohio Brass Company, Mansfield, Ohio, has issued catalog H, devoted to radiator valves, union elbows, globe angle and check valves, pressure regulating valves and steam specialties. Descriptions, dimensions and prices are incorporated in the catalog, whose typographical appearance has much to commend it.

COAL-HANDLING MACHINERY.—The C. W. Hunt Company, West New Brighton, New York, has issued general catalog No. 102, relating to coal-handling and hoisting machinery, conveyors, industrial railways, electric locomotives, electric and steam hoists, "stevedore" manila rope, etc. The catalog contains numerous illustrations and brief descriptions.

ELECTRIC DRIVE IN GRAIN ELEVATORS AND FLOUR MILLS.—Bulletin No. 4742, entitled "Electric Drive in Grain Elevators and Flour Mills," issued by the General Electric Company, describes in considerable detail the application of the induction motor to this work, and contains illustrations of a number of installations in various grain elevators and flour mills throughout the country.

TUNGSTEN LAMPS.—Bulletin No. 4739, issued by the General Electric Company, describes incandescent lamps in which use is made of improved tungsten filaments, which operate at a specific consumption of from 1 watt to 1.25 watts per candle. The bulletin describes this lamp in great detail, and illustrates the various sizes for use on multiple circuits. It contains tables showing cost of operation and life, effect of voltage variation on candle-power and watts, relative costs of lighting with various lamps for equal illumination, etc. It also devotes considerable space to the reflectors necessary to give the best results.

METER TESTING RHEOSTATS.—In bulletin No. 4744, issued by the General Electric Company, is described a device known as a meter-testing rheostat. By means of switches, which form a part of the device, the rheostats may be made to give loads varying from ½ amp. to the full load rating of the rheostat in ½-amp. steps. The rheostat is made in two sizes—one of 15-amp. and the other of 30-amp. maximum rating, weighing 7 and 14 lb. respectively. The device is provided with a handle, and a special arrangement of the enclosing case enables the forming of supports for use while the rheostat is in service.

BUSINESS NOTES.

THE MORGAN CRUCIBLE COMPANY, LTD., of London, England, has opened an American office for the sale of "Morganite" and "Battersea" carbon brushes at 114 Liberty Street, New York City.

THE MINE & SMELTER SUPPLY COMPANY, which maintains large offices and warehouses at Denver, El Paso and Mexico City, with executive offices at 42 Broadway, New York City, announces that it has taken over the agency for the entire western territory of the United States of the well-known lines of pumps made by the Epping-Carpenter Company, Pittsburg, and compressors, made by the Burry Compressor Company, Erie, Pa.

THE WALKER ELECTRIC COMPANY through its western branch in the Monadnock Block, Chicago, recently closed the switchboard equipment for the Chicago & Northwestern Ry. Co.'s Chicago terminal power house. The home office of this company, Philadelphia, reports the closing of the switchboard equipment for the Curtis Publishing Co.'s new power house in that city. These equipments both include very complete outfits of motor-operated remote-control I-T-E circuit breakers. The aggregate cost of these two contracts exceeds one hundred thousand dollars.

INSULATION MAKES HOT FIRE.—A spectacular fire, fed by insulating materials, in the factory of the American Insulated Wire & Cable Company, Twenty-first and Morgan Sts., Chicago, assumed such an alarming aspect at the arrival of the first fire apparatus at 1 a. m., July 6, as to cause second and third alarms for additional companies to be turned in. The fire was in the center of a large wood-working and lumber yard district, but was controlled after causing the complete destruction of the wire company's factory and raw material stores, representing a loss estimated at $60,000. The offices and stock room were not damaged. Following the insurance adjustment, the company will rebuild and re-equip its factory on an enlarged scale.

CROCKER-WHEELER COMPANY ORDERS.—Among the orders recently booked by the Crocker-Wheeler Company, are the following: Two 1000-kw. engine-type generators for the Republic Iron & Steel Company, Hazleton Plant; one 500-kw. generator for A. M. Byers Company, Pittsburgh; one 300-kw. generator for the H. Lauter Company, of Indianapolis; one 175-hp auxiliary pole motor for the Orford Copper Company, of New Jersey; one 1000-kva. alternating current, and one 150-kva. generator for the Big River Lumber Company, of Saskatchewan, Canada; one 150-kva. generator with exciter, for Julesburg, Colo.; one 300-kva. belt type generator with exciter, for the York Card & Paper Co., of Pennsylvania, and two 500-kw. synchronous motor-generator sets for the new Gary plant of the American Sheet and Tin Plate Co.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY [illegible]

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

963,035. ELECTRIC BOND; T. J. Cope, Philadelphia, Pa. App. filed [illegible] the plate, the keeper being integral with the plate.

963,062. SECRET TELEGRAPH SYSTEM; W. P. Phillips, Bridgeport, Conn. App. filed Nov. 8, 1909. Provides a telephone receiver for hearing the message, but mutilates the signals on the sounder so as to make them unintelligible to outsiders.

963,064. QUICK-BREAK KNIFE-SWITCH; C. D. Platt, Bridgeport, Conn. App. filed March 1, 1909. Special construction of blade, an auxiliary blade being pivoted to the main blade.

963,090. STEERING APPARATUS; A. Sundh, Yonkers, N. Y. App. filed Sept. 21, 1905. The steering motor is controlled by a plurality of switches and is used to propel fluid to said switches to keep them clean and to blow out the arcs.

963,091. STEERING-GEAR APPARATUS; A. Sundh, Yonkers, N. Y. App. filed Sept. 21, 1905. A steering motor with a starting resistance, accelerating magnetic switches with a rheostat, with a speed governor for controlling the magnets which operate the switches.

963,[illegible] SYSTEM OF [illegible] tady, N. Y. App. filed [illegible] and for multi rates, including an actuating coil with series connections and a transformer with a primary connected to the translating devices and a secondary connected to the actuating coil for the meter.

963,118. BURGLAR-ALARM; E. A. Canavan, Duluth, Minn. App. filed Oct. 2, 1908. A hammer and cartridge alarm controlled by a normally open electric circuit.

963,123. ELECTRICAL RESISTANCE ALLOY; J. T. H. Dempster, Schenectady, N. Y. App. filed Feb. 1, 1910. The arm constitutes more than 50 per cent of the alloy which includes iron, nickel, chromium and manganese.

963,127. MOTOR-CONTROL SYSTEM; H. R. Emerson, Schenectady, N. Y. App. filed Nov. 13, 1907. For motor-driven printing presses in which a motor and a resistance and a controller are used with means for regulating the amount of the resistance in the circuit, together with a braking resistance with a switch for throwing it in shunt to the motor armature.

963,132. THREE-PHASE TRANSFORMER; J. J. Frank, Schenectady, N. Y. App. filed April 18, 1908. A device transforming from polyphase to polyphase with its windings star connected and an auxiliary closed secondary winding.

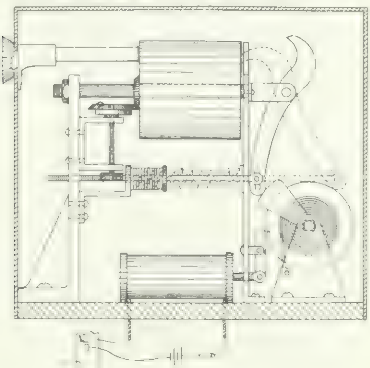
963,138. POWER-TRANSMISSION MECHANISM; M. K. Golden and W. H. Kendall, Detroit, Mich. App. filed Sept. 8, 1909. An

[illegible] longitudinally.

963,160. STARTING DEVICE FOR ELECTRIC MOTORS; H. H. [illegible] 1908. For induction motors which are started by means of a [illegible] the primary circuit closed by the operator and held closed when [illegible]

963,163. LIQUID RHEOSTAT: F. Mackintosh, Schenectady, N. Y. App. filed Dec. 18, 1908. A rheostat having a fluid container with electrodes and an auxiliary container connecting therewith with means for raising and lowering one and a no-voltage device for controlling the auxiliary container.

963,169. APPARATUS FOR STARTING ELECTRIC MOTORS: S. [illegible]



[illegible]

motors and the conductors, overload trips for the switches and a compensator to connect the conductors to the voltage of the source.

963,173. OSCILLATION RECEIVER; G. W. Pickard, Amesbury, Mass. App. filed Sept. 14, 1907. An electrical conductor, an electrical contact with a substantially rough, unpolished fracture surface of a conducting solid, namely, the mineral red oxide of zinc.

963,191. LOCK FOR ELECTRIC LAMPS; E. H. Weber, St. Louis, Mo. App. filed Dec. 27, 1909. For preventing the stealing of [illegible] means for preventing vertical movement thereof with a nut and set screw for embracing the lamp.

963,192. COMBINED TELEPHONE AND CONTROL SYSTEM; H. [illegible] necting subscribers at central by means of a telephone transmitter [illegible] control relay and a timing device for current impulses to operate said control relay.

[illegible] and C. E. Doyle, Youngstown, Ohio. App. filed June 3, 1909. For removing ice by a pneumatically actuated scraper attached to the trolley pole.

963,213. TELEGRAPH APPARATUS; R. L. Dean, Kansas City, Mo. App. filed Feb. 12, 1906. Receiver and recorder consisting of a stylus propelled by a screw with shifting mechanism therefor.

963,216. WOOD SEPARATOR FOR SECONDARY BATTERIES; L. H. Flanders, Edgewood Park, Pa. App. filed Oct. 21, 1908. Separator for electrodes of batteries consisting of wood veneer with wood stiffening ribs.

963,233. LIGHTNING-ARRESTER; B. H. Mann, Webster Groves, Mo. App. filed Aug. 19, 1909. Spark gap terminals connected to each of three conductors overlaid with a glass plate, together with inductance coils mounted thereon.

963,234. CEMENTING-MACHINE; N. Marshall, Newton, Mass. App. filed Jan. 22, 1906. For cementing the filaments of incandescent lamps to the wires by means of a device having a recess for receiving and positioning a stem wire, a device having a substantially aligning recess for the end of the filament, and a filament holder.

963,238. ELECTRIC BUZZER; I. F. McElroy, Albany, N. Y. App. filed Sept. 16, 1909. A magnet with circular diaphragms and sup- [illegible] hanging the edge of the diaphragm within the range of its vibration.

[illegible]

[illegible] Kerin, Oakland, Cal. App. filed June 26, 1909. A plate with [illegible] mounted in each end of the groove for clamping the wire to the [illegible]

[illegible] a casing. Details.

[illegible]

system, having a generator, a battery, a work circuit, a charging circuit, a booster, and independent circuit and a motor for driving the booster.

963,352. SHEET-METAL BOX; A. E. Blackman, Mount Vernon, N. Y. App. filed July 22, 1909. For switch boxes made up of a [illegible]

963,356. RAIL-BOND; C. L. Cadle, Cleveland, Ohio. App. filed March 1, 1906. A laminated flat metal strand with lateral extensions and an arched intermediate portion.

963,374. RELAY; I. Kitsee, Philadelphia, Pa. App. filed Feb. 8, 1909. Cable relay, including a plurality of pairs of magnets with a movable coil for each pair, the coils being secured together on a single moving system, each coil being in its own field and also in the field of another coil.

963,395. RESISTANCE-BOX; L. T. Robinson, Schenectady, N. Y. App. filed Aug. 14, 1909. A base carrying a rigid tubular insulating member with contacts secured to the inner wall to form an unyielding socket for a conducting plug and a resistance strip connected to one of the contacts.

963,412. MAGNETO GENERATOR; C. W. Wilson, Edgewood, Ill. App. filed July 26, 1909. A U-shaped field magnet with resilient limbs and an armature, together with an adjustable member for spreading the pole pieces.

963,425. CONNECTING CLIP; G. Brown Dusinberre; Cleveland, Ohio. App. filed May 29, 1909. For temporary connections consisting of two sheet metal pivoted jaws with an interior spring.

963,432. AUTOMATIC FIRE-ALARM SYSTEM; A. Goldstein, New York, N. Y. App. filed May 23, 1903. A single wire for the thermostat circuit, together with a signal transmitter, transmitting one character of signal for a defect in the circuit and a distinguishing signal for the fire alarm.

963,471. CONDUIT; E. R. Ramsey, Penn Yan, N. Y. App. filed Oct. 29, 1908. Two strips of material wound upon each other with a thread passing through them and locking them together.

963,476. CIRCUIT-BREAKING MECHANISM; W. M. Scott, Philadelphia, Pa. App. filed March 1, 1905. A plurality of electric switches each comprising main and shunt contacts, one above the other, the shunt contacts of an upper switch opening before the lower switch.

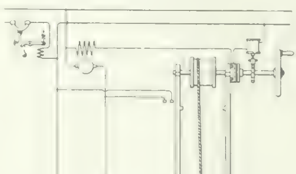
963,480. SWITCHBOARD FOR ELECTRICAL CONDUCTORS; J. F. Skirrow, East Orange, N. J. For telephone system in which the back board carries metal straps and buttons and is perforated so that the conducting pin may pass through it, and is received and held by converging sections of sheet metal.

963,496. LIGHTNING CONDUCTOR POINT AND POINT-ROD PROTECTOR; C. Bajohr, St. Louis, Mo. App. filed Nov. 16, 1909. A platinum tipped point mounted in a tubular jacket of graphite, thus resisting the action of acid gases coming from chimneys, etc.

963,508. BRUSH HOLDER; M. Brodeur, Lynn, Mass. App. filed Sept. 16, 1909. The holder has a channel to receive the brush and a follower and guiding means for the follower.

963,571. TROLLEYS; W. W. Hutchinson, Brooklyn, N. Y. App. filed Aug. 1, 1908. To prevent the trolley from leaving the wire, it being mounted on a pivoted bracket, in which it is swiveled, the bracket being secured to the trolley pole.

963,628. TELEPHONE RECEIVER ATTACHMENT; G. S. McComb, San Francisco, Cal. App. filed Dec. 27, 1909. A telephone receiver



[illegible]

with an arm having a segmental bearing and an intermediate portion at right angles to hold the receiver which is attached to the transmitter.

963,678. ARRANGEMENT FOR STARTING AND REGULATING [illegible] nold, Karlsruhe, Germany, and Jens Lassen La Cour, Edinburg, Scot- [illegible] by the brushes and the other with its magnetic axis displaced ninety [illegible]

963,728. ELECTRIC SIGNAL SWITCH; J. J. Ayer, Cambridge, Mass. [illegible] automatic cut-off, which cuts out the lamp when the current fails.

963,733. PLUG SWITCH; J. H. Kliegl, New York, N. Y. App. filed [illegible] the socket, the plate enabling the plug to be withdrawn from its receptacle without transmitting the stress to the connections of the conductors and contacts.

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PHYSIOLOGICAL EFFECT OF HIGH-FREQUENCY CURRENTS.

An article by Dr. A. E. Kennelly and Mr. E. F. W. Alexanderson in this issue contains a report of a series of convincing tests relating to the physiological tolerance of alternating currents of high frequencies. The tests reported cover facts concerning which much has been written during the past 20 years, but they differ from the earlier tests in that exact measurements were made of the physical quantities involved, while many of the former reports were based on approximations involving a considerable amount of guesswork in connecting the unknown quantities with the data determined. The currents used in the present experiments were obtained directly from an alternator capable of producing any frequency up to 100,000 cycles per second; the currents were measured immediately at the point of application to the bodies of the subjects by means of a hot-wire ammeter, while the e.m.f. required across the body to produce the known current therein was measured by a hot-wire voltmeter. It would be difficult to devise a better method for determining without error the physical quantities dealt with. As was to have been predicted from the knowledge of results obtained by earlier experimenters, the higher the frequency, the greater is the electromotive force that may be impressed between the hands of a person without discomfort. However, even at the highest frequency of 100,000 cycles per second, the permissible electromotive force does not come within the range of values—that is, among the thousand volts—repeatedly mentioned in connection with high-frequency experiments. The highest value reached was only 360 volts with one subject, which value was 50 per cent greater than that obtained on any of the other five subjects. The present authors connected the subjects directly to the terminals of the alternator, while most of the earlier experimenters seem to have inserted the subjects in series with certain impedances across secondary circuits, and the physical measurements were either ignored or confined to an observation of the current and a guess at the voltage.

Viewing the results from strictly a physical standpoint, the circuit through the body from one hand to the other represents an impedance which has a value of perhaps 1250 ohms at 60 cycles, and 500 ohms at 100,000 cycles. The reduction in impedance with increase in frequency indicates that the "skin effect" is either absent or greatly overshadowed by other effects. The report of the experiments does not contain data for determining to what extent the body acts as an electrolytic conductor, or how much the variation in impedance is attributable to a decrease in resistance with an increase of either the current or the frequency. If one were permitted to assign a constant value to the resistance of the subject, he would be justified in concluding that the human body is in effect a condenser, between the plates of which there is a dielectric of high resistance and [illegible]. It is highly probably that this analogue [illegible] but that the resistance

is not constant and the capacity is subject to change. Just what relation exists between the electricity for charging the human condenser and the physiological tolerance remains yet to be determined, but the experiments by Messrs. Kennelly and Alexanderson indicate that a more or less definite relation does exist.

ELECTROMAGNETIC THEORIES OF DYNAMO-ELECTRIC MACHINERY.

It is almost self-evident that the same fundamental laws of energy, in relation to electromagnetism, underlie the behavior of all dynamoelectric machinery, such as generators, motors, and transformers, whether utilizing three-phase, single-phase, or direct currents. In every case we have the interactions of electric currents and of magnetic fluxes. Nevertheless, the working theories used by designers of these different machines differ in considerable detail. Not only the formulas used in designing a direct-current generator and a transformer are different, but the methods of apprehending their respective phenomena are different. A series of articles, by Dr. Hermann Zipp, have lately appeared in *Elektrotechnik und Maschinenbau*, setting forth a nearly uniform geometrical basis of consideration for the behavior of all tyes of dynamo-electric machines. It employs a vector magnetomotive-force diagram, on which are drawn three important vectors; namely, an impressed mmf., a line-current operated m.m.f. and a resultant m.m.f. The product of the two latter components is then developed and from the result, the power generated or absorbed by the machine is deduced. There is considerable interest in any method of converging electromagnetic operations in machines of different classes, but it is doubtful whether, in this case, there is any practical advantage in its adoption.

HARMONICS IN CURRENT AND VOLTAGE WAVES OF TRANSFORMERS.

Among the papers scheduled for the Jefferson convention of the American Institute of Electrical Engineers, but actually read recently at the San Francisco meeting, was one of the above title, by Mr. John J. Frank. A point of special value in this paper is the large number of oscillographic records which it incorporates. The deductions expressed in the paper are readily checked and corroborated by reference to these oscillograms. The value of the oscillograms would have been further increased, if a scale of ordinates in volts or amperes had been inscribed with each; but fortunately a considerable number are analyzed harmonically by the schedule method of Prof. S. P. Thompson. The paper has important theoretical as well as practical bearings. From the theoretical standpoint, the results indicate that the harmonics in the excitation current-wave of a transformer carry no resultant cyclic energy, and so have no effect upon the area of the hysteresis loop for the core. They affect only the shape of that loop. Consequently, if we analyze out the fundamental sine-wave from the complex current-wave in a transformer, the hysteresis loop, drawn with the aid of this fundamental wave, will be an inclined ellipse, containing the same area as the distorted hysteresis loop drawn with the aid of the complete complex wave. The two loops, thus compared, will coincide on the axis of abscissas, and will also extend through the same range of ordinates. If, moreover, the above fundamental current wave be split into two components respectively in and out of phase with the impressed sinusoidal voltage, and a hysteresis loop be drawn with each component in turn, the former will give rise to a vertical ellipse of the same area as before; while the latter will give rise to an inclined straight line, or ellipse of vanishingly small area.

From the above viewpoint, the excitation current of a transformer under sinusoidal impressed voltage may be regarded as a fundamental sine-wave which supplies all the energy to the core, and another fundamental sine-wave in quadrature with the latter, which supplies the pure magnetization, plus higher harmonics, due to cyclic changes in permeability of the core, but otherwise without energy effect. This means that we may consider the essential operations of any transformer, at any load, as due entirely to currents of the fundamental frequency of the circuit, provided that the impressed voltage is sinusoidal. Some of the above deductions were arrived at by Mr. Charles K. Huguet in a paper presented before the Institute a number of years ago. From the practical standpoint, the paper throws much light on the behavior of single phase transformers when connected in three-phase groups. If we take a group of three such transformers, with their primary windings connected in star, and their secondaries either also in star or in opened delta, some remarkable phenomena occur when the group is excited from ordinary three-phase mains. With impressed sinusoidal voltage between mains, one would suppose, at first thought, that the voltage across each individual primary winding, or branch of the star, would likewise be sinusoidal. It sounds, at first, like a contradiction in terms, that when the three main voltages of the impressed primary system are all sinusoidal, the component branch voltages in the three branches of the star group between each main and the neutral are distorted. Nevertheless, they are distorted, and the oscillograms in the paper, taken with commercial transformers under practical conditions, show very marked distortion. Moreover, the three primary transformer voltages, instead of being each 58 per cent of the main voltages between wires, may be each 66 per cent of the same; and the maximum cyclic value of each primary transformer voltage, instead of being 58 per cent of the maximum cyclic main voltage, may be 86 per cent of the same.

The explanation for the above anomaly lies in the fact that any transformer with an iron core, and therefore with hysteresis, requires a triple-frequency component of current in its excitation. But no symmetrical star connection from a three-phase system can carry a triple-frequency component of current, because it is easily shown that such a component would mean that the total instantaneous current arriving at the neutral point would not be the same as the total instantaneous current departing therefrom. In other words, the neutral point would have to store and discharge electricity in each cycle, in order to permit of a harmonic frequency of three times the fundamental. This restriction does not apply to frequencies of 5, 7, 11 or 13 times the fundamental. Therefore, the three transformers in the star group must get on as best they can without any triple-frequency harmonic current. They work, and excite themselves, but with a powerful triple-frequency component in voltage—or with a cyclic distortion in their voltage that the missing component of current would eliminate. If, however, the secondary windings of the transformers are connected in a closed delta, a triple frequency current will flow

around this delta, and will automatically smooth out the disturbance to a considerable extent. Curiously enough, the paper shows that if the group of three single-phase transformers be replaced by a single star-connected three-phase transformer —that is, a transformer with three interlinked magnetic cores symmetrically arranged to carry three-phase magnetic fluxes, each associated with primary and secondary windings—then the distortions, in the primary star branches do not occur, whether the secondary windings are closed or not. In this case the magnetic reactions between the three component magnetic fluxes are such as to prevent the above-mentioned distortion in branch voltages from taking place, although the primary currents can have no triple-frequency components. This fact constitutes a distinct advantage in favor of three-phase transformers over their equivalent single-phase groups. Preference is usually accorded to the latter in this country because an accident to one component does not necessarily put the group out of commission. In Europe, however, the three-phase transformer is in much greater use and favor and deservedly so.

MAGNETIC STORMS.

Some recent investigations reported in the foreign journals tend to throw new light on the origin of the magnetic storms that from time to time sweep over the earth with startling effect on the magnetic elements, with frequent demoralization of service on grounded telegraph and telephone lines, and with the usual accompaniment of flamboyant displays of aurora in the heavens. The connection of these phenomena with great solar activity as shown by sun spots has long been known and accepted as a fact, evident, but not fully explainable. Indeed, it has only been within a year or two that the direct connection of sun spots with electromagnetic solar activities has been shown. The discovery by Hale of Zeeman's effect in sun spots, with consequent discovery of the nature of the direction and magnitude of the magnetic forces involved, is one of the notable contributions of the last quarter century to solar physics; but the connection of the tremendous magnetic fields thus brought into evidence with the magnetic storms and their accompaniments on earth is still far from clear.

When the relations of these phenomena were first noted it was assumed that the connection was a direct electrodynamical one, the solar disturbance being propagated by free waves in the ether and producing powerful inductive action upon the earth and its surrounding atmosphere. It did not take many years, however, to bring out the fact that between the primary disturbance on the sun and the secondary disturbance on earth there was not the accurate synchronism required by this hypothesis. If a visible outburst upon the sun was the immediate cause of electromagnetic disturbances here, the latter should follow the former by approximately eight minutes. In point of fact the interval, so far as it has been discovered by the rather incomplete data available, amounts instead to several or many hours. More recently, however, the hypothesis has been advanced that disturbances on earth are not thus directly produced, but that they are the consequence of the incidence on the earth and its surrounding envelopes of streams of electrons, or more generally, of electrified material, poured out from the sun during periods of extraordinary activity. Such streams would be competent to produce powerful electrical disturbances, and their existence, at least near the sun, is rendered exceedingly probable in view of the now known facts regarding the magnitude of the causative forces in the sun spots.

Whatever the actual cause the resulting disturbances are practically world wide. The great electromagnetic storm of last August was recorded in all quarters of the globe, while the brilliant auroral display of March 28 last was observed in extraordinary splendor at least from Scotland to the Saskatchewan country and very likely much further, and at practically the same time. Now the projected matter theory accounts sufficiently well for the observed delay between sun spot disturbances and the terrestrial response, assuming that we can judge of the time of starting by the mere fact of the sun spots sweeping around as nearly as may be in the earth's direction It is, of course, not certain just what direction the electron streams would take from the solar surface, nor is it by any means clear whether they are irregular outpourings from the sun spots or occur only at certain periods of convulsive activity. The exhaustive studies of the solar surface now being regularly made at Mount Wilson should throw some light on this point, but in any event it is perhaps too much to expect an accurate initial epoch to be decided upon when one considers merely a stream sent forth with unknown direction and velocity from a center of disturbance on the sun to a point somewhat over 100 solar diameters distant.

The studies of Professor Ricco on the time relations between sun-spot transits and electromagnetic storms show that the latter are delayed by a little over 40 hours than the average, corresponding to a velocity of a little less than 1000 km per second for the projected matter, a figure which agrees sufficiently well with the known velocities of the particles emitted from terrestrial sources. It has been objected to this theory of electromagnetic storms, that the electrostatic forces in action should cause a much greater disturbance of potential gradient above the earth's surface than has ever yet been observed in connection with such storms. The natural and promptly made response to this objection was that the upper regions of the atmosphere contain strata of a density which gives relatively good conductivity and such strata to a very considerable extent must act as an electrostatic shield. It is within these very regions of the atmosphere that the intense activity of the aurora is peculiarly manifested, reaching over enormous areas and at just such times as magnetic storms are felt in the regions below.

A very recent addition to the theory of this interesting subject has been made in bringing to light preliminary symptoms to magnetic storms—well-defined, small, but sudden variations in the magnetic elements occurring some hours before the outbreak of the main storm. This preliminary disturbance, which is generally of very short duration, was conspicuous in the great storm of last August and was world-wide in its effect. Such symptoms antedate the storm itself by very varying amounts, sometimes only a couple of hours, sometimes more than half a day. They very naturally suggest that terrestrial electromagnetic disturbances may be connected by more than one linkage with those upon the sun. For instance, it is not at all inconceivable that the preliminary disturbance may reach us in the form of free electromagnetic waves taking their origin at the beginning of the period of electronic eruption which ends in the more powerful and enduring phenomena observed on earth.

Results with Edison Storage Battery Car.

The Edison-Beach car installed on the Twenty-eighth and Twenty-ninth Street Crosstown Railroad, New York City, has now been in operation since the first of the year and under continuous test most of the time. The result of tests for three months made between March 2 and June 1 are now available. These tests may be taken as representing the performance of the car under more adverse conditions than would be encountered in practice on roads of ordinary conditions. The road is made up of 4.77 miles of track laid with various forms of rails ranging in weight from 47 lb. to 109 lb. per yard. There are 46 curves on the road and a 3.5-per cent grade 1000 ft. long. The track was built for horse-car service and no attempt has been made to maintain it. The car runs between the east and west side ferries, and carries an average of 15 passengers, the car making about 458 full stops a day, which is equivalent to eight stops per mile. The maximum speed capacity in this service is 15 miles per hour.

The car was described in these columns Jan. 27, 1910. It is of the single-truck closed type, with a seating capacity of 26 and standing room for 15 more passengers. In one instance the car under test carried 70 passengers. Empty it weighs 10,000 lbs. and 12,400 lbs. with average load. The power equipment consists of two 5-hp, 110-volt motors and 100 A-8 Edison cells for the motor energy and five cells for lighting. The maximum distance which the car has covered in this service on one charge is 86 miles.

During the three months of the test the car was on the road 1132.5 hours and covered 5152.5 miles, which is an average of 57.25 miles per day of 12 hours 35 minutes. The battery is charged once a day, the charge lasting 4.4 hours and taking place at 185 volts and 60 amp.

The total daily energy input to the battery is 48,840 watt-hours and the battery output measured at the motor brushes is 30,280, giving an energy efficiency of 62 per cent. Reducing the total energy consumption to a unit basis, the gross energy input to the battery for this service was 137 watt-hours per ton-mile, and based on motor consumption, 85 watt-hours per ton-mile, the schedule speed being 4.77 miles per hour with eight stops per mile and an average running speed of 5.74 miles per hour.

Up to the present date the car has run more than 10,000 miles on the worst kind of track and in all kinds of weather. During this period there have been no repairs to the car or battery except the renewal of one motor brush and the addition of 70 gal. of water to the battery.

The Patent Caveat Abolished.

Among the last bills to be passed by Congress before adjournment was an act abolishing the patent caveat. The caveat has been a distinctive feature of American patent law, and had for an object to protect an inventor who desired further time in which to mature an invention. The caveat, which was operative for a year, but could be renewed from year to year, set forth the object and distinguishing characteristics of an invention, and was filed in the confidential archives of the Patent Office. No patent could issue on a similar invention without notice to the caveator, who thereupon was expected to file his application. The use of the caveat has been largely curtailed through the practice of inventors in making record of supposed inventions and appending their signature together with those of two or more witnesses. The Patent Law Association of Washington and the Commissioner of Patents favored the bill passed.

The bill was introduced in the House by Representative Gustav Kuestermann, of Wisconsin, who declared that through the use of the caveat great abuses have been practiced and the life of patents has been extended many years longer than the contemplates.

The caveat bill is merely an entering wedge," said Mr. Kuestermann. "The entire patent system in this country needs an overhauling. It took a long, hard fight to get through this one small measure. But the ice has been broken. I have pending in the committee other bills that will go far toward making our patent laws the best in the world. And I am confident these bills will be enacted into law eventually. When the required changes are made in the existing laws, every patent issued by the United States will have behind it the absolute guarantee of the Government, and a poor inventor will have an equal chance with the man or concern of large means."

Priority of Invention of the Compensated Repulsion Motor.

The *Patent Office Gazette* of July 12 gives a decision by the U. S. Patent Commissioner on appeal from the Examiners-in-chief in a case involving priority of invention of the compensated repulsion motor. Two patent applications, both owned by the General Electric Company, are in the Patent Office which involve the invention of this motor, filed respectively by Winter and Eichberg, of Germany, and Marius Latour, of Paris, France. It is stipulated in the suit that Winter and Eichberg made the invention in issue in Austria, November, 1902; reduced to its practice in December, 1902, and disclosed it to Mr. E. J. Berg, of the General Electric Company, early in January, 1903; that Berg on Jan. 10, 1903, transmitted a written description of the invention to the officials of the General Electric Company, which was received at Schenectady by Mr. E. W. Rice, Jr., and read by him on Jan. 24, 1903. On Jan. 14, 1903, Winter and Eichberg filed an application for a patent on the same invention in Germany, and subsequently other applications for patents were filed in various other countries. It is stipulated on behalf of Latour that application for the same invention was filed by him in France Jan. 21, 1903, and that applications were also filed in other foreign countries, the date of the United States application being Jan. 19, 1904. The opinion states that Germany did not adhere to the international convention for the protection of industrial property until May 1, 1903, which is subsequent to the filing of the Winter and Eichberg application. It was therefore held that they are not entitled to the benefit of the filing date of the German application. On the other hand, there is no question that they are entitled to the date of Jan. 24, 1903, when knowledge of the invention was communicated to Mr. Rice in this country. It was further held that Latour is entitled to the date of the filing of his French application with the same force and effect as if the application had been filed in the United States upon the same date, Jan. 21, 1903. As this is prior to the earliest date which could be granted to Winter and Eichberg, namely, Jan. 24, 1903, the priority of invention was awarded to Latour by the Examiners-in-chief, and this was upheld upon appeal by the Commissioner of Patents. On appeal Latour was represented by Mr. A. G. Davis, and Winter and Eichberg by Messrs. A. G. Davis and John C. Pennie. The patent has not yet issued.

Chicago Electric Vehicle Men Form an Association.

The Chicago Electric Vehicle Manufacturers' Association has been incorporated under the laws of the State of Illinois to promote the sale of the electric automobile and the proper care of the vehicle after it has been sold. The new organization is composed of manufacturers and dealers in electric automobiles and of storage-battery men, and all persons of this description engaged in business in Chicago, which is the greatest market for electric vehicles in the West, are eligible for membership. The association has elected officers as follows: President, Mr. L. E. Burr (Woods Motor Vehicle Company); vice-president, Mr. Ralph Temple (Baker Motor Vehicle Company); secretary, Mr. Godfrey H. Atkin (Electric Storage Battery Company); treasurer, Mr. J. C. Cooley (Waverley Company). The president and secretary of the association, with five directors, constitute the board of managers. These directors are: Messrs. E. Louis Kuhns (Studebaker Automobile Company), F. A. B. Smith (Rauch & Lang Carriage Company), John T. Fisher (Babcock Electric Carriage Company,) F. E. Price (Ander-

son Carriage Company), and D. W. O'Brien (Columbus Buggy Company).

In the great impetus that has been given recently to the use of the electric vehicle, it has been realized that one of the serious drawbacks of the past was neglect, through ignorance or carelessness, of the battery. The new association proposes to bend its efforts to instruct owners and garage keepers in this important particular. Its aim will be to undertake the work in a systematic manner, and it expects to open a downtown office soon and to employ a salaried manager to look after the affairs of the organization. The association is organized not for immediate profit, but to promote in a general way the electric-vehicle industry of Chicago and vicinity for the benefit of all engaged in it.

Convention of General Sales Agents of Large Electric Light Companies.

An informal convention of the general sales agents of the electric light companies of New York, Chicago, Philadelphia, Boston, Cleveland, Detroit and Brooklyn was held on July 11 and 12 at Briarcliff Lodge, Briarcliff Manor, New York. This was the first convention of its kind, and is the forerunner of others which will be held from time to time to discuss problems relating principally to the larger electric light companies of the country.

The program consisted of the following papers, not subject to publication: "Filing Systems," by Mr. R. S. Hale; "Collateral Duties of a Sales Department," by Miss S. M. Sheridan; "Residence Lighting," by Mr. E. W. Lloyd; "Standardization of Power Forms and Data," by Mr. J. W. Myers; "Canvassing by Telephone," by Mr. T. I. Jones; "Apartment Lighting," by Mr. J. F. Becker; "Contract Routine," by Mr. E. F. Tweedy, and "Electric Heating," by Mr. M. E. Turner. Those present were Messrs. R. S. Hale, L. R. Wallace and H. W. Moses, of the Edison Electric Illuminating Company, of Boston; J. F. Gilchrist and E. W. Lloyd, of the Commonwealth Edison Company, of Chicago; J. W. Myers and J. D. Israel, of the Philadelphia Electric Company; T. I. Jones and H. G. Disque, of the Edison Electric Illuminating Company, of Brooklyn; A. S. Pope and E. F. Tweedy, of the New York Edison Company; J. F. Becker and E. W. Rhodes, of the United Electric Light & Power Company, of New York; M. E. Turner, of the Cleveland Electric Illuminating Company, and Miss S. M. Sheridan and Messrs. B. J. Denman and G. D. Slaymaker, of the Detroit Edison Company.

The New Street Lighting of Chicago.

Plans for improved street lighting in Chicago, adding to the present equipment of 12,000 lamps 10,000 others, the cost of installing which will be financed by the Sanitary District of Chicago, whose hydroelectric generating station on the Drainage Canal near Lockport will supply the energy for operating the entire 22,000 lamps, were discussed at the July 13 luncheon of the Chicago Electric Club. Mr. William Carroll, city electrician of Chicago, summarized the terms of the proposal, explaining how the city is to pay the district $15 a year for each connected horse-power, energy to be taken about 11 hours a night or 4000 hours a year. The lamp consumption specified is 450 watts. The district will also take over and operate the city's transmission lines and substations, for which it will receive $1 a lamp a year from the city. As the result of combining the transmission systems of the city and the district, both of which are public bodies, the city will gain the use of the district's lines in case of breakdown, while the latter will be able to utilize the city's lines for transmitting its commercial business when they are not required for lighting purposes. Maintenance of the distribution circuits and the lamps themselves will be retained by the city electrical department. The estimated saving to the city will be about $27,000 a year for its street lighting. All of the first quota of lamps are to be installed in three years, and the city is to pay the district's outlay for financing the new lighting within seven years

The absence from the meeting of Mr. E. B. Ellicott, electrical engineer of the Sanitary District, was explained by Mr. N. F. Obright, contract agent, who said that the very matter of the new street lighting itself had held Mr. Ellicott away, as amended drafts of the agreement were then passing between the district and the city offices, which it was expected would shortly reach an agreement on all details.

Mr. F. J. Postel called attention to the advantages of incandescent units, especially of the series tungsten type, for certain classes of lighting in residential sections, and also suggested that if possible the new wiring installation should be placed underground. Mr. Carroll said that careful experiments with series tungstens were being made, and that this type of illuminant would receive consideration in choosing the lamps to be used. As to underground construction at this time he pointed out that the clamor for additional lighting comes from those sections of the city which want, first of all, the lamps, and will willingly accept any overhead work in order to get them. As financial resources for construction work are limited, and as underground work would cost perhaps four times as much as overhead lines, Mr. Carroll fears that the suggestion to cut down by 75 per cent the number of lamps installed, in order to make the appropriation cover proper underground construction, would not be popular with the less discriminating communities needing the lamps. As the system is now planned, said Mr. Carroll, it is contemplated to district the lamps in sections of 1500 each, each district being served from a central substation from which underground feeders will radiate to the points of overhead distribution, thus requiring only single-wire circuits to be carried on poles.

Mr. J. G. Pomeroy brought up the interesting speculation that just as the arc lamp practice of the past ten or even five years has undergone a rapid change and advance, the future is likely to reveal similar progress which may leave the apparatus selected to-day far behind. He believed that the present metallic-flame lamp on direct-current circuits, and the impregnated-carbon flaming-arc lamp on alternating-current, present the best possibilities for the future as economical illuminants. Others who took part in the discussion were Messrs. W. A. Jackson, W. B. Jackson, A. L. Millard, W. R. Bonham, James H. Delaney, J. W. Mabbs, H. B. Gear and O. B. Duncan. Mr. Delaney was appointed chairman of the reception, or "gladhand" committee and instructed to secure identification tags for members, and Mr. George H. Porter reported on the Electric Club picnic, to be held next month.

At the invitation of Mr. Carroll, who declared that his department would welcome any suggestions from the Electric Club on the subject of the installation of the new lamps, the club's regular committee on civic affairs was directed to cooperate with the electrical department and the Sanitary District in the matters of the choice of illuminants and the character of construction to be used. Prof. P. B. Woodworth is chairman of this committee, the other members of which are Messrs. W. L. Abbott, George H. Lukes, James Lyman, Kempster B. Miller, E. A. Rummler and T. P. Gaylord.

Electricity in Colorado Mines.

The mining industry in Boulder County, Colorado, owes much of its present increased activity to the advent of the Central Colorado Power Company with its transmission lines rapidly extending over the county. Energy is now offered at less than half the cost of steam plants with existing coal prices. The management of the power company is also very much alive to the fact that increased mining activity means greater power sales, and it is actively boosting the development of Boulder County's mineral resources. Not only is it displacing steam plants and starting up plants which have been abandoned because of too great producton costs, but is also rapidly displacing isolated water-powers because of their unreliability and because at certain periods of the year they must cease operation.

The two last water-power mills to contract for electric drive are the Wood Mountain Mill, at Wall-street, and Wolf Tongue

Mining & Milling Company, at Nederland. In both cases their water equipment was good for the summer months, and cheap. The cost of making the change was found to be trivial as compared with the continuity of service guaranteed, and the costs have actually been lower through the reduction of maintenance and supervision of the water-power plants. In a few cases where water-power plants have had break-down gasoline engine plants installed, the power company has been able to show costs of operation which have run very much lower than the gasoline costs. In one mine the cost for the same service per month for electricity was $38 against $194 for gasoline, with a cost per month per horse-power of $5.61 for electricity against $28.80 for gasoline. Similar economy has been attained in a number of instances and has done much to increase the use of electricity in the mines.

Among others the Eureka Tungsten Mining & Milling Company states that its motor bill at present is $76 per month, or 50 per cent less than it would be with steam, although this plant is located at the edge of the city of Boulder, with comparatively cheap fuel cost. The Good Luck Mill states that its bill of $400 per month for coal has been cut down to $180 for electric energy, besides saving the wages for firemen and avoiding difficulties that go with delivering and handling coal several miles over mountain roads. At present the Central Colorado Power Company is supplying energy to the mining district from its Shoshone plant, but expects about the middle of August to operate the Boulder plant, when the reliability of its service will naturally be largely increased.

Mexican Hydroelectric Developments.

The waters of the rivers and smaller streams of Mexico are being rapidly put to use for generating electric power and irrigating the rich lands of the valleys. Preliminary steps have been taken during the last few months toward the installation of many hydroelectric plants in different parts of the republic. In many instances power and irrigation projects are combined. A number of applications of concessions of this character are now pending in the national department of Fomento.

Albert B. Fall is seeking a Government concession to use 14,000 gal. of water per second from the Aros River in the Guerrero district, Chihuahua, to generate electricity for use in mines. The plans for the proposed hydroelectric plant have been drawn and its installation will be started as soon as the concession is formally granted. D. J. Spillane has asked for a concession from the Government to use the water from the falls of the Gallinas River in the Santa Maria del Rio district, State of San Luis Potosi, to operate a hydroelectric plant which he is preparing to install there. The energy will be transmitted to mining and industrial centers of that region. The La Cruz Mining & Milling Company has applied for a concession to use 314 gal. of water per second from the Navosaigame River, State of Chihuahua, to generate electrical energy, which will be used to operate the machinery of the mines and mill of the company.

M. Dahgren has applied for permission to use about 16,000 gal. of water per second from the Champayan lagoon in the State of Tamualipas to irrigate a large tract of land upon his San Francisco hacienda. Charles E. Tamez wants a concession for the use of about 600 gal. of water per second from the Pabrillo River, in the State of Nuevo Leon, to irrigate a portion of his Purisima de Conchos hacienda. Pedro Loyola and Luisa L. Vda. de Campos will use about 1200 gal. of water per second from the Laja River to irrigate their lands in the State of Guanajuato if the Government grants their application for a concession for the purpose.

José E. Gaytan is preparing to establish a large irrigation enterprise in the valley of the Yaqui River, in the State of Sonora. He has applied to the Federal Government for a concession for the proposed system of irrigation, including the right to use the water from the river. José Valenzuela has applied for a concession to use the water of the Coaten River, in the State of Chiapas, to irrigate a large tract of land. Dionisio Garcia will construct an extensive irrigating canal system in the State of Michoacan, to irrigate a part of his ranch if his application for a concession to use the waters of the Zitacuaro and San Juan Viejo Rivers for the purpose is granted. Hipolito Maldonado wants a concession giving him the right to use the waters from the San Juan and Las Liebras springs, near Agualeguas, State of Nuevo Leon, to irrigate his lands.

Dirigible Balloons and Electricity.

At a special summer joint meeting of the Chicago Section of the American Institute of Electrical Engineers with the Western Society of Engineers in the latter's rooms in the Monadnock Block, Chicago, July 8, Mr. W. A. Blonck, an electrical engineer of Chicago, who has just returned from a European trip and a study of dirigible-balloon construction abroad, gave an interesting talk, illustrated by lantern slides, on the subject of these craft. With the aid of diagrams he described the essential differences in construction between the three types of dirigibles now engaged in fierce competition in Europe—the rigid-frame, the semi-rigid and the non-rigid. The famous Zeppelin vessels are examples of the rigid type, the gas-bag envelope being reinforced by aluminum metalwork construction. The outer envelope encloses 17 or more small ballonets which contain the gas, applying the separate-bulkhead principle to prevent a local injury from disabling the entire lifting power of the dirigible. Horizontal steering is effected by rudders, and movement in a vertical plane is controlled by the tipping of louvres or horizontal rudders at the front and rear ends of the vessel. When properly set these louvres also assist by an aeroplane action in sustaining the vessel after a certain speed is reached. The semi-rigid construction employs a reinforcing keel for the single gas bag, while the non-rigid type has the car supported from the bag entirely by cables, maintaining a gas pressure of about 1 in. of water column to preserve the shape of the bag. The last type has the advantage of being entirely collapsible for transporting or for escape from a high wind. These latter dirigibles employ an aerostatic principle for steering in the vertical plane, being provided with a small pump for introducing air into one of two small air ballonets at the front and rear of the gas bag, thus displacing the gas and its lifting power at that end and tilting the whole vessel. As indicative of the great interest in dirigibles abroad, the speaker mentioned that even several of the large electrical manufacturing concerns there, notably the Siemens-Schuckert Company, have taken up the construction of these vessels.

Mr. Blonck made several trips in a dirigible and described the sensations experienced, the ease of control, and the beauty of the passing panorama. He does not think that the aeroplane, on account of its inherent high speed and its dependence for its suspension on continuous engine operation, will reach for many years the reliability and satisfactory travel already attained by the gas-supported vessel. The supply of cheap hydrogen gas, as a by-product from other manufacturing operations as in Europe, is essential to the practical development of aeronautics in the United States. A balloon loses from 1 to 2 per cent of its gas content each day, which must be replenished; and at the end of six weeks has to be entirely emptied and refilled on account of the infiltration of air which mixes with the gas.

A suggestion that lines of balloon carriers might be electrically driven by dragging trolleys taking energy from special trolley lines was scouted by Mr. Blonck, who pointed out that the freedom of travel opened up by air craft was one of their greatest advantages, and would be curtailed by trolley connection.

Mr. Blonck told of a new advertising scheme which had appeared in Berlin the week before. A dirigible has its propeller engine fitted with an electric generator for supplying a projecting lantern, and hovers over the city flashing signs on the gas bag, to be read by all the curious observers. The promoter is said to be reaping a fortune, and Mr. Blonck suggested that the method might be employed to even greater advantage in this country where advertising is carried out on a much more extensive scale.

The "Wireless" Devotees of Chicago.

At this time, there are estimated to be not less than 800 amateur wireless-telegraph stations in Chicago. This figure, which has been made on a conservative basis, includes the total present number of active, dormant and neglected outfits in which the interest of their generally youthful owners is at various degrees of intensity. It numbers equipment ranging from the half-inch spark-coils of beginners, up to the high-powered stations of advanced amateurs, which are in all respects equivalent to the commercial outfits. In addition to the amateurs, there are three wireless-telegraph companies having stations in Chicago—the United Wireless Telegraph Company, the Great Lakes Radio-wireless Company and the Continental Consolidated Wireless Company. The first-named concern does a commercial business with its chain of wireless stations on the shore of the Great Lakes, and with 65 vessels equipped with its apparatus.

Amateur interest in "wireless" in Chicago finds expression in a club of 100 members, the Chicago Wireless Club, which holds meetings of an educational nature twice each month, on the second and fourth Fridays, in the Auditorium Building, Chicago. The membership of the club is limited to amateur operators who have wireless stations. The ages of the members range from 15 to 50. The purpose of the club is a double one—to provide practice in transmitting and receiving messages between members' stations, and to hold meetings at which specially skilled or experienced operators and electrical engineers address the club on subjects pertaining to "wireless."

The Chicago club has taken into its own hands the regulation of members' interference with commercial signals, a matter which has elsewhere recently echoed even to Congress. By agreement with the commercial operators, all club members having stations of over ½-kw capacity are limited to special times for sending, during which the commercial stations and low-powered amateur stations are not at liberty to work. The "big" amateurs thus have the ether to themselves the first 15 minutes of each hour from 6 to 11 p. m., weekdays, and all day Sunday. If a low-powered operator wants to talk to one of the high-powered stations, he is instructed to wait until 20 minutes after the hour, and then to put in his message, which will be answered during the first quarter of the next hour.

An official call list is issued by the club, to be posted in all members' stations. Besides a brief enumeration of the "wireless" rules of the road and suggestions for improved transmission, the list gives the name of each member with his assigned call, consisting of two letters, as for example, "B G," and also his address and telephone number. Sometimes the last-named is useful for comparing notes when a detector sticks or a decoherer slurs. Among the precepts of the "wireless" code of etiquette as promulgated by the club, are the following:

Don't misrepresent yourself by wireless or use some one else's call. Never test your spark or "warm up" an electrolytic interrupter, or adjust the vibrator of a coil without first disconnecting the aerial; it is not fair for you to monopolize the time by causing unnecessary interference. Don't interfere with commercial stations, or some day you will miss your antennae.

Until recently, the club sent out a "wireless" bulletin each evening, as a matter of practice for amateur operators in receiving. The bulletin usually consisted of an article of some electrical or telegraphic interest, about 120 words in length, and was transmitted, in succession, from some one of the 1-kw stations or over, every evening at 8 o'clock. These messages were sent slowly, at the rate of about 10 words per minute, and could be received all over the city. Sometimes the program was varied by sending passages in foreign languages, to quicken the receiving ears of the amateur operators. This practice of sending out general bulletins has, for the time being, been discontinued, on account of other activities among the wireless amateurs.

Several members of the club have stations of capacities up to 2 kw, the equal in power of the commercial apparatus at Chicago. The signals of these larger amateur stations are frequently received across Lake Michigan and at a wireless telegraph school at Valparaiso, Ind.

Original experiments with kite antennae have been undertaken by several of the Chicago amateurs. Both the box and Eddy-tailless forms of kites have been used for supporting the aluminum aerial wire, in this way attaining a vertical height of 800 ft. or more, which considerably extends the radius of transmission of a low-powered station. The field set used for this purpose consists of a 1-in. spark-coil energized from four dry cells, the whole outfit being arranged compactly in a suit case. With this apparatus, using the aluminum kite string as the aerial, a transmission distance of 10 miles is attained.

The officers of the Chicago Wireless Club are as follows: President, Mr. Royal C. Dickson; vice-president, Mr. John Hair; recording secretary, Mr. Selden Stebbins, and corresponding secretary, Mr. Ed. M. Muellner.

Investigation of High-Tension Transmission in Massachusetts.

In accordance with Resolve 55 of the Legislature of 1910, the Massachusetts Gas & Electric Light Commission gave a public hearing on July 14 upon the conditions and laws surrounding the transmission of electricity for light, heat or motor service within the State, special consideration being paid to the transmission of energy in bulk over considerable distances and at high potentials. In opening the hearing Chairman Barker called attention to the importance of the subject and its possible technical and commercial difficulties. Notice had been generally sent to municipal authorities and managers of public utility companies in regard to the inquiry, which is to result in a report to the Legislature of 1911 by the Commission, with a discussion and recommendations concerning legislation bearing upon the larger transmission of energy in the State.

Mr. E. W. Burdett, for the Massachusetts Lighting Companies, Massachusetts Electric Companies, and Hyde Park Electric Light Company, stated that the laws of Massachusetts are to-day inadequate to handle large power developments properly, the statutes being absolutely silent in regard to much that relates to the construction and maintenance of lines. At present a town can block a worthy transmission development by standing in the way of the necessary line location. It is necessary to provide the power companies with the authority to exercise the right of eminent domain without the handicap of local obstructions.

Selectman Stone of Clinton voiced the difficulties which had beset his board of late in granting a location within the town to the Connecticut River Transmission Company. It was almost impossible for the selectmen to grant a franchise for the running of a line to the Lancaster Mills, the largest industrial plant in town, on account of the opposition of the public. Finally a location was obtained so that the circuits are carried partly on land owned by the State, in part over private property, and on but one short street. The difficulty was that political considerations carried too much weight with the public. The town authorities felt that the entrance of hydroelectric power was a public benefit to the community, but the troubles which were experienced pointed the way toward taking out of the hands of the local boards the opportunities to block progress. The company's trunk line operates at about 66,000 volts, but a limit of 14,000 volts was placed in the town itself.

Mr. Eugene Carpenter, Newton, Mass., operating lighting plants on Vineyard Sound, suggested the desirability of giving additional authority to the Commission in connection with power-line locations. He emphasized the benefits of centralized power generation, with long-distance transmission and wide local distribution in place of scattered and small plants. The Board should have the power to enforce agreements between local and power companies respecting the location of lines and the responsibility for their maintenance.

Mr. Thos. Robinson, of the Uxbridge & Northbridge Electric Company, said that the day of the small power plant is going by. He felt that one of the most important points to

be considered is that of good construction in all high-tension line work.* He cited instances of distant fires caused by the grounding of a transmission line and suggested that all overhead construction should be standardized so far as possible under the supervision of a competent engineer to be employed by the Commission. This engineer would act in connection with local inspectors of wires. Mr. Robinson felt that the wires in the state should all be under one handling, and deprecated placing them under the jurisdiction of the Highway Commission, which now has supervision over telephone and telegraph lines. It was argued that the entrance of a large power company into a small local field is often a great benefit to the local company, since the incoming power relieves the existing company from an investment which might be too heavy for successful handling. In conclusion, Mr. Robinson said that large power companies should be under the supervision of the Commission in the same manner as central stations and gas companies.

Mr. S. H. Pillsbury, counsel for the Connecticut River Transmission Company, pointed out that under the existing laws a transmission company has no authority to compel either a town or an individual to permit its line to pass through the community. Any town may block any company regardless of the necessities of the case in a broad way. The great majority of states now give power-transmission companies the right of eminent domain. In but 12 states is there no legislation whatever on this subject. Mr. Pillsbury contended that the Commission should be the first authority to which a power company should come in seeking a location for its line in general. The company should be required to apply for a certificate of public convenience and necessity in the same way that an electric railroad goes before the Massachusetts Railroad Commission when it seeks the right to build over a general route. A map of the route should be filed and full opportunity given by the Commission for all parties interested to be heard in the case. If a town objects to the use of its streets and requires the company to build its lines over private land, the company should be allowed to take such land by right of eminent domain. Mr. Pillsbury said that it was his understanding that the Connecticut River Transmission Company is not a public service corporation under the existing law, but that status is fast approaching, especially when the right of eminent domain is granted. Some degree of regulation by the Commission would be desirable in case the right of eminent domain is given to power companies. In a case recorded an aqueduct company became a public service corporation by the grant of the right of eminent domain.

President Henry I. Harriman of the Connecticut River Transmission Company stated that his company has now been operating for about seven months, and that it is selling energy at the output rate of 60,000,000 kw-hours annually. All this output goes to 14 customers, and the total amounts to nearly half the total output sold by all the central stations in Massachusetts. The economy of the service has been evidenced by the securing of nine repeat contracts by the company. Energy is sold at rates varying from 1 to 1.5 cents per kw-hour to the larger customers. The average installation has about 700 hp in service and there are no customers using less than 300 hp, except in the town of Gardner. Mr. Harriman pointed out that the larger user can afford to put in the most economical equipment, so that it speaks well for transmitted energy that it can successfully compete with independent manufacturing plants. The larger water power possibilities now lie in the more remote regions. Mr. Harriman said that within a radius of 175 miles of Boston, Worcester and Springfield there are undeveloped water powers amounting to over 300,000 hp, which would go a long way toward turning every wheel within the state. He touched briefly upon the great advantages of large over small units, and pointed out the improvement in economy of investment due to a better diversity factor. Mr. Samuel Insull of Chicago has recently shown that if all the electrical service of that district could be supplied from one company the investment needed would be reduced by 33⅓ per cent on account of the reduction of duplication. There are noteworthy economic advantages in the development of large water power and steam plants. Turning to the question of rights of way for high-tension lines, Mr. Harriman said that it was surprising how reasonable the public had been in the main in the purchase of over 400 rights for the company which he represented. There were from 10 to 15 per cent, however, that tried to impose extortionate charges, so that it is almost impossible to build lines across country without the right of eminent domain. If the work is attempted without this right, the cost of line construction is inevitably increased, and the result is that the public has to pay a larger charge for its energy than where lines can be put down according to the engineering needs of the situation. The law should be designed to provide for appeals to the Commission in cases of disagreement over line rights of way. Steel towers cannot properly be erected on streets, and as trees have to be cut for 50 ft. on each side of a high-tension line, the provision of the right of eminent domain is a genuine necessity to power companies.

Mr. W. H. Snow of the Holyoke Lighting Department said that he welcomed the coming of larger powers into fields which the smaller plants cannot well afford to occupy. Mr. W. R. Peabody, Boston, counsel for the Amherst Power Company and other interests in the Connecticut Valley, stated that his clients have had the same difficulties in securing line rights as were cited by Mr. Harriman. The State should do all it can to facilitate the entrance of water power in the interests of the ultimate consumer, and eminent domain is a necessity for such work. The progress of hydroelectric development in the Connecticut Valley is being held back by the absence of the eminent domain provision in the law. The right of appeal from the action of local authorities is important, and the law should be set forth so that local authorities cannot impose impracticable restrictions as to voltage at different town boundaries.

Commissioner Schaff stated at this point that it was his opinion that the right of eminent domain should not be granted to power companies unless in the grant there is a provision to the effect that the lines shall be put underground as soon as it is reasonable and practicable. He did not consider that country lines should be placed under the surface.

Mr. M. V. Jones, counsel for the New England Telephone & Telegraph Company, urged the necessity of eminent domain rights for power companies, and said that the telephone companies also need it. It is to-day extremely difficult to construct heavy trunk lines on the highways, and yet the cost of rights of way taken by purchase and not be eminent domain is apt to be very high. Joint use of poles is undesirable where any of the lines carry high potential current. General Schaff said that power companies given eminent domain should be required to make a complete exhibit of their receipts and expenses. Mr. Harriman spoke briefly on the engineering difficulties of placing circuits carrying over 20,000 volts underground. Mr. Mason, representing the Orange Electric Light Company, also appeared on behalf of the right of eminent domain for power companies, and central stations having transmission lines. The Board continued the hearing until Sept. 15 to hear further arguments bearing upon desirable changes in the laws concerning electric transmission.

Ohio Telephone Situation.

Reports have been current at Columbus, Ohio, to the effect that plans are being worked out in the office of J. P. Morgan & Co. for the organization of a company that will take over the Morgan properties in Ohio outright. This will probably be done through an exchange of securities, if the rumor is correct. The properties affected are the United States Telephone Company, the Cuyahoga Telephone Company of Cleveland, the Columbus Citizens Telephone Company of Columbus, the Dayton Home Telephone Company of Dayton, the Toledo Home Telephone Company of Toledo and the local exchanges controlled by the United States Telephone Company and the

Columbus Citizens Telephone Company. The belief is expressed that nothing will be done by the new organization until all the companies are brought up to a high standard. The plants at Cleveland, Columbus and Toledo are in good shape now, but improvements are contemplated for some of the others. The purpose of the new corporation is reported to be to get the properties into a company that will be of sufficient size to attract attention in financial circles and be more readily financed for the future.

Amendments to A. I. E. E. Standardization Rules.

At the White Mountain convention of the American Institute of Electrical Engineers, Dr. A. E. Kennelly, as chairman of the standards committee, submitted a report suggesting certain amendments to the standardization rules of the Institute. Below are given the amendments suggested, some of which represent additional rules and others merely revisions in old rules.

ADDITIONS.

6*a*. *Two-Phase.* A term implying the supply of power through two circuits carrying alternating currents which differ 90 deg. in phase.

9*a*. *A Compensated Alternator* is an alternator which automatically compensates for the drop in voltage in its armature, or in its armature and the line.

9*b*. *A Synchronous Compensator* is a synchronous machine running either idle or under load, whose full excitation may be varied so as to modify the power-factor of the circuit, or through such modification, to influence the voltage of the circuit.

11*a*. *An Inductor Alternator* is an alternating-current generator in whose armature windings the field magnet flux pulsates but never reverses.

11*b*. *An Induction Generator* is a machine similar to an induction motor, but driven as an alternating-current generator.

21*a*. *A Rotor* is a rotating member of a machine.

21*b*. *A Stator* is a stationary member of a machine.

21*c*. *Equalizing Rings* are rings connected to equipotential points of multiple-wound armatures to equalize the voltage between brushes.

23*a*. *A Primary Winding* is that winding of an induction motor or of a transformer which receives power from an external source.

23*b*. *A Secondary Winding* is that winding of an induction motor or of a transformer which receives power from the primary by induction.

Note: The terms "High-tension winding" and "Low-tension winding" are suitable for distinguishing between the windings of a transformer, where the relations of the apparatus to the source of power are not involved.

29*b*. *e*. *A Transformer-Balancer* is an auto-transformer for dividing a voltage in constant proportions, and usually into two equal portions.

29*c*. *f*. *An Induction Starter* is a device used in starting induction motors, converters, etc., when they are started by voltage control, consisting of an auto-transformer in connection with a suitable switching device.

29*d*. *g*. *A Leakage Reactance* is that portion of the reactance of any induction apparatus which is due to stray flux.

49*a*. *A Synchronoscope* is a synchronizing device which, in addition to indicating synchronism, shows whether the machine to be synchronized is fast or slow.

49*b*. *A Voltmeter Compensator* is a device used in connection with a voltmeter to reduce its reading by the amount of the line drop, and thus causing it to indicate the voltage delivered at the distant end, or at any other predetermined point of the line.

49*c*. *A Watt-Hour Meter* is an instrument for registering total watt-hours. This term is to be preferred to the term "integrating wattmeter."

49*d*. *Recording Ammeters, Recording Voltmeters, Recording Wattmeters* are instruments which record upon a time-chart the values of the quantities they are designed to measure.

78*a*. *a*. *Indicating Meters* should be rated according to their full-scale reading of volts, amperes or watts (at unity power-factor in wattmeters).

78*b*. *c*. *Watt-Hour Meters* should be rated by their power delivery at rated volts and amperes at unity power-factor.

84. *The Efficiency* of an apparatus is the ratio of its output to its input. The output and input may be in terms of watt-hours, watts, volt-amperes, amperes, or any other quantity of interest, thus respectively defining energy efficiency, power efficiency, apparent-power efficiency, current efficiency, etc. Unless otherwise specified, however, the term efficiency is ordinarily assumed to refer to power efficiency.

When the input and output are expressed in terms of the same unit, the efficiency is a numerical ratio, otherwise it is a physical dimensional quantity.

86. *Apparent Efficiency.* The volt-ampere efficiency, or the ratio of volt-ampere output to volt-ampere input. In apparatus in which a phase displacement is inherent to their operation, apparent efficiency should be understood as the ratio of net power output to volt-ampere input.

REVISIONS.

9. *An Alternator or Alternating-Current Generator* produces alternating currents, either single-phase or polyphase.

20. *d*. *A Frequency Changer* converts from an alternating-current system of one frequency to an alternating-current system of another frequency, with or without a change in the number of phases or in voltages.

26. (*a*) *Compensator Potential Regulators,* also called contact regulators, in which a number of turns of one of the coils are adjustable.

29. *d*. *Reactance Coils,* sometimes called choke coils, are a form of stationary induction apparatus used to produce reactance or phase displacement.

216. *Condition of Apparatus to be Tested.* Commercial tests should, in general, be made with the completely assembled apparatus and not with individual parts. The apparatus should be in good condition and high-voltage tests, unless otherwise specified, should be applied before the machine is put into commercial service, and should not be applied when the insulation resistance is low, owing to dirt or moisture. High-voltage tests should, in general, be made at the temperature assumed under normal operation. High-voltage tests considerably in excess of the normal voltages to determine whether specifications are fulfilled are admissible on new machines only. Unless otherwise agreed upon, high-voltage tests of a machine should be understood as being made at the factory.

308. *Transmission Circuits.* In alternating-current constant-potential transmission circuits, the following average voltages are recommended: 6600, 11,000, 22,000, 33,000, 44,000, 66,000, 88,000, 110,000.

317. When white lights are used a light turned on should denote danger such as "switch closed" or "circuit alive"; while the light out should denote safety, such as "switch open," or "circuit dead." Low-efficiency lamps should be used on account of their lesser liability to accidental burn-out.

341. *Candle-Power.* The luminous intensity of sources of light is expressed in candle-power. The unit of candle-power should be derived from the standards maintained by the National Bureau of Standards, at Washington, D. C. The hefner is 0.90 of this unit. In practical measurements seasoned and carefully standardized incandescent lamps are more reliable and accurate than the primary standard.

342. *Candle-Lumen.* The total flux of light from a source is equal to its mean spherical intensity multiplied by 4π. The unit of flux is called the lumen. A lumen is the $\frac{1}{4\pi}$ th part of the total flux of light emitted by a source having a mean spherical intensity of 1 cp. A hefner-lumen is 0.90 lumen.

346. *The Efficiency of Electric Lamps* is properly stated in mean spherical candle-power per watt, and preferably in lumens per watt, at lamp terminals.

Upon the combined suggestion of Messrs. G. F. Sever, G. S.

Dunn and C. P. Steinmetz it was decided to submit the amendments to the membership for comments or approval by letter not later than Aug. 1 in order that the rules may be printed in the fall.

Massachusetts Commission News.

The Massachusetts Railroad Commission gave a hearing on July 8 on the petition of residents of Revere for a reduction from 10 to 5 cents in the fare between Revere and Lynn, on the lines of the Boston & Northern Street Railway Company. Town Solicitor Cutler, of Revere, conducted the case for the petitioners, and urged that as the fare between the two municipalities on the company's main line is 5 cents, the same charge should be in effect between points on branch lines and the termini: in other words, the petitioners desired the company to issue free transfers to and from its main line in Revere. In connection with the petition Channing Howard, town engineer of Revere, advocated the construction of a loop line on Ocean Avenue, Revere, to facilitate the handling of the beach traffic. For the company, Bentley W. Warren, Boston, opposed the construction of a loop, stating that it would cost at least $20,000, and maintained that the company cannot afford to establish a 5-cent fare between points on the branch lines and Lynn. If an exception should be made in one case, other neighborhoods served by branch lines would have an equal right to demand the same charge and the results would be disastrous to the company's revenue. Mr. Warren said that already the company is handling considerable traffic at a loss in Revere, and offered to submit any figures that the commission might desire to prove the inability of the company to grant the transfer privilege. The board closed the hearing and took the case under advisement.

The Railroad Commission has recommended that the Boston & Northern Street Railway Company construct a double track in Malden Street, Saugus, as petitioned by citizens of the above town. The finding of the board points out that the present single-track facilities are inadequate for the traffic handled.

The Massachusetts Railroad Commission has approved the plans of the Boston Elevated Railway Company for the construction of an elevated station in Causeway Street, Boston, between Haverhill and Portland Streets, and adjacent to the North Union Station of the Boston & Maine Railroad. The new station will be used by surface cars entering and leaving Boston by the East Cambridge elevated structure over the Charles River dam, and also by Atlantic Avenue shuttle elevated trains connection to the North and South stations. The new station will be provided with a platform 235 ft. long and from 8 ft. to 17 ft. wide for subway cars entering Boston, and a combined surface car and elevated train platform 410 ft. long and from 8 ft. to 17 ft. wide, with passageways to the North Station and street. A noteworthy feature of the design is the location of entrances and exits on but one side of the street, a physical connection also being provided to the North Elevated Station.

The Massachusetts Gas & Electric Light Commission gave a hearing on July 13 upon the petition of the Pittsfield Electric Company for authority to issue 2250 shares of additional capital stock of the par value of $225,000, for the purpose of paying indebtedness and providing for the cost of further extensions of its plant. President Alexander Kennedy appeared on behalf of the company, with William L. Adam, and W. A. Whittlesey, superintendent. Mr. Kennedy stated that the company desires to raise money to supply additional facilities for the generation and distribution of electricity. The territory which it serves is growing so fast that in some cases desirable business has had to be refused on account of the inadequacy of the present plant, which has no margin of power. The company has two plants, one being on Renne Avenue, Pittsfield, and the other at Silver Lake. Mr. Kennedy stated that the Renne Avenue station, which is a non-condensing steam [illegible] of the company. Several [illegible] pany built an oil engine station at Silver Lake, but while this station has met the requirements of good economy, it has been decided to expand no further in this direction on account of the absence of service reliability of the oil engine installation, which has been shut down for two months for repairs. The company was obliged to purchase energy from Dalton and from the Van Cickler Mills, in order to fulfil its obligations.

Superintendent Whittlesey stated that the cost of the improvements was based upon the erection of a 750-kw steam turbine plant at Silver Lake at an estimated expense of about $137,111, and upon improvements in lines, transformers, meters, motors and underground construction, which total $45,000. Among the detail items of cost are: Steam turbine, 750 kw, $12,500; chimney, $4,000; boilers and superheaters, $15,000; building, $25,000; piping, $7,500; piling under building, $3,000; auxiliaries, $5,000; switchboard and tie line equipment, $6,000; coal and ash handling apparatus, $2,500; steel work, $13,000; and engineering, $11,000. Within two years the company will expend $17,000 on its lines, and $5,000 will be applied to the transfer of the lines to Dalton to its own poles, these now being carried on the right of way of the Berkshire Street Railway Company.

Mr. Adam stated that the company employed the Stone & Webster Engineering Corporation of Boston a few months ago to make a thorough study of its power situation and to recommend a line of development for the future. The results of this investigation showed the necessity of building a new plant at Silver Lake, the initial capacity to be 750 kw, and the additions to begin with a 1000-kw unit. Stone & Webster reported that it would be possible by spending a moderate sum upon the old steam plant to operate the system for about three years, but it was considered more advisable to cut loose from the old equipment and start the erection of a modern steam station of the turbine type which could be relied upon to meet the conditions better in the long run. At Silver Lake water can be had free of charge for condensing purposes, and in the long run the least expensive plan is to spend the larger sum at the outset. With the new plant the company can supply points in the city which are not now readily served. The station economy of the turbine installation will improve with time, as the new plant absorbs more and more of the load and as the older steam and oil engine equipment is superseded.

Concluding, President Kennedy said that the directors had fixed the price of the new stock at $120 per share. The company has been paying 8 per cent dividends, so that the return upon the new stock at this price amounts to 6⅔ per cent, or only a little more than the legal rate of interest. Chairman Barker stated that the company's presentation bespoke a conservative attitude regarding capital and dividend requirements. The Board then took the case under advisement.

Maryland Commission News.

The American Telegraph & Telephone Company last week filed an application with the Maryland Public Service Commission for permission to lay its wires underground along the boulevard between Baltimore and Washington. The State Roads Commission has already granted the company permission to use the boulevard for this purpose.

After permission had been granted by the Court for Messrs. James M. Ambler, Philip D. Laird and Joshua W. Herring, constituting the Public Utilities Commission, to intervene in the suit of the Auxiliary Realty Company to restrain the Mayor and City Council from paying parts of the commissioner's salaries, a demurer to the bill of complaint was filed by the commissioners. Admitting all of the statements made in the bill of complaint, it is contended in the demurrer that the company has not stated such a case as entitles it to the injunction it asks. Mr. W. Cabell Bruce, general counsel to the commission appeared for the commissioners in the proceeding. The suit of the Auxiliary Realty Company is to enjoin the City [illegible] for paying $3,000 a year to Chairman Ambler and $2,500 a year to each of the other two commissioners, as

is stipulated by the Public Service Commission law. It is contended in the bill of complaint that this provision was inserted in the act to evade the requirement of the State Constitution limiting the salaries of all State officials to $3,000 a year except when otherwise provided. In their petition for authority to intervene in the case, the commissioners state that the act creating the commission requires its general counsel to appear for it in all proceedings involving any question under this act. The suit of the Realty Company, this also states, involves the validity of the section of the act requiring the city to pay a part of the salary of the commissioners. An order authorizing the commissioners to intervene in the case was signed by Judge Stump.

The commission considered a complaint last week relating to the service of the United Railways & Electric Company of Baltimore. The fare between Baltimore and Ellicott City is 15 cents. The petitioners point out that the fare between Baltimore and Catonsville to residents of the latter place is only 7½ cents. Another protest was registered against the company alleging that the cars on one of its lines are too frequently dangerously overcrowded. The commission is also investigating a protest against the rates for electricity charged by the Mount Washington Electric Light & Power Company. The company has a minimum rate of one dollar a month, whether or not that quantity of electricity has been used. The complainant says that this part of the contract which the consumer must sign with the company, is highly unjust.

New York Commission News.

From public expressions and from letters written by Chairman Willcox, of the Public Service Commission of the First District, to Mayor Gaynor, it became evident last week that the most recent proposal of the Interborough Rapid Transit Company for the construction of subway extensions would not find favor with the commission. The matter has not been officially considered by the commission as yet, but the unofficial expressions have been very definite. In view of this situation, President Shonts of the Interborough has written a letter to Mayor Gaynor in which he modifies the proposal to the extent of expressing his willingness to abandon the Lexington Avenue route and build a line under Madison Avenue, and also to modify his proposal that the city should stand the loss during the first, unremunerative years of operation. These modifications have not yet been officially presented to the commission.

The Public Service Commission last week granted the application of the Manhattan Bridge Three Cent Line for a certificate of public convenience and necessity, authorizing it to run trolley cars between the Long Island Railroad station at Atlantic and Flatbush Avenues, Brooklyn, to the Desbrosses Street Ferry terminal on West Street, Manhattan. The line will cross the East River on the Manhattan Bridge, but as yet the route across Manhattan has not been definitely settled. It was proposed at first to use the existing tracks in Canal Street under a leasing arrangement, but such an arrangement has not been made. The franchise for this road has already been granted by the Board of Estimate and Apportionment.

The commission last week definitely closed the hearings upon the Third Avenue Railroad reorganization plan. These hearings were begun last December and a vast amount of testimony has been taken. At the final hearing Mr. D. G. Connette, transportation engineer of the commission, gave his final estimate of the value of the property on Feb. 28, 1910, as $31,666,224. It is thought that a decision in this case will soon be rendered, and it is believed that the reorganization plan will be sanctioned with some important modifications.

The commission last week adopted a resolution laying out a rapid transit route in Utica Avenue, Brooklyn, south from the Eastern Parkway to a point in Flatbush Avenue near Jamaica Bay. It is proposed to construct this route upon the assessment plan. It is the first line on which the commission has taken action under this plan.

At the request of the Interborough Rapid Transit Company, the commission last week suspended for 30 days the order it issued last April directing the running of subway trains on a two and a half minutes headway. This was done because General Manager Hedley of the company reported that during the summer months the travel in the subway decreased about 25 per cent.

The Public Service Commission last week voted to advertise for bids for the construction of the proposed Tri-borough subway within the next few weeks. Two forms of construction will be advertised; one for private construction and equipment and another for municipal construction and private equipment. The bids will be opened on either Sept. 13 or Sept. 20.

The commission approved last week an agreement submitted by the Tunnel & Terminal Railroad Company, which owns the Pennsylvania tunnel and terminal, and the Pennsylvania Railroad Company, whereby the latter acquires the right to operate the tunnels under the North and East Rivers. The council for the two companies stated that before next March a permanent agreement would be made and submitted to the stockholders of the Pennsylvania Railroad Company. This will involve the formal taking over of the terminal property.

At the hearing last week into the price of gas and electricity charged by the Queens Borough Gas & Electric Company, Mr. Eugene D. Hawkins, attorney for the company, asked for an adjournment, and the case was postponed until Sept. 29. This investigation was brought on the complaint of 100 consumers and has been deferred from time to time for several months. Mr. Hawkins stated, in asking for the postponement, that experts were now going over the books and engineers are studying the properties of the company with a view to establishing their exact value in order to form a basis to justify the claim that the present rates were reasonable. This work he said could not be completed until the latter part of September. Mr. Hawkins also filed in evidence the certificate of incorporation of the company, copies of its mortgages and of the franchises under which it does business.

EXTENSION OF DISTRIBUTING CIRCUITS.

The Public Service Commission, Second District, has made several important rulings defining the commission's powers in the matter of requiring gas companies to extend their gas mains under the streets and establishing principles to be observed by gas corporations in charging consumers for the cost of such construction in part or in whole and in connecting consumers' premises with the service. The ruling presumably also has a bearing on electrical extensions.

In cases where the gas main is already in the street upon which the premises to be supplied are located and where the premises are situated within 100 ft. of the main, the commission ruled that the following division of expenses is reasonable and proper: That the gas company assume the cost of the pipe and the expense of laying the same from the main to the curb and compel the consumer to pay the expense of running the pipe from the curb to the meter.

In cases where the main is already in the street and the premises to be supplied are situated more than 100 ft. from the main, and in cases where the main is not in the street or has not been brought up to a point therein where it is within 100 ft. of the premises sought to be supplied, the commission points out that its powers as amended by the Legislature of this year are ample to require extensions of mains a distance of more than 100 ft., but the commission will exercise its discretion as to the reasonableness of ordering such extension or exercising such large powers.

As to whether a company should discriminate in furnishing service to premises which are wired for electricity at the time of making the application, the commission rules that the company should charge all consumers for curb-to-house services and must desist from the practice of installing service pipes from curb lines to houses free of charge in cases where consumers' houses are not wired for electricity and where the consumer obviously expects to use gas exclusively. The commission also rules that the cost of such installations may be graded or apportioned on the basis of gas consumed or to be consumed.

Should the charge for installation be arbitrary and uniform per foot or be governed by the actual cost of performing the installation of the service, the commission rules that if any charge is to be made at all for installing the service pipe from the curb to the house, it should be made at the actual cost of the work. If an arbitrary charge per running foot proves satisfactory both to the consumer and to the company, such charge may be made, but the right is reserved to the consumer to demand the bill for the actual cost of the work.

The Public Service Commission, Second District, will hold hearings during the coming week on the application of the Livingston-Niagara Power Company for permission to begin construction and approval of the exercise of franchises in Livingston county and for authority to execute a mortgage upon its properties for $350,000 and to issue an equal amount of bonds and $100,000 of common capital stock; and on the answer of the Homer and Cortland Gas Light Company in an order to show cause why it has not carried out the direction of the commission as to the disposition of the proceeds of its bonds which the commission authorized.

The Public Service Commission, Second District has authorized the Mohawk Hydroelectric Company to execute a mortgage upon all its property and franchises to secure the issue of 6 per cent 30-year bonds to the amount of $3,000,000. The company is also authorized to issue its capital stock, $100,000 preferred and $575,000 common stock, and its bonds secured by the mortgage to the amount par value of $932 000, bonds to be sold at not less than 88. The proceeds of the sale of stock and bonds are to be used for the payment of lands and water rights on Peck and Garoga Lakes and along Garoga Creek, for traveling expenses, engineering fees, services of promoters and bankers, the construction of dams, pipe line, power house, machinery, excavation, clearing of flood lands and sundry organization expenses.

The Cayadutta Generating Company has been authorized to take over the right, title and interest in certain franchises granted by the village of Fultonville, town of Mohawk, Montgomery county, and the village of Fonda, to Adam Z. Temple and J. S. Wilson, for the construction and maintenance of electric lighting systems within the boundaries of the localities mentioned. The Cayadutta Generating Company is authorized to exercise the rights and privileges granted in the franchises and to construct, lay down and maintain suitable conduits and other conductors and fixtures in the villages of Fonda and Fultonville. The company is authorized to buy the property and to issue $30,000 of its common capital stock for the purpose of purchasing the property in question, and is also authorized to issue and deliver to the Schenectady Trust Company a first consolidated and refunding mortgage to secure an issue of 5 per cent 30-year gold bonds to the amount of $30,000 and to issue bonds to the full amount of the mortgage. It is provided that the bonds shall not be sold or disposed of at less than 90.

The commission has received a complaint from the A. L. Swett Electric Light & Power Company, directed against the Middleport Gas & Electric Company, alleging unlawful exercise of franchises in the town of Rayalton. The complainant company holds a franchise in the town in question and consent has also been given to the Middleport Gas & Electric Company. The latter named company, however, has not received the consent of the Public Service Commission, Second District, to the exercise of its franchises. The complaint has been served upon the Middleport company and an answer asked for within 20 days.

An order issued by the commission allows the Palmyra Gas & Electric Company, Newark Gas Light & Fuel Company, the New Light, Heat & Power Company, Lyons Gas Light Company and the Wayne County Electric Company to consolidate into the Wayne County Gas & Electric Company. In approving of this consolidation the commission has required that the capital stock of the Wayne County Gas & Electric Company shall be $200,000, which is $45,000 less than the sum of the capital stock of the corporations consolidated; that by means of the surrender of capital stock and charging off surplus, the fixed capital account of the consolidated company will be credited with the sum of $56,700.65; the obligations of the constituent companies, aggregating $13,054.52 shall be cancelled, thus reducing the amount of obligations to be assumed by the new company. The new company has assented to all these conditions.

The New Light, Heat & Power Company, of Newark, N. Y., has been authorized to exercise franchises and erect and maintain a plant for electric lighting, power, etc., in the town of Arcadia, Wayne County. The Palmyra Gas & Electric Company has been authorized to exercise franchises and to construct and equip a plant for furnishing and distributing gas and electricity in the town of Palmyra, Wayne County. The Newark Gas Light & Fuel Company has been authorized to exercise franchises and to construct a plant for the furnishing and distribution of gas for light, heat and power in the town of Arcadia, Wayne County.

A petition has been received from the Olean Electric Light & Power Company for authority to issue $50,000 common capital stock to pay for additions, extensions and improvements to its plant, already made and the completion of others under way.

The Public Service Commission, Second District, has authorized the Mohawk Hydroelectric Company to construct a hydroelectric plant on and along Garoga Creek, Fulton County, for generating electrical energy, and also to exercise rights and privileges under a franchise granted by the Town Board and superintendent of highways of the town of Ephratah, Fulton County. A considerable portion of the electrical energy developed will be sold generally for light, heat and power purposes through the Fulton County Gas & Electric Company. The Fulton County Gas & Electric Company has employed a hydraulic engineer to examine into and investigate the hydraulic features of the proposed water-power development and is satisfied with the ability of the company to carry out the terms of an agreement made. Mr. Walter McCulloch, consulting engineer of the State Water Supply Commission, has also made a report to the Public Service Commission, in which he states that the drainage area and plan of water storage is adequate to develop an amount of electrical power claimed by the applicant; that the proposed hydroelectric development is a feasible engineering proposition; and the cost of the proposed development as estimated by the applicant is not unreasonable.

The commission has ordered a hearing to be held at its Albany office on Sept. 7 to which all gas and electrical corporations in the second district are invited, and where will be discussed the proposition of requiring every gas corporation and electrical corporation and municipality to file with the commission and to print and keep open to public inspection schedules showing all rates and charges made, established or enforced, or to be charged or enforced, all forms of contract and agreement; all rules or regulations relating to rates, charges or service used or to be used; all general privileges and facilities granted or allowed by gas or electrical corporations or municipalities, and prescribing the form of every such schedule; and the further matter of establishing rules and regulations to carry into effect the amended provisions of the law in this respect as changed by this year's Legislature.

Metallic Filaments for Incandescent Lamps.

A patent was granted July 12 to Dr. W. D. Coolidge, of Schenectady, on an application filed Aug. 1, 1906, on a process for making metallic filaments for incandescent lamps. According to the invention, a refractory material is incorporated in a colloidal solution to produce a pasty mass, and this mass is squirted or otherwise shaped to form threads, filaments, rods, or other desired shapes; these bodies are then treated to remove all easily vaporizable components and yield a conductor of refractory material suitable for use in incandescent lamps and other apparatus. As a basis for the refractory conductor,

various metals or elements may be used, such as tungsten, molybdenum, boron, zirconium, titanium, thorium, etc.

Colloidal solutions suitable for use as binding agents are easily produced by well-known chemical methods, such as the Carey Lea method, or may be produced by various methods which yield a pasty and sticky mass though preferably the colloid should be one which can be changed to the metallic state without any special difficulty. Colloidal silver is very easily made and is entirely satisfactory, though colloidal gold is also suitable, as are also colloidal copper and many other metals of relatively high melting point.

The finely divided refractory material may be incorporated in the colloid by simply stirring it in and mixing thoroughly. If silver colloid is used as the binding means and tungsten as the refractory element, it is preferable to have the tungsten in a finely divided condition. This state is easily obtained with tungsten, and in fact with most of the elements above enumerated, for the reason that they are ordinarily obtained as fine powder which may be ground, sifted, or precipitated to separate out the coarse grains and leave a homogeneous residue of exceeding fineness. In adding the tungsten to the silver colloid it is preferable to put in as much tungsten as the colloid will take and still retain the sticky qualities necessary to an easy manipulation of the product. It is probable that the colloid does not chemically unite with the tungsten, but acts more as a suspending medium to take up the exceedingly fine particles of tungsten and to hold them in position by capillary or other forces.

After obtaining threads or filaments of the desired size and shape, and then drying to drive out any excess moisture, they are treated to convert the colloidal metal into the metallic state. This may be conveniently done by chemical methods, as by subjecting the colloid to the action of electrolytes or to the precipitating action of acid fumes. For instance, traces of HCl vapor may be blown over the threads of tungsten and silver colloid and thereby instantly convert the silver into the metallic state in which condition it acts as a firm binding agent for the tungsten particles. The wires or conductors produced as above described have sufficient ductility to permit ready manipulation and mounting on lead-wires. Some of the impregnated colloid may be used as a paste for securing the threads to the lead-wires. The ductile metal, as for instance, silver, gives the wire strength, while the refractory powder with which the silver is impregnated is in sufficient quantity to insure a continuous wire after the silver is removed. The next process is to drive the ductile or low melting metal out of the wire and the pasted joint, and consolidate the refractory powder into a coherent conductor suitable for operation at high temperatures. This may be conveniently done by passing current through the threads or filaments in a vacuum or in an inert atmosphere and thereby vaporizing the silver and sintering the tungsten particles together. The silver comes out entirely and the particles of tungsten draw together and consolidate into a strong wire. Capillary forces are very strong with metals which melt at high temperatures, and this phenomenon assists in producing a coherent product.

Silicon-Carbon Incandescent Lamp Filaments.

A patent for which application was filed April 5, 1906, was issued on July 12 to Mr. Walter G. Clark on a process for making incandescent lamp filaments. The object of the invention is to coat a filament with silica so as to prevent any ionization of the filament or any deterioration by reason of its throwing off emanations. By coating the filament with silica, no emanations can be thrown off and the lamp globe is kept clean. This is desirable because the ordinary temperature of incandescence is not sufficient to melt the silica. To this end silicon is deposited on a carbon filament by a method on which the same inventor was granted two patents dated Jan. 14, 1908; that is, the carbon filament is flashed in an atmosphere containing tetrachloride of silicon, a hydrocarbon gas, and olefiant gas which serves as an absorbent for the chlorine freed by the flashing process; and after the silicon surface begins to appear and while the silicon is being deposited, a little oxygen is admitted into the presence of the filament and the silicon surface will thus be oxidized sufficiently to convert it into silica. Only a very little oxygen is needed, and by regulating the amount, the oxidation can be carried inward to the necessary extent so that in this way the silica coating can be regulated.

Commutation.

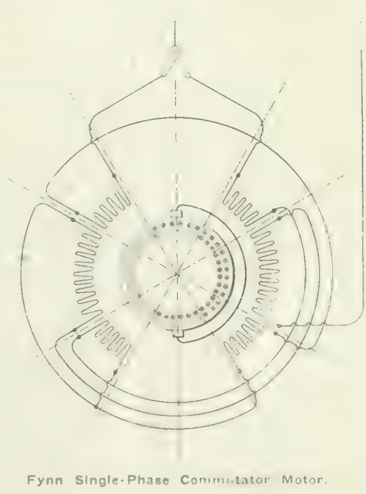
A patent, for which the application was filed in 1902, was issued to Mr. W. E. Goldsborough on March 22. The inventor proposes to improve commutation by the insertion of impedance coils in the commutator leads, these coils to be brought into inductive relation with a stationary short-circuited coil during the period of commutation.

Single-Phase Commutator Motor.

A patent issued to Mr. W. A. Layman covers an improvement in the Wagner-type single-phase motor. The rotor is provided with two windings and two commutators. When starting the brushes on the main winding are short-circuited in the usual way and those of the auxiliary winding are connected in series with the main field winding. When up to speed the main rotor winding is short-circuited and an auxiliary compensating winding on the stator is connected in shunt with the auxiliary rotor winding. The purpose of these auxiliary windings is to improve the starting torque and improve the power factor, both at start and when running.

Single-Phase Commutator Motor.

A motor of the repulsion type in which the motor field is produced by ampere turns on the rotor is the subject of a patent issued to Mr. V. A. Fynn. The rotor is provided with a fractional-pitch winding in order to neutralize the ampere turns in

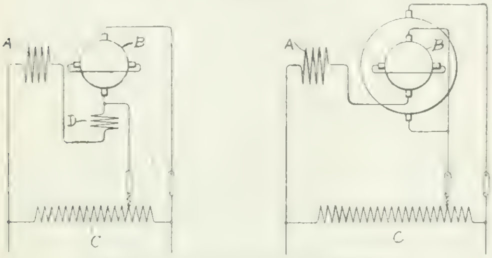


Fynn Single-Phase Commutator Motor.

the commutation belt. The stator winding is made up of three sections, as shown in the illustration. The large section is used to neutralize the ampere turns in the corresponding belt on the rotor, and the other two sections determine the direction of rotation, only one being in circuit at a time.

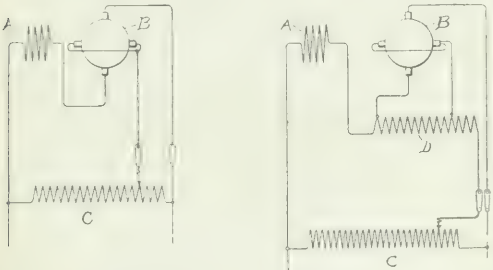
Series Repulsion Motors.

A patent issued to Mr. Friedrich Eichberg aims to improve the efficiency, power-factor and speed torque characteristics of the Winter-Eichberg type of single-phase commutator motor by



Figs. 1 and 2—Series Repulsion Motors.

introducing a series excitation superposed upon shunt excitation. Figs. 1 to 4 show several different connections used to accomplish this result. In the illustrations A is the inducing winding, B the rotor winding, C a transformer and D a winding on the



Figs. 3 and 4—Series Repulsion Motors.

stator adapted to produce a magnetization assisting that produced by the circuit between the excitation brushes.

CURRENT NEWS AND NOTES.

Plans for New York Docks.—New York Dock Commissioner Tompkins has prepared plans for the establishment of a $100,000,000 municipal joint electric railway freight terminal on the North River in Manhattan. The proposal for the new terminals will be put before the Board of Estimate in the fall.

Chicago Meeting of A. E. S.—The American Electrochemical Society will hold its next general meeting in Chicago from Oct. 13 to 15. The selection of Chicago as the meeting place was brought about by the recently organized Chicago Section of the society, of which Prof. H. N. McCoy, of the University of Chicago, is chairman, and Mr. Arba B. Marvin is secretary-treasurer. The Wisconsin Section of the society will co-operate in the arrangements for the meeting.

Steam-Electric Locomotive.—A type of portable isolated plant electric locomotive was tested in Glasgow, Scotland, on July 14. The locomotive is propelled by four electric motors which receive energy from a steam turbo-generator, the generating and propelling equipments being self-contained. The advantage claimed for the type over the steam locomotive is economy in fuel. In comparison with the usual electric locomotive, it is said to be more economical in cost of installation and maintenance.

Telegraphy in Spain.—Wireless telegraphy is a government monopoly in Spain, but a concession for the installation of the equipments and operation of the stations has been granted to a private concern by the Bureau of Posts and Telegraphs. The bureau operates a total of 3830 miles of wire telegraph lines and had in its employ for this service 4811 persons in 1908. During this year the total receipts were $1,835,-227 and the expenditures $1,955,414; the excess of expenditures was, therefore, $120,187.

Coal Land Withdrawals.—Including some land withdrawn on July 14, the amount of coal land withdrawn by President Taft from entry to date totals 71,518,588 acres, having an appraised value of $449,876,208. The tracts are located as follows: Arizona, 161,280 acres; Colorado, 6,151,161; Montana, 20,208,865; New Mexico, 2,944,279; North Dakota, 17,828,162; Oregon, 192,562; South Dakota, 2,870,287; Utah, 5,814,287; Washington 2,207,967, and Wyoming, 13,099,718. All of this land is open to agricultural entry with a limited surface patent.

Japanese Water-Power Plan.—A new policy has been adopted in Japan in connection with the multitude of concessions for hydroelectric plants. For some years there had been a mania for obtaining these franchises, and applications were granted for almost every Japanese river on which a town of 50,000 was situated. Many of the concessionaires proved to be speculators without any idea of carrying on the work. The Tokio Government now has instructed local officials that a time must be fixed within which these concessionaires must get to work or forfeit their rights.

Fuel Testing.—The new Bureau of Mines is given cognizance of testing and analyzing coals, lignites and other mineral fuel substances, belonging to, or for the use of, the Government. Of $100,000 appropriated for this work, $35,000 will be spent in chemical and physical investigation of fuels; $25,000 in the inspection of Government fuel purchases; $22,000 in fuel efficiency investigations; $5,000 in lignite and peat investigations, and $4,000 in briquetting investigations. Among publications of the new bureau now under preparation are the following: Volatile matter in coal; coal analyses; producer-gas tests; petroleum for combustion under steam boilers; final data regarding steam tests; North Dakota lignite as a boiler fuel.

Kansas City Office Building and Substation.—An important addition to the main office building of the Kansas City (Mo.) Railway & Light Company, at Grand Avenue and Fifteenth Streets, is rapidly nearing completion. It is built of brick and is five stories high, with ground dimensions of 84 ft. x 110 ft. The first floor will be devoted to a large substation, while the upper stories will be divided into offices, to supplement the office space in the older portion of the building. The lighting side of the substation will contain a 1500-kw rotary converter, a 700-kw booster, a 500-kw motor-generator set and a 3000-amp-hour storage battery. In the railway portion there will be five machines, consisting of a 2000-kw rotary, a 1500-kw rotary and three rotaries rated at 1000 kw each.

Northern Indiana Interurban to Sell Electricity.—A Michigan City press dispatch, dated July 13, states that the Chicago, Lake Shore & South Bend Railway Company will supply electricity for all purposes in all cities along its line, and that officers of the company are now investigating the franchises under which the electric companies are operating in these cities. The large plant of the company at Michigan City is being enlarged with additional equipment valued at $140,000, and it is believed, apparently, there will be a surplus of electrical energy which the company would like to dispose of to commercial consumers. The modern single-phase interurban railway operated by the company extends from Pullman, Ill., to South Bend, Ind., and passes through Hammond, Indian Harbor, East Chicago, Gary, Michigan City and New Carlisle, Ind.

New Haven Electrification.—According to a statement credited to Judge A. Heaton Robertson, a director of the New York, New Haven & Hartford Railroad the electrification of the line from Stamford to New Haven is being held up because of the continued agitation in Connecticut for a public utilities commission. The work would cost about $10,000,000, including a new passenger station at New Haven.

Tests of Structural Materials.—The new Bureau of Mines authorized by the recent act of Congress came into existence July 1. The bill establishing the bureau as originally approved placed under this bureau structural material investigation, but the Sundry Civil appropriation passed as Congress was about to adjourn amended the law placing cognizance of this subject with the Bureau of Standards, including an appropriation for personnel and equipment.

Maine Electric Association.—The annual meeting of the Maine Electric Association will be held at Portland, Maine, Thursday and Friday, July 28 and 29. On Thursday there will be a dinner at Cottage City, and on Friday a sail down Casco Bay to South Harpswell, where there will be sports and a clambake. Several interesting papers and discussions are promised for the meeting. Mr. F. D. Gordon, of Lewiston, is secretary.

Steam Road in Southwestern New York Seeks Electrification.—The Jamestown, Chautauqua & Lake Erie Railroad Company has made application to the Public Service Commission of the Second District of the State of New York for permission to electrify its line, which extends between Jamestown and Westfield, N. Y., a distance of about 28 miles. This railroad has been operated by steam locomotives and undoubtedly the freight traffic will continue to be handled in this manner. The road connects with the Buffalo & Lake Erie Traction Company's line at Westfield, and no doubt, like that system, of which it is really a part, electrical operation will be obtained by the use of energy from Niagara Falls.

Consolidated Traction Reorganization in Chicago.—In the proceedings growing out of the effort to amalgamate the Chicago Consolidated Traction Company and the Chicago Railways Company of Chicago, Judge Grosscup has taken up the question at issue between the bondholders of the old Cicero & Proviso Street Railway Company and the consolidation committee. The bondholders are contending for a more liberal distribution of Chicago Railways securities than was offered for their property. Judge Grosscup is sitting as arbitrator, and with him, as advisers, are Mr. Calvin Goodrich, president of the Twin Cities Rapid Transit Company, of Minneapolis, and Mr. George G. Moore, financial director of the Michigan United Railways.

New Substations for Commonwealth Edison System.—The Commonwealth Edison Company of Chicago is just completing its new Edgewater transformer substation which is expected to go into operation by Aug. 15. This station supplies energy from the 12,000-volt transmission system to a North Shore residential section, and is in general similar to the new Troy Street substation which was put into service recently. Like the Troy Street station the new substation is located about seven miles from the Fisk Street generating plant. The company is also demolishing and rebuilding its substation at the corner of Twelfth and State Streets, where it is preparing to install six split-pole rotaries, several of which will go in at once. The new State Street substation will be completed about Nov. 1.

An Electric Railway Theater.—Electricity is employed in a number of ways at the new theater of the Boston Suburban Electric Companies at Norumbega Park, Mass., which was opened in May of the present year. The theater was built at a cost of $60,000, and seats 3500 persons. Among the applications of electricity are the lighting of the stage, borders, foots, and auditorium, illumination of green, dressing and property rooms, operation of a baggage hoist, and supply of energy for moving picture machines and stereopticons. Lamp signals are used to a considerable degree about the stage, and ornamental lighting is installed in outside corridors to attract attention to the performances from outside the theater structure. A 2½-hp motor is installed for the operation of an 800-lb. baggage hoist at the rear of the stage. Buzzer signals are installed at various points, and a complete interior telephone service is in operation. The auditorium is lighted by enclosed arc lamps supplied with energy from the railway circuits. The proscenium, border and footlights are mainly 32-cp units, frosted lamps being extensively used in the borders.

One "Side Issue" in Planning a Big Generating Station.—Work on the proposed new generating station of the Commonwealth Edison Company of Chicago, on North California Avenue (extended) and the North Branch of the Chicago River, recently described in the *Electrical World*, has been delayed owing to arrangements with the city authorities for a switch-track railroad connection. This is the generating station which is to be equipped with 20,000-kw turbo-alternators and which will be known as "Northwest" station. The switch-track, which will be about 4000 ft. long, is to connect the power-house site with the tracks of the Chicago & Northwestern Railway, and there have been protracted negotiations with the owners of adjoining property in relation to it. The company has offered to elevate the track, provide subways at all street and alley intersections, maintain a 125-ft. right-of-way and to limit the freight carried to its own material and supplies. After the station or stations (for the ultimate plans contemplate two 120,000-kw stations) are built, the spur will be used principally, no doubt, for the transportation of coal and other central-station supplies. The City Council committee on local industries has had the proposed ordinance under consideration and has been very careful to safeguard the interests of the property owners. It is said that, taking into account the awards for damages to property and the cost of the right-of-way and the railroad itself, the total cost for this switch-track will be between $150,000 and $200,000. After careful consideration the ordinance has been recommended by the local industries committee and doubtless will be passed by the City Council.

Electrically Operated Score Board in Ball Parks.—Enthusiastic "fans" watching games in Chicago and other cities have their pleasure enhanced by an electric score board which "keeps tab" on many of the plays. In Chicago these devices are in place in both the National and American League parks. They show directly the number of "balls," strikes, outs, etc., in figures 20 in. high, all controlled from a keyboard in the press box. The figures are painted on black disks pivoted behind windows in the black scoreboard, and controlled by electromagnets so that the disks roll over through 180 degrees, when the corresponding button is pushed. In this way the first closure of the circuit serves to display the figure, and a second clears it out, bringing the blank side of the disk again opposite the window. The electromagnets are energized by a battery of dry cells, and merely release the disks, which are turned by weights. The score boards installed in Chicago give the number of balls, number of strikes, number of men out, and figures designating the names of the man at bat, the pitchers, catchers and umpires—a key to these numbers being given in the scorecards. The keyboard at the West Side park has 23 buttons, and is also equipped with a telephone for communicating with the man at the scoreboard who hangs up the figures for the innings of the local and other games. As the electromagnetically operated plates are limited to showing in separate spaces for each figure, they could not be conveniently applied to the uses of the ordinary score-by-innings board. The Chicago National baseball park electric scoreboard is the nucleus of a steel-and-concrete advertising display 300 ft. long and 50 ft. high, which cost $17,000 to erect.

Heat-Unit Gas for St. Louis.—The Laclede Gas Light Company, St. Louis, has requested the passage of a municipal ordinance to change the basis of measurement from a candle-power to a heat-unit charge. The claim is that the illuminating value is of secondary importance to the heating value of the gas.

Electric Stimulus to Plant Growth.—Following some of the experiments which have been conducted in Germany, England and elsewhere, ex-Judge Thomas H. Williams, of Brooklyn, is installing an equipment for applying electricity to the soil for the purpose of accelerating the growth of plants and vegetables. A two-acre plot has been set aside for the tests, which will be started about Aug. 1.

Bonus for Employees.—As a reward for continuous service the Capital Traction Company, Washington, D. C., has given $18,000 to 280 of its conductors and motormen. The awards were divided into three classes. To those who had been in the service of the company for 10 years or more, with good records, $100 was given; to those with a five-year record, $50, and to the three-year men, $25.

Accident to Monorail.—On account of the weakness in the supporting structure, the cigar-shaped car of the Pelham Bay Park & City Island Monorail Company left its track near City Island, N. Y., on July 16, injuring about 20 passengers of the 100 who had packed the car for a ride on its first passenger-carrying trip. Haste in erecting the track-way in order to comply with the terms of the Board of Estimate's franchise, is given as an explanation of the weakness which resulted in the derailment of the car.

Compulsory Wireless for Vessels from British Ports.—Following the lead of the United States, England is preparing to pass a bill making compulsory the equipping with wireless systems of all passenger vesels which sail from its ports. A bill covering this ruling has been introduced in the House of Commons by Sir Edward Sasson. It calls for an installation on each vessel capable of receiving and transmitting a distance of 100 miles. A penalty of $5,000 in the event of failure to obey the law is provided.

Cleveland's Three-Cent Fare.—A deficit of $78,828 has been declared by the Cleveland Street Railway Company after four months' operation under the 3-cent fare rule. The report of the company for the month of June shows a deficit of $48,927. The directors passed a resolution to borrow $250,000 to meet pressing obligations. The street railway system was lifted out of a two-year receivership on March 1 and handed back to the original company to be operated on a 3-cent fare basis. A profit was shown on the first month, but since then there has been a steadily growing deficit.

Pupin Cable Across English Channel.—A telephone cable equipped with Pupin "loading coils" for reducing the distortion of the current impulses by the capacity of the dielectric, has been placed in service successfully across the English Channel from Dover to Cape Gris Nez. The cable will be opened for public use between London and Paris as soon as the French Government has completed the connecting land lines. A note relating to this cable appeared in our issue for April 21, 1910, page 980, while certain constructive details were described on page 898 of our issue for April 7.

Wireless Towers for the U. S. Navy.—The United States Navy has decided to construct four wireless telegraph towers between 400 ft. and 500 ft. tall on the highest available point in the District of Columbia. The towers will be of steel, of light and graceful design, and may be copied after the wireless masts on the big battleships. The purpose of the towers will be to give the Navy Department the best opportunity possible for communicating without interruption with its ships far out at sea and with the land stations far removed. Tests recently made by the department lead to the belief that communication with ships in the daytime 1500 miles away and at night 3000 miles distant will be possible.

An Insect Interrupts a 52,000-Volt Transmission Service.—The Nevada-California Power Company, which supplies electrical energy to Goldfield, Tonopah and other Nevada towns from its Bishop Creek, Cal., hydroelectric plant, was recently shut down by an insect commonly known as the "snake-feeder." The company has installed at different points on its 52,000-volt transmission system large horn-gap lightning arresters. On June 23 the large insect mentioned above flew directly between the spark gap of the arrester, with the result that it drew an arc and shut down the entire system. Upon immediate examination, the head and scorched body of the insect were found directly beneath the horn gap, with some signs of life remaining.

Large Electrically Lighted Clock.—Electric lighting plays an important part in the performance of the clock being installed on the United States post office, custom house and court house at Newbern, N. C. Instead of having numerals to indicate the hours, the dial is equipped with 12 opalescent glass disks which show white in the daytime and are rendered visible at night by means of light from behind directed to the disks from incandescent lamps. The hands are made of aluminum and each carries an electric lamp near the point. There is also an electric lamp at the hub of the hands. These lamps show red at night to be easily distinguished from the dial lamps. In the day the time can be read as by an ordinary clock, but at night it is read by the location of the red lamps along the illuminated dial. The clock has four dials, which can be read at a distance of two miles.

California Electrical Contractors.—The California State Association of Electrical Contractors held its annual convention in San Francisco from July 5 to 7. This association, which has been existence for about a year and has a membership of about 150 firms and corporations engaged in the electrical construction business throughout California, has district and subordinate locals in San Francisco, Sacramento, Los Angeles, Santa Barbara, San Diego, Pasadena, Oakland, San José and Stockton. President W. S. Hanbridge, of San Francisco, presided. There was a steamer trip around San Francisco Bay and up the Sacramento River a short distance, and a luncheon by the Jovians at the Palace Hotel. The present officers of the association were re-elected for the ensuing year as follows: President, Mr. W. S. Hanbridge; vice-presidents, Messrs. W. B. Woddill, Los Angeles, and Charles H. Heilbroh, San Diego; secretary, Mr. F. V. Meyers, San Francisco. Los Angeles was decided upon as the meeting place for next year.

Poulsen Wireless System in California.—The first of a number of towers for a Poulsen wireless telegraph and telephone system has been erected on the beach at San Francisco. The tower is 300 ft. high and built of wood from a design by Prof. C. D. Loring, of Stanford University. These towers will form a part of a wireless telegraph and telephone project promoted by the Poulsen company, organized and controlled by Californians and backed largely by Stanford University men. Mr. C. F. Elwell, of Palo Alto, is the president, and the other directors are Prof. Charles D. Marx, of Stanford; Mr. J. Jerome Smith, of Stockton; Mr. R. W. Barrett, of San Francisco, and Mr. Valdemar Poulsen, of Denmark. President Elwell says his company intends to establish 480 stations for communication over the land as well as over the sea, and that when 10 of these are ready the public operation of the system will be undertaken. Los Angeles and Portland will be the next cities to have stations. He claims that the Poulsen system does not conflict with other wireless work and that the operations can be carried on without possibility of interference with others. A part of the Danish inventor's equipment is a contrivance by which, it is represented, messages can be sent by wireless telegraph at the rate of 300 words a minute.

ELECTRICAL TRANSMISSION IN MICHIGAN.

Low-Head Hydroelectric Plant at Buchanan.

TWO thousand horse-power is recovered from a 10-ft. fall in the St. Joseph River near Buchanan, Mich., supplying the electrical requirements of the community, and combining its surplus through transmission lines with the output of several other water-powers on the same stream to furnish electrical energy to a chain of Michigan and Indiana cities.

Buchanan is a thriving manufacturing town of 2300 people in the southwestern corner of the State of Michigan. In 1893 the village first undertook the development of its neighboring water-power on a small scale, erected a wooden dam and installed generating machinery. The municipal equipment comprised a 120-kw, 3300-volt alternator, a 500-light Thomson-Houston incandescent machine and one 50-light and one 60-light Standard arc machines. The full capacity of the fall was not nearly developed by this outfit, and the inadequate construction of the dam and raceway failed to inspire confidence in the individuals who acquired the water-power in exchange for a water-works system which they constructed for the town. A new plant was accordingly built in 1902 by private interests, at an expenditure of about $500,000.

Fig. 1—Low Head 1500-Kw Water-power Plant at Buchanan, Mich.

The concrete dam has a spillway 396 ft. in length, its sill creating a head of 10 ft. above the tailrace. A concrete apron extends 15 ft. below the sill and is continued by a flooring of riprap for a distance of 35 ft. When the river flow is adequate, the head of water at the dam can be increased to 12 ft by raising the flashboards installed on the sill for this purpose. A hoisting cable and motor are provided so that the supporting struts of these boards can be drawn quickly. A wooden log-boom extends several hundred feet upstream from the dam, protecting the headrace from floating material. A combined rack and gate structure crosses the race just below the boom, and is supported by steel and concrete abutments, dividing it into seven 20-ft. openings, so arranged that planking can be inserted between the rack timbers for shutting off the flow when necessary. The forebay measures 200 ft. x 300 ft.

Fig. 2—View of Interior of Buchanan Station During Construction.

The generating station is a brick structure 33 ft. x 272 ft., on a massive concrete foundation forming part of the dam, and houses nine 295-hp and one 135-hp water turbines and a 1500-kw alternator and exciter. The nine main water-wheels are of the 68-in. Leffel vertical-shaft type, connected through Dodge bevel gears to a horizontal shaft 200 ft. in length, which drives the 1500-kw General Electric 2300-volt, 60-cycle, three-phase alternator at 180 r.p.m. The long horizontal shafting is made up in three sections connected by clutches so that only the required capacity of water-wheels need be operated to conform to the demand on the station. The shaft ranges in diameter from 10 in. at the generator to 7 in. at the far end. The speed of the main water-wheels is controlled by two Lombard governors. The 50-kw exciter is driven by a 135-hp, 40-in. Leffel water-wheel, with a Lombard governor. A spare exciter is also arranged to be belted from the main shaft in case of accident to the turbine-driven unit.

For serving the town of Buchanan, a mile distant, the 2300-volt, 60-cycle, three-phase generator buses are extended directly to the local distribution primaries. A 50-light regulating transformer also provides a constant current for the 33 6.6-amp series arc lamps which illuminate the streets. The major part of the output of the Buchanan water-power is, however, combined with that produced by the other hydroelectric plants of the system at Berrien Springs, Twin Brook and Elkhart, which are tied together by transmission lines with a 5500-kw steam auxiliary at South Bend. The 25,000-volt line from Berrien Springs to Niles is brought through the Buchanan water-power station, paralleling the local machine with the system. Three 500-kw water-cooled transformers are installed to raise the generator bus voltage to the transmission potential. The incoming and outgoing circuits are protected by fused stick-type circuit-breakers.

The daily output of the Buchanan station ranges from 18,000 kw-hours to 30,000 kw-hours. Part of this energy may be considered as going to supply the electric railways and lighting circuits of a number of cities which derive their electricity from the Indiana & Michigan Electric Company, including Benton Harbor, St. Joe, Berrien Springs, Buchanan and Niles in Michigan, and South Bend, Twin Brook and Elkhart in Indiana.

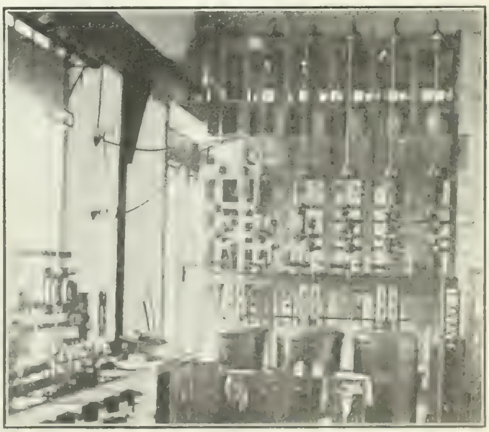


Fig. 3—High Tension Switchboard, Buchanan Station

In Buchanan the company has 250 lighting customers, practically all of whom have meters installed. Eighteen other customers have a total connected load of 500 hp in motors, the installations ranging from 150 hp down. The local manufacturing plants which are operated by electric motors include a

large tool works, a belting factory, an axle works, a zinc horse-collar factory, and a feather-duster factory.

To motor users, energy is supplied on a flat rate of $25 a hp-year, permitting the use of the full load continuously 10 hours a day, without limitations as to the time of the peak lighting load. A metered rate is also offered, ranging from 6 cents to 0.84 cent a kw-hour, depending on the quantity consumed. The average rate at which energy is sold under this charge is 1.6 cents a kw-hour.

Fig. 4—Special Tungsten Street Lighting, Buchanan.

Commercial lighting circuits are supplied at rates of 7 cents and 5 cents a kw-hour where the income from the installation exceeds $40 a year. Below this quantity a rate of 12 cents a kw-hour, subject to a 33⅓ per cent discount for payment within 10 days, is offered, making this charge virtually 8 cents a kw-hour. Residence lamp circuits are furnished with energy at a nominal straight rate of 15 cents a kw-hour, which the 33⅓ per cent discount reduces to 10 cents a kw-hour.

The company supplies 37 arc lamps for street lighting at a yearly contract rate of $53 a lamp. Recently the main street of Buchanan has taken on urban airs by the installation of special tungsten lighting carried on pillars. There are 22 of these posts, with five-lamp fixtures at corners and three lamps on the intermediate posts, aggregating 94 40-watt multiple tungstens. These lamps and posts were installed by the town at an expense of about $1,000, and are supplied with electricity by the company at a charge of $34.34 per month.

The Buchanan water-power was formerly owned by the C. A. Chapin Light & Power Company, but has been since acquired by the Indiana & Michigan Electric Company, of which Mr. Chapin is president and Mr. F. A. Bryan general manager. Mr. H. W. Riley is local manager at Buchanan and Mr. C. E. Babcock operating engineer at the plant.

ELECTRICITY IN IRRIGATION.

The Irrigation Pumping Plant of the Mosida Fruit Lands Company in Utah.

During the past winter and spring the Mosida Fruit Lands Company installed along the shores of Utah Lake an electric irrigation pumping plant—the nucleus of a system that will be, when completed, probably the largest in the country using electric energy exclusively. The system, when completed, will irrigate a tract of nearly 10,000 acres of land that has hitherto been entirely unproductive, even though it lay along the shore of the largest body of fresh water in the West.

The natural conditions could scarcely have been better for a development of this kind. Here was land of such a quality that, when irrigated, would be very valuable, and, adjoining it, a fresh-water lake. The slope was gently toward the lake, and neither height of lift nor length of pipe lines was great enough to make the requirement of power excessive, and withal the 44,000-volt transmission lines of two water-power companies ran within a few miles, and electric energy was obtainable at very low rates during the irrigation season. Investigations and surveys were completed and contracts let for the first unit of machinery late in 1909, and early in 1910 sufficient water was delivered for about 2000 acres of land.

The installation is interesting from an electrical viewpoint in that energy will be used during the summer months only, at which time the transmission company has a comparatively light load. When the system is complete, about 1200 hp will be used at practically 100 per cent load-factor during the irrigation season and between 2,000,000 and 3,000,000 kw-hours of energy will be consumed each year. Although the price charged per kw-hour is extremely low, the gross income to the transmission company will be considerable.

The tract will be irrigated from three ditches lying at heights of about 60 ft., 110 ft. and 200 ft. above the datum plane of the lake. The main pumping plant now constructed is at the shore of the lake, while the upper plant will be located about two miles distant. There is only one pumping unit in service at this time, but the building and intake were constructed of ample size for the final installation. This first unit, rated at 150 hp, elevates water into the lower ditch sufficient in quantity for about 2600 acres of land. There will be two additional units, each of 375 hp, to elevate water to the middle ditch, and one of 275 hp in the upper plant, to elevate water from the middle to the third and highest ditch. All of the details of the complete system were worked out before any equipment was purchased, and each portion now installed will be in harmony with the remainder, when all is in operation.

Energy was obtainable at 44,000 volts, three-phase and 60 cycles, and it was decided to install a substation alongside of the main plant to deliver 2200 volts for all of the motors.

For a final continuous motor load of nearly 1200 hp a transformer equipment of 1200 kw was determined upon, and in order that the first units installed might comprise an integral part of the whole, three transformers of 200 kw each were

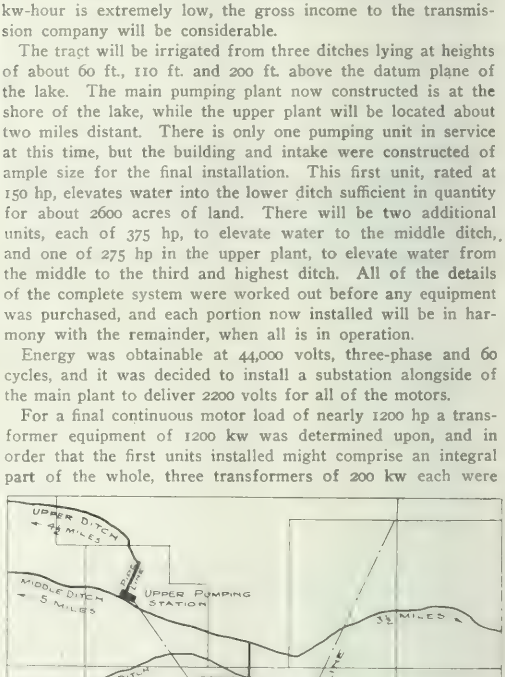


Fig. 1—Map of Ditches, Pipe Lines, and Transmission Lines.

purchased, and connected in closed delta, in a substation built of concrete located only a few feet from the pump house. These have a rating four times that required for the present motor, but as six of this size will complete the substation, this selection was made. The primary connections are arranged for 44,000 volts, 41,800 volts and 39,600 volts, and the secondary for 2200 volts. They are of the oil-insulated, water-cooled type, and the water for cooling is taken from the discharge pipe of

the pump. The transformers are protected by a set of General Electric aluminum-cell lightning arresters, with horn-gap disconnecting switches and primary fuses. A three-conductor cable laid in conduit is used to carry the energy to the motor by way of the panel upon which an oil-break switch is mounted, along with the auto-transformer, fuses, watt-hour meter and an ammeter. A branch leads to a 3-kw, 2200-volt to 110-volt transformer, from which energy is taken for the 2-hp, single-

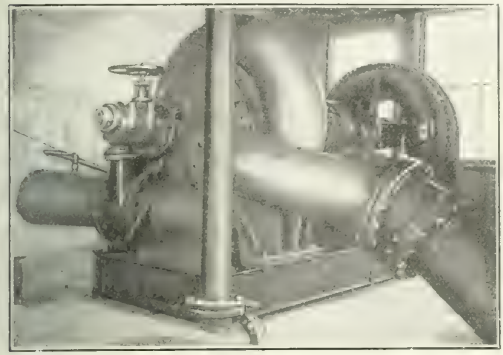


Fig. 2—Three-Phase Motor Connected to Centrifugal Pump.

phase motor used to operate the vacuum priming pump and for the lamps on the premises.

The first unit now in operation consists of a 150-hp, three-phase, 2200-volt, 600-r.p.m. induction motor, directly coupled to a 15-in. horizontal centrifugal pump with a rating of 15 cu. ft. of water per second pumped to a height of 60 ft. plus friction in the pipes. The pump is set upon a concrete foundation 6 in. above the maximum high water of the lake and is constructed with a double suction and "Y" connection terminating in a 15-in. flange. The suction pipe is about 20 ft. in length and increases in diameter from 15 in. at the pump to 30 in. at the inlet. It is made of No. 10 gage galvanized iron, double-riveted and soldered to make it perfectly air-tight. The sump from which the water is taken is built of concrete, with wing walls and a trash rack 8 ft. x 13.5 ft. made of bars of steel spaced about 1.5 in. apart to prevent the access of drift wood, etc., to the pumps. This rack is arranged on a slope in order that it may be readily cleaned of weeds, etc. The building is made of concrete, with a floor space of about 21 ft. x 38 ft. The present pump is located near one end, and openings have been left in the walls for the suction and discharge pipes of the two future units. The discharge pipe of the present unit is 3600 ft. in length and with an average diameter of 30 in. there is friction equal to about 5 ft., making the total pumping head about 65 ft. At the pump this pipe is 15 in. in diameter, but the diameter increases at once to 29 in. in a taper 10 ft. in length. One-half of it is 29 in. and one-half 31 in. diameter. The hill rises rapidly at an angle of 30 deg. just back of the plant and the pipe is turned up through this angle with an easy curve made on a radius of 12 ft. After rising 30 ft. it makes another similar curve nearly to the horizontal, after which the rise is gradual, there being only 30 ft. in over 3000 ft. The first 80 ft. of the pipe is made of No. 8 gage steel and the rest of No. 12 gage. The whole of it is double-riveted in the longitudinal seams and single in the transverse. Each 20-ft. length was dipped at the factory in a hydrocarbon compound impervious to moisture, and after arrival in the field, these sections were riveted together in the trench and covered with earth. No expansion joints are used.

The pump is equipped on the discharge side with a gate valve, which serves the double purpose of holding the vacuum when the pump is being primed and regulating the quantity of water discharged at all times. Only about two-thirds of the full rated output of the pump has thus far been required. When the flow of water is thus restricted, the load on the motor decreases almost in proportion and 100 hp at the motor delivers about 10 cu. ft. of water per second. The vacuum for priming is created by means of a dry vacuum pump driven by a small single-phase motor, the pipes being so arranged that water cannot reach the vacuum pump. The vacuum pipe is tapped into the top of the shell of the centrifugal pump and priming is accomplished by closing the controlling gate valve and operating the vacuum pump until water is drawn from the shell. The valve in the vacuum pipe is then closed and the pump motor started; after full speed is attained, the controlling valve is opened part way until the discharge pipe is filled, and then full way if the corresponding amount of water is required.

The pump and motor are mounted upon a steel and cast-iron base, with a flexible leather-link coupling between the shafts. Each is equipped with two ring-oiling bearings, so that the personal attention required is practically negligible. Thus far the plant has been operated for about 12 hours each day and at only two-thirds output, but it is adapted for continuous service, and after the full 2600 acres under this ditch are under cultivation, it will often be run for weeks at a time without stopping.

When the rest of the equipment has been installed and the plant is complete, it will supply water to 9500 acres of fruit land. The present ditch covers 2600 acres, the middle one 4000 and the upper one 2900. About 40 cu. ft. of water per second will be pumped into the middle ditch lying at a height of 110 ft., by means of two pumps similar to the one now in operation. Each will be connected to a 375-hp motor and the two will deliver water into a pipe line about 5000 ft. in length. Water for the upper ditch will be taken from the middle one by means of a similar pump driven by a 275-hp motor, delivering water to an additional height of 90 ft. through about 1200 ft. of pipe. Three transformers similar to those now installed will be added and the plant will be complete. About 1000 acres of land have already been planted with fruit trees and grain, the ground being broken by means of a traction engine and gang ploughs.

The land is being divided into 5-acre and 10-acre tracts and sold to settlers, usually under an agreement whereby the irri-

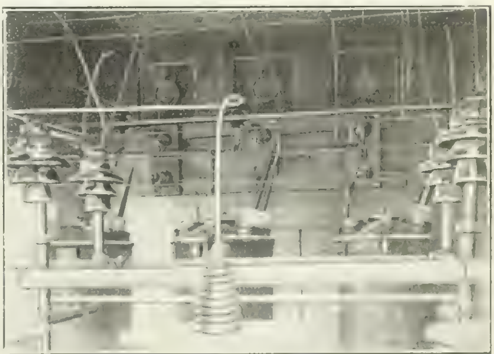


Fig. 3—Transformers, Lightning Arresters, Switches, Etc.

gation company plants the orchards and takes care of them for from three to five years, or until they are in bearing.

The irrigation company installed the substation and the 44,000-volt line connecting with the main transmission line, and thereby secured an excellent contract for energy, based only upon a kw-hour charge without any cost for readiness-to-serve. There is, however, a minimum charge for each month, equal to a certain proportion of the total charge for the previous month. This land will require somewhere between 12 in. and

18 in. of water each season, and to supply this depth over 9500 acres when the plant is completed, and the full acreage under cultivation, the pumps will run for between 2080 and 3120 hours or from 3 to 4.5 months of continuous operation. The cost of energy will lie somewhere between $2.20 and $3.30 per acre of land. The cost of labor will be little beyond that required for maintaining the distributing ditches, and the repairs and depreciation upon the equipment should be covered by a very small charge.

It is evident that the total cost of delivering water upon this land irrigated by means of electric motors will be less than the interest charges alone under many irrigation projects, the water for which is secured from expensive dams, reservoirs and long ditches. The cost of such systems is frequently over $60 per acre, making the annual interest upon the investment $4.80 at 8 per cent, the rate that farmers usually pay in the West. Under a well-designed motor-service irrigation project, the cost of the complete system seldom exceeds $15 per acre of land irrigated, and a farmer can far better afford to pay for energy and interest a sum equal to the interest alone upon the larger investment of a gravity system, since he owes only $15 per acre upon his land, instead of $60. This is only one of the factors that make motor irrigation projects so popular, and as long as desirable land, ample water and cheap energy can be brought together, thus long will they be developed. Land that has been dry for centuries is usually wonderfully productive when irrigated, and when planted for fruit a family cannot well take care of as much as 10 acres. The rapidity with which such irrigated fruit tracts are being settled is wonderful and as the desirable land that can be irrigated by gravity is becoming scarce, one can look to electricity for the greatest and best future results.

A NEW FORM OF DIRECT-READING CANDLE-POWER SCALE AND RECORDING DEVICE FOR PRECISION PHOTOMETERS.

By George W. Middlekauff.

THE new form of candle-power scale herein described was designed for use in the precision photometric work of the Bureau of Standards, and is the result of an attempt to combine the direct-reading feature of the ordinary commercial photometer candle-power scale with the accuracy possible in the use of the precision photometer. It is intended to be used in connection with an automatic recording device, also designed for use in the Bureau of Standards, and described in the *Transactions* of the A. I. E. E.[1] The automatic recorder eliminates the labor and possible errors of reading and recording the great number of settings made in a series of photometric measurements; while the direct-reading scale, described below, eliminates the labor and possibilites of error involved in the considerable computations heretofore necessary in finding the values of the lamps in terms of the mean of a group of standards.

THE PRECISION PHOTOMETER AND METHOD OF MEASUREMENT.

The precision work of the Bureau in the photometry of electric incandescent lamps is done on a standard photometer of the Reichsanstalt pattern, supplied with a Lummer-Brodhun contrast screen, and the measurements are made by the substitution method. That is, the standards and the lamps to be compared with them are placed, in turn, in the socket near the left end of the bar, or "test side," and are balanced against a comparison lamp placed near the right end, or "comparison side." In order to eliminate all variables on the comparison side and thus carry out the substitution method of measurement more perfectly, the carriage, on which the comparison lamp is mounted, is connected rigidly, by means of adjustable rods, to the carriage supporting the photometer screen. As the comparison lamp thus moves with the screen remaining at a constant distance from it, the candle-powers of the lamps measured are directly proportional to the squares of their respective distances from the screen when set at photometric balance.

[1] In a paper on "Carbon Filament Lamps as Photometric Standards," [illegible] by E. B. Rosa and G. W. Middlekauff [illegible] June 28-July 1, [illegible]

OLD METHOD OF READING AND RECORDING SETTINGS.

Before the introduction of this new device the photometric settings were read, by the observer, from a centimeter scale graduated on the bar and the readings were recorded by hand in a book provided for the purpose. From 5 to 15 settings and corresponding readings of the scale, according to their range, were made on each lamp, thus making it necessary for the observer to record from two to even as many as five times during the measurement of each lamp, it being impossible to retain in mind more than about three readings at a time and record them correctly.

This method of reading and recording is objectionable because it consumes considerable time and involves the liability of error, both in reading and recording, besides unnecessarily fatiguing the eye by alternate reading of photometer screen and scale.

OLD METHOD OF COMPUTING CANDLE-POWER.

The readings having been recorded and the mean reading found for each lamp, it was then necessary, in order to find the candle-power values, to perform a tedious set of computations, as shown by the following formula:

$$X = \frac{A + B + C + D + E + F}{a^2 + b^2 + c^2 + d^2 + e^2 + f^2} \cdot x^2$$

where A, B, C, D, E and F are the values of the six standards (it being desirable to use at least this number in every set of measurements) and X is the value of any lamp compared with them; while a, b, c, d, e, f, and x, are the corresponding, respective, mean distances of the lamps as read from the centimeter scale on the bar. Although these computations were much abbreviated by the use of a set of tables prepared especially for this purpose, nevertheless the work was very tedious, involving, at the same time, the liability of error, thus making it absolutely necessary to have all the numerical work checked by a second computer whose task was equally laborious and required fully as much time as that of the first.

The ordinary direct-reading candle-power scale, such as used on commercial photometers, cannot be well adapted to this class of work, because for precise measurement it is practically impossible to adjust the comparison lamp properly to fit the scale with the necessary accuracy; especially since, as stated above, it is desirable to employ at least six standards in the adjustment.

THE NEW FORM OF SCALE.

It occurred to the author that if a candle-power scale were so constructed that it would automatically adapt itself to all the requirements of the comparison lamp adjustment, thus reversing the usual process of adjustment, the difficulty, mentioned above in regard to the use of a commercial photometer scale in precision work, could be completely overcome, and as a consequence the computations for candle-power would be entirely eliminated. It was found that such a scale could be computed and constructed in a very simple and satisfactory manner as explained below and as will be understood by referring to the accompanying figure.

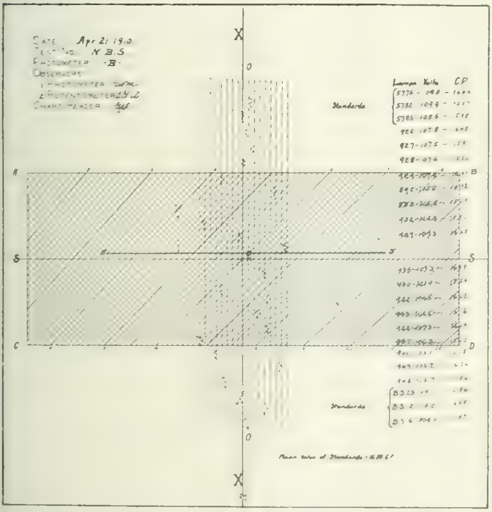
The scale proper is the rectangular area $ABDC$ and is calculated on the basis that a 16-cp lamp is to be photometered at a distance of approximately 120 cm from the lamp, a range of 6 cm either side of 120 cm being made possible in the construction of the scale. The sides AB and CD of the rectangle are two ordinary linear candle-power scales calculated to suit the arrangement of the photometer as described in the second paragraph above, and the points of graduation were determined by means of the formula,

$$\frac{X}{16} = \frac{x^2}{a^2}, \text{ or, } \qquad x = \frac{a}{4}\sqrt{X}$$

where a is the distance of the 16-cp point of graduation from the lamp (or zero of the scale), being 126 cm for the scale AB, and 114 cm for the scale CD; and x is the corresponding distance of any other candle-power point X on the scale which is

being calculated. The rectangle was made 30 cm in length so as to include the candle-power points most commonly required in standardizing work, these being indicated along the sides *AB* and *CD*. The balance for lamps having values above or below those indicated (for instance, 32-cp or 8-cp lamps) may be thrown within this range by means of rotating sectored disks placed on the proper side of the photometer screen. The diagonal lines join the corresponding 1/10-cp points of graduation in the two scales; and since the scales are divided proportionately, all the diagonal lines must converge toward a common point in a line drawn through zero and perpendicular to the two scales. The obliqueness of the diagonal lines, as a system, depends upon the distance between *AB* and *CD*, which may be chosen arbitrarily; but to prevent too much crowding of the diagonal lines, on the one hand, and too large a rectangle, on the other, the 16-cp diagonal line was drawn so as to make an angle of 45 deg. with the sides *AB* and *CD*, the other diagonal lines being drawn in their proper directions accordingly. The rectangle thus becomes 12 cm in width and, as stated above, it was arbitrarily made 30 cm in length.

Now, any line drawn across the diagonal lines and parallel to the length of the rectangle will be divided in exactly the



Candle-Power Scale and Record Sheet.

same proportion as *AB* and *CD* and will, therefore, be a candle-power scale also. Hence, this rectangle includes an indefinite number of linear candle-power scales and corresponding to any *fixed* adjustment of the comparison lamp that will throw the 16-cp balance at any point within the 12-cm range (between 114 cm and 126 cm from the lamp), there will be, in the rectangle, a linear scale which will exactly fit all the requirements of the comparison lamp adjustment. The method of determining the exact position of the proper linear scale for any given adjustment will be fully explained below.

Two important reference lines, *XX* and *SS*, are drawn across the figure perpendicular to each other and to the sides of the rectangle, intersecting the 16-cp diagonal line at its middle point, which is also the middle point of the rectangle and is at exactly 120 cm from the lamp, or zero. The line *XX* will, hereafter, be called the "Index Line," being the line by which the diagonal scale is set at its proper distance from the lamp mounted at zero on the photometer bar; and the line *SS* will be called the "Standard Scale," as it is the linear scale on which 16 cp falls at exactly 120 cm from the lamp, this being the distance adopted in the Bureau's practice as standard in the comparison of electric incandescent lamps of 16-cp intensity, the illumination of the photometer screen under these conditions being very approximately one ft-candle.

THE PAPER RECORD SHEET.

The rectangular figure, as described above, was very accurately drawn just double the required dimensions, and after being photographed down to exactly the correct size, it was transferred to a copper plate etching from which it was printed, in olive green, on sheets of white paper about 35 cm square, one of these sheets being intended for each separate set of lamps photometered.

The paper used for this purpose was specially prepared to withstand changes in dimension due to the ordinary variations in atmospheric moisture. As a further precaution, the longer dimension, which is the important one to keep constant, was printed parallel to the machine direction of the paper—that is, to the direction in which it is the least affected by changes in moisture.

THE RECORDING DEVICE.

While observations are being made, one of the printed sheets of paper may be held under the photometer carriage by means of a flat table, movable at right angles to the photometer axis, or, as is actually done at the Bureau, it may be wrapped on a cylinder whose axis is parallel to the photometer bar. By pressing a key located on the photometer carriage the observer prints on the paper a record dot for each setting as it is made, this being done by means of a printing electromagnet suspended from the photometer carriage by a metal rod, the magnet being provided with two revolving spools carrying a carbon ribbon between the printing point and the sheet on the cylinder. The cylinder rests on the frame of the photometer bench and is turned on its axis by an electrically driven clock connected to its axis by means of a friction clutch which permits it to be turned by hand, if desired, without disturbing the clock. The clock and the printing magnet are operated in series by a battery of six cells, the magnet printing when the key is closed, the clock turning the cylinder ½ mm when the key opens. The record dots are thus prevented from falling together, and by their relative positions, they show the order in which the settings are made.

THE NECESSARY ADJUSTMENTS.

The complete adjustment of the apparatus preliminary to making a series of measurements is simply as follows: The photometer carriage is set at 120 cm on the bar and the paper record sheet is wrapped on the cylinder with the index line immediately under the printing point and overlapping at its opposite ends. Then with a standard 16-cp lamp, burning at its correct voltage, in the socket at zero on the test side, and the comparison lamp burning at the proper voltage to match the standard in color, the rods connecting the photometer and comparison lamp carriages are adjusted so as to throw the intensity balance anywhere within 6 cm either side of the index line, and the apparatus is ready for the measurements to be made. The only adjustment requiring any degree of care is that of placing the index line at its proper distance from the lamp.

RECORDING THE SETTINGS.

Settings are now made on the standard lamp and a corresponding group of record dots is made near the top of the sheet. The standard is then removed, the cylinder is turned by hand a distance sufficient to separate the group of dots already made from those to follow, and other standards, if desired, or lamps to be photometered are placed, in turn, in the socket and for each lamp the settings are recorded by a corresponding group of dots, as before. The record is thus continued down the length of the paper until all the lamps of the set are photometered.

A photographic reproduction of a completed record sheet, or chart, of a series of measurements actually made in this manner on a set of six standards and 17 lamps compared with them, is shown in the accompanying figure, the lamps under measurement being part of a lot designated as "N. B. S." lamps. In the three columns of figures along the right margin are given the numbers of the lamps in the order they were photometered and recorded by the dots, together with their respective voltages and corresponding candle-power values. The cross-mark under each group of dots indicates the average position of the indi-

vidual dots of the group. The candle-power values were read from the linear scale $S'S'$, whose correct position was determined in the manner described below. This will be referred to hereafter as the "Record Scale," being that scale which fits the record printed on the sheet.

READING THE RECORD.

With the chart on a drawing board and a T-square placed with its edge parallel to the index line, preliminary *relative* candle-power values of the six standards were read from the standard scale and each reading was recorded by a mark on the scale as shown. These readings, in the order of the record of the standards, were 16.15 cp, 15.98 cp, 16.00 cp, 15.97 cp, 16.40 cp and 16.08 cp, respectively, their mean being 16.11 cp. As the true mean value of these six standards was 16.00 cp, it is evident that the linear record scale $S'S'$ must lie above the standard scale and at such a distance from it that the 16.00-cp point on $S'S'$ falls on the line OO which was drawn (by means of the T-square) perpendicular to the standard scale at its 16.11-cp point.

The simplest method of determining the proper position for the record scale is to consider the line OO as a linear candle-power scale and draw the record scale intersecting it at the point where the reading is the mean true value of the standards —that is, at 16.00 cp for this particular case. No appreciable error is introduced by considering the line OO as a candle-power scale, because at this part of the rectangle the diagonal lines are so nearly parallel to each other that, for practical purposes, we may consider OO divided in the same proportion as the standard scale and the reading at the intersection of OO and $S'S'$ will be the same on both.

With the record scale $S'S'$ properly drawn, it becomes a simple matter (by means of the T-square) to read off the correct values in candle-power directly and as rapidly as it is possible to set the edge of the T-square over the centers of the various groups of record dots. It has been found by experience, however, that, instead of simply reading off the values in this manner, it is better practice to draw a line through the intersection of each diagonal line with the record scale, a sufficient number of such lines being drawn to include all the groups of record dots close together in value. In the case of groups which are scattered, as for instance the group corresponding to the eighth lamp in the set, it is better to draw lines directly from the centers of the groups to the scale. The advantage of having these lines on the chart is that the values can be more easily and accurately read; and especially that the record is thus made more complete and permanent, permitting it to be checked in a few moments by a second reader.

The values of all lamps of the set, including the standards, are read off to the nearest 0.01 of a candle and written along the margin. If the linear record scale has been carefully drawn at the proper distance from the standard scale, the mean of the standards, as read from it will equal, to within 0.01 of a candle, the true value of their mean. The true candle-power values of the individual standards used in the set given in the figure were, in the order recorded, 16.00, 15.90, 15.98, 15.82, 16.33 and 15.96 respectively. A comparison of these values with those read from the scale and recorded on the chart gives a fair indication of the accuracy of the measurements made on the photometer.

VALUES READ WITHOUT A RECORD.

Although, for the sake of obtaining a permanent record, the settings are usually recorded by dots on the sheet of paper, yet it is not at all necessary to do so. By means of a cross-hair reading index suspended from the photometer carriage the relative values of the standards may be read from the standard scale which is brought immediately under the cross-hair by turning the cylinder. The cross-hair is then set at the mean reading of all the standards and the cylinder is turned until the reading on the diagonal scale, corresponding exactly to the true value of the mean of the standards, falls immediately under the cross-hair. The cylinder is then clamped (no clock being required), and all is ready for the set of measurements on the lamps to be compared with the standards.

With the scale used in this manner it becomes a valuable adjunct to a commercial photometer. It has all the advantages of the ordinary commercial scale and has the further advantage of quick and accurate adjustment without a tedious adjustment of the comparison lamp which is arbitrarily set at the beginning and need not be changed thereafter either in voltage or distance. In using this scale it is, of course, necessary to have the comparison lamp movable with the photometer screen and kept at a constant distance from it throughout the set of measurements.

A MORE EXTENDED APPLICATION.

The scale slightly modified may be extended in its use to the testing of lamps which are placed successively at *different* points along the bar on the test side. It may be used also in reading a record made on a separate sheet of perfectly plain paper. These cases will be fully discussed by the author in a more extended article which will appear in the near future in the Bureau of Standards Bulletin.

CONCLUSION.

This combination candle-power scale and recording device has been in use in the Bureau of Standards almost daily for the past eight months and has proven itself entirely satisfactory. It has eliminated the computations which formerly occupied the entire time of at least one computer, and sometimes that of two. The results of a half-day's work on the photometer can be read off and written on the record sheet in but a few minutes, and the final record can be checked entirely by inspection. There are no tedious preliminary adjustments required and the photometer settings are made and recorded rapidly and accurately. The eye is not unnecessarily fatigued by alternate reading of the photometer screen and scale, and the observer is almost entirely freed from prejudice in reading. The record is simple, permanent and complete, and is easily read, checked and filed.

Bureau of Standards, Washington.

THE PHYSIOLOGICAL TOLERANCE OF ALTERNATING-CURRENT STRENGTHS UP TO FREQUENCIES OF 100,000 CYCLES PER SECOND.

BY A. E. KENNELLY AND E. F. W. ALEXANDERSON.

IT was announced many years ago by Tesla,[1] Elihu Thomson[2] and D'Arsonval,[3] that alternating currents of high frequency produced little sensation when passed through the human body, compared with alternating currents of low frequency and equal strength. This relative insensibility to high-frequency currents was attributed by D'Arsonval to the inability of the sensory nerves to respond to high-frequency stimuli. It is known that an alternating current of sufficient strength to light up an ordinary ½-amp incandescent lamp, included in circuit with the body of an observer, can be easily tolerated at very high frequencies, although only a small fraction of that current strength could be supported without distress at ordinary industrial frequencies up to 150 cycles per second.

Beyond the above facts, but little appears to be known, from the physical standpoint, concerning the influence of frequency on the physiological sensibility of the human body to the passage of alternating currents.

In making observations of alternating-current toleration, it has been difficult to determine the frequency or frequencies employed, owing to the nature of the generating apparatus. This apparatus has in nearly every case consisted of a condenser, discharging through an inductive circuit including the body of the observer. Very recently, however, it has been found practicable to construct, for industrial purposes, alternators giving frequencies up to 100,000 cycles per second. The frequency of these machines is readily measured and controlled. The ma-

[1] N. Tesla, "Experiments with alternate currents of very high frequency [illegible] application to methods of artificial illumination." *Trans. Am. I. E. E.*, May [illegible], 1891, Vol. [illegible], pp. [illegible]-319.

[2] Elihu Thomson, "Physiological Effects of Alternating Currents of High Frequency," [illegible] N. Y., Vol. [illegible], No. 11, March [illegible], 1891, p. [illegible]

[3] [illegible]

chines can deliver a steady terminal potential-difference and current, both of which can be easily measured with hot-wire instruments.

The writers have made a series of measurements on different individuals to determine their relative sensibility to alternating-current strengths at different frequencies up to 100,000 cycles per second, using one of the above-mentioned high-frequency alternators for this purpose.

Application of the Current.

In all of the measurements, the current was passed through the arms and across the chest, by inserting the hands of the subject, up to the wrist (ulnar condyle), in jars of saline solution containing electrodes connected with the alternator. The alternating current, entering the body through the skin of the hands, distributes itself through the liquid electrolytes within the arms, and must diffuse through the chest and trunk of the body. It is well known that when a high-frequency current passes through a cylinder, wire, or prism of good conducting material, such as copper, and particularly a good electrical conducting material with strong magnetic properties, like iron, it penetrates only to a small depth within the conductor, or is confined to a thin surface layer; this effect is commonly called the "skin effect." The skin effect is, however, easily demonstrated arithmetically to be very small with conductors of such relatively low conductivity as saline solutions, so that unless our quantitative data and formulas for the skin effect are very largely wrong, it is certain that the skin effect in the human body is practically negligible, and that up to the highest frequency here considered, the current diffuses throughout the cross-sections of the body in substantially the same manner as a continuous current.

High-Frequency Alternator.

The high-frequency alternator was a 2-kw machine with a stator double armature and an inductor rotor, as built by the General Electric Company for wireless telegraph and telephone work. The machine was similar to that described in a paper by one of the writers, last year,[4] before the American Institute of Electrical Engineers. It was designed to give either 110 volts or 220 volts on open circuit, with multiple or series connections respectively, and to deliver the full output of 2 kw with the aid of a series or shunt condenser. The voltage and current that can be selected for full output may be varied widely, depending upon the capacity and connection of the condenser, under the limitation that the current should not exceed 40 amp in multiple connection. In the experiments here described, a resistance and condenser load (R, C, Fig. 1) was used to raise the voltage above the normal no-load voltage. The maximum voltage used in the tolerance test was 360 volts, with a corresponding current of 0.8 amp taken through the body. The machine was driven by a direct-current electric motor at the full speed of 20,000 r.p.m., through gearing of velocity increasing ratio 10:1. By reducing the speed of the driving motor, the frequency of the alternator was adjustably reduced. The wave form of the e.m.f. generated by the alternator is approximately sinusoidal.

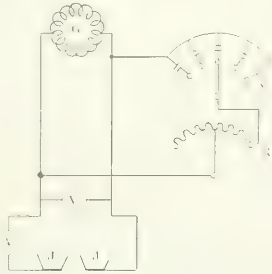


Fig. 1—Electrical Connections Employed in Tolerance Tests.

TABLE OF OBSERVATIONS.

I Initials of Subject	II Frequency Cycles per Sec n	III P.D. Volts	IV Tolerance Current Ampere I	V Inferred Resistance Ohms	VI Tolerance Cyclic Quantity I/n Coulombs per Cycle ÷ 1,000,000	VII REMARKS
D. M.	100,000	250	0.5	500	5	Sensation of heat only.
	75,000	[illegible]	0.32	500	4.3	
	50,000	110	0.18	612	[illegible]	Slight muscular contractions.
	30,000	50	0.09	557	[illegible]	" " "
	16,000	27	0.044	614	[illegible]	" " "
	11,000	17	0.028	614	2.5	" " "
A. E. K.	100,000	200	0.33	600	3.3	Tingling and warmth in wrists.
	50,000	100	0.17	590	3.4	Slight muscular contractions.
	30,000	35	0.07	500	2.3	" " "
P.R.	100,000	360	0.8	450	8.0	Check test on a different date
	50,000	125	0.2	625	4.0	
	[illegible]	[illegible]	0.15	633	5.0	Muscular contractions in arms.
	16,000	32	0.05	640	3.1	" " " wrists and arms.
	11,000	20	0.03	[illegible]	2.7	" " " " "
P. M.	100,000	240	0.45	534	4.5	
	80,000	150	0.26	[illegible]	[illegible]	
	60,000	105	0.18	[illegible]	[illegible]	
	40,000	70	0.12	[illegible]	[illegible]	
	25,000	40	0.065	[illegible]	[illegible]	
	16,000	25	0.040	625	[illegible]	
	11,000	16	0.025	625	[illegible]	
C. M. S.	100,000	200	0.48	417	4.8	
	80,000	150	0.38	[illegible]	[illegible]	
	60,000	80	0.21	[illegible]	[illegible]	
	40,000	50	0.13	[illegible]	3.3	
	25,000	35	0.085	412	[illegible]	
	16,000	22	0.05	440	3.1	
	11,000	12	0.027	[illegible]	[illegible]	
I. T.	62.5	[illegible]	0.0055	[illegible]	88	Mus[illegible]
C. A. W.	62.5	[illegible]	0.0035	2020	[illegible]	"
P. H. C.	62.5	8.4	0.0105	[illegible]	168	"
A. E. K.	62.5	5.1	0.0041	[illegible]	[illegible]	"
C. P.	62.5	6.6	0.0053	1240	[illegible]	"

Electrical Connections.

The electrical connections employed are indicated in the accompanying diagram Fig. 1. G is the high-frequency alternator, C is the variable condenser and R the variable resistance used in a shunt circuit in order to increase and regulate the voltage. V is a hot-wire voltmeter, A a hot-wire milliammeter, JJ metallic jars containing water with approximately 3 per cent of common salt. In the ordinary method of conducting the test, the generator voltage was reduced to a comparatively low value by lowering the excitation of the machine. The subject then inserted his hands in the jars JJ. The voltage was then slowly

[4] E. F. W. Alexanderson, "Alternator for One Hundred Thousand Cycles." *Proceedings* Am. Inst. El. Engrs., [illegible]

and steadily raised until the subject considered that any further increase would give him distress. The readings of current and voltage at the instruments A and V were then noted and the voltage again reduced. The speed of the driving motor would then be altered so as to obtain another frequency, and the measurement repeated. A series of such measurements would thus be obtained on the same subject at, say, five frequencies between 15,000 and 100,000 cycles per second, within an interval of about 20 minutes. The limiting current strength which the subject could take through his arms and body, without marked discomfort or distress, at any given frequency, may be designated as the *tolerance current* for that subject and frequency.

Observations.

The observations are collected in the above table. Column I gives the initials of each subject's name. Column II the frequency in cycles per second. Column III specifies the potential-difference at jar electrodes as measured by voltmeter V. The tolerance current is recorded in column IV, and the inferred resistance of the subject from the potential-

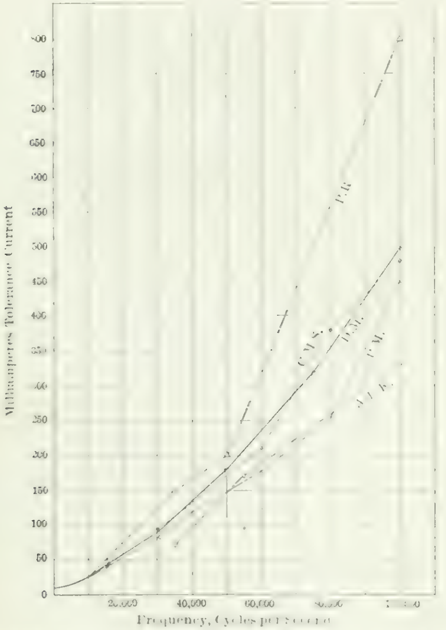


Fig. 2—Curves of Tolerance Current Strengths at Different Frequencies in the Cases of Five Different Subjects.

difference and current, including the resistance in jar solutions, is given in column V. Column VI gives the ratio of the tolerance current to the frequency. This ratio may be called the *tolerance cyclic quantity.* It is a quantity expressed in coulombs per cycle. The actual figures within the column give the result in virtual, or root-mean-square, microcoulombs per cycle. With a sinusoidal current wave, the maximum quantity of electricity passed through the body in each half-cycle will be this virtual quantity multiplied by $\sqrt{2} \div \pi$.

It will be seen that the tolerance current increases from 0.03 amp at 11,000 cycles per second to about 0.45 amp, or even 0.8 amp, at 100,000 cycles per second. This means that the tolerance cyclic quantity increases from about 2.5 microcoulombs per cycle at 11,000 cycles per second to about 4.5 microcoulombs at 100,000 cycles per second.

The last five observations were made near the ordinary lighting frequency of 60 cycles per second. It will be seen that the tolerance e.m.f. varied between 5.1 volts and 8.4 volts with different subjects and the tolerance current between 4 milliamperes and 10 milliamperes. The tolerance cyclic quantity varied between 56 microcoulombs and 168 microcoulombs per cycle.

It was the unanimous testimony of all the subjects experiencing the high-frequency current that at or near 100,000 cycles per second there was a sensation of tingling and heat in the wrists, when the tolerance current was approached, but no muscular contractions were produced, either in the hands or arms. When the frequency was reduced to about 50,000 cycles per second, muscular contractions commenced in the muscles of the forearm. As the frequency was reduced below 50,000 cycles per second, the muscular contraction became more evident.

The tolerance currents for the high-frequency range 11,000 to 100,000 cycles per second, and are given in the accompanying curve sheet, Fig. 2.

Conclusions.

It is evident from the tables and curves that there is a very marked increase in the tolerance current strength as the frequency is increased from 11,000 to 100,000 cycles per second. A man can tolerate only about 30 milliamperes at 11,000 cycles per second, but can tolerate nearly half an ampere at 100,000 cycles per second.

Between 60 and 11,000 cycles per second there is not a very great change in tolerance current, namely, from about 5 milliamperes to about 30 milliamperes.

To a first approximation, between 11,000 and 100,000 cycles per second, the tolerance current strength increases with the frequency, although it is not certain that the increase follows a straight line law. Some of the subjects seem to follow nearly a straight line law of tolerance with frequency. Others seem to show a parabolic law, or a tolerance increasing faster than the frequency. Thus the mean tolerance cyclic quantity was 2.5 microcoulombs per cycle at 11,000 cycles per second and 5.3 microcoulombs per cycle at 100,000 cycles per second, or, roughly, twice as much at the upper as at the lower limit. It is difficult to say what the precise law is, from the observations thus far made. The tolerance current cannot be measured with great precision. It is a physiological estimate subject to variation, not only in different individuals, but also in the same individual at different times.

Since the mean tolerance cyclic quantity was nearly 100 microcoulombs per cycle at 60 cycles per second and seemed to diminish below 2.5 microcoulombs per cycle at 11,000 cycles per second, a minimum is to be expected somewhere between these limits, i. e., at some frequency between 60 and 11,000 cycles per second, a maximum sensibility to current should be looked for, in the sense of a minimum tolerance cyclic quantity I/n.

The reason for the increase of tolerance current with frequencies above 11,000 cycles per second is to be looked for in the condition of reduced nervous sensibility at high frequencies, as suggested by D'Arsonval. That is, it cannot apparently be accounted for physically; so that the explanation may be expected to be physiological.

MOTOR VENTILATION.

Motors which are used almost entirely for producing torque and run very little, such as lifting motors for lifting tables in rolling mills, slip regulating motors in motor-generator flywheel, mine hoist outfits, etc., are designed to dissipate their heat at standstill and therefore require an excess amount of material over a motor of the same rating which has the benefit of ventilation produced when running at full speed. A patent issued to Mr. H. Müller attempts to remove this disadvantage by making the rotor of two members, one coupled to the work and the other free to rotate and fitted with ventilating or fan blades. The free rotor revolves at full speed whenever voltage is applied to the motor, irrespective of the speed of the working rotor, and in this way permits an excellent ventilation of the machine under all conditions.

GASOLINE-ELECTRIC TRUCK FOR HAULAGE IN ARID REGIONS.

By W. D. Hornaday.

A motor transportation line of unusual interest is in operation between Marathon and a point on the Rio Grande, 80 miles south of Marathon. The lead and zinc mines of the Del Carmen Mining Company are situated 5 miles from the international boundary stream on the Mexico side, and for several years the work of blocking out the ore has been going on, but the transportation problem was such a difficult one that shipments could not be made. The nearest railroad point is Marathon, on the Southern Pacific, 80 miles from the river crossing.

It was finally decided by the company to build an aerial tramway across the river in order to handle the ore through a territory that is absolutely impassable for anything but burros. This tramway is 6½ miles long, and was constructed at a cost of $110,000, gold. The problem of transporting the ore from the Texas terminal of the tramway into Marathon was still unsolved, but the company constructed a fairly good wagon road all the way at a cost of about $50,000, and a manufacturer of gasoline traction engines undertook to furnish motive power of that type which would handle the ore economically and speedily. These traction engines proved failures.

At this time Mr. W. G. E. Rolaff, a mechanical and electrical engineer, was asked by the company to devise some method of transportation. The problems to be met with consisted chiefly of the long distance, the absence of fuel of any sort along the route, and the lack of water, there being no water on the road for 40 miles. After thoroughly investigating the matter Mr. Rolaff decided that neither a gasoline tractor nor an electric truck would be satisfactory, under the circumstances, but a combination of the two.

This gasoline-electric truck has a four-cylinder gasoline engine, direct-connected to a 15-kw interpole compound-wound generator with a controller at the driver's seat. The frame of the car is built of 5-in. steel channels in which the subframe carrying the power plant is suspended from three points. The engine has no parts, such as gears, springs, valves, rods, etc., exposed, but all of these are run inside the crankcase and operate in a bath of oil. Lubrication is had by a self-contained system involving no oil pipes of any sort, and the tell-tale on

Fig. 1—Gasoline-Electric Truck.

the driver's seat is a perfect indicator as to the proper working of the oiling system. This construction was rendered necessary by reason of the enormous amount of grit and sand which is always present on the desert and to which the machine is naturally exposed.

The dynamo, which is connected to the engine by a flexible coupling, will carry an overload of 100 per cent with ease for a sufficient length of time to overcome any ordinary hard pulls. The voltage of this generator is 125.

As driving motors the Couple Gear Freight Wheel Company's wheels are being used. They consist of a steel shell enclosing a motor operating from pinions on the armature shaft engaging racks mounted inside of the shell. For this particular purpose this construction is ideal, because it is dustproof, waterproof, protected against all possible abuse from outside influences and the motors are capable of a very heavy overload for a short time.

These motors are connected in such manner that by a simple throw of the controller lever the operator can change from a series connection to a series-parallel connection, and at no time will he jar the machinery as he would if he had to throw gear levers and clutches in a straight gasoline truck of the ordinary type.

The truck proper is suspended in front on semi-elliptical springs designed to carry the power plant, and in the rear on

Fig. 2—Gasoline-Electric Truck.

semi-elliptical springs sufficiently heavy to carry a portion of the load of ore. The ore truck proper is, in fact, a two-wheel cart, 15 ft. long, the front part of which rests upon the rear part of the power truck. The connection between these two is made by a turntable and a universal ball-and-socket joint. This allows for all inequalities of the road and makes turning and backing a very simple operation. The wheels of the ore truck are 5 ft. in diameter, with a 10-in. face; the hubs are cast steel with 9-in. roller bearings and two ball-thrust bearings in each hub; the axle of the ore truck is 4½ in. square. The body of the truck will carry 15 tons of ore.

The truck carries 40 gal. of gasoline, which is sufficient to carry it over 80 miles or 100 miles of road. In addition to being a four-wheel drive, the truck also steers by all four wheels, which allows it to be operated around sharp and narrow mountain roads. Broadly speaking, the truck will travel one mile with a fuel consumption of approximately ½ gal. of low-grade gasoline. The truck makes a speed of 9 miles to 10 miles an hour without load on a good road, and will climb any grades that exist on the 80-mile run between Marathon and the Rio Grande. Some of these grades are as great as 14 per cent, but none of them is very long. When loaded the truck travels from 4 miles to 6 miles per hour, according to the road surface and the grade.

On the dashboard the operator has a combination voltmeter and ammeter, which instrument shows him at all times exactly what power the truck is consuming. During a recent series of tests it was found that when traveling at an average rate of from 8 miles to 9 miles an hour the truck consumed approximately 7½ kw without load. Loaded it showed a power consumption of about 10 kw on level road, and on some of the hills climbed the power consumption rose as high as 20 kw for short intervals. It will travel through sand with comparative ease, and the only difficulty experienced has been on roads of slimy, slick mud. In one instance the driving wheels sank in this sort of mud 7 in. and the trailer went down as deep as 22 in., yet by careful manipulation the truck was successfully pulled out with its load, going over about 300 yd. of this kind of road. It is claimed that a man of ordinary intelligence may be taught in a very few days to handle the truck under the conditions met with in these regions.

Central Station
Management, Policies and Commercial Methods

MORE STREET LAMPS IN FORT WORTH, TEX.

With the proceeds from a $25,000 bond issue Fort Worth, Tex., is extending its street-lighting service. In the outlying districts of the city 250 arc lamps and 400 tungsten incandescents are being installed. North Fort Worth gets the benefit of 50 of these additional lamps, and Main Street and Houston Street in Fort Worth will have 50 more.

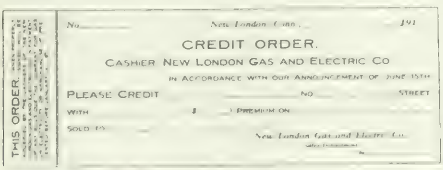
ORGANIZATION OF THE MINNEAPOLIS NEW-BUSINESS DEPARTMENT.

The new-business department of the Minneapolis General Electric Company, under the management of Mr. H. J. Gille, consists of the manager, Mr. Gille; the assistant manager, Mr. R. W. Clark; two power specialists in the engineering department; one new-building man; one sign man; one general man and 10 men assigned to districts. In recruiting men for this department they are first taken into the office, where they can get familiar with the system of the company and its methods of treating the public can be seen. From the office they are sent out to district work in the new-business department. As an incentive to further efforts, they have the possibility of graduating to good positions in other Stone & Webster properties.

The man in charge of new buildings sends the company's booklet on residence wiring to every one taking out a permit for a new residence. A card for the card index is made out for that building, and these cards are given to the district solicitor for the district in which the building is located, who must follow up this building and report promptly whether the building is being wired. It is his duty to see if possible that the wiring is properly done with adequate provisions as to outlets and no delay is allowed in connection with these new-building cards. It is the company's practice to draw plans for the wiring and lighting of high-grade residences. On new residences the architect plans are employed. If it is an old residence, then new floor plans are drawn to show the location of outlets.

MAKING SALESMEN OF CUSTOMERS.

The New London Gas & Electric Company and the three stations controlled by the Rockville-Willimantic Lighting Company, at Willimantic, Rockville and Staffords Springs, Conn., have just inaugurated a scheme of recompensing customers who effect the sale of electrical apparatus or secure a new customer. A copy of the notice sent to customers, which explains itself, is given herewith. The general manager of the properties, Mr. Alex. J. Campbell, looks for good returns, although admitting that the success or failure of the scheme depends on whether the companies succeed in getting the people interested. In addition to the credits given, three prizes aggregating $90 are offered by the companies in their respective territories to the three persons who bring them the most business between June 15 and Dec. 1. Besides notices sent to customers, the company is carrying large advertisements in the local papers calling attention to the plan, in which employees of the company are not allowed to participate.


THIS ORDER

No. New London, Conn., 191

CREDIT ORDER.

CASHIER NEW LONDON GAS AND ELECTRIC CO

IN ACCORDANCE WITH OUR ANNOUNCEMENT OF JUNE 15TH

PLEASE CREDIT NO. STREET

WITH $ PREMIUM ON

SOLD TO

New London Gas and Electric Co.

Fig. 1—Credit Order Blank.

TO OUR. CUSTOMERS.

New London, June 15, 1910.

We have made a practice for some years of paying out a considerable sum of money each year to secure new business. This has been paid principally for advertising and to canvassers.

There is no class of people towards whom we feel better disposed, or to whom we would rather pay at least a part of this money, THAN TO OUR OWN CUSTOMERS.

WE PLAN AS FOLLOWS:

From June 1st to December 1st, 1910, whenever a customer of ours, taking gas or electricity from us, sells one of our appliances to be used on our mains, or brings us a new customer for gas or electricity, the Sales Department will give the party making the sale a credit order on the cashiers. These orders will be accepted in the payment of bills due this Company, if presented before January 1st, 1911.

No sale will be considered made, or customer secured, until accepted by us.

ORDERS WILL BE GIVEN AS FOLLOWS:

FOR	Credit Order For
Each new Gas customer secured,	$1.00
Each new Gas Range sold, - - -	1.00
Each new Gas Cooker sold, - -	.75
Each new Water Heater sold, - -	1.00
Each new Hot Plate sold, - - -	.40
Each new Gas Outlet, - - - -	.10
Each new Gas Radiator sold, - -	.25
Each new Electric customer secured,	$1.00
Each new Electric Motor sold, - -	1.00 per h.p.
Each new Electric Iron sold, - -	.50
Each new Electric Fan sold, - -	.50
Other Electric Appliances sold,	10 per cent. of selling price.

To make the plan more interesting, we offer the following cash prizes for the greatest volume of new business secured, as shown by the amount in dollars of credit orders issued between June 1st and December 1st, as follows:

To the person securing the largest total, $50.
To the person securing the 2d largest total, $25.
To the person securing the 3d largest total, $15.

These prizes are cash and in addition to any credits obtained from our premium list.

Employees of the Company will not be allowed to participate.

NEW LONDON GAS & ELECTRIC CO.

Fig. 2—Notice to Customers.

STRAIGHTENING THE LOAD CURVE AT CEDAR RAPIDS, IOWA.

Intelligent housewives, and laundry people, and tailors, and even restaurant keepers, want to use the new electrical devices because they are in every way superior to old methods, except that in some cases the apparent cost is greater. At the same time central-station managers see in them a means for improving the load factor. As most of the load furnished by these devices comes at a time when the ordinary load is low—either in the daytime, as in the use of electric irons, mangles, washers, etc., or late at night, as in charging automobile batteries—the managers get after this business as "velvet," and in this they are being most ably seconded by the manufacturers of the devices.

It is always of interest and encouragement to central-station men to hear what their colleagues in other places are doing in this direction. A most interesting and instructive example of this is found out on the prairies of Iowa in the town of Cedar Rapids, which contains from 35,000 to 40,000 people. The Cedar Rapids & Iowa City Railway & Light Company, under

Superintendent J. C. Young, is making great strides to the front in the matter of day load.

Mr. Young has, within the last few months, secured and connected-up the very profitable load of the Douglas Starch Company's factory. This load is on 24 hours a day for six days a week, and averages throughout the 24 hours 480 kw, or more than 640 hp. This company now grinds about 5000 bu. of grain per day, and is greatly enlarging its plant, so that it will, upon completion, grind daily about 15,000 bu. The machinery is all operated by three-phase induction motors drawing their energy from the central station of the Cedar Rapids & Iowa City Railway & Light Company.

In the last year the electric company has made very material gains in other directions. There are in the city about 200 factories, large and small, and Mr. Young states that about 71 per cent of the energy required for these is furnished by his central station. There are also five laundries which are equipped with electrically driven washers and mangles, and several tailor shops which are using electric irons exclusively. One restaurant also has short-order heating apparatus using 4000 watts, and this load is carried 14 hours per day. The load in electric irons is also no mean one, when it is considered that there are several dozen of these in the shops alone, each iron requiring from 300 watts to 1000 watts, and being in use about 10 hours a day. Also the housewives of Cedar Rapids have taken favorably to the company's 30-day free trial offer of its electric irons, and there are very many in use in the homes. The load in electric cooking apparatus—toasters, warming pans, coffee percolators, etc.—is also considerable, and, although not quite so profitable as the others mentioned, for the reason that part of it tends to sharpen rather than to smooth off the peak, yet it is sought after because it is worth much in popularizing the use of electricity.

Still another source of day load which, while rather intermittent, is nevertheless considerable, is in the electrically driven suction cleaners, of which there are 100 or more in use in the city. As these are of several sizes from 1/6 hp to 2 hp or 3 hp, and are in use for an hour or more every other day, it can be seen that this load is worth having, especially as it is constantly increasing.

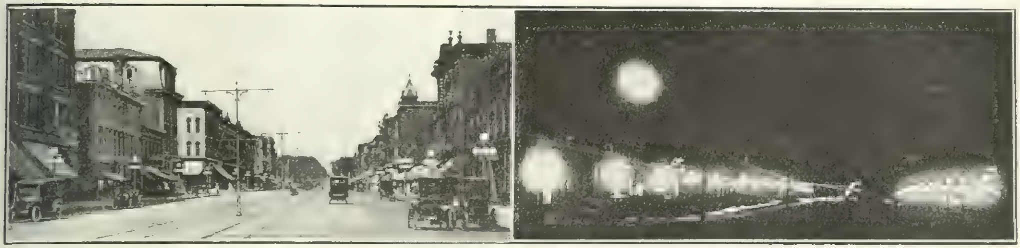


Fig. 1—Tungsten Cluster Illumination.

The Cedar Rapids station under consideration has another source of revenue which is unusually large for the place, and that is in the charging of automobile batteries. The management has heartily encouraged the purchase of electric vehicles, and offered the favorable rate of 5 cents per kw-hour for charging energy, with the result that there are in the city about 25 rectifier charging stations, either in garages or privately owned. The company contemplates the establishment of a charging station of its own.

When it is considered that the charging rate of an electric vehicle may be from 500 watts to 1000 watts, and that the charging is commonly begun after 10 p. m. and continued through the night, when the ordinary light and power load is small, it may be seen that a dozen or so automobile batteries on the circuit are worth having, especially as they require almost no wattless current. An electric vehicle may consume, therefore, from 2000 kw-hours to 11,000 kw-hours annually, about as much as 10 arc lamps.

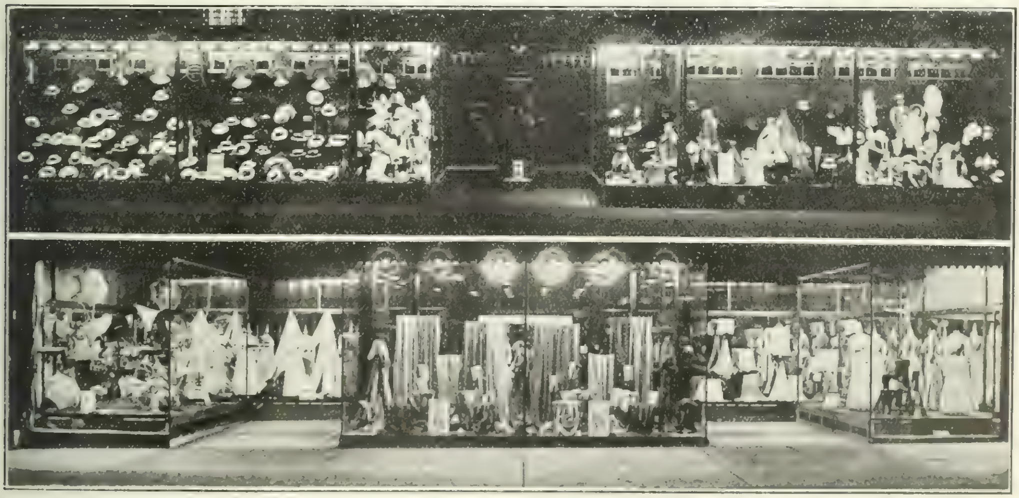


Fig. 2—Show-Window Lighting.

In still another direction the management has also been quite active. In common with other central-station managements it has seen the possibilities of the tungsten lamp for getting business. Mr. Young has taken up in some detail the problem of show-window lighting. He has taken an upper room in the office building and had it fitted up as a sort of trying-out place. Black oilcloth curtains are hung in such a manner that they can be drawn so as to partition off the room into several little darkrooms, and in these divisions articles are arranged as in show windows, and tests made upon them with various sizes and positions of lamps and shades. As a direct result of this somewhat impromptu laboratory he has added to the company's business the lighting of half a dozen or more big show windows for about three hours every evening in the week on a flat rate, and the writer can testify that it would be hard to find any more attractive and pleasingly lighted show windows in Iowa. The units used are 60-watt tungstens, with prismatic glass reflectors of appropriate design. They are placed at the top of the window against the outside wall in such a position that the observer on the sidewalk will not see the lamps at all unless he takes the trouble to look directly upward. These windows belong to clothing, shoe and drug stores. The sharpness of detail and uniformity of illumination afforded have already attracted considerable comment. Some illustrations are given on page 159.

Only a few days ago Mr. Young had stepped into one of the large clothing stores to talk over a lighting proposition. The show window of this store was one of those referred to above.

"Charley," said the proprietor, "aren't you going it just a little bit strong on my window lighting?"

Before Mr. Young could answer the head clerk, who was standing near, spoke up:

"Not at all, Mr. A———. Why, I was downtown here Friday night, and there was a crowd on the streets, and our window had at least a dozen people looking at it, and it was the only one on the block which had anybody."

"Mr. A——— just grinned and said: "I guess it's all right, Charley."

The window referred to (Fig. 2, top) has a frontage of about 25 ft. on each side of the front doorway, and the lighting is given by 30 tungsten lamps, 15 on either side, each lamp of 60 watts rating, with appropriate prismatic glass reflectors. This makes a load of 1800 watts for this one window. The other windows lighted on the same scheme comprise a load of more than 3000 watts, making a total of, perhaps, 5000 watts for special show-window lighting with tungsten lamps.

Another feature which has greatly helped in building up residence service is a special contract offered to new consumers only for the limited period of May 7, 1910, to June 16, 1910. The significant paragraph in this contract is as follows:

"It is understood and agreed that if the order for connection is received and connection is made by the company at any time between May 7, 1910, and June 16, 1910, the said company will allow to the undersigned consumer the sum of nine ($9) dollars as credit to apply on monthly bills for electric energy, provided that the said consumer was not using electric light on the said premises on or previous to May 7, 1910."

ASSETS AND LIABILITIES OF GREATER NEW YORK CENTRAL-STATION COMPANIES.

The New York City Public Service Commission has made a compilation of the assets and liabilities on Dec. 31, 1909, of light, heat and power companies under its jurisdiction, including gas companies. The several electrical companies in Manhattan are entered under the head of the Consolidated Gas Company as associated companies. The gas properties of the

I. CONSOLIDATED GAS ASSOCIATED COMPANIES.

ASSETS OR DEBIT SIDE	New York Edison Co.	United Elec. Lt & Power Co.	Brush Elec. Illum. Co.	Ball Elec. Illum. Co.
Current Assets:				
[illegible]	$3,2[illegible]	$26,105	$4,781	....
Special deposits	97,770	263,802	....	....
Bills receivable from associated companies......		280,000	....	....
Other bills receivable........................	30,275	.....	....	....
Accounts receivable with associated companies.	63,275	5,076	7,942	....
Accounts receivable with City of New York....	2,201,308	282,319	171,502	....
Consumers' accounts receivable..............	1,760,123	131,561	....	....
Other accounts receivable....................	1,311,515	43,548	3,403	....
Interest and dividends receivable.............	507,878	....	....	....
Other current assets..........................	37,774		....	....
Materials and supplies.......................	1,888,343	233,111	....	....
Total [illegible]	$11,180,169	$1,265,522	$187,628	....
Investments:				
[illegible]	$9,2[illegible]8,031	$[illegible]	$4,567	....
Bound investments...........................	1,609,456	1,048,26[illegible]	....	....
Fixed Capital:				
[illegible]	109,323,831	10,827,222	1,327,649	249,950
Fixed capital installed since December 31, 1908 .	3,834,809	374,199	14,985	....
Miscellaneous Temporary Debits:				
[illegible]	7,774	356	....	....
[illegible]	37,212	....	....	....
Other suspense..............................	8,860	[illegible]	9,643	....
Corporate deficit............................		[illegible]	181,060	566
Grand Total..............................	$1[illegible]	$1[illegible]	$1,[illegible]	$250,516
Liabilities or Credit Side				
Unfunded Debt:				
[illegible]	$3,362,458	373,175	34,992	....
[illegible]				....
Interest accrued on funded debt.................	588,477	1,203,300	....	
Interest accrued on unfunded debt...............	182,[illegible]	129,214	....	....
Dividends declared............................				....
Bills and accounts owing to associated companies	13,22[illegible]12	1,437,180	346,086	
Miscellaneous bills payable.....................				
[illegible]	246,165	61,870	130	....
[illegible]	723,611	166,420	752	516
Other unfunded debt...........................	276,322			....
[illegible]	$1[illegible]	$3,371,459	$581,960	516
Funded Debt:				
[illegible]	$4[illegible]	$4,838,000	$275,000	...
Miscellaneous funded debt........	[illegible]12	....	....	...
Reserves:				
Premiums on stocks, etc..........				
Renewal and contingency account	9,143,500	829,374	68,035	
Accrued amortization of capital ..				
Unamortized premium on debt....	220,304		...	
Casualties and insurance reserve...	13[illegible]	12,697	4,567	....
General suspense	56,784	63		
[illegible]	45,080,671	5,318,434	[illegible]	250,000
Corporate surplus	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	$25[illegible]516

II. BROOKLYN COMPANIES.

ASSETS OR DEBIT SIDE	Kings Co. Lighting Co.	Amsterdam El. Lt. H. & Power Co.	Edison Elec. Ill'g Co. of Brooklyn	Kings Co. El. Lt. & Power Co.
CURRENT ASSETS:				
Cash	$268,443.96	$226.54	$98,342.83	[illegible]
Special deposits	102,025.00		97,856.25	[illegible]
Bills receivable	1,000.00		3,724.74	
Advances to Associated Companies			46,881.97	7,712,249.90
Accts. receivable with City	33,025.24		159,042.00	
Consumers' accounts receivable	80,185.70		308,322.43	
Other accounts receivable	10,716.82		16,550.80	
Interest and dividends receivable		[illegible]	182,742.11	14,077.43
Other current assets				
Materials and supplies	[illegible]		[illegible]	
Total floating capital	[illegible]	$229.54	$1,623,162.09	$7,733,215.49
INVESTMENTS:				
Free investments				
Bound investments			[illegible]	6,175,870.00
FIXED CAPITAL:				
Fixed capital December 31, 1908	[illegible]	[illegible]	[illegible]	[illegible]
Installed since December 31, 1908	[illegible]		[illegible]	[illegible]
MISCELLANEOUS TEMPORARY DEBITS:				
Prepayments	1,164.81		769.78	
Unamortized debt discount and expense			491,128.92	[illegible]
Other suspense			3,121.63	
Corporate deficit		[illegible]		
Grand Total	$5,577,322.46	$1,030,265.07	$19,906,739.71	$18,931,933.36
LIABILITIES OR CREDIT SIDE				
UNFUNDED DEBT:				
Taxes accrued	$10,114.04	$659.98	(b) $185,089.15	
Judgments unpaid				
Interest accrued on funded debt	[illegible]	[illegible]	[illegible]	
Interest accrued on unfunded debt			861.15	
Dividends declared				[illegible]
Due associated companies		46,881.97	7,712,249.90	
Miscellaneous bills payable			742,210.00	
Consumers' deposits	83,333.38		85,922.99	
Miscellaneous accounts payable	17,616.73		481,598.29	
Other unfunded debt	6,885.48		36,704.89	
Total unfunded debt	[illegible]	$229,616.95	$9,446,482.62	$196.00
FUNDED DEBT:				
Mortgage bonds	$2,553,000.00	$300,000.00	4,275,000.00	$7,676,000.00
Miscellaneous funded debt	250,000.00			
RESERVES:				
Premium on stocks, etc.				10,542.00
Renewal and contingency account			5,549.47	
Accrued amortization of capital	18,192.84		430,260.74	
Casualties and insurance reserve			182,303.51	
Other optional reserves		648.12	(c) 567,143.37	
Capital stock	2,000,000.00	500,000.00	5,000,000.00	10,000,000.00
Corporate surplus	526,779.99			1,245,195.36
Grand Total	$5,577,322.46	$1,030,265.07	$19,906,739.71	$18,931,933.36

III. MISCELLANEOUS.

ASSETS OR DEBIT SIDE	Consolidated Tel. & Elec. Subway Co.	Empire City Subway Co., Ltd.	Long Acre Elec. Lt. & Power Co.	Bronx Gas & Electric Co.	Queens Borough Gas & Electric Co.	New York & Queens Elec. Lt. & Power Co.	Bowery Bay Elec. Lt. & Power Co.	Richmond Light & R. R. Co.
CURRENT ASSETS:								
Cash	$36,715.42	$24,032.57	$3,174.13	$73,126.29	$24,779.43	$54,610.85	$87.30	$32,594.60
Special deposits						1,950.00		44,840.00
Accts. receivable with Ass'd Cos.	51,499.97							13,680.73
Accts. receivable with City of N. Y.				20,878.54	30,502.60	73,060.31		156,061.14
Consumers' accounts receivable		230,422.52		27,878.66	33,631.84	21,975.34	7,498.66	17,973.31
Other accounts receivable	133,764.58	26,467.18	286.63	6,619.26	3,130.20			7,665.84
Other current assets				991.94				
Materials and Supplies	44,012.37	46,133.10	1,260.44	28,894.97	24,397.19	27,537.44	1,991.93	51,799.43
Total floating capital	$265,992.34	$327,055.37	$4,721.20	$158,389.66	$116,441.26	$179,133.94	$9,577.89	$324,615.05
Investments (free)			500,000.00			7,500.00		445,000.00
FIXED CAPITAL:								
Fixed capital Dec. 31, 1908	$13,817,373.91	$11,290,541.75	$90,736.10	$1,019,265.88	$4,021,323.91	$5,166,343.26	$229.29	$4,884,775.08
Fixed cap. inst. since Dec. 31, '08 —elec	1,368,944.78	392,982.40	897.21	68,044.57	75,709.20	111,885.43		(e) 17,782.29
Fixed cap. inst. since Dec. 31, '08 —gas				25,589.24	[illegible]			
MISCELLANEOUS TEMPORARY DEBITS:								
Prepayments		1,451.03		3,445.31	3,093.76	3,555.82		[illegible]
Unamortized debt disc't and expense			[illegible]			590.32		
Other suspense			(b) [illegible]	17,754.48	409.12		1,000.00	12,896.20
Corporate deficit			[illegible]				6,571.59	124,739.14
Grand Total	$15,452,311.03	$12,012,030.55	$735,203.62	$1,292,489.14	$4,267,187.74	$5,469,008.77	$17,378.77	$5,818,108.01
LIABILITIES OR CREDIT SIDE								
UNFUNDED DEBT:								
Taxes accrued	$582,547.41	$156,388.13	$3,460.11	$25,874.95	[illegible]			$80,495.93
Judgments unpaid								
Interest accrued on funded debt	370,015.25	[illegible]	[illegible]	13,025.00	[illegible]	$48,983.33		[illegible]
Interest accrued on unfunded debt	(a) 113,557.50		383.33	120.00	579.17	[illegible]		
Dividends declared				[illegible]				
Bills & accts. owing to ass'd Cos.	383,009.62		[illegible]					41,629.01
Miscellaneous bills payable—demand			[illegible]	10,000.00	[illegible]			69,000.00
Miscellaneous bills payable—time				75,000.00		250,000.00		399,000.00
Consumers' deposits				[illegible]	[illegible]	18,108.06	[illegible]	4,742.50
Miscellaneous accounts payable	90,747.45	[illegible]	[illegible]	25,264.92	[illegible]	53,423.33	[illegible]	70,952.85
Other unfunded debt	3,005.43			[illegible]	[illegible]			4,424.55
Total unfunded debt	$1,542,882.66	$445,242.34	[illegible]	[illegible]	$147,347.53	$370,889.75	[illegible]	$715,084.84
FUNDED DEBT:								
Mortgage bonds	[illegible]	[illegible]	$500,000.00	[illegible]	$2,017,500.00	$2,338,000.00		$2,200,000.00
Miscellaneous funded debt	[illegible]			[illegible]				
RESERVES:								
Contractural reserves					[illegible]			
Renewal and contingency account		[illegible]		[illegible]				
Accrued amortization of capital				[illegible]	[illegible]	59,809.15		[illegible]
Unamortized premium on debt								
Other required reserves						[illegible]		
Casualties and insurance reserve								
Other optional reserves						930.00		[illegible]
Capital stock	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,500,000.00	[illegible]	2,871,750.00
Corporate surplus	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		
Grand Total	$15,452,311.03	$12,012,030.55	$735,203.62	$1,292,489.14	$4,267,187.74	$5,469,008.77	$17,378.77	$5,818,108.01

Consolidated Company represent total assets of $235,198,000, the figure for its associated electrical companies being $151,639,000, which latter represents practically the entire amount of Manhattan central-station assets.

Wiring and Illumination

ARCH LIGHTING IN OWEN SOUND, ONT.

In Owen Sound, Ontario, Canada, some street arch lighting was undertaken primarily for the purpose of advertising the town, and it has attracted so much attention and has proved so satisfactory that the system is to be extended. The original installation consisted of 20 arches made of iron tubing spanning the main street and placed 35 yds. apart. Each arch carries 21 8-cp, 200-volt carbon lamps spaced 24 in. These are arranged three in series, as the distribution voltage of the town is 600 volts. It is stated that the cost of each arch complete, including lamps, was $20, and the cost of operation is placed at 4 cents per hour per arch. Ten more arches are to be erected at once.

UNDERGROUND DISTRIBUTION IN TORONTO.

The underground distribution system, which is now in course of construction in Toronto, Ontario, will take care of the block of electrical power to be delivered to that city by the Hydro Electric Power Commission of Ontario. The power will be received from the high-tension lines at the main terminal station and thence distributed, partly underground and partly overhead, to six different substations throughout the city, including one in West Toronto. The ducts which are to contain the cables rest on a bed of concrete 4 in. thick, each duct being enclosed in 3 in. of concrete. The minimum distance from road level to top of duct is 34 in. Manholes are located at intervals of approximately 300 ft., and are placed at street intersections where possible. They are of brick construction with a concrete roof, in which a cast-iron frame supported by I-beams is set to carry the covers. Each manhole is drained by a connection to the sewer. Three-conductor cables are being installed.

LARGE ELECTRIC SIGN IN CHICAGO.

The accompanying illustration shows an interesting electric sign on the roof of a building on Michigan Avenue, Chicago, which attracts the attention of automobilists and others passing in either direction on that thoroughfare. The sign is double-faced, and represents the dial of a speedometer designed for use on automobiles. The flasher operates the two sides alternately, so that the number of lamps burning at one time is only one-half of the total installed.

Double-Faced Speedometer Sign.

The indicator of the sign swings across the face of the dial from zero to the highest speed—60 miles per hour. It is outlined by electric lamps closely set together so that the eye can easily follow its motion over the scale.

In the illustration the concentric arcs are the effect upon the photographic plate of the moving pointer.

ELECTRICAL DECORATIONS FOR THE TRIENNIAL CONCLAVE OF THE KNIGHTS TEMPLAR IN CHICAGO.

Elaborate preparations are under way for the thirty-first triennial conclave of the Grand Encampment of Knights Templar of the United States, which will be held in Chicago during the week of Aug. 8 to 13. The conclaves of the Knights Templar are affairs of great magnitude, and it is estimated that the number of Sir Knights, with the members of their families and other visitors, who will come to Chicago for the occasion may be as high as 100,000. Naturally very careful and thorough preparations must be made to shelter and care for this multitude. The city will be in gala attire, and the electrical decorations will be unique and interesting.

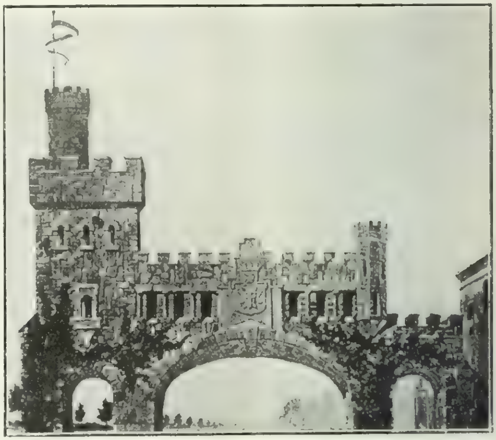


Fig. 1—Entrance Arch, Michigan Boulevard.

An "entrance arch" in imitation masonry and of castellated architecture, will span Michigan Boulevard, near Park Row. This will be outlined in electric lamps and the "windows" in the structure will be illuminated at night to give the effect of rich stained glass. The design of this arch is shown in Fig. 1.

At La Salle and Madison streets will be erected a "grand commandery arch" of pleasing design, as shown in Fig. 2. This will be profusely decorated and illuminated by electricity and be an attractive feature of the street display.

State Street, from Lake Street to Van Buren Street, will be transformed into "The Templar Way." Columns will be erected at frequent intervals along the curb and between them, longitudinally, will be festoons of real laurel. The columns will be surmounted by star-studded globes, and the stars will be outlined in electric lamps. The festoons of laurel will also be entwined with green incandescent lamps. Various emblematic designs will be shown along "The Templar Way," as indicated in Fig. 3, and these emblems will bear electrical decorations in various-colored lamps.

But the crowning feature of the electrical decorations will be an immense spectacular reproduction of the official badge of the conclave. This will be possibly the largest spectacular sign ever built, as it will be 135 ft. in height above grade and 64 ft.

across the word "Welcome" at the base. This electric badge will be erected on Grant Park, south of the Art Institute and facing Jackson Boulevard. Fig. 4 is a reproduction of a photograph showing the design of this electric spectacle. The incandescent lamps do not show in the picture, but actually there will be about 4400 4-cp tungsten lamps in red, white, blue, yellow and purple, bringing out the various features of the design.

Some of the dimensions of this enormous spectacle are of interest. The helmet at the top is 7½ ft. high and 6 ft. wide.

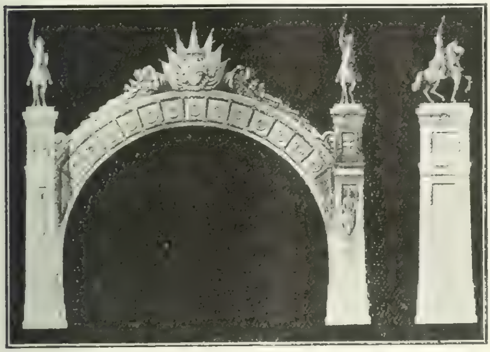


Fig. 2—Grand Commandery Arch, La Salle Street, Near Madison.

That part of the emblem containing the crossed swords is 40 ft. in width by 28 ft. in height. The letters in the words "Chicago 1910," are 3 ft. high. The letters "K" and "T" are 6 ft. high and the letters in the words "31st Triennial Conclave" are 2 ft. high. The sword hilts are 8 ft. in length by 2 ft. in width and the sword points are 5 ft. in length by 2 ft. in width. The eagle in this part of the emblem is 12 ft. from tip of bill to end of wing. The shield below the eagle is 5 ft. in height and the ribbon in the mouth of the eagle is 10 ft. long.

The middle portion of the emblem representing the mounted knights and with the words "Grand Encampment of the U. S." is 32 ft. wide and 22 ft. high. From the top of each knight's head to the bottom of the horses' hoofs is 16 ft.

At the bottom of the badge is the third portion of the emblem, being the Knights Templar emblem. This portion of the

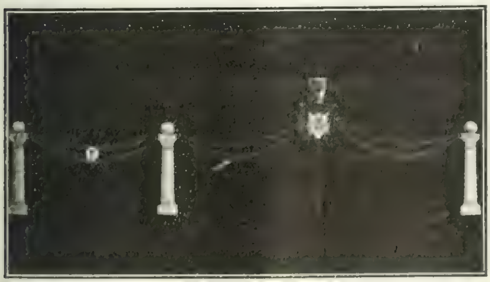


Fig. 3—Side Decorations, The Templars' Way, State Street.

sign is 38 ft. high by 35 ft. wide. The cross in the center is 10 ft. high and 6½ ft. wide. The letters in the word "Welcome" at the bottom of the sign are 10 ft. in height. The entire emblem will be studded with tungsten lamps, and it is interesting to note that in no portion of it will the lamps be farther apart than a distance of 6 in.

Work has been started on the construction of this emblem. The framework for the sign will be of steel set on concrete foundations. An elaborate flashing scheme has been devised, and there will be three separate flashers mounted on the structure, each carrying one of the three parts of the emblem. All three of these flashers will be controlled and operated by a master flasher set at the bottom of the sign. The operation of the sign will be as follows:

The word "Welcome" at the bottom is steady-burning, the lamps here being red. The upper part of the emblem flashes on first. Simultaneously with the flashing of this part of the emblem the circle of lamps around the eagle and shield and the circle of lamps around the letters "K" and "T" revolve. The lamps in the ribbon in the mouth of the eagle give a waving effect to the ribbon.

The second or middle section of the emblem flashes on very rapidly after the first section, and simultaneously the horses' feet of the mounted knights are seen in motion, giving the effect of the pawing of impatient steeds. Quickly following is the flashing on of the third or lower section. The "moving" effect in this section is attained by the flashing of the jewels in the crown surrounding the cross. These jewels "sparkle" electrically. After the third section is flashed on, all of the lights in the entire emblem are flashed off together. Then all the lights in the emblem are flashed on together and remain burning for a short time, after which all the lights in the entire

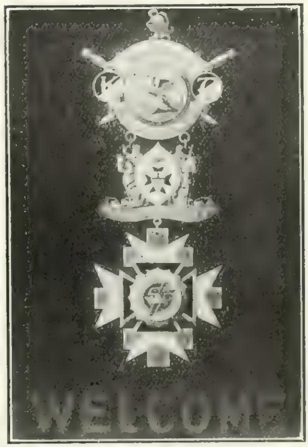


Fig. 4—Electric Sign Representing Official Badge of Knights Templar Conclave.

design are again flashed off, and then the cycle of operation described is repeated.

In carrying out the construction of this electric spectacle 10½ tons of steel will be needed for the framework. The concrete piers are 6 ft. square and 18 ft. deep. Double-braid, rubber-covered wire will be used for the wiring, and 18,000 ft. of it will be required.

This great electric spectacle was planned by Mr. Gorham B. Coffin, chairman of the decorations and electric display committee for the conclave, and Mr. S. W. Van Nostrand, of the Thomas Cusack Company, which company has in charge the designing, construction and operation of the sign. Electricity will be obtained from the Commonwealth Edison Company.

NEW TELEPHONE PATENTS.

NEW APPARATUS.

There have been designed a large number of gong-ringing keys in which the key plungers indicate by their positions which key was last operated.

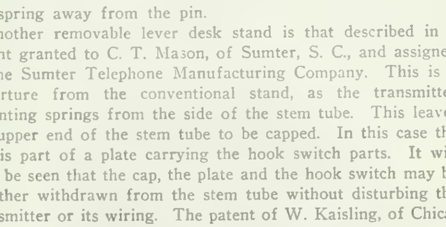
Mr. L. A. Williams, of Evanston, Ill., has designed a key in which this indication involves the push button only, the key plunger having no intermediate position. The push is mounted upon a sleeve which travels upon the spindle of the key plunger.

A spiral spring keeps the push normally at the top of the spindle. When the push is depressed, this spring is compressed and the sleeve travels down the spindle to the indicating position. Then, with further travel, it drives the key plunger to operate the key. Upon release of the pressure, the key plunger returns to normal position, while the key push returns to indicating position, a tooth upon the sleeve engaging a retaining plate. If any other push be depressed the retaining plate will be tilted to release any push locked down. The Stromberg Carlson Company has been assigned this patent.

B. W. Sweet, of Cleveland, has obtained a patent for a hook switch. This is of the removable lever type and the present invention relates to the means of securing the lever in its socket. The socket is of the same section as the lever and when this lever is pushed home, a pin, carried by the lever, engages notches in the socket. As the pin goes into the slot, one end engages a perforation in a slip spring which locks the lever in the socket. To release the lever it is necessary to pry the spring away from the pin.

Another removable lever desk stand is that described in a patent granted to C. T. Mason, of Sumter, S. C., and assigned to the Sumter Telephone Manufacturing Company. This is a departure from the conventional stand, as the transmitter mounting springs from the side of the stem tube. This leaves the upper end of the stem tube to be capped. In this case the cap is part of a plate carrying the hook switch parts. It will thus be seen that the cap, the plate and the hook switch may be together withdrawn from the stem tube without disturbing the transmitter or its wiring. The patent of W. Kaisling, of Chicago, relates to a wall set and the method of mounting thereon the sending dial of an automatic system. The set takes one of the standard forms, having a back board with transmitter arm at the top and a slanting shelf near the bottom beneath which is a box concealing the other working parts. In this case the dial apparatus is mounted upon the shelf and this shelf is made to slide off in a way to clear the sending mechanism. The patent for this set is assigned to the Kellogg Switchboard & Supply Company.

The illustration shows a section of a protector invented by R. H. Manson, the Dean Electric Company having obtained the patent by assignment. The special feature lies in the spring



Manson Protector.

clips for holding the fuses. It will be noted that a very strong and positive pressure may be obtained due to the long legs of the springs and their crossed arrangement.

DESK STAND HEAD.

A new type of transmitter clamping head has been devised by Mr. N. Pedersen, of Genoa, Ill., his patent having been assigned to the Cracraft-Leich Electric Company. The desk stand stem terminates in a button-like piece mounted edgewise, its plane being vertical. Two ears are pressed from sheet metal, which, when placed side by side, form a transmitter support. At the front end, the abutting ears form a disk, half being integral with each ear. Over this is slipped a flanged cap. The mounting is then held by screws passing from within the transmitter casing through the cap piece and into the ear disk.

At the other end, the ears are dished so as nearly to enclose the button-like head of the stem of the stand. Spring washers are placed on either side and a clamping bolt is used to draw all parts together with proper friction. The angular motion of the transmitter is limited, as the flanges of the ears must be cut away to pass the neck of the stand. The extent of the cut in the flanges determines the limits of motion of the transmitter.

TRUNK CIRCUIT.

Mr. W. W. Dean has patented and assigned to the Dean Electric Company a trunk circuit. In arranging for the control of the distant supervisory rèlay from the substation plugged by the trunk, he employs a limit resistance. This resistance is in series with the disconnect relay before the called subscriber answers, at which time the disconnect relay operates in response to current received from the distant connecting cord circuit. Thus the disconnect lamp is cut off. However, the supervisory relay in the connecting cord fails as the current is insufficient. When the called subscriber answers, a relay straps out the control or limit resistance, whereupon the "A" supervisory relay receives an increased current and responds.

Letters to the Editor.

Illumination from Extended Lighting Sources.

To the Editor of Electrical World:

Sir:—In your issue of July 14, Mr. Carl Hering points to the omission of certain details from a letter by me which appeared in your issue for June 30. A review of my letter should convince any one that no attempt was made by me to submit an exhaustive treatise on illumination or to instruct the uninformed concerning the laws of physics and mathematics, but merely to direct the attention of the designing illuminating engineer to a method of calculation not now in common use.

Mr. Hering gives a definition for the "solid angle," and employing this "solid angle" in the method outlined by me, in which use is made of the mathematical solid angle, finds some inaccuracy and at once concludes that the method discussed by me involves quantities which I said could be neglected. The fact of the matter is that Mr. Hering has improperly defined the solid angle as the "window area in square feet divided by the square of the distance from the illuminated plans in feet." Only in the case of area on the interior of a sphere and distance measured from the center of the sphere could his definition be considered as accurate.

Doubtless Mr. Hering had in mind only the case where the illuminating area is small in comparison with the square of the distance from the point, and is perpendicular to the line joining the point and the plane. In this case the use of the solid angle defined by Mr. Hering involves no appreciable error, but under all other conditions the results must be modified, as stated by Mr. Hering, by including those factors which I claimed could be neglected. However, by employing the real mathematical solid angle, the method mentioned by me will give absolutely accurate results, within the range of accuracy of the well-known cosine law, without involving any modifying corrections whatsoever. The inaccuracies "at points near the window" which exist when use is made of the Hering solid angle disappear when the mathematical solid angle is employed.

The solid angle defined by Mr. Hering is not without merit in many problems where its simplicity is sufficient compensation for its minor inaccuracies. However, one should not assume that the determination of the true solid angle involves great difficulties. It may be noted that in the case of a plane circular source, or a source the visual projection of which can be treated as equivalent to a circular plane, the mathematical solid angle (expressed in sphere units) is equal to one-half of the versed-sine of the plane angle subtended by the radius of the source when viewed from the point under consideration. When expressed in steradian units (as tacitly implied by Mr. Hering's treatment) the result will be 2π times the versed-sine of the angle indicated.

In view of the many recent publications dealing with the

illumination from extended lighting sources, including the Illuminating Engineering Society paper of which Mr. Hering was the author, it seems hardly necessary to state that the light flux density at the illuminated object bears to that of the illuminating plane the ratio of the mathematical solid angle to the solid angle covered by a hemisphere.

From the facts presented above it should be evident that by multiplying the light flux density of the illuminating surface (in any chosen units) by the versed-sine of the mean-half plane-angle subtended by this surface, when viewed from the point under consideration, one ascertains immediately the flux density at this point—expressed in the illumination units just selected.

Since the solid angle serves merely as a ratio in the solution of problems relating to extended surface lighting sources, the omission of any mention of the units in which the surface brilliancy, or light flux density, of the lighting plane and illuminated point were expressed, seems hardly sufficient to justify the characterization of my statement as being of the "bob-tail" kind.

Richmond, Va. JOSEPH THOMPSON.

Economy of Car Operation.

To the Editor of Electrical World:

SIR:—In your issue of July 7, 1910, page 38, appears an abstract of the discussion of my paper on "Economy of Car Operation," read at the White Mountains A. I. E. E. convention, in which it is reported that Mr. N. W. Storer and Mr. H. St. Clair Putnam disagreed with me in relation to the energy saving and reduction in tractive resistance of a car with anti-friction bearings.

In my reply to this discussion, which is not reported, I again pointed out that the object of my paper was to show quantitatively the value of coasting in terms of change in average speed and running time, and also to make special reference to the value of anti-friction bearings, in contrast to referring only to the value of anti-friction bearings on street cars.

One diagram in the paper (Fig. 7) shows the effect of slight increases in running time upon the possible increased coasting and consequent saving in energy with an ordinary plain-bearing car. This is followed by an analogous diagram (Fig. 8), upon which similar curves have been superimposed upon the plain-bearing car curves for ball-bearing cars, by which means the advantage of the ball-bearing car over the plain-bearing car (for equal conditions of acceleration, braking and running times) can be compared. In conclusion the economies that are derived from coasting were specified and it was added that all these advantages can be appreciably augmented by the use of anti-friction bearings, in contrast to the inference that all these advantages have been claimed for ball bearings.

The published statement by Mr. Putnam that a possible reduction in tractive resistance of 8 lb. per ton by the use of ball bearings was claimed seems to be a typographical error; since he remarked that the claim made by the author (of about 6 lb. per ton) was too high. This amount is the result of tests made on the Atlantic City & Shore Railroad and recorded in the paper.

Philadelphia. CYRIL J. HOPKINS.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Electromagnetic Theory.—H. ZIPP.—The author attempts to simplify the theory of all kinds of apparatus in which electric energy transformation occurs by means of magnetic fluxes, so that all the different apparatus may be considered from one and the same viewpoint. All apparatus for the transformation of electrical energy can be reduced to the same "fundamental type" which is best represented by the induction motor. In every special case there is a combination of a primary magnetomotive force with a secondary magnetomotive force. These two magnetomotive forces, together with the resulting magnetomotive force, when represented by graphical methods, form a triangle. This triangle of the magnetomotive forces defines completely the condition of operation of any apparatus in which energy is transformed. All such apparatus is considered under the supposition that the primary as well as the secondary is rotary. The author first discusses the "fundamental form of electromagnetic energy transformers" and then takes up the discussion of direct-current machines and synchronous alternating-current machines for single-phase and polyphase currents, transformers and non-synchronous machines.—*Elek. und Masch.* (Vienna), June 19 and 24, July 3.

Small Direct-Current Machines.—G. I. STADEKER.—In a continuation of his illustrated serial on the windings of dynamo-electric machines the author deals with small direct-current machines and first discusses wire-wound threaded-in coils for machines with partially-closed slots and then takes up open-slot windings.—*Elec. Jour.*, July.

Lamps and Lighting.

Metallic-Filament Lamps and Central Stations.—W. A. TOPPIN.—The author argues that the large demand for metallic-filament lamps benefits chiefly the inventors and German manufacturers. He thinks that the British central-station engineer and British manufacturer would be more benefited by counteracting the tendency of buying metallic-filament lamps and the author thinks this can be done by a suitable tariff. In Fig. 1 the curves *ABC* give the cost of lighting as a function of the life for a certain energy rate and the curves *DEF* give the cost of lighting for another energy rate. *A* and *D* are 32-cp carbon lamps costing 31 cents and consuming 4 watts per candle-power, curves *B* and *E* relate to 32-cp tantalum lamps costing 87 cents and consuming 1.7 watts per candle-power, and curves *C* and *F* relate to 32-cp osram lamps costing $1.06 and consuming 1.25 watts per candle-power. The curves *A*, *B* and *C* represent the cost in pence per hour (1 penny = 2 cents) to the consumer, according to the life and type of lamp used, he being charged on the ordinary flat scale of so much per kw-hour. Lamps of different types, but of equal candle-power, are dealt with, and the prices mentioned are for lamps suitable for 250 volts. The charge per kw-hour has been taken at 8 cents as representing an average figure for large and small towns. It will be seen from a comparison between the curve *A* and the curves *B* and *C* that there is every

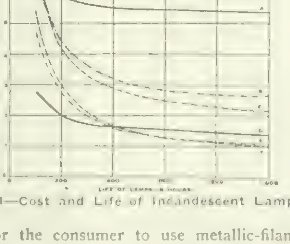


Fig. 1—Cost and Life of Incandescent Lamps.

inducement for the consumer to use metallic-filament lamps. On the other hand, the curves *D*, *E*, *F* show the cost in pence per hour for lamps of the same types as before mentioned, of equal candle-power, but the energy is charged for at only 2 cents per kw-hour. It will be seen that a carbon lamp is most economical up to a life of 400 hours and above that

point the saving by using the new lamps is not great. As the high-voltage metallic-filament lamp does not burn equally well in all positions, and does not withstand frequent handling or much vibration, the consumer will prefer the carbon lamp that has not these defects. Of course, in this case, it would be necessary to charge a fixed rate in addition to the charge for energy. This additional charge may be based on the rental of the house, on the number of lamps installed, on the probable maximum demand, or the actually ascertained maximum demand according to the readings of an indicator or recording ammeter. The last-mentioned method is the most scientifically correct, but the most difficult to work in actual practice, especially as it encourages the consumer to install as many metallic-filament lamps as possible in order to reduce his maximum demand. If the charge is based on the rental of the house, the number of rooms, or the number of lamps, then it is immaterial to the consumer what kind of lamp he uses. The author recommends one of these latter systems.—Lond. *Elec. Rev.*, July 1.

Generation, Transmission and Distribution.

Frictionless Magnetic Worm Gear.—J. Lecoche has formerly devised a frictionless magnetic worm gear in which the worm and wheel run out of contact with a clearance of about 1/32 in. The worm is provided with a magnetizing coil, and a magnetic circuit is arranged through the teeth so that the whole of the power is transmitted by means of the flux passing from worm to wheel. The motor or other source of power is coupled to the worm, and so long as the torque does not exceed the magnetic pull between the teeth, the gear runs synchronously. This has now been modified, the driving motor being combined with the worm, so that the motor flux serves also the purpose of transmitting the torque. This arrangement effects a saving in that the additional field for the gear is dispensed with. This driving gear is especially suitable for machine tools, compressors, air pumps, and other low-speed machines. Fig. 2 is

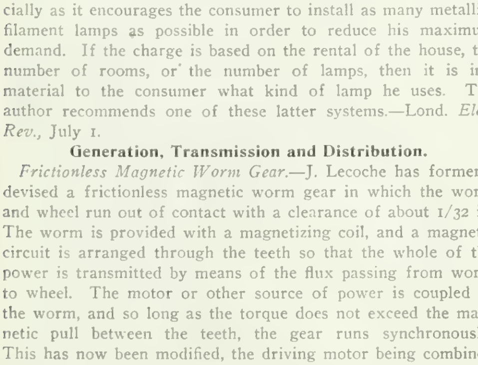


Fig. 2—Details of Combined Motor and Worm Gear.

a diagrammatic sketch of the gear. The worm is built up of a number of star-shaped laminations successively displaced so that the projections form the teeth of the worm. Slots are cut parallel to the axle, and the armature thus formed is wound and provided with a commutator. Semi-enclosed slots are used in order to avoid further decreasing the useful armature surface, which consists of the top surface of the teeth of the worm only. The motor illustrated is a two-pole machine with one pole under the armature. The worm-wheel is built up of laminations displaced so as to give the same pitch, and the second pole of the motor projects over the inner periphery of this wheel. The path of the flux is thus through the rim of the worm-wheel and the armature in series. The gap between the upper pole and the worm-wheel rim need only be very small. The worm-wheel is cut concave, so as to envelop the armature. The magnetic pull on the worm-wheel rim is practically balanced, and the only losses in the gear are the small friction losses in the ball bearings, the losses in the motor, and a very small hysteresis and eddy-current loss in the teeth of the worm-wheel. In the example illustrated, the worm is a 200-volt armature running at 1850 r.p.m. and the worm-wheel runs at about 175 r.p.m., the ratio being 32 to 3. There is no friction at the teeth, and no wear. The combined gear is claimed to be both more efficient and cheaper than an ordinary high-speed motor coupled to a machine-cut worm gear, and runs noiselessly. It starts up under load, but once the wheels have fallen out of synchronism, the worm-wheel stops and the motor has to be stopped and started up again. If all the load is taken off, however, the worm-wheel can be run up to speed without stopping the motor. The motor cannot be overloaded, as the wheels will drop out of step whenever the torque exceeds the magnetic pull between the teeth. The combination is reversible and Lecoche has designed a generator on the same principle to be driven by low-speed engines. In this case, the flywheel of the gas or other engine is provided with a laminated iron rim, the teeth of which mesh magnetically with the generator armature, the latter being constructed in exactly the same manner as described above in connection with the motor. —Lond. *Elec. Eng'ing*, June 30.

Coal Cutters.—A discussion of the relative advantages and disadvantages of the electric and compressed air drive for coal-cutting machines. The principal advantages of the electric drive are its very much high efficiency and greater flexibility of the transmission line; the principal disadvantage is danger from shock. The principal advantage of compressed air is safety. Finally, reference is made to the method of compressing air by electric motors near the face, using the compressed air to drive coal-cutting and drilling machines on the face. This method has several important advantages. The efficiency is not as high as the purely electrical method, the difference being as from 62 to 70 as compared with 80, under similar conditions. The difference is not serious, considering the advantages obtained by the method of electrically compressing the air. The weak point of the ordinary compressed-air system, the pipe line, is practically eliminated.—*Iron and Coal Trades Review*, July 1.

Electric Installations at Collieries.—F. Anslow.—A paper read before the Mining Institute of Scotland on the electric installations in collieries, with special reference to the relative advantages of the three-phase and direct-current systems. He concludes that occasionally instances are found ideally suited to one or the other system, but more frequently it is necessary to weigh carefully the conflicting conditions and to select the system which would result in the best scheme as a whole, keeping in view that safety, reliability, economy in working, and reasonable first cost are the desirable objects.—*Iron and Coal Trades Rev.*, July 1.

Electricity Rules for Collieries.—Three sets of rules enforced at the Estwood collieries in England, one set being for authorized persons in charge of electric generating plants at pit tops, the second for authorized persons in charge of electric plants at pit bottoms, and the third for persons in charge of coal-cutting machines.—*Iron and Coal Trades Rev.*, July 1.

Traveling Crane for Foundries.—W. Franzisket.—An illustrated description of an electric traveling crane for foundries the speed of which can be regulated within very wide limits. The principle of the Ward-Leonard control is made use of.—*Elek. Kraft. u. Bahnen*, June 24.

Load Fluctuations.—A. Reisset.—With reference to a recent article on electric systems of main shaft winding and rolling mill driving, the author discusses the method of equalizing the fluctuations of load by a new method of Brown, Boveri & Company.—*La Lumière Elec.*, June 25.

Traction.

Electrification of Lapland Railways.—The Swedish Riksday accepted the Government proposal for the construction of a large hydroelectric station at the Porjus Falls in the Great Lule River for the purpose of introducing electric traction on the important Lapland railways as well as for the electrification of the line itself. The State holds undisputed rights to falls, representing, at low water, some 70,000 turbine horse-power, which

a regulation of the lakes in Great Lule River will increase to a total of 300,000 turbine horse-power. For railway traffic, according to a load diagram drawn out by the railway department, with an iron-ore transport of 3,850,000 tons and the requisite passenger trains, an average effect of about 10,600 turbine horse-power will be required, taken as an average during 18.5 hours, out of the 24, with a maximum of 12 ore trains and two passenger trains in each direction. The maximum power required for railway traffic has been put at 23,600 turbine horse-power, wherefore, it is proposed to install for railway traffic two 12,500-hp units. For industrial purposes, two units each of 12,500 hp will be employed. The two turbines for traction will drive single-phase generators. The two turbines for industrial purposes will drive three-phase generators. Further, there will be installed, as a reserve, a fifth turbine unit, also of 12,500 hp, partly for single-phase and partly for three-phase current generation. For this purpose one single-phase and one three-phase generator are to be mounted on the same turbine shaft constituting the reserve. The generator e.m.f. is to be transformed for the single-phase systems to 80,000 volts and for the three-phase system to 70,000 volts.—Lond. *Engineering*, July 1.

Gasoline-Electric Omnibus.—An illustrated description of the new Daimler gasoline-electric omnibus, the principal features of which are the use of gasoline and electric motors in the form of detachable units, the abandonment of the usual chassis, and the use of an all-steel body. A gasoline engine with an electric motor coupled on the same shaft is mounted on each side of the omnibus and each set drives a rear wheel by means of worm gearing. The weight of the back axle and the differential is thus saved, and these driving units are so mounted that they can be removed in quite a short time. A battery of accumulators completes the essential part of the equipment, the motors acting as generators at times. By adopting the principle of detachable units the necessity of overhauling the motor is much facilitated.—Lond. *Electrician*, July 1.

Dublin.—R. S. TRESILIAN.—A paper read before the Tramways and Light Railways Asociation at Dublin. The author describes the development of tramways in Dublin from the year 1867 to the present time. Brief particulars are given of the existing generating station and the distribution of electrical energy.—Lond. *Electrician*, July 1.

Installations, Systems and Appliances.

Transmission Systems for Agricultural Districts.—A. VIETZE.—A paper read before the German Association of Electrical Engineers on the growing tendency of German farmers to form combinations and erect their own electric generating and distributing system. It is shown that this has been overdone and that the necessary precaution has not always been observed as to the possibility of making profits. However, under the protection of the Government the situation is now improving. To be economical a transmission system in an agricultural district should be capable of satisfactory extensions, the first expenses in building the plant should be reduced as much as possible, and the methods of financiering should be sound. Moreover, a suitable rate of charging is of great importance.—*Elek. Zeit.*, June 30.

Agricultural Electricity Plants.—An article giving statistical data on electricity plants in agricultural districts in Bavaria. Nineteen per cent of the inhabitants of farms and of villages below 5000 inhabitants are provided with electric lighting and motor service. The load factor of these agricultural plants is very poor. It is 4.86 per cent for those plants which have a rating below 100 kw and 7.10 per cent for those plants which have a rating from 100 kw to 250 kw. The situation is not very promising.—*Jour. f. Gasbeleucht*, June 25.

Vienna.—P. MARTELL.—An article on the electricity station of the city of Vienna. When the street railways of Vienna were taken over by the city in 1898 it was decided to erect a municipal central station. Three-phase currents were adopted for the transmission of energy to substations where the output is either direct current or low-voltage three-phase currents. From 1902 to 1907 the rating has been increased from 16,000 kw to 38,350 kw. The increase is partly due to the buying up of some private stations by the city. While formerly steam engines were used, steam turbines have been employed since 1906 for new units. The number of substations was five in 1902 and seven in 1907. The capital invested up to 1907 was $12,602,200; the net gain in 1907 was $733,460. The charges per kw-hour are as follows: 3.2 cents for traction, 7 cents for public lighting, 14 cents for private lighting, 9 cents for large consumers and 8 cents for industrial purposes.—*Elek. Anz.*, June 19.

Water Rheostat.—J. THILLE.—An illustrated description of a simple water rheostat for laboratory work. The principal feature is the use of running water. The electrodes are of lead. The resistance can be regulated to a certain extent by changing the speed of the water, since the higher the speed the colder the water and the greater its resistance. For most purposes, however, the regulation of the height of the water in the resistance box is also necessary.—*Zeit. f. Electrochemie*, June 15.

Wires, Wiring and Conduits.

Fuses.—H. W. KEFFORD.—A paper read before the Birmingham Section of the (Brit.) Inst. Elec. Eng., in which the author described some experiments on fuses, and put forward some suggestions for a specification of standard fuses.—Lond. *Elec. Eng'ing*, June 30.

Electrophysics and Magnetism.

Point Discharge.—O. A. GAGE.—An account of an investigation of the change of the point discharge in air with varying air pressures for pressures greater than atmosphere. The relation between current and impressed potential difference follows the equation $i\,^{1}\!/_{2} = A\,(V - M)$ for currents varying from 10 to 400 microamperes, where A is a constant, V the potential difference impressed and M the minimum potential. For currents less than 10 microamperes the results are irregular. The pressure of the air has a very great influence upon the true point discharge, due both to an increase in minimum potential and to a decrease in the velocity of the ions. The curves would indicate that the velocities of the positive and the negative ions become more nearly equal at high pressures, due probably to the loading down of the electron by neutral molecules. Some of the results of the author appear to support the view that the velocity of the ions decreases directly as the pressure, while the other results indicate that the velocity varies inversely as the square of the pressure. From the present work there is no means of telling which is the correct relation.—*Phys. Rev.*, June.

Hertzian Waves.—H. POINCARE.—The first parts of a mathematical paper on the defraction of Hertzian waves with applications to the earth.—*La Lumière Elec.*, June 18 and 25.

Hysteresis.—M. G. LLOYD.—A Franklin Institute paper discussing the principles of magnetic hysteresis and methods of measurements.—*Jour. of Franklin Inst.*, July.

Electrochemistry and Batteries.

Aluminum Rectifier.—A. P. CARMAN AND G. J. BALZER.—A paper read before the American Physical Society on the effect of mechanical pressure on the aluminum rectifier. The paper is illustrated by oscillographic curves and it is shown that the rectifying action decreases with increasing pressure and that the cell practically recovers its action when the pressure is removed. This is easily explained by Schulze's theory that the electrolytic valve action is not due to the oxide film on the surface of the electrode itself, but to a much thinner gas film which exists in the pores of the oxide film and separates the electrolyte from the metal. According to this theory the gas layer will be reduced in thickness by the pressure and hence the resistance of the layer is decreased. It is more difficult to explain another observation of the authors, namely, that an increase of temperature decreased the rectifying action of a special cell, but that cell did not recover its rectifying action when the temperature was lowered again.—*Phys. Rev.*, June.

Units, Measurements and Instruments.

Instrument Potential Transformer.—C. P. HARBCHL.—An

illustrated description of an instrument for measuring small quantities of electricity based on a principle of A Einstein. The instrument consists of six "steps" superposed one above the other. Fig. 3 shows a vertical and horizontal section of the second "step" of the instrument. The metallic plates *D* mounted on the columns *B* hold the ball bearings of the axle *C* and also the insulators *J* of the stationary metallic films *E* and *A*. *E* is called the exciter, *A* the receiver (abnehmer). The metallic films *F* are mounted on the axle *C* by means of the insulators *R*. If the axle *C* rotates the films *F* make alternating contact with the spring contacts *H* connected to earth and with the receiver contacts *K* in such a way that all contacts are broken in the moment in which the rotating films *F* are completely surrounded by the stationary films *A* and *E*. If the primary exciter E_1 is maintained on a constant positive potential P_0, it forms together with the film F_1, earthed through H_1, an air condenser. When F_1 moves away H_1 breaks the earth connection and since F_1 is removed from the exciting yoke, while the quantity of electricity F_1 on it has remained constant, the potential F_1 is increased by a constant amount, the absolute value of which is greater than $-P_0$. In the further course of rotation the films *F* get into the receiver A_1 and give off charge to A_1 until the potential of the latter has reached a certain value. The absolute value of this potential $-P_1$, which becomes stationary after a number of revolutions, is much greater than P_0. The ratio of P_1 to P_0 is called the "ratio of transformation of step 1." Since the receiver of each step is connected electrically by means of *L* to the exciter of the next step the same course of phenomena will be repeated here and the receiver of the *n*th step will have after a certain number of revolutions a stationary potential $P_n = a_1a_2 \ldots a_nP_0$ where the *a* represent the ratios of transformation of the different steps. $A_2A_4A_6$ assume charges of the same sign as the primary E_1, while $A_1A_3A_5$ assume charges of the opposite sign. The metallic plates *D* prevent any detrimental effect of one step on another. The whole instrument is protected by means of a metallic case against dust and influence from outside. The connections *L*

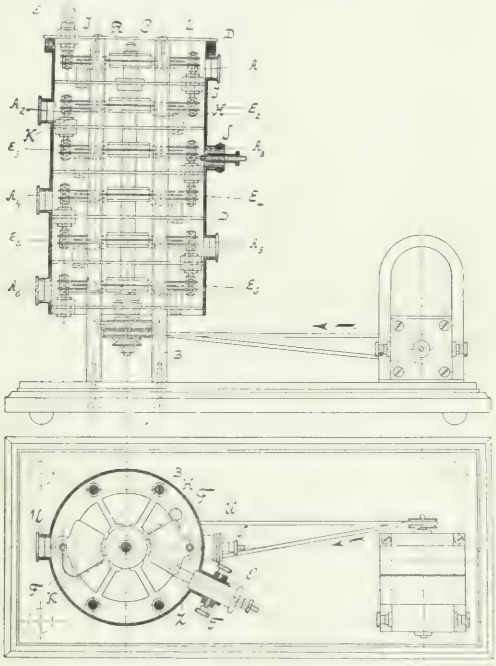


Fig. 3—Diagram of Electrostatic Potential Transformer.

enable one to measure the secondary voltage of the receiver at any step. From this measurement the primary voltage P_0 can be determined. Tests of the instrument have shown that the ratio of transformation *a* of any step is constant and independent of the primary voltage P_0. Variations in the number of revolutions of the driving axle are practically of no influence. The instrument is stated to have considerable advantages over the quadrant electrometer. The proportionality between the primary and secondary voltage is practically perfect. The total ratio of transformation from the primary exciter to a_1 is about 8.5, a_2 72.0, a_3 620, a_4 5200, a_5 45,000, and a_6 360,000.—*Phys. Zeit.*, June 15.

Meters.—P. May.—In watt-hour meters of the Thomson type the commutator and brush collectors usually require electrical cleaning. The positive brush is gradually worn away while small particles attach themselves to the surfaces of the negative brush forming an excrescence. If the construction admits of it it is well from time to time to change both the shunt and the series connections, thus leaving the direction of rotation the same as before while the polarity of the brushes is changed; this will considerably reduce the wear and tear. The author also recommends that the natural period of vibration of the spring collectors be made very short. Moreover, the pressure of the brushes on the commutator should be constant; the pressure should be produced by a steel spring, which takes no part in conveying the current. The e.m.f. between two sections of the commutator ought in no case to exceed two volts; otherwise there is a risk of a short-circuit between the segments. The self-inductance of the armature coils should be kept as low as possible. With a certain type of meter, it has been found possible to have movable brush collectors, which can be displaced more or less by the action of an electromagnet, which carries a current proportional to the whole of the current passing through the meter. Oddly enough, this simple plan has never been applied to the Thomson meter, though any slight increase in cost would be more than counterbalanced by its obvious advantages. An arrangement somewhat as follows might work. Suppose the spring collectors to be arranged on a small lever, pivoted at its center, and carrying a small iron armature, that could be exposed to the action of the field set up by the series coils. The design would cause the collectors to take up a different position with regard to the commutator at full load from what they would have at light load. But this in itself would be of little advantage if deposits were allowed to collect on the negative brush, because at light loads the same errors would arise as before. This could easily be rectified by arranging that as a result of the motion produced by the action of the series field on the suspended armature the brushes should be, as it were, lengthened and shortened. The deposits, which are mostly thrown down at times of full load, would be formed on the brushes at such points as were more or less in contact with the commutator at such times; whereas at light loads, a different position of the brush would be brought into contact with the commutator, which would be smooth and free from deposits. Under these conditions, the readings at light loads ought to remain as accurate as when the meter was new, as the low readings are almost entirely due to the irregular friction of the uneven surfaces, which is much more noticeable when the forces tending to rotate the commutator are small.—Lond. *Electrician*, July 1.

Zero Shift of Moving-Coil Galvanometer.—W. P. White.—An abstract of an American Physical Society paper on the relation between the zero shift and the size of wire in a moving-coil galvanometer. The displacement of zero usually produced by the deflection of a moving-coil galvanometer is at present one of the most serious sources of inconvenience or error with that instrument and is not so well understood as are most other features of the design. It increases, of course, with the magnetic impurity of the materials in the coil and is diminished by the use of a radial field. It also depends on the coil constants. For a coil of given performance, the zero shift increases with the size of wire used and with the dead material, and when so expressed is independent of the field strength, shape of coil,

etc., except as the shape affects the amount of dead material. It increases with the excellence of the galvanometer as measured by the smallness of the inertia of the coil—that is, by the delicacy of the coil; for a given coil it is less for shorter periods. If, however, the shorter period is added to a given sensitiveness, which involves a further increase in the galvanometer performance, the shift increases. If the shift is diminished by diminishing the size of wire in the coil this may increase the coil resistance. Hence, an unnecessarily small coil resistance may prove a detriment in moving-coil galvanometers. If finer wire is used, the resistance and moment of inertia of the coil can be kept constant by increasing the width. This change will require a stronger field, hence in such a case the use of a stronger magnet actually contributes toward reducing the error from magnetic impurity in the coil. Of course, a decrease in the size of wire increases the relative weight of the insulation. For ballistic galvanometers a long period is desired, and as far as zero shift is concerned the increase can best be obtained by increasing the moment of inertia of the coil. In that case the zero shift will actually diminish. However, this change reduces the sensitiveness and may sometimes be undesirable.—*Phys. Rev.*, June.

Alternating-Current Galvanometer.—W. E. SUMPNER AND W. C. S. PHILLIPS.—An abstract of a (British) Physical Society paper on a new form of vibration galvanometer (Fig. 4). It is like a moving coil galvanometer in almost every respect

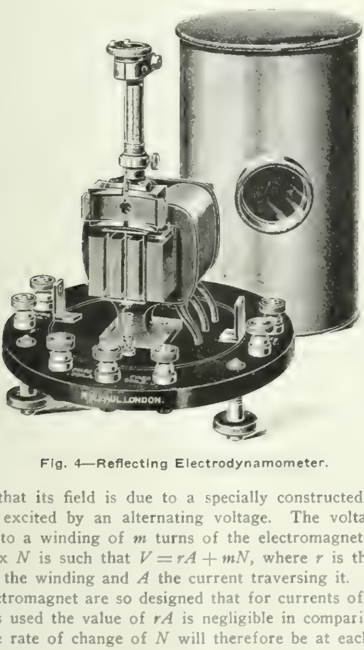


Fig. 4—Reflecting Electrodynamometer.

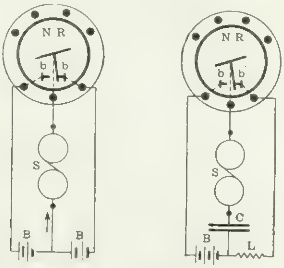
except that its field is due to a specially constructed electromagnet excited by an alternating voltage. The voltage V is applied to a winding of m turns of the electromagnet and the core flux N is such that $V = rA + mN$, where r is the resistance of the winding and A the current traversing it. The coil and electromagnet are so designed that for currents of the frequencies used the value of rA is negligible in comparison with V. The rate of change of N will therefore be at each instant a measure of V, whatever the permeability or hysteresis of the core. The instrument has a laminated electromagnet formed of stampings of two kinds, a rectangular portion with two straight limbs forming the core of the electromagnet, and a specially shaped stamping between the poles. The moving coil of 50 turns swings in a narrow gap separating the stampings in much the same way as in a permanent-magnet instrument. On the limbs of the magnet are windings of 200, 2000 and 4000 turns. The iron will not be too strongly magnetized if the winding used contains 20 turns per volt on 50-cycle circuits, but the instrument is so sensitive that such excitation will be needed only for exceptional tests. If a voltage V be applied to one of the field coils of m turns, and if the same, or another, field winding of n turns be joined up, through a condenser, of K microfarads to the moving coil, the torque acting on this moving coil will be a measure of $Kn\,(V/m)^2$—that is, the deflection is proportional to the square of the voltage. The deflection is independent of the frequency and wave-form if the field winding to which the voltage is applied has a resistance negligible in comparison with its impedance. The instrument may be used with great advantage to compare inductances and capacities by the ordinary bridge methods, the working conditions being: (1) the alternating voltage V applied to the field coil of the instrument must also produce the current in the bridge conductors, (2) the alternate current in the bridge must be brought into time-phase with the voltage V by the use of suitable non-inductive resistors, (3) the moving coil must be placed directly across the bridge. The balance can be adjusted with ease to 1 part in 10,000 when the e.m.f. impressed on the coils or condensers is of the order of 1 volt. When a balance of great precision is needed the minute electromotive force e induced in the moving coil by the alternating field of the magnet tends to cause a small deflection, thereby disturbing the balance. When the moving-coil circuit is non-inductive, the current due to e will be in time-phase with e and in time-quadrature with the flux, so that the corresponding deflection will be negligible. But in all cases any effect due to e can be accurately eliminated by working to a false zero.—*Lond. Elec. Eng'ing*, June 30.

Neutral Contacts and Switches.—W. P. WHITE.—An abstract of an American Physical Society paper. The potentiometer is a more recent instrument than the Wheatstone bridge. In many cases apparatus and methods for electrical measurements are now adapted to resistance measurements, where low-resistance contacts are imperative and thermal electromotive forces must take care of themselves. With the newer methods of measuring electrical quantities by means of electromotive force rather than by resistance, the necessity for small contact resistance largely disappears, and it becomes possible to gain a decided advantage by using neutral contacts—that is, contacts which are free from electromotive force. Such a contact is also needed at one point in a potentiometer system. One requirement for a neutral contact is, of course, obvious, namely, that both metals be alike thermoelectrically. Another less familiar requirement is that there shall be no temperature gradient across the contact surface, since in that case the surface layer of the metal, always different from the inside, will form with it a thermo-element. The necessary elimination of temperature gradient is most easily secured by making the contact between two thin strips of metal (from 0.1 mm to 0.3 mm thick) one of them backed by cork or other thermal insulator. The easiest way to get homogeneous metal is also to cut strips from the same sheet, hence practically the essential of a neutral contact is the use of two thin strips of the same sample of metal. When one side of such a combination was placed in direct contact with a plate heated 45 deg. above room temperature, the resulting electromotive force in the contact was too slight to measure—that is, less than 0.1 microvolt. Under ordinary temperature conditions, therefore, such contacts are practically quite neutral. The metal need not be copper, but if it is not, junctions where the switch metal joins copper must enter as pairs oppositely directed in the circuit, and these must be small, close together, and well shielded, so that the temperature of the two junctions shall always be the same. Three forms of neutral contact have been found useful: (1) A sliding contact, much like an ordinary switch, can be arranged with thin strips of metal. (2) Two tongues of metal can be pressed together directly without sliding. Even with copper such an arrangement requires surprisingly little cleaning, and it produces a switch of very simple construction. One rather complicated switchboard was constructed in this way without a single soldered joint. The resistance of such a contact with about 1 kg pressure is about the same as that of the best sliding switches. (3) A tongue of copper pulled through an ordinary wooden clothes pin can be clamped upon a similar strip, thereby forming a remarkably cheap and very effective neutral contact for semi-permanent connections, or even, in

some cases, for use as a switch contact. The last form of contact has decided advantages aside from its neutrality. Compared with a binding post, it is quicker to manipulate and yet much less likely to become loose, is much more adaptable and convenient, and is inferior only in its slightly greater bulk. A cable with such contacts at its ends, ready for instant connection to almost anything, is a very convenient laboratory appliance. By the aid of a couple of strips of celluloid, equally convenient two-pole contacts of this type can also be made.—*Phys. Rev.*, June.

Telegraphy, Telephony and Signals.

Quadruplex Apparatus.—J. M. Fernandez.—In quadruplex working one of the former difficulties was the breaking of the incoming signals at the non-polarized or "B" side, caused by the operation of the reversing key at the distant end. To overcome this difficulty the use of the relaying sounder was generally adopted. The author has devised a novel simple arrangement which meets the requirements. In Fig. 5, *NR* is the non-polarized seven-terminal differential relay; *S* a polarized sounder, neutrally adjusted, so that its lever will remain against either top; *B* the battery. Normally, the current through b' and *S* in the direction of the arrow maintains the lever of the sounder against the upper top; when the relay is operated its lever comes in contact with *b*, and a signal is produced by reversing the current through *S*. This signal will not be disturbed when the distant battery is reversed, though the contact at *b* may be broken at that time, because to release the sounder it would be necessary that the relay lever should cross the gap and make contact at b', since to affect the sounder it is necessary not only to stop the current, but to reverse its



Figs. 5 and 6—Diagram of Improved Quadruplex Apparatus.

direction. Fig. 6 shows the preceding arrangement modified to obtain the same results without using current from battery *B* continuously. The polarized sounder is then operated by the successive charges and discharges of the condenser *C*.—Lond. *Electrician*, July 1.

Wireless Telephone Transmitter.—W. Dubilier.—A description of a new wireless telephone transmitter for utilizing large amounts of energy. The construction is shown in Fig. 7. The two diaphragms *a* and *b* oppositely disposed are rigidly held on the brass frame so that they can vibrate freely. Upon these are screwed finely polished carbon surfaces *c* and *d*, which form the sides of the cavity containing the carbon granules shown in *e*. These granules form the loose contact between the polished carbon surfaces. To the center of the brass frames are screwed the tubes *f* and *g* which lead around to one mouthpiece *h*. The vibrations are divided up in *f* and *g*, and act on the diaphragm in opposite directions, thus causing these diaphragms to act simultaneously against and away from each other. Thus, instead of a single diaphragm vibrating and compressing the carbon granules there are two diaphragms operating against each other and on the same granules, producing an amplitude of variation far in excess of that which can be accomplished with a single diaphragm.—Lond. *Electrician*, July 1.

Telewriter Exchange.—An account of the opening of the first telewriter exchange in England in which the Ritchie telautograph, or telewriter, is used. The main principle employed in the telewriter is that of producing two independent motions by the movement of the transmitting pencil, each motion causing a change of current in a circuit. At the receiving end these two varying currents produce independent motions, the resultant of which is a reproduction of the movement of the transmitting pencil. The exchange is at present connected to about 50 subscribers, but provision is made for connecting up an additional 750. The switchboard in the exchange is operated in identically the same manner as an ordinary telephone board, the subscribers telling the operator the number desired by means of the telephone hanging at the side of the instrument. No attention is required at the receiving instrument, so that messages are delivered in the absence of the addressee, and read on the latter's return. The first action of the transmitting instrument is to move the paper at the receiving instrument, so that a clear space is always available.—Lond. *Electrician*, July 1.

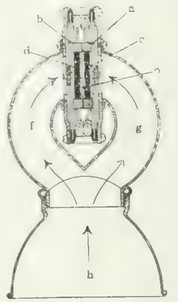


Fig. 7—Cross Section of Wireless Telephone Transmitter.

Miscellaneous.

Electrical Accidents.—The annual report of the electrical inspector of factories in England. He deals at length with the extent to which the regulations are being followed. There were 447 accidents in electrical generating stations and substations. Of these 357 (351 non-fatal and 6 fatal) were of a non-electrical nature, while 90 (86 non-fatal and 4 fatal) were electrical accidents. Accidents to persons cleaning, repairing, or otherwise working upon or near live conductors, form, as usual, the largest class and include four fatal cases. Three of these occurred to unskilled laborers who were employed near exposed conductors at high voltage. The employment of unskilled persons under such circumstances is now forbidden. The fourth fatality occurred to a substation attendant, presumably competent, but who evidently overlooked the danger of the work he was engaged upon, namely, disconnecting a transformer for removal. Two accidents resulting in serious injuries occurred to substation attendants working on switches which had been made dead, but which were in close proximity to live conductors at high voltage not screened off. Electrical accidents in factories, engineering works, and in plants other than electrical generating stations and substations are reported as 249 non-fatal and 8 fatal. The use of poor switches is not infrequently the primary cause for accidents. Another cause which led to quite a number of accidents was the employment of unprotected wires.—Lond. *Electrician*, July 1.

Book Reviews

Mechanical Drawing for Trade Schools. By Charles C. Leeds. New York: D. Van Nostrand. Price, $2.

The course given here consists of 58 lessons, each lesson being made up of a plate and directions for drawing. The lessons cover the use of drawing tools, plane projection, conic sections, construction of curves, sketching, lettering and practice machine and structural drawing.

The Wireless Telephone. By H. Gernsback. New York: Modern Electric Publications. 78 pages, 52 ills. Price, 25 cents.

This little book gives brief descriptions of various wireless telephone apparatus and systems. Instructions are given for constructing an induction telephone which may be used for distances up to 50 ft., and of closed-circuit wireless systems which will transmit distances up to three miles. One of the leading systems, and some that are noticed, do not appear to be practicable.

THE A, B, C OF RAILROAD SIGNALING. By W. H. Elliott. Chicago: Mackenzie-Klink Publishing Company. 75 pages, illustrated. Price, $1.

The subject matter of this little book was presented by the author in a lecture before the Harvard School of Business Administration. It is not intended for those already familiar with signaling systems, but rather for laymen or students of signaling who are about to begin their studies. It offers a sort of bird's-eye view of the subject and as such should be valuable in giving the student perspective and sense of proportion when pursuing his studies into the involved details of the various signal systems.

New Apparatus and Appliances

MEASUREMENT OF INSULATION.

A few years ago a direct-reading insulation resistance instrument was invented by Mr. Sidney Evershed, and under the trade name of "The Megger" has been manufactured for several years in England, and recently introduced in this country by James G. Biddle, 1114 Chestnut Street, Philadelphia.

The "Megger" complete and ready for use is illustrated in

Fig. 1—The "Megger."

Fig. 1, where the instrument is shown one-sixth of full size. The insulation resistance to be investigated is connected between the binding posts, one of which is marked "line" and the other "earth," when the crank is turned at fair speed and the amount of insulation resistance in megohms read from the scale. The whole process requires a few seconds, the operation can be conducted by anyone and it is stated that the results

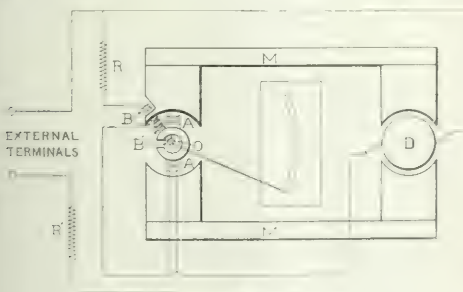


Fig. 2—Diagram of Instrument

have an accuracy considerably higher than that usually obtainable with other apparatus available for such measurements. The instrument is portable, weighing about 20 lb., is self-contained and is not affected in any way by its surroundings. The scale may be marked up to as many as 2000 megohms.

In Fig. 2 is shown diagrammatically the arrangement of the interior parts. Figs. 3 and 4 show the interior construction and the moving system, respectively. Referring to Fig. 2, it is seen that permanent magnets MM are so arranged that a closed magnetic circuit is formed. In this magnetic circuit at one end a pair of pole pieces are placed between which a dynamo armature revolves. At the other end is another pair of pole pieces, within the field of which the moving system works. The dynamo, driven by the crank placed as shown in Fig. 1 furnishes the e.m.f. by means of which the instrument operates. It usually supplies either 250 volts or 500 volts, which is generated on a drum armature by a winding so arranged that the various coils end on commutators of peculiar disk form, the edges of which at opposite sides are gripped by spring washers which roll with them and maintain excellent contact, acting as brushes (see Fig. 3). By much attention to details of construction, the use of ball bearings, and careful designing, a generator requiring very slight torque for propulsion is secured.

The moving system is made of three coils rigidly connected to each other (see Figs. 2 and 4). Tracing out the connections it will be found that the coil AA of the moving system is in series with the apparatus under investigation through the resistance R'; this coil exerts a deflecting force in the field where it is placed proportional to the current in it. Coils B and B' are connected in series. They, with the resistance R in series, are put directly across the dynamo terminals, and constitute the controlling coil of the instrument, the amount of their restraining force being a function of the position they take. As shown in Fig. 2, the indicating needle points to zero on the scale; coil AA has large current in it and coils $B\,B'$ are exerting a maximum restoring force. Reference to Fig. 4 will show how the moving system is assembled. The current is led in and out of the coils through very slender copper ribbons, which produce no torque; there are no springs, and the needle takes a position determined wholly by the torque of current in a magnetic field.

The proper relation between deflecting and restoring forces is secured through the use of the ⊃-shaped iron piece within

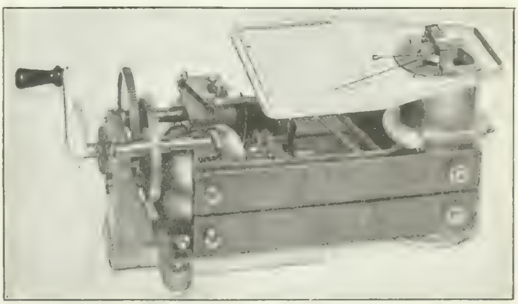


Fig. 3—View of Interior of Instrument.

[illegible]al JJ which may be seen in Figs. 2 and 4. It is mounted securely in place on the frame which supports the moving system.

The fact that the instrument is of the moving-coil-permanent-magnet type gives it all the good points which belong to this class, while being an ohmmeter it is even more constant in

calibration. For some purposes the variable e.m.f. derived from the dynamo operating at various speeds is very useful, while for others it is bad. Whenever required, a friction clutch is interposed between the last gear and the dynamo armature, so contrived that when operated above slipping speed the e.m.f. is practically constant.

The direct application of the "Megger" to the measurement of insulation resistance are too obvious to need explanation. Because of the fact that the resistance determinations on moderate voltage circuits are made at line voltage or perhaps at higher than line voltage, a sort of combined insulation resistance and break-down investigation can be made.

Among the many indirect applications of insulation resistance measurements one or two may be mentioned. Periodic examination of apparatus for insulation resistance, as is done so readily with the instrument, will reveal any depreciation whether due to moisture—a temporary cause—or to the development of a permanent defect. In this way faults and breakdowns can be anticipated and avoided. New apparatus is likely to have insulation resistance so low on account of mois-

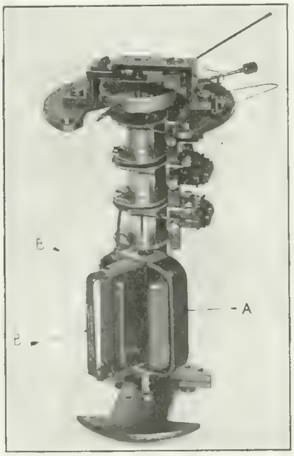


Fig. 4—The Moving System.

ture that it must be dried out before it can be put into service. By the use of the instrument, the time when it is safe to put on normal voltage and set it into operation can be told. There is no guess work about it, and coils are not so baked as to take all the "life" out of the insulation, perhaps scorching them in order to dry them out; and there is no need of applying a breakdown test to strain the insulation and leave it in condition to give way on slight provocation while in regular operation.

I. such tests as these mentioned the instrument is as useful for apparatus designed for high-voltage work as for that whose normal e.m.f. is commensurate with that generated in the instrument.

STORAGE BATTERY WITH POROUS PORCELAIN PROTECTING PLATES.

The Modern Storage Battery Company, of New York, has brought out a storage battery whose main feature consists in the long life of the plates, due to protecting porous plates. The latter prevent the active material or oxide paste falling off, thus suppressing many troubles in storage battery work. The elements of the battery are composed of perforated lead plates, which are covered with small highly porous porcelain plates or cups having on their internal surface the oxide paste. These little porous plates are undulated and fastened securely to the conducting plates. Inasmuch as the oxide is prevented from falling off, the capacity of each cell remains the same. The undulations in the porous plates increase the surface of the oxide paste about 15 per cent, it is claimed, thus increasing the discharge rate. Any expansion taking place merely serves

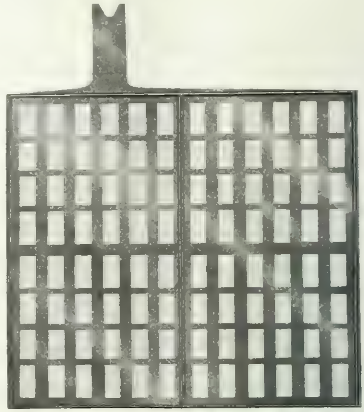


Fig. 1—Lead Conducting Plate.

to make the contact of the oxide paste and the lead plate more intimate and does not increase the internal resistance of the cell. When batteries are overcharged, the boiling of the acid

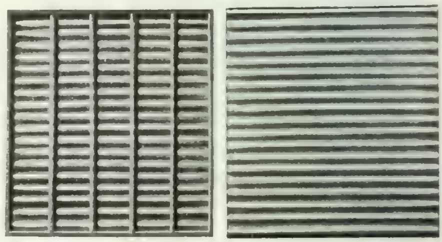


Fig. 2.—Inside and Outside Surfaces of Porous Plates.

does not affect the oxide paste since it is protected by the porcelain covering. The latter also has sufficient capillary attraction to keep the oxide in touch with the acid when the upper portion

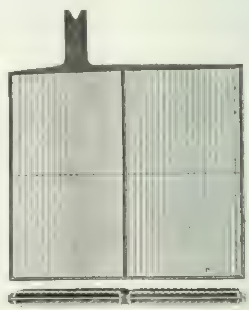


Fig. 3—Completed Plate.

of the plate is not completely submerged in the electrolyte, thus preventing sulphating. Short-circuits caused by oxide falling between plates and bridging them at the bottom is, of course, unknown in the cell described because it is prevented from falling off. The plates are put in special jars where they are firmly held, and the covers themselves are coated with a sealing compound preventing leakage of the electrolyte. Vent caps

are, however, provided to allow free escape of gases. The binding posts, straps and terminals are acid proof, and strong,

Fig. 4—Battery in Box.

hard-wood boxes with free expansion joints are used to house the entire battery.

PORTABLE MEASURING INSTRUMENT.

In order to check the performance of a switchboard voltmeter, for instance, the use of a high-grade portable meter, having an accuracy of 0.5 of 1 per cent, would be far more

Fig. 1—Portable Measuring Instrument.

reliable than a laboratory standard, although the guaranteed accuracy of the latter might be within 0.1 of 1 per cent. In a similar manner, for a very large number of commercial tests an instrument having an accuracy of 1 per cent would be more suited than one certified accurate to 0.5 of 1 per cent. To fill

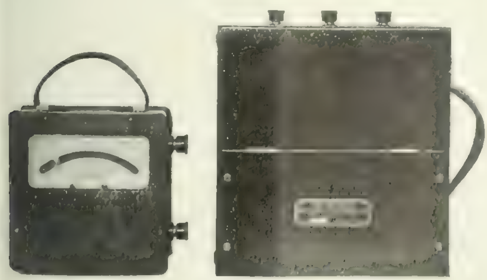


Fig. 2—Portable Measuring Instrument

this particular demand, the Keystone Electrical Instrument Company, of Philadelphia, has developed a new line of direct-current portable instruments. These, it is claimed, have an accuracy within 1 per cent and are the smallest of their kind yet produced. Not only is the light weight of these little instruments a factor in their favor, but it is further claimed that their low cost puts them within reach of many who could not afford to purchase more expensive types.

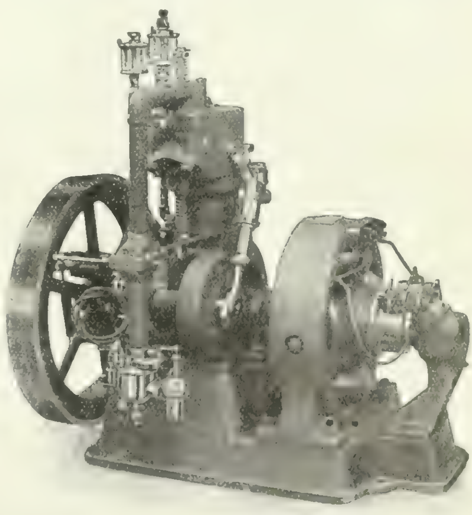
They are supplied in single or multiple ranges, or ammeters and voltmeters can be arranged side by side. Leather carrying cases are also provided when necessary. In common with Keystone ammeters, the shunts are all made interchangeable and the internal resistance of the voltmeters is kept at a high figure which averages 110 ohms per volt.

In designing this new line of testing instruments the makers state three factors were borne in mind; namely, accuracy, size and price. The accuracy was determined at the start as 1 per cent so that it only remained to combine the last two items to the best advantage. Had the size been made any smaller the increased cost of the system to maintain the same degree of accuracy would have been prohibitive. On the other hand, had the cost been needlessly increased it would have defeated one of the chief features of consideration.

The D'Arsonval permanent-magnet system is used, and the scales are drawn in by hand; knife-edge pointers with mirrored scales are also provided to avoid parallax errors. It is claimed that these instruments will stand very much more abuse than precision portables, so that they are particularly well suited for out-door testing where size, weight and ruggedness, coupled with reliability, are the most important items for consideration.

GENERATING SETS FOR ISOLATED WORK.

With the increase of the number of country residences desiring electricity for lighting where central station circuits do not reach, many owners have resorted to the installation of small generator sets driven by gasoline engines. The Carlisle & Finch Company, of Cincinnati, Ohio, builds such sets, one of which is illustrated herewith. A 110-volt generator is connected to a single-cylinder gasoline engine, the set being capable

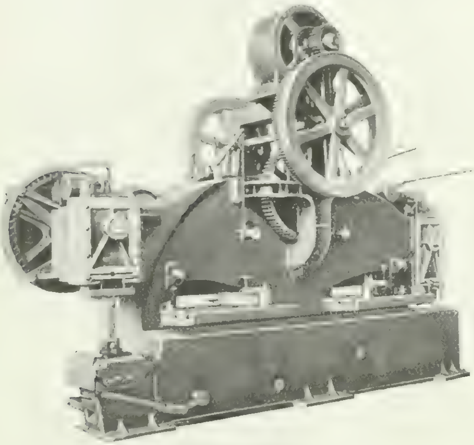


Generating Set for Isolated Work.

of supplying energy to 25 16-cp lamps or a greater number of more efficient lamps like those of the tungsten type. The governor of the engine is said to be sensitive to changes in load, so that lamps may be switched out of circuit without the effect becoming noticeable on the voltage of the circuit. The generating sets have also been used in marine work to generate electricity for search lamps and running lamps and also for interior illumination.

UNIVERSAL SHEARS FOR CHANNELS, ANGLES AND PLATES.

The accompanying illustration shows a motor-driven universal shear for squaring and mitering channels, angles and plates used in structural steel work. This machine was built especially for the Marine Department of the Maryland Steel Company, Sparrows Point, Maryland, and is applicable in any iron works where steel forms must be cut for construction work.



Universal Shears.

This machine has a coping attachment at one end, a plate shear at the other and two intermediate 45-deg. angle shears. The coping attachment can also be used as a punch. The plate shear will cut angles up to 6 in. x 6 in. x 1 in. or 8 in. x 8 in. x ¾ in. and channels up to 15 in. x ¾ in. Each shear is controlled by its own clutch, and the machine can be operated simultaneously by three groups of men without interfering with one another.

The frames, plungers, pendulums, clutches, and all parts subjected to severe shock are semi-steel castings. The shafts are made from hammered steel containing from 0.4 to 0.5 of 1 per cent carbon. The gears are provided with long hubs which extend through the gear casings. Particular attention has been given to obtaining satisfactory lubrication for all bearings. An especially designed automatic stop motion on each shear throws out the clutch when the shear reaches the highest point of its travel, while a similar automatic stop on the coping device is adjustable, thus allowing the plunger to be stopped at any predetermined point in its downward stroke.

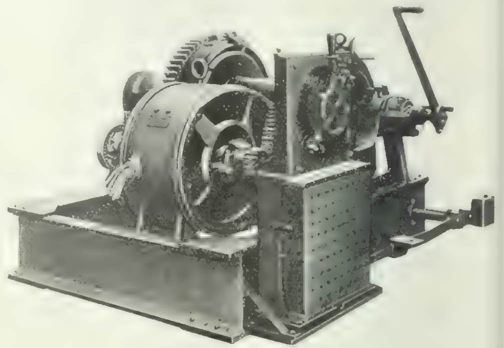
The net weight of this machine is approximately 23 tons and it is designed throughout for long life under most severe service. It is built by the Covington Machine Company, of Covington, Va., and is equipped with a 25-hp, direct-current motor manufactured by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

PORTABLE ELECTRIC HOISTS FOR RENTAL.

The accompanying illustration shows a portable hoisting outfit designed by the Rochester Railway & Light Company and equipped with a Westinghouse motor. The design has proven very effective and has been duplicated for a considerable number of central stations and contractors.

In addition to those already sold, the Rochester Railway & Light Company has retained two completely equipped hoists in stock for rental to contractors, at a nominal charge of $2 to cover costs of delivering and installing the hoist. For local service direct-current motors are used. Several alternating-current motors, which can be mounted interchangeably with the direct-current motors, are also held in stock and substituted when the hoists are to be used in outlying districts of the city. No extra charge is made for changing the motors.

The advantage of an electric hoist are numerous and striking. It is compact, durable and self-contained; fuel and water supply need not be considered; the smoke nuisance is eliminated and the depreciation is minimized. When equipped with an electric brake the hoist is absolutely automatic, a single lever giving both power and brake control. In case of interruption to service the electric brake is automatically set, while a mechanical brake actuated by a foot lever affords additional protection. A suitably arranged friction clutch allows the drum to rotate independently of the motor when lowering the load.



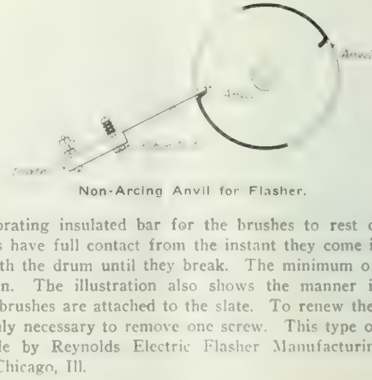
Portable Electric Hoist.

The cost of hoist complete, as shown, is $800, or without the electric brake, $700. The capacity is 2000 lb. at 200 ft. per minute. Actual average cost of continuous operation at rated capacity on recent construction is 60 cents per day.

The motor-equipment for direct-current consists of a 15-hp, 1000-r.p.m. Westinghouse motor back-geared to give a countershaft speed of approximately 230 r.p.m., a controller and resistance are included. For alternating current the equipment consists of a 15-hp, 1120-r.p.m. Westinghouse motor, back-geared to give a countershaft speed of approximately 230 r.p.m. An intermittent service reversing controller is included.

NON-ARCING ANVIL FOR FLASHER.

The accompanying cut shows a "Reco" flasher of the brush-switch type, supplied with a non-arcing anvil, which prevents the burning away of the cylindrical contact. The angle at which the brushes are set to the drum enables the use of the non-vibrating insulated bar for the brushes to rest on. The brushes have full contact from the instant they come into contact with the drum until they break. The minimum of air-gap is ½ in. The illustration also shows the manner in which 1-amp brushes are attached to the slate. To renew the brushes it is only necessary to remove one screw. This type of flasher is made by Reynolds Electric Flasher Manufacturing Company, Chicago, Ill.



Non-Arcing Anvil for Flasher.

Industrial and Commercial News

The Week in Trade.

CONSERVATISM still characterizes most lines of trade and industry. The regular summer stagnation prevails in almost every section of the country. As a whole, however, during the past week business was probably as good, in a retail way, as it was in mid-July, 1909. As yet very few orders are being taken for fall delivery by wholesalers and jobbers. The first delegations of buyers are already in the central markets, but as a rule there appears to be a disposition to move slowly and purchase conservatively. Throughout the entire country there seems to be a feeling of uncertainty and a disposition to wait for a more settled condition of the money and securities market. In the industrial field there is still an abundance of evidence of curtailment. This is not only true in the textile industry, which has been curtailing for months, but it can be observed in the iron and steel industry. In the latter there is also a distinct movement in the direction of lower prices. The steel corporation is quoting some of its wire products at substantial concessions, and in almost every line some price reductions have been made. Another factor in the present condition of uncertainty is the threat of labor troubles in Pennsylvania and other industrial centers. Such disturbances, if at all widespread, would have an extremely disheartening effect upon all branches of trade. It is only when workmen are fully employed that retail trade can prosper. The crop situation, while as yet unfavorable in regard to wheat, is, taken as a whole, quite satisfactory. Collections can only be classed as fair, and in many sections they are distinctly slow. Business failures for the week ended July 14, as reported by *Bradstreet's,* were 202, as compared with 182, the previous week, 206 in 1909, 258 in 1908, 177 in 1907, and 188 in 1906.

The Copper Market.

COPPER recorded some new low levels during the past week. Although the volume of business was fairly large, prices were almost at the bottom of the year. The condition of the copper market is particularly unsatisfactory to the selling side. Consumers and other purchasers understand that production is going on at a rate beyond that of any other previous year. In addition, imports are coming forward in such volume that they add largely to the supply of copper in hand. The only way to meet this situation would be for consumers to vastly increase their purchases, and this has not been done. Prices for copper have not declined in the proper ratio of the supply and demand figures. This is mainly because the Amalgamated Copper Company has such a tremendous investment, and controls such a large portion of the output of copper, that it will not permit prices to be put on a basis below that

Standard Copper.	Bid.	Asked.	Settling price.
Spot	[illegible]	[illegible]	.....
July	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]

The London market June 18 was as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, future	[illegible]	[illegible]
London, best selected	65 10 0	57 15 0

which would mean a profit to the Amalgamated Company. The statistical position of copper is adverse to the market. Every one who knows anything about it understands that more copper is being produced every day and every week than is being consumed. The fact that this is not all thrown upon the market at once, and that the market is not broken thereby, shows that the financial backing of the Amalgamated Copper Company is all powerful. In the meantime very many outside firms and producers are talking about curtailment. These people recognize the fact that unless there is some curtailment in the production of copper the market will be overstocked for all time to come. Imports continue to be large, and many countries are sending their product to America which never before considered this a good market. Exports for the month, including July 18, were 12,697 tons. The daily call on the metal exchange July 18 quoted standard copper as per accompanying table.

Industrial and Commercial Notes.

Gould Storage Batteries for Car Lighting.—The Pennsylvania Railroad has recently made a contract with the Gould Storage Battery Company for 431 sets of storage batteries of 32 cells each, to be used in its car lighting service. It is said that this is the largest single order for storage batteries ever placed by a railroad company. The batteries are the standard 300 ampere-hour twin-cell car-lighting type operated on the straight storage system, except a few which are to be used on axle generators. The company has also recently sold to the Japanese government a storage-battery equipment for the new submarine which Japan has recently constructed. This is the first submarine that country has ever built. The General Electric Company furnished the electric equipment. W. S. Gould, president of the Gould company, says that the business of his concern has been better so far this year than ever before in its history. He says that there has been quite an extensive revival in the demand for storage batteries, and at the present time his company has enough orders on hand to keep the plant fully employed for the next seven or eight months.

Worcester Consolidated Street Railway to Build Power Plant.—Plans are being set in motion by the Worcester (Mass.) Consolidated Street Railway Company for the enlargement of its power generating capacity. A turbine installation of about 3000 kw rating will be made on the company's property in Millbury. About 40 acres of land are owned by the company at Millbury, the site of the new station having for many years been used by a small direct-current generating plant supplying power to the Blackstone Valley lines. The plans now contemplate the transmission of alternating current from the Millbury station to a substation to be located on Park Street, Worcester, within a few hundred feet of the center of electrical distribution for the city. The cost of the work is estimated at about $300,000. The present power supply of the Worcester city lines is furnished by a steam plant located about 2 miles south of the center of the city, the distribution being by 575-volt direct-current.

Umbrella Type Alternators.—Domestic Electrical Appliances.—C. M. Shaw, city electrical engineer for the Corporation of Worcester, England, and of the Municipal Electricity Works, will pay a visit to this country in August and September, and asks us to say that he invites manufacturers to forward him particulars of up-to-date turbine plants and umbrella-type alternators to work on a head varying from 10 to 13 ft., and with a capacity of from 150 to 600 hp, together with names of power houses where the same can be viewed between New York westward to Chicago, and thence eastward through Canada to Quebec. Mr. Shaw wishes also to receive descriptive matter from makers of the latest domestic electrical appliances, not including lighting.

W. H. Schott Company.—The stock in the new W. H. Schott Company has been increased from $2,500 to $300,000. The company has a suite of offices in the Steger Building, 39 Jackson Boulevard, Chicago, and is organized to do a general engineering and contracting business, although, no doubt, as in other days, Mr. Schott and his associates will devote themselves largely to the designing and erection of central-station heating plants. Associated with Mr. Schott, who is president of the company, are M. O. Payne, vice-president and director; J. C. Harding, chief engineer and director, and A. L. Greist, chief draftsman.

Electrose Manufacturing Company.—The Electrose Manufacturing Company, of Brooklyn, N. Y., has been incorporated under the laws of the State of New York with a capital stock of $100,000, the incorporators being Louis Steinberger, of Brooklyn, John H. Poggenburg, of New York City, and Felix Steinberger, of Brooklyn. The stockholders, directors and management are the same as those formerly identified with the Electrose Manufacturing Company, incorporated under the laws of Illinois.

Mexican Electric Properties.—The formal transfer of the holdings of the Electric & Irrigation Company, of Hidalgo, to the Mexican Light & Power Company, the Canadian concern, which has already expended nearly $50,000,000 gold in electrical development in this part of Mexico, marks the beginning of another epoch in the progress and up-building of the great Pachuca mining camp in which many Americans are interested. The Electric & Irrigation Company, of Hidalgo, was one of the pioneer hydroelectric concerns in Mexico. It paved the way for the awakening of the Pachuca camp from the many years of lethargy which hovered over it. It was in 1897 that this company was organized with a capital of one million dollars for the purpose of utilizing the waters derived from the drainage of the great valley of Mexico in which the capital of the republic is situated. With the completion of this stupendous drainage project it was seen that an enormous flow of water came through the tunnel and canal. The company constructed a dam across the Salado River which carried the drainage waters. This dam was situated at Flamenso, from which point a canal was constructed to Juando, 16 miles. The first hydroelectric plant was erected at Juando, and a transmission line built to Pachuca, 30 miles. The company purchased the old electric light and power plant of Rafael M. Arrozarena, in that city. While it was the primary purpose of the company to provide the city of Pachuca with lights and power, it was upon the demand for an extension of the service to the larger of the mines of the district that the original 4,000-horsepower plant was found insufficient and a second hydroelectric plant was installed. It was of 6,000-horsepower capacity.

Charles L. Kiewert Company.—The principal office of the Charles L. Kiewert Company has been transferred from Milwaukee to 39 Cortlandt Street, New York. This change makes practically no change in the business methods of the company, but simply means that the New York office is hereafter to be considered as headquarters. W. F. Hessel, the New York manager, declares that business is better than it has ever been before. The demand for flaming arc lamps, he says, is continually growing and many cities are beginning to consider their use in the lighting of business centers. The "Alba" vertical carbon lamp he says is especially in demand, and quite a number of important installations have been recently made. The Kiewert Company has recently equipped an immense roller coaster in Chicago with 80 lamps of this type. Another product for which his company has found ready sale, according to Mr. Hessel, is the "Bio" carbon for moving picture machines. This carbon was brought out after a year of experimentation and, it is claimed, has nearer the effect of a calcium light than any carbon yet produced. Samples of this carbon were spread around among the moving picture people in March, and, according to Mr. Hessel, the popularity of the light was instantaneous. Orders followed in almost every case where the sample was tested.

Individual Drive in Tractor Plant.—The new tractor plant of the International Harvester Company, Marshall Boulevard, Chicago, which is now under construction, will contain about 600 kw total connected rating of motors, most of which will be in individual units for the drive of the various machine tools. The new factory building is of concrete and steel, and is unusually handsome in exterior design. About $600,000 is being invested in the building and equipment, which will be completed by September. Energy will be supplied from the company's private power plant. The flue gases from a reverberatory furnace used for the manufacture of malleable iron will be led through boilers, imparting their heat content which would be otherwise wasted, to produce steam at 120-lb. pressure, and superheating it 100 degrees. This steam will be utilized by turbines (1500 kw in total rating) driving generators which will supply electrical energy for the tractor plant and other purposes about the works. Experiments with the recovery of heat from furnace gases have been carried on by the International Harvester Company for several years.

Aluminum.—According to a representative of the Aluminum Company of America the demand for this metal has been fairly good during the first six months of 1910. "In no special directions," said this representative, "has there been any great boom in aluminum, but there has been a good, steady business. The principal demand and the principal increase in our business comes from the automobile manufacturers and the makers of automobile bodies. This business has been quite heavy. There have been no big contracts for wire for transmission purposes since the large Canadian order last November, which the *Electrical World* published at the time. We are selling some wire all the time, and aluminum for transmission seems to be growing in popularity, especially in the South, where the Southern Power Company has used it to considerable extent. The price of the metal remains about the same, the crude metal selling from 20 to 23 cents per pound. The reduction in duty rate does not affect price."

Pennsylvania Railroad Pittsburgh Subway.—It is said at Pittsburgh that the Pennsylvania Railroad Company is inquiring into a subway arrangement in that city. The question of a franchise to operate the proposed route from the East End district to the downtown section of the city is being considered. It is proposed also to construct an extension under the Allegheny River to the Fort Wayne station on the north side. All of these lines, if eventually constructed, will be operated by electricity. It is believed that it would be an easy matter to drill a tunnel through the hills to East Liberty and to install a central downtown terminal. From this terminal one tube might reach to the north side coming to the surface in the Fort Wayne yards, and another might reach to the "Panhandle" tracks on the other side of the Monongahela River. All of these plans are entirely tentative, but any plans for a subway terminal in Pittsburgh would mean the electric operation of all of the tunnel trains.

American Conduit Company.—W. W. Grant, representative of the American Conduit Company in New York, reports that the demand for conduits during the first half of 1910 was extremely heavy. He says that the business of his company during this period was more than five times as large as during the same period last year. Good shipments have been made to all parts of the country, and there have been quite a number of large orders from abroad. The company has sold to the Los Angeles Gas & Electric Corporation 500,000 ft.; to the Southern California Edison Company, of Los Angeles, 400,000 ft., and to Mexico, 50,000 ft. "There seems to be a movement all over the country," said Mr. Grant, "in the direction of putting the wires underground, in all cities and towns of any size. In most cases this is being gradually done, and our sales are therefore continuous and promise to extend over a period of years. It will not be a great while before there will be no overhead wires in thickly settled parts of cities."

Pennsylvania Water and Power Company.—President J. E. Aldred, of the Pennsylvania Water and Power Company, which has a transmission plant at Orangeville, Md., is reported to be negotiating with the United Railway and Electric Company, of Baltimore, for the supply of electric power to the latter. The Pennsylvania company owns some interest in the Consolidated Gas, Electric Light and Power Company, of Baltimore, but is far from being in control. An officer of the Pennsylvania company said that a contract had been negotiated but not signed between the Consolidated and the hydroelectric company, whereby the latter would furnish energy to the former. He would not deny that negotiations were pending with the railway company, but did deny that his company was attempting to buy control of the railway.

Activity in Telephone Manufacturing.—It is reported that the great Hawthorn works of the Western Electric Company, in the western suburbs of Chicago, now devoted entirely to telephone manufacturing, are overcrowded with work. Extensions are under way and the company is endeavoring to secure help in some branches, such as tool-making. It is believed that the present year's business will approximate that of 1906, which was a banner year in the telephone industry. In the cable factory, it is said, that the company is insulating 125,000,000 feet of telephone conductor a month. The entire plant is well employed, but more operatives could be used in all departments. All of the departments of the Western Electric Company are well employed.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions of present plants at Morgantown, W. Va.; Buffalo, N. Y.; Elmira, N. Y.; Welch, W. Va.; Leslie, Ark.; Honea Path, S. C.; Waupun, Wis.; Carthage, Mo.; Ephratah, N. Y.; Waterloo, Ia.; Omaha, Neb.; Akron, Ohio; St. Louis, Mo.; Bismarck, N. D.; Martinsville, Ind.; London, Ont., Can.; Miles City, Mont.; Milliken, Col.; Lincoln, Cal.; Mellen, Wis., and Fultonville, N. Y.

General Electric Company Motors.—The Hudson & Manhattan Railroad Company has placed its contract for motors to equip the cars which will go into service on the Newark extension, with the General Electric Company. The order consists of 80 double equipments 200-hp motors, type "M" control.

Financial.

THE WEEK IN WALL STREET.

WHILE the week in Wall Street has in some instances recorded advances, but in the majority of instances recorded declines, there is very little to be learned from the course of prices. The main feature of the market is that it is uncertain and without any positive quality. The majority of the bears is afraid to sell the market, and the majority of the bulls is afraid to buy. There is very little outside trading, and what little there is is, of course, on the buying side. Taking the physical features of the market into consideration, it is a bull market. Prices which are now at a very low level, and which many prophets declare are at the lowest level, should seem attractive, if the theory of the bulls is correct, to all investors. There are at the present time many stocks selling for prices which net with

NEW YORK.

	July 11.	July 18.	Shares sold		July 11.	July 18.	Shares sold.
All. Ch.	8½*	8½*	100	Int.-Met., pfd.	51⅜	50½	[illegible]
All. Ch., pfd.	30*	30*	1	Mackay Cos.	[illegible]	[illegible]	[illegible]
Amal. Cop.	57½	58¾	223,015	Mackay C., pf.	75*	75*	——
Am. D. T.	20½*	20½*	——	[illegible]	125½*	[illegible]	[illegible]
Am. Loc.	40½	39	1,000	Met. St. Ry.	15*	15*	——
Am. Loc. pfd.	107	107	——	N. Y. & N. J. Tel.	139¼*	139¼*	——
Am. Tel. & C.	71½	71½*	——	Steel, com.	70⅜	70	[illegible]
Am. T. & T.	133¼	132[illegible]	4,945	Steel, pfd.	116	115[illegible]	[illegible]
B. R. T.	76¾	77	43,400	W. U. T.	62⅛	61	1,[illegible]50
Gen. Elec.	141½	144	95	West'h., com.	61½	59	[illegible]794
Int.-Met.	18¼	17¼	10,050	West'h., pfd.	115*	115*	——

PHILADELPHIA.

	July 11.	July 18.		July 11.	July 18.
Am. Rys.	41½	42	Phila. Elec.	14¾	14¾
Elec. Co. of A.	11⅝*	11⅝*	Phila. R. T.	19	19¼
Elec. St. B'ty	49¼	49½	Phila. Trac.	84¼*	84½*
E. S. B'ty, pfd.	30*	30*	Union Trac.	45½	45*

CHICAGO.

	July 11.	July 18.		July 11.	July 18.
Chi. City Ry.	180	180*	Chi. Tel. Co.	118	118
Chi. Rs., Ser. 1	70	70*	Met. Tel. Co.	20*	20*
Chi. Rs., Ser. 2	16	15¾	Met. El., pfd.	61½*	62½*
Com. Edison	112	112	Nat'l Carbon	[illegible]	115
Chi. Subways	2¼*	2¼*	Nat'l Car., pfd.	118*	118*

BOSTON.

	July 11.	July 18.		July 11.	July 18.
Am. T. & T.	132¾	132¾	Mex. Tel.	5*	5¼*
Cum. Tel.	142	[illegible]	Mex. Tel., pfd.	[illegible]	6½*
Edison E., Ill.	255*	255	[illegible]	[illegible]	133
Gen. Elec.	142	142*	W. T. & T.	[illegible]	16
Mass. E. Ry.	15¼*	14¼*	W. T. & T., pfd.	87*	86
Mass. E. Ry., pfd.	75*	79			

* Last price quoted.
Shares sold for four days, July 11 to July 16.

their regular dividend apportionments more than 6 per cent. It is hardly understandable that such stocks should go begging when call money is below 3 per cent, and when time money is below 5 per cent. The entire present condition of the stock market is due to a lack of confidence. If the public really believed that the shares and bonds now offered in Wall Street were thoroughly reliable, there would certainly be an excess of buying. The fact that the public is always uncertain as to what may occur with the Interstate Commerce Commission, and in the case of traction with the Public Service Commissions, shows that there is a lack of confidence in the entire investment market. The market for the past week has been for the most part weak, and whenever there was any activity it was the activity of selling and prices declined. The only strength that could be recorded during the week was the strength of stagnation, and the only periods at which there was any strength in prices were those periods in which there was no selling pressure. In the meantime the money market was remarkably easy and the prices of exchange were altogether in favor of the bull side. It seemed apparent at several times during the week that importations of gold would be necessary. The money market on July 18 was as follows: Call 2@2¾ per cent, 90 days 4¼@4½ per cent. The quotations in the table are those of the close July 18.

FINANCIAL NOTES.

Denver Gas & Electric Company.—The annual stockholders' meeting of the Denver Gas & Electric Company has again been postponed, the date now being set for July 26. These postponements have been made in connection with the reorganization plan of the property. Henry L. Doherty & Company, who control the property, are now organizing a holding company for the purpose of taking over this property, together with several others. At the Doherty office, 60 Wall Street, it was said that at the present moment nothing could be definitely given out with regard to the new company, further than to say that the plan was being worked out and that it would be perfected within a few weeks. Neither the name nor the capitalization of the new concern would be stated. It is said, however, that the properties which will be taken over, in addition to the Denver company, are the Lincoln (Neb.) Gas & Electric Company; Knoxville (Tenn.) Gas & Fuel Company; the Empire District Electric Company, of Joplin, Mo. (itself a holding company controlling several properties), and the Spokane (Wash.) Gas & Fuel Company. It was also admitted that three other companies would probably go into the organization, but their names were not given. Under the new plan of reorganization of the Denver Gas & Electric Company, made public last fall, the property was to be taken over by a new company to be called the Denver Gas & Electric Light Company. This new concern had an authorized issue of stock of $10,000,000 and an authorized bond issue of $25,000,000. The earnings of the Denver company for the 12 months which ended June 30, showed an increase in net of $116,307, and an increase in surplus of $67,289.

Sierra & San Francisco Power Company Bonds.—Perry, Coffin & Burr, of Boston; N. W. Harris & Company, of New York, and the Harris Trust & Savings Bank, of Chicago, are jointly offering the public the recent issue of $6,500,000 of Sierra & San Francisco Power Company, 5 per cent bonds, which were referred to in our last issue. The price at which these bonds are offered is 93½, making the investment yield about 5.4 per cent. In the circular making the offer George W. Bacon, president of the company, is quoted as saying that the property will represent a total cash investment of over $11,000,000, upon which the present bond issue is the only obligation. He says that the combined capacity of the hydroelectric and steam properties of the company at present amounts to 68,500 hp, and that early next year the total capacity will be brought up to 78,000 hp. The company is now delivering the United Railroads of San Francisco 12,000 hp from its hydroelectric plant, and this amount will be gradually increased during the present year to the full amount required to operate the railroad system.

Augusta-Aiken (Ga.) Railway & Electric Company.—The stocks and bonds of the Augusta-Aiken Railway & Electric Company, and its allied properties, which were held by the estate of the late E. H. Harriman, have been sold to Redmond & Company, New York bankers, for a consideration of about $2,700,000. This company is a holding concern which controls the Augusta Railway & Electric Company, North Augusta Electric & Improvement Company, Augusta & Aiken Railway Company and several other properties. It is proposed to construct a high-speed electric line from Atlanta, Ga., to Columbia, S. C., a distance of 280 miles.

Wayne County Gas & Electric Company.—The Public Service Commission of the Second District of New York has made an order allowing the Palmyra Gas & Electric Company, the Newark Gaslight & Fuel Company, the New Light, Heat & Power Company, of Newark, the Lyons Gaslight Company and the Wayne County Electric Company to consolidate into the Wayne County Gas & Electric Company. In approving this consolidation the commission made the requirement that the capital stock of the consolidated company should be only $200,000, which is $45,000 less than the total capital stock of the corporations consolidated.

Twenty-eighth Street Crosstown Sale, New York.—At the request of the bondholders reorganization committee, the foreclosure sale of the property of the Twenty-eighth and Twenty-ninth Street Crosstown Railroad Company in New York City was again postponed. The sale was to have occurred July 13 and the new date set for it is Oct. 3. The sale is to satisfy a judgment obtained by the Central Trust Company for $1,639,161. The road, which is a horse car line, is at present operating one of the Edison storage battery cars, but it is said that when the reorganization is completed it will be entirely equipped with these cars.

East Jersey Light & Power Company.—The East Jersey Light & Power Company, recently incorporated at Perth Amboy, has purchased plants in Freehold and Englishtown, and is negotiating for the purchase of the Princeton Light, Heat & Power Company, the Deal Beach Light & Water Company and the Electric Light & Power Company of Hightstown. Several other plants are also being considered in Monmouth and Mercer counties. The East Jersey Company has a capitalization of $1,500,000 and was organized to control in a territory not reached by the Public Service Corporation.

Wilmington & Philadelphia Traction Company.—The organization plan of the Wilmington & Philadelphia Traction Company, which was recently formed with a total capitalization of $6,500,000 to be a holding company for all of the Interstate Railways Company properties south of Philadelphia, is now made public. The formation of the new company effects the merger of these properties with the Wilmington Light & Power Company. The stock of the new company is divided into $1,500,000 preferred and $5,000,000 common, of which there is outstanding $500,000 of each. The company has no bonded indebtedness, but it guarantees payment of all interest charges of the companies included in the merger, and at the same time pays a yearly rental to these companies on a graduated basis. The companies included are the Wilmington City Railway Company, the Wilmington City Electric Company, the Chester Traction Company, the Wilmington & Chester Traction Company, the Delaware County & Philadelphia Electric Railway Company of Clifton Heights, Pa., and the Wilmington Light, Power & Telephone Company. The company does all the electric lighting and power business of the city of Wilmington and has about 92 miles of street railways extending from Wilmington to the suburbs of Philadelphia. It is said that the new merger was formed in order to end a disastrous rate war between competing companies, which had existed for a long time. Nearly all of the properties concerned were acquired by leases extending 999 years. It is understood that O. T. Crosby, who is associated with J. G. White & Company, will be president of the new company.

Associated Gas & Electric Company.—The Associated Gas & Electric Company, which was organized last year by W. S. Barstow & Company, and which controls a number of gas and electric properties in small cities, has purchased through its subsidiary, the Greenville, Ohio, Gaslight Company, all of the mains and plant of the Indiana Lighting Company in Greenville. The natural gas in that section having failed, the Indiana Lighting Company had no further use for this property. The Greenville company is building a new plant and will extend its service in a number of directions. President Barstow of the Associated company says that all of the subsidiary companies are showing satisfactory increases in net earnings, and that there is every reason to expect the company to continue to earn more than the 6 per cent dividend now being paid on the preferred stock.

Electric Railway Bonds in Paris.—D. C. Nevin, president of the St. Louis-Kansas City Electric Railway Company, announces that he is negotiating the sale of a $15,000,000 bond issue in Paris. It is said also that work on the road will be commenced within a short time, and that 75 per cent of the route has already been established. It is proposed to run hourly trains between these two cities with stops at all stations, and also to operate four express trains a day which will stop only at the larger points. The road will handle mail, express and freight. The company has 10,000 acres of coal land in Boone, Howard and Lafayette counties, Missouri. The power plant will be built near these coal fields.

Interborough-Metropolitan Bond Plans.—The financial heads of the Interborough-Metropolitan Company are working on a plan for the retirement of a portion of the outstanding $67,825,000 4½ per cent collateral trust bonds. This action is made desirable because by the recent issue of $4,000,000 of 6 per cent notes the company has increased its fixed charges to almost $100,000 more than its gross income. Of course, the company could easily meet this deficiency by increasing the dividend rate of the Interborough Rapid Transit Company, but it is thought that such a course would cause adverse criticism.

Edison General Electric Company.—At a meeting of the stockholders of the Edison General Electric Company at Schenectady, last week, the company was formally dissolved. The fact that this action would be taken was referred to in our issue of June 23. A certificate of dissolution will be filed with the Secretary of State. The company, which is entirely the property of the General Electric Company, has existed in name only for many years and was kept alive only on account of certain patent rights which have now expired.

DIVIDENDS.

American District Telegraph Company, of New Jersey, quarterly, 1 per cent, payable July 28

American Gas & Electric Company, quarterly preferred, 1½ per cent, payable Aug. 1.

Binghamton (N. Y.) Light, Heat & Power Company, quarterly, preferred, 1½ per cent; common, ¾ per cent, both payable July 15.

Commonwealth Edison Company, quarterly, 1½ per cent, payable Aug. 1.

Electric Bond & Share Company, preferred, quarterly, 1¼ per cent, payable Aug. 1; common, quarterly, 2 per cent, payable July 15.

Grand Rapids Railway Company, preferred, quarterly, 1¾ per cent, payable Aug. 1.

Havana Electric Railway Company, quarterly, preferred, 1½ per cent; common, 1½ per cent, both payable Aug. 13.

International Pneumatic Tube Company, preferred, semiannual, 3 per cent, payable July 20.

Michigan State Telephone Company, preferred, quarterly, 1¼ per cent, payable Nov. 1; common, 1¾ per cent, payable Sept. 1.

Milwaukee Electric Railway & Light Company, preferred, quarterly, 1½ per cent, payable Aug. 1.

Public Service Investment Company, Boston, preferred, quarterly, 1½ per cent; common, semiannual, 1¼ per cent, both payable Aug. 1.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Telephone & Telegraph Company:					
Six months ended June 30, 1910	[illegible]	$1,694,485	[illegible]	$2,586,355	$13,315,353
Six months ended June 30, 1909	[illegible]	1,226,953	[illegible]	3,892,623	10,093,255
Associated Bell Operating Companies:					
May, 1910	[illegible]	5,073,407	3,932,327	1,014,186	2,918,141
May, 1909	[illegible]	4,547,878	[illegible]	829,080	3,057,813
British Columbia Electric Railway Company, Vancouver:					
May, 1910	[illegible]	157,417	99,389	......	......
May, 1909	[illegible]	116,408	81,394	......	......
Blackstone Valley Gas & Electric Company:					
May, 1910	[illegible]	37,340	[illegible]	29,161	8,957
May, 1909	69,972	37,722	[illegible]	28,791	3,459
Columbus (Ga.) Electric Company:					
May, 1910	37,227	15,550	[illegible]	17,615	4,105
May, 1909	30,820	15,875	[illegible]	12,886	2,059
Dallas (Tex.) Electric Corporation:					
May, 1910	[illegible]	81,398	34,194	26,622	[illegible]
May, 1909	[illegible]	66,182	[illegible]	28,839	[illegible]
Denver Gas & Electric Company:					
June, 1910	...	...	76,367	37,382	38,985
June, 1909	...	.....	[illegible]	34,840	37,995
Edison Electric Illuminating Company, Boston:					
June, 1910	[illegible]	159,797	[illegible]	....	....
June, 1909	293,885	[illegible]	[illegible]	.....	
Edison Electric Illuminating Company of Brockton:					
May, 1910	[illegible]	[illegible]	[illegible]	3,787	6,141
May, 1909	[illegible]	16,906	8,609	3,192	[illegible]
El Paso (Tex.) Electric Company:					
May, 1910	[illegible]	[illegible]	[illegible]	8,218	[illegible]
May, 1909	[illegible]	[illegible]	[illegible]	7,900	[illegible]
Galveston-Houston Electric Company:					
May, 1910	[illegible]	[illegible]	[illegible]	23,548	[illegible]
May, 1909	[illegible]	[illegible]	[illegible]	21,420	[illegible]
Jacksonville (Fla.) Electric Company:					
May, 1910	[illegible]	25,330	[illegible]	[illegible]	[illegible]
May, 1909	[illegible]	[illegible]	[illegible]	9,281	7,194
[illegible]					
[illegible]	[illegible]	40,626	[illegible]	[illegible]	21,843
[illegible]	[illegible]	37,340	[illegible]	[illegible]	17,663
[illegible]					
[illegible]	[illegible]	386,958	[illegible]	[illegible]	135,073
[illegible]	[illegible]	350,121	[illegible]	168,013	79,617

General News

Construction News.

(Arranged alphabetically by States.)

BIRMINGHAM, ALA.—F. A. Burr, Thomas O. Smith, Frank Nelson, S. E. Thompson and others are reported to be interested in a project to construct an independent electric railway from Birmingham to Ensley, via Owenton and Shadyside.

HARTSELLS, ALA.—At an election to be held Aug. 8 the proposition to issue $28,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant and water works system, will be submitted to a vote. Plans are being prepared by Xavier A. Kramer, of Magnolia, Miss.; J. H. Corsable is Mayor.

MONTGOMERY, ALA.—The Montgomery Light & Water Company has been awarded a contract by the city to furnish electricity for operating the pumping station of the municipal water works for a term of 10 years, with the privilege of renewal.

FLORENCE, ARIZ.—T. J. Prescott, of Phoenix, Ariz., has been in this city recently making investigations with a view of installing a combined electric light, power, water and ice plant in Florence.

PHŒNIX, ARIZ.—Surveys are now being made for an electric railway from Mesa City to the Chandler ranch, a distance of 14 miles. The proposed railway will be built next fall and will connect with a railway from Mesa to Phœnix, work on which will start in the fall. Another extension from Phœnix to Glendale is also contemplated next winter, which will give about 40 miles of additional car service.

WALKER, ARIZ.—The purchase of an electric hoist and crushing plant is reported to be under consideration by Griffin & Company, of Walker, Ariz.

LESLIE, ARK.—Plans are being prepared by the Leslie Light, Water & Power Company for the construction of an electric light plant and water works system, to cost about $20,000. J. W. Vaughn, of Leslie, and James F. Kiser, of Little Rock, Ark., who were recently granted a franchise by the City Council are understood to be interested in the project.

CHICO, CAL.—Plans are being considered by the Northern Electric Company for the construction of a branch line from Yuba City to Colusa, work on which will soon be started. It is expected that the railway will eventually be extended to Woodland, Cal.

DUNSMUIR, CAL.—The Siskiyou Electric Power & Light Company has acquired all the electrical holdings of the Mossbrae Falls Water & Power Company, which gives the first-named company the entire field for electrical service. The Mossbrae power plant will be abandoned and the distributing system taken down.

EUREKA, CAL.—Plans are being considered by the merchants and the officials of the Humboldt Gas & Electric Company for the installation of an ornamental street lighting system in the business section of this city.

GARDEN GROVE, CAL.—The Town of Garden Grove, (unincorporated) has petitioned the Board of County Supervisors to call a special election in the town to vote on the proposition of establishing and maintaining a street lighting system.

GEORGETOWN, CAL.—The power house of the Horseshoe Bar Electric Company, at Horseshoe Bend, located on the middle fork of the American River, five miles east of Georgetown, has been put into operation. The company will furnish electricity for lamps and motors to towns and mines in this county, which heretofore have not had electrical service. Preparations are being made by S. W. Collins and other citizens of Georgetown to erect a transmission line from the power house to Georgetown for the purpose of supplying electricity to residents in this town. It is expected that the line will be extended to Greenwood and the Garden Valley district, where many valuable mining properties are awaiting power for development. The Horseshoe Bar Electric Company is furnishing electricity to the Cash Rock Gold Mining Company for operating its gold dredge, located about five miles south of the power house.

LINCOLN, CAL.—The Pacific Gas & Electric Company, which owns and operates the local electric light system, is contemplating extensive improvements to the local plant. The system, it is said, will be practically rebuilt and a day service installed.

OAKLAND, CAL.—The San Francisco, Oakland & San José Railroad Company has placed a contract with the Central Railway Signal Company, of Rochester, N. Y., for a complete electric locking signal system for its three mile pier and its main lines. Signals are to be placed every [illegible] ft on the pier.

OAKLAND, CAL.—Application has been made to the superior court by the Richmond Light & Power Company for dissolution. The concern was incorporated in 1902 and Oakland was the principal place of business. The directors are: Evans Williams, J. S. Lanison, A. L. and Harry Chickering and Winfield Dorn.

OAKLAND, CAL.—The Southern P[illegible] has applied to the City Council for a franchise to extend its track skirting the bay shore in North Oakland to the right of way obtained in Berkeley. The franchise if granted will supply the connecting link to complete the loop system of electric service which the company proposes to establish in Berkeley.

PLACERVILLE, CAL.—Notice has been filed with the county recorder by H. H. Baker of an appropriation of 50,000 cu. in. of water of the Rubicon River. The water will be diverted at a point on the river a short distance from what is known as the Grasshopper Bar. The water will be utilized to generate electricity for the operation of electric railways.

POMONA, CAL.—Property owners on East Sixth and Eighth streets have petitioned the City Trustees for street lamps, which, it is said, will probably be installed.

SAN FRANCISCO, CAL.—The Standard American Dredging Company, of San Francisco, Cal., has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for a 500-kw, 2300-volt, three-phase, 60-cycle, 3600 r.p.m. generator to be installed on one of its dredges to furnish electricity to drive a 500-hp. motor direct connected to the dredge pump. The alternator will receive excitation from a 15-kw, Allis-Chalmers generator direct connected to an engine made by the American Blower Company.

SAN RAFAEL, CAL. The Town Trustees have instructed L. Richardson, county surveyor, to visit San Francisco and secure data on its street railway system for the purpose of making a report at the next meeting in connection with the application of W. L. Courtright for a franchise to operate an electric railway within the town limits. The railway is being promoted by capitalists and business men of Novato, San Rafael, San Anselmo, Kentfield, Larkspur, Ross and Corte Madera. It is proposed to raise $125,000 to commence the street railway from Novato through San Rafael and Ross Valley towns to Corte Madera. It is estimated that $65,000 must be raised to float bonds for the proposed railway.

VALLEJO, CAL.—The Board of Trustees have decided not to submit to the voters the proposition to issue $144,000 in bonds for the construction of a municipal electric light plant.

VALLEJO, CAL.—Announcement has been made by the Vallejo Electric Light & Power Company of a reduction in the price of electricity from 11 to 8 cents per kw-hour, the change to take effect Jan. 1, 1911.

GRANITE, COL.—The Granite Tunnel Company, of Granite, Col., is reported to be contemplating the construction of a power plant in the near future. Electric generating machinery will be installed.

GREELEY, COL.—It is reported that farmers in the Oklahoma district, southwest of Greeley, working without irrigation, propose to water an extensive area by lifting water by electricity from Boyd Lake, a distance of 100 ft., to their lands.

HAYDEN, COL.—An electric light franchise has been granted by the Town of Hayden for a period of 25 years.

MILLIKEN, COL.—Arrangements are being made by the Northern Colorado Power Company for the erection of a large transformer station in Miliken, Col., from which electricity will be distributed to farms and adjacent towns.

BRIDGEPORT, CONN.—The B. F. Shaw Company, of Wilmington, Del., has been awarded the contract for the power plant of the Malleable Iron Company, of Bridgeport, Conn.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until July 25 for furnishing 32,000 ft. paper insulated submarine cable, type 321, and 8000 ft. type 327, both under signal corps specification No. 427. A. S. Cowan is captain of signal corps, United States Army.

WASHINGTON, D. C.—The Treasury Department, acting as trustee for all departments except the navy, awarded a contract for supplying the government with approximately 1,000,000 electric lamps. A joint award was made to the General Electric Company, the Columbia Incandescent Company and the Novelty Lamp Company, at a total cost of about $170,000, which will result in a saving of about $30,000 a year over the amount required before the specifications were standardized.

ATLANTA, GA.—Preparations are being made by the Atlanta & Carolina Railway Company to resume work on the construction of its proposed railway, which is to connect Atlanta, Augusta and Athens, with a branch line to College Park. It is reported that work will begin within 60 days. J. W. English, of Atlanta, Ga., is president of the company.

AUGUSTA, GA.—It is reported that W. H. Ellis, 1303 Fifteenth Street, Augusta, Ga., would like to receive estimates on electrical equipment for an $18,000 church.

CARTERSVILLE, GA.—[illegible] commence work on construction of a large dam on the Coosa River, to furnish power to [illegible] purchased the property and

power rights at a receivers' sale, surveys for which have already been made. It is proposed to develop 15,000 hp and to construct an electric railway connecting Rome, Cartersville, Canton and other places in Georgia.

MACON, GA.—The Georgia Southern & Florida Railway Company has contracted with the Central Georgia Power Company to supply electricity to operate all machinery in the Macon [illegible]

BURKE, IDAHO.—The Marsh Mining Company, which is operating near Burke, Idaho, is reported to be contemplating the installation of a concentrating plant and considerable ore-reduction machinery. The present plant of the company is operated by electricity. C. L. Colwell, of Missoula, Mont., is president of the company.

HAILEY, IDAHO.—The Eureka Development Company is reported to be preparing plans for the construction of an electric power plant to furnish electricity to operate the machinery in its mines.

KOOSKIA, IDAHO.—The Department of the Interior has granted the Kooskia Land & Power Company permission to construct a dam on the Clearwater River, in what is now a national forest. The company, it is said, proposes to erect a hydroelectric power plant with an output of from 4500 to 5000 kw. When the plant is completed a number of industrial projects will be established.

SALMON, IDAHO.—Plans are being prepared by the Redrock & Salmon River Telephone Company for improvements and extensions to its system.

ALEXIS, ILL.—Contracts have been signed for the construction of a branch line of the Rock Island Southern Railway, the electric line between Rock Island and Monmouth. In order to secure the extension the Business Men's Club was obliged to purchase the entire right of way and to guarantee the sale of $50,000 in bonds.

DECATUR, ILL.—The Decatur Southern Traction Company is reported to have completed preliminary arrangements for the construction of an electric railway from Decatur, Ill., south through Macon and Assumption to Pana, a distance of 30 miles, for which contracts will be awarded about Aug. 1. R. McCalman, 318 Citizens' T. & T. Building, Decatur, Ill., is chief engineer.

GALENA, ILL.—The H. M. Byllesby & Company, of Chicago, Ill., are reported to have purchased the electric generating plant and distributing systems owned by the Interstate Light & Power Company, with headquarters in Galena, Ill., and which furnishes electrical service in a territory of 200 square miles in the lead and mining fields of southwestern Wisconsin and northwestern Illinois. The company also furnishes electricity in Galena, Ill., Platteville, Cuba City, Benton and Hazel Green, Wis.

MENDOTA, ILL.—The construction of an electric interburban railway to connect Princeton and Mendova, via Dover and La Moille, is under consideration. J. Kendall, of La Moille, and A. R. Unholz, of Princeton, are interested in the project.

PALATINE, ILL.—The necessary funds ($100,000) have been secured to insure the construction of the new electric railway from Palatine through Lake Zurich to Wauconda, and work on surveys will begin in the fall. Electricity for operating the proposed railway will be secured from the North Shore Electric Company.

PEORIA, ILL.—The City Council has granted the Peoria & Galesburg Railway Company a franchise to construct and operate an electric railway in Peoria.

PITTSFIELD, ILL.—The capital stock of the Pike County Telephone Company has been increased from $75,000 to $100,000.

PULLMAN, ILL.—The power house of the Pullman Company, at Pullman, Ill., is reported to have been destroyed by fire on July 17.

ST. CHARLES, ILL.—The City Council has granted a franchise to the Chicago, Wheaton & Western Railway, Heat & Power Company to construct and operate an electric railway in St. Charles, Ill.

CONNERSVILLE, IND.—It is reported that preliminary arrangements have been completed for the construction of an electric interurban railway to connect Connersville and Hamilton. C. L. Henry is interested in the project.

CRAWFORDSVILLE, IND.—Contracts have been awarded by the City Council for electrical equipment for the new municipal electric light plant. The contract for the building will be awarded soon. The cost of the plant complete is estimated at about $100,000.

INDIANAPOLIS, IND.—The Indianapolis Telephone Company has purchased a site in West Indianapolis and will erect a building and install an automatic switchboard. The cost of the work is estimated at $50,000.

INDIANAPOLIS, IND.—The Trustees of Woodruff, a resident corporation, have entered into a contract with the Merchants' Heat & Light Company for lighting that district. It is said that a radical change will be made in the near future in the lighting system of the drives.

INDIANAPOLIS, IND.—An ordinance has been introduced in the City Council requiring all railroads to pay the cost of maintaining electric lamps at points where streets are crossed by railroad tracks. This will involve a large amount, as 19 steam railroads and 12 electric railways enter Indianapolis.

MADISON, IND.—The Southern Indiana Traction Company is contemplating the construction of a power plant in Madison, Ind. J. E. Greeley is vice-president. The company proposes to construct an interurban electric railway to connect Madison and Scottsburg.

MARION, IND.—The City Council is reported to have passed an ordinance revoking the franchise granted the Indiana Gas & Electric Company, of New Jersey, Sept. 18, 1908. The local field is now open to any company wishing to secure a franchise.

MARTINSVILLE, IND.—We are informed that the city is contemplating improvements to the municipal electric plant, which will involve an expenditure of about $10,000. H. K. Johnson is engineer.

MICHIGAN CITY, IND.—The Chicago, Lake Shore & South Bend Electric Railway Company has announced that it proposes to furnish electricity at reasonable rates for lamps, heat and motors at any and all points long its line, also to farmers. The company is planning to install additional equipment in its power house in this city, which will involve an expenditure of about $140,000. Wire will be purchased for the erection of a special circuit.

MUNCIE, IND.—Arrangements are being made by the American Steel & Tin Plate Company for remodeling and enlarging its local factory, which will include the installation of a large amount of new machinery and electrical apparatus.

NEW ALBANY, IND.—The City Council has granted the Louisville & Southern Indiana Traction Company, a franchise to extend its railway to the proposed new fair grounds. It is expected that the system will be extended from New Albany to Frenck Lick Springs.

NEW ALBANY, IND.—Negotiations are under way between the Board of Public Works and the New Albany Gas & Electric Company for lighting the streets of the city. The new contract is for a term of 10 years, under which the company is to furnish arc lamps at the rate of $52.25 each per year. Under the present contract the city pays $58.20 per lamp per year. Under the new arrangements the railroad companies will be required to pay for lamps at the railroad crossings.

OOLITIC, IND.—The plant and holdings of the Social Home Telephone Company of Oolitic, Ind., has been purchased by Frank F. Bingham, of Bedford, Ind. It is understood that the new owner will make improvements and extensions to the property.

SOUTH BEND, IND.—A general improvement company has been organized by local capitalists for the purpose of constructing an electric railway, terminals and a bridge across the Willapa River. The capital stock is placed at $2,000, and the incorporators are: F. L. Gaudett, J. W. Kleeb. W. Hammond and C. B. Weatherwax, of South Bend, Ind.

SYRACUSE, IND.—The Syracuse Cement Company is reported to have awarded the contract for the construction of a dam across the Elkhart River to Wilcutts & Hoover, of Marion, Ind. It is understood that the water power will be utilized to generate electricity for lamps and motors.

TIPTON, IND.—The City Council is reported to have appointed a committee to look into the question of replacing the present arc lamp street lighting system with incandescent lamps and secure the cost of same.

DUBUQUE, IA.—It is reported that plans are being prepared by the Dubuque Packing Company for the construction of a new factory, 80x185 ft. which will be equipped for electrical operation.

IOWA FALLS, IA.—The Iowa Central Telephone Company has purchased the plant and holdings of the Iowa Telephone Company, operating telephone lines between and exchanges in Eagle Grove, Hampton and Iowa Falls. The transaction involves about $85,000; the purchasing company assumes the debts and bonds of the Iowa Telephone Company.

JANESVILLE, IA.—The Royer-Myers Manufacturing Company, recently organized with a capital stock of $25,000, to manufacture gasoline engines, concrete mixers, etc., is reported to be preparing plans for the construction of a factory building, 40x100 ft. It is understood that the plant will be equipped for electrical operation.

MARSHALLTOWN, IA.—The contract for the installation of electroliers on Main Street is reported to have been awarded to the Buchanan-Boughton Company.

WATERLOO, IA.—The Waterloo, Cedar Falls & Northern Railway Company has awarded a contract to James Maine & Sons for the construction of its new power house in Waterloo. The building will be 154x132 ft. and will adjoin the present station. The cost of plant is estimated at about $300,000.

BELLEVILLE, KAN.—Surveys have been completed and contracts for construction will soon be awarded by the Motor Grand Traction Company on 65 miles of its proposed 165-mile railway to connect Chester, Neb., and Wichita, Kan. E. S. Alnutt, of Canton, Kan., is president.

KANSAS CITY, KAN.—The Kansas City Commissioners have adopted a resolution to ascertain the cost of acquiring an electric light plant and operating the same as a municipal enterprise. Electrical service is now furnished by the Kansas City Consolidated Electric Light & Power Company.

COLSON, KY.—The Colson Telephone Company, recently organized, is contemplating the erection of a telephone exchange in Colson and telephone lines to Jeremiah and Indian Bottom. James Brown is interested in the project.

GLENDEANE, KY.—The Glendeane Telephone Company, recently organized is preparing to erect telephone lines from Glendeane to Marydell

HORSE CAVE, KY.—We are informed that the Horse Cave & Eastern Railway Company will commence work on construction of its proposed electric railway as soon as the preliminary engineering work has been completed. The railway will be 25 miles in length and will connect

Horse Cave, Hiseville, Knob Lick and Edmonton. Either gasoline or gasoline-electric cars will be operated for passenger service and steam for freight. Louis Edwards, 1463 Arlington Avenue, St. Louis, Mo., is general manager.

LEITCHFIELD, KY.—Oeize Brothers, of Owensboro, Ky., are reported to have purchased a franchise for an electric light plant and water works system in Leitchfield. Work may commence on the electric plant in August or early in the fall.

LOUISVILLE, KY.—The Louisville Railway Company is reported to be making preparations for building an extension to its system in Louisville to give East and South Louisville a direct railway service with West Louisville and Parkland.

MAYSVILLE, KY.—It is reported that an election will be held to vote on the proposition to issue $75,000 in bonds, the proceeds to be used for the construction of an electric light plant and to secure natural gas in Maysville.

MURRAY, KY.—It is reported that the Murray Traction Company will place contracts about Sept. 1 for the construction of its proposed railway to connect Murray and Calloway, a distance of about 16 miles, for which, it is said, surveys have been completed and most of the right of way secured. Nathan Ryan, of Murray, Ky., is president.

WASIOTO, KY.—The Cumberland River Telephone & Telegraph Company, recently organized, contemplates the erection of a local telephone system and long-distance lines in the Cumberland Valley. The company is capitalized at $25,000. B. N. Worthington is interested in the company.

NEW LIBERIA, LA.—The Southwestern Traction & Power Company is reported to be interested in a project to construct an electric railway in New Iberia and vicinity. F. W. Crosby. of New Orleans, La., is promoter of the enterprise.

NEW ORLEANS, LA.—The New Orleans Railway & Light Company has purchased the franchise for the Spanish Fort extension of the West End Railroad and will build the railway, including the bridge over bayou St. John.

NEW ORLEANS, LA.—The Consumers' Electric Company is reported to have awarded a contract to Otis W. Sharp, of New Orleans, La., for the erection of concrete and steel building for substation. The equipment will include a 500-kw motor-generator set, with necessary switchboard and cable connections, for which contract has been awarded.

NEW ORLEANS, LA.—Plans are being considered for an extension of the Royal Blue Line of the New Orleans Railway & Lighting Company to Shrewsbury. The residents of Jefferson Parish, it is reported, are willing to raise the funds for building the extension, provided the New Orleans company will furnish the rolling stock. The money will eventualy be returned to the contributors with interest.

BANGOR, MAINE.—The Bangor & Northern Railroad Company is installing a motor-generator set in its Kenduskeag power station, which will greatly increase the output of the plant.

BANGOR, MAINE.—The Bangor Railway & Electric Company has entered into a contract with the Eastern Maine Insane Hospital to furnish electricity for lamps and motors for the hospital. The company is planning to install a motor-generator set to increase the output of its plant to provide for the hospital service.

DEXTER, MAINE.—Fay & Scott are reported to be making preparations to utilize the water power at Libby's Mills to furnish power to operate their large machine shops. This power was formerly utilized by the Dexter Electric Company, until it erected a steam power plant in Dexter.

BALTIMORE, MD.—Samuel T. Williams, 223 North Calvert Street, Baltimore, Md., is reported to be in the market for a 50 to 65-kw, 220-volt, three-phase, 60-cycle, alternating-current generator direct-connected or belted with a Corliss type engine; a 10-kw, 220-volt, direct-current, direct-connected or belted unit, and also a 10-kw, 100-volt, direct-connected set.

ADAMS, MASS.—The Renfrew Manufacturing Company is installing a 134-kw generator to supply electricity for its jacquard mill.

ATTLEBORO, MASS.—Announcement has been made by the Attleboro Steam & Electric Company of a reduction in the price of electricity for lamps from 15 to 14 cents per kw-hour, which applies to both commercial and residential service, Edgar Treggoning is manager of the company.

MARLBORO, MASS.—The State Railroad Commissioners have granted the Boston & Western Electric Railway Company a certificate of necessity for the construction of an electric railway beginning in Waltham and extending through Weston, Wayland and Sudbury to Marlboro.

MEDFORD, MASS.—Mayor Brewer has signed a new 10-year contract with the Malden Electric Company for lighting the streets of the city. Under the terms of the contract the company is to furnish 592 incandescent lamps at $14.12 each per year, and 162 arc lamps at $76.63 per lamp per year. The company also agrees to replace the present 25-cp incandescent street lamps with 40-cp tungsten lamps. Provision is also made for a reduction in price and for furnishing of improved type of lamp or apparatus by the company in the event that another municipality shall make a more advantageous or lower priced contract with the company. The contract dates back to March 1 and abrogates a previous agreement made July 20, 1907.

MERRIMAC, MASS.—Beginning [illegible]

electricity for lamps and motors went into effect, as follows: For electricity for lamps a minimum charge of $10 per year will be made; bills over $10 per year will be rendered at 20 cents per kw-hour, with discount on net bills for one year according to the amount used; on bills over $10 and under $20 a discount of 25 per cent will be allowed; over $20 and less than $40, 35 per cent discount; over $40 and less than $75, 40 per cent discount; over $75 and less than $100, 45 per cent discount; over $100 and less than $250, 50 per cent discount; on bills over $250 special rates will be given. When the consumer's bill is estimated to exceed $10 per year net, no monthly bills will be rendered until the meter shows 5 or more kw. Energy for motors will be charged at the following rates for yearly bills. For 250 kw or less $18; over 250 kw and less than 1500 kw, eight cents per kw-hour, or 1500 kw for $105; over 1500 kw, and less than 2500 kw, seven cents per kw-hour, or 2500 kw for $150; over 2500 kw, and less than 5000 kw, six cents per kw-hour, or 5000 kw for $250; over 5000 kw, and less than 10,000, five cents per kw-hour, or 10,000 kw for $450; over 10,000 kw and less than 15,000 kw. four and one-half cents per kw-hour, or 15,000 kw for $600; over 15,000 kw, and less than 35,000 kw, four cents per kw-hour, or 35,000 kw for $1,225; over 35,000 kw, and less than 50,000 kw, three and one-half cents per kw-hour, or 50,000 kw for $1,500; over 50,000 kw, and less than 100,000 kw, three cents per kw-hour. Special rates to consumers using over 100,000 kw.

WORCESTER, MASS.—The Wyman & Gordon Company is reported to be contemplating equipping its plant for electrical operation, and is said to be negotiating with the Worcester Electric Light Company to supply electricity to the amount of 300 hp.

WORCESTER, MASS.—Preparations are being made by the Crompton & Knowles Loom Company to operate its plant by electricity instead of by steam power. The company has recently contracted with the Worcester Electric Light Company for electrical power to the amount of 400 hp.

WORCESTER, MASS.—The stockholders of the Worcester Electric Light Company have voted to make application to the State Gas and Electric Light Commissioners for permission to issue 2000 shares of capital stock, making the total capitalization $1,000,000. The proceeds will be used for the construction and equipment of the new plant to be erected on Webster Street. George T. Dewey is president of the company.

COLDWATER, MICH.—The Water Board is reported to be contemplating the purchase of a power pumping system for the water-works. W. H. Frederick is superintendent of the municipal electric light and water plant.

DETROIT, MICH.—The Anderson Forge & Machine Company is making arrangements to install a 250-kw and a 125-kw, 60-cycle, three-phase, 240-volt alternator manufactured by the Allis-Chalmers Company, of Milwaukee, Wis., in its new plant, now under construction.

DETROIT, MICH.—A new automobile factory is being erected at 1256 Jefferson Avenue, Detroit, Mich., by Frederick E. Wadsworth and H. Scherer. The building will be 65x631 ft., and will be equipped for electrical operation. A sprinkler system will be installed.

GLADSTONE, MICH.—The Northwestern Cooperage & Lumber Company is making plans to increase the output of its plant and flouring mill. Orders have been placed by the company with the Allis-Chalmers Company, of Milwaukee, Wis., for a 500-kw, 480-volt, three-phase, 60-cycle alternator, with exciter and 36 squirrel cage induction motors and switchboard.

IRONWOOD, MICH.—The City Council has passed an ordinance granting franchises to Albert D. Johnston, Florance D. Sullivan and Manuel M. Reid to construct and operate an electric light plant and street railway system in Ironwood, Mich. The franchises are for a term of 30 years, at the expiration of the franchise for the electric plant the city has the privilege of purchasing same, the price to be determined by a committee appointed by the City Council and the company. Under the terms of the franchise the plant is to be in operation by July, 1911. The maximum charge for electricity to private consumers is 10 cents per kw-hour with a discount of 5 per cent if paid within 10 days. The company agrees to furnish electricity for the municipal buildings and school houses in Ironwood for six cents per kw-hour, subject to a discount of 5 per cent if paid within 10 days from date of bill. Arc lamps for street lighting are to be furnished at the rate of $60 per lamp per year. It is understood that a street lighting contract for a term of 10 years has been awarded the company.

LANSING, MICH.—Contracts have been closed with the W. H. Zimmerman Company, of Chicago, Ill., for the engineering and construction work in connection with the electric interurban railway from Lansing to Grand Ledge, Mich., 12½ miles in length. The third-rail system will be used. Arrangements will be made to enter Lansing over the tracks of the Michigan United Railways Company. The new railway will furnish both passenger and freight service, and will ultimately be extended from Grand Ledge to Grand Rapids.

ANOKA, MINN.—Contracts have been awarded by the Water and Light Commissioners for equipment for the municipal water and light plant as follows: To the Allis-Chalmers Company, of Milwaukee, Wis., for a 250-hp compound engine direct-connected to a 175-kw generator, and to R. B. Whitaker & Company, of St. Paul, Minn., for two 150-hp water-tube boilers, at a cost of $20,000.

FARIBAULT, MINN.—The Consumers' Power Company has recently [illegible]

business district in Faribault. When the gas and electric properties in Faribault were purchased by H. M. Byllesby & Company, a contract was made with the city to install an ornamental lighting system. There are 106 standards, each bearing three 40-watt tungsten lamps. All three lamps burn from dusk to midnight and one lamp all night.

GRANITE FALLS, MINN.—At an election held July 15 the proposition to issue $40,000 in bonds, the proceeds to be used for improvements to the municipal electric plant, water works system, was carried. Henry L. Kaselin is city clerk.

ST. PAUL, MINN.—Plans are being prepared for the construction of a 30-ft. dam across the Mississippi River, opposite Fort Snelling, which was authorized by the last Congress. The cost of the dam is estimated at $250,000. Additional funds will be required for power house and equipment. Major Francis R. Shunk, in charge of the United States engineers' office at St. Paul, Minn., is preparing plans.

STAPLES, MINN.—Sealed proposals will be received by the City Council, Staples, Minn., until July 26 for the construction of a heating plant as an extension to the municipal light plant in this city, plans and specifications for which are on file at the office of F. W. Findsen, city clerk.

VIRGINIA, MINN.—It is reported that the city is considering the purchase of the light and water plants of the Virginia Electric Power & Water Company, to be operated by the municipality.

GREAT FALLS, MONT.—The first two units of 6000 hp each of the Rainbow Falls development at Great Falls, Mont., has recently been put in operation. It is expected to have the other four units of 6000 hp each of this plant ready to place in operation some time in August. The Rainbow Falls has a fall of 54 ft. and is the second largest of the five falls in the Missouri River at Great Falls. There is an aggregate drop of 535 ft. in the Missouri River within five miles, with a total possible development of about 330,000 hp. Charles T. Main, of Boston, Mass., is engineer in charge.

LIBBY, MONT.—Investigations have been made recently by Stanton E. Barnum and C. Proctor, of Great Falls, Mont., in Libby, with a view of asking a franchise from the City Council to construct a gravity water system and to install an electric light system. The parties are negotiating with the telephone company to take over the telephone franchise granted some months ago.

MILES CITY, MONT.—Plans are being prepared for improvements to the municipal electric light plant, water-works and sewer systems, to cost $30,000. Burns & McDonnell, of Kansas City, Mo., are consulting engineers.

CARTHAGE, MO.—The Empire District Electric Company, of Joplin, Mo., is reported to be contemplating the construction of a substation in Carthage, Mo. Electricity for operating the station will be supplied from the hydroelectric power plant at Lowell. The company will furnish electrical service to manufacturing plants, including the quarries.

DE SOTO, MO.—The City Council is reported to be considering the question of installing an electric lighting system in connection with the water works plant.

GREENFIELD, MO.—The Greenfield Light & Power Company is planning to enlarge and increase the output of its plant. The new equipment will include a 100-kw, 2300-volt, three-phase, 60-cycle belted alternator, manufactured by the Allis-Chalmers Company, Milwaukee, Wis.

KANSAS CITY, MO.—The Metropolitan Street Railway Company has accepted a franchise requiring it to extend its railway from the terminus of the Quindaro Boulevard line west to Twenty-second Street and thence north to Brown Avenue.

ST. LOUIS, MO.—The contract for the installation of the electric conduit system in the St. Louis post office has been awarded by James F. Knox Taylor, supervising architect, to the Newberry Electric Company, of St. Louis, Mo., for $15,588.

ST. LOUIS, MO.—W. S. Markle, consulting engineer, 1005 New Bank of Commerce Building, St. Louis, Mo., is reported to be in the market for electrical equipment, including a 225 to 300-kw, two-phase, revolving field, 2300-volt, 60-cycle direct-connected generator; also Corliss engine and exciter for same; a 50 to 75-kw, 2300-volt, three-phase, 60-cycle, revolving-field generator, either belted or direct connected with engine and exciter.

BEATRICE, NEB.—It is reported that E. J. Sullivan, of Omaha, Neb., has purchased the plant and holdings of the Beatrice Electric Company. It is understood that the new owner will make extensive improvements to the system.

BROKEN BOW, NEB.—Preparations are being made by the Broken Bow Electric Light Company for the construction of a new power house in Broken Bow.

FREMONT, NEB.—The City Council has granted the Nebraska Traction & Power Company a franchise to construct an electric railway in the City of Fremont, under which the railway is to be completed by [illegible]

LEXINGTON, NEB.—The electric plant of the Lexington Mill & Elevator Company, which furnishes electrical service in Lexington, was [illegible]

OMAHA, NEB.—The contract for construction of the new power house of the Omaha & Council Bluffs Street Railway Company has been awarded [illegible]

has the contract for structural steel. The new building will be located at Fifth and Jackson streets, the cost of which with equipment is estimated at $600,000.

EAST TILTON, N. H.—The Stone & Webster Engineering Corporation, of Boston, Mass., consulting engineer for the Laconia Electric Lighting Company, of Laconia, N. H., has purchased three 250-kw, 6600-volt, three-phase, 60-cycle alternators from the Allis-Chalmers Company, of Milwaukee, Wis., which will be direct connected to hydraulic turbines. Each alternator will be independently excited by a 12-kw coupled exciter.

CRANFORD, N. J.—At a town meeting held July 8 the citizens decided in favor of municipal ownership of its water system and electric light plant. Resolutions were passed authorizing the township committee to appoint a commission to take charge of the matter and secure an engineer to determine the best course to pursue. It was also recommended that bonds be issued to defray preliminary expenses.

EATONTOWN, N. J.—The question of establishing an electric lighting system in Eatontown is under consideration. The Shore Electric Company of Red Bank, N. J., has a franchise to extend its transmission lines to this town.

PERTH AMBOY, N. J.—The East Jersey Light & Power Company, recently incorporated with a capital stock of $1,500,000, it is said, will purchase electric power plants in Southern New Jersey in a territory not reached by the Public Service Corporation of New Jersey. The company has already purchased plants in Freehold and Englishtown, and is negotiating for the purchase of the systems of the Princeton Light, Heat & Power Company, of Princeton, the Deal Beach Light & Water Company and the Electric Light & Power Company of Hightstown, N. J., and several other plants in Monmouth and Mercer counties. William J. Lansley, of Perth Amboy, N. J., is consulting engineer.

SALEM, N. J.—The Salem Electric Company is reported to have purchased property on the water front in Salem, N. J., where, it is said, the company proposes to erect a power plant, with an output of three times the present plant.

AMSTERDAM, N. Y.—The Common Council has granted the Fonda, Johnstown & Gloversville Railroad Company, a franchise to double-track its railway on Main Street in Amsterdam and to construct a belt line.

BOONVILLE, N. Y.—W. G. Stone, hydraulic engineer, of Utica, N. Y., is reported to be preparing plans for the construction of a concrete dam in connection with the municipal electric plant in Boonville, N. Y. The cost of the dam is estimated at $15,000.

BROOKLYN, N. Y.—The Public Service Commission, First District, has adopted a resolution laying out a rapid transit route in Utica Avenue, Brooklyn, south from the Eastern Parkway to a point in Flatbush Avenue, near Jamaica Bay. It is proposed to construct this route upon the assessment plan.

BUFFALO, N. Y.—The Niagara & Erie Power Company, which is controlled jointly by the Buffalo & Lake Erie Traction Company and the Niagara, Lockport & Ontario Power Company has applied to the Public Service Commission, Second District, for permission to issue $100,000 in capital stock and $500,000 in bonds, with a mortgage to bondholders, which will permit increasing the bond issue to $1,250,000. The company proposes to erect transmission lines for the purpose of furnishing electricity generated at Niagara Falls to Dunkirk, Westfield, Jamestown and other towns through the grape belt, possibly extending as far west as Erie. The Niagara, Lockport & Ontario Power Company now furnishes electricity in West Seneca, its transmission line from Niagara Falls circling the city meeting the Buffalo & Lake Erie Traction Company's right of way in West Seneca, which company has rights of way to cities and towns along the lake shore and to Jamestown by a railroad, which it controls.

ELMIRA, N. Y.—Preparations are being made by the Elmira Water, Light & Railroad Company for extensive improvements and extensions to its plant on Madison avenue, including the installation of two new boilers of 600 hp, contract for which has been placed with the Babcock & Wilcox Company, of New York, N. Y.

EPHRATAH, N. Y.—The Mohawk Electric Company has received authority from the Public Service Commission, Second District, to construct a hydroelectric power plant on Garoga Creek in Fulton County, and also to exercise rights and privileges under a franchise granted by the Town Board and superintendent of highways of the Town of Ephratah. A large portion of electricity generated at the plant will be sold to the Fulton County Gas & Electric Company, of Johnstown, N. Y.

FULTONVILLE, N. Y.—The Cayadutta Generating Company has been granted permission by the Public Service Commission, Second District, to take the rights and franchises granted by the Village of Fultonville and the Village of Fonda, to Adam Z. Wemple and J. S. Wilson for the construction and operation of electric lighting systems in both towns. The company is authorized to exercise its rights and privileges granted in the franchises and to construct and maintain conduits and [illegible] systems in the villages of Fonda and Fultonville. The company has been authorized to issue $30,000 in capital stock, the proceeds to be used for the purchase of the above property; also to execute a mortgage in favor of the Schenectady Trust Company to the amount of $30,000 to secure an issue of bonds of same amount, to be sold at not less than 90.

GLENS FALLS, N. Y.—The Public Service Commission, Second District, [illegible] the Mohawk Hydro-Electric Company to execute a

mortgage on its property and franchises to secure an issue of $3,000,000 in bonds, and to issue $675,000 in capital stock. The company is also authorized to issue $932,000 in bonds, secured by the above mortgage, to be sold at not less than 88, the proceeds to be used for payment of lands and water rights on the Peck and Garoga Lakes and along Garoga Creek, engineering fees, etc., and for construction of dams, pipe line, power house, machinery, and sundry organization expenses.

INDUSTRY, N. Y.—Bids will be received by Miss Lura E. Aldridge, president Board of Managers, of the State Agriculture & Industrial School, Industry, N. Y., until Aug. 9, for electric feeder cables, poles and transformers for the State Agricultural & Industrial School. Plans and specifications may be consulted and blank forms of proposal obtained at the State Agricultural & Industrial School, Industry, N. Y., and at the office of Franklin B. Ware, state architect, Albany, N. Y., where plans and specifications can also be secured.

NEW YORK, N. Y.—The contract for completing the electric equipment on school No. 101, Borough of Manhattan, contract for which had been declared abandoned, has been awarded to Cowden & DeYoung, 45 East Forty-second street, New York, N. Y., for $7,583. C. B. J. Snyder is superintendent of schools.

NEW YORK, N. Y—The Public Service Commission has granted the application of the Manhattan Bridge Three-Cent Line for a certificate of public convenience and necessity for an electric railway from a point near Atlantic Avenue and Flatbush, Brooklyn, to a point at or near the Desbrosses Street ferry, in Manhattan, by the way of the Manhattan Bridge.

NEW YORK, N. Y.—The New York Electric Lines Company has applied to Henry G. Thompson, commissioner of the Department of Water, Gas and Electricity, for permission to place its wires in the subways controlled by the Consolidated Electrical Company and the Empire Subway Company, which are owned by the city. The New York Electric Lines Company proposes to operate light, power, telephone and telegraph lines.

ROCHESTER, N. Y.—The Livingston-Niagara Power Company has applied to the Public Service Commission, Second District, for permission to begin construction and approval of the exercise of franchises held by the company in Livingston County; also for authority to execute a mortgage upon its properties for $350,000 to secure an issue of bonds of the same amount and to issue capital stock to the amount of $100,000.

HICKORY, N. C.—Announcement has been made by M. E. Thornton, president of the Thornton Light & Power Company, Hickory, N. C., that arrangements have been completed for financing its proposed hydroelectric power plant on the Catawba River, where 8000 hp will be developed for transmission. The company proposes to supply electricity for railways, lighting and industrial purposes.

BISMARCK, N. D.—The Hughes Electric Company is reported to be constructing a new electric plant, the equipment of which will include boilers with mechanical stokers, an 800-hp cross-compound engine and an electric generator.

FARGO, N. D.—At an election held July 6 the citizens voted to issue $35,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

AKRON, OHIO.—Preparations are being made by the Northern Ohio Traction & Light Company, of Akron, Ohio, for the construction of a new power plant in this city. Plans are now being prepared and it is expected that bids will be called for in the near future. The cost of the entire plant is estimated at about $2,000,000.

HAMILTON, OHIO.—Arrangements are being made by the Mosler Safe Company, of Hamilton, Ohio, for increasing the output of its power plant. The company has recently placed orders with the Allis-Chalmers Company, of Milwaukee, Wis., for a 200-kw, 240-volt, 425 r. p. m. generators.

ADA, OKLA.—The McKenna Construction Company, which is promoting the construction of an interurban Electric railway between St. Louis, Mo., and Oklahoma City, Okla., has secured water rights for a power plant at Ada, Okla. The proposed railway will be equipped with modern sleeper coaches.

PORTLAND, ORE.—The United Railways Company, of Portland, Ore., has awarded a contract to Porter Brothers for the construction of an electric railway from Burlington to [illegible], a distance of [illegible] miles. Contract for substation equipment was awarded to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa. The company is reported to have asked for bids for the construction of the railway from [illegible] to Bay City, [illegible] miles in length.

McCALL FERRY, PA.—It is reported that the Pennsylvania Water & Power Company is contemplating the duplication of its hydroelectric generating plant on the Susquehanna River at McCall Ferry, [illegible] view to doing away with the [illegible] auxiliary steam power plant.

NEW CASTLE, PA.—Plans are being considered by the New Castle, New Wilmington & Sharon Railway Company [illegible] electric railway to connect New Castle, New Wilmington, and West Middlesex, a distance of [illegible] miles. [illegible] is interested in the project.

SCRANTON, PA.—The Delaware, Lackawanna & Western Railroad Company has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for six [illegible]-kw, [illegible] phase, two 150-kw, three-phase and one 100-kw, single-phase, oil-filled, self-cooled transformers. The transformers will be installed in collieries and washeries at Scranton, Nanticoke and Taylor, Pa.

GREENVILLE, S. C.—The City Council has granted the Home Light & Power Company, of Greenville, S. C., a 30-year franchise in this city. A. E. Sussex is city clerk and treasurer.

HONEA PATH, S. C.—The City Council is reported to have engaged J. B. McCrary & Company, consulting engineers, of Atlanta, Ga., to make surveys and prepare plans for the construction of an electric light plant in Honea Path, S. C.

PIERRE, S. D.—Bids will be received by T. C. McNamee, clerk of the Board of Education, Pierre, S. D., until Aug. 8 for the construction of power house, installation of heating plant and plumbing; separate proposals for each. Plans and specifications for the above are on file at the office of the clerk of Board of Education, Pierre, S. D., and at the Builders' Exchanges in St. Paul and Minneapolis, Minn., and at the office of George Issenhuth, architect, Huron, S. D.

RAPID CITY, S. D.—Orders have recently been placed by the Dakota Power Company with the Allis-Chalmers Company, of Milwaukee, Wis., for three 100-kw and three 75-kw, oil-filled, self-cooled, 60-cycle, 20,000-2300-volt transformers.

KNOXVILLE, TENN.—Preparations are being made by the Knoxville Railway & Light Company for the construction of an extension to its power house, to cost about $7,000, work on which will commence in the near future. A 3000-kw turbine will be installed, contract for which has been placed.

PORT ARTHUR, TEX.—Two applications for franchises to construct an electric interurban railway between Port Arthur and Beaumont, a distance of about 25 miles, are under consideration by the Board of County Commissioners of Jefferson County. One application was submitted by H. J. Meyers, president of the Port Arthur Traction Company, and the other by I. D. Polk, of Beaumont, Tex.

SAN ANTONIO, TEX.—M. Bargas Company, of San Antonio, Tex., it is reported, would like to secure estimates on electrical equipment.

SNYDER, TEX.—The Snyder Ice, Light & Power Company is reported to have awarded a contract for construction of power house in connection with its ice plant.

SWEETWATER, TEX.—The Council has granted a franchise to C. M. McLain, G. E. Romsey and W. E. Barrow, all of the Sweetheart, Tex., to construct and operate a street railway in this city.

CISCO, UTAH.—Plans are being prepared by the Hampson-Fielding Engineering Company, of Denver, Col., for the construction of a power plant for the Grand Valley Fruit & Water Company, at Cisco, Utah. The proposed plant will cost about $300,000 and will furnish power and water for irrigation purposes.

PROVO, UTAH.—The Provo Electric Company has submitted a proposition to the City Council offering to sell its distributing system to the city for $100,000. The city recently voted to issue bonds to the amount of $110,000 for the construction of a municipal plant.

RUTLAND, VT.—The Rutland Railway, Light & Power Company has secured the entire right of way for its proposed extension from Fair Haven to Poultney.

CAPE CHARLES, VA.—The New York, Philadelphia & Norfolk Railroad Company has awarded the contract for power plant and other equipment for the new shops and roundhouse at Cape Charles, Va., to the B. F. Shaw Company, of Wilmington, Del.

FALLS CHURCH, VA.—We are informed that the Washington-Virginia Railway Company will commence work on the construction of its proposed electric railway to connect Washington, D. C., and Falls Church, Va. M. E. Church, of Falls Church, Va., is president and general manager.

PULASKI, VA.—The General Chemical Company has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for two 40-hp direct-current motors.

ELLENSBURG, WASH.—Water rights have been filed by the Cle Elum Falls Power Company with the county auditor appropriating 5000 cu. in. of water per second from the Cle Elum River, to be used for generating electricity. J. C. Donnelly, of Tacoma, Wash., is president of the company.

EVERETT, WASH.—The Robinson Manufacturing Company has contracted with the Allis-Chalmers Company, of Milwaukee, Wis., for a 155-kw, 480-volt, three-phase, 60-cycle, 900 r. p. m. alternator, one 60-hp, one 40-hp and one 20-hp, squirrel cage induction motors, which will be installed in the new plant now being constructed by the company.

LANGLEY, WASH.—The Whidby Island Telephone Company is reported to be considering plans for extensive improvements to its system.

PORT ORCHARD, WASH.—Joseph E. Wickstrom is reported to have been granted a water and light franchise in Port Orchard.

REPUBLIC, WASH.—It is reported that the North Washington Power Company, which owns and operates a power plant in Republic, has leased the plant in Oroville, Wash., and proposes to build a transmission line 45 miles in length to this town.

TACOMA, WASH.—Owing to the warrant plan of paying the contractors for work in connection with the construction of the proposed substation of the Nisqually power plant no bids were submitted July 5. The cost of the station is estimated at $95,000. It is said that the city [illegible]

WENATCHIE, WASH.—The Farmers Telephone Company is reported to be contemplating increasing its capital stock from $50,000 to $150,000.

WENATCHEE, WASH.—Notice of appropriation of 800 cu. ft. per second of water from the Wenatchee River and 3000 cu. ft. per second from Lake Wenatchee has been filed by J. M. Thatcher. The water is to be used for power purposes.

FLEMINGTON, W. VA.—The County Court has granted W. [illegible] Davidson and W. C. Wyckoff a franchise to construct and operate a street railway in the Town of Flemington, W. Va.

MORGANTOWN, W. VA.—Plans are being prepared for the construction of a concrete gravity dam across Deckers Creek, in connection with the power plant improvements to be made by the Union Utilities Company. H. R. Warfield is general manager of the company and V. F. Hammel, engineer in charge.

PETERSBURG, W. VA.—We are informed that the question of installing an electric light plant and water works system is not under consideration as was reported in these columns in the issue of June 23.

WELCH, W. VA.—The Davy-Pocahontas Coal Company, recently incorporated, is reported to have purchased 3400 acres of coal lands for development. The company, it is said, will install mining machinery, erect tipples, miners' dwellings and construct an electric power plant to supply electricity for lamps and motors, at a cost of about $125,000. The initial installation will provide for about 1000 tons daily, which will be increased to 3000 tons. As yet no contracts have been awarded. Walter L. Taylor is president. The Baltimore offices are located at 609 Continental Trust Building.

MELLEN, WIS.—Plans are being considered by the Mellen Water & Light Company for improvements and extensions to its system, which will involve an expenditure of about $30,000. If certain agreements are reached, for which negotiations are now under way, the company proposes to extend its mains, install additional pumps, sink wells for water and make other improvements, bids for which will be asked for in the near future. A. W. Pribnow is general manager.

MILWAUKEE, WIS.—The Phoenix Knitting Works is reported to be planning the erection of a six-story addition 80x120 ft. to its factory and a new power plant. It is understood that machinery, including a sprinkler system will be purchased in the near future.

WAUPUN, WIS.—Preparations are being made for remodeling and enlarging the municipal electric light plant, bids for which, it is said, are now being asked.

WAUPUN, WIS.—Arrangements are being made by the C. A. Shaler Company, of Waupun, Wis., for the construction of a factory building, which will be equipped for electric motor drive throughout. The company has not yet decided whether to install a power plant or purchase electricity from the municipal plant.

CALGARY, ALTA., CAN.—At an election to be held July 28 the by-law to appropriate $125,000 for the construction and equipment of a municipal power plant will be submitted to a vote.

LEDUC, ALTA., CAN.—The municipality is contemplating establishing an electric light and power service in Leduc. The city officials are negotiating with the City of Strathcona to supply electricity from its municipal plant for lamps and motors in this town.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company is reported to have awarded a contract for grading the extensions of its North Vancouver lines in the Capilona district to McAlpine Roberts & Company, of Vancouver, B. C.

GRAND FALLS, N. B., CAN.—It is reported that arrangements have been made between the Grand Falls Power Company and William Van Horne and others interested in the property by which the latter will take over the plant and holdings of the old company and develop the water power at the falls.

GALT, ONT., CAN.—Contracts have been awarded for the distributing station in connection with the Hydro-Electric Power Commission project to the Packard Electric Company, of Warren, Ohio., and the Canadian General Electric Company, for $9,104. The transmission line will be extended to Galt from the transformer station at Hespeler. The cost of installation of the incandescent street lighting system, together with the amount paid for the overhead distributing system purchased from the Galt Gas Light Company will make the total cost of installing the system for securing service from the Hydro-Electric Power Commission, about $25,000.

KENORA, ONT., CAN.—The Reese Engineering Company is reported to have acquired the property and holdings of the Kewatin Power Company. The new owners, it is said, propose to supply several municipalities in Manitoba with electrical power. It is understood that the City of Brandon contracted with the company for 2500 hp at $20 per hp per year, the service to commence December, 1911.

KINGSTON, ONT., CAN.—It is reported that the Seymour Power & Electric Company, of Campbellford, Ont., Can., has submitted an offer to supply electrical power in Kingston, at $25 per hp per year.

LONDON, ONT., CAN.—Sealed tenders will be received by the Board of Water Commissioners, London, Ont., Can., until July 29, as follows: Section "A"—Two 3,000,000-gal. turbine pumps, 250-ft. head, 750 r.p.m. Section "B"—Two 250-hp, 750 r.p.m., self-starting synchronous motors with direct-connected exciters. Section "C"—Two 350-kva, three-phase, 13,200-2300-volt, self-cooled transformers. Section "D"—Switchboard equipment for sections "B" and "C." Section "E"—Switchboard equipment for incoming and outgoing transmission lines, with lightning arresters, etc. Section "F"—One 25-kw, single-phase, self-cooled, 2300-110-volt lighting transformer. Frequency of all current 25 cycles. Form of tender, instructions to bidders, plans and specifications, may be obtained from O. Ellwood, secretary of Board of Water Commissioners, London, Ont., or from H. J. Glaubitz, consulting engineer, Continental Life Building, Toronto, Ont.

OTTAWA, ONT., CAN.—Sealed tenders will be received until July 26 for work required in connection with the Transcontinental Railway shops east of Winnipeg, Man., as follows: (1) Air, steam, water and oil piping system; (2) yard water system; (3) pipe tunnels and wiring ducts. Plans and specifications may be seen at the office of Gordon Grant, chief engineer of the Commissioners, at Ottawa, Ont., and the office of S. R. Poulin, District engineer, St. Boniface, Man., P. E. Ryan is secretary of the Commissioners of the Transcontinental Railway.

YORKTON, SASK., CAN.—A resolution has been passed by the Town Council authorizing the preparation of a by-law calling for an expenditure of $35,000 for a municipal electric light plant.

HOSTOTIPAQUILLO, JALISCO, MEX.—Plans are being considered by the Cinco Mines Company for the construction of an electric railway from its property, in this district, to the railroad shipping point at Magdalena. The proposed railway will run through the mountains and will afford transportation for other mines and industries of the district.

MEXICO CITY, MEX.—Preliminary steps have been taken during the last few months toward the installation of many hydroelectric power plants in different parts of the republic, for which a number of applications for government concession are now pending. Albert B. Fall has applied for a government concession to use 14,000 gal. of water per second from the Aros River in the Guerrero district, State of Chihuahua, to be utilized to generate electricity for use in mines. Plans have been prepared for the proposed hydroelectric power plant, work on which will begin as soon as the concession is granted. A concession has been asked for from the government by D. J. Spillane to use the water from the falls of the Hallinas River in the Santa Maria del Rio district, State of San Luis Potosi, to operate a hydroelectric power plant. Electricity generated at the plant will be transmitted to mining and industrial centers in that region. The La Cruz Mining & Milling Company has made application for a concession to use 314 gal. of water per second from the Navosaigame River, in the State of Chihuahua, the water power to be used to generate electricity to operate the machinery in the mines and mills of the company. Application has been made by M. Dahgren for permission to use 16,000 gal. of water per second from the Champayan Lagoon in the State of Tamaulipas to irrigate a large tract of land in his San Francisco hacienda. In many instances the applications are for power and irrigation projects combined.

MONTEREY, MICH., MEX.—Contracts have been placed by the Monterey Railway, Light & Power Company, with the Allis-Chalmers Company, of Milwaukee, Wis., for a 100-hp 220-volt, three-phase, 60-cycle, squirrel cage induction motor and three 50-kw transformers. The motor will be connected with one of the pumps which supply the water system. The Monterey company has a concession from the Mexican Government to supply the city with water and electricity.

QUERETARO, QUER., MEX.—The [illegible] Mining & Milling Company is constructing a hydroelectric plant near its mines in the Queretaro district. It is expected to develop about 400 hp, which will be used in the mines and reduction mill of the company.

TERLINGUA, MEX.—The Chisos Mining Company is installing an electric power plant at its quicksilver mines in this district. The plant will furnish electricity for lamps and motors for the camp.

New Industrial Companies.

THE BODERICK-BOLTE ELECTRICAL COMPANY, of East St. Louis, Ill., has been incorporated by F. B. Bolte, Charles F. Boderick and Charles Chartrand, all of East St. Louis, Ill. The company is capitalized at $15,000 and proposes to manufacture electric appliances.

THE COMBINATION TAIL LIGHT & ILLUMINATED AUTOMOBILE NUMBER CORPORATION, of Lewiston, Maine, has been incorporated with a capital stock of $150,000 to manufacture and sell patent automobile lights and all other electrical appliances. J. Addison Patron, of Winthrop, Mass., is president and treasurer.

THE ELECTRIC TIME RECORDER COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $15,000. The incorporators are: Louis S. Heile, Frank T. Milchrist and H. A. Dumas. The company proposes to manufacture electrical and mechanical devices.

THE GARVER TRACK LAYING COMPANY, of Urbana, Ill., has been chartered with a capital stock of $30,000 to construct steam and electric railways. Taylor Garver, the promoter of the company, is inventor of a track-laying machine operated by compressed air, which it is claimed is capable of laying four miles of track a day. Oliver W. Lamb, of Urbana, Ill., and Harry M. Grant, of Casey, Ill., are among the stockholders.

THE INNER GLOBE LAMP COMPANY, of Boston, Mass., has been chartered with a capital stock of $125,000 for the purpose of manufacturing and dealing in electrical supplies. [illegible] W. Hyde, of Boston, Mass.,

is president and S. Washburn, of Dorchester, Mass., is treasurer of the company.

THE JOHNSON & CAREY COMPANY has filed articles of incorporation with the Secretary of State, at Dover, Del. The company is capitalized at $200,000 and proposes to do a general engineering and construction business. The incorporators are: W. T. Carey, C. E. Malin, of St. Paul, Minn., and E. S. Johnson, Bettendorf, Ia.

THE LANCASTER MOTOR COMPANY, of Lancaster, N. Y., has been incorporated with a capital stock of $2,000 by George A. Davis, Frederick Howard, of Lancaster, N. Y., and Odell R. Blair, of Buffalo, N. Y. The company proposes to manufacture engines, motors, automobiles and accessories.

THE MOORE ELECTRICAL & AUTOMOBILE COMPANY, of Wilmington, Del., has been chartered with a capital stock of $50,000 by R. E. Moore, Edward R. Pusey and Enoch Moore, Jr., all of Wilmington, Del.

THE PORT CHESTER ELECTRIC COMPANY, of Port Chester, N. Y., has filed articles of incorporation with a capital stock of $2,500 for the purpose of doing a general contracting business. The incorporators are: Irving M. Austin, Frederick D. Austin and William A. Davidson, all of Port Chester, N. Y.

THE ROYERS-MYERS MANUFACTURING COMPANY, of Janesville, Ia., has been organized with a capital stock of $25,000 for the purpose of manufacturing gasoline engines, concrete mixers and tile machines.

THE SIEGEL MACHINE COMPANY, of New York, N. Y., has been incorporated by John Camein, 465 East 139th Street, Borough of Bronx, New York; S. Levin, 25 East Ninety-ninth Street, New York, N. Y., and Warren McConihe, 42 East Fifty-first Street, New York, N. Y. The company is capitalized at $5,000 and proposes to manufacture and repair engines, boilers and machinery.

THE SIMMS MAGNETO COMPANY, of New York, N. Y., has been incorporated with a capital stock of $1,000,000 to manufacture magnetos, etc., by V. D. Hecht, H. M. Kelbarn, A. Nathan, C. S. Guggenheimer and M. Stiefel, of New York, N. Y.

VANDEWATER & COMPANY, Ltd., of Elizabeth, N. J., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing internal combustion engines, steam engines, automobiles, etc. The incorporators are: J. Correja, of Iselin, N. J., and F. C. Vandewater, E. Vandewater and S. R. Vandewater, of Elizabeth, N. J.

THE WHITE SUPPLY COMPANY, of the Borough of Bronx, New York, N. Y., has been incorporated by John Doyle, Robert W. Tindall and John T. Clancy, all of New York, N. Y. The company is capitalized at $10,000 and proposes to deal in chandeliers, lamps, brackets, globes, etc.

THE W. M. P. MOTOR COMPANY, of New York, N. Y., has been chartered with a capital stock of $25,000 by L. R. Walton, F. D. Preston, of New York, N. Y., and L. R. Moody, of Bayside, N. Y. The company proposes to manufacture motors.

New Incorporations.

ROBERTSDALE, ALA.—Articles of incorporation have been filed for the Alabama Telephone & Telegraph Company with a capital stock of $5,000. The company proposes to operate a telephone system in Baldwin, Conecuh, Escambia, Monroe and Washington counties. The officers are: Ellis L. Munna, president; Spalding Peck, secretary and treasurer, and J. H. Haswell, general manager.

HELENA, ARK.—The Lake View Telephone Company has been chartered with a capital stock of $10,000 by S. Straub, E. M. Allen and others.

DOVER, DEL.—The Mexico & Toluca Light & Power Company has filed articles of incorporation with the Secretary of State with a capital stock of $5,000,000. The incorporators are: H. W. Davis, of Wilmington, Del.; W. S. Woodhull, of East Orange, N. J., and J. C. F. Hickey, of New York, N. Y.

BONIFAY, FLA.—Articles of incorporation have been filed for the Bonifay Telephone Company with a capital stock of $5,000. The officers are: Albert Jernigan, president; C. A. Prim, secretary and treasurer.

BOISE, IDAHO.—The Bear & Lick Creek Power Company has been incorporated, with a capital stock of $500,000 by S. D. Gosbert and others.

LAPORTE, IND.—The United Light & Railways Company has been organized to take over the property and holdings of the Laporte Gas Light Company and the Laporte Electric Company and six other public corporations, the controlling interests of which are owned by the Childs-Hulswith syndicate. The company will act as a holding company, and companies in the merger will be operated separately. Frank T. Hulswit is president of the company; Richard Schaddell, first vice-president; Ralph S. Childs, second vice-president and Benjamin C. Robinson, secretary and treasurer.

OXFORD, IND.—Articles of incorporation have been filed by the Oxford Telephone Company with a capital stock of $25,000. The company proposes to construct and operate a telephone system in Oxford and Benson counties. The incorporators are: Joseph W. McConnell, William McConnell and William D. McConnell.

PITTSBORO, IND.—The Home Telephone Company, of Pittsboro, has been incorporated with a capital stock of $3,000 for the purpose of constructing and operating a telephone system in Pittsboro and extending its lines throughout Park County. The directors are: J. D. Gentry, J. F. Leonard, W. E. Beaman, W. M. Dillon and C. O. Suber.

REDKEY, IND.—The Redkey Electric Company has been incorporated with a capital stock of $10,000 for the purpose of generating and transmitting electricity for lamps, heat and motors. The directors are: R. E. Breed, H. L. Finley and Frank B. Ball, all of New York, N. Y. The principal office of the company will be located in Muncie and the place of business will be in Redkey.

LAKE CHARLES, LA.—The North Calcasieu Telephone Company has been granted a charter with a capital stock of $10,000. The officers of the company are: W. B. Welborn, Jr., president; M. A. Shirley, vice-president; C. M. Green, secretary, and S. J. Andrews, treasurer.

PORTLAND, MAINE.—The Brunswick Power Company has been granted a charter with a capital stock of $750,000 for the purpose of doing a lighting and power business. The directors are: Arthur S. Bosworth, treasurer; Frederick O. Conant, Ernest J. Eddy, George F. West, Constant Southworth, and William D. Sewall.

BRIDGEMAN, MINN.—The May Northern Telephone Company has been chartered with a capital stock of $10,000 by F. D. Newkirk, John C. Martin, E. Dalley and J. M. Schmit. John C. Martin is president of the company.

HAVRE, MONT.—Articles of incorporation have been filed for the Havre Electric, Steam Heat & Telephone Company with a capital stock of $200,000 by C. C. Swinbourne and others.

CAMDEN, N. J.—The Carbon Electric Company has been granted a charter with a capital stock of $500,000 for the purpose of manufacturing coal, coke, gas and oil; also generating electricity for lamps and heat. The incorporators are: Charles L. Walton, Walter L. Bowen and H. G. H. Tarr, all of 419 Market Street, Newark, N. J.

JERSEY CITY, N. J.—Articles of incorporation have been filed for the East Jersey Light & Power Company by A. Foulds, of Passaic, N. J.; A. W. Bailey and C. E. Robertson, of New York, N. Y. The company is capitalized at $1,500,000 and proposes to operate light and power plants.

ARKVILLE, N. Y.—The Arkville Home Telephone Company has been incorporated with a capital stock of $1,000 by H. Eugene Genung, Ella Genung, Scudder T. Whipple, all of Arkville, N. Y.

COLDEN, N. Y.—The Colden-West Falls Telephone Company has filed articles of incorporation with a capital stock of $1,500 to erect a telephone line between Colden and West Falls and in the towns of Aurora, Hamburg and Boston.

SILER CITY, N. C.—The Vonlee Telephone Company has been incorporated by J. Wade Siler, C. N. Bray and others. The company is capitalized at $10,000.

MEDINA, OHIO.—The Medina County People's Telephone Company has been granted a charter with a capital stock of $50,000. The incorporators are: C. P. Dickerman, M. E. Branch, Charles Maythem, C. E. Jones and S. W. Batchtell.

CARMAN, TEX.—The Eagle Chief Telephone Company has been charactered with a capital stock of $1,000 by R. M. Johnson, S. Terrell, of Carmen, Tex., and A. T. Whitworth, of Augusta, Tex.

GORDON, TEX.—Articles of incorporation have been filed for the Gordon Water, Light & Ice Company by J. J. Rice and others.

PLEASANTON, TEX.—The Bexar-Atascosa Telephone Company has been formed with a capital stock of $3,000 to erect a telephone line from Pleasanton to San Antonio, Tex.

TOPPENISH, WASH.—The Toppenish Light, Cold Storage & Central Heating Corporation has been organized by A. H. Campbell, of the Reservation Electric Light Company and others. The company proposes to construct electric, ice and central heating plants.

Personal.

MADAME CURIE has been awarded the Albert medal of the (British) Royal Society of Arts for the discovery of radium.

SIR WILLIAM RAMSAY has been elected a foreign associate of the Paris Academy of Science to fill the vacancy caused by the death of Alexander Agassiz.

MR. VALLETTE L. BENEDICT, of the Los Angeles office of the General Electric Company, has resigned to become manager of the Los Angeles Fire Alarm Company.

MR. WILLIAM R. WIL[illegible] of the New York Public Service Commission, left New York [illegible] July 24, to spend several weeks abroad.

MR. W. R. REYNOLDS, chief electrician of the Municipal Water, Light & Heat Plant, of St. Marys, Ontario, Canada, has been appointed manager of the municipal electric plant at Ingersoll, Ontario.

DR. JOHN F. KELLY, on the recommendation of the Franklin Institute, has been awarded by the City of Philadelphia the John Scott medal in recognition of his inventions and improvements in piano players.

PROF. JOHN H. [illegible] professor of electrical

[illegible] School of Technology, Potsdam, N. Y., in order to accept the appointment of lecturer in electrical and mechanical engineering at the University of Manitoba, Winnipeg, Can.

MR. T. THORNE BAKER, of London, England, who lectured before the New York Electrical Society on May 11, 1910, has been awarded a silver medal by the British Society of Arts for a paper on the subject of photo-telegraphy, which covered the same ground as his New York lecture.

MR. F. W. WEBSTER, general manager of the Stockton (Cal.) Electric Railway Company, has been appointed general manager of the Fresno (Cal.) Traction Company, to succeed Mr. A. G. Wishon, who will devote his time to the management of the San Joaquin Light & Power Company and the Fresno City Water Company.

MR. OCTAVE CHANUTE, the Chicago consulting engineer, who was recently removed from Carlsbad to the American Hospital at Paris, suffering from bronchial pneumonia, is reported to be improving. Mr. Chanute has been traveling in Europe studying the design and manipulation of air craft there, a science to the development of which his own investigations have perhaps been the most important contributions.

MR. VICTOR H. TOUSLEY has been appointed chief inspector in charge of the Bureau of Inspection of the Department of Electricity of the city of Chicago. Mr. Tousley has served 12 years in the office of which he is now head, having acted for the last five years as assistant to the late chief inspector, Mr. George D. Bayle. Mr. Tousley's promotion was won as the result of civil service examination in which he made the highest mark among a number of contestants.

MR. HENRY B. OTIS, who has been identified with the electrical industries of Chicago since 1899, has entered the firm of Charles G. Rush & Co., electrical dealers and contractors, Chicago, and will devote his attention to the power-apparatus department. Mr. Otis was connected with the dynamo testing department of the Western Electric Company from 1899 to 1905, becoming Chicago manager for the Cutter Company of Philadelphia in the latter year. Recently he has been engaged in work for the contract department of the Sanitary District.

MR. SYLVESTER S. HOWELL has become associated with Mr. Paul M. Chamberlain, engineer, Marquette Building, Chicago, under the firm name of Chamberlain & Howell. The new firm will carry on the designing and consulting engineer practice established by Mr. Chamberlain. Mr. Howell received his collegiate education at Iowa State College, and since 1887 has given his attention to engineering work. He has had a wide experience in connection with electrical and mechanical installations, resigning a position wth the Underfeed Stoker Company of America to form his present connection.

MR. J. F. JONES has been appointed by the Wagner Electric Manufacturing Company, of St. Louis, in charge of an office just established by that company in Birmingham, Ala. Mr. Jones was graduated in 1901 from the Alabama Polytechnic Institute with the degree of E.E. and M.E., and immediately thereafter entered the employ of the General Electric Company, of Schenectady, where he worked his way successfully through the testing and inspection departments and finally specialized in the transformer sales department. In November, 1905, he engaged with the Fort Wayne Electric Works, with which he remained in various offices until February, 1909, when he resigned, to take a responsible position in the home office of the Wagner Electric Manufacturing Company, of St. Louis.

Mr. J. F. Jones

MR. L. R. POMEROY has been appointed chief engineer of the railway and industrial division of J. G. White & Company, Incorporated. Mr. Pomeroy was from 1874 to 1880 engaged in commercial business, special auditing, drafting and designing of cars and locomotives. From 1880 to 1886 he was secretary and treasurer of the Suburban Rapid Transit Company, of New York. For four years following this, he was a special representative of the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in the same work with the Cambria Steel Company and the Latrobe Steel Company, jointly, this assignment in-involving metallurgical engineering and experimental research to adapt special steels for railway axles, crank pins and piston rods. From 1899 to 1902 he was assistant general manager of the Schenectady Locomotive Works. For six years following this he was a special representative in the railway field for the General Electric Company, this work covering the electrification of steam roads, railway shops, and the general application of electricity for all railway purposes. For the past two years he has been assistant to the president of the Safety Car Heating & Lighting Company. In these lines of work Mr. Pomeroy has devoted a large portion of his time to consulting work in the special field of railway shops, machine tool operation and the adaption of tools to the work, [illegible]

Obituary.

MR. WILLIAM McINNES, who claimed to have been the inventor of the [illegible] annunciator, died at Belvidere, N. J., on July 11, at the age of 80. Mr. McInnes was for many years a telegraph operator in the employ of the Western Union Telegraph Company.

MR. JAMES BIGLER, who in 1879 organized the Newburgh (N. Y.) Telephone Company and, with the Western Union Telegraph Company, owned most of its stock, died in Newburgh on July 16, aged 92 years. For some years he was president of the Hudson River Telephone Company, which laid the first telephone cable under the Hudson River.

MR. ALBERT E. SILK, manager of the Chicago office and store of the Jewell Belting Company, of Hartford, Conn., died suddenly in Detroit on July 12 and was buried in that city two days later. Mr Silk, who was 50 years of age, had been with the Jewell company for a number of years, and he had an exceptionally wide acquaintance in the belting trade. His wife survives him.

MR. ALOIS MIRCHING, who assisted in the development of a stock quotation ticker while superintendent of the early electrical apparatus manufacturing firm established by Mr. Charles T. Chester, died in Brooklyn, N. Y., on July 14. Mr. Mirching was born in Vienna 78 years ago. He came to New York when 17 years old and took up the study of electrical subjects when electrical engineering was in its infancy. He is survived by four sons and four daughters.

DR. MIHRAN K. KASSABIAN, a physician and surgeon who spent the last few years experimenting with X-ray apparatus, died in Philadelphia on July 11 as a result of the burns received during his experiments. Dr. Kassabian was born in Asia Minor in 1868 and was educated in a missionary school in Argens, where he afterward taught the school. He came to this country in 1894 and entered the Medico-Chirurgical College. His studies were interrupted while he was serving his adopted country in the hospital corps during the Spanish War. On his return from the war he received his diploma and was appointed instructor in electro-therapeutics and skiagrapher in the Medico-Chirurgical College. In 1902 he resigned that position and was appointed director of the Roentgen Ray Laboratory and lectured on the Roentgen ray in the Philadelphia General Hospital. He published in 1907 a book that has been used as a college text, being now in its second edition. Dr. Kassabian had been delegate to international congresses of X-ray operators in many parts of the world. His papers on the subject are numerous, and in none of them does he refer in any way to the dangers of X-ray experimentation. In 1902 his hands were constantly burned, but he adhered to his purpose to improve the system and to wring from it the still hidden benefits. Two years ago two fingers of his left hand were amputated because the cancerous malady produced by the burns had spread through them. The operation had no effect to check the progress of the malady. About a year ago several glands were removed from the left arm pit, but this operation also failed to stop the disease. Last month the pectoral muscles were removed from his chest, and he had been out of the hospital only two weeks when he went back to die.

Trade Publications.

ELECTRIC IRONS.—The American Electric Heater Company, Detroit, Mich., is distributing mailing folders devoted to heating devices with special notice of electric irons.

CIRCUIT BREAKERS.—The Cutter Company, Philadelphia, Pa., has issued in book form a well-prepared treatise on circuit breakers for protecting all kinds of electric circuits.

SIGN FLASHERS.—The Reynolds Electric Flasher Manufacturing Company, 191 Fifth Avenue, Chicago, Ill., has issued bulletin No. 11 with a supplement relating to electric sign flashers.

ICE MACHINERY.—A neatly executed bulletin of the Carbondale Machine Company, Carbondale, Pa., deals with machinery for making ice by means of the exhaust steam from power plants.

FEED-WATER HEATERS.—The Whitloch Coil Pipe Company, Hartford, Conn., has issued a 78-page loose-leaf catalogue covering feed-water heaters, exhaust heads, separators and other steam-heating specialties.

POLYPHASE INDUCTION MOTORS.—A line of induction motors ranging in power from 316 hp to 200 hp is described and illustrated in a bulletin recently issued by the Lincoln Electric Company, Cleveland, Ohio.

TIME SWITCHES.—The Williams Time Switch Company, 47 John Street, New York, has issued a folder devoted to time switches designed for automatically controlling the time of use of any desired electric service.

LIFTING MAGNETS.—The Cutler-Hammer Clutch Company, Milwaukee, Wis., has issued a folder relating to lifting magnets, the details of which are well shown in a cross-sectional view which is fully explained.

PUMPS.—Electric motor-driven twin-volute turbine pumps for house tank and similar service are illustrated and described in mailing folders being distributed by the Watson-Stillman Company, 50 Church Street, New York.

INDUCTION MOTORS.—Bulletin No. 600 of the Sprague Electric Company, 527 West 34th Street, New York, gives much interesting data relating to induction motors of the single-phase, polyphase and commutator types.

OIL ENGINES.—Mirrless, Bickerton & Day, 225 Gresham House, Old Broad Street, London, England, have issued an illustrated bulletin dealing with Diesel oil engines, which are stated to consume not over 0.5 lb. of oil per hp-hour.

VIBRATORS.—Motor-driven vibrators, massage machines, hair dryers, centrifugal machines and therapeutic appliances are illustrated, described and listed in a bulletin issued by the Shelton Electric Company, 105 West 42d Street, New York.

MAGNETO-GENERATORS.—Bulletin No. 157B, of the Holtzer-Cabot Electric Company, Brookline, Mass., gives much detailed information relating to magneto-generators and spark-coils for use with marine, stationary and automobile engines.

COMBUSTION RECORDER.—Automatic devices for recording the amount of carbon dioxide present in flue gases are well discussed in an illustrated bulletin issued by the Precision Instrument Company, 49 Larned Street West, Detroit, Mich.

RAILWAY MATERIAL.—Catalogue No. 10, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., is a 200-page publication in which are listed and described all varieties of direct suspension line material for low-voltage railways.

PRESSURE RECORDERS.—The Precision Instrument Company, 49 Larned Street West, Detroit, Mich., is distributing bulletins devoted to Wright pressure and vacuum recorders and indicators for showing the condition of supply of steam, gas, water or air.

PORTABLE LAMPS.—In its general catalogue, the McKenna Brass Company, First Avenue and Ross Street, Pittsburgh, Pa., are shown portable electric lamp desk stands, electric wall and desk fixtures with sliding lamps and stationary electric lamp desk stands.

ELECTRICAL TESTING SETS.—Circular No. 510 of the Thompson-Levering Company, 244 Arch Street, Philadelphia, Pa., describes in detail switch-dial and testing sets designed for making measurements of resistance, voltage and current, and locating faults in cable circuits.

STEAM TRAPS.—Bulletin No. 267 of the American Blower Company, Detroit, Mich., deals with traps which are said to be applicable anywhere that steam is used, for whatever purpose, and can be used for draining any system on which a pot float or bucket trap is now, or would be, used.

ELECTRICAL SPECIALTIES.—The Fairmont Electric & Manufacturing Company, Philadelphia, Pa., has issued a perpetual loose-leaf catalogue dealing with pot-heads, arc-lamp hangers, conduit fittings, electrolier fittings, ground clamps and test connectors, which are illustrated, described and listed.

INSULATING VARNISHES.—The Sterling Varnish Company, Pittsburg, Pa., has issued a catalogue devoted to elastic and extra elastic insulating varnishes. It is also distributing samples of cloth covered with varnish which is said to withstand a temperature of 212 deg. Fahr. without being affected.

PRECISION INSTRUMENTS.—James G. Biddle, 1114 Chestnut Street, Philadelphia, has recently issued a 16-page bulletin (No. 735) which describes a new type of precision indicating wattmeter, as well as precision current and potential transformers. These instruments are made by Siemens & Halske, of Berlin.

RECORDING INSTRUMENTS.—The Bristol Company, Waterbury, Conn., has issued as a neatly executed 64-page bulletin an illustrated index of recording instruments. The publication is not a catalogue but rather a set of illustrations of the most important models of instruments for recording pressure, temperature, current, voltage, power or time of mechanical movements.

DISTRIBUTING APPARATUS.—Under the title "Electrical Distributing Apparatus," the J. Lang Electric Company, of 421-429 Lincoln Street, Chicago, issues its general catalogue No. 810. Knife switches, fuses, plugs and receptacles, floor boxes, panel boards, cabinets, switchboard panels, and other fittings are illustrated and described. Prices are given, and the catalogue makes an attractive book [illegible].

BELT DRIVEN ALTERNATORS.—Bulletin No. [illegible] of the General Electric Company describes three sizes of polyphase, 60-cycle generators for use in small isolated plants. These generators are of the belt-driven revolving-armature type, and are designed for service at any power factor between 0.8 and 1.0. They range in rating from 7.5 kw to 25 kw and are designed for 120 volts, 240 volts, 480 volts and 600 volts.

TELEPHONE POWER PLANTS.—Bulletin No. 1008, describing telephone power plant equipments for non-multiple switchboards, has been issued by the Western Electric Company. It contains 24 pages and is illustrated with many diagrams and cuts. This bulletin presents some features of apparatus designed especially for telephone plants. The subject matter covers only such apparatus as is required for non-multiple switchboards up to 800 lines.

ELECTRICAL HARDWARE.—In a bulletin entitled "House Goods" the Western Electric Company lists a complete line of electrical apparatus used for convenience in modern buildings. Among the items are annunciators; bells and buzzers; burglar alarms, with a dozen types of springs to fit windows, transoms, doors, etc.; heating devices, including chafing dishes, percolators, electric irons, warming pads, curling iron heaters; fire alarm thermostats; dozens of types of lighting fixtures; medical batteries; push buttons, in all the different forms and finishes, arranged for ringing one or many different bells; electric massage vibrators; watchmen's registering systems; door switches for automatically lighting a lamp when a door is opened; convenient lamp holders with adjustable cord for taking an electric lamp into a closet or other places not regularly lighted; washing machines; vacuum cleaners; sewing machine motors; inter-phones, or private line telephones for room-to-room or house-to-garage communication.

BUSINESS NOTES.

THE PACIFIC STATES ELECTRIC COMPANY has opened an office in Portland, Ore., where a complete stock of electrical supplies, instruments and apparatus will be carried.

THE WRIGHT WRENCH MANUFACTURING COMPANY, Canton, Ohio., has changed its name to The Wright Wrench & Forging Company. This company has just moved into its large new factory covering several acres of ground, which gives ample room for its fast growing business. Its plant includes a forging department and it is prepared to take care of a general forging business in addition to the manufacture of quick adjustable wrenches.

CIRCUIT-BREAKERS FOR CHICAGO TERMINAL POWER HOUSE.—The Cutter Electric & Manufacturing Company, through its Chicago office, recently closed a contract for the circuit-breakers for the Chicago & Northwestern Railway Company's terminal power house in Chicago. The equipment, as specified by Pierce, Richardson & Neiler, consulting engineers, is composed of I-T-E motor-operated remote-control circuit-breakers and switches for the protection of the engine, turbine and motor-driven generators. This apparatus is so constructed that, whether being operated electrically from the control board or manually at the breaker, it cannot be held closed against an overload or reversal of current, and is equipped with direct-acting inverse-time-limit "Dalite" devices throughout.

NEW SHOP FOR GREEN FUEL ECONOMIZER.—The Berlin Construction Company has received the contract for rebuilding the fan shop of the Green Fuel Economizer Company, at Matteawan, N. Y., which was almost totally destroyed by fire some weeks ago. It is expected to have the new building erected and complete, ready for occupancy, about the middle of August. The new shop will have about 25 per cent more floor space than the old shop, including a test room fully equipped with chambers, gages, etc., suitable for making exhaustive tests on the capacity, pressure and efficiency of the improved fans built by this concern for heating and ventilating, mechanical draft, and other services. The new building will be of steel construction throughout, and will be heated by the hot-blast system, with frequent outlets near the floor to secure uniform distribution of the heat. This system has been applied by the Green Fuel Economizer Company with great success in several buildings that were peculiarly difficult to heat, such, for instance, as the new foundry of the Waterbury Castings Company, where [illegible]

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY [illegible]

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

963,735. ELECTRIC SWITCHING DEVICE; [illegible], [illegible], Pa. App. filed April 10, 1908. [illegible] by an electric motor controlled by a switch [illegible].

963,736. ELECTRIC ARC LAMP; T. E. Adams, Cleveland, Ohio. App. filed July 14, 1909. An electrode [illegible] of members parallel with the axis of the electrode and projections spaced apart and connecting said member.

963,745. PROCESS OF MAKING INCANDESCENT ELECTRIC LAMP FILAMENTS; W. G. Clark, New York, N. Y. App. filed April 5, 1906. Coats a filament with silica.

963,755. MOTOR SADDLE; H. W. Forslund, Chicago, Ill. App. filed Dec. 14, 19[illegible]. Electric hoist for elevators in which the motor is suspended from the ceiling by a particular form of saddle.

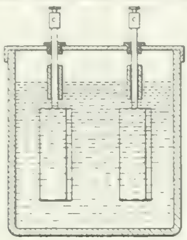
963,762. PROTECTIVE DEVICE FOR ELECTRIC APPARATUS; F. W. Harris, Wilkinsburg, Pa. App. filed May 6, 1907. A thermostat in spiral form for protecting electric circuits.

963,763. ELECTRIC THERMOSTAT; F. W. Harris, Wilkinsburg, Pa. App. filed May 6, 1907. A thermostat in spiral form with magnetizable plates between and at the outer sides of the spiral and an armature of magnetic metal perpendicular to the plates.

963,764. ELECTRIC CIRCUIT INTERRUPTER; F. W. Harris, Wilkinsburg, Pa. App. filed May 6, 1907. Spiral thermostat to act on a latch to open the switch which controls an electric circuit.

963,809. PROTECTIVE DEVICE FOR ELECTRODES; Theodore Sahrig, Berlin, Germany. App. filed Sept. 25, 1906. Protector for aluminum cells in which the covering for the electrode extends below the fluid level and is composed of rigid material which resists the chemical effect of the electrolyte.

963,817. DIPPING MECHANISM FOR ELECTROPLATING APPARATUS; J. H. Shaw, New Haven, Conn. App. filed May 3, [illegible]



963,809—Protective Device for Electrode[illegible]

A rotary carrier supporting a work holder which when rotated raises or lowers the holder.

963,825. LIMIT SWITCH FOR MOTOR OPERATED DEVICES; H. A. Steen, Pittsburgh, Pa. App. filed Dec. 2, 1909. Includes a shaft, a sleeve rotatable thereon carrying contact fingers and rotated by a spring and a latch for holding the sleeve.

963,830. LIGHTNING ROD CONSTRUCTION; T. Thompson, Burlington, Iowa. App. filed April 20, 1910. A conductor with a tubular member and an angular tube and a coupling connecting it to the conductor.

963,843. SIGNALING APPARATUS; G. M. Willis, Chicago, Ill. App. filed Jan. 10, 1908. Watchmen's signal, including a make-and-break mechanism for causing a code signal controlled by a key to be sent over the line.

963,846. INSULATED JOINT; G. Wright, Schenectady, N. Y. App. filed Feb. 2, 1910. Joints for gas pipes and electric fixtures consisting of two nipples with square flanges and an interposed sheet of insulation.

963,852. GALVANIC BATTERY; S. Benko, Budapest, Austria-Hungary. App. filed Jan. 19, 1909. Operates batteries by passing the electrolyte containing a depolarizing gas through the pores of a negative electrode by creating alternately a pressure and then a vacuum on one side of the electrode.

963,859. CIRCUIT BREAKER; E. A. Burrows, Chicago, Ill., and F. P. McIntosh, Elkhart, Ind. App. filed April 9, 1906. High-potential switch immersed in oil operated by a solenoid controlled by a push-button.

963,865. PANTOGRAPH TROLLEY; F. E. Case, Schenectady, N. Y. App. filed Feb. 25, 1909. Has pivoted standards carrying a traveling contact and raised by springs.

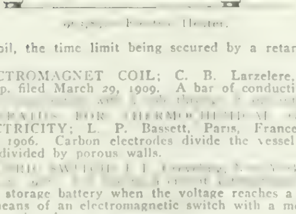
963,867. ELECTRIC-CONTROL SYSTEM; W. M. Chubb, San Francisco, Cal. App. filed July 12, 1909. For controlling motors by means of a divided circuit containing a resistance which actuates a solenoid and an iron core moved by the solenoid to cause a contact point to move to a point of like potential in the circuit.

963,872. LAMP FILAMENT; W. D. Coolidge, Schenectady, N. Y. App. filed Aug. 1, 1906. Colloid of a low melting metal incorporated with a refractory powder.

963,879. JUNCTION BOX; J. R. Duff, New York, N. Y. App. filed Nov. 13, 1906. Has a ring-shaped electric terminal connecting member and star-shaped connecting member supported on the ring member.

963,892. ELECTRIC HEATER; C. D. Haskins, Schenectady, N. Y. App. filed June 23, 1909. The heating surface is softened by the heat developed in the heater.

963,897. TIME LIMIT RELAY; E. H. Jacobs, Schenectady, N. Y. App. filed Feb. 23, 1909. A tripping member such as a latch of a circuit breaker is struck a hammer blow by the core of a solenoid



963,892—Electric Heater.

overload coil, the time limit being secured by a retarder such as a bellows.

963,907. ELECTROMAGNET COIL; C. B. Larzelere, Schenectady, N. Y. App. filed March 29, 1909. A bar of conducting material of [illegible]

[illegible]. APPARATUS FOR THERMOELECTRIC GENERATION OF ELECTRICITY; L. P. Bassett, Paris, France. App. filed March 26, 1906. Carbon electrodes divide the vessel into compartments, subdivided by porous walls.

[illegible]. ELECTRIC SWITCH; [illegible], New York, N. Y. App. filed March [illegible] between generator and storage battery when the voltage reaches a predetermined point by means of an electromagnetic switch with a movable member of low magnetic reluctance.

964,015. ELECTRICITY MEASURING INSTRUMENT; J. Gorner, [illegible] Main, Germany. App. filed [illegible] 31, 1906. For alternating currents with a shunt in series, electromagnet for producing a shifting field and a choking circuit cooperating with the series magnet.

964,033. GENERATOR APPARATUS; O. M. Leich, Genoa, Ill. App. filed June 19, 1908. Magneto generator in which foucault currents are prevented by means of a slotted armature.

964,037. CONTROLLING MEANS FOR ELECTRIC CIRCUITS; J. K. Lux, Jersey City, N. J. App. filed Sept. 2, 1909. Single pole snap switch with a torsional spring with means for releasing the movable contact after the spring has been put under tension.

964,086. FIRE-ALARM SYSTEM; W. Carroll, Chicago, Ill. App. filed Feb. 11, 1909. Trouble on the line will not produce a false alarm and the signal box in any room communicates an alarm to central and indicates the room in which the fire is located.

964,096. PROCESS OF ELECTROPLATING; Thomas A. Edison, Llewellyn Park, Orange, N. J. App. filed March 19, 1906. Chlorinates copper sulphate solution and adds to a copper plating bath as the chlorin becomes exhausted by reaction with the hydrogen on the cathode.

964,145. MICROPHONIC TRANSMITTER; C. L. Chisholm, Marysville, New Brunswick, Canada. App. filed Aug. 5, 1908. A carbon diaphragm metal plated on its edge.

964,169. CURRENT INTERRUPTING DEVICE; O. M. Leich, Genoa, Ill. App. filed June 19, 1908. Form high-frequency currents produced by an induction coil with a make-and-break apparatus connected with a condenser circuit.

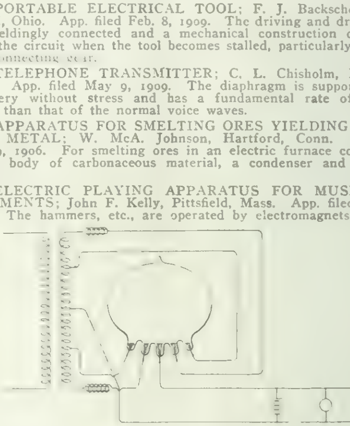
964,171. CIGAR TIP CUTTER AND LIGHTER; H. F. Lichty, Creston, Iowa. App. filed Aug. 16, 1909. A pivoted lamp supporting standard carrying a contact for co-operation with the first-mentioned contact and a movable operating member for communicating motion to the standard, with co-operating contacts carried by the standard and the operating member so as to automatically light the cigar-igniting lamp when the cigar is cut.

964,197. PORTABLE ELECTRICAL TOOL; F. J. Backscheider, Cincinnati, Ohio. App. filed Feb. 8, 1909. The driving and driven shafts are yieldingly connected and a mechanical construction operates to break the circuit when the tool becomes stalled, particularly by means of a connecting gear.

964,214. TELEPHONE TRANSMITTER; C. L. Chisholm, Marysville, N. Y. App. filed May 9, 1909. The diaphragm is supported on its periphery without stress and has a fundamental rate of vibration higher than that of the normal voice waves.

964,268. APPARATUS FOR SMELTING ORES YIELDING A VOLATILE METAL; W. McA. Johnson, Hartford, Conn. App. filed Nov. 9, 1906. For smelting ores in an electric furnace containing a porous body of carbonaceous material, a condenser and ring electrodes.

964,274. ELECTRIC PLAYING APPARATUS FOR MUSICAL INSTRUMENTS; John F. Kelly, Pittsfield, Mass. App. filed Sept. 14, [illegible] The hammers, etc., are operated by electromagnets controlled



964,336—Means for Maintaining Vapor Converters in Operation.

by a perforated record sheet and the loudness of the tones is varied by changing the tunes of the magnet winding.

964,281. ELECTRIC LAMP HOLDING SOCKET; H. Wallace Lawrence, Denver, Col. App. filed July 16, 1909. Details in the construction of a lamp socket.

964,297. LIGHTNING ROD UPRIGHT; G. J. Moore, Maryville, Mo. App. filed Feb. 10, 1910. The lower end has a loop to receive the rod and the upper end is tapered to provide a point.

964,312. VIBRATOR; A. Pfanstiehl, Highland Park, Ill. App. filed Feb. 1, 1910. Current interrupter for induction coils with a stationary anvil plate, a vibratory ring carrying an armature and a plate having a sliding adjustment on its base for adjusting a tension spring.

964,336. MEANS FOR MAINTAINING VAPOR CONVERTERS IN OPERATION; P. H. Thomas, East Orange, N. J. App. filed Dec. 24, 1903. For charging storage batteries in which the converter has a plurality of main positive electrodes, a plurality of auxiliary positive electrodes, a common negative electrode and a source of accelerated electromotive force.

964,343. ROTARY FIELD MAGNET; E. Volkers, Berlin, Germany. App. filed April 2, 1909. A rotary field magnet including a number of permanent magnets of spiral shape.

964,376. INSULATOR SUPPORT; J. Blackburn, Kirkwood, Mo. App. filed July 17, 1909. A pin, a base at right angles thereto, jaws embracing a crossarm and engaging the base, the jaws being secured to the crossarm.

964,418. ELECTROMAGNETIC CIRCUIT CONTROLLER; H. G. Geissinger, New York, N. Y. App. filed Dec. 23, 1909. For motor starters and the like in which an electromagnet has an armature and energizing coils for lifting and retaining the armature respectively, the lifting coil being in series with the translating mechanism and the retaining coil between the main conductors.

964,459. MANUFACTURE OF METALLIC SILICIDES; G. Strauss, Paris, France. App. filed April 16, 1908, and Oct. 26, 1909. Heats calcium carbide with silica in an electric arc.

964,474. MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS; D. J. O'Brien, San Francisco, Cal. App. filed July 22, 1904. For making tube lamps by preparing the tube for exhaustion, glanding the tube, inserting the filament and anchoring the ends to the glands, capping the glands and fitting them for connection to an electric circuit, and then exhausting the air and sealing the tube.

13,130. (Reissue.) TELEGRAPHIC TRANSMITTER; P. Dinger, Cleveland, Ohio. App. filed May 17, 1909. A vibrator transmitting dots and a short lever pivoted adjacent thereto, a spring checking it, dash contacts and a key lever controlling the lever and contacts.

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THE ENGINEERING SOCIETIES AND THE METRIC SYSTEM.

Many engineers complain concerning the slow progress made by the English-speaking peoples in the adoption and use of the metric system in the regular work of life. Every year finds the limits of that system more clearly defined, with the English-speaking peoples as the sole civilized supporters of an archaic medley of weights and measures that arouses both surprise and amusement in the minds of the non-English-speaking peoples. With no other possession are the English-speaking peoples in such complete isolation among the civilized inhabitants of the globe. In formulating vain regrets, however, concerning the tardiness of progress from time-honored national complexity toward international simplicity of measures, we are apt to forget that the blame is shared individually by all of us, and that no individual can escape his own personal share. Measures and measurements are not inherent in Nature, or meted out to us by our environment. They are the attributes and activities of men. As in the power of language, so in the power of measures, it is the use by individuals which constitutes authority. If we are ever to induce a change on the part of the many in either, a beginning must be made in that change on the part of a few. If no one begins, the rate of change necessarily remains zero.

Certain steps have lately been taken toward progress in this direction. It has recently been determined and officially announced by the American Electrochemical Society that, in future, all papers read before that body and containing expressions in English measure must have the corresponding metric values, to a like degree of numerical precision, inserted immediately thereafter in parentheses. Credit is due to this society for having led the way in this direction. The same rule, wherever practicable, has likewise been officially announced by the Illuminating Engineering Society as regards its papers and publications. A similar use of metric values has, it is rumored, been decided upon and officially ordered for adoption in the next six months by the American Institute of Electrical Engineers. Not even the most rabid anti-metrist can complain against the adoption of the above rule by engineering societies. The advantages of the plan are that it not only furnishes a key to foreign engineers concerning what would otherwise probably remain as pure cyphers in our papers, but it also supplies a numerical check upon the numerical statements appearing in the text. When, for instance, an electric car weighing 50 tons (45 metric tons) of dimensions 50 ft. x 9 ft. x 9 ft. (15.2 m x 2.8 m x 2.8 m) is described in a publication as being accelerated at the rate of 1.5 miles per hour per second (2.4 km per hour per second), the engineer in foreign countries ordinarily gives up all attempt at understanding the statement; but when the parentheses are supplied the statement ceases to be national, and becomes immediately raised to the international plane. We heartily recommend this practice to all engineers and engineering societies.

LIGHTING OUTDOOR ARENAS.

The lighting of the large outdoor arena of the Military Tournament at Chicago, which is described elsewhere in this issue, is interesting as one of the latest and best-planned attempts to light successfully a large outdoor field at night for amusement purposes. The lighting of arenas of this kind for military maneuvers, Wild West shows and the like, by means of a large number of lamps of high candle-power hung comparatively low over the arena has heretofore often proved unsatisfactory. In the present case the illumination provided on the field probably much exceeds that in most previous attempts. With flaming-arcs hung 35 ft. above the ground with a power expenditure of about 0.18 watt per square foot, we come close to indoor lighting practice, as the approximate observed average intensity of 1 foot-candle shows. The installation was creditable to its designers as representing one of the best planned attempts at arena lighting yet installed. But an evening's observation of the results forces the conclusion that there is yet room for much improvement in the lighting of such space.

Much has been stated recently about the effect of bright lamps in the range of ordinary vision, and with this in mind one might be led to expect considerable discomfort in facing a field with flaming-arc lamps 35 ft. above the ground. Such was not the case, however, as far as the ordinary observer with normally strong eyes was concerned, as the opal diffusing globes and the long distances from the lamps to the eye successfully prevented noticeable glare effects. There was, however, a very marked detrimental effect of another kind. Even on a perfectly clear night and immediately following a dust-laying rain, the field to the ordinary observer looking across it appeared to be enveloped in a kind of haze or mist. An experiment made by shading the eyes so that they received less direct light from the lamps greatly reduced this apparent mist, the amount of decrease in the effect being dependent directly on the amount of the shading of the eyes from the direct rays of the lamps. An efficient way to shade the eyes is by the use of a short black tube, but as it is unlikely that the public will ever be educated to the point where it will carry shading tubes to an event of this kind to enable it to see better, the conclusions are obvious that better shading of lamps should be studied in the future in connection with work of this kind. If flaming-arc lamps are used of the usual type with inclined electrodes in which the arc is located in the upper part of the globe, properly designed hoods or reflectors for such lamps would have the further advantage of permitting the use of clear globes. On account of the small amount of vertical space taken up by the arc, the shading of the arc would, on the whole, be less difficult than the shading of the long vertical tungsten filament, which has already been successfully accomplished in indoor work of this general class.

THE WIRELESS DETECTIVE BUREAU.

A new and sensational application of wireless seems to have reached its climax in the search for an alleged murderer on the transatlantic steamers during the past week. Time was when the evildoer would grow whiskers, put on dark spectacles and slink aboard some craft bound for an unexpected port, with strong hopes of getting there and departing safely; but wireless has changed all this and the interesting part of the present search is the report, whether true or false, sent from a steamer in mid-ocean as to the presence of two suspected passengers, for whom the police will be waiting with open arms upon the ship's arrival in port. In other words, it has come to this, that a search for a criminal is not the least impeded by the fact that he has taken ship, if only the wireless is working well. If his temporary home is equipped with wireless he might even be summarily arrested and clapped into irons by the captain on the request of the authorities on either side to wait securely until the arrival at port—which action, indeed, is reported by wireless to have been taken in the case of an alleged London murderer and his accomplice, now at sea. One can recall not a few searches for criminals in bygone years which would have been greatly facilitated had wireless messages then been possible. There is, of course, a possibility of mistake from telegraphed means of identification. In the case which prompts this note it may even chance that a couple of relatively innocent persons have been summarily seized by the police, but it is at least evident that the distinction between sea and land is in large measure lost and there may be risk to absconders even in retiring to the fancied security of Tangier or other port of refuge. One must own, however, that while the conquest of the sea by wireless is rapidly extending, it is not yet complete. A steamer may be in touch directly or by intermediaries with the shore every day of the trip along the well-known Atlantic lanes, but any considerable departure from a few crowded courses means that the intermediaries have disappeared. Although the range of wireless is by no means unlimited, it is at the present time sufficient to cover the Atlantic and even the Pacific thoroughly from a few well-selected stations, and this is the first great work which the wireless companies or the respective governments ought to undertake in order that a steamer equipped with wireless service would never be out of touch with one of the network of stations. As it now is, a steamer may readily be driven out of her course and disabled so as to be as completely out of reach for many days as she would have been before wireless was thought of. This condition should be remedied and remedied at once merely for the safety of the world's commerce, and incidentally perhaps for a more complete and world-wide detective system than even the present exigency succeeded in disclosing.

SPACE DISTRIBUTION OF MAGNETOMOTIVE FORCE.

The similarity in operating phenomena of the induction motor to the stationary transformer as well as to the shunt-wound direct-current motor and alternating-current generator has been the means of simplifying to a remarkable extent the theoretical treatment of the first-mentioned machine. It has also been the cause of certain inaccuracies, which, however, are of a quantitative rather than a qualitative nature. These facts are well illustrated by the numerous discrepancies found in the values given by various writers for the relation between the core flux and the magnetizing current, or ampere-turns per phase winding. Almost all of the writers have based their treatments upon the transformer features of the machine, the discrepancies being attributable to differences in values assumed for the flux and for the space and time relation of the component and resultant m.m.fs. Certain of the writers tacitly assume an open secondary circuit and "stepped" space distribution of the flux, assign to the flux that value demanded by the

counter e.m.f., and determine the component or resultant m.m.f. for producing this flux. Others imply the existence of a flux sinusoidally distributed in space and calculate the m.m.f. for producing the maximum value of this flux. All of these writers take into account the differences in time-values of the component m.m.fs., and a few of them consider the space distribution of the ampere-turns of the separate phase windings, but almost none make allowance for the effect of local secondary currents upon the space distribution of the flux over the primary core and upon the maximum value reached by this flux.

A discussion of the above discrepancies and one of the causes therefor is given in this issue in an article by Prof. B. B. Brackett. The author finds that much confusion of terms and inaccuracies in results are caused by the failure to recognize the space distribution of the m.m.f. Attention should be called to the fact that the author has treated the problem as purely one of transformer action with open secondary. When the secondary is closed the wave-shape of the space distribution of the flux is similar in all respects to the wave-shape of the time-value of the impressed e.m.f., and the m.m.f. to produce this space distribution is the resultant of currents in the secondary and primary circuits. By assuming the secondary to be closed and treating the machine as a revolving-field, counter-voltage generator, one can easily determine the maximum instantaneous value of the flux at any point from the space distribution of the conductors and the e.m.f. that must be counter-generated therein. It is customary to calculate the core loss watts from the volume of the core and the maximum flux density throughout each part thereof. An exactly similar method can be employed for determining the wattless exciting volt-amperes from the volumes of the core and the air-gap, the maximum flux density in each part and the permeability of the material for each density, that for air being unity at all times.

ADJUSTABLE-SPEED ALTERNATING-CURRENT MOTOR.

The numerous advantages of the polyphase induction motor over the direct-current motor for constant-speed service are thoroughly appreciated by all electrical engineers. Moreover, its few disadvantages for constant-speed service and its many shortcomings when used where adjustable speed is desired are well understood at the present time. The excitation of the direct-current machine represents, say, 1 per cent continuous loss in the resistance of the magnetizing coil, but the energy for the magnetic field after it has once been established remains stored therein without affecting the external circuit in any way. In the case of the induction motor there is an even greater mean power loss in the resistance of the magnetizing coil and a transfer of energy to and from the magnetic field from and to the external circuit during each alternation of the impressed e.m.f., the amount given to the magnetic field being somewhat less than that returned therefrom. Thus the excitation of this machine represents a power loss in the copper, a power loss in the iron and a consumption of wattless volt-amperes for maintaining the magnetic field. Although the volt-amperes taken by the machine at no load may reach even 30 per cent of the amount consumed at full load, yet the machine possesses so many other features that are highly advantageous that this disadvantageous feature is considered insufficient to prevent its wide adoption for constant-speed service.

The simple revolving-field induction motor is essentially a constant-speed machine, although it can be caused to exert its full-load torque at any speed from standstill to the normal running value. The most convenient method of reducing the speed is by inserting resistance in the secondary circuit, the "slip" for any chosen value of torque varying directly with the total resistance of the secondary circuit. This method possesses two disadvantages, namely, low efficiency on account of the loss in the inserted resistance and poor speed regulation under fluctuating loads, the latter being particularly disadvantageous where truly adjustable speed is desired. Two methods of speed variation which result in a fairly high efficiency and well-defined adjustability of speed are found in the use of pole-changing arrangements and in the employment of cascade or tandem control. The results obtained from these two methods are fairly comparable; each is limited in the number of steps of speed changes, and each requires an excessive amount of wattless volt-amperes at low speed. The former method involves the use of a machine specially constructed to produce different numbers of magnetic poles, while the latter requires at least two separate motors for carrying a single load.

A method closely related to the last named, but one in which certain of the limitations just noted are removed, is described in the Digest of this issue. The second machine of the cascade set is a variable-speed, adjustable-speed or constant-speed polyphase commutator motor. This machine receives the energy from the secondary of the induction motor and, instead of dissipating it as would be done if resistance were inserted in the secondary circuit, delivers most of it as mechanical work at any place desired. Interest centers chiefly around the construction of the polyphase commutator motor. The rotor winding is similar to that of the armature of a direct-current machine. The stator winding consists of "compensating" coils for each phase in addition to the exciting coils. The compensating coils perform the double function of neutralizing the m.m.f. of the armature current and counterbalancing the e.m.f. generated in the armature by the alternation of the field flux, being joined in series with the armature for this double purpose. Evidently the e.m.f. between the terminals of the armature and the compensating-coil circuits varies solely with the product of the field flux and the speed of the rotor, and is independent of the frequency. The machine can be given any of the load-speed or voltage-speed characteristics possessed by any type of direct-current motor by the proper arrangement of the exciting coils; moreover, the load-speed characteristics of the commutator motor are imparted to the whole cascade set, so that the speed control of the equipment is equally as simple as that of an installation of direct-current motors. Both the value and time-phase of the counter e.m.f. generated by the commutator motor are adjustable at will. When the e.m.f. is in direct time-phase opposition to the secondary e.m.f. of the induction motor, only the speed of the set is affected; when it is in time-quadrature therewith, only the excitation of the induction motor is affected. By proper adjustment of the e.m.f. the whole of the excitation may be supplied by the commutator machine, and the set will operate at unity power-factor. No details are available as to the methods employed for eliminating sparking, but it is reported that the machine commutates satisfactorily. The chief disadvantage resides in the cost, which would be prohibitive in many installations.

National Electrical Contractors' Association.

The tenth annual convention of the National Electrical Contractors' Association was held at Atlantic City on July 20, 21 and 22, 1910. The headquarters were at Young's Hotel and the meetings were held on the Million-Dollar Pier. There were no exhibits of electrical apparatus or devices this year, as this feature of conventions has not been encouraged to any great extent by the contractors' association for the last three or four years.

The convention was opened with an address of welcome by Hon. Franklin Stoy, Mayor of Atlantic City, who in a few well-chosen remarks welcomed the delegates and their friends and conferred on them the freedom of the city. Mr. G. M. Sanborn, president of the National Electrical Contractors' Association, appropriately responded. Among the papers read and discussed at the convention were the following: *Fire Insurance Supervision of Electrical Installation,* by Mr. Washington Devereux, chief inspector, Philadelphia. *Electrical Inspection,* by Mr. G. E. Bruen, New York City, representing the National Fire Protection Association. *Welfare,* by Mr. Louis B. Schram, chairman committee on factory inspection of the National Civic Federation; this paper dwelt on the means for safeguarding wage earners against industrial accidents. *Relations Between the Architect and the Contractor,* by Mr. William A. Boring, architect, New York City.

The feature of the convention was the address by Mr. Charles L. Eidlitz, past-president of the National Electrical Contractors' Association. Mr. Eidlitz's annual address at these meetings is always looked forward to by contractors on account of the shrewd advice and fruitful suggestions contained.

The officers elected for the ensuing year are as follows: Mr. Marshall L. Barnes, of Troy, N. Y., president; Mr. C. R. Kreider, of Chicago, first vice-president; Mr. H. C. Potter, Boston, second vice-president; Mr. J. C. Hatzel, New York, third vice-president.

It was decided to hold the next annual convention at Niagara Falls. It was left to the executive committee to decide whether the meeting will be held in the Hotel Clifton on the Canadian side or at some hotel on the American side.

The Sons of Jove held a rejuvenation during the convention on the evening of July 21 at the Windsor Hotel following an elaborate dinner. About 30 new members were initiated and the affair was one of the pleasant features of the convention. Bro. H. B. Kirkland and Bro. Frank H. Stout had charge of the ceremonies.

Unusual Accident to Water-Power Plant.

A rather unusual accident occurred recently in the Fulton hydroelectric plant of the Janesville Electric Company, of Janesville, Wis. This plant is located on the Yahara River,

View of Destroyed Water-Power Plant.

about 12 miles from Janesville, and is operated at 14-ft. head. Electrical energy generated here is transmitted to Janesville, where the principal office of the company is located.

The plant at Fulton had an old wooden flume and the company has for some time been considering the replacement of this flume by a reinforced concrete structure, plans for which were under preparation. A leak in the flume was the cause of the bottom dropping away from the side walls, and the rush of water through this gap cut away the ground from under the generator room, which collapsed and fell through the cavity with all of its contents. The accompanying illustration is a reproduction of a photograph showing the damage done by this unusual washout, it being estimated that several thousand dollars will be necessary to make the plant effective.

Since Fulton is one of the four water-powers which the company owns, the service was not crippled in any way. It is expected that the damage will be speedily repaired.

Extension of Chicago's Street-Lighting System.

Negotiations are still under way between the city of Chicago and the Sanitary District in relation to the details of the agreement by which the Sanitary District will finance and maintain an extension of 10,000 arc lamps to the existing street-lighting equipment of the city of Chicago. The main outlines of the proposed contract have been settled and there seems to be little doubt that the plan will be carried into effect. However, the finance committee of the City Council is desirous of effecting some changes in the agreement as tentatively adopted, and these changes are now under discussion. It is possible that a form of ordinance will be accepted by both sides to be presented at a special meeting of the council to be held within a week or so. Among the amendments now under discussion are the following:

Extending the terms of the contract so that the city may purchase energy for building illumination and power for use in operating bridges and even pumping stations, if electrical operation is later thought advisable.

Giving the city, as well as the sanitary district, the right to cancel the contract in the event of default by the other party.

Giving the city in exchange for its granting the district the right to use the municipal poles and conduits the right to use the district's equipment of this nature.

Adding a stipulation that the sanitary district's lien against the lighting equipment shall not hold if it is in default.

Defining more closely that the district accepts the city equipment in its present condition.

Making the payments by the city contingent upon the tax levy and the annual appropriation bill's passage.

Power Development on the Wolf River.

The Wisconsin Traction, Light, Heat & Power Company, with which Mr. John I. Beggs, president and general manager of The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., is prominently identified, has purchased water-power rights on the upper Wolf River in Northern Wisconsin and intends, at some future date, to develop this power and transmit it by electricity. The necessary land has been secured near Gardner's Dam in Langlade County, about 70 miles from Appleton. The power that will be developed there will be used by the interurban railway system operated in the Fox River valley by the Wisconsin Traction, Light, Heat & Power Company. Electrical energy will also be sold for other purposes without doubt. It is said that the company will spend over $1,000,000 in this improvement, although no time has been set for the beginning of operations.

St. Louis Electrical People at a Picnic.

A party of about 300 persons, made up of members of the League of Electrical Interests of St. Louis and ladies, attended an old-fashioned basket picnic at Valley Park on Mera-

mec River, 19 miles from St. Louis, on July 16. Every person wore a circular tag giving his name and that of his company connection if there was one. There was music by an orchestra during the day and all sorts of games and amusements. In the afternoon there was an exciting ball game at which the "Negatives," headed by Mr. F. D. Beardslee, lost to the "Positives," led by Mr. T. C. Laufketter, by a score of 4 to 3. The prize for winning this game was a box of cigars, and in it were about 12 cigars with "short-circuits" which could not be repaired. During the evening there was a prize waltz which was won by Miss Ryan and Mr. Leo Comisky, of the Jandus Electric Company. Mr. James Dorney, of the Westinghouse company, with Mrs. Dorney, captured the two-step prize. Another prize-winner was Miss Huebler, who won the ladies' accurate ball-throwing contest.

There was a court to handle all cases of "talking shop," and several "criminals" were prosecuted by "Judge" L. M. Sperry and defended by Mr. W. E. Rapp. The presiding judge was Mr. R. J. Russell, of the Century company. Fines of $5.00 were imposed, and, according to the terms of the sentence, this money was expended in sodas and other light refreshments for the ladies. Canoeing, bathing and other recreations were enjoyed. Mr. C. E. Brenton, auditor of the Union Electric Light & Power Company, was missing for a long time, and after a prolonged search was finally found at a distant point on the river quietly gazing at reflections in the water. Some one started the story that Mr. Brenton was looking at other reflections than his own. The country around Valley Park has many romantic spots, and many members have a longing to return, provided good company can again be secured.

The outing was the first of several to be given during the summer season. It was entirely successful, and credit is due the various committees. Mr. L. M. Sperry was master of ceremonies, and the chairmen of the various committees were: Transportation, Mr. J. R. Cullilane; grounds, Mr. F. Johnson; prizes, Mr. J. P. Casey; program, Mr. R. J. Russell.

Annual Report of City Electrician of Los Angeles.

Some interesting facts are contained in the annual report of Mr. R. H. Manahan, city electrician of Los Angeles, Cal., recently filed with the board of public works of that city. The report covers the year ended June 30, 1910, and shows that the cost of electric street lighting in Los Angeles was $272,133.48. Of this amount, $216,605.53 was paid by the city for street arc lighting, while property owners paid $22,372.80 for special ornamental street lighting. The number of permits issued for electrical construction and repair work was 14,782, representing an increase of 32 per cent over the year before.

Mr. Manahan calls attention to the fact that more assistance is needed in the department of electrical inspection, which has to cover a territory of 100 sq. miles. He recommends that all wires should be enclosed in conduit in the fire district and in all public buildings and large apartment houses outside of the fire district. Attention is called to the fact that petitions have been presented for the ornamental lighting of Pico Street, from Main Street to Vermont Avenue, 1.97 miles; Seventh Street, from Boyle Street to Hoover Street, 4.13 miles; Sixth Street, from Main Street to Alameda Street, 0.81 mile; Third Street, from Main Street to Hill Street, 0.21 mile, and First Street, from Hill Street to Chicago Street, 2.10 miles. The present mileage of this type of street lighting is 6.8 miles, and with the extensions enumerated above the total will be about 16 miles of special ornamental street lighting.

During the year the report shows that 221 street arc lamps were installed, making a total of 2804 lamps in the old city proper. There are still a number of streets in Los Angeles that are poorly lighted, and Mr. Manahan recommends that at least 400 additional street lamps be placed in position during the present fiscal year. These new lamps will cover, as far as possible, the unlighted sections in the recent annexations as well as the city proper. The city electrician notes that Hollywood is lighted throughout by 50-watt tungsten lamps under a five-year contract and he suggests a revision of this contract by which the city may secure a more advantageous rate, at the same time assuring the company a fair return on its investment.

To Prevent Unauthorized Climbing of Poles.

Several accidents having occurred in Chicago due to boys climbing poles carrying high-tension wires, the subject was brought up in the City Council, and the city electrician was instructed to make an investigation. Under date of July 11 Mr. William Carroll, the city electrician, has made his report on this subject. He mentions that in the Twenty-seventh Ward of Chicago and elsewhere the Sanitary District maintains poles supporting wires carrying a voltage of 12,000 volts or more. It is possible for children to climb these poles and receive an electric shock causing serious injury and possibly death. Mr. Carroll reports that he has conferred with the electrical engineer of the Sanitary District on the subject and that both have agreed that it is difficult to provide safeguards on poles which will allow linemen to climb them and at the same time prevent irresponsible persons from doing so. However, he believes that conditions can be improved by making the poles more difficult to climb by persons not provided with linemen's spurs. The Sanitary District is now arranging to equip one or more of its poles with a device which will make it almost impossible for anyone to mount the poles unless aided by the spurs used by linemen. It is proposed to wrap the poles with galvanized-wire mesh to a height of 15 ft. or 20 ft. If this method proves satisfactory, all of the Sanitary District's angle-iron poles located within the city will be similarly protected. In conclusion, Mr. Carroll recommends that an ordinance be passed making it a misdemeanor for unauthorized persons to climb poles or other structures of any kind carrying electric wires or conductors of any description. The report was referred to the committee on judiciary of the City Council.

Water-Power Possibilities in Government Waterway Plans.

In the Rivers and Harbors bill passed at the recent session of Congress and approved by President Taft are several provisions for improvements of internal waterways which may result in making water-powers available for industrial purposes. For the construction of a waterway from Lockport, Ill., by way of the Des Plaines and Illinois rivers, to the mouth of the Illinois River, $1,000,000 is appropriated. The Secretary of War is to appoint a board of five members to be composed of four engineer officers of the army and one civil engineer taken from civil life. This board shall report on the feasibility of the proposed waterway and the manner in which it should be built, in case it is recommended. It will also consider other aspects of the subject, such, for instance, as the possible lowering of the level of the Great Lakes by reason of the construction of the waterway.

After conference with the authorities of the State of Illinois, the board shall report upon the extent to which the United States may co-operate with the State of Illinois in the construction of a navigable waterway from Lockport to the mouth of the Illinois River in conjunction with the development of the water-power by the State authorities between Lockport and Utica, Ill., for which the people of the State have authorized their General Assembly to appropriate $20,000,000.

Should the board consider co-operation with the State to be desirable, it is directed to prepare plans and estimates of the cost of the work recommended to be done by the United States alone or in co-operation with the State of Illinois. Until these plans and estimates have been submitted and a project for the improvement adopted by Congress, the appropriation of $1,000,000 mentioned above is not available for expenditure.

The board of engineers is also directed to consider and report upon the improvement of the Mississippi River between

the mouth of the Illinois River and the mouth of the Ohio River by the construction of a dam at or near Jefferson Barracks, and a dam at or near Commerce, and the development of water-power incidentally created by such dams. Jefferson Barracks is 8 miles below St. Louis and Commerce is 36 miles above Cairo, Ill. The law requires that the reports called for from the engineering board of five men shall be submitted to the chief of engineers of the War Department not later than Nov. 1, 1910.

If these projects are carried out a large water-power will be developed in the Illinois River, perhaps near Utica, Ill., while considerably larger water-powers—no doubt over 100,000 hp in each case—will be developed at the proposed dams at Jefferson Barracks and Commerce, where the great volume of the Mississippi River will be available. When these great engineering undertakings are carried to completion, the energy of the developed water-power will be transformed into electricity, no doubt, and so transmitted and distributed for industrial use.

Another water-power project mentioned in the Rivers and Harbors act approved June 25, 1910, relates to the improving of the Mississippi River from St. Paul to Minneapolis. The modified project recommended by the chief of engineers in his report dated March 3, 1910, is formally adopted and all future work on this improvement must be carried out in accordance with this report. In the making of leases for water-power under the provisions of this project a reasonable compensation must be secured to the United States and the rates as fixed are subject to revision by Congress.

Annual Meeting of Massachusetts Electric Lighting Association.

The annual meeting and dinner of the Massachusetts Electric Lighting Association was held at the Tedesco Club, Swampscott, Mass., on July 7, about 50 persons being present. President C. L. Edgar was in the chair. After the usual routine business, resolutions were passed regretting the death of the late Gen. A. B. R. Sprague, of Worcester, who had been a vice-president of the Association. The following officers were then elected for the ensuing year: President, Mr. C. L. Edgar, Boston; vice-presidents, Messrs. C. F. Prichard, Lynn, and A. F. Dow, Fall River; secretary, Mr. E. W. Burdett, Boston; executive committee, the foregoing gentlemen and Messrs. F. S. Pratt, Boston; R. W. Day, Springfield; A. E. Childs, Boston; A. B. Tenney, Boston; George T. Dewey, Worcester, and J. W. Stevens, Greenfield.

LEGISLATIVE WORK IN MASSACHUSETTS DURING 1910.

The twenty-first annual report of the executive committee, which was then read by the secretary, reviewed the history of legislative work during the session just closed, with special reference to the central-station industry. The committee reported that the year closed without the passage of any legislation hostile to the interests of the association. Some of the matters before the Legislature were of the same general character as those of previous years, while others were novel in their character.

Upon the question of municipal ownership three important bills were presented. The first was similar to bills presented in previous years, seeking to reduce the legal requirements for the establishment of a municipal plant in a city to a single vote of each branch of the City Council, ratified by a single majority vote of the voters at an annual or special election. This bill was withdrawn.

Another bill sought to authorize any two or more manufacturers or merchants to unite or co-operate in supplying each other with electric service, upon receiving permission to do so from the Board of Aldermen or Selectmen. The passage of this bill would, of course, have thrown the business open to any two or more persons who might see fit to unite for that purpose and would practically have constituted a repeal of the entire body of the present law relating to electric lighting in this State. The bill was unfavorably reported and adversely acted on.

Another bill, introduced on petition of a representative of the city of Haverhill, while preserving some of the forms of the present law, would have, in fact, if enacted, put the companies entirely at the mercy of the towns and cities in which they operate. It provided that a city or town might establish a plant for municipal or commercial purposes, either by the purchase of an existing plant or by the installation of a new municipal plant, at its option. It further provided that the company might offer to sell its existing plant to the city, but it specially provided that the city or town should be under no obligation to purchase. The city solicitor of Haverhill appeared, among others, in advocacy of the bill, under instructions from his city government. The legislative committee asked leave to withdraw the bill, and the House refused substitution after debate and roll call. The result, if this bill had been enacted, is made very plain by the fact that since it was defeated the city government of Haverhill has taken final steps toward the establishment of a municipal plant, but under the existing law the right of the company to sell its plant to the city at its fair market value for the purposes of its use is fully preserved.

On petition of a representative from the city of North Adams two bills were considered with respect to charges for meters; one to prohibit or regulate the charges for the use of gas meters, and the other to prohibit or regulate the charges for electric meters. The latter bill sought to make it unlawful for any company to make any charge for a meter or for anything except electricity actually used. This bill arose out of the recent institution of meter charges in North Adams, which had not previously been in force. It was advocated principally by citizens and officials of that city, but was opposed not only by counsel for the Massachusetts Electric Lighting Association, but by the Municipal Electric Lighting Association also. Neither bill became a law.

The Board of Gas and Electric Light Commissioners made several recommendations, which resulted in the following enactments:

Chapter 124: That the provision of the Revised Laws authorizing a change in the character of the business of a corporation by a vote of all its stockholders, as applied to gas or electric lighting companies, shall not authorize gas companies to engage in the business of making or selling electricity unless authorized so to do by the Board of Gas and Electric Light Commissioners, and that electric service companies shall not engage in the business of making or selling gas at all. It is difficult to suggest any reason for any such distinction between gas and electric companies, but the matter seemed not to be of sufficient practical importance to justify strenuous opposition to the measure.

Another act passed on recommendation of the gas commissioners was chapter 197, that the provisions of the Revised Laws authorizing a company confined by its charter or agreement of association to doing business in a particular city or town to extend or remove its business, or any part thereof, to any other city or town in the State shall not apply to gas or electric light companies, except that the gas commissioners may authorize such a corporation to carry on the business for which it was incorporated in a city or town other than that named in its agreement of association or charter. This act has no application except to companies whose operations are confined to a given territory by the express provisions of their charters or agreements of association.

A bill was introduced primarily in the interests of a transmission company seeking to obtain for electric service companies the right to erect and maintain transmission lines over private lands, with authority to exercise the right of eminent domain under certain conditions. Other bills were introduced seeking to secure very much enlarged rights of appeal to the gas commissioners from the action of aldermen and selectmen with respect to the locations and operations of electric service companies. One of these bills went so far as to give the right of appeal in all cases of refusal by local authorities to grant locations upon application.

While none of these bills was enacted in the form in which

it was introduced, they were made the basis of a resolution providing for an investigation by the Board of Gas and Electric Light Commissioners into the whole subject of the conditions and laws affecting the transmission of electricity in public ways or over private lands. This resolution offers what is believed to be a valuable opportunity for the thorough investigation and study of what has become a most vexatious and uncertain condition of the law affecting the rights of companies in the transmission and use of electricity in this State and the securing of remedies therefor. This matter had become so serious that a bill was introduced in the interests of the members of the electric lighting association in 1908 looking toward a similar investigation, but was subsequently withdrawn.

The utmost confusion and uncertainty now exist with respect to many of the operations of the companies in the use of public streets for their poles, wires and conduits. Probably a large proportion of the locations are more or less defective and may constitute public nuisances. In case of injury arising from the presence of these structures in public streets, the owners will be practically helpless in suits for the recovery of damages for such injuries either to persons or property. The right to transmit energy at high voltage through one town to another has also become a matter of first importance in some cases. All of these things are to be investigated by the Board of Gas and Electric Light Commissioners, who are required to report the results of their investigations, with such recommendations for legislation as they may deem advisable, to the next General Court. It is hoped that results of high importance to the companies may be worked out by means of this investigation.

An increase in the salaries of the Board of Gas and Electric Light Commissioners was proposed early in the session, and received the support of the association. Whether higher salaries always produce better men in public employment may be open to serious question, but it is certainly true that they have a tendency to do so. Chapter 539 increases the salary of the chairman from $4,000 to $5,000, and that of the other commissioners from $3,500 to $4,500 each, from and after July 1, 1910.

Conflicts of interests have heretofore arisen owing to the provision of law that the right to subscribe for shares of increased capital stock belongs to those who were stockholders at the time of the vote to increase. As there was no express authority of law to vote to increase the capital after the action of the Board of Gas and Electric Light Commissioners authorizing such increase, considerable periods of time sometimes elapsed between the date of the vote to increase and the date when the shares were offered to stockholders. To remedy this and other difficulties a bill was agreed upon, after a good deal of discussion between the representatives of the electric lighting association, the gas commissioners and others, which became law as chapter 374. This act provides that the vote to increase the capital may be passed either before or after the application to the gas commissioners for the necessary permission to do so, but that no such application shall be made except upon vote of the stockholders. The act further provides that the rights to new stock shall accrue as of the date of the vote to increase the capital, whether passed before or after the action of the gas commissioners, but it requires that in order to be valid notice of the increase shall be given to stockholders within 60 days after the final action of the board.

One of the most, if not the most, important matters that was pending in the last Legislature was the proposed amendment to the constitution striking out the requirement that all taxes shall be "proportional," as well as reasonable, and giving the Legislature the power to classify property for the purposes of taxation. This was known as the "three-mill" amendment. A special board, of high character, had investigated this subject and had reported adversely upon it. The necessary resolution was, however, adopted by the Legislature in 1909, and, if it had been readopted by the Legislature of 1910, would have gone to the people for ratification at the next annual election.

The special commission above referred to predicted great disturbance of values of domestic stocks and bonds in case of the final adoption of the amendment, as well as constant agitation for special classifications for taxation of different kinds of property. They said: "The provisions of the tax laws might easily in the course of time be elaborated into the extreme complexity of a tariff act, with innumerable classes and rates. The situation would be a constant menace to stablity of values."

Certain mercantile and manufacturing interests of the State were very open and active in their advocacy of the amendment, but it finally failed of passage.

A resolution was introduced by the Public Franchise League of Boston to provide for an investigation of voluntary trusts or associations controlling the capital stock of public-service corporations. This was debated before the committee on the judiciary, which reported almost unanimously against it. The House chairman of that committee, however, secured a substitution of the resolution for the report of the committee in the House; however, it was finally defeated in the Senate.

A very elaborate bill was introduced, looking to the creation of a new public service commission for the control, supervision and investigation of all the public-service corporations of the State, and the abolition of the existing State commissions now dealing with the different classes of public-service industries. The bill consisted of 89 sections, modeled on the laws of another State. It did not meet with the approval of the committee or the Legislature.

After extended negotiations between the representatives of the city of Salem and the different public-service corporations operating therein, an act for the placing of wires under ground in the congested portion of that city was agreed upon, reported by the committee, and enacted by the Legislature. When it reached the Governor, however, objection was made by the board of gas commissioners to a provision of the bill that the companies interested should be allowed to capitalize the future cost of moving, changing, repairing or replacing any part of the underground conduits, ducts, cables or manholes to be laid pursuant to the requirements of the act by reason of any change in or removal of the Salem railroad tunnel, or of a change in the location or grade of the railroad, or of the abolition of grade crossings in the city. The amount to be capitalized for such purposes was the actual and reasonable cost, as determined, after public notice and hearing, in the case of an electric light company by the gas commissioners, in the case of a telephone or telegraph company by the Massachusetts Highway Commission, and in the case of a street railway company by the railroad commissioners. Although this provision of law was deemed by the parties in interest to be perfectly reasonable, covering merely the cost of removing or reconstructing new work done pursuant to the law in case of interference with it by other public improvements, the companies interested consented to its elimination from the act. The Senate accordingly recalled the bill from the Governor, and it was re-enacted without the provision referred to, as chapter 448. The provision objected to was allowed, however, to remain so far as street railways were concerned, because it was claimed that they already had the right referred to and the railroad commissioners did not object to its re-enactment in this special form.

On petition of the Pittsfield Electric Company the time for the removal and placing underground wires in a certain portion of that city was extended by chapter 318.

Other bills were presented, discussed and disposed of relating to the insulation of electric wires, fees or deposits for opening streets, old age pensions, employer's liability and labor laws, etc., but none of these required special mention.

Massachusetts Commission News.

Final hearings were held by the Massachusetts Railroad Commission on July 20, 21 and 22 upon the petition of the Boston & Eastern Electric Railroad Company for a certificate of exigency authorizing it to build a high-speed interurban railroad between Beverly, Salem, Lynn and Boston. The plans of the company have been fully described in previous issues

of this paper. At the last session of the Massachusetts Legislature the company was given the right to build a tunnel under Boston Harbor and a subway to Post Office Square for the purpose of entering the city. Interest in the final hearings centered in a new proposition by the Boston Elevated Railway Company for the use of the existing East Boston tunnel and in the arguments of counsel summarizing the reasons for and against the authorization of the road. It was stated that the Boston & Eastern company has already expended nearly $200,000 in preliminary engineering and legal charges.

The full board was present at all the hearings. On July 20, Mr. Frederic E, Snow, for the Boston Elevated Railway Company, stated that his company was willing to enter into an agreement with the Boston & Eastern by which the passengers of the latter road would be turned over to the Boston Elevated at Porter Street, East Boston, and for a 6-cent fare brought into the city by the latter company and distributed throughout the metropolitan district. Mr. Snow proposed to handle this traffic in the East Boston tunnel, with surface cars from the tunnel mouth to the Porter Street district, or else extending the tunnel to Porter Street. The latter plan, embracing about 1800 ft. would cost $500,000. Mr. Snow said that if the Boston & Eastern passengers should thus be turned over to the Boston Elevated, the latter company would transport them to their destinations more quickly than if carried to Post Office Square by the independent line and then by a foot passage brought in touch with the present Boston system. It would also save the Boston & Eastern the expenditure of $2,800,000 for a separate tunnel. Mr. Snow said that the East Boston tunnel affords almost ideal connections with the present rapid transit lines and that a separate tunnel could not properly distribute the incoming traffic. He thought that the Boston & Eastern could afford to reduce its fares at least 30 per cent if it was not required to build a tunnel.

Corporation Counsel T. A. Babson, of the city of Boston, pointed out that the city desires a fuller use to be made of the East Boston tunnel. He repeated his opinion that the Boston & Eastern would cut into the earnings of that tunnel and postpone the day when the penny toll could be discontinued. He felt that there is no real protection to the city against the failure of the Boston & Eastern company to fulfill its obligations. The Law Department of the city was in favor of the Boston Elevated plan. Mr. Snow then took the floor for a moment and stated that he was prepared to show that the capacity of the existing tunnel is not fully utilized, if the Commission desired it. The present cars run in the tunnel seat 52 passengers each, and the average number carried is 30.

On July 21, Mr. Woodward Hudson, for the New York Central Lines and Mr. Benj. N. Johnson, for the General Electric Company, Lynn Works, argued in opposition to the granting of the certificate. Mr. William H. Coolidge, for the Boston & Maine, then submitted a long argument in opposition, claiming that the policy of the state protects transportation interests already serving the public well, and contending that the new road would seriously injure the existing roads. He urged that the Boston & Eastern could not possibly be a financial success without destroying the entire traffic of the existing lines and producing new traffic not now in sight from any source. He then presented a letter from President C. S. Mellen of the New York, New Haven & Hartford Railroad Company which stated that whether the business is profitable or not, there is an obligation upon the existing suburban routes that it shall be handled efficiently, and that "any policy which diverts the business from the existing routes, or prevents its increase to a very much greater volume than at present, simply prolongs the agony and loss to existing transportation lines, and it would seem the true policy should be to build up the business on existing lines until the volume of the same may overcome the loss now the result of rates made to attract volume and possibly future profit."

Mr. Bentley W. Warren, counsel for the Boston & Northern Street Railway Company, argued that the board should not grant the certificate unless it was convinced that the want of the new road is a great public inconvenience; that the possibility of induced travel is immaterial in a question of exigency; that the Board must be satisfied that the existing companies cannot or will not improve their facilities, before permitting the new road. He also filed requests for rulings upon legal points associated with the case.

On July 22 Mr. Warren again protested against the entrance of the new line and argued that it could not pay its way in the field. Col. Melvin O. Adams, President of the Boston, Revere Beach & Lynn Railroad, said that the Boston & Eastern would furnish ruinous competition to his line. The final argument of the case was then given by Mr. C. S. Baxter, for the Boston & Eastern. Mr. Baxter urged that the best engineers in the country have passed favorably upon the financial feasibility of the project; that the company has acted entirely within its legal rights as regards capitalization and procedure; that the commission has already committed itself to the need for the road; and that the plan of the Boston Elevated for the use of the East Boston tunnel would destroy the high-speed functions of the enterprise. The hearing was closed and the board took the case under advisement.

New York Commission News.

The Public Service Commission of the First District of New York, through its attorney, has applied to the Supreme Court to set aside the finding in the suit brought by the commission against Receiver Whitridge, of the Union Railway Company, to recover $800,000. This suit was originally brought for an alleged violation of an order of the commission directing the equipment of the cars of the company with a certain type of wheel guard. The suit was thrown out by the Supreme Court justice who tried the case, and the present application on the part of the commission is for the purpose of having it replaced upon the calendar with a view to a new trial.

The Pelham Park Railroad Company and the City Island Railroad Company have been ordered by the Public Service Commission to give four days' notice before undertaking to put into operation the new monorail road extending from Bartow station on the New Haven Railroad to City Island. This order was brought about on account of the accident which occurred at the first attempt to operate the road, and in which quite a number of people were injured. Mr. E. G. Connette, transportation engineer of the commission, is not as yet ready with his report on the accident.

Additional hearings may be ordered upon the reorganization plan of the Third Avenue Railroad Company before the Public Service Commission renders its final decision. A large number of hearings have been held since the case was opened last December and a vast amount of testimony has been taken. It is now said, however, that the commission desires to have further evidence before rendering its decision. It is considered practically certain that any reorganization plan which the commission approves will scale down the capitalization of the new company to the actual present cash value, or actual cost of reproduction of the property. Consequently, in the case of the Third Avenue company, there must be written off from the existing capitalization an amount equal to the depreciation which has taken place.

The Public Service Commission, Second District, has authorized the Olean Electric Light & Power Company to increase its common capital stock from $35,000 to $85,000 and to issue the increase of $50,000, the proceeds to be used for indebtedness incurred in additions and betterments to its plant. The conditions of the grant are that the company is required to credit to fixed capital $2,261.14, the amount charged to capital which was expended for replacements not properly the subject of capitalization.

The commission has served an order upon the Lockport Light, Heat & Power Company requiring it to show cause why an order should not be entered requiring the gas manufactured, distributed and sold by this company to equal the standard

illuminating power for coal gas. The law provides that this gas shall be of at least 16 cp. Six out of seven tests made by the commission from January to July inclusive have shown the candle-power to be less than the standard fixed by law.

CURRENT NEWS AND NOTES.

N. E. L. A. Membership.—During the past month the National Electric Light Association has enrolled 251 new members. The present total is 5791, a gain of 2654 since the convention of 1909.

Pennsylvania Electric Light Convention.—The Pennsylvania Electric Association will hold its third annual convention Sept. 14-16 at the Glen Summit Springs Hotel, on Mount Nescopec, near Wilkes-Barre. This association recently became a section of the National Electric Light Asociation.

Increase in Staff of Bureau of Standards.—The equipment and forces of the Technological Branch of the United States Geological Survey, except that employed in coal testing, has been officially transferred to the Bureau of Standards. An additional appropriation of $50,000 was made to the bureau for carrying on its new line of work.

Chicago Section of American Electrochemical Society.—A Chicago section of the American Electrochemical Society was organized July 7, with Prof. Herbert N. McCoy, of the department of chemistry, University of Chicago, as chairman, and Mr. Arba B. Marvin, 950 Commercial National Bank Building, Chicago, as secretary-treasurer.

Central-Station Incandescent Lamp Situation.—The National Electric Light Association has authorized the appointment of a committee of seven operating and technical men for the purpose of making research into the subject of lamp efficiencies and central-station rates as brought forward in a paper presented at St. Louis by Mr. S. E. Doane.

N. E. L. A. Geographic Section.—The Nebraska Electrical Association has applied for affiliation with the National Electric Light Asociation, and application has been made for the formation of a Georgia State Section. The Canadian Electrical Association has appointed a committee to consider the advisability of that body becoming a N. E. L. A. section.

Telephony in Italy.—The Italian Minister for Posts and Telegraphs is reported to have presented a bill for the construction of a number of new telephone lines for intercommunication between various towns and districts in Italy. The bill proposes a total expenditure of $148,000, of which $12,000 is to be devoted to the purchase of apparatus for experimental purposes.

N. E. L. A. Electrical Solicitors' Handbook.—A new and revised edition of the N. E. L. A. "Electrical Solicitors' Handbook" has been issued. Considerable new matter has been added relating to electric vehicles, garage operations, load and diversity factors. The illumination section has been rewritten and enlarged. The book is only available to members of the association. New members receive a copy free, the price to other members being $1.

Telephone Rate Litigation in Los Angeles.—Suits are pending in the Federal courts brought by the Sunset Telephone Company and the Pacific Telephone & Telegraph Company to prevent the city of Los Angeles from enforcing the new telephone rate ordinance. At the request of the city attorney, who points out that it will be necessary for his office to employ high-grade experts to make an investigation of the properties and business of the telephone companies, the City Council has appropriated $15,000 to be used in the legal defence. The cases will come up for hearing about Sept. 1. Both sides will submit affidavits and no oral testimony will be presented.

Public Utility Regulation in Charlotte, N. C.—The first test by the city of its power to "regulate public or quasi-public corporations," under a remodeled charter, has been instituted by petitioners from Elizabeth Heights, a suburb, who ask the executive board of the city to compel the Charlotte Gas & Electric Company to extend its gas mains into the suburb. The petition, together with an order to file an answer within 10 days, has been served on the electric company, and when the answer is in the real contest will begin. Appeal to the State Corporation Commission is allowed either side, following the verdict of the executive board of the city in the matter at issue.

Barclay Printing Telegraph.—The current issue of the British *Post-Office Electrical Engineer's Journal* contains an interesting article by Major W. A. J. O'Meara, giving an account of a recent visit to this country to study American telegraph and telephone practice. An account is included of the Barclay printing telegraph, which, it appears, is now operated in over 65 circuits from 21 cities. The longest line is from New York to Atlanta (740 miles), and the circuits extend to the Pacific Slope, there being lines between San Francisco and Portland and Los Angeles, and one from the latter city to Denver. Major O'Meara states that during a day when he was in New York 1019 messages were sent from New York to Chicago in 8 hours and 37 minutes over one of the duplexed circuits, and 814 messages were received. New York had 25 and Chicago 24 circuits.

Pittsburgh Electric Railway System Criticized.—In a report to the Mayor of Pittsburgh, Mr. Bion J. Arnold severely criticizes the system of the Pittsburgh Railways Company. Mr. Arnold previously made a report on the electric traction system to the Pittsburgh Civic Commission, which led to his engagement by the municipality for this further report. Mr. Arnold's conclusions are that the traction system is grossly over-capitalized, is in poor physical condition and has been incompetently operated, particularly with respect to maintenance and car routing. Fixed charges in rentals and interest are so high that the company has now an annual deficit of over $1,000,000, and cannot under these conditions rehabilitate the property. Mr. Arnold therefore recommends that the city shall take a hand and advises: "Co-operation in the planning, building and operation of the system, publicity of plans and results and a fair division of the burdens and the benefits of operation. One city, one system and adequate service are the objects which should be worked for by all those charged with the responsibility of making decisions."

Annual Outing of Electric Club of Chicago.—The Electric Club of Chicago will hold its annual outing at Ravinia Park on Saturday, Aug. 6. Ravinia Park is a beautiful North Shore pleasure ground, and it is hoped that the outing this year will be as successful as the one given last year at Michigan City, which was greatly enjoyed. A special train will leave the Wells Street station of the Chicago & Northwestern Railroad at 10:15 a. m. There will be various athletic sports and games, both for ladies and gentlemen, and prizes will be given to the winners of all events. Donations from electrical concerns are solicited as prizes, and Mr. George H. Porter, Western Electric Company, 500 South Clinton Street, Chicago, will be pleased to receive gifts of this character. During the afternoon and evening there will be concerts by the Walter Damrosch orchestra, and there will also be dancing in a pavilion. Mr. Porter, who is chairman of the entertainment committee of the club, is in general charge of the arrangements. Other committees are as follows: Finance, R. M. Van Vleet, J. G. Pomeroy; publicity, H. A. Mott, F. S. Hickok; athletics, W. S. Tausig, F. W. Clement; entertainment of ladies, Otis B. Duncan, W. R. Bonham F. T. Wilbur; reception, William Carroll, W. L. Abbott, Robert E. Mitten, F. F. Skeel, James H. Delaney and J. J. Schayer.

Large Electromagnetic Clutch.—What is said to be the largest electromagnetic clutch ever built has been placed in service at the Ormesby iron works of Cochrane & Company, Middlesbrough, England, for connecting a 1000-hp motor to a blowing engine. The clutch is 7.25 ft. in diameter and weighs 12,500 lb.; it is designed for transmitting 1000 hp at 75 r.p.m. The power required to keep the clutch in operation is 2 kw.

The Rowland Telegraph.—A receiver has been appointed by Judge Norris in the Baltimore branch of the United States Circuit Court for the Rowland Telegraphic Company, of Baltimore. The bill of complaint filed shows that the assets of the company represented by office fixtures and factory equipment are $28,171.42 as against liabilities amounting to $418,418.14. Patents and patterns of the apparatus manufactured by the company are placed at $257,631.29, but are stated in the bill of complaint as next to valueless as assets.

Aid by Wireless.—On July 22 effective aid was rendered by wireless telegraphy when the liner *Momus* developed a fire in its hold and was able to communicate the information to its sister ship, the *Comus*, which rescued the passengers and stood by for two days until the fire was under control. Assistance was offered by several vessels that had picked up the wireless signal of distress, but the *Momus* was able to transfer her passengers to the *Comus* and anchor near Cape Canavarel, off the coast of Florida, 335 miles north of Key West, until the fire had been extinguished.

Reforestation.—The U. S. Department of Agriculture, Forest Service, has 24 National Forest Nurseries with an annual productive capacity of over 8,000,000 seedlings. As an indication of the difficulty of the reforestation problem, it may be pointed out that if the output is 8,000,000 seedlings, this quantity falls short of being sufficient to plant 8 sq. miles of denuded land. The expense of attendance during three years in nursery and of transportation would appear to render this method impracticable for planting large areas. Ten tons of seed will be used this year, most of which will be sown where the trees are to stand. On the basis of 60 per cent of loss, the above quantity will seed about 200 sq. miles.

Smokeless Pittsburgh.—Pittsburghers are learning that part of the local "fog" is in reality smoke, and have started a "blue sky" campaign, the agitation being aided by the railroads. The Baltimore & Ohio is suspending for 30 days any fireman who permits his locomotive to emit black smoke within the city limits. The Pennsylvania imposes a 10 days' sentence. The example of the railroads has been followed by several manufacturing plants. After installing smoke preventers in the factories, employers have warned the firemen that needless smoke will cause their suspension. The outcome of the Chicago campaign relating to the use of electricity as a smoke preventive is being watched with much interest by the Pittsburghers.

Electrical Operation of Powerhouse Switch Railway.—The elaborate stipulations made by the committee on local industries of the Chicago City Council in relation to the switch railway to connect the new Northwest generating station of the Commonwealth Edison Company with the Chicago & Northwestern Railroad tracks have already been mentioned in these columns. It is interesting to note, further, that it is made an express provision of the ordinance that the motive power for the operation of cars on the proposed switch railway shall be electricity, except during the period when the generating station is under construction and electrical energy is not available. The switch railway must be elevated, as before noted, and, in addition, the Commonwealth Edison Company must agree not to allow it to be used for any other purpose than for its own requirements. The railway construction must be of substantial and permanent character, with bridges spanning the streets, supported on abutments of stone or concrete masonry, or on rows of iron, steel or reinforced-concrete columns. The ordinance giving the company permission to build and operate this railroad has a life of 20 years.

Block Lighting in Chicago.—The committee on gas, oil and electric light of the City Council of Chicago has recommended for passage an ordinance granting the Inter-Ocean Newspaper Company authority to supply electricity in a certain circumscribed area in the downtown business district by means of underground conduits. The buildings which may be served are those fronting on the south side of Monroe Street, between State Street and Clark Street, and fronting on both sides of Dearborn Street, between Monroe Street and the alley south of it. The ordinance contains a provision, however, that the grantee must remove all of its underground pipes, conduits and connections at any time the commissioner of public works may direct.

Automatic Telephone Exchange for Chicago.—Work on the designing of the new automatic telephone exchange system for the central business district of Chicago is proceeding steadily under the direction of the receivers of the Illinois Tunnel Company. There will be four exchanges, the locations of which are announced. One will be on the third floor of the Chemical Bank Building, at 85 Dearborn Street, where 4200 sq. ft. of floor area has been leased. The second will occupy two floors in the old Chronicle Building at 164 Washington Street and also a part of the basement in the rear, the total amount of area here being about 12,000 sq. ft. The third exchange will be located on the ground floor of the building at 19 Plymouth Place, the floor area being about 5500 sq. ft. The remaining exchange location is in the Brooks Building, on the southeast corner of Jackson Boulevard and Market Street, the area being about 5000 sq. ft.

New Turbine Equipment for Boston Edison Company.—The Edison Electric Illuminating Company of Boston has placed a contract with the General Electric Company for a turbo-alternator of 15,000 kw regular maximum output rating to be installed in the L Street generating station at South Boston. The turbine, which will be delivered for service in May, 1911, will be the largest prime mover in New England. Moreover, it will be one of the largest turbine sets in the country, with the exception of a similar type to be installed by the Commonwealth Edison Company of Chicago at about the same time; the latter machines will be of 20,000-kw rating. The new Boston turbine will occupy a floor area 19 ft. long and 17 ft. wide, and its height from the floor will be 35 ft. 9 in. The buckets of the turbine will be carried on a periphery 14 ft. in diameter and the speed of the machine will be 720 r.p.m., which means a circumferential velocity of 6 miles per minute. The new machine is of the vertical Curtis type, with six stages, and its total weight will be 800,000 lb. The average high-efficiency steam engine if built for this rating would occupy about 10 times the space of the turbo set, the latter requiring only 11,457 cu. ft., or 0.77 cu. ft. per kilowatt. The turbine will be operated on steam superheated 150 deg. at 200 lb. pressure. The Boston Edison Company already has two turbines of 7500-kw rating in operation at its South Boston plant, and three of 12,000-kw rating. There will be a saving in increased weight of about 25,000 lb. in the new machine, in proportion to the size of the existing 12,000-kw units, which weigh 625,000 lb. each. For the new turbine a condensing equipment having 25,000 sq. ft. of cooling surface will be required, compared with 16,000 sq. ft. in the condensers of the 12,000-kw sets. The circulating pump for the 15,000-kw installation will have a capacity of 30,000 gal. per minute, compared with 22,500 gal. per minute on the largest pump the company is at present operating. The alternator will deliver energy at 7000 volts, the frequency being 60 cycles.

BOSTON ELEVATED RAILROAD COMPANY'S NEW TUNNEL.

Use of Electricity in the Construction of the Cambridge Subway.

THE Boston Elevated Railway Company is at present building a double-track subway in the city of Cambridge, Mass., between the Charles River and Harvard Square, to form the major part of a new rapid transit route connecting Cambridge and the other outlying suburbs with the business center of Boston proper. It is expected that when this subway is completed the running time between Harvard Square and Park Street, Boston, will be reduced from 23 to 8 minutes. Trains are to be operated in the subway, which will connect at the Boston end with a tunnel under the West End district and Beacon Hill, the Boston section being under construction by the Boston Transit Commission. Stations are being built underground at Kendall, Central and Harvard Squares, Cambridge, and the engineering work of the subway is being performed under the direction of Mr. George A. Kimball, chief engineer of the Bureau of Elevated and Subway Construction, Boston Elevated Railway Company. The contractor for construction work in the field is the Nawn Contracting Company, Boston.

One of the most interesting features of the construction work is the extent to which electricity is being employed in connection with excavation, pumping, illumination, tunneling and communication. The work has been so carefully planned and systematically carried out that the contractor is at present about nine months ahead of time on the enterprise. A large part of the electrical supply for the work is furnished by the Cambridge Electric Light Company. The service is of an exceedingly desirable character, since it is required 24 hours per day and seven days per week.

The principal centers of electrical distribution in connection with the subway work are at the Boston Elevated Railway Company's storage building, on Dunster Street, near Mount Auburn Street, and at the contractor's machinery plant at the corner of Massachusetts Avenue and Bay Street. The subway structure is being built of reinforced concrete throughout, with the addition of some structural steel work at the stations. The general method of construction is by open cut from the Charles River through Main Street and Massachusetts Avenue to Central Square. Between Central Square and Putnam Square the subway is being tunneled, and west of Putnam

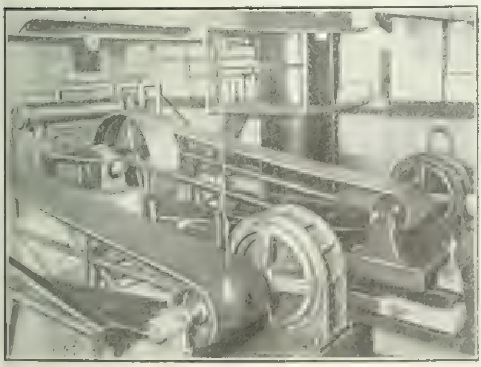


Fig. 1—Electric Air-Compressor Plant, Dunster Street

Square the open-cut method will be pursued to the terminal yard of the subway near Harvard Square. The uses of electricity in the work include the operation of electric derricks and cable ways for the handling of excavated material and concrete; the operation of electric hoists; air compressors, elevators, pumps, concrete grouting equipment, and concrete mixing. At present construction work is under way throughout nearly the entire length of the subway in Cambridge, with the exception of one section of the tunnel which is being completed by shield and hydraulic jack, and a section west of the incline on the west side of the Charles River. The surface-car service between Boston and Cambridge via Main

Fig. 2—Transformers and Switchboard in Dunster Street Plant.

Street or Massachusetts Avenue has been largely diverted to other thoroughfares.

Fig. 1 is a view of the interior of the contractor's plant at Dunster Street, which is the principal receiving point for service delivered by the Cambridge Electric Light Company. In

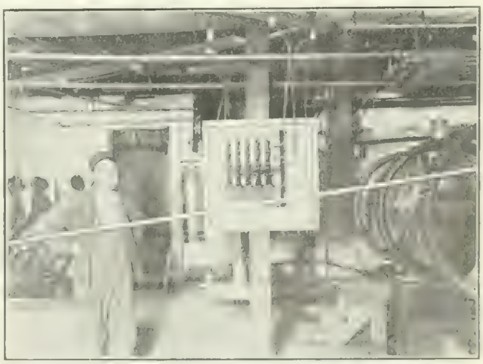


Fig. 3—Electrically Operated Contractor's Plant at Bay Street

this plant are located six 75-kw Westinghouse oil-cooled transformers mounted on a gallery and two 200-hp General Electric induction motors belted to two Ingersoll-Rand "Imperial" type air compressors. The transformers are installed in two banks of three each, and they reduce the potential from 2300 volts to 550 volts for use at the motors. From the transformers leads are brought across the top of the gallery and

downward to a wooden switchboard, covered with asbestos, on which are mounted two three-phase oil switches controlling the induction motors. The motors are wound for operation at 600 r.p.m. Fig. 2 shows the transformer gallery, motor leads and switchboard, the cables for the motors being carried underneath the floor after leaving the watt-hour meters. Lightning arresters are installed on the primary connections of the transformers where the cables enter the building.

Each motor is belted to a compound horizontal compressor running at 255 r.p.m., and supplying air to a receiver of 1500 cu. ft. capacity at a pressure of from 90 lb. to 120 lb. per square inch. Although the plant is of a temporary character the compressors and motors are mounted on concrete foundations.

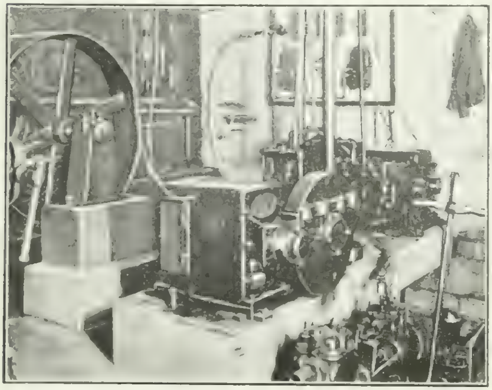


Fig. 4—Electrically Driven Compressor in Bay Street Contractor's Plant.

The motors are started by resistance variations in the rotor circuit. The air-compressor plant is lighted by incandescent lamps supplied with central-station energy through an ordinary lighting transformer. In some cases the compressed-air supply is employed in the operation of hoisting engines of the steam type. The absence of smoke and dirt in the subway construction is noteworthy. The operation of the cableways by air is practically noiseless compared with the usual donkey engine service. A typical cableway operated by air from the electrically driven plant is at work near Harvard Square, the length being 375 ft. It is equipped with a 35-hp air hoisting engine and bucket of 30 cu. ft. capacity, and handles spoil which is brought to the surface through a vertical shaft connecting with the excavations. About one load per minute is handled. Another representative hoist is driven by a 30-hp Westinghouse three-phase, 220-volt induction motor supplied with energy from a transformer located on a pole outside the portable house in which the winding drum is located. An external starting resistance is used in connection with the motor. An electric derrick was used in construction by the so-called "slice" method in Massachusetts Avenue. East of Harvard Square the excavation for the train tracks was performed by cableway. On the entire work the maximum number of electric derricks in operation was five, with three cableways.

A portion of the tunnel in Massachusetts Avenue, between Pleasant and Remington streets, is being built by the tunnel method on account of the greater depth of the subway here and also on account of the heavy surface-car traffic. The roof of the subway is from 10 ft. to 20 ft. below the surface of the street in this section, the inside width being about 26 ft. 10 in. The contractor's plant is located at the corner of Massachusetts Avenue and Bay Street, and it extends southward to Green Street, the latter thoroughfare being about 21 ft. lower than Massachusetts Avenue. The plant includes a yard for the disposal of excavated material, which is conveyed in small cars, holding about 1 cu. yd. each, from an elevator shaft equipped with a steam hoist and an electric hoist. Near the mouth of the shaft is a power plant, shown in Fig. 3. In this plant are installed electrically driven pumps, compressors and small machinery used in repair and emergency construction work. Energy for this surface is supplied mainly by the Boston Elevated Railway Company from one of the direct-current feeder circuits of its surface line system.

The tunnel section of the subway is being built by the shield method. The shield weighs about 70 tons and travels on eight steel rollers on each side wall of the tunnel as the work advances. The shield is propelled by 14 125-ton hydraulic jacks attached to the shell at about equal distances around its circumference, reacting on cast-iron rods imbedded in the arch. The shield moves forward at the rate of about 67 ft. per week, and the hydraulic pressure which operates the jacks is supplied by two duplex, double-acting Watson-Stillman two-stage pumps, each being belt-driven by a 40-hp, 550-volt Holtzer-Cabot motor controlled by a Cutler-Hammer starter. The driving belts are each 8 in. wide, and the pumping plant is provided with a 15-ton accumulator to maintain a steady pressure on the delivery line leading to the shield. The motors run at 900 r.p.m. normally and are of the shunt-wound type. The pumps supply water to the jacks at pressures either of 1500 lb. or 5000 lb. per square inch, according to the demands of the work. The higher pressure is used only when the cutting edges of the shield are unable to force their way through the earth at the lower pressure. The cleanliness, convenience and especially the compactness and low labor cost of operating the electric drive in a limited space of this kind are proving valuable features to the contractor.

The plant also contains two Westinghouse electrically driven automatic air compressors, shown in Fig. 4. These are run at 1100 r.p.m., and have a capacity of 84 cu. ft. per minute each. They supply air at a pressure of 60 lb. per square inch for the ventilation of drifts, and for the operation of a Caniff grout mixer, which forces grout into the space between the outside of the concrete arch of the subway and the surrounding earth

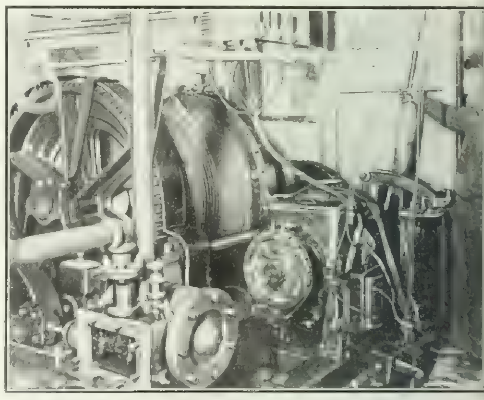


Fig. 5—Electric Hoist at Bay Street Plant.

left by the passage of the shell of the shield. There is a bolt cutter driven by a 5-hp, 550-volt induction motor supplied with energy from the Cambridge Electric Light Company's service, and the blacksmith shop is equipped with a forge blower driven by a 1-hp belted motor.

In the preliminary excavation of the tunnel section when the shaft at Bay Street was built, a sump was excavated in one corner into a stratum of coarse gravel, and a 4-in. centrifugal pump, direct-driven by a 15-hp, 500-volt direct-current motor, was installed in connection with an automatic starter operated by a float. This equipment has kept the premises free from water since its installation, and is in operation but one-third of the time. It possesses marked advantages over the usual method of pumping by Italian laborers. The capacity of the set is 350 gal. per minute.

The floor of the subway at Bay Street is about 45 ft. below he surface of Massachusetts Avenue, and the sump is 10 ft. leep, 10 ft. long and 8 ft. wide. At the Bay Street plant is lso an electric hoist driven by a General Electric railway moor, rated at 30 hp, and shown in Fig. 5. The hoist is used in aising excavated materials in cars from the level of the ubway floor to tracks located on a wooden platform in the Bay Street yard, from which the contents of the cars are lumped by gravity into teams. Laborers and supplies are also arried into and out of the subway at Bay Street by the hoisting plant. A steam-driven hoist is located beside the electric

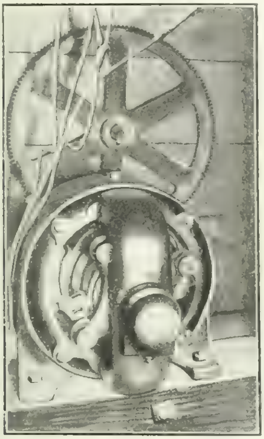


Fig. 6—Motor-Driven Concrete Mixer at Bay Street Plant.

ioist in the Bay Street shaft house, and both are used at times of heavy load. The electric hoist is fitted with a solenoid rake, and its input is measured by a watt-hour meter, so that he contractor can determine the cost of the work more accuately. The railway company's circuit is used to operate the ioist, a simple main switch being installed on the wall to cut nergy on and off the controller. The starting resistance is nounted on the ceiling of the shaft house, as shown in Fig. 5.

The concrete for the tunnel section of the subway is pre-

'ig. 7—Radial Jib Hoist, Electrically Operated, Central Square.

ared in a "Municipal" mixer located in a gallery about 20 ft. elow the street level. The mixer has a capacity of about ½ u. yd. and is driven through a gear and pinion by a 10-hp, 00-volt, direct-current shunt motor of General Electric make. A Cutler-Hammer starting box is used in connection with this utfit, and the motor drive is shown in Fig. 6, the motor and gearing being situated on the outside of a bulkhead which separates the mixer from the driving mechanism. The comfort afforded the operator of the mixer by electric drive is a strong point against the usual steam drive, and the motor service proves compact and convenient in the limited space underground where the apparatus is obliged to work.

The contractor has an electrically driven stone-crushing plant of his own in Jamaica Plain, which has a connected motor installation of 175 hp. This includes an air compressor driving drills and other tools, with a 55-hp motor; two stone crushers driven by a 75-hp motor; a 35-hp motor driving a derrick with an 80-ft. boom, and a bull wheel on the derrick driven by a 10-hp motor.

On the open-cut sections of the work east of Bay Street a number of electric hoists are in service, including one of 50 hp driving a 450-ft. cableway; another of the same capacity in an adjacent section of the excavation; a 40-hp hoist, and a radial jib electric hoist, shown in Fig. 7, working near Central Square. This crane is equipped with a 20-hp, 500-volt Westinghouse direct-current motor for hoisting service and a 7.5-hp motor for turning the tower. At the east end of the subway, near the bridge incline on the Cambridge side of the Charles River, a concrete well of the same dimensions as the sump at Bay Street has been built to handle the drainage in the subway east of Kendall Square. This is equipped with a 3-in. centrifugal pump driven by a 15-hp, 550-volt motor and a ventilating fan run by a 1-hp motor. In the residential sections of Cambridge the absence of leaky boilers and hissing steam engines has been much appreciated during the subway construction, and the operators of the electric hoists consider them superior on rough work to steam or air.

ISOLATED INDUSTRIAL GENERATING INSTALLATION.

The Steam Turbo-Generator and Induction-Motor Equipment of Amoskeag Textile Mills.

By Albert L. Clough

THE Amoskeag Manufacturing Company operates an extensive plant for the manufacture of cotton textiles and worsted goods, which lines both banks of the Merrimack River at Manchester, N. H. About 16,000 operatives are employed and nearly 500 miles of cloth are produced each working day.

Originally, water-power, derived from the Amoskeag Falls, was mainly relied upon, but with the growth of the plant steam power was very extensively introduced so that, at the present time, about 16,500 hp is developed by water and about 21,000 hp by steam. Electric lighting has been in general use in this plant ever since it became practically feasible and electric motors were introduced, upon a comparatively small scale, early in their commercial development and their application has been gradually but consistently extended, until now the generator equipment installed aggregates about 20,000 kw in rating.

Rather recently the mills of several neighboring corporations were acquired by this company, and a very large new textile plant, known as the Coolidge Mill, was constructed. Thus the situation demanded increased electrical generating equipment and led to the erection of the installation described in this article, which has just been placed in regular service.

This power house is of heavy red-brick construction with 24-in. walls and granite foundations. The turbine house is 151 ft. x 67 ft. in size, and the boiler house is 539 ft. long and 45 ft. wide, the turbine and boiler houses forming a letter "L" construction. In the angle of the "L" is located the coal pile, which measures about 120 ft. x 500 ft. on the ground and is capable of containing 16,000 tons. This is surrounded by a line of reinforced concrete posts, grooved for the reception of the heavy plank forming the coal fence. The coal pile extends

to the railroad siding and the unloading of cars and the distribution of coal in the pile is performed by a Mead & Morrison electric traveling crane, which reaches all parts of the pile.

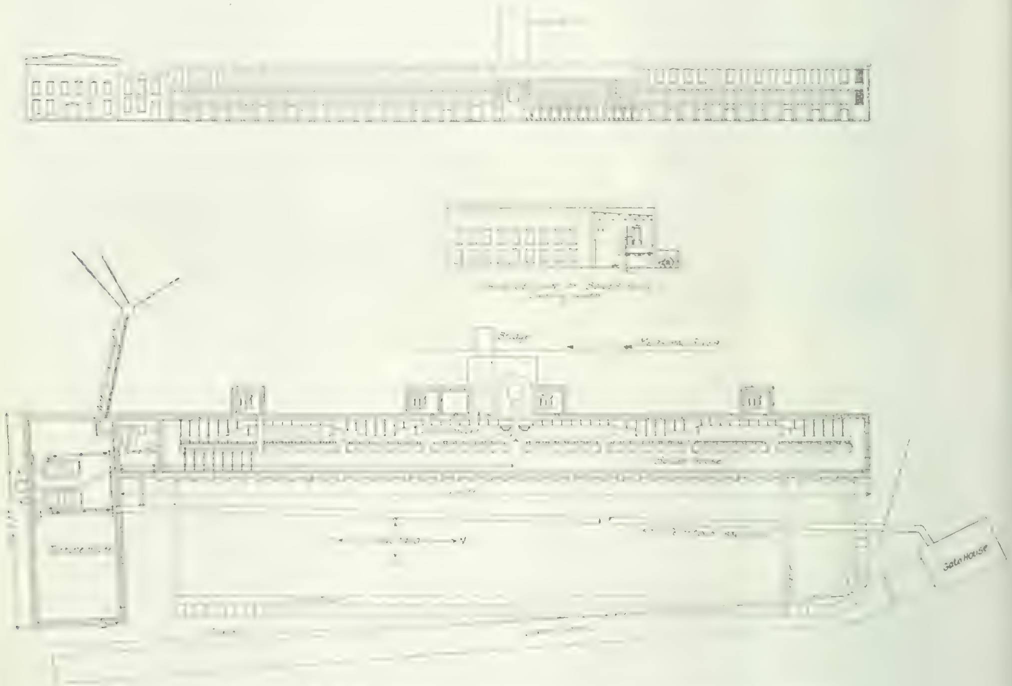
The turbine house has a basement 10.5 ft. high and the turbine room is 30 ft. high to the steel roof trusses and 22 ft. in clear height to the Niles-Bement traveling crane, an 8-in. pilaster for which is added to the masonry in each bay. Cast-iron columns support the boarded plank floor of the turbine room, which is entirely clear of the turbine foundations. These foundations rest upon the solid ledge and are of very heavy concrete construction.

The boiler equipment consists of 64 Manning vertical boilers, of 150 hp rating, set in a single line nearly 500 ft. in length, with their doors facing the coal pile. Half of these were built by Dillon, of Fitchburg, and the other half in the Amoskeag Manufacturing Company's shops. They are divided into four groups of 16 each. Near the center of the

stoker ram cylinders and all blower engines is piped to the feed-water heaters.

A Sturtevant economizer is applied to each group of 16 boilers, the dampers being so arranged that the chimney gases may be sent directly to the stack in case repairs are necessitated, and feed-water by-pass connections are also fitted. The tubes of the economizers are continuously scraped by means of electric motors acting through worm gearing, one motor serving two economizers.

Two main steam pipes, 20 in. in diameter, with riveted joints and chain supported from the roof trusses, are carried the entire length of the boiler house. One of these branches into two pipes, 12 in. in diameter, to serve the two turbines and the other is at present intended to furnish steam to other parts of the plant. Each boiler is connected to its main through a 4-in. horizontal pipe with a connection swivelling on a vertical axis at the boiler and at the main, to allow for expansion and con-



Sections and Plan of Boiler House and Power Plant, Amoskeag Manufacturing Company.

boiler house stands the brick stack, 200 ft. in height, with a 12-ft. flue. There are two horizontal uptake flues, each serving one-half the boilers, these being constructed with ⅛-in. steel shells and 4-in. brick lining and having a 14-ft. x 4-ft. cross-section. The main entrance flue to the stack is 8 ft. x 14 ft. in section. An air duct 3 ft. x 4.5 ft. in cross-section at the blower end and tapered and fitted with manually operated invidual dampers is provided under the boiler fronts of each group of 16 boilers. Each duct is fed with air from a Sturtevant blower, directly connected to a simple slide-valve engine, under automatic throttle control, the four blower units being located in small brick additions built upon the rear wall of the boiler house at intervals along its length. The automatic control of each blower is effected by means of a steam-pressure relay which starts the blower engines under low boiler pressure, thus regulating the forced draft independently upon each group of 16 boilers. A Jones underfeed stoker is fitted to each boiler, the rate of action of each stoker of each group being determined by the action of its blower engine through a [illegible] The exhaust steam from all

traction. All boilers are covered with asbestos and banded with Russian iron.

The pumps and feed-water heaters are located in a room between the turbine room and the boiler house proper. The pump equipment consists of a large compound duplex direct acting steam unit and a smaller simple duplex unit. The foundation is also in for another unit identical to that first mentioned. A Reilly tubular feed-water heater takes all the exhaust steam from the auxiliaries and a large open heater is also provided. The piping is so arranged that various combinations can be made in order that the feed water may be by-passed around either heater in case of need. The feed-water supply is obtained from the company's private reservoir.

There is an opening in the boiler-house wall in front of each boiler and the coal pile is always maintained full enough at these points so that coal will fall in upon the floor so close to each feed door that it may be shovelled directly into the stoker hopper. The ash is cleaned from the rear of the boilers to the floor and is removed by dump carts to be used for filling.

The two Curtis turbines which drive the two 3500-kw genera-

tors are of the horizontal type and are said to be of larger size than any of this type that the General Electric Company has heretofore constructed. They are of the five-stage type, with two rows of rotating and one row of stationary buckets per stage. The initial pressure is 180 lb. The bearings are cooled by means of coils of copper tubing embedded in the babbitt, through which water is circulated under gravity head from the company's canal. An oil pressure of 75 lb. is maintained by means of a pump directly driven from the turbine shaft; this pressure is utilized to operate the governor cylinder, the oil passing to the bearings through a manually operated throttling valve which reduces the pressure to about 15 lb. per square inch. Roller-bearing thrust collars resist the axial pressure of the shaft. A direct acting steam pump, mounted upon the turbine base, furnishes the oil pressure required before the turbine starts. The steam is admitted through cam-actuated poppet valves, operated by the governor cylinder through gearing and a horizontal shaft, and the valve action is such that all valves but one are always in either the open or closed position, so that there is throttling at only one valve at any time. The governor is of the centrifugal type, spiral-gear driven from the turbine shaft, and controls the pilot valve which admits oil pressure to one side or the other of the governor cylinder. The emergency safety-stop mechanism consists of a centrifugal governor device carried directly upon the turbine shaft, which, when operated by excess speed, throws out a trigger which releases the throttle valve of the turbine, which in turn closes under the action of unbalanced steam pressure. Each turbine is fitted with a synchronizing device, operated from the switch gallery. This consists of a small direct-current motor, with reversing controller at the switchboard. The motor acts to compress or release a spring in the governor mechanism that is capable of influencing the turbine speed to the extent of 2 per cent, to allow synchronism to be attained. Condensers of the Bulkley type are employed, located just outside of the wall of the turbine station, and the supply of condensing water is derived from a 5-ft. penstock, furnishing gravity head sufficient to maintain the water level at a point about 2 ft. below the heads of the condensers. Priming from the reservoir pressure is required at starting only, after which only the gravity head is used. A vacuum of 28 in. is normally maintained.

The generator equipment consists of two 3500-kw General Electric horizontal-type turbo-generators, having an actual safe output of 4000 kw each. These units are of the six-pole, rotary-field, fan-cooled type and deliver three-phase current at 60 cycles and 2300 volts to a delta-connected system. The rated speed is 1200 r.p.m., with a guaranteed regulation to within 2 per cent from one-half to full-load and the rated output in kva is 4375, with a power-factor of 80 per cent.

There is space in the turbine house for the installation of two other similar units, so that the present rating of 8000 kw can be increased to 16,000 kw.

The exciter equipment consists of three 35-kw direct connected 125-volt direct-current units. Two of these are driven by 2300-volt, three-phase motors, and are located upon the switchboard gallery, while the third is direct connected to a horizontal, single-stage, non-condensing Curtis turbine and is located on the main floor under the gallery. Energy for operating the exciter motors may also be derived from the 2300-volt service of the Manchester Traction, Light & Power Company and from other power stations of the Amoskeag Manufacturing Company. On the switchboard gallery is also located a 75-kw motor-generator unit which furnishes direct current for operating the coal-handling crane.

The switchboard, located upon a steel gallery at the rear of the turbine house, consists of 16 slate panels, of which three are generator panels (one of which is at present blank), three exciter panels, one a panel for the Tirrill voltage regulators, one an incoming line panel for the Manchester Traction, Light & Power Company's service wires, and eight are feeder panels, one of which is now blank. No e.m.f. higher than 125 volts is brought to the board, all switches being of the remote controlled type, and all conductors without exception, in the whole installation are in pipe conduit, with condulet fittings.

The arrangement of this station provides for the operation of all feeders either from the turbo-generators or from the Manchester Traction, Light & Power Company's service wires and thus there are two sets of three buses and all feeder switches are triple-pole, double-throw. The Tirrill regulator is capable of controlling four exciters with one set of contacts to spare. One of the feeder panels is especially equipped to supply energy to the new Coolidge Mill, which is operated entirely by electric motors. The rating of this panel is 4000 kw at 2300 volts. The other feeder panels, which furnish energy to other mills, vary in rating from 475 amp to 750 amp at 2300 volts.

The solenoid-controlled oil switches are enclosed in brick cells, with asbestos wood doors, located upon the main floor under the gallery. Separate cells are provided for the switches in each leg of the generator leads. Each throw of each switch is provided at the board with indicating lamps, red for closed and green for open, and special 125-volt direct-current buses on the back of the board supply energy for the solenoids, which are relay-operated for closing and directly operated for opening, special arcing contacts taking the solenoid discharge.

In the basement, under the switchboard, are located all series and shunt instrument transformers, all conductors being completely inclosed in pipe conduit.

The conductors from the generators to the board are six 1,000,000-circ. mil lead-covered, varnished-cambric cables in Orangeburg fiber conduit embedded in Portland cement, which is carried to a point above high-water mark. From the Coolidge Mill switchboard panel six 1,000,000-circ. mil cables are run up to the power-house wire tower and from these are taken nine 300,000-circ. mil bare hard-drawn stranded cables, which cross the Merrimack River by way of an island on steel towers; four triple-petticoat porcelain insulators are used upon each conductor at each tower. A three-phase lightning arrester of the aluminum-cell type is installed at each end of this line and at the entrance of the Manchester Traction, Light & Power Company's circuit, while over the peak of each tower is run a grounded steel cable for additional protection.

In the entrance at the Coolidge Mill is a solenoid oil switch, controlled from a convenient point upon each of the floors, so that the service can instantly be cut off in case of fire. Distribution in this mill is from three bare vertical buses, carried on porcelain insulators in three deep slots in a vertical concrete duct formed upon the wall of a fireproof tower of the mill. The weight of the buses is supported upon special strain insulators at the top of the tower.

On each floor of the mill is a switchboard from which distribution to that particular floor is effected. In this mill are 126 three-phase, 2300-volt motors, each equipped with its own switchboard, circuit-breaker and instruments. No transformers are used in any part of the system except for lighting upon a small scale and there are practically no fuses employed in the entire installation.

All distribution to motors is through three-conductor, varnished cambric cable tested at 7500 volts and rated at 3000 volts working pressure, enclosed in iron-pipe conduit, so that there are absolutely no exposed wires. The pipe conduits throughout the entire plant are painted an applegreen to prevent their being mistaken for water or steam pipes.

The lighting of the Coolidge Mill is by means of direct-current series enclosed arc lamps operated from Brush multi-circuit generators, direct connected to three-phase induction motors fed with energy from the general supply system of the mill.

The arrangement of the motors for driving the machinery of the various departments of the Coolidge Mill is of considerable interest and would, in itself, furnish material for a special article. Suffice it to say that the varying requirements of the machinery in the various rooms call for special motor provisions, the aim being to secure the desired results with a minimum of lineshafting and with a maximum of all-around economy. All large motors are located in special closed

rooms, with ventilation provided by means of fans. The small motors are mostly supported on the ceiling and reached by special steel galleries.

A very effective system of motor maintenance and inspection is in force, which assures each motor attention at frequent regular intervals, while in case of need an attendant can immediately be summoned to any department by telephone.

GLASGOW ELECTRICALLY-DRIVEN SEWAGE DISPOSAL WORKS.

THE main drainage and sewage disposal works recently completed by the Glasgow (Scotland) Corporation, next to that of the London County Council, is the largest of its kind in the world; the aim of the promoters, the Glasgow Corporation, being the prevention of the discharge of the sewage of the city in the River Clyde. The area at present embraced covers 41½ sq. miles, and includes the whole of the city of Glasgow, with the burghs of Rutherglen, Govan, Pollokshaws, Partick, Renfrew, Clydebank and the intervening portions under the county authorities of Lanarkshire, Renfrewshire and Dumbartonshire. The amount of sewage and proportion of rainfall drained from the area is estimated at 250,000,000 gal. per day. For its collection some 30 miles of new sewers have been constructed, varying in size from 2 ft. 6 in. to 10 ft. in diameter. The stations at Dalmarnock and Kinning Park present nothing of interest to electrical engineers, the pumps being of the steam-driven reciprocating type. The sewage from Govan and Renfrew and district is pumped at the Shieldhall works by three centrifugal pumps, and is given a lift of 21 ft. to bring it to the level of the Glasgow sewage.

The whole works are self-contained—that is, electricity at 250 volts is generated on the spot and everything is electrically driven. Another feature is that there are no belt drives, except for the tools in the mechanics' shop. The lime agitators are three in number, and are for the purpose of keeping the lime mixture in a condition ready to be discharged into the sewage as it enters the catchpit. For this agitating process the mixture

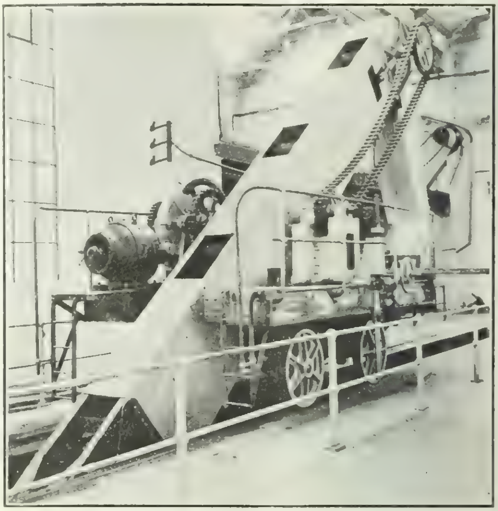


Fig. 2—Catchpit Dredger at Shieldhall.

passes into three brickwork tanks, each measuring 100 ft. by 30 ft. by 5½ ft. deep. Along each side of each tank there are gantry rails, and on these rails runs backward and forward, automatically reversing at each end, a specially made four-wheeled stirring arrangement, which in traveling keeps the lime liquid in a creamy condition, it being necessary to discharge a saturated solution into the sewage at the catchpit.

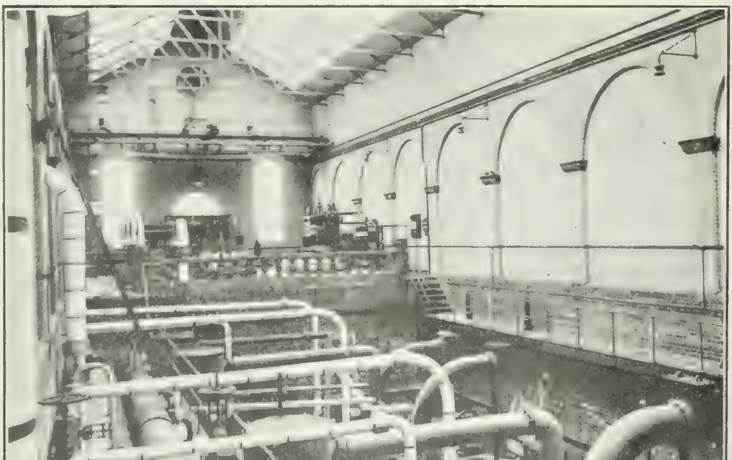


Fig. 1—Main Engine Room, Shieldhall, Glasgow.

These traveling stirrers are driven by endless steel ropes fixed to the screens permanently, but passing over drums which are automatically reversed. These drums, of which there are three to each stirrer, are in turn driven by a 15-hp motor, one motor to each stirrer, through speed-reduction gear and reversing clutches on the drum shaft. The lime mixture is conducted along concrete-lined ducts, and there are suitable penstocks controlled by small motors.

The mechanics' shop has the usual machine tools for repair work and an overhead 8-ton hand-operated traveling crane. There are here two 10-hp and one 5-hp motors. Next to it is the boiler house, containing three Babcock & Wilcox chain-grate mechanically-stoked boilers, and an ash hoist driven by a 30-hp motor on to a line of shafting, and one stand-by feed pump, an economizer, driven by a 5-hp motor, and a large fresh-water storage tank.

Adjacent to the boiler house is the main engine room, as shown in Fig. 1. Here are three Crompton-Howden 150-kw

steam sets generating at 225 volts, the generators being of the shunt-wound direct-current type. The main and feeder distribution switchboards are fitted with double-pole circuit breakers, switches, instruments and fuses, mounted on enameled slate and are of the usual construction. There are also an 8-ton hand-operated overhead traveling crane, two condensers, using the treated solution, by the way, for condensing purposes, and two air pumps.

The pumps for the Govan and Renfrew sewage are also in this room. They are of the centrifugal type, driven by Howden engines. There is one 24-in. diameter for dealing with 600,000 gal. per hour, one 18-in. diameter dealing with 330,000 gal., one 15-in. for 240000 gal. and two 10-in. diameter. The sewage entering these is controlled through hand-operated penstocks.

The iron liquor tanks are of special construction, being lined with oak, then a section of puddle, and another lining of oak, to prevent leakage and at the same time to withstand the liquor's chemical action. These tanks being built in the ground necessitate the pumping of the liquor into the catchpit. This is effected by a double-ram suction pump driven by a 3-hp motor, direct coupled, situated in the adjoining oxidizer house. In this house are also the three oxidizer drums, as they are termed. The iron liquid, like the lime mixture, must be a saturated solution, and to keep it so and prevent settling or precipitation these revolving drums are necessary. The drums are each 11½ ft. long and 8 ft. diameter, and are constructed entirely of oak. The axles are also of oak and revolve on rollers. The drums are geared to a shaft which in turn is driven by either of two 30-hp motors through a suitable clutch gear. From the drums the liquor gravitates to the catchpit.

Adjoining is the lime store, capable of storing 1000 tons of lime. In this store are also the four pan mixers for slacking the lime and making the mixture. They work in pairs, and are all driven by a 30-hp motor geared to a shaft with clutches for each pair of pan mixers. From here the lime mixture goes to the agitation tanks and back to the catchpit, which is in the house adjoining the lime store.

The catchpit is 170 ft. long, 17 ft. deep and 16 ft. wide, tapering down to a depth of about 18 in. at the bottom. A part of it is seen in Fig. 2. Along each side are standard rails on which runs a unique piece of gear of special construction and the first of its kind. It is to the design of Mr. W. D. Hamilton, the consulting engineer. At Dalmuir a man is required to sit in the traveling carriage, but as this means sitting over the open sewer all the time during a shift, the disadvantage of such an arrangement was obvious, hence this development.

As indicated in the photograph, it consists of a four-wheeled truck carrying a bucket dredger and elevator. The sewage on entering the catchpit meets the lime mixture, which causes the solid matter to precipitate and settle at the bottom of the sloping-sided catchpit. This, therefore, requires constant clearing, obtained by the use of this special dredger. The dredger is self-contained, and after starting requires no attention. It automatically reverses itself at each end of its travel, in moving along the catchpit rails, by means of the kick lever (seen projecting downwards in line with the wheels) striking a buffer fitted at each end of the catchpit. This reverses the clutch-reversing gear on the opposite side of the carriage.

The bucket conveyor at the same time continues elevating the solid matter and empties it through a chute into a truck following up behind. These trucks or wagons are specially made and used for this purpose alone. They are coupled up as usual in railway practice, and move back and forth with the dredger. Being for standard gauge, they are despatched all over the country with the sludge for agricultural use, but the solids obtained are used principally by the corporation on sewage farms. Some of it is used and sold in cakes as fertilizer.

The whole dredger, carriage and elevator is driven by a 30-hp motor fixed on to the carriage as seen. Energy is collected in the usual way through a trolley and three wires. The starter for the motor is fixed to the back of the engine room wall, and the motor is a shunt-wound machine; hence the reason for the three wires seen in the view.

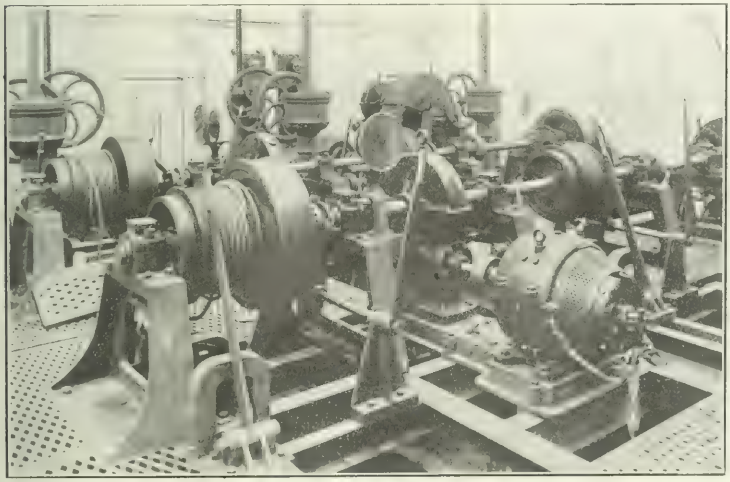


Fig. 3—Screening Plant Motor Equipment at Shieldhall.

Having dropped most of the solid matter in its passage along the catchpit, the sewage is now attacked by the iron liquor, which enters at the end remote from the lime end. This liquor is made to spray over the sewage by means of a baffle plate. The sewage then passes through a screening plate. These screens are to remove any solids unaffected by the lime, which accumulate at the screens and are removed by a stationary elevator and discharged through a chute into a truck standing below.

These screens are of three different meshes, and can be removed for cleaning purposes periodically like ordinary sluices. For the hoisting of the screens on to the floor level motor equipments are fitted aloft. Each of the grids or screens is fixed to a wire rope, which passes round a revolving drum, which in turn is made to revolve through a friction clutch. The motors driving these are rated at 5 hp and are shunt-wound. The equipment stands on a raised gallery about 15 ft. above the floor level. Speed reduction is obtained through worm and pinion in an oil bath. On this gallery are also the hand wheels operating sluices to close any screen opening when necessary.

After screening, the sewage and treated liquor passes on into the open air, and, by means of suitable brickwork channels, is led into the precipitation tanks of brickwork, 15 in number, and each measuring 400 ft. by 60 ft. wide and normally holding a depth of 8 ft. of treated sewage.

Here it is allowed to rest for a time to allow the iron liquor to purify it, after which it is pumped into two iron sludge tanks, each 115 ft. by 45 ft. by 10 ft. deep. These pumps are three in number, 9 in. diameter and of centrifugal type, each driven by a 20-hp motor. The clear liquor passes off into the river, the sludge passes through pipes 18 in. in diameter to specially built steam hopper barges, by which it is taken out to the open sea and there dropped. The purified liquor discharged into the river can be used for condensing purposes and is otherwise fit for many manufacturing purposes.

ELECTRIC PUMPING IN CALIFORNIA.

By Alton D. Adams.

One hydroelectric system in California has increased its connected [illegible] from about 1124 hp to [illegible] hp in six years, and 86 per cent of this latter power was devoted to pumping for irrigation. Some 1800 acres, devoted mainly to the cultivation of citrus fruits, were irrigated by means of this pumping, so that about 0.21 hp of motor rating was required per acre on an average in the latest year, or 1909.

The pumping was done from wells where the depth of water varied down to more than 80 ft., and the lift of the water above the surface at the wells ranged up to more than 100 ft.

Prior to September, 1909, the generating plants of the electric system had a total rating of 3850 kw, so that this rating amounted to about 0.21 kw per acre irrigated, not counting the other motor and lighting loads. There was, however, a connected lighting load of about 1530 hp at the end of 1909, so that the total stationary motor and lighting load was then 5880 hp, and the 3776 rated hp of the motors devoted to pumping for irrigation represented 64 per cent of this total.

The following figures represent the approximate lighting and motor loads and the total lighting and motor load at the end of each year:

TABLE I.—LIGHTING AND MOTOR LOADS.

End of Year	Lighting Load, hp	Motor Load, hp.	Total Connected hp.	Per cent. Motor Load to Total Load
[illegible]	[illegible]	1,124	1,810	62.0
[illegible]	[illegible]	1,407	2,155	65.5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1906	872	2,372	[illegible]	72.5
1907	[illegible]	[illegible]	3,934	[illegible]
1908	1,124	[illegible]	4,717	76.0
[illegible]	1,530	4,350	5,880	74.0

At the end of 1903 the motor load was 62 per cent of the total, and at the end of 1909 it was 74 per cent. During the period of six years the connected motor load increased about 3126 hp.

The area of about 1050 square miles in which this motor and lighting load is connected lies nearly exclusively in Tulare County, and the largest city served is Visalia, which had a population of 3085 in 1900. Tulare County has an area of 4952 square miles, or nearly five times as great as that served by the electric system, and its population in 1900 was 18,375. In the same year the area of irrigated land in Tulare County was 86,854 acres, or nearly five times the 18,000 acres now irrigated by means of service from the electric system.

The electric lines now include the more populous part of this county and nearly all of its towns, and it may be assumed that the included portion had as much population in 1909 as the entire county in 1900. On this assumption, the total connected load of lamps and motors amounted to 32 hp per 100 people, and the motors used in pumping amounted to 20 hp per 100 people, in 1909. Per square mile of the total area included by the electric lines, the horse-power rating of the pumping motors was 3.6 in the last named year.

Prior to September, 1909, the total generator equipment of 3850 kw at the stations of the electric system was equivalent to 5133 hp, or to 87 per cent of the connected motor and lighting load.

The following table gives the maximum station load for each

[illegible] MAXIMUM AND MINIMUM [illegible]

[illegible]	Maximum Load, hp	[illegible]	[illegible]
[illegible]	3,310	2,400	[illegible]
[illegible]	4,060	[illegible]	[illegible]
[illegible]	[illegible]	3,155	[illegible]

of the years named, the minimum load on the day of the maximum, and the percentage of minimum to the maximum, approximately.

The figures for each year represent a day of 24 hours. In 1907 and 1908 the day of maximum load came in the last third of September, and in 1908 it came on July 29. As a large part of the motors used for pumping operate day and night they must account for the exceptionally high percentages of 64 to 72 for minimum to maximum loads, and the percentages for average loads would, of course, be higher. The maximum loads came between 8 in the morning and noon.

In each case the maximum load was well within the station rating of 5133 hp, and the maximum load of 1909 was 78 per cent of the connected lighting and motor load at the end of that year. The station rating was 87 per cent of this connected load.

During 1907 the average load was 1575 hp on the electric station, or 47.5 per cent of the maximum in that year, and during 1909 the average station load was 2162 hp, or 47.1 per cent of the maximum. As an accident to one of the water-driven generators made it necessary to use steam-power for the first time in 1908, the average load has not been computed for that year.

The figure of 47 per cent for the ratio of average to maximum yearly loads in this electric pumping system is much above the corresponding ratio for electric lighting and motor-service systems in cities, which usually runs from about 25 to 30 per cent. In this electric pumping system the high load factor must be due to the long-hour use of the pumps, which are often kept going day and night during the irrigation season.

The following table contains the average yearly load, the highest average load in any calendar month and the percentage of this yearly to monthly average in each of three years, approximately:

TABLE III.—AVERAGE LOADS.

Year	Average Year's Load, hp	Highest Average Monthly Load, hp	Per Cent Yearly to Monthly Average
1904	1,013	1,336	78.5
1907	1,575	2,836	55.5
[illegible]	2,162	3,432	63.0

The year 1904 was selected for analysis because it was the last in which the total output was generated by a single hydroelectric plant, the year 1907 was selected because it was the last in which the total output was generated by two hydroelectric plants, and 1909 was selected because it was the latest year. It may be noted that from 1904 to 1909 the average yearly load at the stations more than doubled.

In southern California most of the irrigation is done from April to October inclusive, though some water is used in every month, and the distribution of the demand for pumping has a marked effect on the electric output. Thus in 1909 the total output of the electric system under consideration was about 2864 hp on an average from April to October inclusive, and an average of only about 1166 hp for the months of January, February, March, November and December. The average horse-power of load at the stations in each month of 1909 was as follows, approximately:

[illegible]—AVERAGE MONTHLY LOADS.

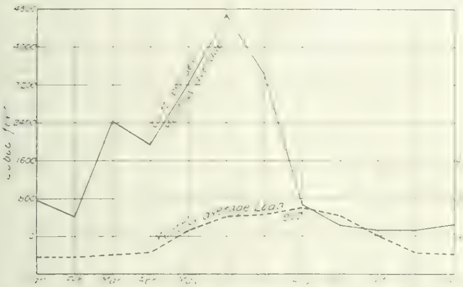
January	1096	[illegible]	[illegible]
[illegible]	[illegible]	August	3408
March	1120	[illegible]	[illegible]
April	1860	October	1908
May	3072	November	1302
[illegible]	[illegible]	[illegible]	[illegible]

June, July and August were thus the months of greatest average loads in 1909, and this corresponds approximately with the results in other years.

Fortunately for the operation of irrigation pumps by hydroelectric plants the maximum discharge of rivers in the arid regions corresponds nearly in time with the greatest demand for water on the land, so that when pumping must go on at the greatest rate there is the most hydroelectric power to do the work. Such a relation exists in the hydroelectric system under consideration which operated under the above loads with the

water-power of the Kameah River exclusively up to the end of the year 1907. As may be seen from the discharge diagram here presented for the Kameah River in 1906, the latest year that figures are in hand, the greatest mean monthly flow occurred in June and amounted to 4670 cu. ft. per second, carrying away the melted mountain snow. The river began its rise in March and high water continued past the end of July.

For comparison with this curve of river discharge there is also plotted a curve of the average monthly load at the electric stations in 1907, the last year in which all the power was developed by the Kameah River. The two curves illustrate the relation in point of time of the pumping load and the rate of



Kameah River Discharge Curve and Load Curve.

river discharge. It is this relation that makes it possible to operate a hydroelectric plant on a load composed largely of pumps for irrigation with a high load factor.

As noted above, the average load at the single hydroelectric station of this system, in 1904, was about 1013 hp, and that station had a rating of 1350 kw or 1800 hp, so that the station load factor for the year was 56.2 per cent, a figure much above that usually obtained at hydroelectric stations.

In 1905 a second station on the same river brought the equipment rating up to 2850 kw, or 3800 hp, and in 1907 the average load for the two stations was about 1575 hp, so that the station load factor was 41.4 per cent. While this load factor is above the ordinary for hydroelectric plants, more work could probably have been done, for the maximum load on the stations was 3310 hp in 1907.

From the above data it is evident that hydroelectric plants and irrigation pumping are mutually beneficial in the arid and semi-arid States. Without a load of irrigation pumps it appears that most of the great volume of high river discharge in midsummer must be lost to energy production, since there is at that time no other equivalent load to use it. Without hydroelectric plants with their cheap 24-hour service the extent of pumping for irrigation must be more limited.

A large part of the above data has been derived by computation from the diagrams in the paper on "Hydroelectric Power as Applied to Irrigation" in the *Proceedings* of the American Institute of Electrical Engineers, April, 1910, and the remainder has been taken from United States public documents.

SPACE DISTRIBUTION OF MAGNETOMOTIVE FORCE

The Magnetizing Current in the Three-Phase Induction Motor.

By B. B. BRACKETT.

MANY of the statements of various writers concerning the magnetizing component of the no-load current of polyphase induction motors are either inexact or positively incorrect. Certain other statements are correct, but very hard to understand. One finds it difficult to determine whether total, resultant, equivalent or some other kinds of currents or magnetomotive forces are being discussed. And final conclusions or the formulas given for computing values are in some instances very uncertain and may lead one into errors of application even though the forms are correct for one who can understand them.

A recent edition of a well-known text-book on alternating-current machinery very carefully develops a formula for the magnetizing current in the case of the two-phase motor. Then follow these statements: "In a three-phase machine, at the instant when the magnetizing current in one winding is at maximum value ($\sqrt{2} I_{mag}$), the magnetizing current in each of the other two windings is at half maximum value $\left(\frac{\sqrt{2}}{2} I_{mag}\right)$, and hence the current which sets up the m.m.f. is $\sqrt{2} I_{mag} + 2\left(\frac{\sqrt{2}}{2} I_{mag}\right) = 2\sqrt{2} I_{mag}$ . . . . the magnetizing current per phase for the three-phase induction motor is found to be one-half that for the two-phase motor, or half that given by equation (5)."

The first statement is perfectly correct, at least as far as it refers to the currents at the time and their sum at the instant, but the last statement supposed to be derived from the former one is quite incorrect. The reasoning employed overlooks the relative positions of the coils on the stator. The conclusion would be correct if the coils of all the phases were placed exactly over each other, and not in the partially overlapping positions required for the production of rotating fluxes. The pole pitch and the width of the flux around the air-gap under all conditions are fixed by the coils of any one phase, and this peripheral distance cannot be widened to include an extra two-thirds of this space, as would be involved in assuming that all the flux of the two groups of coils carrying the one-half maximum current unites directly with the flux from the coils having the maximum current in them. If one phase winding is used alone the pole pitch is exactly the same width as when all phase windings are used at the same time in polyphase operation. One phase winding only with the rotor stationary produces a simple alternating flux, similar to that of the familiar stationary transformer. Two or more phase windings supplied with polyphase currents produce a resultant rotating flux that is more or less constant in value and in distribution over the now moving pole face, the total value of this moving flux being at all times approximately equal to the maximum value of the alternating single-phase flux. The exact way in which these fluxes unite into one is often overlooked, or is treated in an abstract way that can not be readily identified with the actual phenomena involved.

In the three-phase motor each winding may be considered to produce its own flux just as if the two other windings were not present. The other two fluxes may be considered as being displaced one-third of a pole pitch, one to one side and the other to the opposite side from the first flux. This difference in position may be called a 60-deg. displacement, if desired.

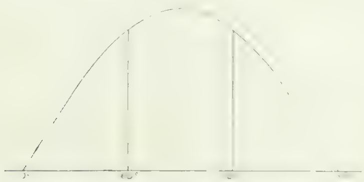
One thing more needs to be observed and remembered. Where the flux for one pole for one winding ceases it immediately reverses its direction. Hence, the flux in one pole space will in general be the resultant of the flux produced by the windings of one phase for one pole and the flux from two other similar windings, overlapping two-thirds of the width of each, but usually contributing more than two-thirds their value at the time, due to the distribution of each flux in its own zone, while this must be reduced by two other fluxes that overlap one-third of a pole space, and in general represent less than one-third the flux per pole in those windings at the instant.

To refer to the coils themselves or to their magnetomotive forces, it may be said that the flux from one pole, in the pole space to which it must be confined, is produced, at the time considered in the quotation above, by the full maximum current in the coils belonging to one phase and the half maximum value in two other windings, each of which overlaps two-thirds the entire width of a pole winding in such a way as to aid the first coils, and also overlaps one-third of a pole space with current flowing in a direction to oppose the flux. To assume that each of the two last windings contribute to the flux per

pole in proportion to their currents is not only to overlook the fact that they do not lie entirely within a pole space, but also to neglect counteracting effects of a part of two corresponding groups of coils. Any diagram of a typical three-phase winding will make these relations clear, if the above is not in itself sufficient.

It is quite as much an error to overlook the relative space displacement of the coils of the different phases as it is to neglect the time-phase displacement and take the arithmetical sum of quantities that should be considered as vectors and combined vectorially into a resultant value. In fact, in this case it is really the same thing, for the correct results may be reached by treating either the component fluxes or the magnetomotive forces as vectors. But to consider the overlapping effects of the various windings will keep one's thoughts nearer what actually occurs than would the more abstract vector method; and this coil-position method may be applied correctly to any known distribution of the flux over the pole space.

It is well to consider more completely the effects in the case of a sine wave, or ideal distribution of the flux. From the properties of the sine curve, shown in the accompanying



Space and Time-Phase Magnetizing Relations.

figure, it may be seen that one-fourth of the area of the curve lies between the 0-deg. and the 60-deg. ordinates, or between 120 deg. and 180 deg. Either of these represent the outside one-third of the overlapping pole spaces discussed above. Likewise, between 0 deg. and 120 deg. will be found three-fourths of the area, representing the value of the two-thirds overlap that is mentioned above. These values may be determined by simple integration, or from any carefully plotted sine curve by means of the planimeter.

Now if Φ represents the flux produced by the maximum current in one of the phase windings, one may consider that at the same time the half maximum currents in the two other windings have established fluxes of $\Phi/2$. Of this $\Phi/2$ flux, one-fourth, or $\Phi/8$, lies in each of the outer one-third of the flux zones; and three-fourths of $\Phi/2$, or $3\Phi/8$, in each of the two-thirds of a pole space. The resultant flux for a complete pole space will therefore be $\Phi + 2(3\Phi/8) - 2(\Phi/8) = (3/2)\Phi$, or the two-third space overlap in a contributing direction and the one-third space overlap in an opposing sense, for both the second and the third phase windings have increased the flux exactly 50 per cent over the maximum that the same current now in each winding of the three would produce in any one of the three alone. To get any desired flux under these conditions there must be supplied to each of the three phase windings two-thirds enough current to produce the same flux in any one of the windings alone.

The method here suggested may be readily used to study the effects of flat or peaked wave distribution over the pole space. If the wave is more or less flat topped, the outside one-third of the flux space will naturally contain a relatively greater portion of the total flux; and, hence, the reducing effect of the second and third phase windings will be increased. A study of the actual wave of distribution will tell how much. Should the distribution of the flux be uniform over the whole pole space, the portion of the fluxes to be added and subtracted would be the same as the space overlap of the various coils. Then the total or resultant flux, under the conditions discussed above, would be $\Phi + 2\left(\frac{2}{3}\frac{\Phi}{2}\right) - 2\left(\frac{1}{3}\frac{\Phi}{2}\right) = 1\frac{1}{3}\Phi$. Here the two other phase windings add only 33 per cent to what one phase winding alone would produce. Hence, to produce any definite flux would require three-fourths the current in each phase winding that would alone give the flux in any one of the windings.

In most standard motors the flux distribution is somewhat flatter than that represented by the sine wave, and the magnetizing current is a shade larger than two-thirds, or 60 per cent, of the single-phase value. This will usually appear in the analysis of the relative no-load currents and power-factors of a motor when tested for both three-phase and single-phase operation. Theoretically the wattless component of the current in the leads not opened, when the change to single-phase is made, should decrease slightly less than is usually observed to be the case. The change that may be noted for most motors indicates a greater relative magnetizing efficacy for a current in one phase only than would exist if the coils could be so placed that those of one phase would give a flux with sine distribution.

If the distribution could be more concentrated at the center, or more peaked, than that corresponding to the sine wave, opposite results might be detected.

These differences are usually smaller than could be predetermined with any accuracy whatever in the design of a motor not yet constructed, but the completed motor may show the peculiarities of its flux distribution and the relation of this to the sine wave distribution. The whole method may be used to verify and to emphasize the correct relation between the current in each phase winding of the three-phase motor and the flux produced by the three currents in three-phase relations

Central Station

Management, Policies and Commercial Methods

DENVER ELECTRIC SHOW.

Denver will have its first electric show at the Auditorium in that city beginning on Saturday evening, Oct. 8, and closing a week later, on the evening of Oct. 15. The members of the Colorado Electric Club have organized the Colorado Electric Club Exposition Company, capitalized at $10,000, the shares of which were all subscribed at the time the organization was effected. This company will give the show. The main floor of the Auditorium and also a portion of the basement will be divided into exhibit spaces which will be sold to exhibitors at a fixed schedule of prices, varying according to the size and desirability of the space. All of the flooring will be covered with a green carpet and the aisles will be 10 ft. wide. Admission will be charged to the show, the price of tickets being 50 cents for the evening and 25 cents in the afternoon. Music of a high grade will be provided, and an especial effort will be made to provide attractive and spectacular lighting features.

The approach to the Auditorium from Eighteenth Street on both Champa and Curtis Streets will be emphasized by illuminated archways extending over three blocks and made by stretching rope cables with a portière effect across the streets. Franklin's kite will be reproduced on a large scale in electric light and an electrically illuminated bell 40 ft. in diameter will also be an attraction. Inside the building the principal lighting feature will be a Pike's Peak sunrise effect. The various tints preceding and blending in the ruddy glow on Pike's Peak on a fine morning will be faithfully reproduced by electricity.

The club has set aside $500 for various prizes and awards, as well as $300 in scholarships in recognized educational insti-

tutions as prizes for the most original electric devices exhibited by pupils of the graded schools or high schools. There will be a first prize and a second prize for the best arranged and most attractive display, as well as a first and second prize for the best exhibits shown in action. There will also be a first and second prize for skill displayed in arranging exhibits not in motion.

The price of a space will include posts and railings; also ample light for all ordinary purposes; also wiring outlets for all spaces on the main floor and in the basement for additional electrical energy. The price further includes one sign for each space, floral decorations, one table and two chairs, and watchman service. On the main floor 110-volt or 220-volt, single-phase, 60-cycle alternating current will be supplied to the amount of 1300 watts to each exhibit space. Direct current at 220 volts or 440 volts is also obtainable. All electrical energy used by the exhibitor, except that supplied for general illumination, will be furnished at his expense.

The officers and directors of the Colorado Electric Club Exposition Company are as follows: President, H. L. Woolfenden (Allis-Chalmers); first vice-president, F. W. Frueauff (Denver Gas & Electric); second vice-president, J. B. Griffith (Nernst Lamp); secretary and treasurer, C. F. Oehlmann (Denver Gas & Electric); directors: Alvin R. Hall (Capitol Electric), George A. Woolley (General Electric), W. J. Matthews (Denver City Tramway), Walter F. Brown (Colorado Telephone), W. P. Carstarphen, Jr. (Carstarphen Electric), John M. Connelly (Denver Gas & Electric), B. S. Manuel (Westinghouse Electric & Manufacturing).

The officers and directors are chairmen of committees as follows: Admissions, Mr. Brown; decorations, Mr. Griffith; entertainment, Mr. Manuel; lighting, Mr. Oehlmann; novelties, Mr. Carstarphen; prizes and awards, Mr. Hall; publicity, Mr. Connelly; sale of space, Mr. Woolley; transportation, Mr. Matthews.

AUTO TRUCK TO ADVERTISE RESIDENCE LIGHTING.

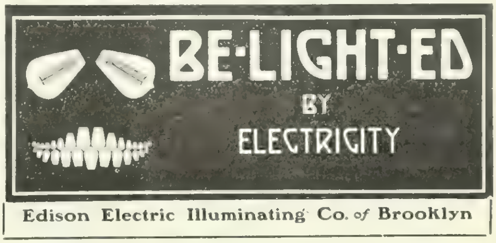
About 12 of the outlying local business centers of Chicago have their streets rendered especially bright and attractive by special tungsten-pillar illumination, the expense of erecting and operating which is borne by the merchants benefited. Besides these there are many other local-improvement associations in the city whose expressed purpose is to render their own particular communities more attractive for residence and business, and who are also potential users of some similar special street lighting.

As these new tungsten installations are opened up, from time to time, the Commonwealth Edison Company, which furnishes the energy for all this special lighting, usually joins with the local merchants in holding a parade in the newly lighted district. For this purpose it has equipped one of its 5-ton electric delivery trucks with a small electrically lighted model of a dwelling which advertises its house-wiring proposition. The house is outlined in small tungsten lamps and there are also signs carrying the name of the company, all supplied with energy from the vehicle battery. The truck is usually accompanied by a number of young women from the company's offices who ride inside the house, and the parades are generally the occasions of the greatest merriment for everybody. The merchants in the neighborhood are pleased at this attention of the company, and the advertisement for electric service in dwellings is presented at a time when the advantages of electric lighting are obvious to the community which centers about the brightly lighted area.

Auto Truck for Advertising Residence Lighting.

CENTRAL-STATION STREET CAR ADVERTISEMENT.

The street-car advertising design shown in the accompanying illustration is now being used in Brooklyn, where it has attracted considerable attention for its clever adaptation of the Roosevelt "de-light-ed." This car card is the result of a system of suggestions which the Edison Electric Illuminating Company, of Brooklyn, has in force, whereby prizes are awarded monthly to those offering the most useful ideas and improvements in method. The "be-light-ed" idea was supplied by the purchasing agent to a district clerk, who is also more or less of an artist. The card is, therefore, altogether a home product.

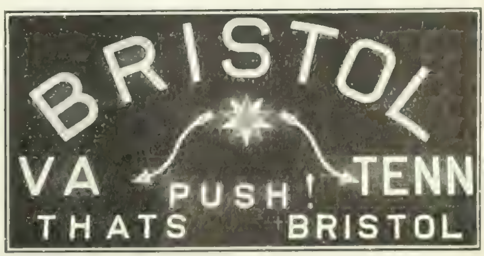


Brooklyn Street Car Advertisement.

"SLOGAN" SIGN.

The accompanying illustration shows a "Slogan" sign presented to the city of Bristol, Tenn.-Va., by Henry L. Doherty & Company. The sign is 30 ft. high by 60 ft. long, contains 700 white, 100 red and 100 green lamps, or a total of 900 lamps. The word "Bristol" remains stationary, and the star scintillates. The arrows flash immediately before the appearance of the words "Va.-Tenn.," the word "push" then spells itself and "That's Bristol" follows.

The sign, which was erected at a cost of $1,200, was designed by Mr. Geo. Williams, of Henry L. Doherty & Company, New York, and will be maintained in lamp renewals and energy by the Bristol Gas & Electric Company. It was presented on the night of July 4, the Mayors of the twin cities accepting and turning on the light.



"Slogan" Sign in Bristol, Tenn.

The sign is most advantageously located, facing the railroad, that it may be seen by every one passing through Bristol and for miles around the surrounding country. The largest crowd ever seen in Bristol witnessed the lighting of the sign.

SALE OF ELECTRICAL ENERGY BY THE CENTRAL COLORADO POWER COMPANY.

Articles have appeared in these columns from time to time describing the system of the Central Colorado Power Company, which owns water-power plants in Colorado with a present rating of 20,000 kw and transmits energy over 100,000-volt transmission lines for supply at Leadville, Denver and several mining camps. This company sells energy at wholesale to the Denver Gas & Electric Company, and supplies central-station service to the central-station company which it controls at Leadville. It also sells at wholesale to the United Hydroelectric Company in the Clear Creek district through a substation at Idaho Springs.

In the Boulder mining district and in the mines around Dillon, the company sells directly to the consumer at retail. It is the purpose of the present article to discuss especially the rates and methods of charging for the retail service. For this there is reproduced herewith a very handy chart which the company keeps in pocket blue-print form for the use of its representatives when talking motor-service contracts. This

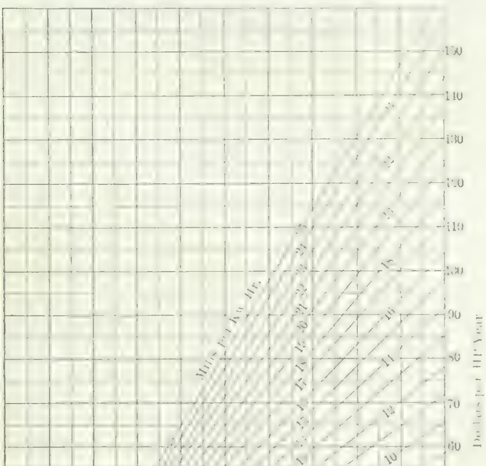


Fig. 1—Chart of Load Factors and Costs at Various Rates

chart, Fig. 1, indicates the dollars per hp-year, which are the equivalent of various rates per kw-hour at various yearly load factors, the load factor in this case being the standard A. I. E. E. definition of the ratio of the average load for the year to the maximum load of the year.

The standard rates of this company are based on a fixed service charge, which is as follows: The first 100 hp, $39 per year per horse-power; the next 400 hp, $27 per year per horse-power; the next 500 hp, $21 per year per horse-power; all over 1000 hp at $12 per year per horse-power. The foregoing is for the fixed or readiness-to-serve portion of the rate. In addition to the fixed portion there is an energy charge of 1.3 cents

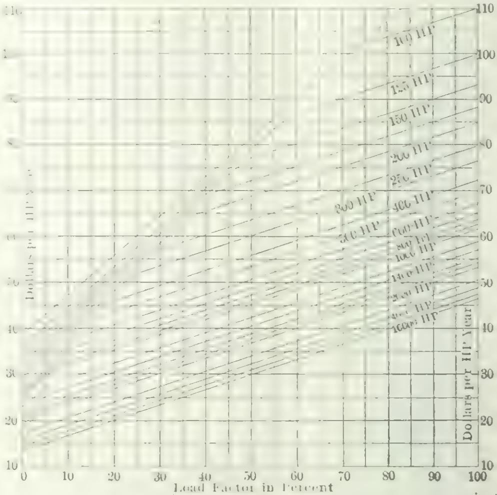


Fig. 2—Chart of Costs for Various Maximum Loads.

per kw-hour for the first 40,000 kw-hours and 0.5 cent per kw-hour for the remainder.

In Fig. 2 is given a chart prepared by the company to show the rate per kw-hour which would be obtained under this system of rates at various load factors with various connected loads. To use the chart one should follow the vertical line corresponding to the load factor of the particular load under consideration up to the curve corresponding to the maximum demand in horse-power of the load, and at the point of intersection with the horse-power curve the horizontal line will correspond to the dollars per year per maximum horse-power.

The following is an abstract of the company's forms, or standard motor-service contracts, which may be of value to other companies drawing up such contracts:

The company agrees to supply the user electric power at a potential of approximately ...... volts, not exceeding ...... electrical horse-power at any one time, to be used only for operating ...... at the users property known as ...... at or near ...... Colorado, and for lighting said property, which the user agrees to pay for at the following rate each month, to be paid before the ...... day of the succeeding month.

A fixed charge per month per horse-power of maximum demand as follows: For the first 100 hp, $3.25; for the next 400 hp, $2.25; for the next 500 hp, $1.75; for all additional horse-power, $1. Add for all energy used, as shown by meter, 1.3 mills per kw-hour for the first 40,000 kw-hours used each month and 0.5 mills per kw-hour for all additional energy.

The day for commencement of service is then named. The maximum demand is determined by the company by meters, disregarding starting peaks and those due to short-circuit or accident to user's apparatus. The user agrees to pay fixed charges upon not less than a specified horse-power whether any energy is used or not. A blank is then left for any special stipulations or requirements. The user agrees to pay a definite sum to the company, which is an advance on the cost of the pole line, this sum being repaid to the user by the rebate of a certain named per cent of the monthly motor-service bill. The company agrees to supply and the user agrees to take from the company all electrical energy required by the user during the

contract, provided the company has such energy free for disposal.

Certain rules and regulations of the company are made a part of the agreement. The agreement must continue in force for a term of years named from the commencement of service and thereafter until the expiration of six months' written notice by one of the parties to the other of its intention to terminate the contract. If after a named period of months after commencement of service, the user permanently abandons operation of the property named in the contract, the company will remit its charges under the contract, beginning a named number of months after receipt of written request. If the user thereafter resumes operation on his property, the agreement is to be in full force and effect for the remainder of the term of the contract, not deducting the period of suspension of operation. The agreement is to bind and benefit the successors and assigns of the respective parties, but neither the user nor his assigns shall assign any right under this contract without the written consent of the company.

The user is to make or procure rights-of-way for the company's lines across the property owned or controlled by the user, and shall furnish a building of size, type and location satisfactory to the company for transformers, meters and other apparatus. The company shall deliver energy at the building in the form of three-phase alternating current of approximately 60 cycles. The user must advance to the company the cost of all lines in excess of 500 ft. in length from the company's established distributing circuit, and must furnish all apparatus, appliances and circuits required for utilizing the service beyond the points where the company delivers the energy. All apparatus and material supplied by the company remain its property and are to be returned by the user in the condition received, ordinary wear and tear excepted. All the user's apparatus must have the highest practicable power-factor and be suitable for operation with the electricity supplied by the company. The user must keep his installation in good condition, and must not make any changes without the written consent of the company. The company may examine the user's installation at any time and may refuse to commence or continue service unless it is satisfactory. Suitable meters are supplied by the company to be connected at or near the point where energy is delivered. The user may install meters at his own expense for checking the company's measurement. In case of dispute as to the accuracy of the company's meters they are to be calibrated, and if found inaccurate proper allowance must be made, but not for more than 30 days prior to calibration. When the company's meters fail to register, it adjusts its charge on the basis of energy registered during a reasonable period of operation under similar conditions.

Fig. 3—Typical Mine Hoist Installation.

The company may at any time examine, change or repair its property on the premises of the user. The user must not interfere with or alter the company's meters or other property or permit the same to be done. The user must indemnify the company for all demands and expenses for injury or damage to persons or property in or about the property of the user. The company may suspend service for inspection, alterations or repairs for not exceeding 12 hours every two weeks upon giving the user notice. For every other or longer interruption of service, special provisions are made. The damages for interruption of service are to be 1.5 times the fixed charges under the contract. Upon violation by the user of any obligations of the contract, the company may suspend the supply of energy until the user shall cease such violation.

For mine hoisting a different schedule of rates prevails, known as the hoist rates. The rate quoted for this service is the standard rate. Fig. 3 shows a typical mine hoist installation on this company's lines.

Wiring and Illumination

IMPROVED LIGHTING IN RACINE, WIS.

Merchants and property owners in the block on the main street, between Fourth and Fifth streets, in Racine, Wis., have agreed to pay part of the cost of special column lamp posts on that street. The electric light company is installing several side lamps on Wisconsin Street as an experiment, and if they prove to be satisfactory it is stated that the city will enter into a contract with the company for a number of them to take the place of the overhead lamps. On the completion of the duct work property owners will be required to pay the cost of making connections with the underground mains, as they do now with sewer, water and gas services.

SPECIAL STREET LIGHTING FROM BRACKET LAMPS ON BUILDINGS.

A departure from the standard pillar arrangement of special street lighting which has recently obtained such a vogue throughout the country makes use of the lamps on ornamental brackets supported from the adjacent buildings. An experimental block of this construction has been installed on East Sixty-third Street, Chicago, a South Side business thoroughfare. The immediate reason for the unusual arrangement in this instance was the presence of the elevated-railroad supports along the curb line, which would detract from the effect of the vertical posts. The lamps installed will be three-glower Nernst units rated at 300 cp on 220 volts. Twenty of these lamps will be used to the block, 10 being installed on each side of the street at approximately 40-ft. distances. The lamps will be suspended from brackets, utilizing the characteristic downward distribution of this type of illuminant to the best advantage in lighting the sidewalk. The brackets support the lamps at a point about 12 ft. above the sidewalk and 5 ft. out from the building line. The installation has been put in on a 30-day trial agreement, and if successful this arrangement of lamps will be extended along other blocks on Sixty-third Street.

ORNAMENTAL POST LIGHTING AT FT. DODGE, IOWA.

The business men of Ft. Dodge along with other public-spirited citizens have entered into a contract with the Downing Electrical Co. of Ft. Dodge for a system of lighting the business district with the Corinthian Standard of the Flour City Ornamental Iron Works of Minneapolis. The longer blocks will have four standards on a side and the shorter blocks, three on a side. There will be about 70 poles installed, each equipped with five 100-watt tungsten lamps. The conduits will be run from post to post along the curb line under the creosote block paving, the curb stone being drilled to al-

low the conduit to enter under the post which will be located on the walk adjoining the curb.

The expense of installing the lamps is borne principally by the merchants and the owners of the property. The estimated cost per front foot is $1.75, four-sevenths of which will be paid by the owner and three-sevenths by the tenant.

The Ft. Dodge Light & Power Co. has agreed to light all posts, make necessary renewal of globes and lamps, and paint the posts once a year, at the flat rate of $7.00 per post per month. All five lamps on each post to burn till 11 p. m., and the top light all night.

The principal business street of Ft. Dodge is beautifully adapted for the boulevard system of lighting by reason of its gradual slope from one end to the other. The adoption of this special lighting is due to the enterprise of the Commercial Club in securing sufficient subscriptions to "boost Ft. Dodge" electrically.

SPECIAL TUNGSTEN STREET ILLUMINATION IN LANSING, MICH.

The enclosed-carbon street arcs on the principal sections of Michigan and Washington avenues, at Lansing, Mich., are being replaced by multiple tungsten lighting, both fixtures and energy supply to be furnished by the city. The tungsten pillars, which were made by a local firm, are 14 ft. high, 11 ft. of which is made up of a single casting in which the final wrought-iron pipe is inserted. This upper pipe ends in a ball fixture from which the cross-arms and top lamp are supported. The corner fixtures carry five 100-watt lamps, and the intermediate pillars three 100-watt lamps. These are wired on two circuits, so arranged that the side lamps may be extinguished at midnight, while the top lamps burn all night. Three-wire, lead-covered cable wrapped in steel tape has been used in the conduits.

The iron lamp standards are installed four to the block on each side of the street, at about 66-ft. intervals, giving one fixture for every three store fronts. About 180 will be erected in the first lot to be installed, lighting the principal blocks of Washington Avenue and the Michigan Avenue approach to the State capitol. Later the illumination will be extended to the side streets, adding 100 more fixtures. The standards complete with lamps and globes have cost $45 each, exclusive of wiring and conduit. The expense of installing has been met from the surplus fund of the city electric light plant, which furnishes the bulk of the local commercial and domestic lighting, having about 3000 customers. The energy supply for this special tungsten illumination will also be furnished by the city plant as part of the regular street-lighting system. Mr. Frank Baker is city electrician of Lansing.

FUSING OF BRANCH CIRCUITS OF LOW-VOLTAGE LAMPS.

Since the advent of the 5-cp, 10-volt tungsten sign lamp many inquiries have been received by those having electrical inspection in charge, asking under what conditions the series, parallel, or series-parallel connection of these lamps will be permitted for sign purposes. It is obvious that at these low voltages the National Electrical Code's permissive 660-watt rule is not sufficient, unless some additional limit, such as the Chicago regulation allowing only 12 sockets to each circuit, is specified. For at 10 volts a 660-watt branch circuit might be carrying 66 amp, a current strength entirely beyond the intended capacity of the equipment and wiring usually furnished. The use of such currents would involve the redesign of many fittings in order that their binding posts and contact pieces might take the larger conductor required.

With a view to agreeing on some tentative ruling to govern branch circuits of low-voltage lamps, representatives of the Underwriters' Laboratories, the Underwriters' National Electric Association and the Chicago city inspection department recently met in Chicago and formulated the following:

For low-voltage circuits employing pressures not exceeding 50 volts, current strengths per branch circuit not greater than 12 amp will be authorized.

For branch circuits of voltages lower than 50, the same 12-amp limiting current rule will apply.

The Chicago department is permitting the use of 10-volt tungsten lamps in series for outdoor sign purposes, but has not yet been confronted with the question of allowing this arrangement for indoor decorative or lighting purposes. The only installation of the latter kind in Chicago is the use of about 4000 4-cp, 12-volt lamps wired nine in series for lighting the mail-distributing cases of the Chicago postoffice, over which, as government property, the local inspection bureau has no jurisdiction.

The Chicago bureau allows, however, the series connection of such low-voltage lamps as the 27-volt type where all the lamps are on the same fixture (insulated from the piping system), and are controlled from one switch. The obvious drawbacks about the series connection of low-voltage lamps are the possibility of a ground occurring between the lamps of the series, overloading and breaking the one or more lamps which are subjected to the abnormal potential, and so involving fire risk; and the likelihood of different sizes of lamps being inserted in the series, which would overload the smaller units. For these reasons the installation of series lamps is confined to a close group of lamps all mounted on a single insulated fixture which is likely to be free from possible grounds.

TESTS OF ILLUMINATION OF A LARGE ARENA.

The lighting of the arena for the United States army tournament at Chicago, July 4 to 14, represents perhaps the most extensive flaming-arc lamp illumination of an outdoor field ever attempted. The arena itself measured 400 ft. x 600 ft., surrounding which were rising tiers of seats about 100 ft. deep, making a total area illuminated 600 ft. x 800 ft., or about 11 acres. The arena occupied an almost ideal location in a great sunken rectangular field left for a future flower garden by the graders in disposing the excavated material from the Chicago freight tunnels, with which the entire Grant Park lake front has been reclaimed. The tiers of seats, providing accommodations for about 40,000 persons, were built on the sloping sides of these banks.

Eighty 550-watt Aurola flaming-arc lamps, hung 50-ft. centers in 10 spans of eight each, furnished the field illumination. These lamps were suspended by drop wires, at a uniform height of 35 ft. above the arena, from the 600-ft. twin spans of steel messenger cables passing over 50-ft. poles set back of the seats, and guyed from the tops of 40-ft. poles, which were in turn anchored by deadmen. A maximum stress of about 15,000 lb. was employed in the span wires.

The lamps were supplied with 60-cycle alternating current, being operated two in series across each side of a 110-220-volt, three-wire circuit supplied from a temporary transformer installation.

As before noted, the lamps were of the 550-watt type, employing the V-arrangement of electrodes for giving the maximum downward distribution of light, most of the flux being included within an angle of 35 deg. from the vertical. Electrodes impregnated to produce a brilliant yellow light were used.

The events in the arena included all kinds of military maneuvers and drills by the infantry, cavalry, artillery, engineers' corps, signal corps, hospital corps and other branches of the regular service. Nearly 3000 soldiers took part. Performances were given daily at 2.30 and 8 p. m., the evening maneuvers making some kind of artificial illumination absolutely necessary.

The 80 flaming-arc lamps installed proved entirely adequate, providing illumination sufficient for all movements, even on the opposite side of the arena, to be seen easily. Some of those seated on the upper rows of seats experienced difficulty in clear vision, due to the glare of the luminous sources, in spite of the use of opal globes and the suspension of the lamps as high as was practicable. This difficulty did not amount to real discomfort, but was principally noticeable by contrast as, when the eyes were shaded, objects at the far side of the arena stood out with striking distinctness. Every one, including the soldiers who took part in the performances, seemed well pleased with the quality and intensity of the illumination, and many persons remarked the beauty of the scene when the lamps were turned on.

Under a lamp at edge of field	1.24	foot-candle
Under a lamp at center of field	0.91	"
" " " " "	1.35	"
Between two lamps in adjacent rows	0.84	"
Between two lamps in same row	0.86	"
Between four lamps	0.71	"
Average	0.99	"

Fig. 1—Panoramic View of Arena During U. S. Army Manœuvres, Chicago.

From a series of tests of the illumination of the field made with a Sharp-Millar photometer following one of the performances an average intensity of about 1 foot-candle was obtained. Readings taken at various points on the field selected at random gave the results shown in the accompanying table, each figure in the table representing the mean of five settings.

For the arena, 400 ft. x 600 ft., or 240,000 sq. ft., and assuming the 80 lamps to take their rated power, totaling 44,000 watts, the intensity of illumination obtained indicates a consumption of about 0.185 watt per lumen.

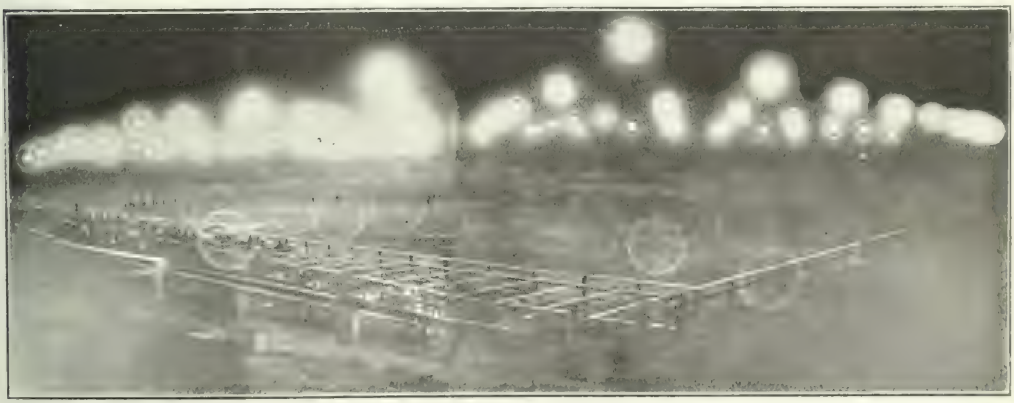


Fig. 2—Night View of Arena Lighted by 80 Flaming Arc Lamps.

The special illumination of the tournament arena was erected by the construction department of the Commonwealth Edison Company and the energy for lighting the lamps was supplied by the company. The Aurola flaming-arc lamps were furnished by the Chicago office of the Charles J. [illegible] Company.

NEW TELEPHONE PATENTS.

IMPROVED TRANSMISSION CIRCUITS

There have been a great many different circuit arrangements proposed for utilizing the telephone repeater. The chief aim in all of these is to devise an arrangement by which the repeated or reinforced currents will not react upon the circuits in a way to set up a singing of the apparatus.

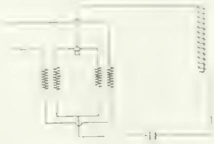
It is with such a circuit that a patent recently issued to Mr. P Stragiotti, of Hurley, Wis., is concerned. According to his plan the line is cut at the repeater station and each branch is led to an artificial line equivalent to it. Between the real and artificial lines, two induction coil secondaries are bridged, one pair of coils being associated with each branch of the line.

Two repeaters are used. The receiving element of one being looped into each branch of the line, between the two bridged induction coils. The transmitting elements are then associated with the opposite line branches by being connected in series with the two primaries of the induction coil, which in turn are connected to the two end terminals of a double-wound impedance coil. The mid points of the impedance coils are then connected together through a battery.

When an incoming telephone current arrives on one branch of the line, a major proportion of it passes through the receiving element of one repeater. The transmitting element of this sends out reinforced impulses through the connected induction coil primaries. These in turn produce effects in their secondaries, which being connected to circuits of equivalent constants, produce exactly equal effects. This, therefore, leaves the receiving element of the second repeater connected between equipotential points and therefore unaffected.

There is, further, no overlap of the two sets of primaries, as the impedance coils are so designed as to prevent any interdisturbance.

In the cut is shown a circuit in which the same inventor has made use of a differential transmitter. The transmitter is in two sections, one increasing and the other simultaneously decreasing its resistance. By the use of the two induction coils



Straglotti Transmitter.

and the large impedance coil a maximum effect is produced in the secondary. The effect of the impedance is to maintain the instantaneous current value in the circuit constant. Thus, the action of the transmitter is accompanied by a forced redistribution of the currents in its two circuits.

SERVICE METERING SYSTEM.

Mr. R. H. Manson has obtained a further patent upon his service metering system. This system contemplates a motor with a governor, which motor operates during conversation to drive a dial mechanism and thus to record the elapsed time of actual conversation. In the present arrangement a condenser bridges the motor armature terminals. To the Dean Electric Company has been assigned the patent.

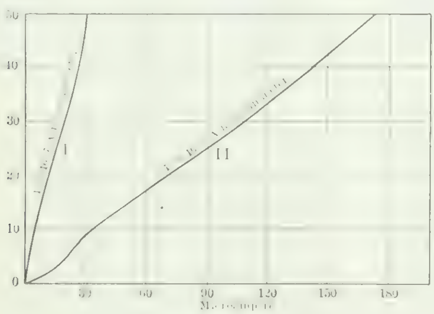
LETTERS TO THE EDITOR.

Locations of Vessels by Wireless Telegraphy.

To the Editor of Electrical World:

SIR: Your issue of July 22, 1909, contains a communication from the writer on the subject of location of vessels by wireless telegraphy, and I have waited a year hoping some one would suggest a better means than the one I proposed. As this has not come to pass, I wish to take up the subject again owing to its very great importance to the shipping industry.

In your issue of Aug. 12, 1909, Mr. Espenscheid says it is unlikely that an operator aboard a ship meeting with an accident would be disabled before his instruments are rendered useless. The case of Mr. Eccles, the hero of the ship *Ohio*, contradicts



Microammeter Deflections.

this view. This disaster happened near British Columbia, in August, 1909, I believe. Five lives were lost, among them being the operator Eccles. If he had died a few minutes before sending off telegrams 128 lives would have been lost. Wireless telegraphy of to-day is so compact and sturdy that the operator can easily be injured when the instruments would be undamaged.

Following are some considerations I wish to present:

1. I have raised the sensitiveness of my device, as shown in the above cut. With a microammeter (1 deg. = 1 micro-ampere, direct-current) the full deflection is reached at 170 micro-amperes. The more sensitive microammeter, 10 deg. = 1 micro-ampere, direct-current, has not yet been proved on ships, but I believe after some experiments it will also give good service. Naturally, if the differences of the readings at the angle points are small, the sides of the triangle should be taken larger. In my opinion ½-deg. readings are quite sufficient.

2. There are 20 milli-amperes constantly flowing through the barretters and compensating each other in the microammeter; this corresponds to $20.10^{-3} \times 20.10^{-3}\,70 = 28{,}000$ micro-watts. The ship compass itself needs very little energy, and yet it is well adapted for shipboard use; therefore the second paragraph of Mr. Espenscheid's letter has little bearing. I need merely mention here that watches, which are not electrical instruments, need very little energy.

3. If the ship in peril is moving, and thus vitiates the readings of the rescuing ship, the latter can stop and check the readings. Of course, all cases cannot be enumerated; disturbing effects will make the readings wrong, but can be corrected in many cases. For instance, if the outgoing energy decreases constantly, as in the case of storage-cells running down, a difference can yet be noticed in the received energy, because the decrease of the latter cannot be the same in moving from or to the imperilled ship. I do not claim that my proposed method will succeed in every possible case, but if only one ship is rescued with its help my purpose is well attained.

4. Ships generally attempt to keep only the prescribed wave-length; for instance, if the length of 300 m is set, the first ship works with 295 m, the second with 298 m, the third with 310 m and so on. I found on the *Adria* that it is possible to select every wave-length and hear separately each ship; naturally, this needs instruments which measure better than the ears. Ears do not show differences at the maximum values, while the barretter measures these most exactly.

Mr. Espenscheid's last proposition, the determination of the position of the ship in peril by the help of two other rescuing ships, is an excellent one and is always applicable. If C is the imperilled ship, ship A can measure the distance from C and B; B can measure from C and A, and thus all three sides of the triangle are known. Whether C is on the left or right side a fifth measurement will decide at once.

In reference to the letter of Messrs. E. Bellini and A. Tosi (Sept. 9, 1909) I repeat again that "I willingly admit the superiority of the radio-goniometer, especially when a barretter-set is used instead of a telephone-receiver." But I am afraid it will take a considerable time for the "patented" methods to come in general use. My proposed method is not patented and can be used by every one.

Budapest, Hungary. BÉLA GÁTI.

Rotating Incandescent Lamp Standards.

To the Editor of Electrical World:

SIR: In your editorial of July 7, on "Carbon-filament lamps as photometric standards," you raise the question why we rotate standard lamps when measuring them with highest precision, saying: "Incidentally, and without desiring to offer undue criticism, it may be asked what possible use there is for standardizing lamps on the hypothesis that they are to be rotated when in use. There may be cases when it is desirable to rotate a lamp under measurement for the purpose of determining its mean horizontal candle-power, although we hope to see this particular measurement soon dropped out of sight in favor of a mean spherical measurement expressed either in candles or lumens; but we fail to see the least necessity for having standard lamps, in which the highest precision is desired, exposed to the added risk of rotation to no possible good purpose. A standard with a filament of such contour as to give quite uniform horizontal distribution and furnished with suitable sight marks for alignment on the photometer bar is much more convenient and probably also more materially reliable than a rotating standard. Moreover, metallic filament lamps,

which are already in very great commercial use, do not lend themselves readily to rotation, even if anyone wants to rotate them; and hence there is less use for real or imaginary measurements in rotation than there ever has been before."

There are a number of practical questions raised in this paragraph which we desire to answer.

1. As to "what possible use there is for standardizing lamps on the hypothesis that they are to be rotated when in use," we would say that the Bureau of Standards is constantly being called upon to standardize lamps for actual use in photometric measurements rotating, and must therefore maintain a complete equipment for the purpose. More measurements, by far, are actually made in practice with lamps rotating than stationary, and when a standard is used by the method of substitution it is preferably a rotating standard, when all the other lamps are rotating. We are therefore considering "real" measurements and not "imaginary" ones.

2. The Bureau employs both rotating and stationary standards, and has done so for years. Lamps to be used only stationary are generally made especially for the purpose. Rotating standards are usually of the standard oval anchored type. In seasoning and standardizing hundreds of these for practical standards, we are able to select the very best for standards of highest precision. In the course of our experience, in which many hundreds of standard carbon-filament lamps have been used and thousands of precision measurements made, we do not recall having broken a filament by rotation (180 r.p.m.), nor, so far as we know, done any lamp any harm by rotation. We measure the current and voltage to within about one part in 20,000 and equally well whether the lamp is rotating or stationary. We are not discussing fragile or experimental lamps, but the kind referred to in the paper commented upon.

3. As to the precision attainable in the measurement of rotating lamps, the opinion has sometimes been expressed that the slight flicker due to rotation is an objection and that more accurate settings can be made on stationary lamps. This is not, however, our experience. On the contrary, our most experienced photometricians find that they can set as closely on the rotating lamps as on the stationary lamps, and with less effort, for reasons which we cannot take the space to discuss here. We do not assert that the precision and consistency of measurements are greater with rotating lamps. But we believe that our recent results on rotating lamps are superior to any that we have seen published on either rotating or stationary lamps. We shall later make a more complete comparison of the possibilities of accuracy in the two cases.

The curves in Fig. 4 in our paper in the *Proceedings* of the A. I. E. E. are very disappointing, and do not fairly represent the original curves. No adequate idea of the constancy of the candle-power can be obtained from these, although the printed figures are correct. One point we especially emphasized is that the candle-power is constant even though the resistance and current vary considerably, provided that the voltage on the lamp during its life is so varied that the watts are kept constant. The detailed figures which justify our claims as to accuracy of measurement and constancy of value will be given in a fuller paper to be published in the near future in the *Bulletin* of the Bureau of Standards.

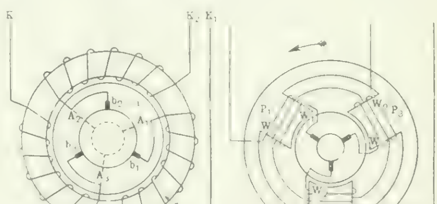
Edward B. Rosa,
Geo. W. Middlekauf,
Washington, D. C. *Bureau of Standards.*

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Cascade Connection of Induction Motor and Commutator Motor.—R. O. Kapp.—An illustrated article on a method in which an ordinary induction motor works directly on the mains, and has in its rotor circuit a three-phase commutator motor which supplies the necessary back e.m.f. to effect speed variation, and gives up the power it absorbs either to the main shaft or to some other shaft running at a constant speed, or drives a generator, which puts power back into the mains. The advantages of this system are: (1) The speed can be regulated in as many steps as are required; (2) The loss of efficiency is very small; (3) The power factor can be improved, so as to be unity, thus making a smaller induction motor possible; (4) Any required relation between speed and load is possible, as in the case of direct-current machines. A method of this kind developed by Brown, Boveri & Co. and employing the Scherbius commutator motor is described in detail. The chief feature of the Scherbius motor is that it has the characteristics of a direct-current machine. The rotor is a drum-wound armature with commutator. The stator has two windings. One is for excitation, the other is a "compensating" winding. The latter is a drum winding, arranged to be electrically an exact counterpart of the rotor. Its function is to counteract the transformer e.m.f. induced in the rotor by the rotating field. In the Scherbius motor the compensating winding is connected to the brushes in opposition to the armature, as shown in Fig. 1. The exciting winding is not shown. When the machine is at rest the transformer e.m.fs. generated in the compensating winding and the rotor are equal and vectorially opposed, so that the resultant e.m.f. between the brushes is zero. When the machine starts running, the rotor e.m.f. becomes lower as the difference of speed of rotation between field and rotor decreases, but the e.m.f. induced in the compensating winding remains constant. These two no longer balance and there remains at the terminals an e.m.f. equal to their difference. Eventually no e.m.f. is induced in the rotor, and the back e.m.f. is equal to that of the compensating winding only. The motor runs equally well above synchronous speed if a higher e.m.f. is impressed, the back e.m.f. of the rotor and the compensating winding then acting in the same direction. It will be seen that the back e.m.f. is proportional to the speed, precisely as with a direct-current machine. In



Figs. 1 and 2—Diagram of Motor Connections.

order to compensate for the lag of the current behind the voltage in the main motor, the commutator or motor must have a leading current. To obtain this each field magnet is provided with separate windings from two phases as in Fig. 2. The flux vector is then the resultant of the current vectors in the two phases, and its position depends on the proportion of the number of coils from each phase. In this way it becomes possible to produce any required angle between the current and the e.m.f. by choosing a suitable combination of the exciting coils. An advantage of this type of motor is that it may be shunt, series or compound wound; in each case its behavior is precisely the same as that of a direct-current machine, and these properties are imparted to the whole set when it is worked in cascade with an induction motor. The applications which have hitherto been developed are: The driving of ventilating fans for mines, the driving of rolling mills, relief of

the central station of sudden loads with the help of a flywheel; the working of turbo air compressors which require a motor that can run above synchronism. A flywheel buffer set as employed at the Stordö Kisgruber in Norway is illustrated in Fig. 3. It is the main motor and in this case use is made of a double-commutator motor of which the speed is regulated by means of the lever *h*. The flywheel is not on the same shaft as the motor, which takes the full power, but on the shaft of a

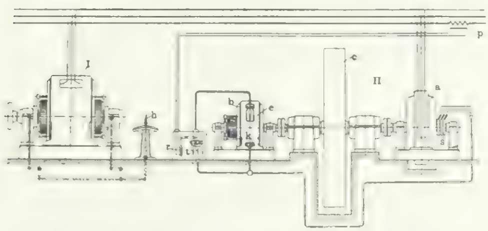


Fig. 3—Diagram of Connections for Flywheel Buffer Set.

separate set connected in parallel with the main motor. This set consists of the Scherbius motor *b*, the flywheel *c* and a three-phase induction motor all on one shaft. A series transformer *P* in the mains is connected to a relay *r*; *t* is an auto-transformer, through which the motor *b* is excited. When the load becomes heavy, the relay *r* works a regulating device in the auto-transformer, which strengthens the field of the shunt-wound commutator motor *b*. This motor is connected across the slip-rings of *a*, which starts to run more slowly owing to the increased back e.m.f. The flywheel is made to give up some of its energy and drives *a* as a non-synchronous generator, which supplies energy to the mains. In order that this may happen, the e.m.f. of *b* must exceed that across the slip-rings of *a*. The field of *b* must be adjusted so that this happens at the required speed. *A* will act equally well as a generator whether it be running above or below synchronism. In this method by far the greater part of the energy is taken directly by the working motor, and only that which varies above or below the average goes through more than one machine, so the efficiency is good.—Lond. *Electrician*, July 8.

Alternating-Current Commutator Motors for Constant Speed.—F. NIETHAMMER.—If a simple alternating-current commutator motor with direct-current armature is provided with two brush axles perpendicular to each other, both sets of brushes being short-circuited, the motor behaves in general like a single-phase induction motor; at no load it assumes about synchronous speed while with increasing load the slip increases; when operated above synchronism, it can return energy into the network. The starting torque is zero. The author discusses how the motor can be started and how the power factor can be improved. Several modifications of this design, especially those due to Fynn, and built by two German companies, are described and illustrated by diagrams.—*Elek. und Masch.* (Vienna), July 3.

Mutual Induction.—J. REZELMAN.—A mathematical paper, illustrated by diagrams, on the determination of the mutual induction between the external coil connections of dynamo-electric machinery.—*La Lumière Elec.*, July 2.

Lamps and Lighting.

Flame Arc Lamps.—E. W. MARCHANT.—An article on the use of flame and other arc lamps for exterior illumination. In the ordinary vertical electrode arc the maximum illumi-

	Mean Hemispherical Candle Power	Watt per M. H. S. C. P.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.69

[illegible] at an angle [illegible] from [illegible] below the horizontal. In the inclined electrode lamp the maximum intensity of illumination is in a direction vertically underneath the arc. This alteration in distribution of light is a disadvantage, since it gives maximum effect immediately below the lamp. The following results were obtained in efficiency tests made without globes, the arc consuming in each case 10 amp at 45 volts.

The use of globes with the lamps reduces the cp very greatly. With the globes used on the flame lamps the light was usually reduced to about one-sixth of its former value, though in some

	Mean Hemispherical Candle Power	Watt per M. H. S. C. P.
Yellow-flame lamp........	[illegible]	1.05
White-flame lamp.........	200	2.15
Ordinary carbon arc lamp	190	2.25

cases the absorption of the globe was even greater, the light emerging being only one-tenth of that actually produced by the lamp. The following results were obtained in tests made with globes otherwise under the same conditions as before.

It is questionable whether globes which absorb so much light should be used, but the author thinks that these globes are very brilliant and conspicuous objects when the lamp is burning, and where a lamp is used (as it is in many cases) for spectacular purposes the brilliance of the globe becomes of practical utility. At the same time, where illumination is wanted, it is obvious that a comparatively clear globe should be employed.—*Illum. Eng.* (London), June.

Moore Vacuum Tube.—P. HEYCK.—A letter in which the author criticises Wedding's recent article in which the Moore vacuum tube lamp was compared with indirect illumination by means of incandescent lamps and arc lamps. To prove that the Moore tube is not more economical, the following figures are given: The Moore tube consumes, according to Wedding, 3304 watts, giving a mean horizontal illumination of the floor of 39.4 lux, the area of the floor being 17.4 m x 8.6 m = 150 sq. m. This gives a specific consumption of 0.56 watt per lux-sq. m. Corresponding measurements with arc lamps have shown that the specific consumption of an open direct-current arc lamp with pure carbon electrodes and with entirely indirect illumination is 0.212 watt per lux-sq. m. The same lamp with normally-arranged carbon electrodes and semi-indirect illumination consumes 0.262 watt per lux-sq. m. The open alternating-current arc lamp with pure carbon electrodes and entirely indirect illumination consumes 0.355 watt per lux-sq. m. The room in which these measurements were made had been painted five years ago so that the ceiling was no longer a very good reflector. Wedding remarked that Heyck gave no data on the maximum and minimum illumination obtained in tests and said that the Moore lamp gives a more uniform illumination.—*Elek. Zeit.*, July 7.

Photometers.—An illustrated article on various photometers and illuminometers recently exhibited at the Municipal Exhibition in London. Photometers of the three classes, quality of brightness, contrast, and flicker, were represented. Of commercial testing instruments the Trotter "universal photometer" and the Harrison street photometer are described. Finally mention is made of the Thorner illumination tester which enables a rough idea to be formed as to whether the daylight illumination in a room is satisfactory or not. The instrument really compares the brightness of an image of the sky with the actual illumination to be examined. It consists of an inclosed box the interior of which is arranged as shown in Fig. 4. It contains a sheet of paper *fg* with an aperture at *a*. Vertically above this fine aperture *a* is to be found a convex lens *d* and an inclined plane mirror *e*, which can be rotated about both a horizontal and a vertical axis. The aperture *a* is situated at the focal length of the lens *d*. A second

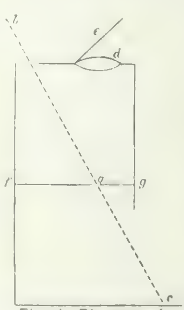


Fig. 4—Diagram of Photometer.

paper surface at c receives the available intensity of illumination to be examined. An observer, looking along the direction of the dotted line *bae*, sees the surface *fg* and this second surface through the aperture *a*. He then turns the mirror *e* in such a way that an image of a portion of the sky is formed on the region of the paper screen *fg*, adjacent to the aperture *a*. He now judges the value of the existing illumination by merely observing whether the surface illuminated at *c*, seen through the aperture, appears brighter than the image of the sky formed on *fg*, or vice versa. If it appears darker, as shown in the left-hand diagram of Fig. 5, the illumination is said to be too weak. If,

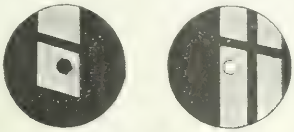


Fig. 5—Values of Illumination.

on the other hand, the spot appears brighter, as in the right-hand diagram, the illumination is judged to be sufficiently bright. Of course, it may happen that no portion of the sky is visible from certain positions in a room. When this happens, however, it is safe to condemn the daylight illumination in the room without further test. As the standard brightness of the image of the sky is to some extent an arbitrary value, several stops are provided, which correspond to illuminations in the ratio 1, 1⅓ and 2. Determinations are best carried out in cloudy weather. Naturally precautions must be taken to avoid abnormal conditions. The effects of a heavy fall of snow, for instance, and the light reflected upward as a result, would cause an abnormal distribution of illumination in the room tested. In the same way results obtained when the sunlight is streaming directly into the room will be too high, while, in the case of a clear sky, the process of testing is somewhat affected by the fact that the image of the sky appears a different color to the aperture.—*Illum. Eng.* (London), June.

Metallic-Filament Lamps and Shock.—Th. Muller.—An English translation of his recent German paper describing an experimental method for determining the resisting power of metallic-filament lamps against mechanical shock.—Lond. *Elec. Rev.*, July 8.

Metallic-Filament Lamps.—F. Jacobsohn.—The conclusion of his article on the development and prospects of the metallic-filament incandescent lamp with useful references to existing literature and patents.—*Illum. Eng.* (London), June.

Projector Lanterns.—C. W. Denny.—An illustrated article suggesting an automatic method of magnetic control of large projector lanterns.—Lond. *Elec. Rev.*, July 8.

Light Houses.—J. Benard.—An illustrated article on the lighting of light houses by electricity and giving a sketch of the progress made in the equipment of light houses in the last 100 years.—*La Revue Elec.*, June 30.

Photometric Curves.—J. S. Codman.—An article describing a simple method of finding quickly the mean cp and flux from photometric curves when plotted on ordinary polar paper.—*Illum. Eng.*, July.

Photometry of Street Lamps.—H. E. Harrison.—A general discussion of methods of photometry of street lamps with reference to the errors due to variations in standard lamps, errors due to observation, and errors due to angular uncertainties.—*Illum. Eng.* (London), June.

Generation, Transmission and Distribution.

Trient.—E. Rudolph.—The conclusion of his illustrated description of the electric plant of the city of Trient in Austria. For transmission from the power station to Trient the e.m.f. of the three-phase currents is raised from 5250 volts to 20,000 volts. At the main transformer station in Trient the e.m.f. is reduced from 19,000 volts to 5000 volts and three-phase currents at 5000 volts are distributed through the outlying districts of the city where seven transformer stations are provided for reducing the e.m.f. from 5000 volts to 225 volts for the supply to consumers. The center of the city is supplied with direct current from an existing station, but as the generating equipment was not sufficient, part of the three-phase currents is supplied to this station and converted to direct current by motor generators.—*Elek. und Masch.* (Vienna), July 3.

Steam Turbines.—Rateau.—An abstract of a paper read before the International Mining Congress at Düsseldorf on exhaust steam and mixed-pressure turbines. The first mixed-pressure turbines were made with two bodies, one for high and the other for low pressure; the present turbines comprise, in a single body, a range of high-pressure wheels and another range of low-pressure wheels; the exhaust steam enters an annular port between the two ranges. The regulation of these engines is not dependent solely upon the speed governor, because in this event the steam from the accumulator would flow freely into the turbine, and its pressure would fall very low for high-pressure operation; moreover, this method of regulation requires speed variations that would render impossible the paralleling of alternators driven by mixed-pressure turbines with those of the other groups. The author solved the problem by causing the speed governor to act upon both inlet valves together, the latter controlling each other without acting on the speed governor. A spring tends to hold the low-pressure valve open, and consequently to close the high-pressure valve. On the other hand, the low-pressure valve is subjected to the pressure variations of the accumulator as soon as the pressure sinks beneath a certain value. The movements it receives are, at the same time, transmitted to the high-pressure valve, which enables one kind of steam to be replaced by the other, without the speed varying. The author then points out an objection that was made regarding high-pressure operation of mixed turbines, and shows that by a suitable selection of the number of wheels, an efficiency can be obtained with these turbines which is equivalent to that of high-pressure turbines.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Steam Turbines.—J. McK. Newton.—The first part of a paper, illustrated by numerous diagrams, on high-speed steam-turbine rotor design and construction.—Lond. *Eng'ing*, July 8.

Electric Drills.—W. Kohlmann.—An abstract of a paper read at the International Mining Congress at Düsseldorf on the development of the mining industry in the Minette district. It was mentioned that the necessity of providing compressed air for drills was inconvenient, as it was only used for this purpose. The Siemens & Halske rotary drill had been used to some extent, but in the author's opinion the drill of the future is the electrically-operated percussion drill, a majority of the Minnette mines having at their disposal a source of supply of cheap electrical energy in the adjacent smelting works, and there being no difficulty in the way of laying electric cables in the mines. However, up to the present the available forms of electric percussion drills do not fulfil the requirements of the work. In the underground haulage, which presents no difficulty, the haulage roads being wide and usually straight, electric locomotives and endless ropeways have largely replaced horse traction during the past few years.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Electric Pumping.—Schultze.—An abstract of a paper read before the International Mining Congress at Düsseldorf. The author described a particularly compact electrically operated plunger pump of German make, at work in a shaft of the Zollverein colliery. The machine, which is able to raise 138 gal. of water per minute against a total head of 1443 ft., consists of three single-action plunger pumps. The whole set, though accessible in every part, is so compact that the foundation occupies a space of only 6.5 ft. by 10.5 ft.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Electricity in Agriculture.—H. Wallem.—The first part of a paper in which the author discusses the various applications of electric motors for driving agricultural machinery, especially threshing machines. The article is to be continued.—*Elek. Zeit.*, July 7.

Traction.

Railless Traction.—H. England.—A paper read before the Tramways and Light Railways Association at Dublin. The au-

thor first refers to the unsatisfactory financial results shown by the majority of tramways in England, and discusses the conditions under which a tramway running in a sparsely populated district can be made a profitable investment. At present railless traction seems to offer the only satisfactory method of extending operations. He then describes the various systems of railless traction in use and gives particulars of the working costs and cost of construction; and finally refers to the difficulty and expense in obtaining franchises for the operation of railless schemes.—Lond. *Electrician*, July 8.

Installations, Systems and Appliances.

Battery Plant in Colliery.—W. MAURICE.—A paper read before the Inst. of Mining Engineers in London on the storage battery plant at the Hucknall colliery. The battery plant is used for the supply of direct current in a pit (No. 1 pit) in which the original small direct-current generating plant had become insufficient to cope with the load. The energy transmitted to the battery plant is the surplus from a generating plant supplying a three-phase system in another (No. 2) pit about 1.3 miles distant. Fig. 6 shows the arrangement. The

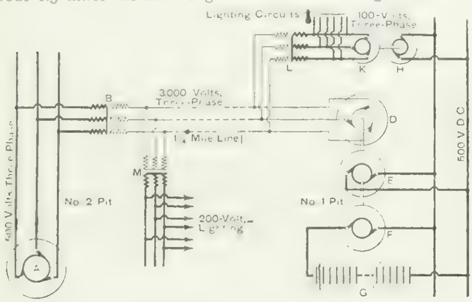


Fig. 6—Diagram of Connections of Generating and Battery Plant.

110-kw Rateau exhaust-steam plant *A* generates three-phase currents at 500 volts and supplies energy to the underground haulage gear in No. 2 pit with a fluctuating load varying between zero and the full output of the generator. A 90-kw transformer *B* steps up the pressure to 3000 volts, and the surplus energy is transmitted over an overhead line to No. 1 pit, where it is converted to direct current by means of a motor-generator set. This set consists of a 3000-volt synchronous motor, *D*, coupled to a 50-kw, 500-volt, compounded direct-current generator *E*. A Lancashire reversible booster, *F*, for automatically regulating the working of the battery, is coupled to the same shaft. The battery *G* consists of 240 cells with a total rating of 400 amp-hours on the 10-hour discharge rate, or 236 amp-hours on the 1-hour rate. For the purpose of supplying energy for the alternating-current lighting loads of both pits from the battery when the generator *A* is shut down, a small motor-generator set, *H, K*, has been installed, connected to the high-tension line through a transformer, *L*. The lighting circuits at No. 2 pit are supplied at 200 volts alternating current through the 3000-200-volt transformer, *M*, and those of No. 1 pit and of the adjoining offices and private houses are supplied at 100 volts alternating current from the generator *K*, or through the transformer *L*, when the main generator is running. The small original direct-current generator set in No. 1 pit has been retained, and is electrically connected to the battery plant; this machine is generally used as a motor to drive a 36-in. circular saw, but it can be driven as a generator by the original steam engine, and then assists the battery plant. During the time when the generator *A* is running—usually 16 hours per day and five days per week—the generator set, *D, E, F*, also runs, the generator supplying energy for the load at No. 1 pit, and at the same time charging the battery through the booster, *F*. Whenever the haulage-load on set *A* increases, the motor-generator tends to drop its load, and the charging current supplied to the battery falls off. In case of a heavy overload on the haulage system the motor-generator reverses, taking energy from the battery, and returning it to the generating station to assist the generator *A*. Any fluctuations in the load at No. 1 pit are meanwhile taken care of by the automatic reversible booster, so that all of the fluctuations are taken up by the battery, the output of the direct-current generator not being affected. Thus the generating set, *A*, is kept running at or near full load; the motor-generator supplies energy to No. 1 pit, and any surplus is stored in the battery. When the battery is fully charged, the motor-generator set is shut down, and energy for the load at No. 1 pit is supplied from the battery for the remainder of the 24 hours. The total equipment installed in the two pits is rated at about 300 hp. In the discussion Mr. W. C. Mountain thought he would not care to put a battery into a colliery; five or six years ago this was done in a German colliery at a cost of $45,000 and it had to be scrapped after less than a year's working. Mr. D. S. Bigge suggested that it would have been more economical to increase the turbine generating plant provided more exhaust steam was available. The author replied that more exhaust steam was available but additional turbine plant together with the transmission line would have cost very much more than the battery plant. He had arranged with the battery manufacturer for a ten years' maintenance contract at a very low cost.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Earthing in Mines.—W. FOSTER.—An abstract of a paper read before the Warwickshire and South Staffordshire Section of the Association of Mining Electrical Engineers. He started by describing the measurements he had made to determine the maximum pressure permissible in the earthing system. The arrangement of his tests is shown in Fig. 7. Direct current was employed. The first reading was taken as soon as the person

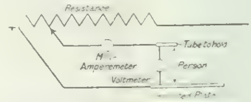


Fig. 7—Grounding Arrangement.

felt the effects of the current, and continued until the maximum was reached which the person would stand voluntarily. Seventy-two tests were made. A few samples of these are given below:

Volts	Amperes	Ohms
110	0.12	916
74	0.22	336
55	0.3	183
36	0.25	144
32	0.3	107
16	0.072	222

Each person's resistance had fallen toward the end of test, owing, probably to the perspiration on the hand. Seeing that a person would not stand voluntarily more than 32 volts, at which pressure he was taking 0.3 amp, it appears inadvisable to allow a potential difference between earthed metal work and earth of more than 50 volts. The author then proceeded to discuss the earthing on different systems. In the two-wire insulated direct-current system, when only one fault occurs, the system balances itself about this fault, and no interruption is caused in the working; but should a second fault occur, there is a short-circuit across the system. With the concentric system any fault, as a rule, causes a short-circuit. A three-wire direct-current system, with neutral insulated is similar to the two-wire, but a reduced pressure is applied to the short-circuit. A three-phase system, with all three phases insulated, is like the two-wire direct-current system, and a three-phase system with neutral earthed corresponds to the three-wire direct-current system. He did not approve of the system of finding one good earth and making connection to it. In his opinion a system with well-distributed ground connections is best, more especially when protective apparatus is employed to isolate faulty sections; such apparatus requires only a small current to operate it, and inserts only a small resistance in the earth connection. Mr. English, in discussing the paper, agreed with the author's recommendation to distribute the earth connections as generally as possible. He further stated that in his experiments 800 ohms was the lowest resistance of a human

body under conditions similar to those described in the paper. —Supplement to Lond. *Elec. Eng'ing,* July 7.

Electric Cooking.—K. Wilkens.—An article in which the author endeavors to show that electric cooking can be made commercially profitable since the time when energy is used for cooking is not coincident with the time of the peak load of the station. To introduce electric cooking on a large scale it is necessary to provide a suitable rate for service. Various methods are discussed. The simplest is one in which the consumer is charged not for the kw-hours but for the kilowatts, a device being installed which limits the amount of power that can be taken from the mains. The same rate is therefore charged for lighting, cooking, motor drive, etc.—*Elek. Zeit.,* July 7.

Electric Valves.—A. Tian.—An article on the application of electric (aluminum) valves for the protection of the field-magnet circuit at the moment of interruption of the circuit. The author claims the electric valve to be a very effective means of protection.—*La Lumière Elec.,* July 2.

Wires, Wiring and Conduits.

Protection of Insulated High-Tension Wires.—H. Wommelsdorf.—A critical discussion of an uncertain point in the rules of the German Association of Electrical Engineers concerning the protection of insulated high-tension conductors in electric plants. The author thinks that one of these rules is not clearly stated and that in many cases the conductors in German electric plants, especially in 500-volt, three-phase plants, are therefore not properly installed.—*Elek. Zeit.,* June 30.

Fuses.—Hundhausen.—An illustrated paper on a system of non-interchangeable electric fuses.—*Elek. Zeit.,* June 23 and 30.

Electrophysics and Magnetism.

Radium Emanation in the Atmosphere.—J. Satterly.—An account of an investigation on the amount of radium emanation in the lower regions of the atmosphere and its variation with the weather, made during one whole year in Cambridge, England. The cocoanut charcoal method was employed. The average radium equivalent per cubic meter is 105 gm x 10^{-12} gm. The lowest value is 35 gm x 10^{-12} gm, and the highest 350 gm x 10^{-12} gm, a ratio of 1:10. The amount of emanation is usually lowest during cyclones, that is, during windy, wet weather, when the barometer is low; it is usually highest during anticyclones, that is during dry weather with light variable winds and a high barometer. In cases where this rule breaks down, a study of the trajectories of the surface air-currents reveals that when air has traveled over the sea to Cambridge or very rapidly over land, the emanation content is low, while when the air has spent much time over land, the emanation content is high. The results of other experiments are discussed; Eve's results obtained by a similar method at Montreal differ from the author's, but this is probably due to different geographical conditions. Experiments made by measuring the active deposits on exposed wires seem to give misleading and indefinite results. The number of ions produced per cc per second in free air at Cambridge due to the radium emanation present is about 2.1 on the average, with a minimum value of 0.7 and a maximum value of 7.0.—*Phil. Mag.,* July.

Transient Phenomena.—K. W. Wagner.—Some theoretical notes on some simple transient phenomena which take place before the stationary condition in an alternating-current circuit is reached, and the technical importance of such transient phenomena.—*Elek. Zeit.,* June 30.

Hertzian Waves.—H. Poincaré.—The [illegible] of his mathematical paper on the diffraction of Hertzian waves.—*La Lumière Elec.,* July 2.

Units, Measurements and Instruments.

Cradle Dynamometer.—J. Dyson and [illegible].—A paper read before the Manchester Section of the (Brit.) Inst. Elec. Eng. on the application of the cradle dynamometer to the testing of electrical machinery. After referring to early applications of the cradle-dynamometer principle to the testing of electrical machines, the authors describe a dynamometer used at the Manchester School of Technology, the cradle being supported on ball bearings instead of the customary knife edges. Particulars of experiments with this machine are given, and also some results for the relation between hysteresis and eddy-current losses and the flux density in the air-gap.—Lond. *Electrician,* July 8.

Excess Voltage Indicator.—A note on a recent British patent issued to V. Arcioni. (14,965, 1909; June 30th, 1910). This is an alternating-current induction relay in which a spring-controlled metallic disk is acted on by shunt magnets connected between each phase or side of the system and earth. The form of the instrument is such that the torque due to the magnets being out of phase is negligible. The disk has a gap opposite but unsymmetrical to each magnet pole. Each magnet exerts its own torque on the disk independently, so that excess voltage between phases or between any one phase and earth will have effect.—Lond. *Elec. Eng'ing,* July 7.

Telegraphy, Telephony and Signals.

Telephone Progress.—B. Gati.—The author makes some remarks on Brown's telephone relay, together with other notes on recent progress in telephony. He refers to his microphones, which are water-cooled, work with 1 amp and speak to a distance of 2500 km on a 4-mm diameter bronze-wire circuit. The new microphones overcome a line resistance which is 1000 times as great as before. He then gives some records of disturbing currents which occur on the best Hungarian lines and asks what effect the telephone relay would have. His reply is that it would strengthen the disturbing currents and produce at the end of the circuit a terrible noise. For alternating (high-frequency) telegraphy he finds the relay of Brown a wonderful help. Working on modern (highly self-inductive) cables, the resonating effect shuts out entirely the disturbing currents; in this case with aid of the relay, it is possible to actuate, for instance, a Siemens-Halske or Creed rapid printing set.—Lond. *Electrician,* July 8.

Loaded Telephone Cables.—F. Jacob.—A communication on the effect of leakage on loaded telephone cables and the attenuation coefficient.—Lond. *Electrician,* July 8.

Miscellaneous.

The Frequency of a Lightning Flash.—F. Emde.—For the protection of electric installations against lightning flashes it is of importance to know the frequency of oscillographic atmospheric discharges. The author treats this problem mathematically, considering the electromagnetic field of a lightning flash between the cloud and the earth as a vertical cylinder, the outer surface of which has at all times a zero magnetic intensity. The calculations of the author are based on Maxwell's theory, and a comparatively simple formula is found for the fundamental frequency. This is between 2000 and 8000 cycles per second: the average being about 5000 cycles. When the electric field is approximately uniform, before the lightning flash started, the amplitudes of the higher harmonics are comparatively small and it is sufficient to consider the fundamental oscillation alone.—*Elek. Zeit.,* July 7.

Book Reviews

Index to Proceedings of National Electric Light Association. 1885 to 1909. New York: National Electric Light Association. 243 pages.

This Index is based on a plan originally prepared some years ago for a proposed index to the *Transactions* of the American Institute of Electrical Engineers. President C. L. Edgar during his administration of the National Electric Light Association in 1904-5, took direct charge of the execution of the task, and the briefs to accompany the classified entries of papers were prepared by members of his professional staff during a period of several years, most of the work being done by Mr. E. S. Mansfield. The plan of the index is based in part on the syllabus method of law reports, and in detail is as follows: Each paper is the subject of a syllabus or brief which notes the significant points covered by the paper, the briefs being classified chronologically in the present case under twenty-four

classes of main subjects. There is also an author index and a general word index. One seeking for information on a given subject first glances through the briefs in the class representing that subject, in order to determine which paper or papers printed in the *Proceedings* contain the specific information he seeks. This system relieves him from the necessity of taking down all the volumes containing papers on the subject, some or many of which, after the expenditure of time in examination, he might find did not include anything of specific interest to him. Should he wish to follow up a subject closely, he will next have recourse to the general index for references to papers in other classes where the subject is treated incidentally to the main topic of such papers; these index references are to the briefed entries in order that one need not take down all of the corresponding volumes of the *Proceedings* in order to learn if the information is along the lines he is following up.

By this system, one first jots down the volume and page references to papers he has selected after a glance through the classified briefed entries; he may then in addition jot down additional references found in the general index which relate to the subject in hand, check these by returning to the classified briefs, and mark off those which he thus finds do not interest him specifically. He has then a final list to everything in the *Proceedings* in which he is at the moment interested, and only the volumes thus closely selected need be taken from the shelf for consultation.

The preparation of a syllabus or brief of a few lines that will characterize properly a paper of some thousands of words, is obviously not a simple matter, and Mr. Mansfield and his collaborators are to be congratulated upon the successful manner in which they carried out this essential part of the work. Much credit is also due to Mrs. C. S. Gale, who prepared the general index and put all of the matter in form for the printer.

In future editions of the index several changes in make-up can be made with advantage. For example, at present the general index precedes the classified briefs, though the latter form the important section of the work, and the index entries refer to them. There appears to be no reason why the author index should be in type larger than that of the general index, particularly as the larger type used actually detracts from legibility. The reference numbers in the general index are rather formidable in appearance. This is owing to a departure from the original plan of the work, through the use of references both to the classified briefs and to the volumes of the *Proceedings*. This duplication appears to be unnecessary, as the time required to refer initially to the briefs would be much less in almost every case than the time required to take down the various volumes of *Proceedings* and examine lengthy papers in order to determine if the information contained is of the kind sought.

A part of the original scheme of the index was to print in each annual volume of *Proceedings*, briefs of, and a general index to, the papers in that volume, this matter to be prepared according to the plan of the separately printed main index. By this means not only would each volume be well-indexed in itself, but the matter thus printed would be on hand as material to bring the separately printed index up to date from time to time in new editions. This plan is partly recognized in the *Proceedings* for 1909, and the index section of that volume is reprinted as a supplement to the present Index volume. Unfortunately, however, instead of briefs suitable for later incorporation in their appropriate classes, abstracts of considerable length are given of the papers; and the general index is in such great detail as not to be suitable for direct incorporation with the main general index. A special technical index like the present one should have essentially the character of a finding index, as presumably it will be consulted for serious purposes that would not be served by a collection of abstracts which, even if of considerable length and satisfactorily compiled, would rarely if ever obviate final recourse to the original papers.

To the fortunate possessor of a file of the *Proceedings* of the National Electric Light Association, the present volume will be a prize, and particularly so to public reference libraries containing a set. The *Proceedings* date from the very beginnings of the central station industry, and their pages reflect every step in its technical and commercial evolution. This valuable mine of information, heretofore inaccessible, owing to lack of guidance to its treasure, is now opened in a manner that enables every nugget to be quickly located.

New Apparatus and Appliances

COMBINATION PHOTOMETRIC AND VACUUM TESTING OUTFIT.

Purchasers of incandescent lamps desiring to install a testing outfit, and who do not have at their disposal a dark room, will doubtless be interested in the photometric apparatus shown herewith, which has just been placed on the market by the Dwyer Machine Company, of Lynn, Mass. The photometer is enclosed within a large case which, together with curtains, protects the sensitive screen from stray sources of light. The inside of the case is darkened, and the inside of the photometer proper is lined with black velvet. Photometers are supplied for measuring the candle-power of tungsten-filament lamps up to 1000 cp.

The lamps may be lighted on testing sockets independent of the photometer, and the light graduated by means of rheostats from red heat to rated candle-power or above for the purpose of discovering bright spots on the filaments. Lamps with filaments containing any brightness, or with filaments not of a uniform temperature throughout their length, are usually considered defective. The apparatus has also provision for testing the vacuum of lamps. Of all the tests made on incandescent lamps that for vacuum is the most important, because lamps with varying vacuum will not give satisfactory service. Instructions accompanying the apparatus describe 10 degrees of vacuum and indicate the life which can be expected from each. To

Combination Photometric and Vacuum Testing Outfit.

install the apparatus it is simply necessary to make two connections to the main circuit, when the devices are ready for immediate use.

RAPID ERECTION AND REMOVAL OF ELECTRIC CIRCUITS.

During the first week in June there was given in St. Louis, Mo., under the auspices of the National Benevolent Association a county fair. This was held in University City for the benefit of the Babies and Mothers' Home, and electricity was employed for lighting and heating throughout. The circuits were fed from the mains of the Union Electric Light & Power Company. Inasmuch as the fair was held during the week of the National Electric Light convention, the regular force of electric light men was naturally very busy entertaining visitors and attending to routine work. Three days were allotted in which to erect the poles and wire the buildings and tents used. Fig. 1 herewith shows the poles and main secondary wires, transformers and suspension of lamps, which were held by a Matthew's guy anchor at each end of the pole line. The anchor served a double purpose of holding both the strain of the wires and the weight of the arc lamps suspended 30 ft. apart from a stranded guy wire. By the use of quickly attached Matthew's line material, previously painted poles, malleable-iron pole brackets and porcelain strain insulators, the work was finished with dispatch. The problem consisted in erecting 19 poles; two 30-kw, one 40-kw and one 10-kw transformers; approximately 1½ miles of wire; hanging 72 arc lamps and 600 incandescent lamps, and connecting the service to each tent. This work was accomplished by two foremen, six linemen and four helpers in 24 hours. After the fair the entire outfit was removed by one foreman, four linemen and two helpers in 10 hours. Fig. 3 shows a crew of the Union Electric Light & Power Company pulling up and taking down a pole by means of jack screws. These poles were 35 ft. long and were pulled up bodily from the ground without digging around them at an average of less than five minutes each. The entire installation shows what can be done by good organization and labor-saving specialties in picking up unexpected and profitable business.

Fig. 1—General View of Grounds Without Tents, Etc.

Fig. 2—View of Poles and Secondary Circuits

Fig. 3—Removing Poles By Means of Jackscrews.

COMBINATION WINDOW AND SIGN LAMP.

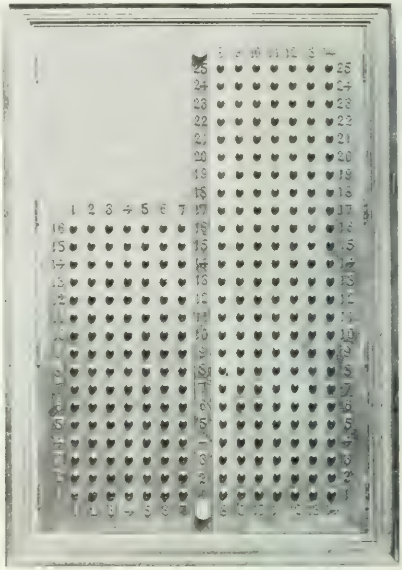
The Federal Electric Company, Chicago, manufactures a combination art-glass screen or sign for window work, the lamps for which also illuminate the window. The letters are made in colors contrasting with the background, and are all standard in size so as to slip easily into a grooved brass frame-

Combination Window and Sign Lamp.

work. The lamp reflectors being adjustable to any angle throw the light to best advantage upon the window display, the small amount of light which escapes through the shades being all that is necessary to illuminate the sign. The latter hangs close to the plate glass by heavy brass chains, and occupies space that cannot be utilized for any other purpose. The framework of the fixture consists primarily of a light, but strongly trussed, steel frame having brass-bound parallel runners or guides at the top and bottom. Electric lamp sockets are placed at regular intervals along the under side of the top trussed rod, which is used as a conduit for the wires. The trussed rod is fastened with a clamp, which permits the turning of the rod so that all the sockets, with the lamps which they carry, can be adjusted to any angle. The curving of the supporting brackets well away from the inner surface of the sign removes them from the line of light so they do not cast a shadow. The height of the plate is 10 in., while the actual height of the letter is 6¼ in. The widest plates are 8 in. for the letters "M" and "W." All other characters, except the letter "I" and punctuations, are 7 in. wide. The narrower plates are 3½ in. wide. Tungsten lamps are used to advantage in these signs.

POSITION INDICATOR FOR GROUP OF ELEVATORS.

The elevator equipments of the new Oliver Building, Pittsburgh; the County and City buildings, Chicago, and the Hotel Sherman, Chicago, include a bank of indicator lamps as shown in the accompanying illustration, placed in view of the starter on the first floor and arranged to light corresponding to the position of the cars at the various floors. The position indicator pictured is that of the 25-story Oliver Building, where there are 14 cars, seven of which run only to the 16th floor. The cord controlling the dial indicators over the various elevator doors, which moves proportionally to the travel of the corresponding car, is attached to a contact brush which moves over a commutator group of contacts, each of which is connected to a lamp behind one of the bullseyes shown. The circuits for all 14 of the cars are cabled to the position indicator which, by the lighting of the lamps in each row, shows the position of all the cars at a glance. The cabinet is of bronze



Position Indicator for Elevators.

and has the lamps mounted directly on the doors, so that opening these gives free access to the connections. This position indicator is manufactured by the Elevator Supply & Repair Company, Chicago.

PROJECTOR FOR PHOTO-ENGRAVING PURPOSES.

The accompanying illustration shows a projector being manufactured by the Carlisle & Finch Company, Cincinnati, Ohio, for Mr. Burgoyne Jones, of Cincinnati, who perfected the apparatus for photo-engraving use. Owing to the great number of two, three and four-color process prints employed in catalog work, it was found that the old style of arc lamp was too slow for producing results without a great deal of expense, and that it was frequently necessary to make 19 to 24 negatives, which were rephotographed and manipulated in various ways to produce the necessary plates. Mr. Jones, with the aid of the special projector, succeeded in getting results with only three negatives, one for each color, thus cutting down the time to one-tenth that required by the old process. The searchlight consists of a powerful marine projector with a 24-in. parabolic mirror and two sets of dispersion lenses, set cross-wise so as to throw an approximately square beam of light. The secret of the success is said to lie in the quality of glass used in these lenses, which are especially made for this particular purpose. At a distance of 20 ft. the projector throws a beam 12 ft. to 15 ft. square, of an intensity equal to or greater than sunlight, so that a negative can be made in a few seconds.

Projector.

VERTICAL-CARBON FLAME ARC LAMP FOR DIRECT-CURRENT SERIES, MULTIPLE AND MULTIPLE-SERIES SERVICE.

The remarkable efficiency, pleasing appearance, and exceptional quality of light which characterize the flame arc lamp have rendered it pre-eminently adapted for the economic illumination of large areas. Moreover, it is now generally conceded that the flame arc lamp is the most efficient illuminant yet developed, and that the penetrating quality of the brilliant, golden yellow light is such that even under the most adverse atmospheric conditions, such as those imposed by fog or smoke, it provides a highly satisfactory illumination.

A disadvantage of the usual 6.6-amp vertical carbon direct-current flame arc lamp has been the large and wasteful resistance necessary. This new lamp is designed for connecting directly in a 6.6-amp direct-current circuit without any change in the system, simply replacing the other lamps where desired.

Although these lamps are now made for direct-current service only, they find a wide application, being suitable for lighting squares, parks, or special store sections in cities where the 6.6-amp series luminous arc, or the series direct-current enclosed 6.6 amp system, is used for street lighting. They are adapted for multiple and multiple-series service in addition to the above.

The lamps are equipped with a light opal globe and a 26-in. diffuser. The casing, which is of copper with black oxidized finish, is made up in two sections so arranged that, by telescoping the sections, the mechanism is exposed, rendering it unnecessary to remove the entire casing in order to see that the lamp is properly trimmed.

The arc is held in the same position at all times, as the mechanism is of the focusing type. With the exception of this feature, the lamp mechanism is similar to that used in the General Electric standard enclosed lamp, which has given perfect satisfaction during years of service. The lower carbon holder is provided with a ball-and-socket joint to allow perfect alignment of both carbons.

Vertical Carbon Flame Arc Lamp.

A life of about 20 hours is obtained with one trim when the lamp is adjusted for 6.6 amperes. The design and the materials used are such as to combine attractive appearance, great strength and durability with minimum weight. Particular attention is called to the increased illuminating efficiency obtainable; an average of 2800 mean lower hemispherical candlepower being claimed by the maker.

This increased efficiency, combined with the fact that lamps may be connected directly in the circuit offers the central stations operating direct current an opportunity to take over the lighting of foundries, wharves, etc. The lamp is made by the General Electric Company.

IMPROVED MANHOLE TRANSFORMER.

Distributing transformers as installed in underground vaults, are liable to flooding from heavy rains or overflow water, and consequently one of the main requirements of service is that the manhole transformers shall be water and air tight. Hence, it is necessary to enclose the transformer in a hermetically sealed case, and design it for an exceedingly low temperature rise, which conditions imply careful design as well as the highest grade of workmanship. At the same time, the transformer must not only be so constructed that it is possible to make it water-tight, but such that the unit can be installed quickly and easily. Also, it is necessary that the design shall permit the transformer to be connected to or disconnected from the line without removing the cover or otherwise opening the case.

Manhole Transformer.

Any expansion of the oil under a rising temperature, of course, compresses the air in the upper portion of the transformer case and causes a rise in pressure. Under abnormal operating conditions, such as a short circuit, a considerable rise in this pressure may occur, which will make the transformer case liable to serious injury. In order to avoid any danger from such occurrences, a safety or relief valve for any excess pressure should be provided. The completed transformers should be tested at the factory at a sufficient air pressure to insure their being air-tight and moisture-proof.

The Westinghouse Electric & Manufacturing Company has designed a transformer to fulfill the foregoing conditions of service, a view of which is given in the accompanying engraving. The magnetic circuits and coils of this transformer are the same as those of the standard Westinghouse type transformer, but they are mounted in a case of special design, that adapts them to manhole service. The illustration shows a transformer supplied by the Westinghouse Electric & Manufacturing Company to the Kentucky Electric Company, Louisville, Ky., one of the largest electrical companies in the country employing underground distribution. The many advantages of this type of construction have led to its adoption for the entire line of transformers designed for manhole service.

Industrial and Commercial News

THE WEEK IN TRADE.

NOT only is the customary midsummer dullness doing its part to contract trade at the present time, but there is an unusual degree of conservatism which is detracting from the ordinary buying movement. From all parts of the country reports are received that there is a disposition to await further developments in the crop situation before laying in new stocks for fall business. Quite a number of buyers are in the leading markets, but their operations are governed by extremely conservative views. Reports as to the fall trade outlook are rather optimistic in the southwest and in the central West, but in those sections of the country where spring wheat is one of the more considerable crops there is not this feeling of optimism. In some of the smaller cities throughout the West clearance sales did something to stimulate retail trade, but as a rule the retailers report that there was more difficulty in disposing of excess stock this year than there was last year. Weather conditions for the week have not materially changed, and there is still a feeling that too much drought has prevailed both in the western grain belts and in some sections of the cotton district. Corn, as a rule, is in good shape, but in many sections, unless there are rains within the next few days, the process of maturing will be retarded. In the industrial world there is the same tendency to curtail and shade prices that has been observed for the past few weeks. Collections ranged about fair, and reports from the smaller banks of the country indicate that there will be little surplus of cash to carry over slow accounts. Failures for the week which ended July 21, as reported by *Bradstreet's*, were 215 as against 202 the previous week, 239 in the same week of 1909, 263 in 1908, 155 in 1907 and 171 in 1906.

THE COPPER MARKET.

COPPER conditions were distinctly improved last week and there was even a fractional advance in the selling price of standard and electrolytic. This improvement is due entirely to well-credited reports which have reached this country from Europe, that a comprehensive "copper understanding" has been almost perfected. It is hardly believed that any merger of the large interests is planned at this time, but the fact that John D. Ryan, president of the Amalgamated; Professor Penrose, of Utah; A. Chester Beatty, of the Gugghenheim Exploration Company; Charles N. McNeill, of the Utah Copper Company, and many English, Scotch and French copper investors had recently been in London together and had been holding meetings, seems to be very significant.

Standard Copper	Bid.	Asked	Settling price.
Spot	[illegible]	[illegible]	....
July	[illegible]	[illegible]	11.81¼
August	11.75	[illegible]	11.90
September	11.85	12.10	11.97½
October	[illegible]	12.15	12.02½

The London market July 25 was as follows:

	Highest. £	s	d	Lowest. £	s	d
Copper, spot	54	8	9	54	3	9
Copper, futures	55	1	3	54	16	3

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
London, best selected	[illegible]	[illegible]

It is even said that J. Pierpont Morgan has been called into consultation, and that he may probably formulate a plan which will reduce the production of copper to the needs of the consumers. It is said that while in Europe Mr. Morgan was in conference with the Rothschilds and the Baron Hirsch interests. There certainly has been some movement in the direction of curtailment in this country. Word has been received from the Butte camp that several thousand men have been laid off, and that a reduction of about 3000 tons of ore per day has been made in the aggregate output. It is believed in Butte that the ultimate curtailment in that section will reach 25 per cent. During the week there were reported some heavy copper sales. Most of this metal was electrolytic which, it is said, averaged about 12½. It was also claimed that several [illegible] at 12⅝ cents. Exports for the month have amounted to 18,284 tons, which is much less than the exports for the same month last year. The imports have been heavy, but are hardly up to the average recorded in June. Daily call on the Metal Exchange July 25 quoted standard copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Western Electric Company's Business.—In the issue of July 21 we referred to the fact that the telephone department of the Western Electric Company was being operated overtime, and that the Hawthorne plant had been practically given over to this branch of manufacture. It is given out by the company that this is not, however, the only branch in which increased business is being done. The general sales, it is said, run at a rate which would mean a business of $61,000,000 for the year. This rate compares with $46,000,000 for the year 1909, and is a higher ratio than any business ever done by the company, except in 1906, when the gross sales amounted to $69,000,000. Discussing the situation, an officer of the company said: "The normal rate and the steadiness with which our business is running lead us to believe that the improvement will be maintained. There is nothing like a boom in sight, but on the other hand there is nothing in sight which leads us to think an immediate decline in the business of the country is in order. The foreign business of the company is exceptionally good, but it is without any special feature."

Electrical Jobbers' Association.—The convention of electrical supply dealers of the United States, known as the Electrical Jobbers' Association, was held at Hotel Clifton, Niagara Falls, Ontario, July 19, 20 and 21. The meeting was very largely attended, there being present about 150 supply men and a like number of manufacturers and their representatives. The three days were divided between business and entertainment features, the business meetings being held in the mornings and the afternoons devoted to baseball, automobiling and various other entertainments for the visitors and their lady guests. The next meeting of this association will be held at Hot Springs, Va., in October, and the one to follow that next spring, will be held at Del Monte, Cal. It was decided after some discussion to make this journey to the Pacific Coast in order to bring into closer relationship the various supply men of that section of the United States, several of whom have taken a great deal of interest in the association, and made the journey across the continent to attend conventions.

Insulated Wire Trade.—One of the principal manufacturers of insulated wire reports that the present condition of trade is not at all satisfactory. He says that not only are prices somewhat demoralized, but that the liberal contracts which were anticipated, on account of the considerable amount of building that seemed, early in the spring, to have been planned, have not been realized. There is a disposition, he says, on the part of contractors to use cheaper materials, and this is particularly disadvantageous to those manufacturers who strictly adhere to high-class rubber insulation. According to this manufacturer, the prices made by makers of cheaper grades of insulated wire are below anything that can be quoted by the old line standard manufacturers. This sort of competition has done much to interfere with the trade of some of the principal concerns.

New York Electric Lines Company.—The suit of the New York Electric Lines Company, the wire-leasing concern which is endeavoring to get space in the conduits of the Empire City Subway Company, Ltd., in New York, came up for hearing in the Supreme Court last week and was by mutual consent postponed for hearing until Aug. 2. This mandamus proceeding, which was detailed in full in our issue of July 14, is the entering wedge of the independent telephone interests in New York City. The Great Eastern Telephone Company, which has contracted with the Electric Lines Company for the use of its wires, if space in the conduits is secured, claims to have already more than 100,000 subscribers, under contract, in the downtown district of Manhattan.

Westinghouse Electric Annual Meeting.—The stockholders' meeting on July 27 of the Westinghouse Electric & Manufacturing Company has given rise to much newspaper gossip concerning strained relations between Mr. George Westinghouse and Mr. Robert Mather, chairman of the board of directors. In a statement from his home in Lenox Mr. Westinghouse said that having agreed with the directors last spring to accept a vacation until Aug. 1, so far as official duties of president are concerned, he will not preside at the meeting, nor be present nor represented there. Referring to personal relations, Mr. Westinghouse says that there should have been a constant, proper and considerable recognition of his position as president and of his knowledge and experience gained as the founder and manager of the company, but such has not been the case. On the contrary, he says the chairman within a month after his election embarked upon a course, the inevitable effect of which was to insure the existing deplorable conditions which will make it difficult while he remains president of the company to exercise the duties of an official except when specifically required by the board, and that he naturally opposed the efforts to eliminate him from responsible positions and also, when he thought the interests of the company required, opposed and voted against some of the chairman's recommendations to the board, the carrying out of which he thought would involve loss either in money or prestige. With such an excellent showing of profits for the last two months, he said the assenting stock of the company should now be worth near par, adding that lack of confidence in the management of a company has much to do in making low prices for its securities.

Increase in Rubber Trade.—The United States Rubber Company has unfilled orders on hand at the present time in larger volume than ever before in the history of the company. Up to the present time the sales of the company in its present fiscal year, which began April 1, have averaged about 60 per cent ahead of the same period last year. The Rubber Goods Manufacturing Company, which is controlled by the United States Rubber Company, has also a very large number of orders booked, but its business is not quite up to the standard of the parent company. An official of the United States Rubber Company says that within two or three years the company will begin to get the benefit of its investments in crude rubber plantations in Brazil and Sumatra, and in four or five years should be getting practically all of its entire requirements of crude rubber from its own plantations. The company uses about 20,000,000 lb. of rubber a year, and the ownership of these plantations will make it entirely independent of the crude rubber market. While this official is of the opinion that there will be a very large increase in the general rubber trade within the next five or six years, he does not expect that the price of crude rubber will again reach the high figures of last winter, when up-river Para sold for $3.00 per lb. While very little of this quality of rubber is now used for insulating purposes, the price of Para rubber generally controls the prices of the lower grades.

Susquehanna Transmission Company.—The Susquehanna Transmission Company, which will build the transmission line from the power plant of the Pennsylvania Water & Power Company at McCall Ferry, to Baltimore, has nearly acquired the necessary right of way on which to erect the towers and string the cables. The complete right of way has been secured through York county, Pennsylvania, and Howard county, Maryland, but more difficulty has been experienced in Baltimore county, and condemnation proceedings will be necessary in several instances in the latter county before the acquisition of the entire right of way will have become an accomplished fact. The steel towers on concrete bases, on which the transmission cables are to be strung, have been erected across York county and this work is now going on in the northern part of Howard county. The company is acquiring a strip of land 100 feet wide all of the way from the dam to Baltimore and will fence it in the entire distance, in order that live stock and persons may be less likely to trespass on the right of way.

San Joaquin Light & Power Company.—The properties of the Power, Transit & Light Company, of Bakersfield, Cal., and the Merced Falls Gas & Electric Company, of Merced, Cal., have been purchased by the San Joaquin Light & Power Company, of Fresno, Cal. The latter company is establishing a system for furnishing the oil fields of California with energy. and the plants just purchased will be used for that purpose. The San Joaquin company is now building a hydroelectric plant on the San Joaquin River, where it is expected to develop 20,000 hp. High-tension transmission lines will be constructed from Porterville to Bakersfield, 70 miles, and from Madera to Merced.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Oroville, Wash.; Slater, Mo.; Pittsfield, N. H.; Dalton, Ga.; Frederick, Md.; Wilmington, Del.; Buffalo, N. Y.; Guanacevi, Durango, Mex.; Waddington, N. Y.; Newark, N. J.; St. Petersburg, Fla.; Chelan, Wash.; Wernersville, Pa.; Delta, Col.; Wheeling, W. Va.; Hamburg, Ark.; Norwood, N. Y.; Fulton, N. Y.; Sheridan, Wyo.; Lynchburg, Va.; Edmonton, Alta., Can.; Miles City, Mont.; Lincoln, Ill.; Raleigh, N. C.; Berea, Ohio.; Altoona, Pa.; Cleveland, Ohio, and Devine, Tex.

To Use Steinway Tunnel.—The Long Island Railroad announces that, upon the completion of the electrification work on its North Shore Division, it will establish a station at Hunter's Point Avenue in Long Island City, which will give all passengers coming to New York on any of the divisions a choice of taking the Pennsylvania tunnel or the Steinway tunnel into Manhattan. This will give the passengers using the Long Island Railroad a direct connection with the present subway system at Forty-second Street and Park Avenue

Assessment on Electrical Goods in Warehouse.—The General Electric Company maintains a large warehouse in Chicago for the storage of electrical machinery and supplies. The fact was brought to public notice lately when the Board of Assessors made an assessment of $285,000 on the company in Chicago. A protest was made, however, and the Board of Review reduced the assessment, which was made for the purpose of collecting the personal-property tax, to $170,000.

Attachment Plugs for Panama.—The Isthmian Canal Commission will open bids in Washington, on Aug. 2, for furnishing at the Isthmus of Panama 800 Edison base attachment plugs in four lots designated as items 30, 31, 32 and 33 of zone requisition 4598-A. Details relating to the bids can be ascertained from circular No. 597-A which can be obtained from Captain F. C. Boggs, Corps of Engineers, U. S. Army, General Purchasing Agent, Washington, D. C.

Centralization of Management in Nebraska.—E. A. Bullock, who controls the central stations at Norfolk and York, Neb., and Missouri Valley, Ia., has recently purchased from E. J. Sullivan controlling interest in the Beatrice Electric Company. Mr. Bullock now has an office at 515 Brander's Building, Omaha. Frank McMaster has tendered his resignation as manager of the Beatrice Electric Company.

Easton (Pa.) Gas & Electric Company.—Plans have been completed by the Easton Gas & Electric Company for the installation of an additional 2000-kw turbine unit in its steam power station. A new switchboard will also be installed. H. L. Doherty & Company operate the property.

Allis-Chalmers Turbine Sales.—The Allis-Chalmers Company has sold to the Knight Power Company, of Provo, Utah. two 1650-hp horizontal water turbines operating under a head of 170 ft. These turbines will be regulated by a regulating cylinder operated by penstock pressure.

Equipment for Boston Edison.—The Edison Electric Illuminating Company of Boston has ordered from the General Electric Company a new steam turbo-generator of 15.000 kw capacity. It is expected that the new generator will be delivered next May.

Financial.

THE WEEK IN WALL STREET.

IRREGULARITY and light trading were the features of the Wall Street market last week. During the entire week the Stock Exchange handled less than 3,000,000 shares, and what trading occurred was principally among the professionals. There was very little outside buying, and very little buying by any of those large interests which have heretofore attempted to support the market in its weakest stages. Although the figures for the week show that most of the stocks in which there was any trading at all recorded declines, many people in Wall Street assume to see evidences of a better tone in the market. Many of the best experts declare that the worst of the liquida-

tion is over, and that the holdings of speculators and professional traders have been fairly well sold out; or, in other words, that the bottom has about been reached. All that is needed for a substantial recovery is to develop some buying interest, either inside or outside of the professional ranks. The most startling occurrence of the week was the heavy decline in the common stock of the National Lead Company. When it became known that the dividend on this issue would be reduced from a 5 per cent basis to a 3 per cent basis there was a rush to sell, which carried the stock down more than 20

NEW YORK.

	July 18.	July 25.	Shares sold.		July 18.	July 25.	Shares sold.
All.-Ch	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	300
[illegible]	[illegible]	5[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	200
Am. D. T....	20½*	[illegible]*	——	[illegible]	[illegible]*	[illegible]	[illegible]
[illegible]	[illegible]	31[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]*	——
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]*	——
[illegible]	[illegible]*	[illegible]*	——	[illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T..	132½	13[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B. R. T.....	77	73⅛	20,725	W. U. T.....	[illegible]	[illegible]	[illegible]
[illegible]	14[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]-Met	[illegible]	16	7,210	West'h., pfd..	115*	115*	——

PHILADELPHIA.

	July 18.	July 25.		July 18.	July 25.
Am. Rys..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elec. Co. of A......	11⅝*	11⅝*	Phila. R. T........	19¼	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]*
[illegible]	[illegible]*	[illegible]*	[illegible]	[illegible]*	[illegible]

CHICAGO

	July 18.	July 25.		July 18.	July 25.
Chi. City Ry.......	180*	[illegible]	[illegible] Tel. Co	[illegible]	[illegible]*
Chi. Rs., Ser. 1.....	70*	70*	Met. El. Co........	20*	20
[illegible]	15[illegible]	[illegible]*	[illegible]	[illegible]*	60*
[illegible]	[illegible]	[illegible]	[illegible]	115	115*
[illegible]	[illegible]*	2½	Nat'l Car., pfd......	118*	[illegible]15

BOSTON.

	July 18.	July 25.		July 18.	July 25.
Am. T. & T.........	132¾	[illegible]	Mex. Tel......	[illegible]*	[illegible]
[illegible]	[illegible]	141*	Mex. Tel., pfd	[illegible]*	[illegible]*
Edison E., Ill......	255	255	N. E. Tel.....	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	W. T. & T....	[illegible]	[illegible]*
[illegible]	[illegible]*	[illegible]	W. T. & T., pfd....	86	86
Mass. E. Ry., pfd...	79	[illegible]*			

* Last price quoted.
Shares sold for four days, July 18 to July [illegible]

points in a few days. The decline in the price of this issue has been almost 50 per cent since the first of the year. Although there was little gain in prices, the copper stocks were, as a rule, a trifle stronger on the reports that definite arrangements were being made to curtail production. It has been generally recognized for many months that, unless something was done in this direction, dividends could not be earned very much longer on Amalgamated and some of the other heavily capitalized corporations. In the money market there was a little buying of bonds developed, but they were in very small lots and it was generally understood that the purchasing was done by small investors who were putting their July dividends back into securities. While the money market continues to be very easy, the banks were somewhat astonished, and considerable gossip was originated, by the suggestion from Secretary of the Treasury MacVeagh, that national currency associations be formed in order that in time of need the banks might more easily issue the emergency currency provided for in the Aldrich-Vreeland law. The necessity for such issue seems so far away from the present conditions of the money market that the suggestion was rather startling. Quotations for money remain easy, and on July 25 were: Call, 1½ @ 2¼ per cent; 90 days, 4 per cent. The quotations in the table are those of the close, July 25.

FINANCIAL NOTES.

American Telephone & Telegraph Company.—The report of the American Telephone & Telegraph Company for the first six months of 1910 shows a substantial improvement in total earnings over the corresponding period of last year. From time to time it has been pointed out in these columns that the monthly earnings of the company were exceeding those of the corresponding month in 1909. From the preliminary figures of the half year's report, it now appears that the total earnings of the company for the six months expanded more than $2,300,000, while net earnings showed an increase of nearly $2,000,000. The fact that the company's gross revenues were about $17,595,000, and that the net profits were almost $16,000,000, shows that the property is operated on an extremely conservative and economical basis. Last year the company's total earnings, including dividends, interest, traffic and other receipts, amounted to almost $33,000,000, or about $5,000,000 more than in the previous year. In view of the fact that the total earnings for the first half of the year 1910 were more than $17,500,000, it is evident that the record for the year will show practically as good an increase as the record for 1909. The net income available for dividends for the first six months of 1910 was equal to 5.12 per cent on the present $259,694,200 capital stock outstanding. This is at the rate of 10.24 per cent for the year, and indicates that after the regular 8 per cent dividend has been paid there will be a material surplus carried over.

National Lead Company.—Within the past week there has been a serious slump on the New York Stock Exchange in the price of the common stock of the National Lead Company. This is largely due to the fact that at the meeting of the directors last week the company declared a dividend of ¾ of 1 per cent, payable Oct. 1. This stock has heretofore been paying dividends at the rate of 5 per cent per annum. At the first of the year the common stock of the National Lead Company sold for about 90; last week it touched the low point of 47. President L. A. Cole, of the company, says that the reduction of the dividend on the common stock was made necessary by the diminishing trade of the company. This he holds to be due, to some extent, to the high price of linseed oil, which price he believes will be permanently high, and which tends to diminish the amount of lead products used. The profits of the company have been reduced, and Mr. Cole anticipates a lesser net revenue. It is said that this reduction in the dividend of the National Lead Company will have no effect upon the affairs of the American Smelting & Refining Company. While both of these companies are controlled by the same interests, their inter-relations are not intimate. The American Smelting & Refining Company sells pig lead to the National company, but it does not handle its ores nor has it any stock ownership or stock control.

Washington, Baltimore & Annapolis.—It was reported last week that the Washington, Baltimore & Annapolis Electric Line would be in a position to pay six months' interest on the $2,145,000 issue of the 5 per cent terminal bonds on Sept. 1, amounting to something over $51,000. The company met the interest for the quarter ending June 1. The company is making a good record from an earning standpoint. The report for June was issued last week and shows an excellent increase over 1909. Gross earnings were $53,818, as compared with $49,063 for the same month of last year, making an increase of 9.69 per cent. The statement places the net earnings at $24,576, as against $14,503 for 1909, or a percentage increase of 69 per cent. For the fiscal year ending June 30 the gross earnings were $638,114, operating expenses $365,601, and net earnings $272.512.

Electric Consolidation in Louisville.—The joint committees on gas and water of the boards of Aldermen and Councilmen of the city of Louisville have been hearing arguments upon the proposed consolidation of the Louisville Gas Company, which owns the Louisville Lighting Company, with the Kentucky Electric Company. Details of this consolidation have not yet been worked out, as it is necessary for the city authorities to sanction the merger and issue a new franchise. Under the law, any new franchise will have to be advertised and sold to the highest bidder, and until the consolidated company has purchased such a franchise it would be impossible to determine the necessary capitalization of the new company. At the present time there is active competition between the two companies in the business section of the city.

American Power & Light Company.—The American Power & Light Company, the new holding concern organized last month to take over the properties of the Northwest Corporation located in Idaho and Oregon, details of which were given in our issue of June 16, has purchased the hydroelectric plant and distributing system of the Wasco Warehouse Milling Company, of The Dalles, Ore. The plant consists of a hydroelectric station on White River and transmission lines to Dufur and The Dalles, Ore. The energy is used for lighting and power, including the operation of the large flour mills of the Wasco company.

Stromberg-Carlson Telephone Manufacturing Company.—F. N. Kondolf, president of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, has just submitted to his stockholders a report of the business of the company for the first six months of 1910. This shows a net profit for the period, after deducting $45,241, for maintenance and renewals, of $70,158 as compared with $33,536 in the previous six months. The total surplus of the company on June 30 was $240,593. The company has outstanding $3,000,000 stock equally divided between preferred and common.

Michigan State Telephone Company.—Announcement has been made by N. W. Harris & Company, bankers, of New York, that they have sold their interest in the Michigan State Telephone Company to the American Telephone & Telegraph Company. The bankers owned the majority of the common stock of the company. The Michigan company has an authorized issue of $4,000,000, 6 per cent cumulative preferred, and $6,000,00 common stock. There is outstanding $2,285,000 preferred and $3,500,000 common. According to the terms of the purchase, four shares of the stock of the American Telephone & Telegraph Company are to be exchanged for five shares of common stock of the Michigan State Company. The minority stockholders will be given an opportunity to exchange their holdings on the same basis. The Michigan company was incorporated in 1904, and was the successor of the Michigan Telephone Company. The company in 1909 leased the property of the Northeastern Telephone Company, which operates in fifteen counties in Michigan. The number of telephones the company had in use, according to a report dated Dec. 31, 1909, was 132,270.

United Light & Railways Company.—Announcement has been made of the merger of eight public service corporations in Indiana, Iowa, Michigan, Tennessee and Illinois under the name of the United Light & Railways Company. The holding concern will have a capital stock of $30,000,000. The companies included are: The Laporte (Ind.) Electric Company, the Laporte Gaslight Company, the Cedar Rapids (Ia.) Gaslight Company, the Fort Dodge (Ia.) Light Company, the Muscatine (Ia.) Light & Traction Company, the Cadillac (Mich.) Gaslight Company, the Mattoon (Ill.) Gaslight Company and the Chattanooga (Tenn.) Gas Company. The new company will take over the holdings of the Childs-Hulswit syndicate of Grand Rapids, which owns the controlling interest in the public service corporations named above. It is said that other properties will probably be secured in the near future. The gross earnings of the eight companies taken over were last year $861,600.

Federal Telephone & Telegraph Company.—The Federal Telephone & Telegraph Company, of Buffalo, has certified to the Secretary of State of New York that it has merged the following telephone companies, of which it owned all of the capital stock: Corning, Watkins, Ithaca, Springfield, Marilla, Canisteo, Wellsville, Hornellsville telephone companies; Conewango, Valley Home, Cohocton Valley telephone and telegraph companies; Elma Telephone Exchange; Citizens Telephone Company of Bath, Attica Home Telephone Company, Citizens Telephone Company, of Akron, N. Y., and the Valley Telephone Company. The certificate is signed by Bert G. Hubbell, president of the Federal Telephone & Telegraph Company. This company operates under Bell patents in Buffalo and the surrounding territory.

Foxboro (Mass.) Electric Company.—The Foxboro Electric Company has applied to the Massachusetts Gas & Electric Commission for permission to increase its capital stock from $16,500 to $60,000. The demands upon the plant have outgrown its capacity and the proceeds of the new issue are to be used for extensions and improvements.

Laclede Gaslight Company.—The report of earnings for the first six months of 1910 of the Laclede Gaslight Company, of St. Louis, shows that the company is earning a trifle more than 9 per cent on the $8,500,000 outstanding common stock. The actual amount available for dividends on this stock at the end of the six months' period was $383,499.

DIVIDENDS.

Amalgamated Copper Company, quarterly, ½ of one per cent, payable Aug. 29.

Cambridge (Mass.) Electric Light Company, quarterly, 2½ per cent, payable Aug. 1.

Connecticut Railway & Lighting Company, quarterly, preferred and common, each 1 per cent, both payable Aug. 15.

Jacksonville (Fla.) Electric Company, semi-annual preferred, 3 per cent; common, 3½ per cent, payable Aug. 1.

Montreal Light, Heat & Power Company, quarterly, 1¾ per cent, payable Aug. 15.

National Carbon Company, quarterly, preferred, 1¾ per cent, payable Aug. 15.

Ohio Traction Company, preferred, quarterly, 1¼ per cent, payable Aug. 1.

United States Motor Company, preferred quarterly, 1¾ per cent, payable July 30.

West Penn Railway Company, preferred, quarterly, 1¼ per cent, payable Aug. 1.

Western Telephone & Telegraph Company, preferred, semi-annual, 2½ per cent, payable Aug. 1.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Light & Traction Company:					
[illegible]	[illegible]	[illegible]	$274,161	....	......
June, 1909	[illegible]	[illegible]	[illegible]	....	......
Baton Rouge Electric Company:					
May, 1910	[illegible]	[illegible]	[illegible]	[illegible]	871
May, 1909	[illegible]	[illegible]	[illegible]	[illegible]	*395
Cape Breton Electric Company, Ltd.:					
May, 1910	[illegible]	[illegible]	[illegible]	[illegible]	4,158
May, 1909	[illegible]	[illegible]	7,073	[illegible]	2,037
Houghton County (Mich.) Electric Light Company:					
May, 1910	[illegible]	[illegible]	8,717	[illegible]	4,383
May, 1909	[illegible]	[illegible]	7,379	[illegible]	[illegible]
Keystone Telephone Company, Philadelphia:					
[illegible]	[illegible]	[illegible]	52,683	....	....
[illegible]	[illegible]	[illegible]	48,398	....	....
Kings County Electric Light & Power Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	304,270	[illegible]	[illegible]	[illegible]	[illegible]
Laclede Gas Light Company:					
Six months ended June 30, 1910	[illegible]	[illegible]	[illegible]	[illegible]	383,499
Six months ended June 30, 1909	[illegible]	[illegible]	[illegible]	[illegible]	294,958
Lowell (Mass.) Electric Light Corporation:					
[illegible]	32,847	[illegible]	[illegible]	[illegible]	7,854
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5,973
Montreal Street Railway Company:					
[illegible]	[illegible]	198,848	[illegible]	[illegible]	126,662
June, 1909	354,918	[illegible]	[illegible]	[illegible]	116,463
Niagara Lockport & Ontario Power Company:					
June, [illegible]	[illegible]	18,262	27,264	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	16,489	[illegible]	*[illegible]
Northern Texas Electric Company:					
[illegible]	[illegible]	64,483	53,282	[illegible]	[illegible]
[illegible]	104,899	57,947	[illegible]	[illegible]	[illegible]
Ontario Power Company, of Niagara Fall					
June, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	46,079	[illegible]	*[illegible]	[illegible]	*[illegible]
Paducah (Ky.) Traction & Light Company:					
[illegible]	[illegible]	[illegible]	[illegible]	6,987	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	7,027	[illegible]
Philadelphia Company:					
[illegible]	1,681,633	[illegible]	[illegible]		...
[illegible]	1,378,449	857,372	[illegible]		...
Puget Sound Electric Railway Company:					
[illegible]	169,190	[illegible]	[illegible]	50,679	[illegible]
May, 1909	156,053	[illegible]	47,988	47,831	[illegible]
Seattle Electric Company:					
May, [illegible]	[illegible]	[illegible]	[illegible]	105,736	[illegible]
May, 1909	[illegible]	[illegible]	[illegible]	103,315	79,184
Southern New England Telephone Company:					
Year, [illegible]	[illegible]	[illegible]	[illegible]	461,622	84,780
Year, [illegible]	[illegible]	1,725,885	538,890	[illegible]	77,285
United Railways of St. Louis:					
[illegible]	996,808	[illegible]	[illegible]	[illegible]	[illegible]
June, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Deficit.

General News

Construction News.

BOAZ, ALA.—It is reported that T. W. [illegible], of Gadsden, Ala., is interested in a project to establish an electric light and power plant in Boaz.

OPELIKA, ALA.—At an election held July 15 the proposition to issue $85,000 in bonds for the construction of an electric light plant and water works system was carried.

SAFFORD, ARIZ.—The Pacific Gas & Electric Company, of Los Angeles, Cal., is reported to be contemplating the installation of an electric light and power plant in Safford, Ariz.

HAMBURG, ARK.—The Board of Commissioners of the Hamburg District has selected a site for the proposed water and light plant. The lot was donated by J. M. Parker, general manager of the Arkansas, Louisiana & Gulf Railway Company. Work will commence at once on construction of the plant, and it is expected to have it in operation within 90 days.

NASHVILLE, ARK.—The J. C. Stephenson Lumber Company, of Nashville, Ark., is reported to have been granted a franchise to supply electricity for lamps in Nashville.

ALHAMBRA, CAL.—The Board of Trade of Alhambra has recommended that the City Trustees call an election to vote on the proposition to issue $75,000 in bonds for the purpose of erecting a municipal distributing system. It is proposed to purchase electricity to operate the system. It is understood that the City of Pasadena, which operates a municipal plant, has offered to furnish the service at a low rate. The Home Telephone Company, of Alhambra, has offered the use of its poles to the city, free of charge, for a term of years.

ECHO, CAL.—The Board of Supervisors has sold to the Mount Whitney Power Company a 50-year franchise to erect transmission lines over certain highways in Kern County for the distribution of electricity for lamps and motors. The amount paid for the franchise was $50.

EMERYVILLE, CAL.—Application has been made to the Board of Trustees of the Town of Emeryville by the Great Western Power Company for a franchise to erect transmission lines for the distribution of electricity for lamps and motors in Emeryville. Bids will be received by the Board of Trustees until Aug. 15 for the above franchise. F. H. Farr is town clerk.

FRESNO, CAL.—The San Joaquin Light & Power Company has purchased the properties of the Power, Transit & Light Company, of Bakersfield, Cal., and the Merced Falls Gas & Electric Company, of Merced, Cal. The new plants will be the basis of the system by which the company will supply Kern, Midway and Maricopa oil fields with electricity for the operation of oil wells. It is proposed to erect a high-tension line from the vicinity of Porterville to Bakersfield, a distance of 70 miles. At present a second transmission line is being erected from Madera to Merced to furnish electricity in Merced. The San Joaquin Light & Power Company is now erecting a large dam, 125 ft. in height, on the San Joaquin River, which will develop about 20,000 hp.

GROVELAND, CAL.—Arrangements are being made by Manager Graham, of the Gold Ship mines, to install an electric power plant at once and to erect a mill to crush the cement gravel.

LOS ANGELES, CAL.—Preparations are being made by the Pacific Electric Railway Company to secure the right of way for an electric railway between Rose Hill and Lincoln Park, a distance of two and one-half miles. The cost of the proposed railway is estimated at about $100,000.

OAKLAND, CAL.—Bids will be received by the Board of Public Works, Oakland, Cal., until Aug. 19, for furnishing electrical equipment for the new building for the Fire Alarm and Police Telegraph Department, of the City of Oakland, now under construction at Oak and Thirteenth Streets. Frank R. Thompson is clerk of the Council.

PORTERVILLE, CAL.—Work has commenced on construction of the proposed electric railway to connect Porterville, Tulare, Poplar, Woodville, Springville and Globe, 87 miles in length. H. H. Holley is interested in the project.

RIVERSIDE, CAL.—Plans are being considered by H. E. Koebig, Sr., and associates for extensive developments of water power and for impounding water for irrigation purposes, both in Strawberry Creek and the south fork of San Jacinto River. Applications for rights of way, building permits and other privileges in the national forest reserve have been granted by the United States Government. The work includes the erection of a large dam across Strawberry Creek at the lower end of the Domenigoul ranch. Notice of appropriation of water to be taken from the south fork of the San Jacinto River has been filed by the same parties; the water to be used exclusively for power purposes. The power plant is to be located at a point in the south fork near the junction of Strawberry Creek.

[illegible], CAL.—The Pacific Gas & Electric Company has [illegible] Sacramento, Folsom and Oak Park. The company will furnish 2000-cp arc lamps in East Sacramento and Oak Park at the rate of $6.30 each per month, the same as paid in Sacramento; in Folsom, where 40-watt lamps are used instead of arc lamps, a flat rate of $75 a month or $900 a year will be charged. The electors of Curtis Oaks have asked the Board of Supervisors for permission to call an election to vote on the proposition to form a special lighting district in Curtis Oaks.

SAN BERNARDINO, CAL.—The City Council is considering the question of calling an election to vote on the proposition to issue bonds for the construction of a municipal electric light plant. The city now pays $12,000 annually for street lighting, and when the next contract is awarded and 100 or more lamps installed it is expected that the cost will be about $20,000 per year.

SAN FRANCISCO, CAL.—Plans are being considered for an extension of the Jackson Street car line through the western part of the Presidio reservation out to Fort Point.

DELTA, COL.—The Delta Electric Light Company is contemplating the installation of a 100 or 200-kw generating unit and a boiler in its plant, and establishing a day service next spring. J. E. Shue is treasurer and manager.

LAS ANIMAS, COL.—Plans are being prepared by the Colorado Telephone Company for improvements to its systems in Las Animas, Lamar and Holly, and other plants in the Arkansas Valley. A new cable plant will be installed in Las Animas, at a cost of $8,000; the improvements at Lamar and Holly will cost about $16,000.

KILLINGLY, CONN.—Preparations are being made by the Attawaugan Company to equip its mill for electrical operation. A contract has been placed by the company for a 700-hp engine which will be connected to a generator.

NEW HAVEN, CONN.—Proposals will be received at the office of the Board of Education, 87 Orange Street, New Haven, Conn., until July 30 for wiring and lighting the New Haven High School, for equipment for domestic science and manual training rooms at Prince Street School, and for new engine and generator at the Boardman Manual Training School in this city. Bids will be received for each building separately. Specifications and forms of proposal may be obtained at the above office. G. T. Hewlett is secretary of Board of Education.

TORRINGTON, CONN.—The Torrington Electric Light Company has submitted a proposition to the Borough Board in relation to improving the present street lighting system. The company offers to replace the present 25-cp incandescent lamps with 80-cp tungsten lamps for $32 per lamp per year. At present there are about 354 electric street lamps, the cost of which is estimated at about $8,500 per year. The new system would increase the cost from $4,000 to $5,000. The lamps will be lighted every night until midnight, but after that hour the moonlight schedule will be followed. The present contract calls for moonlight schedule.

WILMINGTON, DEL.—It is reported that the Wilmington Malleable Iron Company, of Wilmington, Del., will increase the output of its power plant by the installation of two generators with a rating of about 700 hp and an additional boiler. The company is now building an addition to the power house.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Aug. 5, under proposal No. 471, for furnishing two transformers, one with a rating of 10 kw and the other of 3 kw. A. S. Cowan is disbursing officer.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 19, for furnishing and installing lighting fixtures in the United States buildings at Gonzales, Tex.; Greenwood, S. C.; Michigan City, Ind.; Paris, Ky.; Pittsfield, Mass.; Augusta, Maine, and Eureka, Cal., in accordance with drawings and specifications, copies of which can be obtained at the above office. James Knox Taylor is supervising architect.

WASHINGTON, D. C.—The last session of Congress voted appropriations for construction, extensions and improvements of power plants, electrical equipment, etc., for public buildings, etc., for the year ending June 13, 1911, as follows: For the installation of electrical burglar devices in post office, court house at Chicago, Ill., and post office and subtreasury building at Boston, Mass., $30,000; for purchase and installation of an underground electric transmission system at Proving Ground, Sandy Hook, N. J., $6,500; for rearrangement and addition to power plant, including the erection of new power house, at Watertown Arsenal, Watertown, Mass., $55,700; for repairs of Interior Department and Pension buildings and of old Post Office Department building, Washington, D. C., including the preservation and repair of steam heating and electric lighting plants and elevators, $20,000; for installation of electric elevators in the pension office building and changes in building, $15,000; for construction and installation of electric light, power and telephone cables between the city of Galveston, Tex., and the quarantine station on "Pelican Spit," $5,000, and for equipping with motor [illegible] lathes used in small gun shop, [illegible]

ST. PETERSBURG, FLA.—The St. Petersburg Investment Company is planning to install two 250-hp Berry boilers and a tungsten series street lighting system. H. Walter Fuller is manager.

TAMPA, FLA.—Mayor McKay is reported to have recommended a bond issue for municipal ownership of the lighting plants.

WHITE SPRINGS, FLA.—The City Council is considering the question of calling an election to vote on the proposition to issue $45,000 in bonds, the proceeds to be used for the construction of an electric light plant, water-works and sewerage system. The city recently voted against issuing bonds to the amount of $20,000 for water-works and sewerage systems. G. S. Mobley is Mayor.

DALTON, GA.—Plans and specifications have been completed by H. S. Jaudon Engineering Company, of Savannah, Ga., for electric light plant and water-works. The electric plant will be combined with the water-works plant. The electrical equipment will include noncondensing engines direct-connected to generators, with a rating of 500 hp. The equipment of the pumping plant will consist of a steam pump and an electric pump for pumping water from Mill Creek into settling basin. Filter tanks, etc., will be located at this station. Two steam pumps and one electric pump will pump the water after it has been filtered into the reservoir on top of Mount Rachel.

JACKSON, GA.—The Middle Georgia & Interurban Railway Company has received permission from the State Railroad Commission to issue $100,000 in capital stock and $50,000 in bonds. The company proposes to construct and operate an electric railway between Jackson and Griffin, Ga.

VALDOSTA, GA.—The Consolidated Light & Power Company has applied to the State Railroad Commission for permission to issue $50,000 in capital stock and $75,000 in bonds, the proceeds to be used for the construction of an electric light and power plant in Valdosta, Ga. The company also proposes to operate an electric light plant in conjunction with the generating plant.

BOISE, IDAHO.—The Snake River Irrigation Company is reported to have awarded contracts for the construction of dam, power house and retaining wall for the Castle Butte project, located on the Snake River about 38 miles south of Boise. The cost of the work is estimated at more than $500,000. E. C. Crocker is vice-president.

LEWISTON, IDAHO.—The Lewiston-Clarkson Investment Company is reported to have entered into a contract with the Washington Power Company, of Spokane, Wash., for electricity to be delivered at Moscow, Idaho, on a new transmission line to be erected from Palouse to Moscow, there to connect with the Lewiston system.

CARTERVILLE, ILL.—The Egyptian Traction Company, which proposes to construct an electric railway to connect Mt. Vernon, Ind., and Murphysboro, Ill., 100 miles in length, has been granted franchises for a term of 50 years in the cities of Carterville and Carbondale. The company will also ask for franchises in Marion, Crainville and Dorrisville. T. E. Hixon, of Eldorado, Ill., is general manager.

CHICAGO, ILL.—Bids will be received by the City of Chicago, 705 City Hall Building, Chicago, Ill., for furnishing and installing switchboard complete for the new City Hall, according to plans and specifications on file in the office of the Department of Public Works, City Hall. Proposals must be on blanks furnished by the above office. B. J. Mullaney is commissioner of public works.

DECATUR, ILL.—Preparations are being made by the City of Decatur for the construction of an entire new municipal electric light plant, bids for which are now being asked. Bonds to the amount of $75,000 were voted for the purpose. J. J. Miller is chief electrician.

DECATUR, ILL.—A meeting of the stockholders of the Decatur Southern Traction Company will be held Aug. 31 to vote on the proposition to increase the capital stock of the company from $25,000 to $1,500,000 and to mortgage its property to secure an issue of bonds. H. C. Simmons, of Virden, Ill., is secretary.

LINCOLN, ILL.—Plans are being considered by the Lincoln Water & Light Company to increase the output of its plant by the installation of alternating-current, 60-cycle generators in the near future. E. McDonald is superintendent.

PANA, ILL.—The City Council has granted the Decatur Southern Traction Railway Company a franchise to construct an electric railway in Pana. The proposed railway will connect Decatur, Macon, Assumption and Pana. R. McCalman, of Decatur, Ill., is chief engineer.

PORT BRYON, ILL.—Surveys have been completed by the Tri-City & Northeastern Interurban Railway Company for its proposed electric railway between Albany and Morrison. Work will soon commence on construction of the railway, which is to connect Watertown, Port Byron, Cordova and Albany. J. W. Simonson, of Port Byron, Ill., is president.

SANDOVAL, ILL.—The installation of a municipal electric light plant in Sandoval, at a cost of about $10,000, is reported to be under consideration.

SOUTH HOLLAND, ILL.—The Eastern [illegible] Company has applied to the Village Board for a franchise to construct an electric railway in South Holland, Ill. The company is a subsidiary of the Consolidated Railways Company, of Chicago, Ill.

CORYDON, IND.—Frank R. Wright, owner of the Corydon Light, Water & Ice Company, is in the market for a second-hand, [illegible] kw, direct connected unit, which must be in good order.

DALEVILLE, IND.—A company has been organized by the citizens of Daleville for the purpose of installing an electric light plant.

GAS CITY, IND.—The Marion Light & Heating Company is reported to have applied for a franchise in Gas City, Ind., to erect transmission lines to supply electricity to manufacturing plants in this city.

MIDDLETOWN, IND.—A special election will be held to vote on the proposition of establishing a municipal electric light plant or to place a contract with a private company as in the past. The cost of installing a new plant is estimated at $28,000. The town owns its water plant and the sentiment is strong for the installation of an electric plant.

NEW ALBANY, IND.—Edward H. Hartley, of New Albany, Ind., is interested in a project to organize a company for the purpose of supplying gas and electricity in New Albany. The company, it is said, will furnish street lamps at the rate of $50 per lamp per year and gas at 80 cents per 1000 cu. ft., which is a reduction of 20 per cent on the present rates.

POCAHONTAS, IA.—The city is contemplating the construction of an electric light plant, to cost from $12,000 to $14,000, bids for which will be asked for in the near future. George Schneider is city clerk.

HERINGTON, KAN.—We are informed that the Water and Light Department of the City of Herington is negotiating with the City of Hope to supply electricity in that city. A transmission line eight miles in length will be erected, and 50 kw will be supplied at 10,000 volts. C. E. Stromquist is superintendent of the municipal water and light plant

PARSONS, KAN.—The City Commission is considering a resolution calling for a special election to vote on the proposition to issue $40,000 in bonds for the construction of a municipal electric light plant.

WICHITA, KAN.—The contract for the construction of the new power house of the Kansas Gas & Electric Company has been awarded to the Deiter & Wenzel Construction Company, of Wichita, Kan. The cost of the entire plant is estimated at about $787,000. The cost of the building is $112,000; the equipment $341,000; for line construction in the city $50,000. The remainder will be used for repairs and distribution of lamps, etc. Contracts have already been placed for equipment of the plant.

WICHITA, KAN.—The Arkansas Valley Interurban Railway Company has graded 15 miles of its proposed 30-mile railway between Wichita and Newton, Kan., which later will be extended to Hutchinson, Kan., 55 miles from Wichita. Electricity for operating the railway will be purchased from the Kansas Gas & Electric Company, of Wichita, Kan., at 33,000 volts. The cars will enter the business center of Wichita over the tracks of the Wichita Railroad & Light Company. W. O. Van Arsdale is president of the company and O. A. Boyle, vice-president and general manager.

NEW ORLEANS, LA.—The committee of the Sewerage and Water Board on drainage has submitted the report of the advisory board of engineers for drainage with an estimate of cost. It is estimated that about $5,500,000 will be available for construction purposes during the next four or five years. The board of advisory engineers recommends that approximately $2,257,000 be expended in lined and covered canals; for wood-lined subchannels, $1,034,000, and for additional power and equipment, total cost $1,410,000—water purification stations and pumping stations 1, 6, 2, 7, 3 and 5. The first item is for utilizing the surplus boiler power and room at the water purification station for generating electricity, from which transmission lines are to lead to pumping stations number 1 and 6, forming a loop into which both the central power station and the additional machinery at the water purification station will feed, thereby greatly enhancing the efficiency of the service and minimizing the possibility of accident.

DEXTER, MAINE.—Announcement has been made by the Dexter Electric Company that a 24-hour service will be established as soon as improvements have been completed to its power plant. A new generator is being installed in the power station. It is expected to have the work completed by Aug. 15.

BALTIMORE, MD.—The Baltimore County Commissioners have granted the United Railways & Electric Company a franchise to extend its Monument street line to Orangeville.

BEL-AIR, MD.—At a meeting of the stockholders of the Bel-Air Electric Company an amendment to its charter was accepted, giving it the right to condemn property along Winter's Run. The company also approved of an issue of $25,000 in bonds. The company is building an auxiliary plant on Winter's Run, about three miles below the main plant.

ELKTON, MD.—At a special election held in Elkton recently the proposition to issue $75,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant and water-works system and for extensions to sewerage system, was defeated.

FREDERICK, MD.—P. O. Keilholtz, Continental Building, Baltimore, Md., has been engaged by the Frederick Railroad Company and the Hagerstown Railway Company to prepare plans for the construction of a power house to be used jointly by both companies.

BOSTON, MASS.—The contract for installing electrical equipment in the addition to the Girl's High School has been awarded to Alfred J. Hixon.

BOSTON, MASS.—Sealed bids will be received at the office of the auditor of the school committee, Room 53, 168 Tremont Street, Boston, Mass., for furnishing and delivering (within one year from date from acceptance of the bid), at such school buildings as the auditor of the

school committee may designate, high-efficiency, metallic filament lamps in accordance with the following schedule: 5435-25-watt, clear; 202-40-watt, frosted; 50-60-watt, frosted, and three 100-watt, frosted. William J. Porter is auditor.

FOXBORO, MASS.—The Foxboro Electric Company has petitioned the State Board of Gas and Electric Light Commissioners for permission to increase its capital stock from $16,500 to $65,000, the proceeds to be used for extensions and improvements to its plant.

MARLBORO, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 25 for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office at Marlboro, Mass., in accordance with plans and specifications, copies of which can be obtained from custodian of site at Marlboro, Mass., or at the above office. James Knox Taylor is supervising architect.

BAY CITY, MICH.—Negotiations between the Tittabawassee Power Company and the City Council have been brought to an end owing to the failure of the latter to authorize the Mayor and Comptroller to enter into a contract with the company. The City Council recently voted to enter into a contract with the Tittabawassee Power Company to supply electricity to operate the municipal electric light plant at the rate of 8 mills per kw-hour on the basis of a minimum of 500 kw per hour.

BRONSON, MICH.—The city is reported to be considering the purchase of the local electric light plant and installing a water-works system.

DETROIT, MICH.—It is reported that work will soon commence on the new structural steel shop and office building of the Henry B. Lewis Structural Iron Works, of Detroit, Mich. The building will be 115 ft. x 200 ft., and will be equipped with an electric traveling crane.

SAGINAW, MICH.—Orders have been placed by the Marquette Motor Company, of Saginaw, Mich., with the Allis-Chalmers Company, of Milwaukee, Wis., for two 100-kva, 4600-115-volt and three 150 kva, 4600-460-volt, oil-filled, self-cooled transformers, which will be used for the distribution of electricity for lamps and motors about the works.

HIBBING, MINN.—The Mesaba Telephone Company is making extensive improvements to its system in Hibbing. All open wires will be replaced by cables. A new toll line is being erected between Swan River and Grand Rapids.

PELICAN RAPIDS, MINN.—The contract for furnishing machinery, equipment, etc., for changes and additions to the municipal electric light plant has been awarded to the Power Engineering Company, of Minneapolis, Minn., for $4,521. H. N. Bruce is village recorder.

KANSAS CITY, MO.—The Inter City Viaduct Company, which owns the toll viaduct between Kansas City, Mo., and Kansas City, Kan., has applied to the City Council for a franchise to extend its switching system in the north and wholesale and manufacturing district and over viaducts in the west bottoms. The switching is to be done by electric locomotives.

ST. JOSEPH, MO.—The St. Joseph & Savannah Railway Company has awarded the contract for the construction of its proposed railway between St. Joseph and Savannah, a distance of 15 miles, to the J. H. Flick Construction Company, of Chicago, Ill. John H. Van Brunt, of St. Joseph, Mo., is president.

SLATER, MO.—Sealed proposals will be received at the office of J. A. Stern, city clerk, until Aug. 9 for furnishing material and labor for extension of water-works system and electric light plant as follows: (1)—For furnishing material and labor (except as outlined in subsequent items) for extending water-works and electric light systems. (2)—For construction of reservoir. (3)—For furnishing generators, switchboard and transformers, f.o.b. Slater, Mo. (4)—For furnishing two high-speed engines for 60 and 100-kw generators, f.o.b. Slater, Mo. (5)—For furnishing boiler and feed pumps, f.o.b. Slater, Mo. (6)—For furnishing material and erecting chimney. Plans and specifications are on file at the office of the city clerk and at the office of Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo. Extra copies of the plans may be secured of the engineers upon payment of $5 to cover [illegible] same. John T. [illegible] is Mayor.

CULBERTSON, MONT.—The installation of an electric plant in Culbertson is under consideration.

LIBBY, MONT.—At a mass meeting held recently favorable action was taken on the application of George H. Stanton, C. C. Proctor and E. K. Barnum for a franchise to construct an electric light plant and water works system in Libby. It is expected that the Council will take favorable action on the franchises.

MILES CITY, MONT.—Sealed proposals will be received at the office of J. E. Farnum, city clerk, until Aug. 22, for furnishing materials and constructing extensions and improvements to the electric light and water works systems for the city of Miles City, Mont., for which separate bids will be received as follows: (1) For furnishing all material and constructing main and outfall sewer, sewage pumping and disposal plants; (2) for furnishing certain materials and constructing intake and reinforced concrete settling basin, filter chambers, etc.; (3) for hauling and laying cast-iron pipe and setting hydrants and valves; (4) for furnishing material and constructing power house; (5) for furnishing all cast-iron and fittings, f.o.b., Miles City, Mont.; (6) for furnishing all hydrants and valves, f.o.b., Miles City, Mont.; (7) for furnishing and erecting steel tower and tank of 200,000 gal. capacity, all at an elevation of not less than 100 ft., and furnishing and erecting a steel chimney and breeching, chimney to be 72 in. in diameter and 100 ft. high; (8) [illegible] four units, each having a capacity of 500,000 gal. per day; (9) for furnishing all pumping machinery, consisting of six turbines and centrifugal type, motor driven units, and two steam-driven air compressors; (10) for furnishing f.o.b. Miles City, and supervising the erection of one fully equipped air lift system for sewage pumping; (11) for furnishing one 200-kw, 60-cycle, three-phase, 2300-volt generator, one 50-hp motor and two 15-kw exciters f.o.b Miles City; (12) for furnishing and erecting one 250-hp Corliss engine; (13) for furnishing all power station switchboard equipment. Plans and specifications are on file at the office of the city clerk and at the office of Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo. A complete set of plans may be secured upon payment of $15 on application to the engineers; Section 1 and 2, $10 each; 3, 4 and 8, $2 each; for 5, 6, 7, 9, 10, 11, 12 and 13 no charge will be made. Specifications covering Sections 10, 11 and 12 may be obtained from the Superintendent of the Water and Light Department, Miles City, Mont.

BEATRICE, NEB.—E. A. Bullock, 515 Brandeis Building, Omaha, Neb., who controls the central stations at Norfolk and York, Neb., and Mission Valley, Ia., has recently purchased the controlling interest in the Beatrice Electric Company from E. J. Sullivan.

MILFORD, NEB.—Owing to inability to sell its bonds, the city of Milford has postponed the letting of contracts for the construction of the proposed electric light plant and water-works system. Plans were prepared by Martz Brothers, of Seward, Neb.

PITTSFIELD, N. H.—The Pittsfield Light & Power Company has recently been organized to construct an electric light plant in Pittsfield, N. H. The company has entered into a contract with the town for street lighting for a term of five years. C. F. Gardner, of Raymond, N. H., is treasurer and general manager of the company and will have charge of installing the plant, which will be driven by steam power. F. W. Hutchins, of Pittsfield, N. H., is president, and George H. Colbath, of Pittsfield, N. H., is secretary.

BURLINGTON, N. J.—The City Council has passed over the Mayor's veto the ordinance granting the syndicate which purchased the property of the Burlington Electric Light & Power Company a 50-year franchise in Burlington.

JERSEY CITY, N. J.—Plans have been prepared by McLaughlin Brothers, 521 St. James Street, Philadelphia, Pa., for the construction of a machine shop for James Craig, to be erected on Garfield Avenue, Jersey City, N. J. The building will be equipped with electric traveling crane and machinery for the construction of engines. McLaughlin Brothers will have charge of construction and installation of equipment of the entire plant.

NEWARK, N. J.—Sealed proposals will be received by the Committee on Public Buildings of the Board of Freeholders, Essex County Court House, Newark, N. J., until Aug. 5 for the installation of an electric light and power plant at the Essex County Court House, Newark, N. J., in accordance with plans and specifications prepared by Runyon & Carey, consulting engineers, 122 Market Street, Newark, N. J., where copies of plans and specifications and blank proposal forms may be secured. Louis E. Voorhees is chairman of public buildings committee.

LAS CRUCES, N. M.—Application has been made to the City Council by the Las Cruces Light & Power Company for a franchise to construct an electric light plant and water works system in Las Cruces. H. B. Holt is interested in the company.

AUBURN, N. Y.—Announcement has been made by the George Junior Republic of a gift from John D. Rockefeller and V. Everett Macy, of New York, N. Y., of funds to install an electric light plant in the little republic, the minimum cost to be $7,500.

BOONVILLE, N. Y.—We are informed that bids will not be asked for the construction of the concrete dam to be built in connection with the municipal electric plant; the work will be done by the day. The cost of the work is estimated at about $25,000. W. G. Stone, of Utica, N. Y., is engineer in charge.

BUFFALO, N. Y.—Bids are being received by the Board of Supervisors, City and County Hall, Buffalo, N. Y., for the construction of an electric light and power plant for the Erie County Penitentiary. The power house will be 60 ft. x 65 ft., built of stone, brick and steel.

CATSKILL, N. Y.—The Catskill Traction Company is planning to extend its railway from the Greene County Agriculture Society's Fair Grounds, at Cairo, westward along the Susquehanna Turnpike to Oak Hill, a distance of 12 miles. W. C. Wood is president.

FRIENDSHIP, N. Y.—The Friendship Telephone Company, of Allegheny County has increased its capital stock from $7,500 to $1,000,000. The company proposes to extend its telephone lines throughout the United States.

FULTON, N. Y.—The Victoria Paper Company, which is planning to enlarge and remodel its paper mill, is reported to be contemplating the installation of gas-producer units with a rating of 1500 hp for driving its plant.

GAROGA, N. Y.—Contracts have been awarded by the Garoga Water Power & Transmission Company for the construction of hydroelectric plants on Peck Lake and Garoga Lake, N. Y., including power house, to the Empire Engineering Corporation, 60 Wall Street, New York, N. Y. The plans call for the development of 20,000 hp.

GLOVERSVILLE, N. Y.—Plans are being made by the Fulton County Gas & Electric Company for the construction of a high-tension transmis-

sion line from Gloversville to Ephrata, a distance of nine miles. The proposed line will require 135 steel towers. A brick substation 60 x 33 ft. will be built.

JAMESTOWN, N. Y.—We are informed that the Jamestown Lighting & Power Company is erecting a substation in Jamestown. The company will purchase electricity from the Jamestown Street Railway Company. It is expected to have the station completed and in operation by Sept. 15. Albert S. Price is secretary and treasurer.

NEW YORK, N. Y.—Bids will be received until Aug. 3 by F. A. Neely, secretary State Armory Board, State Capitol, Albany, for electric wiring and fixtures in State Arsenal, Seventh Avenue and Thirty-fifth Street, New York, N. Y. Plans and specifications may be seen and blank forms of proposals obtained at the above office and at the State Arsenal, New York, N. Y.

NIAGARA FALLS, N. Y.—The Ontario Power Company has just completed its new penstock, 1⅛ miles in length and 18 in. in diameter, at a cost of about $500,000. The company is now concentrating all efforts on completion of its power house.

NIAGARA FALLS, N. Y.—Preparations are being made by the National Lead & Battery Company, of Niagara Falls, N. Y., for the construction of a large addition to its plant on Elizabeth Street, in the Niagara Power Land Company manufacturing district. The company manufactures storage batteries, etc. D. M. Hepburn, of Niagara Falls, N. Y., is manager.

NORWOOD, N. Y.—Plans are being prepared by the Norwood Paper Company for the construction of a 4000-hp hydroelectric plant. The work will include the construction of a large concrete dam and flume. B. Cleveland, of Watertown, N. Y., is engineer.

OLEAN, N. Y.—The Olean Electric Light & Power Company has been authorized by the Public Service Commission, Second District, to increase its capital stock from $35,000 to $85,000, the proceeds to be used to pay for indebtedness incurred in making additions and improvements to its plants.

SCOTIA, N. Y.—It is reported that plans are being considered for the construction of municipal electric and gas plants in Scotia, N. Y.

WADDINGTON, N. Y.—Preparations are being made by the New York & Ontario Power Company to begin work on the construction of its proposed hydroelectric generating plant at Waddington, on the St. Lawrence River, which, it is expected, will be under way by October. The cost of the plant is estimated at $5,000,000, and about 50,000 hp will be developed.

CHARLOTTE, N. C.—Surveys have been completed by the Isothermal Traction Company for its proposed interurban railway from Asheville to Rutherford, which constitutes the first division. Work will soon commence on the survey of the second division, from Rutherford to Asheville, through the heart of the Appalachians. The company proposes to construct an interurban electric railway, 100 miles in length, from Gastonia to Asheville, via Mt. Holly and other cotton mill towns.

HICKORY, N. C.—It is reported that plans are being considered for the manufacture of a new electric iron-ore smelting furnace in Hickory, electricity for which is to be supplied by the Thornton Light & Power Company. The new process is attributed to a Canadian inventor, who is said to be negotiating with the power company for power service and other facilities for manufacturing the new smelters. It is estimated that $750,000 would be required to complete the plant for the above purpose.

RALEIGH, N. C.—The Carolina Power & Light Company is reported to have submitted a proposition to the Board of Aldermen, offering to replace the present street lamps with magnetite lamps at an increased cost of $800 per year. The company, it is said, proposes to install a new street lighting system at a cost of about $200,000.

GRAND FORKS, N. D.—The name of the Grand Forks Gas & Electric Company, the holdings of which were recently purchased by H. M. Byllesby & Company, of Chicago, Ill., has been changed to the Red River Power Company. Extensive improvements will be made to the system this season, involving an expenditure of about $100,000. They will include the installation of a 750-kw, engine-driven generator, the construction of from 20 to 25 miles of electric transmission line for the distribution of electricity in the residence districts and the construction of nearly four miles of new 4-inch gas mains. In the past there has been practically no electrical service in the residential districts in Grand Forks. The Red River Power Company has announced a substantial reduction in the rates for electrical and gas service.

BEREA, OHIO.—It is reported that plans are being considered for improvements to the municipal electric light plant, for which bonds to the amount of $16,000 have been voted.

CINCINNATI, OHIO.—The Cincinnati, Portsmouth, Pomeroy & Pittsburgh Electric Railway Company is reported to have completed preliminary arrangements for construction of its proposed electric railway from Cincinnati, Ohio, to Pittsburgh, Pa., along the Ohio River Valley, work on which, it is said, will begin within 60 days. A. E. Cox, of Huntington, W. Va., president.

CINCINNATI, OHIO.—Sealed bids will be received by the Board of Hospital Commissioners, City Hall, Cincinnati, Ohio, until Aug. 9, for furnishing all material and installing lighting fixtures, inter-communicating telephone system, vacuum cleaning system, laundry machinery, etc., required for the completion of the present building for the contagious group of the New General Hospital, located at Eden and Bethseda avenues, Cincinnati, Ohio, in accordance [illegible] which are on file at the office of the architects, Samuel Hannaford & Sons, Sixth and Vine streets, Cincinnati, Ohio.

CLEVELAND, OHIO.—The power plant of the Flushing mine of the Kennon Coal & Mining Company, of Cleveland, was destroyed by fire recently. The equipment of the plant consisted of three boilers, one generator and engine. The loss is estimated at from $10,000 to $20,000.

CLEVELAND, OHIO.—We are informed that the Cleveland Southwestern & Columbus Railway Company expects to purchase stokers for a 3275-hp power house, located in Elyria, in the near future; also coal and ash-handling machinery. E. F. Schneider, of Cleveland, Ohio, is general manager.

ARDMORE, OKLA.—It is reported that Messrs. Cravens & Mort, of Milton, Ia., and Patterson & Moore, of Enid, Okla., are negotiating for the purchase of the property of the Ardmore Traction Company, which is in the hands of C. L. Byrne as receiver.

DURANT, OKLA.—The installation of a municipal electric light plant is reported to be under consideration.

FOSS, OKLA.—The City Council is reported to be considering the question of installing an electric light system in Foss.

VINITA, OKLA.—The Vinita Electric Light, Ice and Power Company is contemplating changing its system from single to three-phase about Sept. 1. C. E. Lahman is secretary and manager.

ASHLAND, ORE.—Application has been made to the City Council by John R. Allen, representing the Southern Oregon Railway & Power Company to construct an electric railway in Ashland, Ore. The company proposes to build a railway through the Rogue River Valley and Southern Oregon.

ROSEBURG, ORE.—J. L. & S. A. Kendall, owners of the hydroelectric plant at Roseburg, Ore., have purchased a 20 x 36 "Reliance" type, heavy duty engine from the Allis-Chalmers Company, of Milwaukee, Wis., which will be belted to the generator to operate the plant during the low-water period. The plant at present is equipped with a turbine connected to a 200-kw, 60-cycle, three-phase, 6600-volt alternator.

ST. JOHNS, ORE.—The Portland Railway, Light & Power Company has been granted a franchise by the City Council to construct and operate an electric railway over certain streets in St. Johns.

THE DALLES, ORE.—The American Light & Power Company, recently organized to take over properties of the Northwest Corporation in Idaho and Oregon, has purchased the hydroelectric plant and distributing system of the Wasco Warehouse Milling Company, of The Dalles, Ore.

ALTOONA, PA.—The Pennsylvania Central Light & Power Company is reported to be preparing plans for the construction of an electric light and power plant in Altoona, Pa.

BERWICK, PA.—Preparations are being made by the Berwick & Nescopeck Street Railway Company, of Berwick, Pa., for the construction of from four to eight miles of track, contracts for which, it is expected, will be awarded during the next 30 days. A. C. Sickels, of Berwick, Pa., is president.

BRADFORD, PA.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 29, for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office in Bradford, Pa., in acordance with drawing and specifications, copies of which may be obtained from the custodian of site at Bradford, Pa., or at above office. James Knox Taylor is supervising architect.

CHESTER, PA.—It is reported that plans are being considered by the Chester Traction Company for extensive improvements to its system in Chester and throughout the county, including the double-tracking of its railway between Wilmington and Darby.

ERIE, PA.—The contract for construction of power house and laundry building to be erected at Second and State streets, Erie, Pa., for the Hamet Hospital, including boilers, conduits and laundry equipment, has been awarded to the Henry Schenk Company, of Erie, Pa. D. N. Dennis is president; Esenwein & Johnson, 781 Ellicott Square, Buffalo, N. Y., are architects.

MERCERSBURG, PA.—The contract for erecting the power house in connection with the Mercersburg Academy has been awarded to C. W. Strayer, of Harrisburg, Pa., for $6,900. George A. Woods is a member of the building committee.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company, it is said, will apply for a franchise to extend its railway from Chester Avenue, Yeadon, to the Sixty-ninth Street terminal.

PHILADELPHIA, PA.—The contract for installing power plant equipment at the navy yard, Philadelphia, Pa., has been awarded to the [illegible]

PHILADELPHIA, PA.—The Autocar Company, of Ardmore, Pa., is reported to be in the market for a gas engine with a rating of 30 or 40 hp, direct-connected to generator to supply electricity for 300 lamps in a car garage which it is now erecting at Twenty-third and Market Streets, Philadelphia, Pa.

PITTSBURGH, PA.—Contracts have been placed by the Morris & Bailey Steel Company with the Allegheny County Light Company to furnish electricity for lamps and motors for its cold rolling mill at Wilson Station. The contract calls for 400 kw.

PITTSBURGH, PA.—Bids will be received at the office of the city

[illegible] until Aug. [illegible] the administration building, nursery and bakery and remodeling plumbing and sanitary system of the Women's Home and Hospital for the Department of Charities, Marshalsea station, Pittsburgh, Chicago, Cincinnati and St. Louis Railroad. Plans, specifications and proposals can be secured at the office of John P. Brennan, assistant superintendent of the bureau of building inspection, corner of Sixth Avenue and Cherry Alley, for which a deposit of $10 will be required for each set. E. R. Walters is director of Department of Charities.

SOMERSET, PA.—The Somerset Telephone Company has filed a notice of increase in capital stock with the Secretary of State of from $[illegible] to $[illegible].

WERNERSVILLE, PA.—Plans are being made for enlarging the electric light plant at State Hospital for the Insane, at Wernersville, Pa., the cost of which is estimated at about $15,000.

CHARLESTON, S. C.—It is reported that a special committee has been appointed by Mayor R. H. Rhett to engage engineers to make investigations and estimate of cost of construction of a municipal electric light plant in Charleston, S. C.

LEXINGTON, S. C.—It is reported that Dreher Shoals have been purchased by James U. Jackson, of Augusta, Ga., and associates, who propose to develop the same and construct a hydroelectric power plant.

DEADWOOD, S. D.—The Consolidated Power & Light Company, of Deadwood, S. D., is in the market for an electrically operated pump that will automatically keep the water pressure in a building above that of the city main which supplies the water, without the aid of a tank placed in the building. Morgan M. Maghee is assistant manager.

PIERRE, S. D.—The South Dakota Interurban Railway Company has filed amendments to its charter increasing its capital stock from $1,000,000 to $2,000,000 and changing its western terminal to Chamberlain on the Missouri River, instead of Bijou Hills. As yet the promotors have done no active work on the proposed railway, but have been securing the rights of way and doing other preliminary work.

DECHERD, TENN.—It is reported that contracts have been awarded by the city for the construction of an electric light plant and waterworks system.

LEXINGTON, TENN.—Application is reported to have been made by C. P. Wilson to the City Council for a franchise to construct and operate an electric light plant in Lexington, Tenn.

BASTROP, TEX.—The installation of a Corliss engine and an ice plant is contemplated by the Bastrop Water & Light Company. W. B. Ransome is president and manager.

BRYAN, TEX.—A proposition has been submitted to the City Council offering to construct water, sewerage and electric light systems in Bryan, to cost from $75,000 to $100,000. When completed they are to be turned over to the city and a vender's lien note on the same retained by the owner, payable in 10 years. It is understood that the Council favors the proposition.

DEVINE, TEX.—Messrs. Burnett & Fennemen, of Indianapolis, Ind., have submitted a proposition to the town offering to install an electric light plant and an ice factory in Devine. The town, it is said, will furnish a site, free of charge, for the proposed plants. It is stated that the electric plant will be completed and in operation within 90 days.

ELGIN, TEX.—The plant and holdings of the Elgin Automatic Telephone Company have been sold by U. P. Culp, receiver, to Mrs. W. H. Rivers for a consideration of $6,500. It is understood that the new [illegible] improvements to the system.

EL PASO, TEX.—The Allis-Chalmers Company, of Milwaukee, Wis., has recently received an order from the Southwestern Portland Cement Company, of El Paso, Tex., for an 8-in. centrifugal pump direct connected to an induction motor. Electricity for operating the motor will be transmitted 1½ miles. The pump will deliver about 2000 gal. per minute against a head of 80 ft. to a reservoir which supplies the plant.

GOLIAD, TEX.—The plant and holdings of the Goliad Water & Light Company are reported to have been purchased by E. Glaze, of San Antonio, Tex. The new owner, it is said, proposes to make improvements to the systems.

GREENVILLE, TEX.—At an election held recently the proposition to grant S. A. Price, of Dayton, Ohio, and associates a 50-year franchise to construct and operate an electric street railway in Greenville was carried. Preparations are now being made by the promoters to begin work on construction of the railway at an early date.

TEMPLE, TEX.—The bondholders of the Belton & Temple Traction Company, who recently purchased the property at a receiver's sale, have taken over the property. Preparations are being made by the new owners [illegible] improvements to the [illegible] into several new residence parts of the city. W. G. Haag was receiver for the company.

FARMINGTON, UTAH.—Preparations are being made by the Home County Telephone & Electric Company for extending its transmission line from Hooper to Plain City, a distance of about 12 miles. The company has a power plant in the Farmington Canyon and supplies electricity in Farmington and Hooper.

GUNNISON, UTAH.—The Gunnison Valley Power Company, which is developing its water power site, has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for equipment for its plant, including a 540-hp, single horizontal turbine with cast-iron spiral, operating under a head [illegible] connected to a [illegible] 60-cycle, three-phase, 450-r.p.m. alternator; a 10-kw exciter will be direct connected to an extension of the main shaft. Three 100-kva, oil-filled, self-cooled transformers will be used to step up voltage for transmission.

PRICE, UTAH.—The injunction against the City of Price, which was filed by Frank Grosse, restraining it from building an electric light plant on one of the side streets, has been sustained by Judge A. H. Christenson. This action will make it necessary for the city to secure another location for its power house.

PROVO, UTAH.—The Allis-Chalmers Company, of Milwaukee, Wis., has recently received an order from the Knight Power Company, of Provo, Utah, for two 1650-hp, 514 r.p.m., single horizontal turbines operating under a head of 170 ft. The turbines will be regulated by a regulating cylinder operated by the penstock pressure, which can also be controlled electrically from the switchboard or mechanically from the turbine. In case of emergency a direct mechanical gear can be placed in operation.

LYNCHBURG, VA.—Bids will be received by the special board of the Virginia State Epileptic Colony until Aug. 1 for the following work on the site of the Colony in Amherst County, near Lynchburg, as follows: (1) For a complete heating system, boiler, power and lighting plant, etc. (2) For 4-in. pipe line connecting the colony with the water main of the City of Lynchburg, about 5,000 ft. in length. Dr. A. S. Priddy is executive officer of the Virginia Epileptic Colony.

PORTSMOUTH, VA.—It is reported that a movement has been started by the business men of Middle Street, between High and King streets, for the installation of an ornamental street-lighting system.

BELLINGHAM, WASH.—Application has been made to the City Council by the Bellingham-Skagit Railway Company for a franchise to construct and operate an electric railway in Bellingham. If granted the company agrees to have the road completed by July 1, 1911.

CHELAN, WASH.—Plans are being considered by Brown & Company, of Chelan, Wash., for the construction of a new 5000-hp hydroelectric power plant. George D. Brown is president and general manager.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has applied to the Commissioners of Yakima County for a franchise to erect transmission lines over Grandview addition and Second Avenue addition to Sunnyside. Another franchise is also asked to construct a line north from Sunnyside to transmit electricity for irrigating purposes.

OROVILLE, WASH.—The North Washington Power Company has leased the plant and distributing system of the Similkameen Power Company, of Oroville, Wash., for a term of 10 years. Preparations are being made by the North Washington Power Company to begin work immediately on the erection of a transmission line across the country to transmit electricity into the Republic camp. It is expected that the output of the plant will be increased to meet the demands of the increasing service.

TACOMA, WASH.—The contract for the construction of the head work and tunnel in connection with the municipal electric plant on the Nisqually River, has been assigned by Wright, Sweeney & Cummings, to George Milton Savage and W. E. Nichols, for $655,255. The cost of the entire plant is estimated at $2,000,000.

WILSON CREEK, WASH.—The City Council has granted C. J. Wellar a 50-year franchise to operate an electric light and power plant in Wilson Creek.

WHEELING, W. VA.—Plans are being prepared by Sargent & Lundy, engineers, of Chicago, Ill., for the new power plant to be erected by the Consumers' Electrical Company in Wheeling, W. Va., at a cost of about $700,000.

MANITOWOC, WIS.—The Electric Company, of Manitowoc, Wis., has commenced work on the reconstruction of its entire system. The present equipment, consisting of three steam and one gas engines, driving eight bi-polar and three multi-polar generators, which have been in use over 20 years, will be replaced by a new boiler plant, condensing steam turbine plant and three-phase, 60-cycle, 2300-volt distributing system. Frank P. Woy, consulting engineer, of Madison, Wis., will have charge of the work.

OSHKOSH, WIS.—The E. B. Hayes Machine Company, of Oshkosh, Wis., is reported to have under consideration the construction of a new building 60 ft. x 250 ft., with a wing 30 ft. x 80 ft., which will be used as a power house, blacksmith shop, etc. The main building will be equipped with an electric traveling crane.

PULASKI, WIS.—The Pulaski Merchants' & Farmers' Telephone Company has increased its capital stock from $5,000 to $10,000.

WASHBURN, WIS.—The Washburn Electric Light & Power Company has changed its system to 60-cycle, 15,000-1100-110-volt, and established a day service. A new substation having an output of 150 kw has been erected. Electricity for operating the system is purchased from the Ashland Light, Power & Street Railway Company, of Ashland, Wis. M. A. Sprague is president of the Washburn Electric Light & Power Company.

BASIN, WYO.—The city has purchased the plant and holdings of the Wyoming Light & Power Company, for a consideration of $18,000. The plant will be owned and operated by the municipality.

SHERIDAN, WYO.—The Federal Light & Traction Company, which recently took over the property of the Sheridan Electric Light & Power Company, is contemplating the construction of a power plant on Tongue River and developing 4000 hp at a cost of about $150,000.

EDMONTON, ALTA., CAN.—It is reported that negotiations have practically been completed whereby the Edmonton Heat & Power Com-

pany, Ltd., will supply the City of Edmonton with electrical power to the amount of 10,000 hp to operate the municipal electric plant at the rate of $20 per hp per year. The present plans of the company call for the construction of a new hydroelectric plant at Rocky Rapids, 125 miles up the Saskatchewan River, work on which will be started at once. About 36,000 hp will be developed. The transmission line will be about 60 miles in length.

MEDICINE HAT, ALTA., CAN.—A by-law appropriating $50,000 for the construction of an electric light and power plant will be submitted to the ratepayers on Aug. 15. A. K. Grimmer is city engineer.

NEW WESTMINSTER, B. C., CAN.—It is reported that plans are being considered by the Canada Power Company, of Stave Falls, for erecting a transmission line from Stave Falls to Pitt River for the purpose of supplying electricity to the towns of Haney, Hammond and other villages.

WARDNER, B. C., CAN.—The Bull River Falls Mining & Power Company has changed its name to the Bull River Electric Power Company, Ltd., and increased its capital stock from $1,000,000 to $2,000,000. The company is erecting a 12,600-hp hydroelectric power plant. G. E. Henderson is president and manager.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by the chairman of the Board of Control, Winnipeg, Man., Can., until Sept. 1, for furnishing and installing 46,000 ft. of 13,000-volt, three-core cable. Copies of specifications and form of tender may be obtained at the office of the power engineer, Carnegie Library Building, Winnipeg, Man., and also at the offices of Smith, Kerry & Chace, Confederation Life Building, Toronto, Can. M. Peterson is secretary.

BEAVERTON, ONT., CAN.—The Beaverton Electric Light & Power Company is erecting three transmission lines, two miles in length, and will furnish electricity for one 50-hp, one 15-hp and one 10-hp motor. The company will also supply electricity for lighting Ethel Park, Beaverton, where about 300 lamps are used. James Dobson is owner and manager.

SEAFORTH, ONT., CAN.—A by-law will be submitted to the rate payers on Aug. 8 authorizing the town to enter into an agreement with the Hydroelectric Power Commission to supply electricity to the amount of 400 hp and to appropriate $25,000 for the installation of an electrical distribution system.

TORONTO, ONT., CAN.—Contracts have been awarded by the University of Toronto for the construction of the power house, tunnels and part of the machinery in connection with the new central heating plant to L. K. Comstock & Company, of New York, N. Y.; for boilers to the Babcock & Wilcox Company, of Montreal, Que., Can.; to W. J. McGuire, Ltd., of Toronto, Ont., Can., for heating mains; the total aggregating $250,000. Darling & Pearson, of Toronto, Ont., Can., are the architects.

GUANACEVI, DURANGO, MEX.—We are informed that J. E. Knotts, of Guanacevi, Mex., is contemplating the installation of a 50 or 75-kw, three-phase, 2200-volt, 60-cycle generator connected to engine in his mill for the purpose of furnishing electricity for lamps and motors in the City of Guanacevi. About three miles of transmission line will be erected, and a street-lighting system installed.

NEUVO LAREDO, MEX.—The electric street railway system of this city, owned and operated by F. E. Scoville, of Laredo, Tex., was placed in operation July 17. Electricity for operating the system is furnished from the plant of the Laredo Electric & Railway Company, of Laredo, Tex.

New Industrial Companies.

THE ALLIANCE DEVELOPMENT COMPANY, of Olean, N. Y., has been granted a charter with a capital stock of $25,000 for the purpose of doing a general electrical business. The incorporators are: Alfred Tothill, Edward M. Tothill and Peter J. Messer, of Olean, N. Y.

THE AURORA MANTLE AND LAMP COMPANY, of Dover, Del., has been chartered with a capital stock of $145,000 by J. Arthur Corrodus, of Llanerch, Pa.; Charles B. Downs, of Philadelphia, Pa., and James M. Shatterfield, of Dover, Del.

THE BAIRD ELECTRIC COMPANY, of Chicago, Ill., has been chartered with a capital stock of $5,000 for the purpose of manufacturing electrical apparatus. The incorporators are: George C. Dent, F. A. Campbell, E. P. Baird, all of Chicago, Ill.

THE BROWN-SMITH BATTERY COMPANY, of Bloomington, Ind., has been incorporated with a capital stock of $25,000 by Charles L. Rawles, Fletcher Gardner, M. E. Showers, J. E. P. Holland, Phillip Hill and L. V. Van Buskirk. The company proposes to manufacture electrical supplies, storage batteries, motors, dynamos and all materials connected with batteries and electrical apparatus.

THE COMO ELECTRICAL COMPANY, of Como, Monmouth County, N. J., has been chartered with a capital stock of $50,000 by William W. Rowan, of Asbury Park, N. J.; Thomas Hinckley, of Spring Lake, N. J., and William E. Anderson, of Englishtown, N. J. The company proposes to manufacture mechanical and electrical devices.

THE DELAWARE ELECTRICAL SUPPLY COMPANY, of Dover, Del., has been incorporated with a capital stock of [illegible] by Harry [illegible] Richardson, of Laurel, Del.; John T. Evans, of Laurel, Del., and William T. Shockley, of Dover, Del.

THE DUNKIRK ELECTRICAL MANUFACTURING COMPANY, of Dunkirk, N. Y., has been organized by Albert W. Cummings, Harry T. Litchfield, Owen B. Mulholland, Charles J. Carney and John Lechner. The company is capitalized at $100,000 and proposes to do a general electrical business.

THE HUGHES ELECTRIC COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $50,000 for the purpose of manufacturing electric specialties. The incorporators are: George T. Hunes, T. M. Craven, F. A. Cothan and E. H. Williams, all of Chicago, Ill.

THE JACOBS ENGINEERING COMPANY, of Ottawa, Ill., has been chartered with a capital stock of $30,000 by W. F. Jacobs, Charles C. Jacobs and W. C. MacFarlane. The company proposes to do a general engineering and contracting business.

THE LOVELACE AEROPLANE & MOTOR COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 for the purposes of manufacturing and selling motors, engines, self-propelling vehicles, etc. The incorporators are: H. Amerman, F. W. Marshall, of New York, N. Y., and E. M. Morrison, of Brooklyn, N. Y.

THE NATIONAL ELECTRIC ENAMELING COMPANY, of New York, N. Y., has been incorporated by Merritt H. Rice, Charles Edmund Harvey and Francis A. Woodward, of New Rochelle, N. Y. The company is capitalized at $200,000 and proposes to manufacture brick, tiles, earthenware, etc.

THE NIELSON-FLEMING ENGINEERING & CONSTRUCTION COMPANY, of New York, N. Y., has been chartered by G. S. Fulton, of New Rochelle, N. Y.; W. A. Stevens, of Garden City, N. Y., and G. Stockman, of New York, N. Y. The company is capitalized at $100,000 and proposes to do a general engineering and contracting business.

THE PARAGON SELLERS COMPANY, of Chicago, Ill., has been incorporated by Edward N. Piatt, Ralph E. MacDuff and Elbert E. Dewey. The company is capitalized at $20,000 and proposes to manufacture electrical specialties.

THE RAILWAY IMPROVEMENT COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 by R. L. MacDuffie, G. W. Fairchild and A. H. Carlisle, of New York, N. Y. The company proposes to do general contracting and electrical work of all kinds; also to do a general electrical and mechanical engineering business.

THE SAYLOR GENERATOR GRATE & STOKER COMPANY, of Boston, Mass., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing and selling furnaces, boilers, etc. The incorporators are: Franklin G. Saylor, of Quincy, Mass., president; Charles W. Adams, of Quincy, Mass., treasurer, and John A. Phelan, of Quincy, Mass., clerk.

THE SIMMS MAGNETO COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $1,000,000 for the purpose of manufacturing magnetos. The incorporators are: Victor D. Hecht, Horace M. Kelbarn, Alfred Nathan, Charles S. Guggenheimer and Mortimer Stiefel, all of New York.

THE WIRELESS MUSIC COMPANY, of Chicago, Ill., has been incorporated by Walter J. Merritt, John Cochinsky, August Knickels and M. M. Ashton, 8 Borden Block, Chicago, Ill. The company is capitalized at $[illegible] and proposes to transmit sounds by wireless system.

New Incorporations.

MORRILTON, ARK.—The Morrilton Light & Power Company has been incorporated with a capital stock of $20,000 by William L. Moose, Clifton Moose and C. H. Burr. The company proposes to generate and sell electricity.

WILMINGTON, DEL.—The Interstate Light & Power Company has filed articles of incorporation with the Secretary of State with a capital stock of $3,000,000. The incorporators are: William J. Maloney, Millard C. Taylor and E. Buterworth Davis, all of Wilmington, Del.

WYOMING, DEL.—The Kent Water, Light & Power Company has been chartered with a capital stock of $25,000 by Hugh T. Downing, Webster N. Haas, and Harry T. Shelley, all of Philadelphia, Pa.

OCALA, FLA.—The Marion County Telephone Company has been incorporated with a capital stock of $10,000 to operate a telephone line from Citra to Ocala, Lake Weir and Leesburg.

CALDWELL, IDAHO.—The Homestead Rural Telephone Company has been incorporated with a capital stock of $5,000 by W. H. Davis, A. W. Smith and others.

BLOOMINGTON, ILL.—Articles of incorporation have been filed by the Kinloch-Bloomington Telephone Company with a capital stock of $500,000. John T. Lillard is president and H. F. Farwell is secretary of the company.

COLLINSVILLE, ILL.—The Collinsville Electric Company has been incorporated with a capital stock of $100,000 by J. J. Frey, A. W. Crawford, E. B. Hess and Jacob J. Frey, of Hillsboro, Ill. The company proposes to operate gas, electric and water plants.

DECATUR, ILL.—The Macon County Telephone Company has been incorporated with a capital stock of [illegible] to [illegible] telephone system. The incorporators are: J. W. Collins, W. E. Surface and A. V. Brownback.

ELGIN, ILL.—The Elgin Traction Company has been incorporated with a capital stock of $100,000 by George S. Webb, William T. Angell and W. D. Bell. The company proposes to construct an electric railway in Elgin.

SEYMOUR, IND.—The Jennings & Jackson County Rural Telephone Company has been incorporated with a capital stock of $3,000 by Michael Hunt, William Kessler, Jacob Noll, Clayton Downs, Frank Hill and Fred Neihouse. The company proposes to construct and operate a telephone system in Jennings and Jackson Counties with principal office in Seymour.

SEYMOUR, IND.—Articles of incorporation have been filed for the Chestnut Ridge & Farmington Telephone Company, by Albert Ahlbrand, William Booth, B. F. McIntyre, John F. Albering, George Nuss and A. A. Ruddick. The company is capitalized at $3,000 and proposes to construct and operate a telephone exchange in Farmington and extend its lines throughout Jackson County.

KANSAS CITY, MO.—The Big Niangua Hydroelectric Company has been chartered with a capital stock of $150,000 by R. E. Bremer, P. M. Bremer and H. M. Bremer.

ST. LOUIS, MO.—The McKanna Interurban Company has been organized with a capital stock of $500,000 to construct an interurban electric railway from St. Louis, Mo., to Oklahoma City, Okla., via Ada, Roff and Stonewall. The power plant will be located about 16 miles north of Ada, Okla. J. J. McKanna, of Oklahoma, Okla., is president of the company.

KINDERHOOK, N. Y.—The Kinderhook Electric Light Company has been chartered with a capital stock of $1,000 by John B. Gose, Hiram S. Churchill and Charles J. Gose. The company proposes to operate a light, heat and power plant.

COLUMBUS, OHIO.—Articles of incorporation have been filed for the Columbus, Mt. Vernon & Mansfield Railway Company with a capital stock of $10,000 for the purpose of building an electric railway connecting Columbus and Mansfield, via Mt. Vernon. The directors are: J. W. Lehman, J. M. Adams, David Lehman, Thomas W. Varley and George W. Rhodes.

PRINEVILLE, ORE.—The Cove Power Company has filed articles of incorporation with a capital stock of $50,000 for the purpose of constructing a hydroelectric power plant on the Crooked River at Cove Orchard. The present plans call for the erection of a dam and a canal to carry the water a distance of 2280 ft. to the generating plant where, it is estimated, that about 6000 hp can be developed. The directors are: W. A. Booth, president; Warren Brown, secretary and treasurer; D. F. Stewart and G. M. Cornett.

PITTSBURGH, PA.—The Pittsburgh, Steubenville & Wheeling Street Railway Company has been granted a charter to construct an electric railway from Pittsburgh to Steubenville and Wheeling. A railway will also be built between Dormont and Bridgeville, four miles in length. The company is capitalized at $40,000 and the incorporators are: W. E. Hildebrand, Oliver Building, Pittsburgh, Pa., president; John F. Klein, of Carnegie, Pa., and C. W. Behney, of Cecil.

GREER, S. C.—The Fairview Telephone Company has been chartered with a capital stock of $2,000 by W. D. Cox, C. Ballenger and I. P. Few.

NASHVILLE, TENN.—Articles of incorporation have been filed for the Eastern Tennessee Power Company with a capital stock of $1,750,000 for the purpose of development of water power to generate electricity. The company has secured rights of way from Chattanooga to near Parksville on the Ocoee River, where a large power plant will be erected.

SALT LAKE CITY, UTAH.—The Utah & Salt Lake Electric Railway Company has been organized to construct an electric railway to connect Salt Lake City and Payson, a distance of 70 miles. The company will be capitalized at $1,500,000. Simon Bamberger, Stephen Chipman, James A. Clare and others are interested in the enterprise.

BUFFALO RIDGE, VA.—The Buffalo Ridge Telephone Company has been granted a charter with a capital stock of from $1,000 to $5,000. The incorporators are: C. A. DeHart, of Buffalo Ridge, Va.; J. A. Nolen, of Elamsville, Va., and J. B. Brammer, of Woolwine, Va.

RICHMOND, VA.—The Richmond Power Company has been granted a charter with a capital stock of $500,000. The company proposes to erect a power plant near the coal mines at Midlothian and transmit electricity to Richmond, Norfolk and other points. It is understood that the initial installation will develop about 10,000 hp. The incorporations are: S. Dabney Crenshaw, of Richmond, Va.; Levin Joynes, of Richmond, Va.; F. W. Meulen, of New York, N. Y., St. John Clarke, of New York, N. Y., and Henry Twombley, of New York, N. Y.

ADRIAN, WASH.—Articles of incorporation have been filed for the Adrian Power & Water Company with a capital stock of $457,000 by [illegible] H. W. [illegible]

HUNTINGTON, W. VA.—Articles of incorporation have been filed under the laws of the State of Delaware by the Cincinnati & Pittsburgh Electric Railway Company with a capital stock of $1,000,000. The incorporators are: A. E. Cox, F. S. Kanode and C. R. Wyatt, of Huntington, W. Va. The company proposes to construct and operate [illegible] Pittsb[illegible]

ELDERON, WIS.—Articles of incorporation have been filed for the Elderon Telephone Company with a capital stock of $10,000 by A. J. Plowman, F. E. Bump and H. H. Manson.

Personal.

SIR J. J. THOMSON, F.R.S., has been elected president of the (British) Junior Institution of Engineers.

SIR WILLIAM CROOKES, the famous chemist, has been given the order of merit by the British Government.

DR. AUGUST RAPS, of the technical staff of Siemens & Halske, Berlin, has received the honorary degree of Doctor of Engineering from the Dantzig Technical High School.

MR. CLAUDE L. DAWSON, secretary of the Anderson Traction Company, has resigned his position with that company, to go to Puerto Cortez, Honduras, as United States Consul.

MR. JOHN S. PECK, consulting electrical engineer of the British Westinghouse Electric & Manufacturing Company, Manchester, England, is visiting this country in the interest of his company.

MR. E. W. STEVENSON, electrical engineer of the Hazard Mfg. Co., Wilkes-Barre, Pa., sailed for England on the White Star liner *Adriatic* on Wednesday, July 27, for a vacation for seven weeks.

DR. JOHN B. WHITEHEAD, formerly associate professor in the department of applied electricity at the Johns Hopkins University, has been appointed professor of applied electricity in that institution.

MR. VICTOR F. GATES has resigned from the Pittsburgh office of the Sprague Electric Company to take up the sale of American Conduit and Wireduct in the South, and will locate in Atlanta, Ga. He will be succeeded by Mr. H. Lee Reynolds, formerly of Doubleday-Hill Electric Company.

MR. ROBERT J. CHAMBERS, general manager of the Montgomery, Ala., Light & Water Power Company, delivered an address last week before the Business Men's League of Montgomery, in which he very plainly pointed out existing conditions which hampered the progress of the city. To emphasize a plea for closer co-operation, Mr. Chambers made a donation of $1,000 to the funds of the League.

MR. CHARLES M. NININGER, an Atlanta resident for a number of years, and connected with the Southern Bell Telephone Company there, has recently been promoted to the office of manager of the local Bell Telephone Company's exchanges, with the official title of district commercial manager. Mr. Nininger succeeeds Mr. A. H. Marchant, who has resigned his position with the Atlanta exchanges. Mr. Nininger, who will have supervision of more than 15,000 telephones, has been special agent to the superintendent of the first division, comprising the State of Georgia, and also held a similar position in Alabama, prior to which he was manager of the Montgomery exchange. He also served as special agent and chief clerk in the auditor's office after coming south from Baltimore, having been with the company since 1905.

Obituary.

MR. EDWARD ATHERON BESSEY, instructor in electrical engineering in the Colorado State Agricultural College, died at his home in Fort Collins on July 12. Mr. Bessey was 35 years of age and a graduate of the University of Nebraska. He had been in the employ of the Stanley Electric Company and General Electric Company at Pittsfield, Mass., the Denver Gas & Electric Company and the Central Colorado Power Company before taking a position in the Colorado Agricultural College last fall. He leaves a widow and a son two years old.

MR. JOHN DENISON EVARTS DUNCAN died at Ann Arbor, Mich., on July 13, at the home of his mother. Mr. Duncan was born at Union Falls, Clinton County, N. Y., in July, 1871, and, with his parents, moved to Ann Arbor, Mich., in 1879, where he lived until the completion of his technical education. Upon graduation in 1889 from high school, he entered Michigan University and was graduated from the School of Engineering in 1893, receiving the degree of Bachelor of Science in Mechanical Engineering. The following year was spent in post graduate work at Cornell University, from which he received the Master's Degree in Mechanical Engineering [illegible] From 1894 to 1896 Mr. [illegible] was employed by the Terre Haute Street Railway Company, Terre Haute, Ind., and [illegible] Stanley Electric Manufacturing Company, of Pittsfield, Mass.,

MR. J. D. E. DUNCAN.

With the latter company he was [illegible] with Mr. Stanley and Mr. [illegible] in their extensive experimental work connected with the solving of high tension problems which [illegible] first studied at their factory. On leaving the Stanley Electric

Manufacturing Company, Mr. Duncan successively held engineering positions in New York with the Metropolitan Street Railway Company; Western Electric Company; New York Telephone Company; Westinghouse, Church, Kerr & Company; and Consolidated Railway Electric Lighting & Equipment Company. On his return from a trip to Alaska on engineering work connected with a mining enterprise, Mr. Duncan entered, in February, 1901, the employ of Sanderson & Porter as managing engineer of their New York office. While directing the engineering work of this firm Mr. Duncan had been in responsible charge of the design and execution of many large and diversified engineering projects. By all who knew him and his work he was considered to be an engineer of exceptional ability and sound judgment. When taken ill Mr. Duncan was returning from a business trip of investigation and inspection made in the far west where he had gone to examine electrical properties for which his firm is acting as consulting and constructing engineer. Mr. Duncan was a life member of the American Society of Mechanical Engineers, a member of the American Institute of Electrical Engineers, the Brooklyn Engineers' Club, the Engineers' Club of New York, the Machinery Club of the City of New York, the Masonic order, the Michigan Club of New York, the University of Michigan Club, and the Cornell University Club. In 1901, Mr. Duncan married Miss Lena Hill, of Lyons, N. Y., who, with his mother and two brothers, survives him.

Trade Publications.

AIR HEATERS.—Much valuable information concerning "hot blast" heaters is given in bulletin No. 273 of the American Blower Company, Detroit, Mich.

ARMORED HOSE.—In its booklet No. 517, the Sprague Electric Company, 527 West 34th Street, New York, discusses the advantageous features of flexible steel armored hose for conveying air, water or steam under pressure.

MECHANICAL REFRIGERATION.—Brief descriptions are given of refrigerating apparatus particularly adapted for operation by means of electric motors in an illustrated catalog and price list issued by Fred W. Wolf, 301 Fisher Building, Chicago, Ill.

ELECTROPLATING DYNAMOS.—A bulletin recently issued by the Lincoln Electric Company, Cleveland, Ohio, gives an outline of the requirements of a successful electroplating generator and then offers a machine which involves several new features. One type is built without a commutator.

MINE TELEPHONES.—In bulletin No. 1110 of the Western Electric Company are given numerous illustrations and descriptions of telephones and signal apparatus for mines. The apparatus treated has been designed for use in a combined system of party-line code ringing telephones and emergency signal bells.

INSULATORS.—Much information relating to transmission-line insulators is contained in Catalog No. 2 of the Pittsburgh High-Voltage Insulator Company, Derry, Pa. The weight, height, diameter test e.m.f. and working e.m.f. are given in full for a line of pin-type insulators designed for circuit e.m.fs. up to 66,000 volts.

AUTOMOBILE ELECTRIC LIGHTING.—The Stuart-Howland Company, 1 Winthrop Square, Boston, Mass., has issued an illustrated circular giving particulars of an equipment for lighting automobiles by means of electric lamps receiving energy from storage batteries. A separate booklet deals with the batteries for this service.

ELECTRIC WIRING MATERIAL.—The H. T. Paiste Company, Philadelphia, Pa., has issued its condensed Catalog No. 16, which, being intended chiefly for reference, contains merely brief descriptions, illustrations and price lists of electric light wiring material. Among the new devices shown are special forms of wall sockets, receptacles, pipe taplets, molding taplets and sign receptacles.

SEWING-MACHINE MOTORS.—A publication of interest, especially to the housewife, has been issued by the General Electric Company, entitled "Sewing Machine Motors." The Bulletin, which is No. 4727, illustrates and describes in more or less detail two types of sewing-machine motors which may be easily applied to any of the standard sewing machines of either the drop-head or the stationary-head type. These motors are intended for ordinary domestic use, and are made for alternating current and direct current of standard voltages.

BUSINESS NOTES.

RIDGWAY ENGINES.—Of a large number of four-valve engines recently sold by the Ridgway Dynamo & Engine Company, Ridgway, Pa., two (28 in. x 32-in.) were ordered by the Susquehanna Railway, Light & Power Company, of Wilkes-Barre, Pa., and one (12 in. x 16 in.) by the Nittany Light, Heat & Power Company, State College, Pa.

THE PHŒNIX ELECTRIC COMPANY, of Mansfield, Ohio, is now represented in the Chicago district by Mr. Alvin Fox, 1249 La Salle avenue, formerly with the Allis-Chalmers Company. The company makes both alternating and direct-current motors from 1/6 to 50 hp and pays particular attention to motors designed for elevators and machine-tool drive.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 19, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

964,498. ELECTROMAGNETIC PROPELLING SYSTEM; R. Dean, Findlay, Ohio. App. filed Jan. 28, 1907. The vehicle carries electromagnets and a controller, and the roadbed carries soft iron bars spaced apart. When energized the magnets pull the car by their attraction for the soft iron bars.

964,503. ELECTRICAL MUSICAL INSTRUMENT; I. Engstrom, Chicago, Ill. App. filed July 14, 1909. Bells are rung by electrical means controlled by the finger key.

964,513. INTERCOMMUNICATING TELEPHONE SYSTEM; W. W. Hawkins, Cleveland, Ohio. App. filed May 9, 1906. A series of selective push-buttons for giving the signal, the buttons at each station being held in their operative positions, thus controlling the talking circuit and automatically release when the receiver at the station is hooked up.

964,521. HOT WIRE ELECTRICAL MEASURING INSTRUMENT; J. T. Irwin, London, Eng. App. filed May 25, 1907. Polarizes the wires of the instrument from the current supply to be measured and compensates for the heat capacity of the wires by employing condensers or inductive resistances.

964,530. TRACK INSTRUMENT FOR SIGNALING SYSTEMS; T. MacDougal and J. McK. Chambers, Boulder, Col. App. filed April 20, 1909. The passing train closes a circuit to operate the signal, this being effected through a lever system, and a circuit closer being controlled by clockwork.

964,536. ELECTRIC SWITCH; W. S. McLewee, Yardley, Pa. App filed Feb. 13, 1909. Slidably mounted switch, including a base and socket to receive a cutout.

964,552. WIRE STRETCHER; J. H. Rager, Vintondale, Pa. App filed Feb. 11, 1910. For trolley wires, including a body bar with grooves in which the wire is secured, a central standard carried by the bar and having a yielding engagement with the trolley wire.

964,566. MANUFACTURE OF ALUMINUM AND ITS ALLOYS; H. F. D. Schwahn, Belleville, Ill. App. filed Dec. 7, 1908. Electrolytic process of making aluminum by [illegible] temperature sulphite of aluminum with carbon and then electrolyzing.

964,569. RAILWAY SIGNALING DEVICE; P. H. Shue, Denver, Col. App. filed June 9, 1909. Semaphore type controlled by an electromagnet, which controls a pendulum escapement to actuate a transmission mechanism to revolve the semaphore.

964,586. INSULATOR; J. R. Tufts, Jr., Weymouth, Mass. App. filed Nov. 29, 1907. An inner member having a support and a cavity with an annular coiled clamping jaw and an outer member sliding in the cavity having lined orifices.

964,592. FUSE; F. H. Weston, Jr., Schenectady, N. Y. App. filed April 10, 1902. A cartridge fuse comprising a sinuous strip of fusible metal surrounded by non-conducting absorbent material.

964,612. IMPULSE TRANSMITTER FOR ELECTRIC SIGNALING SYSTEMS; E. E. Clement, Washington, D. C. App. filed Nov. 1, 1906. For sending groups of numbers by means of a number wheel controlling a contact and a plurality of short-circuiting devices cooperating with the wheel to determine different numbers of impulses.

964,619. ATTACHMENT PLUG; J. C. Dallam, Schenectady, N. Y. App. filed Jan. 11, 1905. For incandescent drop lights or plugs, including a one-piece base carrying recesses receiving contact clips with center and side contacts at the other end of the base connected to the clips.

964,622. TELEPHONE RECEIVER; W. W. Dean, Elyria, Ohio. App. filed March 7, 1910. The instrument is encased in a metal shell, the walls of which are folded at the open end to form an abutment for the receiver support.

964,630. DYNAMO-ELECTRIC MACHINE; J. P. Feeney, Schenectady, N. Y. App. filed April 6, 1908. For supporting end turns against centrifugal force by means of a row of members, each having a flange engaging the exterior of a single end turn and secured by a single stem.

964,654. INTERLOCKING SAFETY MECHANISM FOR CONTROLLING DEVICE; F. H. Kittredge, Joliet, Ill. App. filed May 17, 1909. For power lines, including a movable circuit-closing member, a blocking member and a connection between so as to hold the movable circuit-closer open after movement.

964,659. MEANS FOR OPERATING AND CONTROLLING SINGLE-PHASE ALTERNATING CURRENT MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed May 19, 1909. Single-phase alternating commutator motor with series connected armature and field and means for supplying variable voltages to the motor and for causing the ratio of the amount of current which traverses the field to that which traverses the armature to vary as the voltage applied.

964,664. ARC LAMP; G. M. Little, Pittsburgh, Pa. App. filed May 6, 1907. For composite electrodes with intake side apertures with portions bent so as to direct drafts of air into the casing.

964,665. STARTING DEVICE FOR ELECTRIC LAMPS; G. M. Little, Pittsburgh, Pa. App. filed May 6, 1907. For avoiding the slag on the electrodes by moving the electrodes into and out of engagement to establish the arc by [illegible].

964,666. CASING FOR ARC LAMPS; G. M. Little, Pittsburgh, Pa. App. filed May 6, 1907. For ventilating arc lamps by means of a chimney tube projecting between parallel plates.

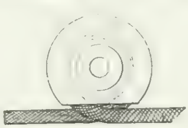
964,667. GUIDE AND HOLDER FOR ARC LAMP ELECTRODES, G. M. Little, Pittsburgh, Pa. App. filed May 6, 1907. For supporting and guiding a movable electrode, the electrode holder having a stop with a guide, the stop being automatically thrown out of alignment with the guide at one end of its travel.

964,687. BATTERY AND HOLDER; G. L. Patterson, New York, N. Y. App. filed May 26, 1908. Dry battery holder, including two socket members anchored in an insulating head, the sockets and terminals being non-symmetrical, to prevent reversal of polarity.

964,691. ARC LAMP; R. Fleming and C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Jan. 16, 1906. Flaming arc lamp making use of a [illegible] and a special form of feeding mechanism, consisting of clutches and levers for feeding the electrode.

964,692. INCANDESCENT ELECTRIC LAMP; E. W. Rice, Jr., Schenectady, N. Y. App. filed Sept. 13, 1907. For supporting against rough handling, by holding the loop under spring tension and providing auxiliary anchors for preventing transverse vibration.

964,710. ELECTRIC SIGNALING SYSTEM; J. D. Taylor, Edgewood Park, Pa. App. filed April [illegible], 1908. For electric roads in which



964,[illegible].—Insulator

the rails carry propulsion and signaling current. Makes use of signal controlling relays and conductors in inductive relation to the track rails.

964,711. ELECTROMAGNETICALLY OPERATED SWITCH; J. F. Tritle, Schenectady, N. Y. App. filed July 1, 1908. For power circuits. Makes use of an E-shaped frame for the field to carry the coil and parts.

964,714. ALTERNATING CURRENT MOTOR; P. Utne, New York N. Y. App. filed March 25, 1909. The rotor is of non-magnetic metallic material and the field coils are supplied with alternating currents in the windings of two opposite magnets.

964,737. INSULATED DISTRIBUTER FOR ELECTRIC SERVICE WIRES; J. B. Ashley, Seattle, Wash. App. filed July 14, 1909. An insulating casing surrounding a wired distributing support, with a plurality of divisions carried by the casing to receive a plurality of wires.

964,741. CONTACT FORMER OR LINE TAPPER; C. A. Beghtol, Canon City, Colo. App. filed July 3, 1908. For ceiling blocks and the like, including an attaching shank carrying a head and an insulation cutting blade carried by the head.

964,742. DYNAMO ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed Dec. 23, 1904. Double commutator machine with positive and negative collecting devices for each commutator, the positive collectors of one commutator having a greater resistance than the negative and the positive collectors of the second commutator having a less resistance than the negative collector of the second commutator.

964,751. MOTOR CONTROL; E. R. Carichoff, Schenectady, N. Y. App. filed April 27, 1908. A main switch for the motor circuit, a circuit changing switch, a signal magnet for both switches and a selective magnet for controlling its action with a master controller for controlling both magnets.

964,759. ELECTRIC HEATER; A. S. Cubitt, Pittsfield, Mass. App. filed Feb. 16, 1910. For supporting the heating element or plurality of coils, by an intermediate support common to the coils and electrically connecting them at equi-potential points.

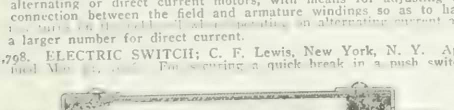
964,760. ELECTRIC CURRENT INTERRUPTER; P. B. Cumings, Fremont, Neb. App. filed Aug. 28, 1908. For leading sneak currents to ground through a fuse by means of a clamp and spring, together with a pivoted member engaging the clamp and spring to clamp the conductor.

964,770. DYNAMO ELECTRIC MACHINE; J. P. Feeney, Schenectady, N. Y. App. filed Dec. 29, 1909. For supporting the end turns against centrifugal force by members having interlocking portions.

964,793. METHOD OF OPERATING AND CONTROLLING SINGLE-PHASE ALTERNATING CURRENT MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed July 9, 1906. The method of regulating an alternating current motor with series connected armature and field coil by adjusting the speed steps and causing the ratio of field circuit turns to armature turns to vary directly as the speed.

964,794. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed April 5, 1907. For commutator alternating or direct current motors, with means for adjusting the connection between the field and armature windings so as to have [illegible] on alternating current and a larger number for direct current.

964,798. ELECTRIC SWITCH; C. F. Lewis, New York, N. Y. App. filed May [illegible]. For securing a quick break in a push switch



964,[illegible].—Fuse

Includes a sliding rod on which a contact member is slidably mounted, and a stop on the rod limits its movement. A pair of springs grip and hold the sliding contact until their pressure is overcome by the movement.

964,819. LOOSE MOTION DEVICE FOR ELECTRIC CONTROLLERS; R. Van R. Sill, Newark, N. J. App. filed June 10, 1909. A [illegible] wheel coacting with a [illegible] and a pair of jaws held closed by a spring, one of which is [illegible] to the star wheel, so as to avoid holding the controller at a point which [illegible]

[illegible] SYSTEM OF ELECTRICAL DISTRIBUTION; [illegible] Wood, [illegible] Pa. App. filed July [illegible] storage [illegible] with generators controlled by an electrolytic [illegible] operation of an electromagnetic [illegible]

[illegible] AUTOMATIC SWITCH; [illegible] R. Austin, Longbeach, Cal. App.

filed April 30, 1907. For automatic telephone systems for selecting one of a number of trunk lines by means of a series of fixed contacts, an arm carrying a movable contact, a reciprocating electrical contact for moving the arm and a stop controlled by another electromagnet.

964,858. METHOD OF OPERATING ELECTRIC MOTORS; B G. Lamme, Pittsburgh, Pa. App. filed May 3, 1904. For commutator types of motors driven by alternating or direct current. The field coils are connected for each of a plurality of lower speeds, so that only a portion of the total current traverses the field coils while the total current traverses the armature.

964,863. SEPARABLE ATTACHMENT PLUG; H. Hubbell, Bridgeport, Conn. App. filed Aug. 25, 1909. A screw shell with a groove above the thread and an attachment plug having a shell with a slot and spring in the slot and having attaching portions engaging the groove in the shell.

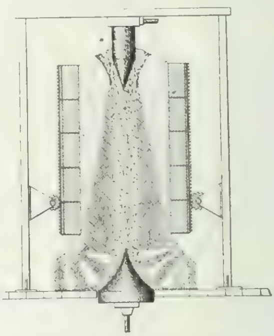
964,892. DAMPER REGULATING MECHANISM; B. C. Wickes, Auburn, N. Y. App. filed Dec. 9, 1909. A fluid pressure device for controlling a damper, the former connected to a water main and controlled by a valve operated by an electromagnet.

964,953. CURRENT DISTRIBUTING AND COLLECTING MECHANISM FOR ELECTRIC RAILWAYS; F. G. Clark, New York, N. Y. App. filed Oct. 7, 1908. A catenary support for connected rails with means for adjusting them vertically and horizontally in combination with a trolley having a two-face tube supported on a universal joint carried by an arm connected to the car.

964,961. CABLE CONSTRUCTION; H. W. Fisher, Pittsburgh, Pa. App. filed March 24, 1910. For detecting the temperature within the cable at a remote point by means of a thermo-couple contained within the cable at said point.

964,969. ELECTRIC WIRE COUPLING; A. H. Hesterhagen, Jersey City, N. J. App. filed April 14, 1910. A base plate of non-conducting material with a metallic coupling on the back having an anchor and screw holes together with a cap of non-conducting material fitting over the base.

964,994. STORAGE BATTERY INDICATOR; P. M. Marko, New York, N. Y. App. filed Dec. 14, 1909. A shunt circuit permanently carried within the storage battery casing, and including a constant resistance



965,142.—Method of Making Silicon Carbid.

equal to the normal load thrown in circuit when short circuiting the battery to test its strength with a voltmeter in parallel.

964,995. STORAGE BATTERY; P. M. Marko, New York, N. Y. App. filed March 8, 1910. An electric meter within the opening of a storage battery casing.

965,017. SELECTIVE SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed Feb. 15, 1909. For railways to call up selectively stations from the central office by means of step-by-step selectors at the sub-station with electromagnetic means for operating them.

965,028. RAILWAY SIGNALING APPARATUS; P. H. Shue, Denver, Col. App. filed May 17, 1909. Track instrument actuated by a train to close the circuit to operate a semaphore.

965,059. CURRENT REGULATOR; V. G. Apple, Dayton, Ohio. App. filed Dec. 21, 1908. A pile of carbon plates arranged in a circuit with an electromagnet for controlling the pressure. Details.

[illegible] SPACE TELEGRAPHY; C. D. Babcock, New York, N. Y. App. filed July 17, 1907. An oscillation producer in which the discharge is muffled, having electrodes, one of which is provided with a plurality of points contained in a vessel holding gas under pressure. The electrode is rotated.

965,062. CHOKE COIL; H. J. Beck, Philipsburg, Pa. App. filed Sept. 2, 1909. An angular core carried by a standard on which coils are slidably mounted.

965,084. MEANS FOR TRANSMITTING POWER; C. Cleiren, Brussels, Belgium. App. filed Jan. 19, 1909. Speed reducing gear in which the first speed is obtained by connecting the motor with the wheels, so as to give the maximum motor couple and as the resistance diminishes the power of the motor is transmitted electrically to the wheels so as to increase the speed.

965,103. ELECTRICAL CONTACT; G. W. Goodbridge, Bridgeport, Conn. App. filed May 11, 1910. Center contact for plug receptacles in which cup members one inverted within the other are used, with a spring for separating them.

965,123. INSULATOR; C. Smithson and J. W. Osborne, Winchester, Ill. App. filed Sept. 23, 1909. An insulator having a hood, together with a support fitting within the hood with a central threaded stem.

965,139. STARTING DEVICE FOR ARC LAMPS; G. M. Little, Pittsburg, Pa. App. filed Sept. 3, 1907. An electromagnet winding, with a switch for governing a shunt thereto, a thermostat for the switch with a conductor in series with the winding an armature carried by the switch and actuated by the magnet.

965,142. METHOD OF MAKING SILICON CARBID; F. J. Tone, Niagara Falls, N. Y. App. filed Jan. 7, 1909. A continuous process in which a charge of silicious and carbonaceous material surrounds a core of conducting resistance material. The resistance and charge are moved during the passage of the current, and renewed

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THE OHIO ELECTRIC LIGHT ASSOCIATION CONVENTION.

It is a striking illustration of the strength of the electric lighting and motor-service industry that a single state association can call together over 350 persons at its annual convention, as was the case at Cedar Point, Ohio, last week at the Ohio Electric Light Association convention. Not many years ago the attendance at a National Electric Light convention did not exceed this figure. While some might fear that the great activity displayed by the National Electric Light Association and the rapid increase of membership in it might detract somewhat from the state associations, quite the contrary appears to be the case. In fact, there has been a notable increase in strength of the state associations along with the recent rapid growth of the national association. What all this really means is that the central-station industry is waking up to its strength and importance, and to the possibilities of the business. Central stations in their various territories are performing the large variety of services for their communities, which we have for many years maintained they should perform. There was a marked tendency this year in the Ohio association to send a large number of men from one company, just as was the case in the recent National convention. For example, at the Ohio convention all of the directors of one company operating in a town of about 8000 inhabitants were present, and the total delegation of the company was six men. The directors were not technical men, but were prevailed upon by the president of the company to attend this convention in order to place themselves in a position to act more intelligently upon matters which are coming up for them to decide. Many other companies also sent a number of men instead of a single representative, as was the custom in former years.

This year the discussions and papers were entirely on subjects of practical importance in operation and management, instead of extended descriptions of new apparatus, which have sometimes taken large places on the Ohio program. The subjects were so distributed, and the discussions likewise, that no one feature could be said to stand out prominently. Probably more discussion was given to the subject of rates than to any other one question, as the recent announcement of the manufacturers that tungsten lamps in small sizes which are not fragile will soon be regularly on the market has set many managers to thinking as to what changes in the rate schedule can be made to enable them to handle residence business at a profit with a reduced kw-hour consumption. The question of making a motor-service rate which will be acceptable to owners of isolated power plants and at the same time profitable to the central station, is also more live than ever. The results reported from tungsten lamps in street lighting service may be considered as highly encouraging. Not only is the life of the lamps remarkably long, but the candle-power is well maintained throughout the whole life, which performance is in striking contrast to the rapid deterioration of certain of the rival illuminants.

OUTDOOR BUSBARS.

As recently noted in detail in these columns, the 100,000-volt busbars of the Denver substation of the Central Colorado Company are all out doors, except for very short distances where they pass directly from insulated roof bushings to transformers in the substation building proper. The 100,000-volt oil switches are each in a separate switch house just large enough for one three-phase switch, and the lightning arresters are also in a separate building by themselves. The cost of the entire substation, considering the relative amount of investment involved, is probably lower than for a substation enclosing the 100,000-volt bus bars which would afford equal security from damage by arcs between busbars. The higher the voltage, the more difficult becomes the problem of properly housing and enclosing bus bars of such high potential. For 100,000-volt lines the best insulating barrier is plenty of air space out doors, for while this may be temporarily broken down, it is at least self-healing and does not require expensive repairs after an arc between conductors. Outdoors the necessary safe space between conductors is cheaply obtained in such locations as are likely to be selected for 100,000-volt substations. To enclose and protect properly in one building the amount of 100,000-volt wiring that exists around the Denver substation, and to make it as safe as it is now, would require a building of formidable proportions. Of course, the climatic conditions in this case are extremely favorable for the dispositions adopted. The tripping coils perform their work through the medium of long insulating rods which connect them mechanically with the low-voltage switch control circuits.

THE COMPOUNDING OF ALTERNATORS.

Among the numerous methods used for compounding alternating-current generators a most prominent one is that involving the use of a rectifier through which passes the load current either directly or indirectly, and which furnishes unidirectional current for a "series" winding on the field poles of the alternator. A modification of this method consists in placing the "series" winding on the field poles of the direct-current generator supplying excitation for the alternator. In either event the degree of compounding depends upon the value of the load current and is affected only slightly by any change in the power-factor of the load. A large change in the power-factor usually means much sparking at the rectifier and a decrease in the compounding effect. An arrangement in which use is made of certain of the features of the above-described method, but which omits the rectifier and obtains a compounding effect varying largely with the power-factor of the load, is described in an article by Prof. Andre Blondel, abstracted in the Digest in this issue.

In an alternating-current generator, the armature m.m.f. depends solely upon the value of the armature current, but the effect upon the voltage regulation varies largely with the power-factor. When the power-factor is unity the mean armature m.m.f. is in a direction to distort the field magnetism, but not to alter its value. If the power-factor could be reduced to zero the distortion would cease, but the armature m.m.f. would either directly assist or oppose the field-circuit m.m.f. according to whether the wattless current were "leading" or "lagging." At intermediate power-factors the opposition to the field-circuit m.m.f. varies directly with the value of the lagging component of the armature current. It will be seen, therefore, that so far as concerns the change in the field magnetism of the alternators, perfect "compounding" could be obtained by a method which allowed the field circuit m.m.f. to vary directly with the lagging component of the armature current.

In the Blondel arrangement the load current from the armature winding of the alternator is passed, without rectification, through a special "series" winding on the rotor (armature) of the direct-current exciter of the alternator. This special winding revolves synchronously with the alternator, and the current therein is so directed that its lagging component assists the field-circuit m.m.f. of the exciter, which is itself a separately excited machine. Thus, the greater the value of the lagging component of the load current on the alternating-current generator, the greater is the assistance rendered in magnetizing the field cores of the exciter, the greater is the exciting current supplied to the alternator and the higher is the internal generated e.m.f. of this machine. For the Blondel arrangement there are claimed absence of delicate mechanism and ease of adjustment of both the no-load voltage and the degree of compounding. When once the adjustments have been made the operation is strictly automatic and depends solely upon electric and magnetic reactions.

THE RATING OF LAMPS IN STREET LIGHTING SERVICE.

The ever-present subject of the proper method for rating lamps used in the lighting of streets was brought into some prominence at the recent convention of the Ohio Electric Light Association. In the discussion of one of the papers mention was made of the fact that certain gasoline lamps bearing a rating of 60 cp actually varied in output from a maximum of a little below 60 cp to a minimum of perhaps 20 cp. The existence of such a discrepancy between actual output and the rating of the lamps should not be considered as indicating an attempt on the part of the lighting company to deceive the people paying for the lighting service; it shows merely that there is no definite relation between the rating and the output, the former being an arbitrary designation of the lamp. That is to say, even though the lamps had been rated at 100 cp, the company cannot be accused of an attempt at deception, provided only that those paying for the service were aware of the exact lamp to be used and knew from previous observations what results to expect. However, the arbitrary designation of lamps in candle-power is apt to work hardship when two types of lamps rated according to different arbitrary methods are to be compared, since the candle-power basis is the one most likely to be selected for this purpose. For example, it is manifestly unfair to compare the cost of operating 60-cp electric lamps with 60-cp gasoline lamps, when each is rated in arbitrary units having no direct relation to the candle-power obtained.

The discrepancy noted above is not confined to incandescent mantle lamps, but exists with certain types of electric lamps, especially those formerly in common use for street lighting. When electric street lamps were rated at 2000 cp or 1200 cp no harm resulted from the fact that the lamps did not deliver candle-power according to their ratings, because it was recognized that the ratings referred merely to certain well-known

types of lamps. However, with the introduction of improved lamps for street-lighting service which were more conservatively rated, confusion was brought about and the more recent types of lamps frequently suffered in the comparisons that were made with the earlier types.

Just what plan should be adopted for rating street lamps of various types only extended experience can determine. There can be no doubt, however, that a rating based on the initial maximum candle-power in a single direction under the best laboratory conditions is not a fair one to apply to a type of lamp which deteriorates rapidly in service and has a wide range of candle-power in different directions in the vertical plane. The best criterion is the service rendered, and possibly a rating based on the average service obtained will prove the most satisfactory in the end. In any event, it is highly undesirable to refer to a lamp having a mean spherical candle-power in service of, say, 30 cp as a 60-cp lamp, or to designate as 1200 cp a lamp giving perhaps less than half that value in spherical candle-power.

THE QUARTZ MERCURY ARC IN STREET LIGHTING.

We note from our foreign contemporaries the introduction of quartz mercury arcs into the street-lighting system of Paris. The units, a description of which appeared in our issue of March 17, employed are of 1000 cp and 2000 cp in fairly dense diffusing globes. The results are stated to be very satisfactory, the intrinsic brilliancy being so reduced to give a soft and pleasing effect even with the great intensity of the lights, and the life of the tubes being about 2000 hours. The quartz lamp has made no impression as yet in this country, owing chiefly to the fact that until quite recently the world's whole output has been the product of a single factory in Germany, and it is quite obvious that no large commercial use of quartz lamps over seas from this source would be feasible, particularly as the tubes have a most evil reputation for fragility. Of late, however, several manufacturers have taken up the work of producing the tubes, itself a task of no small technical difficulty, and it is not unlikely that before long we may have an adequate source of supply in this country. Given this, the quartz lamp would have to be taken very seriously as a possible street illuminant. Its economy is approximately that of a first-class flame arc, say, from ¼ watt to ⅓ watt per candle. The color is sufficiently good for street work, and the steadiness considerably better than that of any other very powerful illuminant. Beside this, there is the great advantage of having a lamp running practically without attention and requiring replacement of active material only two or three times a year. An additional advantage which might be turned to very great account is the fact that the source being a fixed tube only a few inches long and perhaps ¼ in. or so in diameter can be very readily adapted to shades or to prismatic reflectors which would give almost any type of distribution desired for efficient street service.

Against these advantages stands an element of danger from the very powerful ultra-violet radiation produced by the quartz lamps, which is well known to be dangerous to the eye. Just how dangerous it is and how easily the danger can be eliminated is not yet well known; but the lamps of one of the chief German makers are sent out with a name plate bearing a specific warning against the employment of the lamp without a glass outer globe. How far this globe is actually efficient in cutting off the ultra-violet rays is not definitely known, but it undoubtedly cuts them off to a considerable extent, and it is not impossible that the absorption of some of the damaging radiations by the air itself may be sufficient to render the light harmless in case of a broken globe, if suspended at a suitable height for street lighting. The tube is so small that automatic lighting should be a very easy matter, and a lamp of very high efficiency requiring no trimming and but infrequent renewals would certainly prove a great boon to the central-station man, who now is between the devil and the deep sea, when it comes to first-class arc lighting, with inefficient enclosed arcs on the one side and expensive trimming for flame arcs on the other. Even the magnetite lamp, excellent as it is in many respects, is far less efficient and requires much more care than these quartz lamps are reputed to do. We hope somebody will shortly undertake the manufacture of tubes in this country so that central-station operators may have a fair chance to experiment with them both for street and commercial work, although for the latter they possess less advantages than for the former, in view of the progress that has been made in incandescent lamps. The situation is a most interesting one, and we shall await with a great deal of interest further reports from the Paris installation as to the practical working of the system on something more than a casual and experimental scale. Meanwhile the element of danger well recognized with respect to the quartz lamp ought to be thoroughly investigated to determine its real magnitude and significance.

THE MANUFACTURE OF ICE BY CENTRAL STATIONS.

The economies and profits incident to the operation of a combination electric and steam-heating station are quite generally known, for the subject has been freely discussed before national and state bodies and in the technical press. Although their total number is almost twice as great, combination electric and ice-making plants have not been taken so seriously in the North; however, in the South, where natural ice is not a competitor of the manufactured product, they are in general use. As manufactured ice is coming into greater and greater use for hygienic reasons, due to the pollution of fresh water streams by sewage and the refuse of manufacturing establishments located on their banks, the question of combination electric and ice-making stations becomes one of much importance to the central-station industry. Already the country abounds with independent ice-making establishments, which, even as they are, offer profitable and legitimate off-peak central-station loads. Unfortunately, few central-station companies have succeeded in acquiring such loads. The rates may be too high or there may be other reasons for not driving the compressors by electric motors just at present. Sooner or later, however, the steam-driven compressors will be supplanted by electrically driven machines, because the load is of a kind to appeal to progressive central-station managers who can thereby best dispose of surplus electrical energy and obtain a load factor for their stations sufficiently high to justify any concession made in acquiring it.

An electric light station, however small, can create a market for its surplus energy at its own door by the installation of ice-making machinery. [illegible] a steam-heating load, ice-making

does not require extensive underground work and is absolutely under the control of the station at all times. According to the conditions of the electric light load, much or little ice can be manufactured and during dull lighting seasons or at times of light load, the ice-making plant can be operated at its maximum output and the ice placed in storage against the day of its use. These are mere details of operation and have nothing to do with the greater problem. There are certain precautions to be taken at the outset, however, and in erecting an ice-making plant it is well to use the experience of others as a guide. Many who have gone into the ice-making business have been carried away by enthusiasm over brilliant possibilities only to learn that all that glitters is not gold. Those who have been successful have studiously avoided the will-o'-the-wisps of exuberant expectancy. Realizing that the market is limited to a certain season, they wisely provided for abundant storage, installing a medium-size plant in preference to one capable of meeting the maximum one-day demand for ice. This plan enabled the plant to be operated continuously and obviated all of the disadvantages of intermittent use. The employment of steam-driven apparatus in preference to motor-driven apparatus may be attributed to the attitude of the manufacturers of ice-making machinery. To them is usually left the selection of the entire ice-making installation and, being rooted and grounded in steam practice, the employment of electricity seems an innovation. The trouble is that there are very few power-plant engineers conversant with refrigerating engineering. The two subjects are bound to come into closer and closer relationship so that power-plant engineers should become familiar with the outlook from a refrigerating viewpoint.

Two efficient refrigerating processes are in use at the present time; the compression process and the absorption process. Both produce refrigeration by the boiling of ammonia. In the former, use is made of a compressor and a water cooler to produce the liquid ammonia; while with the latter, the absorptive power of water for ammonia gas and the loss of this quality with rise in temperature are employed to produce the same result. The latter is the older system, but the former is more widely employed at present. It is claimed, moreover, to be higher in efficiency for small units, while in larger units the absorption system is superior to it. The efficiency of both types of machinery depends largely on the intensity of refrigeration, the compressor machine losing rapidly with a diminution in the temperature required, whereas the efficiency of the absorption machine remains practically constant. The ability of the latter type of apparatus to use exhaust steam is one of its most important features. The compressor plant lends itself readily to motor operation, hence its popularity. Even where the compressor is steam driven certain economies are obtained. The logical method of operating compression plants, however, is to drive the compressors by electric motors and to utilize the exhaust steam from the engines for the necessary distilled water employed in making ice. Both of these the central station possesses, and this fact should be impressed on the manufacturers of ice-making machinery. Small stations only partially loaded can thus install motors, which in an alternating-current station would improve the load factor, better the efficiency of the plant as a whole, and use all of the exhaust steam available. With the absorption process, a fair-sized ice plant can be operated from the exhaust steam of the station, which would otherwise go to waste.

THE MAKING OF RATES.

The fundamental purpose of a system of charging for electrical energy is to secure the maximum net profit from the plant concerned. One may theorize all he pleases regarding the matter and in the last resort it comes straight back to this simple principle. Electric supply companies are not in business for their health, and while most company managers in these days have a wholesome feeling of responsibility to the community they serve as a public corporation, it is their business in the interest of their stockholders to secure such profit as may be from the administration of the property. Experience has taught that certain very moderate limits of price cannot be exceeded without cutting the net profits, and it is a fact that electrical energy is almost the only important commodity the price of which to the public has been constantly lowered throughout a time of exceptionally rapid rise in general prices. We have yet to hear of any central-station manager who has followed the example of some of the electric railway companies by going around and moaning to the authorities concerning the increased cost of material and labor, basing thereupon a long-drawn plaint, the burden of which is that he should be allowed to raise his prices to the people. With a full realization that their product should be made a necessity and not a luxury, the central-station men have kept their prices for electrical energy on the downward grade and thereby very generally have increased the net profits.

The above has been given by way of preliminary to the interesting question of the method of charging for electrical energy which shall be applied in any given community. Inasmuch as public regulation and sound business policy unite on fixing an upper limit of price beyond which it is not safe to go, the principal function of any particular system of charging is to get business, all the business that the community can fairly yield, in such wise as to increase the earnings of the supply company. We are presenting in the current issue one of the many attempts to solve the rate problem upon the basis of the fixed and variable charges involved in the operation of the plant for the service of its customers. On the hypothesis explicitly or implicitly introduced the solution arrived at by Mr. Marks is a correct deduction from the premises. But what we wish to point out here is not the particular segregation of items of fixed and service costs from which a particular conventional system of rates may be derived, but rather some of the fundamental principles upon which all rate systems for electrical energy must depend if they are to fulfill the function heretofore stated.

A central-station manager knows, or should know, very accurately the gross cost in fixed and variable charges of the product delivered in any given year or month. If he can secure a certain net profit from sales after these expenses are paid it could almost be said that he is not interested in the exact sort of schedule on which the sales are made, always provided that it is a schedule which will help him get more and more profitable business. The central-station man deals with the aggregate. The consumer, who deals with the items which make up the aggregate, on the other hand, is keenly interested in getting his service at the lowest possible price, but is perturbed in spirit only when the aggregate seems unwarrantably high, or when he knows or fancies that he is paying a higher price than his neighbors.

The two conditions that have to be filled by any system of charging are increase of business, and hence of profit for the station, and decrease of complaints among the consumers. The various rate systems which have been advocated are various imperfect attempts to meet these two conditions. There is no such thing as a judicial or scientific method of charging which is even approximately justified by the facts. Explicitly, or implicitly, all the rate systems, except the flat rate, involve the averaging of certain factors and conditions which apply differently to the cases of different consumers, and from the standpoint of punctilious precision affect some consumers favorably and others adversely. To begin with, why should one take a yearly average of cost, either fixed or variable, as the criterion of constructing a charging system? It is more logical, more scientific and more precise to take a quarter, or a month, or a week, or some other short interval of time as this criterion. The shorter periods are not taken simply because they are not convenient and because it seems wiser to run the chance of inequitable distribution of charges than to go to the trouble of a higher degree of precision. In point of fact the average cost of a kw-hour delivered is a continuous variable over a range in most stations almost or quite as wide as the range of retail prices. Why should not a consumer who uses energy only during the winter get the benefit of the better load factor during that period, and why, on the other hand, if one is a stickler for precision, should not a consumer who wants off-the-peak energy at a time when the daily cost of output runs high, pay more for it than if he desired energy during hours when the books would necessarily show that the cost of production is less, if the books are strictly kept?

Here is the logical flaw in all so-called scientific systems of rates that are based on implicitly averaging wide variables. It is a perfectly justifiable process from a commercial standpoint, and from a commercial standpoint it is as sound to average one set of variables as another. One of the common rate systems, of which Mr. Marks' is a type, consists in dividing the stand-by charges in proportion to the amount of the public service demanded by the patron and then fixing the quantity price by reference to some more or less formal segregation of the variable charges. It is a process superficially sensible enough, but it has no claim to absolute equity or scientific precision. It is simply an arbitrary division of costs in which certain factors are taken by general average. It is a little difficult to define the amount of the public service demanded by a patron and, by various rate makers it has been taken as proportional to the connected load, to the maximum demand for a particular part of the year, or for each month separately, to the area of the building served, and to various other things which have seemed for the particular purposes to be convenient. The practical demand of a given consumer for the setting apart of part of the plant for his use depends on a great number of factors, most of which have from time to time been recognized in rate making, although the aggregate of all of them is too intricate to serve as a basis of a schedule which would be reasonably comprehensible and reasonably easy to carry through the bookkeeping department; hence the very loose but entirely justifiable procedure of averaging and [illegible] place and conditions convenient.

It is well known, for instance, that in residence lighting the practical reservation of equipment demanded is very much less than in the case of lighting small shops, and, moreover, comes at a totally different time. A theater, on the other hand, demands a considerable reservation of equipment in theory, but in practice calls for it at a time when the reservation does not generally mean increase of plant equipment or of relative operating costs. Again, a system rigorously worked out on any pure demand basis gives absolutely no excuse for discrimination between motor and lighting loads, assuming them to be distributed over the same system, and yet as a matter of fact it is found commercially necessary in many places to make this discrimination for the sake of fulfilling the first function of every charging system—that is, of getting profitable business.

The maximum demand system is an equally futile attempt at an equitable basis in the sense of scientific accuracy, although it has proved convenient and useful, like many another system, in certain cases. Practically the equipment reserved for a given customer depends not only on his maximum call for energy, but on its duration and frequency and on the time at which it occurs. It hence is a matter of common knowledge that certain classes of customers, notably residences, are severely punished by that particular method of averaging the standby charges. The diversity factor, in short, instead of being a small and inconsequential matter, is a very large and important one. From the standpoint of precision even a contract system at so much per lamp per month in certain classes of service is just as justifiable and just as precise as any of the others. It is merely again a question of averaging the conditions. It has been found in certain cases that one can, on the basis of the equipment installed, average the demand and the energy used at one stroke. In fact, one could, by taking a sufficient number of consumers and studying their conditions of service, devise schedules that would be substantially as effective and fair as any others, while basing them on things as diverse as the dimensions of show windows or the annual contribution of each customer to the poor box.

It is not the purpose of these remarks to decry the efforts of Mr. Marks in studying the subject of rates, but merely to point out that any attempt to evaluate rates which depend on averaging quantities which themselves vary widely is bound to produce discriminations which in many individual instances work badly. And after all, to recur to the statement with which this comment opens, the purpose of rates is to get business, and it is found in practice that in order to get that large volume of business which tends to increase production and hence to decrease costs it is necessary first or last to sell to the consumer at a price which makes the proposition of electrical service attractive to him. At a price, for example, which makes it inexpedient to operate isolated plants for lighting or gas engines for motor service. In other words, rate making in the last resort is a matter of policy, as Mr. Marks himself suggests in presenting three sliding scales derived from three different segregations of the cost, and proposing an arbitrary average price for certain classes of consumers. It is always necessary to know the cost of producing output, but the price at which it is distributed is a matter in which the best financial results are obtained only by studying the needs of the consumers.

Convention of the Pennsylvania Electric Association.

The convention of the Pennsylvania Electric Association, State branch of the N. E. L. A., to be held at Glen Summit Springs Hotel, Glen Summit Springs, Pa., Sept. 14, 15 and 16, will be made as attractive as possible from every point of view. The location, 2500 ft. above sea level, is on the main line of the Lehigh Valley Railroad. The entertainment committee is arranging a program to make the convention pleasing to the ladies and to provide amusement for all. Opportunities are provided for boating, bathing, baseball, tennis, bowling, etc.

The program committee is arranging for the preparation of the following papers: *Steam Heating, Advantageous Points in Station Operation, New Types of Lamps from the Operating Standpoint, Operation of Electrical Vehicles, Domestic Appliances, Investment Justified by Smaller Companies for Securing Motor Load, Rates.* These papers are being written from a practical standpoint and will be arranged so that members who find it inconvenient to attend all of the sessions may be able to select one day to advantage. The discussion will be made a prominent feature of the meeting.

Association of Railway Electrical Engineers.

The date of the annual convention of the Association of Railway Electrical Engineers, to be held in the Hotel La Salle, Chicago, has been changed. The convention will be held on Sept. 27-30 next, instead of a week later, as originally planned. The organization has about 400 members, and a well-attended and useful convention is anticipated. Mr. E. M. Cutting, of the Southern Pacific Railroad, Oakland, Cal., is president of the association, and Mr. George B. Colegrove, of the Illinois Central, Chicago, is secretary. This association is the successor of the Association of Car Lighting Engineers, but it has outgrown the original restricted scope indicated by that title, and is now a flourishing organization of steam-railroad men interested in electrical problems, with a wide field and an earnest purpose. Electricity is used for so many things by the steam railroads, as the operation of shop motors, car lighting, signaling systems, and the like, that the association has ample opportunity for usefulness.

A feature of the coming convention will be an extensive exhibit of electrical appliances. The Railway Electric Supply Manufacturers' Association is an affiliated organization, formed to further the interests of the manufacturers who have business relations with members of the Association of Railway Electrical Engineers. The association of manufacturers and supply men will have charge of the exhibit at the coming convention. The president of the Manufacturers' Association is Mr. W. L. Bliss, of the United States Light & Heating Company, of Milwaukee, while Mr. J. Scribner, of the Chicago office of the General Electric Company, is the secretary. Electrical manufacturers and dealers represented in the Manufacturers' Association are heartily in accord with the objects of the parent association, and are enthusiastic over the prospects for an unusually successful convention in Chicago next month.

Electricity for California Oil Fields.

The San Joaquin Light & Power Company, of Fresno, Cal., has purchased the holdings of the Power, Transit & Light Company in and about Bakersfield, Cal., together with the properties of the Merced Falls Gas & Electric Company in and about Merced, Cal. The purchase of these important properties has been made in order to secure a market for the large amount of electrical energy that will be produced by the San Joaquin company in the Crane valley on the north fork of the San Joaquin River. The newly acquired plants will be the basis of a system by which the company will supply the Kern, Midway and Maricopa oil fields with electricity for the operation of oil wells.

A large amount of the electricity now produced by the San Joaquin company is used in the reclamation of heretofore waste land around Fresno and in the pumping of water for irrigation purposes, but there will be a surplus for which the generating company is finding a new market. It has been shown that oil wells are very satisfactorily and economically operated by electric pumps, and it is proposed to use the electrical energy in the drilling of wells also.

The Power, Transit & Light Company, of Bakersfield, not only furnishes gas and electricity used in and near that city, but also owns and operates the street-railway system. The Bakersfield power house, which is now supplying the necessary electricity for these operations, will be used in the future as a substation. Electrical energy will be supplied to it at high potential by a transmission line which will connect the San Joaquin company's generating station near Porterville with Bakersfield, a distance of about 70 miles. A second transmission line from Madera to Merced, to supply the Merced system, is now under consideration.

There are three power development sites on the San Joaquin River that may be utilized eventually. At site No. 1 a dam 125 ft. high is being erected, which, when completed, will be more than 1200 ft. in length. When this dam is in use a lake 5 miles in length and more than 16 miles in circumference will be formed. The dam and power plant at this point will cost fully $1,250,000 when completed. The other dam sites are below the dam now under construction, but will not be developed until the capacity of the plant now building is reached.

Los Angeles business men are largely interested in the San Joaquin Light & Power Company, the president, Mr. W. G. Kerchkoff; the vice-president, Mr. Allan C. Balch; the secretary, Mr. L. M. Farnham, and the treasurer, Mr. K. Cohn, being from that city. The general manager is Mr. A. G. Wishon, of Fresno.

Montreal Light, Heat and Power Company Controversy.

For a year and a half or more the Montreal Light, Heat & Power Company has been lighting the streets of Montreal, Canada, without any agreement with the city as to price, except that it is to be "at such rate or charge as we (the company) may consider fair and equitable to both parties under the circumstances."

A five-year contract for furnishing 1666 arc lamps and a small number of incandescent lamps equivalent to 148 arc lamps, making a total of 1814 equivalent arc lamps, expired Dec. 31, 1908, without any arrangements having been made between the city and the company for continuing the contract. Negotiations had been carried on for over a year, during which time the City Council had endeavored to award the contract to a syndicate which proposed to erect a new plant, but was prevented from taking this action by an injunction. After further negotiations early in 1909 the present indeterminate price was accepted by the city authorities on the basis of a proposal made by the company on Jan. 14, 1909. The significant passage of the proposal is as follows:

"The Montreal Light, Heat & Power Company will be pleased for the time being, and until further notice, to continue lighting the present limits in that portion of the city streets not already under contract with the company, at such rate or charge as we may consider fair and equitable to both parties, under the circumstances, but such charges we will always be prepared to submit to arbitration."

The supply was continued and the company forwarded accounts to the city now amounting in all to over a quarter million of dollars. These accounts the city contests on the ground that they are excessive.

A few months ago the Montreal Light, Heat & Power Company began suit against the city for the amount it claimed due for the service rendered, on a basis of about $90 per arc lamp per year. The court agreed, with the consent of both parties to the suit, to the appointment of a Board of Arbitrators consisting of three men—one to be selected by the city, one by the

company and these two to select the third. The Board of Arbitration appointed accordingly consists of: Prof. L. A. Herdt, of the electrical engineering department of McGill University; Mr. R. G. Black, general superintendent and engineer of the Toronto Electric Light Company, and Mr. A. A. Dion, general superintendent and chief engineer of the Ottawa Light, Heat & Power Company.

The legal interests of the city are in the hands of Messrs. O. Lavelle, K.C., and W. H. Butler, of the city legal department, and Mr. G. H. Montgomery, K.C., represents the company. The engineering experts for the city are Messrs. Robert A. Ross, of Ross & Hoguet, consulting engineers, Montreal, and W. J. Robinson, general superintendent of the Dominion Electric Company, Montreal. The lighting company is represented by its chief engineer, Mr. R. M. Wilson; Mr. Henry Floy, consulting engineer, of New York, and Mr. R. S. Kelch, of Montreal.

The first hearings conducted by the arbitrators were held in the Court House, Montreal, on July 26 and 27. Mr. Montgomery began the proceedings for the company by giving a history of the contract between the Royal Electric Company—afterwards merged into the Montreal Light, Heat & Power Company—and the city, by which the latter was to pay $60 per arc lamp per year. This contract expired Dec. 31, 1908, and no renewal was effected, though there had been some negotiations between civic representatives and the company. The company maintained that it was losing money at $60 per lamp and announced that it would not accept a new contract at such a low figure. Mr. Montgomery then reviewed the negotiations which led finally to the appointment of the present Board of Arbitration. On one occasion, the city had suggested a method of arbitration which Mr. Montgomery referred to as "a ridiculous proposal, which was never intended to be taken seriously." Following the expiration of the contract, the company had declined to supply lighting at the former contract rate. Periodical accounts were submitted to the city for lighting supplied subsequent to the expiration of the contract, and these, the company contended, were fair and equitable to both parties under the circumstances.

In reply to a question from one of the arbitrators, Mr. Montgomery said he included in the term "under the circumstances" all that had led up to the present situation—to the fact that the lighting was not supplied under a contract, but from month to month, and was subject to voluntary cancellation at any time.

Mr. W. H. Butler contended, in reply, that the pourparlers leading up to the present situation were not pertinent to the case. A contract did exist between the Montreal Light, Heat & Power Company and the city, by virtue of the letter of Jan. 14, 1909, but there was no duration to such contract, and the city was bound to pay "a fair and equitable price." The fact that there had been pourparlers had nothing to do with determining the price of the commodity, and these did not come in under the words "under the circumstances."

"The arbitrators are called upon," Mr. Butler added, "to determine what is a fair and equitable price in virtue of the letter of Jan. 14, 1909. We say that you are not charging a fair and equitable price."

Argument then turned on a motion made by counsel for the [illegible] for more particulars of the accounts. Mr. Montgomery opposed the motion on the ground that it was nothing less than an appeal from a ruling made by Mr. Justice Lafontaine declining to grant a similar motion. The Board of Arbitration denied the motion, the city thus losing the first point.

The company then called its first witness, Mr. Arthur Parent, superintendent of the city lighting department, who testified with regard to the city's contracts with the Royal Electric Company, the predecesor of the Montreal Light, Heat & Power Company, and recited facts concerning negotiations between the company and the city looking toward a new contract before the expiration of the preceding five-year contract, which expired Dec. 31, [illegible]

At the second day's hearing, the lawyers continued to raise legal objections and legal questions, which caused proceedings to advance slowly. The company called Mr. R. M. Wilson, its chief engineer, to testify at length regarding the arc-light service furnished the city, and on the exacting requirements, such as the necessity for maintaining an extensive patrolling staff, which practically goes over the whole lighting system every night, as penalties are exacted in case of failure of the lights for even brief periods. Mr. Wilson also described the physical property of the company, which includes three steam reserve plants with operating crews, always maintained ready to take up load in case of an accident to any or all of the four water-power plants, which normally furnish all electrical energy, namely, the Shawinigan, the Chambly, the Lachine and the Soulange plants. The current is delivered within city limits at different voltages, the maximum being 44,000 volts. The Shawinigan plant delivers the largest amount of power over a transmission line, approximately 80 miles in length. The arc service is supplied mainly through overhead lines aggregating 310 miles in length connected with three substations advantageously located in different portions of the city.

On account of the illness of the general manager of the Montreal Company, hearings were adjourned for two weeks, until Aug. 10, when the company will submit figures in detail showing investment costs, maintenance, depreciation and other items relating to the expense of maintaining arc service.

New President for the Westinghouse Electric & Manufacturing Company.

At the annual meeting of the stockholders of the Westinghouse Electric & Manufacturing Company held in Pittsburgh on July 27 the four members of the board of directors whose terms expired at that time were re-elected. These directors are Messrs. A. G. Becker, Chicago; George M. Verity, Middletown,

Pres. Edwin F. Atkins.

Ohio; William McConway, Pittsburgh, and Charles A. Moore, New York.

At a meeting of directors held in New York on July 29 all of the former officers, consisting of Messrs. Robert Mather, chairman of the board of directors, New York; George Westinghouse, president, Pittsburgh; E. M. Herr, first vice-president, Pittsburgh; L. A. Osborne, second vice-president, Pittsburgh; Charles A. Terry, third vice-president, New York; G. W. Hebard, acting vice-president, New York; H. D. Shute, acting vice-president, Pittsburgh; W. A. Esselstyn, secretary, New York; T. W. Siemon, treasurer, Pittsburgh; H. F. Baetz, assistant treasurer, Pittsburgh; E. St. John, assistant treasurer, New York; James C. Bennett, comptroller and auditor, Pittsburgh, and W. B. Covil, Jr., assistant auditor, Pittsburgh, were re-elected with the exception of the president.

Mr. Edwin F. Atkins, a director in the company, was chosen [illegible] Boston, in [illegible]

and received his education in the private schools of that city. In 1903 the honorary degree of A.M. was conferred upon him by Harvard University. He is principally known as a manufacturer and importer of Cuban sugars. He was president of the Bay State Sugar Refinery Company in 1878-88, and a partner in E. Atkins Company, importers of sugars, commission merchants and bankers, since 1874. He was also vice-president and director of the Union Pacific Railway system from 1889 to 1895. He is now president of Ætna Mills Soledad Sugar Company, Cuba; Trinidad Sugar Company, Cuba; Boston Wharf Company, and director of American Trust Company, Eliot National Bank, West End Street Railway, Guarantee Company of North America and the American Sugar Company. Mr. Atkins' home is at Belmont, Mass. He is a member of the Belmont Spring Club, the Oakley Country Club, the Brookline Country Club and the Boston Exchange Club.

Ohio Electric Light Association Convention.

The sixteenth annual convention of the Ohio Electric Light Association was held at Cedar Point, on Lake Erie, near Sandusky, July 26, 27 and 28, 1910. The registration reached 355, exceeding all previous records. It seemed to be generally agreed that the association has at last found a satisfactory convention place which is free from the heat of the larger cities and more convenient than Put-in-Bay Island, where so many of the former conventions have been held. Cedar Point is a bathing resort located just across Sandusky Bay, about 15 minutes from Sandusky by boat. Hotel Breakers furnished the accommodations.

The first session was scheduled for Tuesday morning, but owing to lateness of arrival of many, the session was postponed and consolidated with the afternoon session of that day. The first session was therefore called to order at 2 p. m. Tuesday. President J. C. Rothery, of East Liverpool, having moved from the state, the duty of presiding fell upon Vice-President E. H. Beil, of Youngstown. In his opening address Mr. Beil called attention to the fact that the Ohio Electric Light Association is now second only to the National Electric Light Association in strength and number of members, which fact should be a source of much satisfaction to the Ohio men. He said that the association is of well recognized value for the exchange of ideas about the management of plants, but it is even more important in enabling members to keep posted as to possible legislation and to combat bad legislation when proposed. Commenting on the rapid changes in the electric lamp situation, he called attention to the fact that it was only five years ago that Dr. Louis Bell presented a paper on the tantalum lamp before the Denver convention of the N. E. L. A. This lamp indicated a saving of 40 per cent over the older types, but in five years it has been superseded by the much more efficient tungsten lamp. It is impossible to tell what the next five years will bring forth. He referred to the fears entertained by many central-station companies as to the effect of tungsten lamps on earnings, stating that as a matter of fact the results had not been as bad as feared, in some cases being quite the contrary.

Mr. E. A. Bechstein, chairman of the committee on general arrangements and manager of the Sandusky Gas & Electric Company, made a brief address of welcome. This was followed by the report of the secretary and treasurer, Mr. D. L. Gaskill, of Greenville, who showed the association's finances to be in excellent shape with a balance of $446.88 in the treasury. One of the reasons for this good showing was the amount of nearly $2200 received from advertising in the association's souvenir program for 1910. This souvenir program was a very handsome piece of work bound in violet leather. The secretary announced that during the year the association had been legally incorporated as an association not run for profit. The auditing committee, consisting of Messrs. J. T. Kermode, of Cleveland, and T. D. Buckwell, of Toledo, reported having audited the treasurer's books and found them correct. Applications for membership from 14 central-station companies for [illegible] and 8 manufacturing and supply [illegible] for associate membership were received and accepted.

Certain amendments to the constitution which were discussed at the last convention were again brought up, these amendments covering the method of electing officers and appointing the nominating committee. The amendments were drawn with a view of preventing clique rule and at the same time assuring the selection of men who are familiar with the policies and methods of the association and who have demonstrated their willingness to work. As Mr. M. E. Turner, of Cleveland, who drafted these amendments and who has given the subject much attention, was absent, and as no other members felt competent to discuss the change without further study, the matter was tabled, with the understanding that it would be taken up at a later session if Mr. Turner arrived, or if not, at the next convention.

STEAM TURBINES.

The first paper taken up was "Low-Pressure Turbines and Their Operation," by W. C. Anderson, manager of the Canton Electric Company. He briefly discussed the advantage of the steam engine for utilizing high boiler pressures and the turbine for utilizing pressures below atmospheric or vacuum, and described an installation of a 500-kw turbine which his company has made at Canton. This is a combined mixed and low-pressure turbine, which fits very well into conditions in that station.

The second paper was by Mr. Frank Brosius, of the Columbus Railway & Light Company, on "Turbine Troubles." All of the Columbus men being absent on account of the street railway strike at Columbus, this paper was read by Mr. F. M. Tait, of Dayton. Abstracts of these two turbine papers are given elsewhere in this issue. Their presentation brought out considerable discussion, which was participated in by Messrs. W. S. Townsend, of East Liverpool; John C. Gilmartin of Toledo, and others. This discussion ended the Tuesday afternoon session.

On Wednesday morning after announcements by the secretary of entertainment features, Secretary Gaskill moved that a nominating committee be appointed according to the proposed amendments to the constitution, namely, that the association elect two members, that the president appoint one member and that the two retiring members of the executive committee act on the nominating committee. This motion being carried Messrs. S. M. Rust, of Greenville, and F. O. Plymale, of Gallipolis, were elected members of the nominating committee by the association. The president appointed Mr. W. J. Hanley, of the General Electric Company, Cleveland. The two members from the executive committee consisted of Mr. W. P. Engle, of Defiance, and Mr. W. F. Hubbell, of Wauseon, these being the retiring members of the executive committee.

MODERN SINGLE-PHASE MOTORS.

Much interesting information concerning the present standing of single-phase motors, the available types and their relative advantages, was given in a paper by Prof. F. C. Caldwell, of the Ohio State University. The author outlined the performance characteristics of the series motor, the induction motor, the repulsion motor and the repulsion-induction motor. One or more of these types are made in this country by 10 different manufacturers. The motors range in rating from 0.05 hp to 50 hp, with efficiencies from 50 to 87 per cent and power factors from 50 to 99.5 per cent, the highest power factor being obtained with the repulsion-induction motor. Of the total of 1043 motors used by 18 of the member companies, 70 per cent were rated at not over 1 hp, while less than 1 per cent had a rating above 5 hp.

In the absence of Prof. Caldwell his paper was read by the secretary. The paper was briefly discussed by Mr. B. H. Gardner, of Dayton.

ELECTRIC VEHICLES.

"What Progress Is Being Made in the Introduction of Electric Vehicles in Ohio" was the subject of a paper by Mr. J. T. Kermode, of Cleveland, who gave electric vehicle statistics from a number of cities showing Cleveland to be in the lead. This paper was discussed at considerable length by Messrs. R. E. Russell, of the General Electric Company; D. L. Gaskill, of

Greenville; C. W. Chapelle, of the Electric Storage Battery Company; R. W. Lagenke; John Gilmartin, of Toledo; F. M. Tait, of Dayton; W. C. Anderson, of Canton, and W. R. W. Griffin, of East Liverpool.

BUSINESS-GETTING METHODS.

In a paper entitled "Methods of Obtaining New Business in Cities of Fifteen Thousand and Less," Mr. L. A. Pettit, Jr., of the Middletown Lighting Company, discussed the scope, organization and management of a new-business campaign in a city of the size designated. The author claimed that as much, if not more, time and money should be expended in the education and in the stimulation of interest among present consumers as among prospective consumers. He laid particular emphasis on the desirability of gathering complete information as to existing conditions in the community, this information being tabulated as simply and conveniently as possible. The data should cover the location and description of each residence or office building whether wired or not, and each factory, specifying the output operating conditions, motor and lighting service requirements. The information can be kept best by means of a card-index system arranged according to the location of the buildings; various colored cards may be used to distinguish between wired and unwired buildings. The employees of the company should be well-instructed solicitors thoroughly familiar with the latest developments in energy-consuming devices. The company should maintain a show-room for displaying all electrical appliances that can be classed as necessities rather than luxuries.

In discussing this paper Mr. W. S. Townsend told of some novel methods used at East Liverpool for advertising the company.

TUNGSTEN STREET LIGHTING.

On Wednesday afternoon Mr. Claude C. Smith, of the Bradford & Gettysburg Electric Light & Power Company, read a paper giving his experience with series-tungsten lamps for street lighting. This was followed by a similar paper by Mr. C. C. Custer, of the Miami Light, Heat & Power Company, Piqua, Ohio. Messrs. C. J. Crippen, of Youngstown; W. S. Townsend, of East Liverpool; J. R. Cravath, of Chicago; James O'Toole, of Hamilton; F. Glosser, of Marion; Harry G. Glass, Westinghouse Company, and others, gave their experiences with tungsten street lighting. Abstracts of these papers and the discussions are given elsewhere in this issue.

TRANSMISSION OF ENERGY.

Mr. D. L. Gaskill called attention to the growing importance of long-distance transmission to supply small towns with energy from a central plant and moved that the chair appoint a standing committee of three on long-distance transmission to make a report at the next convention. This motion was carried.

EFFECT OF TUNGSTEN LAMPS UPON THE EARNINGS.

A clear discussion of the relation between high-efficiency lamps and rates for energy for lighting service was given in a paper by Mr. E. L. Booth, of the Bellaire Light & Power Company. The author remarked that without question any condition which retards the adoption of a more efficient means of production, is fundamentally, from an economic standpoint, at serious fault. A more efficient means of converting electrical energy into light should create an actual economic saving to the central station. However, under most of the existing methods of charging for electrical service and electrical energy all of the economic saving created by the high-efficiency lamp goes to the consumers, and sometimes they even secure a reduction in the cost of light greater than the actual economic saving; the difference, of course, is direct loss to the central station.

In order to overcome the present defects the central station's costs which are proportionate to the maximum demand and those which are proportionate to the number of consumers should be combined and applied to the consumer as a service charge. They should be applied in such a way that the convenience of electrical service will not have to be sacrificed on account of prohibitive cost, and in such a way that the small consumer will not feel that he is being discriminated against in favor of the large consumer. It should not limit the free installation of lamps or energy-consuming devices by imposing a charge on the connected load, but rather on the consumer's maximum demand upon the central station for energy. The kw-hour rate should be made so low that a reduction in the consumer's energy consumption, no matter how great it may be, could never reduce the revenue derived from the consumer below the cost of serving him and supplying him with energy. If the service charge had been equitably established the only reduction in cost the consumer would receive would be that due to the decreased consumption of energy. The revenue which the central station could earn with a given station output would then increase with the number of consumers which it could serve.

The effect of the high-efficiency lamp upon the central station's earnings resolves itself into the question of rates, and the ability of the central station to secure new business. The greatest field for securing new business with high-efficiency lamps is among the small consumers, and in the residential districts. This should improve the load factor of the central station, because with the increase in the number of small consumers the average simultaneous demand of the consumer decreases, and with a development of residential lighting, the commercial and domestic peaks not being coincident, should enable the central station to add many new consumers without increasing the maximum demand on the central station, and thus increase the earnings. With the increased number of consumers there should be greater opportunities for developing off-peak business by the introduction of flatirons, motor fans, toaster stoves, vacuum cleaners, and numerous other energy consuming devices, thus adding to the central station's receipts. The central stations should get together and formulate a uniform method of charging for electrical service and energy that will apply with equity to all sources of electrical illumination, no matter how efficient they may be, and that will make it possible for the economic saving created by the high-efficiency lamps to be fairly divided between the central station and the consumer.

In discussing Mr. Booth's paper Mr. M. B. Cooper, of the engineering department of the National Electric Lamp Association, pointed out that the effect of the tungsten lamp on earnings is largely a question of rates and he reviewed some recent ideas on the rate question in which there is a tendency to increase the fixed demand charge and decrease the output or kw-hour charge made to consumers. He favored basing the demand charge on the area to be lighted instead of the connected load. Mr. B. H. Gardner, of Dayton, pointed out some difficulties with the systems with high readiness-to-serve charges and also with the schemes for flat-rate residence lighting which have been proposed, namely, those using low-voltage tungsten lamps and those using an excess demand indicator or flat-rate controller.

OFF-PEAK LOAD.

A paper on "Securing Off-Peak Load" was read by Mr. Harry G. Glass, of the Westinghouse Electric & Manufacturing Company. He stated that the desirability of securing off-peak load is generally acceded, and what concerns most managers is how to secure this load. He then made a number of suggestions as to methods to be employed, his paper being in general similar to papers given before the Minnesota, Nebraska and Iowa conventions and already abstracted in these columns. Mr. J. C. Martin, of Wilmington, discussed this paper at length, telling of building up the day load in Wilmington where he has about 85 per cent of all the possible power business in the town.

EQUITABLE MOTOR-SERVICE RATE.

Mr. B. H. Gardner, of the Dayton Lighting Company, outlined a motor-service rate which he claimed to be equitable in all respects. The rate is based on the desirable income per kilowatt of demand rather than the income per kw-hour. As an example he fixed a rate under certain stated conditions at 12 cents per kw-hour for one hour's use of the demand per month. To this value he added a certain percentage to the

cost of producing the energy, the percentage for a use exceeding 110 hours being 30. The author claimed that it is more profitable to sell energy at 4 cents per kw-hour when the income per year per kilowatt is $100 than to obtain 15 cents per kw-hour when the income is only $50 per kilowatt per year.

Mr. Gardner's paper was discussed by Messrs. M. B. Cooper, of the National Electric Lamp Association; F. M. Tait, of Dayton, and W. C. Anderson, of Canton.

CENTRAL-STATION FACTS AND FACTORS.

Mr. J. R. Cravath, of Chicago, presented in the form of a table, and a discussion thereof, certain facts as to the investment, income, operating data, territory served, etc., relating to 13 central stations in Ohio. The information was compiled according to the method shown in our issues for April 29, May 6 and June 24, 1909, and Jan. 13, 1910. The companies are indicated by numbers, the numbers herein used being selected to conform in sequence to the numbers shown in our issue for Jan. 13, 1910. In connection with the averages for the 13 Ohio stations are shown the averages for 26 Iowa stations tabulated in our issue for May 6, 1909.

CENTRAL STATION FACTS AND FACTORS

Company Number..	23	24	25	26	27	28	29	30	31	32	33	34	35	Ohio Aver	Iowa Aver
Kw rating of stations	80	100	120	110	202	80	205	120	450	1,050	1,150	1,350	5,500	..	..
Total population of district served	1,000	1,500	2,000	3,000	3,000	1,200	5,000	6,000	8,500	12,000	16,000	25,000	125000		
Total liabilities per kw of station equipment	[illegible]	$300		$136	$143	$125	$582	$125	$119	$128	$220	$435	.....	$220	$220
Gross yearly income per kw of station equipment	$40	$60		$90	$55	$56	$108	$73	$73	$53	$50	$50	$73	$63	$90
Gross yearly income per $100 liabilities	[illegible]	$20		$66	$25	$45	$19	$60	$61	$41	$20	$11.50	$7.49	$35	$45
Per cent. of cross yearly income spent for operation, including everything but interest and depreciation.	[illegible]	[illegible]		72	47	45	51	60	64	55	80	60	58	57.5	65
Yearly operating expenses per $100 liabilities	$22	$10		$50	$12	$20	$9.54	$36	$39	$22	$17	$7	$4.33	$20.75	$27
Total connected load in kw per kw of station equipment	1 [illegible]	1.5	0.8	1.8	0.81	1.5	2.9	0.75	2.46	1.4	2.0	1.2	2.0	1.75	1.8
Connected kw load in lamps per kw of station equipment	1 [illegible]		0.8	1.0		1.5	1.86	0.75	1.72	1.14	1.25		1.06	1.17	1.4
Connected kw load in motors per kw of station equipment	[illegible]		0	0.7		0	0.73	0	0.24	0.19	1.50	.	0.94	....	0.3
Connected kw load in heating apparatus per kw of station equipment	0.0		0	0.7	.	0	0.30	0	0.49	0.07	0.02		...	...	0.1
Kw hours sold or accounted for per 100 kw hours generated				90	66		.	90	.	74.3	75	89	90	.....	.....
Kw transformer equipment per kw of alternating current station equipment	0.8		1.0	.	0.5		..	2.5		0.5	0.5	3.7	1.82	1.41	1.1
Kw transformer equipment per kw of connected load	0.8		2.0		0.56	.	..	0.88	0.55	0.5	0.37	0.46	....	0.76	......
Kw transformer equipment per kw connected in residence district	0.8						.	0.83	...	0.61	0.25	...	.	0.62	...
Kw station equipment per employee all departments	80	50	60	27	67	40	10	60	50	50	100	50	50	53	63
Yearly load factor—per cent		28.8		23	27.4		26.4	22		30	25	30	28.1	26.8	32
Gross yearly income per capita of population	$[illegible].20	$4.00		$3.30	$2.40	$3.75	$4.44	$1.20	$3.48	$4.64	$3.50	$2.72	$3.23	$3.30	$3.93
Liabilities per capita	$7.40	20.00		$5.00	$9.66	$8.35	$2.30	$2.50	$5.70	$11.21	$14.00	$23.52	$43.00	$11.20	$9.00
Watts station rating per capita	80	66	60	37	67	66	41	20	47	87	64	54	44	56	44
Number of consumers per 100 of population	7.5	13	2.5	9.6	4.0	8.9	10.22	3.0	10.8	7.9	6	4.3	3.12	7.0	9.0
Number of residence consumers per 100 of population	5.5	10	2.2	6.0	1.0	7.0	5.44	1.5	9.0	5.8	4	2.7	...	5.0	....

Mr. D. L. Gaskill pointed out that although much thought had been given to simplifying these items so that any company which has its records in proper shape could fill them out, a number of companies had reported to him that they did not have the necessary records to answer these questions. Mr. Gaskill expressed the opinion that any company which is so ignorant of the fundamental facts of a business as to be unable to supply most of the information called for in the table which had been presented is like a ship in dangerous waters and should get in shape immediately to know what it is doing. Mr. J. C. Martin, of Wilmington, also spoke strongly as to the value of a comparison of this kind of statistics and urged that a standing committee continue this work. Mr. D. L. Gaskill moved that the matter of collecting information of this kind be referred to the publicity committee in connection with Mr. Cravath and make another report at the next convention. This was carried. Mr. C. W. Lee, of New York, expressed the opinion that there is too much of a tendency among central-station companies to withhold information of this kind. If they have such information available there will be less trouble in store for them when control by commission becomes the law.

ELECTION OF OFFICERS.

On Thursday afternoon the opening of the session was occupied with appointment of committees and election of officers. The president announced the appointment of the following committee on long-distance transmission in accordance with a motion carried at a previous session: Messrs. J. T. Kermode, of Cleveland; W. S. Townsend, of East Liverpool, and John C. Gilmartin, of Toledo.

Officers for the ensuing year, in accordance with the recommendations and report of the nominating committee, were elected as follows: President, Mr. E. H. Beil, of Youngstown; vice-president, Mr. W. C. Anderson, of Canton; secretary and treasurer, Mr. D. L. Gaskill, of Greenville. Executive committee, Messrs. E. A. Bechstein, of Sandusky; Sheldon Roberts, of Columbus; J. C. Martin, of Wilmington; W. S. Townsend, of East Liverpool, and W. E. Richards, of Toledo; advisory committee, Messrs. Samuel Scovil, of Cleveland; F. M. Tait, of Dayton, and D. L. Gaskill, of Greenville; publicity committee, Messrs. E. L. Booth, of Bellaire; C. M. Lott, of Hicksville, and Claude C. Smith, of Bradford; finance committee, Messrs. J. T. Kermode, of Cleveland; B. H. Gardner, of Dayton, and F. O. Plymale, of Gallipolis; membership committee, Messrs. W. J. Hanley, of Cleveland; E. Van Winkle, of Cleveland; Paul Stewart, of Cincinnati; P. J. Williams, of Columbus; F. C. Caldwell, of Cincinnati; N. C. Cotabish, of Cleveland, and I. M. Cassell, of Cleveland.

Mr. F. M. Tait, of Dayton, spoke in the highest terms of the work done for the association by its secretary, Mr. D. L. Gaskill, and said that the salary was nowhere near commensurate with the value of the work. Frequently Mr. Gaskill was obliged to neglect his own work to look after association matters. He moved an increase in the secretary's salary from $750 to $1200 per year. Mr. J. C. Martin, of Wilmington, seconded this motion and in doing so called attention to the broad field of increased usefulness which is opening before the association. He referred especially to the work which might be done in connection with insurance rates and in helping to frame up legislation under which the companies can operate if commission regulation is to come. The motion was carried.

TESTING WATT-HOUR METERS.

Mr. John Gilmartin, of the Toledo Railway & Light Company, arranged for publication, with personal comments, the replies received from the member companies to questions relating to the methods employed and advocated for maintaining the accuracy of watt-hour meters in electric lighting and motor service.

Following the presentation of Mr. Gilmartin's paper, Mr John T. Kermode, of Cleveland, moved that a standing committee be appointed to make a report at the next convention. This was carried and the president appointed Messrs. John Gilmartin, of Toledo; J. T. Kermode, of Cleveland, and O. H. Hutchings, of Dayton.

THE PURCHASE OF STATION APPARATUS.

In a paper entitled "Best Methods to be Followed in the Purchase of Station Apparatus," Mr. R. J. Feather, of the Columbus Railway & Light Company, outlined a method to be used

in selecting apparatus for a generating station. The method is based on the relative total costs of the apparatus offered, the costs including not only the initial installation, but the running expense and depreciation capitalized. The interest on these costs are compared with the yearly cost of the energy lost and selection is made of that apparatus which shows the lowest relative energy lost on the basis of its total cost.

In the absence of the author, this paper was read by Secretary Gaskill. After a short discussion of the paper, Mr. Bechstein, of Sandusky, moved the appointment of a committee on motor applications to report at the next convention. This was carried and the president appointed Messrs. E. A. Bechstein, of Sandusky; C. I. Crippen, of Youngstown, and B. H. Gardner, of Dayton.

Mr. F. M. Tait, of Dayton, moved that a vote of thanks be extended to Mrs. Clara Turpen Grimes, of Dayton, and Mrs. Mannix for the very enjoyable music furnished at various occasions during the convention, and to Mr. P. B. Arnold, of the Union Spring Company, Pittsburgh, Pa., for his sleight-of-hand entertainment Tuesday evening; also to the management of the Cedar Point hotel and resort for the excellent provisions for the convention. The convention then adjourned.

THE PRESIDENT ELECT.

Mr. E. H. Beil, president-elect, is assistant engineer of the Mahoning & Shenango Railway & Light Company, which is the holding company controlling six companies, including the

Pres E. H. Beil.

Youngstown Consolidated Gas & Electric Company. Mr. Beil's work is the management of the light and power department of the Youngstown Consolidated Gas & Electric Company, in which work he has been engaged since 1905. Mr. Beil received a common-school education and started as an oiler in the plant of the Youngstown Electric Light Company in 1893. He worked up through various positions to that of superintendent of the light and power company in 1905. He is 35 years old, and for a number of years past has been active in Ohio Electric Light Association affairs.

ENTERTAINMENT FEATURES.

Cedar Point has probably the finest bathing beach on the Great Lakes. Although various other entertainment features were provided, bathing naturally led the list. For the ladies during the convention sessions music and cards were the order of the day Tuesday and Thursday afternoons. Wednesday afternoon they were taken for a launch ride on Sandusky Bay and Thursday morning were given a bowling party.

Tuesday evening at 7 o'clock the entire association was tendered an informal dinner at the Breakers Hotel, after which Mrs. Clara Turpen Grimes sang a number of times to a very appreciative audience, and Mr. T. B. Arnold gave some very mystifying sleight-of-hand performances with cards. This dinner was followed by a visit to [illegible] of the Cedar Point resort, for which tickets were provided for all attending the convention. On Wednesday evening there was a banquet at 7 p. m., at which music was the entertainment. Mrs. Grimes again sang a number of selections, and the convention joined in singing a number of popular songs, the words of which were printed and distributed with the menus. This was followed by dancing at the dancing pavilion. Thursday evening the theater was visited.

Tungsten Street Lighting Experience.

At the Cedar Point convention of the Ohio Electric Association, Mr. Claude C. Smith, of Bradford, Ohio, presented a paper outlining the experience of the Bradford & Gettysburg Electric Light & Power Company with series tungsten lamps used for street lighting. In November, 1908, the company installed a series street-lighting system using the 75-watt, 60-cp tungsten lamp, which was the largest unit then available. The specifications of the local committee on street lighting called for mast arms not less than 16 ft. long, the lamps to be 16.5 ft. above the roadways. These mast arms were built by the local linemen and were of 1.25-in. iron pipe trussed with the ⅜-in. iron rods, which were spread about 18 in. apart near the center of the area by a V-shaped spreader iron. The arms cost complete installed on poles about $4 each. Four men with a horse and wagon erected on an average of 20 arms per day. On the last installations the ⅜ truss was displaced with No. 4 steel messenger cable, which makes the work of erecting and adjusting the arms much easier. These mast arms have given little trouble, there having been only one failure, which was due to the heel bolts pulling out of the pole; the truss rods prevented the arm from coming in contact with the ground and was in no way damaged, the lamp filament remaining intact. Two instances were noted where the slip socket was blown from the hood by violent wind storms. The actual number of lamp filaments broken by storms was three for the year. Four lamps were broken by stones and other missles, 57 lamps were lost by burnouts and 35 lamps proved defective after a few hours' burning due to the failure of the cement joint between the filament and the leading-in wires. This defect was notable only on the first consignment of lamps and they were replaced gratis by the manufacturer.

While different makes of lamps were tried, the experience showed that they all have weak features, such as poor joints, early blackening and short life. At present these faults are almost eliminated. Six series sockets have been destroyed by excessive arcing across the film cut-outs. On the Gettysburg installation of 20 lamps gauze film cut-outs were first installed, but they gave some trouble from jumping over and were too sensitive. They were replaced with mica strips. This 20-lamp installation receives energy from the 220-volt mains through a 3-kva, variable-tap transformer and a series regulator; the 60-lamp plant has a 11.5-kva, variable-tap transformer and a series regulator. The variable-tap transformers are arranged with taps at 12.5 per cent, 25 per cent, 37.5 per cent, 50 per cent, 62.5 per cent, 75 per cent, 87.5 per cent and 100 per cent voltage. The series regulators have given excellent service, which is corroborated by the small number of lamp renewals. With regulators of this type no short-circuiting device is required for starting, the 220-volt primary on the installations being opened and closed by 8-day time switches. These switches gave some trouble during the extremely cold weather of last winter and frequently stopped about the hour when the arc circuits were due to be cut out in the mornings. This trouble was eliminated by installing small heating elements (about 15-watt consumption) inside the clock cases.

The life of the 75-watt, 60-cp, series tungsten street lamps has been very good, in fact much better than was expected. The average life of lamps for the Bradford installation of 60 lamps from Feb. 1, 1909, to Feb. 1, 1910, was about 2300 hours. The maximum life of the oldest lamps on June 25 was 5280 hours, and these lamps are still in service.

The lamps are spaced about 400 ft. apart and give satisfactory illumination.

A second paper on the same subject was presented by Mr. C. C. Custer, of the Miami Light, Heat & Power Company, which has used the series incandescent lighting system for about 10 years. The first installation consisted of 32-cp, 5.5-amp carbon lamps consuming 4 watts per candle, receiving energy from an alternating-current system through a constant-current regulator. Subsequently use was made of 4-amp, 32-cp graphitized carbon lamps consuming 2.7 watts per candle. In 1908 the 32-cp tungsten lamp consuming 1.25 watt per candle was adopted. The carbon lamps had an average life of 1200 hours, the graphitized carbon lamps operated for about 800 hours each, while the average life of the tungsten lamps has been about 3300 hours, excluding those that proved defective initially. About 20 per cent of the tungsten lamp breakage was the result of causes outside of the lamp itself; namely, crosses with high-tension wires, lightning discharges and the vandalism of small boys. Those broken by lightning are easily distinguished by a kink almost always found in the filament.

The higher first cost of the series tungsten lamp is more than offset by its longer life. It gives a better quality of light than the carbon or graphitized lamp, and a decided saving is made in the energy necessary to operate the lamp. The lamp is possibly a little more fragile than the carbon series lamp, but there ought to be very little breakage from this cause if the lamps are installed properly. In order to protect the lamp from vibration it is better to suspend the lamp from a span wire or other flexible means of support and avoid rigidly attaching the lamp. Where a mast arm is used it is better to have the mast arm terminate in a pulley through which the lamp may be suspended by a rope and not rigidly attached to the mast arm. The tungsten lamp is also better fitted for operation on series circuits than the carbon or graphitized lamp for the reason that it will withstand surges of current without injuring the filament.

In series incandescent lighting there is always some trouble experienced with open circuits, because if a lamp is broken when the current is not on the circuit, the open place must be located before the circuit may be put in operation. In case of an open circuit it is hazardous to the life of mercury-arc rectifier tubes to attempt to puncture the cut-out films in the lamp by throwing the tube on the circuit. However, the trouble from open circuits has been minimized by the following method: A series receptacle is put on each arc panel of the switchboard and when the arc circuit is not in operation a 4-cp lamp is run in series with the circuit all day, from current furnished from the neutral and one of the outside wires of the Edison three-wire system. These pilot lamps give a continuous visual test of the condition of the circuit in regard to the open circuits or grounds, so that the state of the circuits can be seen at a glance and open circuits immediately detected.

DISCUSSION.

Mr. C. I. Crippen, of Youngstown, said that on two occasions his company had lost every tungsten lamp on a circuit; the cause was not exactly known. It was supposed to be due to a "cross" or kick in the regulator. The series-tungsten lamps are very satisfactory to the citizens.

Mr. W. N. Townsend, of East Liverpool, said that his company operates 60 series-tungsten lamps on an arc-lamp circuit. Some trouble from breakage had been experienced where tungsten lamp-bracket fixtures had been placed on poles from which railway span wires were supported. At Midland, Pa., the constant-current transformer is operated without an attendant.

In answer to a question, Mr. Custer said that the brackets from which trouble had been experienced in breakage of lamps were located on street railway poles. These brackets might prove all right if located on ordinary poles where there is but little jar.

Mr. Jas. O'Toole, of the Hamilton (Ohio) Municipal Plant, reported having in operation 300 tungsten lamps. He ties the constant-current regulator arm so as to limit the current to 7.5-amp maximum. The operation had been very satisfactory.

Mr. O'Toole suggested that if the tungsten lamps were hung in the center of the street in such a competition it would give the electric lamp an advantage which the gas lamp could not show.

Mr. F. Glosser, of Marion, told of losing a street-lighting contract with tungsten lamps in competition with gas-mantle burners. The gas-mantle burners were claimed to be of 100 cp. The council and citizens agreed that the tungsten lamps of lower rated candle-power really gave more light, but the high rating of 100 cp for the gas-mantle burners, he said, secured the business to gas.

Mr. J. R. Cravath, of Chicago, told of some tests of gasoline street lamps which had been made in that city, which showed that the mantle burners were far below their rated 60 cp. Most of them were below 30 cp and many below 20 cp, yet a gasoline burner is much more likely to maintain its candle-power than is a natural gas burner because of the variation in pressure. If, therefore, a company could get a street-lighting contract based on actual performance rather than on rated candle-power, the tungsten lamp would be sure to come out ahead.

Mr. Harry G. Glass told of his experience with a Pennsylvania central station in which a street-lighting competition came up, and wonderful claims were made for the candle-power of the gas lamp. By taking the council over to a neighboring town where gas lamps had been in service for some time and the candle-power had depreciated, the day was won for the electric light.

Mr. W. C. Anderson, of Canton, suggested that if the gas company does not furnish the candle-power contracted for, a test of the lamps in service is in order. In his case he had convinced the council that actual performance rather than rated candle-power should be considered.

Co-operation in Selling Electricity and Electrical Goods.

The last meeting of the Electric Club of Chicago for the season, on July 27, was marked by an informal discussion on "Co-operation Between Central Stations and Manufacturers of Electrical Appliances." At least, that was the title given in advance, although the discussion broadened out to include co-operation with the jobber, dealer and contractor. The first speaker was Mr. H. E. Niesz, manager of the Cosmopolitan Electric Company, who called attention to the diversified demand made by central-station companies on manufacturers for electrical machinery and supplies. This demand begins in the generating station itself, and includes the transmitting and distributing lines connecting the power house with the customer's premises. The large quantity of different kinds of electrical apparatus needed to supply this demand is remarkable. The investment necessary on the part of the central station is very large, and the fixed costs on it constitute a large proportion of the cost of producing electrical energy. The cost of the transmission and distribution, including conduit, cables, junction boxes, transformers, overhead lines, lightning arresters, etc., is perhaps three or four times the entire cost of the generating station itself.

This business is placed with the manufacturers by the central-station companies themselves, but in addition, there is the large item composed of energy-consuming devices installed on customers' premises, such as lamps, motors, meters, heating appliances, etc. Sometimes these are purchased by the company and sometimes by the customer. To show the element of cost entering into the production of electrical energy by the amount spent by central-station companies in buying supplies from manufacturers, Mr. Niesz mentioned one item. He said that every kw-hour sold in Chicago, for instance, contains a charge of ½ cent for lamp renewals where standard carbon-filament lamps are used. This fact illustrates the extent to which manufacturers are interested in the central-station business.

How to bring about better co-operation between the central stations and manufacturers is a problem. Mr. Niesz considers that one opportunity for reaching a better understanding is afforded by the electrical show. Here the sellers of electricity

and of electrical apparatus can meet and assist each other. One class is largely dependent on the other. Devices for the use of electricity must be available before electricity can be sold. The electrical show affords one means of co-operation, but there are many other ways of "getting together" which may be employed.

Mr. E. L. Callahan, of H. M. Byllesby & Company, touched on the merchandising of energy-consuming devices. The central station has only recently awakened to the necessity of establishing new-business departments and of having a management combining commercial skill with engineering ability. Electric-service companies, even in small towns, are now endeavoring to sell electrical energy at all hours of the day. Manufacturers should, and do, co-operate by sending representatives to spend some time with the central-station companies, going out with the representatives of the latter to visit possible customers and to make tests and give expert advice in cases where steam or gas engines may be replaced by motors, for example. The manufacturers' experts thus actually help the central-station men to get the business. This missionary work increases the business of both the manufacturer and the local company, and methods of this kind should be retained and extended. This form of co-operation may be extended almost indefinitely, and may be applied not only to motors, but to signs, heating appliances and many other classes of work.

Mr. S. F. Dibble, of the General Electric Company, referring more particularly to the sale of motors, said that the central stations depend to an increasing extent on the manufacturers for direct assistance and co-operation. This assistance is readily extended, and the results are mutually satisfactory. The speaker laid especial emphasis on the maintenance of proper selling prices by central-station companies. He said that the prices established by the manufacturer should not be cut. The electrical dealers naturally resent the selling of electrical apparatus below the regular price by central stations, and their influence may prevent not a few steam or gasoline plants from being replaced by electric motors. The central station has more prestige, perhaps, than the dealer in trading with the public, and its interests and those of the manufacturer should be identical. Cut prices result in retaliation by dealers and a demand on manufacturers that may ultimately result in cheapening the product, and in some degree, at least, in a demoralization of the business.

Mr. R. H. Kilner of the Westinghouse Electric & Manufacturing Company spoke of co-operation in advertising. The manufacturers are glad to furnish attractive pamphlets, circulars and other trade literature free of charge for distribution by central stations to their customers. The manufacturer is glad to disseminate information over his own trade name. This form of co-operation also relieves the central station of much detail work. It also assures the manufacturer that the statements made refer to up-to-date machinery and supplies, and not to devices that are practically obsolete. It is beneficial both to the manufacturer and to the central station to put into service the latest types of apparatus to secure the resulting economy.

Mr. W. T. Dean, of the General Electric Company, said that his company is heartily in favor of close co-operation. Motor specialists, heating specialists, lamp specialists and others are sent far and wide over the country to do educational work. These specialists are high-grade technical men, capable of giving engineering advice of value in the various branches of the industry to which they devote their attention.

Mr. J. Scribner, of the General Electric Company, said that no argument is needed on the question of co-operation; all will agree that it is highly desirable. If the central station cannot sell its output the manufacturer cannot sell his appliances. That co-operation is very essential is, therefore, self-evident.

Mr. C. A. S. Howlett, of the General Electric Company, declared that the central station should sell electrical energy and the manufacturer should sell the devices. If the former does sell the latter's devices, it should maintain the established prices.

Mr. F. A. Ketcham, of the Western Electric Company, spoke from the viewpoint of the jobber. The jobber depends for his livelihood on the sales of electrical apparatus. If the central station and the manufacturer fail to agree and cut prices, the jobber is, perhaps, the one who suffers most. Mr. Ketcham advocated that the central station sell energy-consuming devices at a profit, and devote the profit to extending its new-business campaign.

Mr. R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company, said that all electrical men, of whatever description, should work toward making electricity more popular. Electrical men should advocate electricity all the time, for all practicable purposes, and not simply talk of motors or lamps or whatever each man's individual specialty is. All should help to create a demand beneficial alike to manufacturers, central stations, dealers and contractors.

Mr. B. G. Jamieson of the electrical engineering department of the Commonwealth Edison Company, said it is a fact that engineers generally seem to lack the commercial instinct. He quoted with approval Mr. Insull's recent advice to young engineers to familiarize themselves with the commercial conditions influencing the business of central-station companies.

Mr. Glenn Marston remarked that there are three parties to this co-operation movement, namely, the central station, the manufacturer and the contractor. By co-operation with the contractor the central station will be enabled to control the output of electrical apparatus in a given town to a large extent. He spoke of one case where the central station had organized a contractors' association. By working with this association, the central station secured business to fill up the valleys in its load curve, and at the same time the contractors were satisfied. Mr. Marston, like Mr. Howlett, endorsed what Mr. Dibble has said about maintaining prices. Cutting prices is a bad practice in any business, he said, and he concluded by emphasizing again the importance of securing the good will of the contractor.

Indiana Electric Light Association Convention.

The second annual meeting of the Indiana Electric Light Association will be held in the Denison Hotel, Indianapolis, on August 17 and 18.

Papers will be read as follows. "Relation of Central Lighting Stations to Supply Houses," by Mr. Gordon E. Varney, Indianapolis: "Commercial Value of Low-Head Water-Power," by Mr. F. A. Bryan, South Bend; "Relation of Purdue University to Electric Public-Service Companies of Indiana," by Prof. C. F. Harding, Purdue University; "The Cost of Light," by a representative of the engineering department of the National Electric Lamp Association; "Ornamental Lighting," by Mr. E. Darrow, Indianapolis; "Municipal Ownership in Indiana," by Mr. R. A. MacGregor, Connersville; "Methods of Introducing Energy-Consuming Devices," by Mr. J. K. McDonough, General Electric Company; "New Developments in Heating Devices," by Mr. W. F. Hadaway, Westinghouse Electric & Manufacturing Company; "State Supervision of Public Utilities," by Mr. Thomas C. McReynolds, Kokomo; "Feeder and Generator Regulators," by Mr. F. W. Shackelford, General Electric Company; "Steam Heating Construction," by Mr. G. M. Williams, Indianapolis.

In addition, there will be the annual address of President C. C. Perry, of Indianapolis, an address by Mr. Charles A. Bookwalter, of Indianapolis, a Question Box and various other features. At the close of the first day's session, the visitors will be taken on an automobile trip to various places of technical interest, such as the Mill Street plant and Kentucky Avenue plant of the Indianapolis Light & Heat Company, the Washington Avenue plant of the Merchants' Heat & Light Company, the power plant of the Indianapolis Traction Terminal Company and the filter plant and pumping station of the Indianapolis Water Company. Mr. Percy Worth is chairman of the local entertainment committee. The secretary of the association is Mr. J. V. Zartman, Indianapolis.

Ottawa Meeting of the American Peat Society.

The annual convention of the American Peat Society was held in Ottawa commencing on July 26. A large number of American visitors attended the convention, including three representatives of the United States Steel Corporation, Messrs. J. A. Gray, C. A. Meissner and W. A. Forbes, of New York.

The principal paper read on the opening day was on the history of the peat industry in Canada, by Mr. Alexander Dobson, of Beaverton, Ontario. He noted that half a century ago the peat bogs near Farnham, Quebec, for a year supplied fuel for an entire division of the Grand Trunk Railway. It was found, however, that owing to unscientific and uneconomical processes the peat supplied was not thoroughly dried, and was more expensive than coal, with the result that the producing company failed. Under better methods of peat production it was predicted that the unsuccessful attempts of the past would soon be followed by the growth of a profitable industry, supplying a large commercial and industrial need.

A résumé of the work of the society and of the peat investigation branch of the United States Bureau of Mines was given by Prof. Charles A. Davis, peat expert of the bureau at Washington. In the afternoon the members visited the Government fuel-testing plant in Ottawa, and at night were banqueted as guests of the Dominion Government.

Dr. Eugene Haanel, of Ottawa, superintendent of the Dominion Bureau of Mines, was re-elected president of the society, and the other officers were also re-elected for the incoming year.

It was decided to hold the next annual meeting of the society at Kalamazoo, Mich.

Wisconsin Commission News.

The Wisconsin Railroad Commission, in a decision dated July 25, granted the application of the Milwaukee & Fox River Valley Railway Company for a certificate of convenience and necessity. The certificate relates to a proposed street and interurban electric railway to be built from the city of Milwaukee northward and touching the cities of Cedarsburg, Newburg, Plymouth, Elkhart, Chilton, Appleton, Fond du Lac, Kaukauna and Menasha. The company will do both freight and passenger business. The entire route lies in a territory which is one of the oldest and most highly cultivated sections in the State and a portion of it extends through what has been in the past substantially a closed domain, bounded by Lake Michigan on the east and the Milwaukee River on the west, and hitherto without railroad facilities.

The line of the Malwaukee & Northern extends northward from the city of Milwaukee on the west side of the Milwaukee River and the traffic zones of several other steam and electric roads will overlap those of the proposed road over certain very limited sections of its route. The former road was the chief objector at the first hearing held April 14, 1908, as well as at the eight subsequent hearings. Its principal objection was the threatened invasion of its profitable field in Cedarburg and in some of the territory between Cedarburg and Milwaukee. The testimony shows that this condition of affairs will be true to some extent, but while the Cedarburg business is doubtless important to the objecting road, the whole of that part of the business in controversy amounts to only a fractional part of 1 per cent upon the investment of the objector's line and can scarcely be called vital. The isolated nature of a large section of the territory to be covered by the proposed line, due largely to the fact that there are very few bridges across the Milwaukee River, will prevent any considerable encroachment upon traffic territory which naturally and legitimately belongs to the objecting roads.

A vast amount of testimony was introduced at the hearings to prove that the proposed road could never be a commercial success. But the commission says: "After carefully considering the different estimates of the cost of construction, the volume of the traffic, and the revenues to be derived therefrom, we are of the opinion that, while the project doubtless involves many uncertainties, these uncertainties do not create a risk of such magnitude as to justify this commission in denying promotors and investors the privilege of assuming it. We are inclined to the view that these risks are no greater than the risks which have been assumed many times heretofore in the projection of new railways which have since become useful and profitable institutions. There can be no question regarding the public service which the proposed line may perform in behalf of the territory through which it expects to operate; and no one can tell exactly what the financial results will be of operating a new railroad through a territory the greater part of which has never before enjoyed the facilities of a near-by line.

"It is one of the purposes of the statute under which this application is made to insure the public against the undertaking of unusually hazardous enterprises. It was doubtless contemplated to prevent the projection of lines for speculative purposes and through which the innocent purchaser would be made to suffer loss. The proposed line has been investigated at every point with sufficient thoroughness to take it out of the class of purely speculative ventures and place it upon a basis of reasonably sound business promotion. The uncertainties with respect to the probable results of operation of the project are no greater than the uncertainties which generally exist in new ventures of this character, and they are not great enough to warrant this commission in withholding the certificate which will give the investors an opportunity of trying out their scheme."

It was made evident at the hearings that grave injury would result to the objecting roads if the petitioning road were permitted to operate only certain sections of its proposed road. But the testimony showed, and the commission is convinced, that the road in its entirety is a public necessity, and that consequently the commission has no authority to authorize the construction of a portion of the line, having determined that public convenience and necessity require the construction of the whole line. The order as issued by the commission specifies in detail the exact route to be traversed and requires that the whole road shall be built and operated and not certain sections of it.

The possibilities of a rate war between the new road and the other roads were repeatedly touched upon in the proceedings. Such a possibility unquestionably exists, but it is within the power of the commission to prevent it and to compel the competitors to charge a rate which is reasonable under all the circumstances in the case. It was made very clear in the decision that such authority should be exercised if the occasion arose

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission gave a hearing on July 28 upon the petition of the Grafton Electric Company for authority to purchase the Millbury Electric Company, Douglas Electric Company, Upton Electric Company, and the Uxbridge & Northbridge Electric Company. The petition requests the board to approve the issue of new stock of the par value of $242,000 in addition to a petition pending before the board for an issue of $23,000, making a total issue of $265,000. President Thos. T. Robinson appeared for the various companies.

After giving the history of the various undertakings, Mr. Robinson said that it has been the effort of the management to reduce the entire territory to a common standard of voltage, transformers, prices, etc., and as the territory is now served, a consolidation will not require any added construction, revision of prices, nor dismantling of power stations. The natural tendency of the consolidation should be along the line of reducing the prices now charged, and as a beginning of this policy a 5 per cent reduction was made on July 1. The growth of business in the territory has been remarkable. The gross receipts of all the companies for the fiscal year 1899 were $20,400, and for the year ending June 30, 1910, they were $87,700. The consolidated organization will be called the Worcester Suburban Electric Company. The present improvements at the Uxbridge power station will enable the company to produce energy eco-

nomically and in sufficient volume for several years to come. Mr. Robinson said that the consolidation will greatly simplify the management of the companies in the purchase of supplies, accounting and raising of money. The board took the case under advisement.

The commission has authorized the Electric Light & Power Company, of Abington and Rockland, to issue 540 shares of stock at a price of $150 each for the cancellation of indebtedness and the addition of equipment to the plant. The board has also approved the issue by the Suburban Gas & Electric Company, of Revere, of 1190 shares of stock at a price of $140 per share, for the meeting of indebtedness and plant extension charges.

The Worcester Electric Light Company has petitioned the board for authority to issue new capital stock to the amount of $200,000 par value, at a price of $180 per share, for the purpose of meeting the cost of building a new steam-turbine plant at Curtis Pond, Worcester, and of providing for the necessary extensions of its underground conduit and cable system.

The Foxboro Electric Company has petitioned the commission for the right to issue additional stock of $43,500 par value for the purpose of enabling the company to purchase the power plant of the Standard Gage Manufacturing Company of Foxboro. The company has recently met a demand for 24-hour electric lighting service and also for motor service on the part of large manufacturers and small consumers. It has determined that its present plant cannot be economically adapted to the new requirements. The plant to be purchased from the Standard Gage Company will be turned into a thoroughly modern central station.

The Railroad Commission has issued a decision dismissing the petition of citizens of Lawrence for an extension of the transfer privilege on the lines of the Boston & Northern Street Railway Company within the city. The board states that it appears that for 5 cents a passenger may, by means of a transfer, ride on the Haverhill line, a maximum distance of 9.27 miles, and on the Lowell line, a distance of 9.2 miles, and that both facilities are accorded residents of the Prospect Hill district in Lawrence. The board says that a consideration of these transfer privileges, taken in connection with a statement of the number of passengers carried on the Prospect Hill-Beacon Street line leads it to conclude that no recommendation ought to be made with respect to additional transfers. Regarding the petition of the citizens for additional car service, the board decided that none could be recommended, and it also declined to request the company to extend the track on Allston Street as desired by the petitioners, the contour of the territory and the volume of traffic being unfavorable.

The Boston Transit Commission gave a public hearing on July 27 upon the relocation of the westerly terminus of the Riverbank Subway. Counsel F. E. Snow, for the Boston Elevated Railway Company, opposed the change on the ground that it would introduce operating difficulties which would be objectionable. The original terminus of the subway was planned near the Charlesgate East, and the present plan is to carry it as far west as the junction of Beacon Street and Commonwealth Avenue.

New York Commission News.

Owing to the impossibility of having the voluminous forms of contract for the proposed tri-borough subway printed in time, the advertisements for bids were not made last week, and in all probability will not be made until some time in September.

Commissioner Bassett, of the First District, has handed down a decision, for the commission, in which he grants the request of the Coney Island & Brooklyn Railroad to issue $489,539 bonds, par value. This issue is made in order to acquire proceeds to the amount of $391,630, which amount the commissioner decides is justified. The bonds must be sold for not less than 80.

The Public Service Commission, Second District, will give hearings at Albany on Monday, Tuesday and Wednesday of the coming week, at Rochester on Thursday and at Jamestown on Friday. On Monday at Albany the application of the Warwick Valley Light & Power Company for permission to execute a mortgage for $25,000 and to issue an equal amount of 5 per cent 20-year gold bonds will be heard. The Dwass Electric Company, of Schenectady, is required to show cause why the proceeds of the sale of securities authorized by the commission were not expended in accordance with the authorization of the commission. The Lockport Light, Heat & Power Company is required to answer an order to show cause why it should not manufacture and sell gas in conformity with the standard prescribed by the commission, as tests made by inspectors of the commission at various times have shown the gas to be below the candle-power required by law.

On Tuesday the commission will hear the application of the Ithaca-Auburn Power Company for permission to exercise franchises and to commence construction of its lines, and also for permission to execute a mortgage and issue bonds and capital stock.

On Thursday, at the Chamber of Commerce Rooms in Rochester, the commission will hear the application of the Livingston-Niagara Power Company for permission to exercise franchises and construct lines for furnishing electricity for light, heat and power purposes, and for authority to execute a mortgage and issue stock and bonds. At the same time the application of the Livonia Light & Heat Company for permission to exercise franchises granted, the application of the Livonia-Honeoye Electric Light & Railroad Company and the Lima-Honeoye Light Company for consent to transfer and lease of property and franchises and the application of the Lima-Honeoye Light Company for authority to issue capital stock will also be heard. A further hearing will be given on the question of whether or not steam shall be allowed as motive power on the Newark & Marion Railway Company. On Friday, at Jamestown, the commission will give a hearing upon the complaint of the Mayor of Jamestown as to proposed increase in rates for natural gas in that city.

The Public Service Commission, Second District, has authorized the Riverhead Electric Light Company to exercise a franchise granted by the town board of the town of Southampton for the furnishing of electric light for that town. The commission has also authorized this company to issue its five-year 6 per cent bonds to the amount of $5,000, proceeds to be used for the construction and equipping of a distributing line from its station at Riverhead to the village or lighting district of West Hampton Beach. The commission has also authorized this company to issue its seven-year 6 per cent bonds to the amount of $2,300, proceeds to be used for the purpose of purchasing and installing generating machinery and switchboard.

The Newburgh Light, Heat & Power Company has been authorized to purchase an electric lighting plant from Marion Borden Halliday, owned and operated by her in the town of Shawangunk, Ulster County. The commission has also authorized the Newburgh Light, Heat & Power Company to exercise rights and privileges granted by the Town Board and Highway Commissioners of the town of Gardiner, Ulster County; by the Board of Trustees of the village of Montgomery, Orange County; by the superintendent of highways and Town Board of the town of Montgomery, Orange County, and by the Town Board of the town of Shawangunk, Ulster County, for the construction and operation of an electric lighting service in these places. The company is also authorized to begin construction under these franchises and erect a transmission line, capable of carrying 33,000 volts, from Forest Glen, in the town of Gardiner, in a southerly direction to the town of Shawangunk, and through the town of Shawangunk to connect with the distribution lines in that town, then southerly and east of the village of Walden and thence southwesterly to the village of Montgomery and such other distribution lines as will enable the company to distribute and sell electricity in the territory which holds franchises. The same company has been authorized to

issue first mortgage bonds to the amount of $70,500, the proceeds to be used for the construction and equipment of a high-tension electrical transmission line from Forest Glen to Montgomery, a distance of 15 miles, and electrical distributing systems in towns and villages for which they hold franchises.

The commission has approved the transfer by Clarence Mulkins to Carlton A. Graves for the sum of $5,000, of the electrical plant and distributing system in the village of Walton, Delaware County.

The commission has closed upon its records the complaint of the Mayor of Little Falls against the Utica Gas & Electric Company as to the minimum meter charge to energy consumers in Little Falls, price charged consumers of gas in Little Falls, and quality of gas furnished, and as to place of manufacture and method of transmission and distribution of gas. Mayor Timothy Dasey states that a report made by the engineer of the commission is apparently very complete and is carefully and thoroughly made. Upon the report it is apparent that it would be unwise for the city at this time to continue further the investigation and he, therefore, authorizes a discontinuance of the proceedings.

The Public Service Commission of the Second District has received a complaint from Mr. Christopher Deering against the Auburn Light, Heat & Power Company asking that the company be required to furnish electricity for lighting purposes at the complainant's residence in Auburn. The complainant charges that at the time he built his house, about two years ago, the Auburn Light, Heat & Power Company agreed to furnish him with electric energy and upon the strength of the agreement he wired his house for electric light; that since that time he has asked the company repeatedly to furnish the service, but that it has refused to extend its line. An order was issued to the company by the commission on July 26.

The commission has received a complaint from the residents and property owners of the village of Hagaman stating that the 10-cent fare charged by the Fonda, Johnstown & Gloversville Railroad from Hagaman to Amsterdam is unjust and unreasonable and asking that an order be made requiring a 5-cent fare between these points. The complaint has been served upon the company and an answer asked for in 20 days.

The commission has dismissed the complaint of Mr. William S. Lodge against the United Traction Company as to the excess of through as compared with local fares charged between Albany and Troy, the decision holding that under the company's tariff as in force at the time of the hearing on June 1 last the complaint was sustained, but that under the tariff made effective since the hearing the complaint should be dismissed. In disposing of the case the commission announced the following important general rulings:

1. That through rates or fares greater than the sum of local rates or fares to and from an intermediate point are prima facie unlawful and are seldom capable of justification. In this connection reference is made to several decisions of the Interstate Commerce Commission upholding higher interstate charges fixed by two adjoining States. The commission says that such determinations are based plainly upon the view that local conditions or requirements applying in different States, while material upon the question of the reasonableness of a through interstate charge, are not necessarily controlling; that this follows for the same reason that State authority cannot be controlled by a through interstate rate or fare or assignable part thereof in fixing a rate or fare within the State. The two regulating functions are exercised in wholly independent jurisdictions and applied to distinct subject matters.

2. When through fares do exceed the sum of local fares the passenger is entitled to use the local fares by purchase of tickets or payment of cash fares to and from the intermediate point and conforming otherwise to conditions governing the transportation.

3. When a carrier by interurban electric railroad has established a tariff fixing a passenger fare between two points which is greater than the sum of the stated local fares to and from an intermediate point, and provided a regulation in the tariff that the passenger continuing to ride through in the same car must pay the higher through fare, the carrier is required by the law to adhere to its tariff rate and regulation during the time such fare and regulation are permitted to remain in force, and the passenger in exercising any right he may have to combine and use the lower local fares cannot claim the co-operation of the railroad company to the extent of defeating application of the through fare and regulation specified in the published tariff.

CURRENT NEWS AND NOTES.

Chicago Electric Club.—The last regular meeting of the Chicago Electric Club before the summer intermission was held on July 27. Following the annual outing to be given in Ravinia Park on Aug. 6, activities will cease until Sept. 7, when the next regular meeting will be held.

Removal of Poles and Wires in Chicago.—On the application of the city electrician, the City Council of Chicago has appropriated $25,000 for the removal of poles and wires from streets and for the construction of conduits for the extension and improvement of the municipal electric street-lighting system. This work is undertaken as a part of the plan by which the Sanitary District will supply 10,000 additional arc lamps for Chicago.

Fall Meeting, New England Section, N. E. L. A.—The New England Section of the National Electric Light Association will hold a meeting at The Griswold, Pleasant Point, New London, Conn., on Sept. 13 and 14. There will be a topical discussion on *Rates*, a paper on *The Development of the Electric Sign Business*, a paper on *Special and Decorative Street Lighting*, and one on the *Best General Policy of Central-Station Publicity*. The secretary of the section is Mr. L. D. Gibbs, of the Edison Electric Illuminating Company, Boston.

Contract Agents Relax Their Cares.—About 115 men connected with the contract department of the Commonwealth Edison Company, Chicago, attended the annual dinner of the department at the Bismarck Garden, North Clark Street, on the evening of July 19. Mr. E. W. Lloyd, general contract agent, shepherded the flock, and Messrs. L. A. Ferguson, W. L. Abbott, R. L. Elliott and other heads of departments were present as guests. The party filled three special street cars on the journey to the garden, and the evening was spent pleasantly and informally. There were no speeches.

Wisconsin State Telephone Association.—The Wisconsin State Telephone Association was organized recently at Madison, Wis., by representatives of a large number of telephone companies in that state. The object of the association is to advance the interests of telephone companies and to oppose the enactment of laws detrimental to the telephone business. It is said to be the policy of the new association to be non-partisan; that is, to further the general telephone operating industry without regard to controversies between Bell and Independent organizations.

Steam Supply from a Commonwealth Edison Plant.—The committee on gas, oil and electric light of the City Council of Chicago has recommended that an ordinance be granted to the Illinois Maintenance Company permitting it to supply steam for power and heating from the Commonwealth Edison Company's plant at the southwest corner of Market and Washington streets, to the Hearst Building, at the northeast corner of Market and Madison streets. The proposed steam main is a short one, yet it must cross Market Street, and the permission for laying it is granted in a 20-year ordinance, with a compensation of 3 per cent of the gross receipts to the city, and carefully safeguarded as to change or relocation on the demand of the department of public works of the city.

Meeting of R. S. A.—The Railway Signal Association will hold its annual meeting in Richmond, Va., on Oct. 11. The headquarters will be at the Hotel Jefferson.

Underground Distribution in Sacramento.—The Sacramento Electric, Gas & Railway Company has almost completed the work of putting its wires underground in the downtown district, and will soon begin removing its poles. Wherever the company can get permission to attach trolley wire supports to buildings it will do so. Where it cannot get this permission it will erect iron poles and remove the old wooden ones. The ordinance requiring all companies owning poles and wires to put their wires underground in the business district was passed by the trustees some months ago, and is being complied with by all companies.

Telephones in Engine-Rooms.—The attention of the city authorities of Los Angeles has been called to the alleged fact that the new telephone ordinance does not provide for rates to be charged for telephones placed in engine-rooms of office buildings or other buildings. It is contended that these telephones can be classified neither as business nor residence telephones, and it has been suggested that this particular service be placed under the head of "business telephones unclassified," for which the companies have been charging $3 a month. Complaint is made that $5 a month has been charged for engine-room telephones.

Electric Smelting in California.—Reports from the electric smelter at Héroult, near Redding, Cal., are to the effect that the smelter has been in operation since the middle of July. The output is said to be 20 tons of pig iron a day, and the plant has been operated with entire satisfaction so far. A party of iron-masters and others from San Francisco recently inspected the electric smelter and pronounced the demonstration a success. It is said that iron is made at a cost of $12 a ton, and that it is worth $30 a ton on the Pacific Coast. It is reported that nearly $300,000 has been spent in perfecting the installation, and it is now regarded that the period of experimentation has passed, and it is said that five additional furnaces will soon be built.

The Electrotherm and the Summer Girl.—It is interesting to observe that the electrotherm has received recognition in the "Health and Beauty" corner of the daily papers. A recent writer of notes of this description says: "The girl who will travel this summer should take with her an electric heating pad. This is light and soft, with a covering of muslin and another of eiderdown. It will heat in about 15 minutes and can be so manipulated that it keeps at any given heat. Why bother with a hot-water bottle, steamed flannels, baked bricks, hot boxes or any of the old methods for applying heat to the body when you can have an electric pad that can even be used as a foot-warmer in the automobile in a pinch?" The last statement would seem to indicate a recommendation of the electric automobile as well as the heating pad.

Colorado Convention.—The Colorado Electric Light, Power and Railway Association has sent out its first announcement for the 1910 convention, which is to be held at Hotel Colorado, Glenwood Springs, Sept. 21 to 23, 1910. It is announced that papers will be printed in advance to afford an opportunity for discussion. Papers are promised on the following subjects: "High and Low-Tension Pole Lines," "High and Low-Pressure Steam Turbines," "Non-Synchronous and Synchronous Motors." The committees on "Grounding Secondaries," "Insurance," and "Meters" will report. As usual, the Question Box will be a prominent feature. The Sons of Jove promise an enlivening entertainment during the meeting. The hotel rates, American plan, are $4 per day for room without bath and $5 per day for room with bath. Mr. J. C. Lawler having left the State, Mr. F. D. Morris, 323 Hagerman Building, Colorado Springs, is acting as secretary.

Irrigation Water for Hydroelectric Energy in Utah.—One of the most important irrigation systems in the State of Utah is the Davis and Weber counties canal, which is 17 miles long and carries a maximum of 750 cu. ft. of water per second. It serves at present more than 500 fruit orchards and farms in the counties indicated. The canal is diverted from the Weber River at the mouth of the Weber Canyon and is carried along the side of a stretch of hills overlooking the Uintah Valley. At a certain point on the canal, 4 miles from the mouth of the canyon, there exists a sheer drop of 220 ft. to the valley below. This head will be utilized in conjunction with a hydroelectric power station in the valley, the discharge to be returned to the Weber River. The maximum power available is, approximately, 15,000 hp. The initial installation will be designed to develop about 6000 hp. The consulting engineer for the hydroelectric installation is Mr. H. A. Strauss, of Chicago.

Proposed Engineering Societies Building for Chicago.—Men engaged in engineering and technical pursuits in Chicago have not viewed the success of the Engineering Societies Building in New York and the proposed erection of a similar structure in Boston without hoping that the time is not far distant when Chicago will have like facilities. The subject was brought up at the meeting of the Electric Club of Chicago on July 27 by Mr. C. A. S. Howlett, former president of the club, who called attention to the situation and said that, owing to the number of technical societies in Chicago meeting in various places, there is a real need for such a building. Mr. Howlett suggested that in the fall the matter be taken up by the club. The Western Society of Engineers is the principal local engineering society of Chicago, and several years ago the subject of erecting an engineering building was discussed quite energetically among the members of that society. Nothing came of the discussion, however, and since then the society has moved into larger quarters, under a lease that will not expire until 1918. Many of the technical men of Chicago feel, however, that the various professions and industries represented have reached a stage in their career which should be marked by the dignity of an engineering building, and it is possible that a determined effort to bring about the erection of such a building will be begun before long.

The Ever-Present Electromagnetic Gun.—A recent issue of a London paper contains an inspiring account of the results to be expected from the electromagnetic gun, a recent model of which is described as follows: "It consists of a plain brass tube, open at each end. Over the tube a number of coils of copper wire are placed, the wire being wound on bobbins and the coils slipped on separately with the end of each coil projecting from the end of the bobbin. One set of ends of these coils, of similar polarity, are fastened together and led to a switchboard, where they are attached to a metallic brush. The other ends are separately led to the switchboard, each being fastened to adjacent pieces of contact metal lying flat on the board. In the circuit at a convenient point is the source of the electric current. If the metallic brush be now rapidly drawn across the face of the metallic segments, increasing in speed as it goes, the current is passed through each of the successive coils at a correspondingly increased speed. The shot, which is of cast iron, and fits easily into the tube, is inserted at the lower end. It is at once drawn forward by the first coil, then caught up by the second, and so on, advancing toward the muzzle at an ever-increasing speed until it leaves the barrel and starts on its deadly errand." The writer mentions the "absurdly small cost" and simple equipment for a gun capable of firing a 132-lb. shot at a muzzle velocity of 4450 ft. per second. He seems to have ignored the energy stored in the shell, which equals 40,000,000 ft.-lb., or 70,000 hp-seconds. Unless more than 70,000 hp were used in "firing" the gun, its length would have to be more than 2225 ft. The principles of mechanics and magnetism involved in the electromagnetic gun were discussed in our issues for Dec. 5 and 26, 1908, and [illegible]

Electric Cranes for Italy.—The Italian Minister of Public Works has authorized the expenditure of $86,000 on the supply and construction of electric cranes for docks on the River Tiber.

Wireless Telegraphy Between London Universities.—Prof. J. A. Fleming, at the University College, and Prof. E. Wilson, at King's College, London, have established wireless telegraph stations for communication between these institutions. Instruction is given at each place in the principles and practice of radio-telegraphy.

Brilliancy of Electric Light.—A Denver paper records the fact that during the recent passage of Halley's comet the city lights were turned off for a short period one evening to enable the people to see the wanderer in the sky. So brilliant are the lamps, it is contended that had not their rivalry been withdrawn it would have been difficult or perhaps impossible to see the comet.

Increased Membership in A. S. I. R. A.—At the forthcoming annual convention of the American Street and Interurban Railway Association, to be held at Atlantic City from Oct. 10 to 14, it is expected that the association will represent 100 more electric railway companies than in 1908, the total being about 360. The associate membership enrollment at present exceeds 1050, as compared with 249 in 1908.

Iron Pipes for Telephone Poles.—In constructing a telephone line along the Panama Railway Company's system use will be made of poles consisting of 2-in. galvanized-iron pipe standing 15 ft. out of the ground, each pole being equipped with one 6-pin, 6-ft. cross-arm. At first there will be erected telephone circuits, each consisting of two No. 10 copper wires, the extra two pins being provided for future extensions.

Award for Water Power Diversion.—The Croton Falls Electric Light Plant, of which George Juengst & Sons are the owners, has been awarded $118,732 for the diversion of 30,000,000 gal. of water daily for reservoir K of the Croton Dam in the New York City watershed. The Croton Falls Electric Plant at present supplies energy to Croton Falls, Brewster, Purdys, Somers, Goldenbridge and Katonah, N. Y.

Mr. Insull's N. E. L. A. Address.—Owing to the demand for the full text of the address on "Twenty-five Years of Central-Station Commercial Development," delivered by Mr. Samuel Insull at the St. Louis convention of the National Electric Light Association on May 25, 1910, the *Edison Round Table,* which is the organ of the Commonwealth Edison Branch of the N. E. L. A., with office at 139 Adams Street, Chicago, has reprinted the address in pamphlet form.

Wireless Telephony Civil Service Position.—On August 24 the United States Civil Service Commission will hold examinations throughout the country for those who are versed in the science of wireless telephony. All vacancies in the Government service requiring such qualifications will be filled from the list of competents thus secured. A position of "assistant in wireless telephony for the signal service at large," paying $1,080 per annum, is now open, and an appointment will be made from those who pass the August examination, which will consist largely of theoretical and practical questions in electrical engineering, with especial attention to wireless telephony.

Electricity for Mining in Canada.—The Temiskaming and Northern Ontario Railway Commission, in its report on mining and water-power developments in the Cobalt mining district of New Ontario, Canada, states that on the Metabitchouan River, about 2 miles from the Montreal River landing on Lake Temiskaming, the Mines Power Company is installing four hydroelectric generating units capable of developing in all [illegible] hp. This company is building a dam [illegible] ft. long at a height of 50 ft., which will give a working head of 312 ft. Each unit consists of a 2750-hp turbine directly connected to an electric generator. This plant is nearly 25 miles from Cobalt, and will need four substations, with transformers, for distribution of the energy.

Shortage of Water.—Hydroelectric installation in various sections of the country are experiencing difficulty in keeping their turbines running on account of the summer drought. The Connecticut River has decreased its flow to such an extent that the Connecticut River Transmission Company has been unable to deliver energy to all of its customers and several are using steam-engine equipments to supply the deficiency during the drought. At Minneapolis the Twin City Rapid Transit Company has received effective aid from the Minneapolis General Electric Company and the Pillsbury Flour Mills Company. The latter company closed its mill "A," said to be the largest in the world, in order that its water-power could be used by the Rapid Transit company during the low-water period.

Peat Possibilities.—The possibility of utilizing the peat deposits of the United States for fuel is attracting increased attention. A recent writer says that a good tract of peat of 28 acres in exent and averaging 9 ft. in depth, on proper treatment, should yield 50,000 tons of peat fuel, or enough to support a community of 100 families for 35 years, if the average consumption of each family were as much as 20 tons a year. It is also computed that the same peat deposit would furnish a manufacturing or electric lighting plant of 100 hp fuel for more than 40 years, allowing 300 10-hour days to the year and 8 lb. of fuel for each horse-power developed. If it were practical to use the peat in gas producers, it is estimated that the supply from the 28 acres would last the 100-hp plant for nearly 100 years, under the conditions named. The report of the American Peat Society, which was held at Ottawa, Ont., is printed on another page.

Electricity Directly from the Coal Mines in Texas.—In the center of a coal field at a point about 36 miles above Laredo, Tex., on the Rio Grande, a syndicate headed by Mr. H. A. Stucky proposes to erect a generating station, the fuel for which will be coal screenings. The energy will be transmitted to Laredo, Carrizo Springs and Cotulla, in Texas, and to a number of places in Mexico, including Monterey and Lampazos. The Uvalde & Crystal City Railroad, which is now operated by steam between Uvalde and Carrizo Springs, is to be extended to the coal fields, where the power plant will be located, and will be converted to electric traction, energy to be furnished by the proposed plant. The extension of this road will be about 35 miles long, making in all about 110 miles of track that will be operated electrically. It is expected that energy will be furnished for irrigation pumping on both sides of the Rio Grande for a distance of 100 miles along that stream. The initial equipment of the plant will be rated at 50,000 hp.

Cleveland Electrical League.—More than 250 people attended the first annual outing and chicken dinner of the Electric League of Cleveland, Ohio, at Willoughbeach Park, on Lake Erie, on July 30. On account of overlooking the necessity of securing a permit, the baseball game between the Mazda team and Fagan's Tigers had to be omitted, two other teams having secured the desired paper. This was one of the special features, but other events took the place of it and the electric people got along famously without it. The league, which was organized for the promotion and development of the local electrical market, glories in the slogan: "All Together, All the Time, for Everything Electrical." The officers are as follows: President, Mr. G. E. Miller, Cleveland manager of the Westinghouse Company; vice-president, Mr. E. E. Noble, superintendent of construction of the Cleveland Electric Illuminating Company; secretary, Mr. H. H. Cudmore, president the Brilliant Electric Company. The committee in charge of the outing consisted of Messrs. G. S. Milner, chairman; G. E. Miller, E. E. Noble and J. R. Crouse.

COMBINATION ELECTRIC LIGHT, WATER AND ICE PLANT.

Successful Operation of the Loveland Citizens Electric Company in a Town of 3,000 Inhabitants.

LOVELAND, Ohio, is a town of about 3000 inhabitants located on the Little Miami River, 23 miles from Cincinnati, on the main lines of the Baltimore & Ohio Southwestern and the Pennsylvania Railroads. By reason of its natural advantages, railroad facilities and public utilities, it is expected that the town will grow phenomenally within the next few years. The electric light plant and water-works have been designed with this rapid growth in view and are capable of rendering service to a greatly increased population without being rebuilt or remodeled from year to year to meet these demands.

The Loveland Citizens Electric Company owns and operates the electric-light and water systems and also an ice-making plant. From its office in the power-plant building these three enterprises are conducted by a single office force and head. The water for the city is obtained from a deep well on an island 2600 ft. from the station. By the use of a vertical centrifugal pump direct-connected to a vertical motor the water is delivered to the pumping station into a container located under the large pumps (Fig. 4). The storage tank is made of cement and holds about 45,000 gal. From this tank the water is taken by the pumps shown and delivered into a tank located 1200 ft. from the power station under a pressure of from 105 lb. to 120 lb. This water tank holds 120,000 gal. and from it the town receives its supply.

The boiler-room in the power station contains two 200-hp water-tube boilers, either of which can carry the load on the station. Water is fed to the boilers by two duplex pumps interconnected so that either one can supply one or both boilers. The latter are connected to the stack through breaching with an "S" bend to reduce friction of gas in the stack as much as possible. The fuel is dumped from the car into a track hopper, whence it is conveyed by an elevator at nominal expense to the storage room. Before the installation of this elevator the cost of unloading a car of coal approximated $10, owing to the disadvantages under which the work was performed. An ordinary hopper-bottom car can now be unloaded at an expense of about $2. A weighing device is arranged to weigh the coal as delivered to the boilers and a record is kept of the amount; the water is measured in a settling basin, so that the management knows how much water is being evaporated with a given amount of coal.

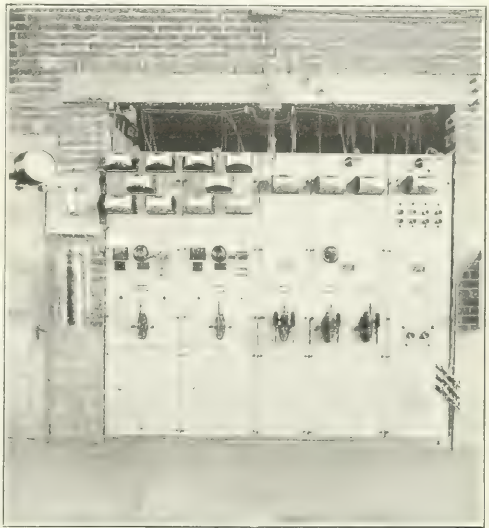


Fig. 2—Switchboard.

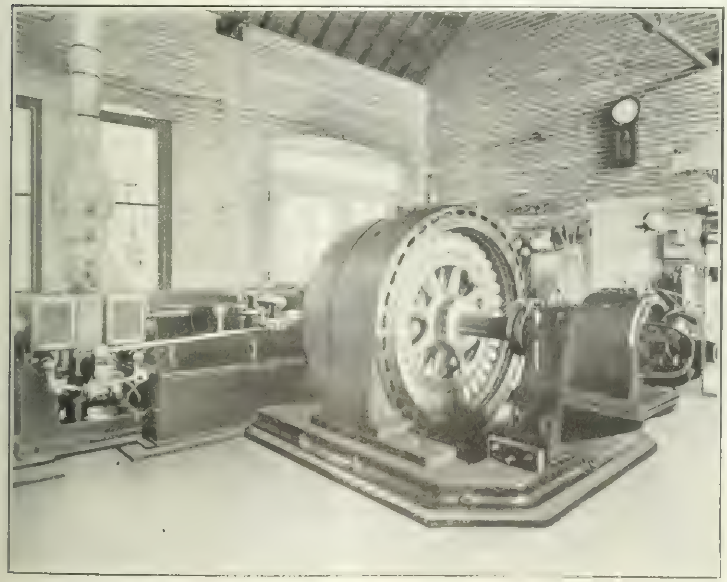


Fig. 1—One of the Generating Units in the Loveland Station

The company has installed a home-made water softener comprising two tanks 10 ft. in diameter by 8 ft. deep. Each tank holds about 4700 gal. of water, which automatically flows into it and automatically ceases flowing.

To every 10 gal. of water are added 13 grains of soda ash and 134 grains of lime. The water is then agitated by revolving paddles having a number of ½-in. holes bored in them. The paddles are fastened to a piece of shafting set in the center of the tank, the bottom of the shaft resting in a socket. To the top of the shaft is attached a small, grooved beltwheel from which a belt connects to a countershaft. After the water is agitated about 30 minutes and subjected to heat from a coil of pipes extending around the inside of the tank, it is allowed to settle for four or five hours. The coil of pipe is heated with exhaust steam and the heat is sufficient to augment the chemical treatment of the water.

After the water has remained in a quiet state for four or five hours, the valve to the feed-water heater is opened and the water thus treated flows through an iron tube or filter 20 in. in diameter, 6 ft. of its length is filled with hay, 6 ft. with excelsior and 4 ft. with charcoal. The water is removed from

the tank by a siphon. The bottom of the tank is fitted with a blow-off through which all solids are washed when the tank is empty. While one tank is being emptied the other is being filled and treated, and the cycle is continued with most flattering results. The treated water showed the following impurities on analysis:

ANALYSIS OF WATER.

Impurities	Parts per Million
Turbidity	Trace
Sediment	Trace
Color	None
Oxygen required...	[illegible]
Nitrogen as free ammonia........	[illegible]
" albuminoid ammonia	[illegible]
" nitrites	Trace
" nitrates	1
Chlorine as chlorides	[illegible]
Alkalinity	[illegible]
Incrustants ...	22
Iron	None
Total solids.............	[illegible]
Number of bacteria to cc	[illegible]
Colon bacilli............	None

Before the installation of the water softener the boilers had to be cleaned at least every three weeks. At the present time the boilers are cleaned every three or four months, and at the end of that time are in much better condition than they were when cleaned every three weeks. Moreover, great savings are made in fuel, boiler maintenance, etc. Besides coping with the water problem, the Loveland company is working on the problem of heating the air before it is delivered under the grates of the boilers, hoping in this way greatly to improve the economy.

The steam pipes furnishing steam to the engines are so arranged that one engine will not be affected by the steam of the other engine, and the pipes are carefully covered with asbestos magnesia to render the service more efficient. The exhaust line is equipped with an oil separator of large capacity through which the steam passes, and is arranged with a by-pass to the feed-water heater and purifier. By means of a valve the flow of exhaust steam and water to the heater can at all times be [illegible] correctly regulated. At the head of the exhaust steam by-pass there is installed an automatic back-pressure valve designed to pass exhaust steam from the power plant to the ice-making plant, 70 ft. away.

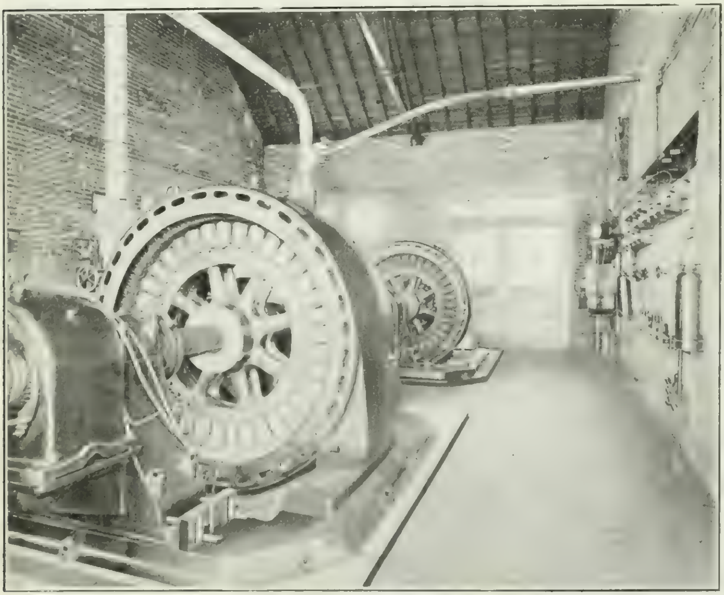


Fig. 3—General View of Generator Room.

The engine room contains two four-valve engines which have been in operation approximately four years. The total expense for repairs on these engines during that time was $8.40, and $100 covers the amount expended for repairs on the generators and exciters. The engines are direct-connected to 125-kw revolving-field, three-phase, 2200-volt, 60-cycle alternators. The exciters are direct-connected on the extended shaft, which is so arranged that the bearings can always be adjusted to the shaft to keep it in alignment in case of wear.

Each machine has for its operation and control a panel on the switchboard, which is equipped with horizontal instruments, necessary switches, etc. The incandescent lighting service for the town is divided into two circuits, known as the East Loveland and the West Loveland circuits, so that if anything should happen to interfere with the service of one part of the town the other section need not be disturbed. Besides, there are junction boxes on poles at fixed points over both East and West Loveland for isolating troubles, so that the switches at the station are used only in emergency. The arc lamp service consists of series arc lamps on two independent circuits.

The management has induced every user of steam engines in Loveland to cease using engines as prime movers and to use electric motors instead. In every instance where engines have been displaced by electric motors the change was accompanied by a saving to the user as well as a profit to the central station. In five years' operation there has not been more than one outage, and that was occasioned at the instance of the Mayor of Loveland when an iron flagpole was blown over and rested on the electric light feed wires. Much trouble was experienced at first in the operation of the water plant in maintaining the service boxes. The old type of box would become so displaced that the key could not be put on the service cock to shut off the water and the lids would also break off. A new type of water-service box has been installed with excellent results.

The ice plant, which is operated in conjunction with the lighting and water plants, has much of interest. One of the purposes of the management has been to give its patrons an all-day and all-night electric service. Consequently, the electric light plant was operated much of the time on a very light load and with poor efficiency. The installation of an ice plant was therefore of much assistance to the electric light plant.

The ice plant consists of a compressor room, freezing tank, flat cooler, storage tank room, ice dump, from which ice is passed through a chute to an ante-room, whence it may be loaded on wagons from the platform or placed in an ice storage room. Under the latter room there is another room which can be used for cold storage purposes or for storing ice. Over the ice storage room proper are built fruit storage rooms, meat storage rooms and egg storage rooms, each room being so piped that the correct temperature can be maintained at all times for the proper storing of perishable goods. Great care was manifested in the selection of all building material and machinery and the installation was made symmetrical. Water is pumped with a 2-hp motor direct-connected to an American, horizontal, centrifugal pump, the discharge of which passes over the ammonia condenser, whence it flows over the steam condenser and

then to the sewer. The never-failing supply of cool water makes the latter plan quite feasible and economical. The efficiency of the system due to the cooler water acting on the gas in the ammonia coils is enhanced, the operation of the plant is more regular, and the energy required by the compressor is less than is required by most compressors when warmer water is flowing over the ammonia condenser.

During the past season the plant took care of approximately 20,000 cu. ft. of refrigeration, besides manufacturing 15 tons of ice daily.

Ice plants in cities of less than 75,000 inhabitants in the

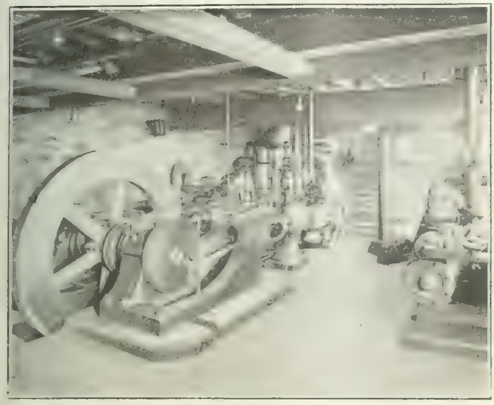


Fig. 4—View of Pump Room.

northern and central states cannot often be operated, for want of market, longer than six or seven months. Besides this disadvantage, in order to take care of the trade it is frequently necessary to deliver ice in such small quantities as to represent a direct loss. Ice must therefore be kept in storage, and unless the temperature is kept at 32 deg. Fahr. or lower it will shrink rapidly. To store ice at this temperature it is necessary at times to operate the compressor at least two or three hours in every twenty-four. This operation can be regarded as a direct loss, but every business has its disadvantages as well as its advantages.

The management of the company at Loveland maintains that success in the ice business is attained only by the exercise of great attention, and the storage of large quantities of ice in preference to maintaining a plant of large capacity. This enables the plant to be operated continuously and overcomes the very objectionable feature of having to operate the plant for only a few days at a time, or a few hours each day. Unless the plant is operated continuously, the correct temperatures of the storage rooms cannot be easily maintained. This is of extreme importance, if success is to attend the storage of fruit, vegetables, etc. When, as often happens, a large quantity of fruit or other product is placed in storage rooms for about a week, and then a portion of it is removed, the cold storage rooms are left almost vacant and it is necessary that the temperature of the storage rooms should be accurate for the lesser quantity as for the larger quantity. Were the ice-making plant not operated continuously, the cost of maintaining the cold storage of fruits, vegetables, etc., would be prohibitive.

In a room adjoining the office in the power house a large assortment of electric and plumbing material is kept in stock in order to enable quick installations to be made. This is a matter of importance, since it often leads to the acquisition of a new customer for electricity or water or both. When the right type of man is detailed on the job he can usually show the customer that it is to his advantage to install both electricity and water. At the same time he may find a householder who should have a refrigerator and thus secure a customer for ice. The refrigerators are sold at cost plus $1 to cover the expense of handling, and electricity and water are installed practically at cost.

Based on its experience, the company emphasizes the importance of having sufficient ice storage to take care of the capacity of the plant, so that it may be operated continuously. Unfortunately, figures are not available for publication showing the cost price of the manufacture of ice by the Loveland plant; but it is said to be sufficiently low to be attractive. A patent has recently been granted one of the directors of the ice company for a process by which ice is made from raw water without distillation.

CENTRAL STATION ICE MAKING.

Equipment for Making Ice in Connection with Electric Energy.

THE combination of the electric service business with that of ice making in small towns is one that is beginning to receive increased attention. The plant installed last summer by the Sterling Consolidated Electric Company, of Sterling, Col., is a good example of what may be accomplished by such combinations.

The town of Sterling is located on the South Platte River, and is in an agricultural and stock-raising community. The conditions limiting the design of the plant were to provide apparatus for an existing population of 4000 and space, as far as practicable, for additional apparatus to accommodate a probable growth to 8000. At the same time a limit was placed upon the amount of money to be expended.

The boiler plant consists of two horizontal, water-tube type units each of 177-hp rating, with space for a third. These are equipped with induced draft apparatus, and are hand fired. The coal bins are outside the boiler room, and are closed off from the boiler room, excepting for the necessary openings in front of each boiler through which the coal enters by gravity. This arrangement prevents in a large degree the dust due to coal handling in the boiler room. Coal is shoveled into the bins directly from the car. The induced-draft equipment consists of two fans, each of sufficient size to operate the plant, and each driven by a directly connected vertical engine the speed of which is automatically controlled by the steam pressure. In cases of emergency both fans can be used to operate the boilers at an overload. The initial cost of the induced-draft apparatus was less than that of a stack for equal

Fig. 1—View of Station Building Showing Storage Tank and Miniature Chimney.

service, while the cost of operation is more than offset by the absolute control given over the draft.

There are two generators, each directly connected to a horizontal engine of the high-speed type. The smaller unit is of 75-kw rating, with a simple engine. The larger is of 150-kw rating, with a compound engine. Each generator has its individual exciter, placed near the cylinder of the engine and belt driven from the main wheel of the engine, this arrangement being economical of space. The smaller unit is now used to take care of the day load, which it was estimated would never be large, there being little opportunity for a large motor load. There is space left within the present building for a

third unit, of 150-kw rating, or for a larger unit of the turbine type should it be decided to operate condensing.

The energy is generated as three-phase, 60-cycle current, at 2200 volts, which is distributed single-phase for lighting and small motors, and three-phase for large motors. The street lighting is taken care of by a 35-lamp series enclosed arc system operated on a moonlight schedule. The switchboard is of blue Vermont marble, consisting of six panels; two of these with the usual complement of instruments are for the control of the two generators, one for arc apparatus, two for single-phase service, and one for three-phase service. At present the single-phase load is divided between two of the phases, while the arc load is on the other. By this means the voltage on the incandescent lamps can be kept uniform. Phase regulation is contemplated, but has not as yet been found necessary.

The ice-making plant has a rated output of ten tons of ice, 20-ton refrigerating, in 24 hours, cold storage not considered. There is one ammonia compressor, with space for a second. The compressor is driven by a directly connected Corliss engine. The freezing system is that known as the Vaile, in which the tank is divided into a number of sections each of which has its own circulating system, by which it is possible to repair any one section without interfering with the operation of the other sections. They are 300-lb. cans, and the time of freezing is 48 hours. The cans are handled by a hand-operated crane. Each section of the freezing discharges its warm brine into a common receptacle from which the circulating pump draws its supply. The ammonia condenser and brine cooler are of the standard double-pipe type; the brine cooler is located in the ice storage room. The storage room has a volume of 5000 cu. ft., which has been found to be ample. The can-dump floor of the storage room and the loading platform are on the same level, so that the lifting of the ice is reduced to a minimum. The thermal insulation of the ice plant is of cork throughout; in the storage room this is covered with cement on the side walls and concrete, cement finished, on the floor.

The exhaust steam of the entire plant passes through the feed-water heater, which is also equipped with an oil separator, and thence to condensing coils on the roof of the building. The distilled water thus obtained, after reboiling to expel the

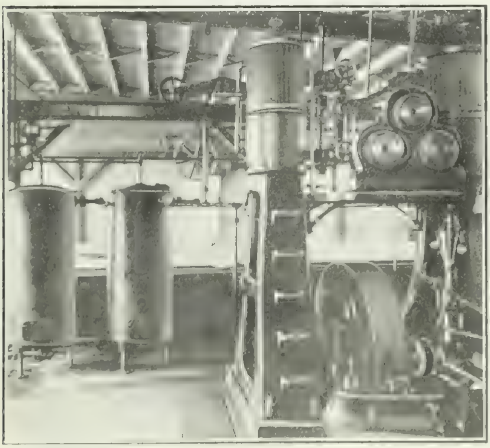


Fig. [illegible]—Ice-Making Machinery.

air, is filtered and then passes to the supply tank, where it is partially cooled by the brine returning from the refrigerating tank. This forms the supply for ice making, and results in pure, clear ice, free from bubbles.

The water supply for the plant is obtained from two wells, one of which is about 600 ft. deep and the other about 60 ft. There is also a connection to the city mains for reserve.

In operating the ice plant it has not been found economical to store ice for any considerable length of time. The storage room, therefore, is only large enough to equalize the supply to the demand, the maximum demand for any one day being somewhat over two carloads.

In connection with the lighting and other business the company has carried on a coal business in rather a novel way. Mine-run coal is purchased, on which a favorable price and freight rate are obtained. When this is shoveled from the car

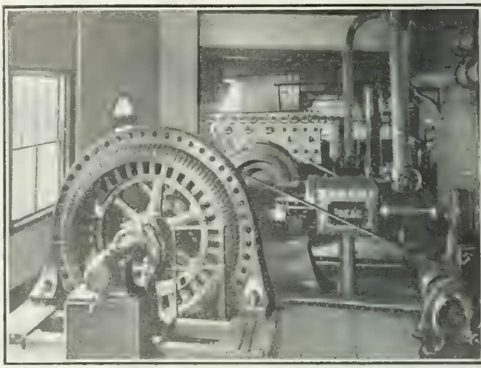


Fig. 3—Electric Generating Equipment.

the larger lumps are separated and sold for domestic use, rated as lump coal, while the slack and smaller lumps are separated and used to operate the plant. By this means the company can always supply its customers with a clean, good product with no small coal except that due to handling and cartage from the retail bins.

The plant was started during the latter part of last year's ice season. The ice plant was not run a sufficient length of time to get it well systematized, but all indications point to the fulfillment of all that was expected of it in connection with the electric service business. The ice business is best at a time when the lighting is at its poorest. The ice plant can be pushed during that part of the day's run when the lighting load is least, and during the heaviest demand for ice one additional man to the operating force is all that can be charged to that part of the business. The total combination, including the coal business, makes one that has already proved satisfactory and one that should find favor in many small towns similarly situated.

ELECTRICITY FOR FACTORIES AT KOKOMO, IND.

The Electrical Distribution System of the Kokomo, Marion & Western Traction Co.

THE generating station of the Kokomo, Marion & Western Traction Company, at Kokomo, Ind., produces electrical energy for the operation of an interurban railway between Kokomo and Marion, 28 miles, and for lighting and power purposes in Kokomo, Greentown, Swayzee and Converse. A feature of the business of the company has been the very large growth in the motor and lighting demand during the past few years, following the adoption of aggressive methods for developing and securing new business. Nor will the management be content, to quote an official of the company, until the Kokomo power house "turns every wheel in Howard County."

In 1904 the local lighting business in Kokomo was divided among 290 consumers, out of the city's population of 15,000. Two years later this number had been increased to 800 customers, and now in 1910 the company has 1600 meters on its lines in Kokomo, with the present population of 18,000, not including the 100 customers in Greentown and 50 in Swayzee.

In the meantime the motor load has grown to a total connected rating of 1400 hp. During the period from 1902 to the present time the total annual earnings from the lighting department have increased from $13,000 to approximately $105,000 for 1910. It is now also likely that the interurban line will be extended westward to Frankfort and eventually to Terre Haute.

The generating station of the Kokomo, Marion & Western Traction Company is a modern brick structure, 100 ft. x 120 ft.,

Fig. 1—Generating Station of Kokomo, Marion & Western Traction Co., Kokomo.

with railway siding connection to the tracks of the Lake Erie & Western Railroad. The plant equipment comprises two 1000-kw Allis-Chalmers steam turbines driving 1000-kw, 2300-volt, 60-cycle, two-phase alternators at 1800 r.p.m., and a 550-hp Russell engine driving a 400-kw, 2300-volt, 60 cycle, two-phase alternator at 165 r.p.m. The last unit is held in reserve for standby service. Two exciters of 30 kw and 35 kw rating, respectively, are provided, one engine driven and the other operated by an induction motor.

The boiler equipment comprises four of the 235-hp Stirling type, one 407-hp Stirling and one 400-hp Atlas. Coal is handled by shoveling from the piles opposite the fire doors, where it is discharged from cars brought in on a railroad siding on a steel trestle, which extends the length of the fireroom and further to a storage yard north of the boiler house. After the unsuccessful trial of a screw ash conveyor, the ashes are now raked by hand from the furnace pits, and conveyed in small cars to an elevated ash bin outside the building. The furnaces discharge their flue gases into three stacks, two approximately 125 ft. high and the third 110 ft. high. Water for condenser and boiler feed purposes is derived from a nearby creek, supplemented by the supply from a deep well delivered by a 4-in. motor-driven centrifugal pump. The feed-water and boiler pumps are in duplicate.

The present station output to the various railway, lighting and motor loads does not exceed the rating of one of the turbine units, so the plant works at the advantage of having a

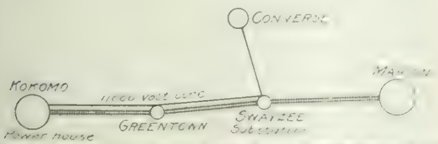


Fig. 2—Map of Interurban Railway and Transmission Line.

duplicate equipment in reserve. This argument has been found a potent one in going after motor business, and the policy of maintaining a spare unit will be adhered to when the present equipment becomes fully loaded, by adding another machine.

Sixty-cycle, two-phase energy, generated at the alternators at 2300 volts, is stepped up to 11,000 volts and converted into three-phase by the T-connected bank of 150-kw station transformers, for transmission to the substation at Swayzee, which feeds the interurban trolley and the distribution lines to neighboring towns. The 11,000-volt transmission from Kokomo to Swayzee is brought along the tops of the poles carrying the side-arm trolley suspension for the interurban railway. The Swayzee substation, which occupies a building with the interurban ticket office and waiting room, contains one 200-kw and two 75-kw rotary converters. The 550-volt, direct-current energy for operating the Kokomo street-railway system and for feeding into the Kokomo end of the interurban trolley is regenerated on the main power-house turbine-room floor by two 216-hp motor-generator sets, whose driving elements are energized from the 2300-volt, two-phase generator buses.

Two storage batteries are provided for reserve in feeding the 550-volt railway lines, one at the Swayzee substation, with a discharge capacity of 320 amp-hours, and the other in a small one-story battery house adjacent to the main power station at Kokomo, and having a discharge capacity of 480 amp-hours. These batteries are continuously floated on the trolley feeders and serve to assist in smoothing out the characteristic fluctuations of the railway load. The feeder wires are of 300,000-circ. mil and 500,000-circ. mil cable. The interurban rolling stock comprises six passenger cars each equipped with four 60-hp motors and several freight and work cars. The hourly schedule calls for simultaneous operation of three of these. The 22 city cars are fitted with two 40-hp motors, and run on 10-minute schedules over the city lines.

Of the 5,000,000 kw-hours produced annually at the Kokomo generating station approximately half goes to operate the electric railway systems, the interurban requiring about 1,800,000 kw-hours and the local car lines 620,000 kw-hours last year. The demand of the 1400 hp in motors installed in the 100 or more Kokomo factories and shops aggregates almost 1,000,000 kw-hours yearly. The commercial lighting, a feature of which is the store and sign business, consumed 715,000 kw-hours in 1909, and the lighting of residences required 210,000 kw-hours. The company also supplies 460,000 kw-hours yearly to 225 street arcs, all but 20 of which are in Kokomo.

The Kokomo, Marion & Western Traction Company sells electricity for lighting and power according to the following rates:

Commercial lighting, 10 cents per kw-hour; $1 minimum monthly. Discounts for payment of bill within five days from 5 per cent to 25 per cent, depending on size of bill. Long-hour

Fig. 3—Engine Room in Power Plant of Kokomo, Marion and Western Traction Co., Kokomo.

users guaranteeing 40 hours' use of entire installation per month are given a 10-cent rate for the first block of consumption and 5 cents per kw-hour for all used additional. Cash discounts on 10-cent portion of bill.

Residence lighting, 12 cents per kw-hour; $1 monthly minimum; discount, 10 per cent for payment within five days.

Energy for motors, 5 cents per kw-hour. Minimum, $1 per connected horse-power of motors. Discount, from 20 per cent

to 40 per cent for prompt payment, rate of discount depending on size of monthly bill. Under this rate the customer agrees not to use energy during the hours of peak lighting load.

In addition to the above, flat rates of a fixed sum per season are offered for operating fans purchased by the customer. Twelve-in. fans, $6 per season; 16-in. fans, $8 per season; ceiling fans, $12 per season, payable in two payments, one on installation and the second July 1.

Fig. [illegible]—Electric Kitchen in Private Residence, Kokomo.

The competitive natural gas rate, for both domestic and manufacturing purposes, is 25 cents per 1000 cu. ft.

The revenue from the various classes of energy-supply business in Kokomo for the first five months in 1910 as compared with the same months in 1909 was itemized as follows:

[illegible]

	5 Mo. 1910	5 Mo. 1909
[illegible]	$5,791 70	[illegible]
Commercial Lighting..	16,072.49	14,777.20
Residence Lighting....	10,187.46	8,358.30
[illegible]	11,132.06	4,883.72
Miscellaneous Lighting	101.72	65 32
	[illegible]	$33,596.24

The majority of the services are metered, although a few flat rates remain in the system. For sign lighting and for the halls of buildings where lighting is furnished to offices and tenants a flat rate is made, based on a charge of 1½ cents per watt per month.

About 600 electric irons are in use in Kokomo. The electric company sells these to customers at nearly cost, in order to enjoy the income from having these energy-consuming devices on its lines. To the same end, minor repairs on electric irons are made free of charge. An electric iron has also proved an attractive prize when offered free to those new customers who have their lighting installations connected up during a given month. This program of giving away an iron to each new consumer is carried out usually during one month of each year, and is generally the means of placing about 60 to 70 irons and hastening in as many new customers.

Kokomo has taken kindly to the use of electric heating and cooking appliances, and there is hardly a consumer of electricity who has not some kind of electrical convenience of this kind. Five families in the little city have all-electric kitchens, doing all their cooking by electrical energy at 5 cents per kw-hour, which is the special rate granted for this service when measured through an independent meter. Those families who use electricity for cooking express themselves as thoroughly delighted with its convenience and cheapness, although the electric company has learned that at the rate granted for this kind of service electric kitchens are not altogether good business from the central-station standpoint. The number of burn-outs [illegible] elements, which [illegible] brought back upon the electric company for repair or renewal, has been a source of annoyance, so that the heating and cooking utensil business has not been pushed in Kokomo nearly as much as the general acceptance of the devices would warrant.

None of the five kitchens arranged for electric cooking has any alternative means of heat, and complete dependence is placed on the electric outfit. A typical Kokomo electric kitchen is that of Mrs. Herbert Murden, shown in the accompanying photograph, and which comprises:

Large frying pan	1400 watts	Broiler	1100 watts
Small frying pan	550 watts	Percolator	[illegible] watts
Hot plate	900 watts	Cereal cooker	900 watts
Chafing dish	650 watts	Oven	1650 watts
Tea-kettle	800 watts		

The consumption of this particular electric kitchen ranges from 100 kw-hours to 150 kw-hours per month, food being prepared for two persons. In other instances where there are as many as five in the family, the monthly bill does not exceed $4 to $6. The minimum monthly charge for the separate meter which is installed on each electric kitchen is, as in the case of any other service meters, $1. Precautions are taken that good current-carrying capacity is provided each kitchen, and special transformers are usually installed very close by to insure an ample supply of energy without affecting the voltage at the lamps of other residences.

The company supplies 207 series street-arc lamps in Kokomo, for which it receives $60 per lamp a year. On the principal business streets special incandescent arches have been installed for several years. The cost of lighting and maintaining these is collected from those merchants having stores nearby who are willing to help defray the expense. Each of the seven arches with its 50 8-cp carbon lamps costs $15 a month to light. Each merchant who contributes to the lighting fund pays from $0.50 to $2 a month. Plans are now on foot to replace this obsolete arc form of lighting with multiple tungstens on concrete pillars. A sample of this curb lighting, installed in advance by a progressive merchant, is shown in Fig. 6. Four posts, each carrying three 100-watt tungstens, will be erected in each block at the expense of adjacent owners and will be paid for out of the city lighting fund.

As before noted, energy from the Kokomo generating station is employed to light and to supply energy for motors for Greentown, Swayzee and Converse, which are adjoining villages of 1500, 1500 and 2000 population, respectively. The retailing of electric service in the first two named is handled by the traction company itself, while the business at Converse is controlled by a company which purchases its supply at the local switchboard. After meeting the transmission, distribution and metering charges, this energy is sold to customers

Fig. 5—Decorative Arches and Special Lighting, Kokomo.

at the rate of 10 cents per kw-hour. The Converse load is well-proportioned, carrying a number of motors during the day-time and some all-night street lighting.

In Kokomo and vicinity at least 100 distinct industries are supplied with electrical energy for their motors, aggregating about 1400 hp in connected load. Much of this aggregate rating

Fig 6—Special Tungsten Pillar Lighting Main St., Kokomo.

represents steam power that has been supplanted by the persistent power-business promotion of the company's solicitors.

Perhaps the largest single installation using energy from the Kokomo system is a stone quarry near town, from which approximately 10,000 cu. yd. of road ballast is taken per month. Over 300 hp in 220-volt, two-phase motors are in use for drill-

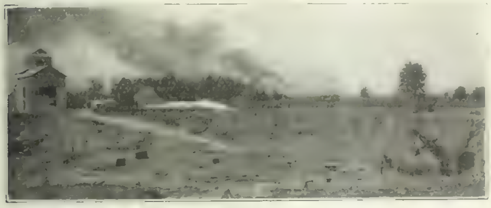


Fig. 7—Electrically Operated Drill, Shovel and Crusher in Stone Quarry.

ing, shoveling and crushing the rock. A 10-hp motor connected by portable cables drives the drill used in loosening the rock. The 40-ton shovel employed for loading the broken talus into the cars is equipped with a 60-hp hoist motor, a 30-hp thrust motor and a 30-hp motor for operating the shovel swing motion. For the hoisting and crushing operations 150 hp in

Fig. 8—Motor-Driven Drill and Shovel in Quarry.

squirrel-cage motors is employed in the crusher house. A 30-hp motor driving a centrifugal pump is also installed to free the quarry of the water which constantly drains into the pit. The energy consumption for producing [illegible] stone is about 1½ kw-hours. For [illegible] away from the quarry a 240-hp locomotive capable of handling six loaded cars is used.

An accompanying illustration shows how a motor was installed to replace a steam engine in a paper mill. In general, drives of this kind are a class of business difficult to get, as steam is used for cooking the pulp, thus making the operation

Fig. 9—75-HP. Motor Belted to Engine Flywheel, Driving Pulp Beaters in Paper Mill.

of an engine very economical. In the instance shown, the motor is belted onto the engine shaft, from which the connecting rod has been disconnected. Before the motor was installed the mill owner held out against the use of central-station energy, as the dismantling of his engine, he said, would make it impossible to utilize the refuse which collects and which is from time to time burned as fuel. As the motor is now installed, belted to the shaft wheel, the engine piston rod can be put in place when necessary and the mill operated by steam power until the refuse is consumed. The installation shown comprises a 75-hp, 220-volt, two-phase motor driving three 600-lb. pulp beaters. This load continues for 24 hours daily throughout the year during the operation of the plant. About 30,000 kw-hours per month is consumed by this installation, including the lighting of the plant.

Another paper mill in this district, which employs 200 hp in engines to operate its beaters and paper machines, utilizing the exhaust steam for cooking the paper, has recently added 100 hp

Fig. 10—Motor-Driven Ammonia Compressor in Refrigerating Plant.

in motors to this equipment, and also employs electrically driven pumps, paper cutters, gluing machines, machine tools, etc.

In the local steel and wire mill 200 hp out of the 5000 hp required at this plant is [illegible] supplied by motors, and the electrical generating equipment commonly operated during

the daytime has been shut down and its place taken by central-station supply.

A local brass works has 100 hp in motors installed; a drill-bit factory takes 85 hp; two of the three local automobile factories employ electric drive, and other large customers of the traction company are a spark-coil factory, two machine shops, three glass factories, flour mills, grain elevators, a planing mill, a knitting works, lumber yards, etc. Curiously enough, too, the traction company supplies energy for operating a 5-hp pumping motor for the water tank of its steam-railroad competitor, the "Clover Leaf," along the line of its transmission.

During the past year the new-business department of the electric company has devoted its soliciting efforts to the development of the motor field, extending its lines to connect with this class of larger business. Feeling its position now secure in this direction, the company has turned its attention toward the enlargement of residence and other small business on its already existing lines. As the result of this change in policy, the future business of the company will be carried on at even a greater apparent profit than when heavy investments were required in distribution line extensions.

The officers of the Kokomo, Marion & Western Traction Company are: President, Mr. G. J. Marott; vice-president, Mr. L. J. Kirkpatrick, and secretary-treasurer and general manager, Mr. T. C. McReynolds. Mr. P. H. Palmer is assistant general manager and superintendent of the lighting department, and Mr. O. M. Booker is solicitor, lately having taken the position previously filled by Mr. C. E. Layton. Mr. C. C. Trees is auditor and Mr. Matzoff is superintendent of transportation.

AMERICAN SWITCHBOARD PRACTICE—I.

Influence of Distant-Control Switchgear on Alternating Current Station Design.

By Stephen Q. Hayes.

The influence of distant-control switchgear on station design is becoming a more and more important factor as the size and voltage of generating, transforming and distributing stations increase. For this reason a short investigation of some of the more important features of modern switchgear with their direct and indirect influence on station design may be of interest and value.

In the early stations of small size and low voltage the switchgear usually comprised a few knife switches, fuses, indicating devices and lamps mounted in a more or less haphazard manner on the walls of the station and practically no space whatever was taken up by this switching apparatus. The next step in advance was to assemble the apparatus on a switchboard and to locate this switchboard near the station wall or in any place not otherwise occupied by engines, generators and similar machinery. The switchboard, as a rule, was the last thing to be located and was looked upon as about the least important part of the equipment. With the further increase in the output and voltage of the circuits to be controlled, it was found generally advisable and often essential to take more space for the switching appliances than could be arranged for on a panel switchboard and distant-control switchgear was the natural result.

It has become the usual practice in alternating-current installations of 2200 volts and above, having ratings of more than 2500 kva, seriously to consider using distant-control switchgear and as the size and voltage increase the practice becomes more nearly universal. In certain cases even of smaller ratings or lower voltage, distant control is adopted. For moderate-sized stations hand operation is used for the switchgear, but some auxiliary source of power is employed in practically all alternating-current stations of 10,000 kva or more, and frequently in smaller ones. Such auxiliary control is found advisable owing to the amount of power to be handled, the physical exertion required to manipulate large apparatus, the number of circuits to be controlled, the high voltage used, the advisability of concentrating the control of widely scattered devices or for other similar reasons.

It is self-evident that all of this distant-control apparatus must be located somewhere, and it is the idea of the writer to suggest by examples the proper location for such apparatus in the station. To secure the best results careful consideration must be given to the question when the station is being designed, or otherwise great difficulty is apt to be experienced in securing satisfactory results. This question of switchgear may be considered under three heads: (1) Switchboards comprising the panels, pedestals, desks and posts containing the instruments and control devices. (2) Apparatus consisting of switches, circuit-breakers, rheostats and similar devices. (3) Layouts including the arrangement of the structures for the breakers and busbars as well as the relative location of generators, transformers, feeders and their switching equipment. This article deals almost exclusively with the station layout, as it is considered impracticable to attempt to cover the switchboards themselves and the apparatus in a short article, although a few words regarding them may be advisable.

The panel type of switchboard is normally used where the number of circuits is comparatively small or where the number of instruments desired for each circuit is so large that the space needed for the meters practically necessitates this type of construction. Pedestals and instrument posts are frequently used for generator circuits where self-contained units are wanted and with this construction it is customary to control the feeders from a panel board. Where concentration of the control equipment is essential the benchboard or desk is usually the most convenient type of switchboard to use.

Concentration of control necessitates arranging all of the switchgear for distant operation either manually or by some auxiliary source of power, and this has resulted in the development of electrically actuated devices for carrying out all of the operations necessary for the control of a power plant. The exciter main switches and generator field switches are sometimes provided with operating solenoids, while the rheostats have solenoids or motors to drive them. Similar devices can be furnished for governor speed control and occasionally for valve control, allowing a machine to be started, brought up to speed and voltage and connected to the circuit by the operator manipulating a few control devices located on the switchboard.

The satisfactory operation of the station hinges principally on the switching appliances supplied for the control of the main circuits, and while various types have been designed from time to time, oil switches and circuit-breakers have practically superseded all other types for handling alternating-current circuits of large output and high voltage. An oil switch or circuit-breaker consists essentially of a device for opening a circuit under oil in a more or less restricted space and it has been found that when circuits of large current capacity are opened in this manner under conditions of overload or short-circuit explosions sometimes occur that blow oil out of the breaker and occasionally rupture the tanks. For this reason it is customary to locate oil circuit-breakers carrying heavy currents in masonry compartments and usually so to design the breakers that each pole is in a separate compartment. The busbars and connections are also placed in masonry compartments so designed that leads of opposite polarity are separated by walls, shelves or septums in such a manner that if trouble occurs in one compartment it will not be communicated to the adjacent ones, and the proper design of such compartments is of great importance.

This article deals particularly with the general arrangement and relative location of the breakers, busbars and similar devices and the effects of their location on the broad problem of station design. In an article of this kind it is, of course, impossible to show all of the various station designs of different companies for different voltages, so a few representative plants have been selected principally to show the influence of switchgear on station designs intended for various voltages.

It will be noted that the various installations illustrated in this article are provided with top-connected, solenoid-operated, oil circuit-breakers, but bottom-connected, motor-operated breakers can also be used. Most of the features of station de-

sign, as illustrated and described, although taken from the design of one company, would apply almost as well to the installations furnished by other manufacturers, although the type of switchgear employed has a great deal to do with the best relative location of the circuit-breakers, busbars and similar appliances.

For the purpose of this article alternating-current stations may be considered as divided into the following classes: Converting stations, generating stations and transforming stations. This classification is, of course, more or less arbitrary and the same plant frequently would come under two or more of these headings, so a few words of explanation may not be amiss as to why this classification has been adopted.

In converting stations, whether provided with rotary-converters or motor-generator sets, there are no prime movers to be considered and the apparatus can usually be located to better advantage and can be arranged in such a manner as to simplify the switching equipment and to make the wiring as short and direct as possible.

In generating stations provision has to be made for the generators with their prime movers and auxiliaries as well as for the switching equipment, which may or may not occupy a comparatively large amount of space. These stations, as considered in this article, are stations where practically all of the energy is sent out at the generator voltage, no provision being made for step-up transformers. These stations, as a rule, are limited to a voltage of approximately 13,200 volts and are ordinarily used for railway service, or central-station service in large cities where underground distribution is required.

Transforming stations as considered in this article comprise either generating stations or receiving stations where the bulk of the energy passes through either step-up or step-down transformers, and where the switchgear is consequently grouped in connection with these transformers in order to secure the most satisfactory results.

CONVERTING STATIONS.

When converting stations provided with rotary-converters or motor-generators do not contain any prime movers they present many opportunities for skilfully designing the plant in such a manner as to secure the simplest arrangement of building and the best location for the switching equipment is frequently the governing feature in the design. The proper grouping of the apparatus in a rotary-converter station depends, of course, on the voltage of the alternating-current circuit, size of rotaries,

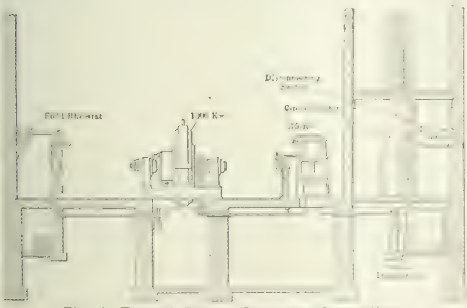


Fig. 1—Typical Rotary Converter Substation.

type of transformers and similar features, and the building varies accordingly, provided the shape and size of the available lot is such as not to hamper the design of the station.

It is, of course, impossible to illustrate and describe the many different combinations of transformers, rotaries, etc., installed by various manufacturers in different plants, so what is practically the standard design of one company for large rotaries fed from underground circuits is used to illustrate some of the features in the design of the station that depends on the switching equipment.

Fig. 1 shows a sectional view of a rotary-converter substation containing 1000-kw, six-phase rotaries with air-blast transformers fed from 13,200-volt underground circuits. As may be noted, the incoming leads from the cable duct pass through an oil breaker and disconnecting switches to the busbars that are located on a gallery, and provision is made for an additional set of busbars and additional set of disconnecting switches to be installed at a later date so that any breaker may be connected to either of the two sets of buses.

The circuit from these busbars passes back through other disconnecting switches and breakers to the high-tension terminals located at the bottom of the air-blast transformers. The low-tension leads from the transformers go to a starting panel provided with double-throw disconnecting switches that permit one-third and two-thirds of a normal voltage to be impressed on the rotary for the purpose of starting. The rotaries are provided with a series field circuit on the negative side, and the negative and equalizer switches are placed on a pedestal at the machine, and the negative and equalizer buses run on a bracket in the basement. The positive leads run to the panel board near the left-hand wall and the positive bus is located on the back of this board. The railway feeders are run out through underground ducts and the entire wiring of this station is very straight away from the high-tension incoming lines to the low-tension outgoing feeders. All of the high-tension circuits are provided with electrically operated breakers controlled from the main switchboards. As may be noted, the entire design of this station hinges on the proper arrangement of the switching equipment.

A similar arrangement of stations can frequently be utilized to advantage where motor-generators are used instead of rotaries and the circuit-breakers for the motors can frequently be arranged along one side of the building. The corresponding switching equipment for the generators can be placed on the other side of the building and all of the apparatus controlled from a single point. With such an arrangement the wiring is kept very straight and simple and the space is utilized to the best advantage.

GENERATING STATIONS.

Generating stations from the viewpoint of their switching equipments may be considered of two types, one distributing at the generator voltage, and the other stepping up the voltage by means of transformers before feeding out to the line. The former type is the one covered in this section of the article, while the latter type, in this paper, is spoken of as a transforming station because it is customary to devote a certain portion of the building or a separate building to the transformers and switchgear. Many stations, of course, feed out both at the generator voltage as well as at a higher one.

The end of the building is a favorite location for the switchgear when the number of circuits is such that this location provides sufficient space for the breakers and the busbars, making due allowance for probable future additions. With this arrangement it is customary to provide a number of galleries for the switching equipment, and the switchboard, whether in the form of panels, pedestals or control desks, is usually placed on one of the upper galleries so that the station attendant can readily watch the operation of the machines which he is controlling.

Fig. 2 shows a sectional view taken through the switching galleries located at one end of a comparatively old plant which contains a large number of 6600-volt generators and feeders. The generators are controlled from pedestals and instrument posts, while the feeders are controlled from a panel board, all of this switchboard being located on the top gallery. The operator standing at the control pedestals faces the generator room and by looking down can watch the machines he is controlling or by looking up can see the instruments that indicate the current, voltage, output, power-factor, etc., of the various machines. In this plant the generator leads are carried up the pilasters that support the front of the gallery and pass through breakers on the top gallery to the generator bus, returning through selector breakers to either of the two sets of busbars that are located on the upper mezzanine gallery. These main busbars in turn connect to the feeder selector breakers on the lower mezzanine and thence through the main feeder breakers

on the engine-room floor. The position of the series and the shunt transformers, disconnecting switches, barriers, etc., are clearly shown. The exciter and the auxiliary control board was placed on the engine-room floor, while the electrically operated field rheostat face plates for the generators, with their resistances, are placed on the lower mezzanine gallery.

In this particular plant each generator and each feeder are provided with one main and two selector breakers, so that there were always two breakers in series between any generator or feeder and the busbars. This provision was made to guard against the possible failure of an oil circuit-breaker, but it has been found that such dependence can be placed on the modern oil circuit-breaker that it is now seldom considered necessary to use two breakers in series.

Where the end of the building does not provide sufficient space, the switching equipment is frequently located along one of the side walls, usually the side remote from the boiler-room in a steam station or the penstocks in an hydraulic station. The switching equipment when arranged in one or more galleries along the side of the building can easily be extended as the

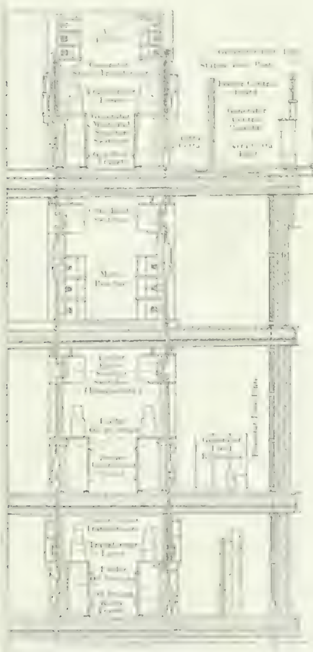


Fig. 2—Generating Station, Switching Galleries at End.

space available for the switchgear increases proportionately with the space available for the generating equipment if the building is lengthened. With this arrangement it is usually customary to locate the generator breakers directly opposite the individual machines and to run the busbars the length of the station. In this manner the length of the generator leads will be reduced to a minimum and it is sometimes possible to use bare conductors for these leads. The switchboard itself, if electrical operation is provided, may be located either on one of the side galleries or at the end of the building in such a position that the switchboard attendant can readily watch the operation of the machines which he is controlling.

Fig. 3 shows a section taken through the switching galleries of a plant where the circuit-breakers, busbars, etc., are located on galleries along one side of the building. This station contains at present two 7500-kva, 25-cycle, 6600-volt, three-phase turbo-generators; three 10,000-kva turbo-generators, with provision for five additional turbo-generators, which will probably be of 10,000 kva rating. These machines, while now connected for 6600 volts, will later be reconnected for 11,000 volts, and all of the circuit-breakers, busbars, disconnecting switches, etc., in this plant have been designed with this end in view. As shown in the right-hand portion of the engraving the generator circuit-breakers are located on the top gallery and leads are

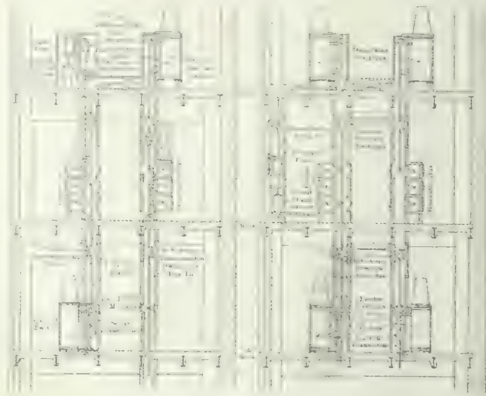


Fig. 3—Generating Station, Switching Galleries at Side.

brought in suitable ducts to this point. The series transformers for the generator circuit are located under a false floor and the leads after passing through these transformers go into the oil circuit-breakers, then drop down through the floor to disconnecting switches and to the busbars. In addition to the generator breaker on the top gallery, group breakers are also installed, while on the lower gallery are located the feeder breakers and bus tie breakers.

The location of the disconnecting switches, series and shunt transformers, busbars and connections is clearly shown, and it may be noted that in front of the disconnecting switches have been placed doors with clear wire-glass panes so that the position of the disconnecting switches may be readily seen without opening the doors. The busbars are located in masonry compartments completely enclosed, but doors are provided opposite each terminal in order to facilitate inspection.

In this installation the generators are controlled from a desk placed on the upper gallery at what will be the center of the complete station, and the desk is so arranged that the station

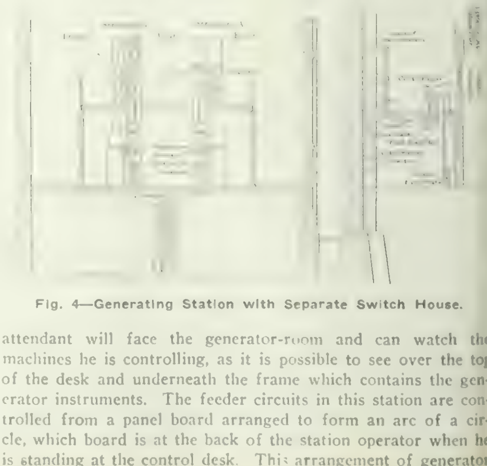


Fig. 4—Generating Station with Separate Switch House.

attendant will face the generator-room and can watch the machines he is controlling, as it is possible to see over the top of the desk and underneath the frame which contains the generator instruments. The feeder circuits in this station are controlled from a panel board arranged to form an arc of a circle, which board is at the back of the station operator when he is standing at the control desk. This arrangement of generator

control desks and feeder panel boards is very compact indeed.

As an example of an independent switch house, Fig. 4 shows a section through the switching galleries of a plant which controls a number of 13,200-volt generators and feeders. Both the generators and the feeders are controlled from a desk in the generator station, which desk is located on a platform so that the operator can readily observe the machines he is controlling. In this station the field rheostat and field switches are hand operated. The leads from the generators are brought in three-conductor cables to the basement of the switching house, and after leaving the cable bells the single-conductor leads pass through series transformers to either or both of two oil circuit-breakers and thence to the main busbars. The feeder circuits are in a similar manner connected to these two sets of busbars through two circuit-breakers.

In this installation the disconnecting switches that isolate the oil circuit-breakers are placed directly in the back of the circuit-breaker structure, so that there is practically no likelihood of trouble arising from one station attendant closing the disconnecting switches while a second attendant is working on the breaker. The arrangement of the circuit-breaker, disconnecting switches, series and shunt transformers, busbars and barriers is clearly shown. As may be noted in Figs. 2, 3 and 4 the type of circuit-breaker used in these installations can be readily connected to busbars either above the breaker or below the breaker, and all of the circuit-breaker leads can run up or all down or some each way.

THE COST OF ELECTRICITY.

By W. D. Marks.

In the *Electrical World* for Sept. 2, 1909, the writer discussed the price of electricity, using for that purpose the reports of some 17 Massachusetts companies to the Board of Gas and Electric Light Commissioners of that state. This discussion then deferred the consideration of the cost of electricity and, as will be the case also in this article on costs, confined its considerations entirely to financial methods and data, omitting any reference to the physical methods of producing electricity, or of distributing it, as of minor commercial importance compared with the financial laws and methods developed. In fact, the expansion and prosperity of a commercial electrical enterprise depend far more on the grasp and ability of its management than on the perfection and economy of its machinery.

The points developed in the article of Sept. 2, 1909, were as follows: "If increased sales (of electricity) at a lower profit per unit result from lowered prices, this increased sale also reduces the investment or capital per unit sold and so the same or greater profits or dividends may result from lowered prices, if the plant does not have to be appreciably enlarged for the greater sales."

Going to bedrock for the foundations of a severely practical investigation the various details of 17 companies in practical operation in Massachusetts were analyzed and the hitherto hidden empirical law of demand for electricity was brought to light. It is $s = (640 \div p) - 45$; in which $s =$ the sales per capita in kw-hours, and $p =$ the average price per kw-hour in cents.

In Fig. 1 this law is graphically laid down and compared with the actual practical results in 15 Massachusetts cities ranging from 132,000 to 33,000 population. For all practical purposes the law's verification appears complete within a range of from 4 cents to 10 cents average prices per kw-hour for electricity, now received by prosperous companies paying generous dividends. The response of the public, in increased consumption, to lowered prices is sure and regular.

Only one of these companies has water-power for a portion of its load. The rest are practically (save in population) identical as to cost of fuel, labor and construction and situated in cities of like climates and equal wealth per capita and use steam power only.

Further in the article mentioned reference was made to the average cost of a municipal electric light station and distribution system per kilowatt of station capacity and also to the wide differences in the capitalization and assets per kw-hour sold, ranging from 9.25 cents to 53.5 cents, depending on the annual hours of use of the full capacity of the station, the annual hours also ranging from 4000 hours to 700 hours per year.

With this much of recapitulation of matters already covered, required for a full comprehension of further investigations, the discussion of the cost, and consequently the price of electricity as obtained from profitably operating electric stations, can be taken up on the same severely practical basis of actual operating results.

PER CENT PROFITS ACTUALLY REALIZED.

Absolutely practical derivation from many instances is the condition of value in such an investigation as this, and actual results attained are the only facts upon which the reasoning must rest.

The writer has no impartial inventories of the 15 electric plants used for the purpose, but in their reports to the Massachusetts Gas and Electric Light Commission finds the tax valuations of 12 of them. The tax value of a plant may be less than its real value, since tax assessors generally seem to assess the values of properties at a certain percentage of their known cost or of their present value. The available tax values may be considered in the absence of other data as the lowest appraisements possible to be mutually agreed upon by the tax assessors and the company's officials. Depreciation of plant will surely be included by the company and the assessors must permit the cash and stock of materials used in operation to be omitted from the tax returns.

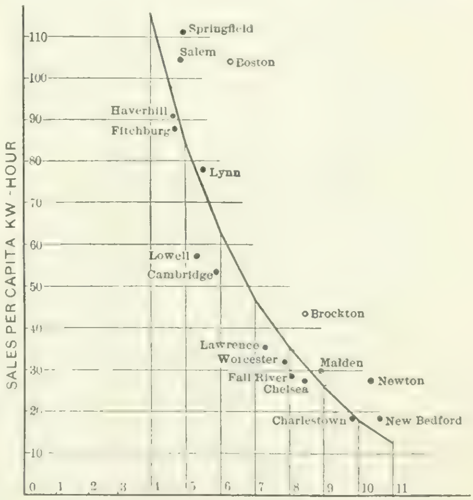
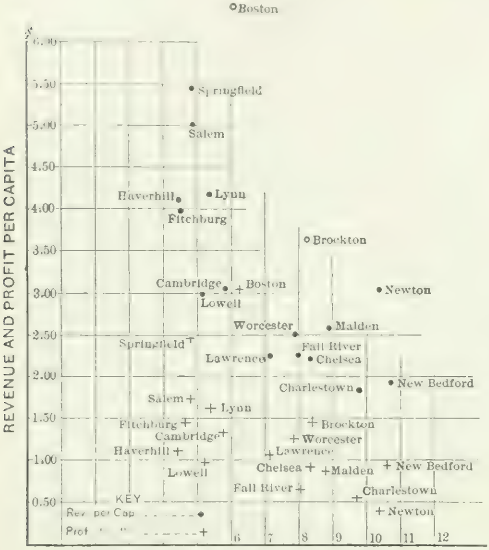


Fig. 1—Curves Showing Sales of Electricity per Capita.

These considerations operate to produce an apparently smaller investment per kw-hour sold, but as these plants are taxed under the same state law, the result is only to produce a proportionate reduction of apparent value, leaving the figures valuable for comparisons with each other.

In the case of each of these 12 companies the cost of a kw-hour is obtained by dividing the total operating expenses by the total number of kw-hours sold. Depreciation for the current year is temporarily omitted from expenses for a reason to be hereafter explained. The tax investment per kw-hour is obtained by dividing each company's tax valuation by the total sales in kw-hours. The data for the subjoined tabulated

results are taken from the Massachusetts Gas and Electric Light Commission report to June 30, 1908.



AV. PRICE PER KW.-HOUR: CENTS-MASS. REPT. 1908
Fig. 2—Curve Showing Revenue and Profit per Capita.

FIRST GROUP OF 1908.

Cities	Cents per kw-hour		
	Average Price	Cost	Tax Investment
Springfield	4.86	2.64	15.3
Salem	4.80	3.13	10.8
Haverhill	4.31	3.21	11.9
Fitchburg	4.57	2.99	13.4
Lynn	5.41	3.27	8.5
Lowell	5.19	3.50	19.3
Cambridge	[illegible]	3.24	20.2
Averages..	5.02	3.14	14.2

Profit per kw-hour. =1.88 or 13.2 per cent on 14.2 cents

SECOND GROUP OF 1908.

Cities	Cents per kw-hour		
	Average Price	Cost	Tax Investment
Lawrence	7.16	4.06	18.9
Worcester	[illegible]	4.03	28.6
Newton	10.40	9.33	14.4
Malden	[illegible]	6.05	22.0
Fall River......	8.00	5.70	26.9
Averages..	8.46	5.83	22.2

Profit per kw-ho[illegible]

As a practical fact it may be observed from the above tabulation that the lower price (5.02 cents) produces an average profit of 13.2 per cent, as against a lower profit of 11.9 per cent for the price of 8.46 cents per kw-hour on the basis of the tax valuation of the investments in these companies.

With the exception of Springfield, favored by water-power, it would be impossible to find a group of 12 companies operating under more nearly the same conditions save as to population.

It is, therefore, safe to infer that an average reduction of 3.44 cents in the price by the first group has not reduced the percentage of profit on the investments made by this group's companies. On the contrary, the profit is increased 1.3 per cent by the lowering of prices, and the sales per capita computed by the law of demand above stated would increase from about 30.6 kw-hours per capita annually to 82.5, an increase of nearly threefold in sales.

From the point of view of citizens desiring to increase the manufacturers and consequently the commercial prosperity of their cities, rationally regulated low prices for electricity for long-hours use are a boon whose value cannot be overestimated. Another point of view of the reduction of the operating cost of producing electricity by reason of the increased sales per capita is illustrated in Fig. 3. Depreciation for the current year, as before, is also temporarily omitted in this diagram. The broken-line average cost curve laid down by a similar method to the price curve appears to have the same rude approximation to hyperbolic law and to be a function of the sales per capita. The fact may be observed that the price and the cost of supplying electricity move down together as the sales per capita increase and that there always is an average profit shown on each kw-hour sold, which varies very little while going from 10 cents to 4 cents average price per kw-hour sold.

DEPRECIATION.

Each year, in order to compute the total cost per kw-hour sold of electricity, it is necessary to include the depreciation per kw-hour; and yet the depreciation cannot be considered as proportional to kw-hour sales. It is customary in many electric works to allow a certain average percentage of the value of the works, fixed plant or as above figured of its taxable value. This percentage is a much disputed quantity, but in fairly equipped works it is hardly ever claimed to be less than 3 per cent or over 7 per cent. In fact, any percentage is a guess, and a careful inventory and appraisement furnishes the only means of fixing depreciation accurately. In this appraisement care must be taken to discriminate between physical decay, obso-

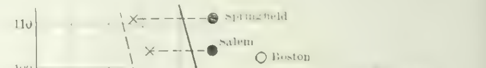


Fig. 3—Curve Showing Sales per Capita, KW-Hours.

lescence and inadequacy of plant. The current repairs are usually charged to operating expenses as they occur, and physical decay becomes less in proportion to the thoroughness of repairs.

In the 12 Massachusetts companies cited the depreciation is not charged to operating expenses, but is charged directly to profit and loss, if at all, and credited to various accounts. If one assumes the extremely liberal average of 7 per cent de-

preciation, the first group of seven low-priced companies earning 13.2 per cent is able to divide 6.2 per cent of the tax value and to put aside a 7 per cent reserve depreciation fund; and the second group of five higher-priced companies earning 11.9 per cent is able only to divide 4.9 per cent and put aside 7 per cent.

GENERAL CONSIDERATIONS.

For the first group the following obtains:

Price		[illegible] per kw-hour
Operating expense	[illegible]	[illegible]
Depreciation	[illegible]	[illegible]
Net earnings		[illegible]

For the second group the following obtains:

Price		8.46c per kw-hour
Operating expense	[illegible]	[illegible]
Depreciation	[illegible]	[illegible]
Net earnings		[illegible]

The second group shows the larger profit per kw-hour, but it gives a smaller per cent profit on the investment made.

The explanation of this stubborn series of facts appears to be the following: With a rational method of lowering prices the response of the public to it is a sure increase of sales per capita according to the law of demand exhibited above. (See article, Sept. 2, 1909). The increased sale of energy results in a decreased operating cost per kw-hour sold and also usually results in a decreased investment per kw-hour sold. The decreased investment per kw-hour results in a decreased depreciation per kw-hour sold, since depreciation depends principally upon time and the cost of the investment.

For these reasons the per cent of profit on the investment required appears rather to be increased than decreased by a rational lowering of average prices down to a limit of 4 cents per kw-hour, beyond which point practical data are not obtainable from Massachusetts electric light companies (see Fig. 3).

Since fuel, the largest factor increasing with the load, will rarely exceed 25 per cent of the operating expenses, its increased cost with the kw-hours sold is over-compensated by the other decreases in operating expenses, in depreciation and in investment, per kw-hour, thus producing the lessened cost per kw-hour and the increased per cent of profit on investment computed in groups 1 and 2 and graphically shown in Fig. 3 from actually realized results.

It should be noted, too, that the physical differences in the character and economy of the operative machinery of the various stations do not appear to have appreciably affected their results in sales.

With this elucidation of the general principles governing the supply and sale of electricity based as yet entirely on average prices, the method of attaining the low rates found so profitable, both by the public and the public-service electric companies, can be considered.

METHOD OF COMPUTING PRICES TO CONSUMERS.

There is but one right method of computing judicially fair prices to consumers, and there are innumerable wrong methods. Superficial theories and incorrect reasoning and data appear to be common alike to the managers and to the consumers of electric light companies. In some instances local causes and obscure influences will greatly vary the results attained by companies and must be eliminated.

In the article of Sept. 2, 1909, the general principles forming the basis of a proper sliding scale have been stated and a crude computation of a table used profitably in 1890 in the Philadelphia Edison Company given merely as an illustration of the method. The later 1909 results of a nameless electric light company in a city of 132,000 population will, therefore, be used in the formation of a series of sliding scales, based on a more careful examination and separation of the quantities to be segregated under two heads. (1) The capacity of the public service demanded by a patron. (2) The quantity in kw-hours of the commodity electricity actually consumed by a patron.

The first head covers the amount of wages and hire of the station machinery and staff of employees required by a consumer for his possible use. The second head covers the exact cost of the kw-hours supplied to each consumer. The first usually covers the fixed expenses due to the capacity (regardless of the commodity sales), such as the fixed annual expenses for office and general management, together with the profit on, and the depreciation of, the capacity demanded by a patron. The second is the cost of supplying a measured quantity of electricity to a patron.

The data required for the practical construction of the various sliding scales of rates to patrons in such a manner that each shall pay an even profit to this company for services rendered are as follows:

The total income for the year 1909 was:

Public street arc lamps		$77,002.00	
Public street incandescent lamps	$3,361.50		
Comm. arc lamps, contract	[illegible]		
Comm. arc and incand. lamps, meter	198,197.18	$216,625.57	
Electric motors		53,915.96	$347,543.53
Total operating expenses		$171,549.78	
Average 5 years' depreciation		79,441.67	250,991.45
Net annual earnings			$96,552.08
Dividends paid 10 per cent $800,000. Capital stock			80,000.00
Undivided surplus			$16,552.08
Sales, 4,879,973 kw-hours @ 7.12 cents			$347,543.53
Cost, [illegible] @ [illegible]			[illegible]

The capacity of the connected load appears to be about:

Public street arc lamps	330 kw or	4.27 per cent		
Commercial [illegible]	[illegible] " "	[illegible] "		
Electric motors	1,469 " "	19.00 "		
Total	7,721 kw or	100.00 per cent		
Annual hours use per kw connected load		632.04		
Daily " " (307 work days in the year)		2.06		
Total assets reported 1909 (checked by tax)			$1,472,523.06	
Assets per kw of connected load				190.7166
Net annual profit 6.53 per cent, $1,472,523.06			96,552.08	

If the assets are divided in proportion to the capacity of the connected load served the following obtains:

Public street arc lamps	$62,936.48
Commercial lighting	$1,129,423.71
Electric motors	280,163.00
Total	$1,472,523.19
Variation in decimals	0.13

Since there are 845 public street arc lamps of the 4-amp (390 watts) type served through underground conduits, and also no segregation of assets or appraisement of plant, one is obliged to reject $62,936.48 as too small and substitute an estimate covering the cost beyond doubt of 845 lamps and appurtenances, 375-kw (500-hp) engine, boiler and appurtenances, real estate shared, 242 miles copper No. 6 and 100 miles of duct, making a total of $290,000, or about $343 investment per lamp.

With the use of underground service, $190.72 per kilowatt capacity of connected load as a practical result does not appear to the writer to be an excessive investment, and it will, therefore, be used as an approximate and fair basis in the sliding scales for computing 5 per cent profit and 7 per cent depreciation on commercial lighting and electric motor circuits as being without doubt liberal treatment of the electric company.

STREET LIGHTING COST.

The contracts for the public street arc lamps are usually made

yearly on the basis of a regular 10.8 hours of lighting each night for 365 nights, and will be more conveniently dealt with before the discussion of the sliding scales is taken up.

Cost of energy 1,301,000 kw-hours @ 2 cents	$26,022.00
[illegible]	[illegible]
Depreciation $290,000 @ 7 per cent	20,300.00
Total operating cost 845 lamps	$49,483.40
Profit $290,000 @ 5 per cent	14,500.00
Price 845 lamps @ $75.72	$63,983.40

Dismissing this special street-lighting service requiring so small a per cent of the capacity of an electric light station, the consideration of the data required for fixing the cost and price of kw-hours consumed by patrons not bound to regular hours' use, but charged for from the records of an electric meter may be resumed.

COST AND PRICES OF METERED ELECTRICITY.

The present used system of metering electricity to consumers in kw-hours is exceedingly unsatisfactory, since each successive kw-hour supplied to a consumer costs less than its predecessor owing to the presence of an annual service charge due mostly to the impossibility of cheaply storing one day's supply. For instance, in the present case of two hours' average daily use of 7721 kw connected load the highest demand upon 4960 kw of installed generating machinery has proved to be 3000 kw. If, however, electricity sufficient for 24 hours could be stored, the station could be operated 24 hours with one-half of one-sixth of 7721 kw or 1287 kw capacity and the annual service charge for idle investment almost ignored.

OPERATING EXPENSES.

Tabulation covering sale of 4,879,973 kw-hours, 1909, with installed station capacity of 4960 kw:

[illegible]	Totals	Per kw hour Sold
Rental for real estate	[illegible]	$.0000
Wages, clerical labor commissions	15,265.07	.0031
Directors allowances	400.00	.0001
Salaries of officers	11,750.00	.0024
General salaries	[illegible]	.0008
" office expense	1,918.84	.0004
Taxes	27,697.84	[illegible]
[illegible]	6,318.98	[illegible]
Law expenses	[illegible]	.0001
[illegible]	28.00	.0000
Incidental expenses	504.22	[illegible]
Horse-keeping	5,200.75	.0011
Rent of poles	18.95	.0000
Total capacity or annual service charge	$73,935.87	.0151
[illegible]	[illegible]	.0040
[illegible]	[illegible]	.0006
Steam plant repairs	4,159.43	.0008
Electric plant repairs	2,705.68	.0006
Repairs and renewals of lines	12,398.61	.0025
Repairs: meters, lamps and motors	3,049.31	.0006
Distribution tools and appliances	194.10	.0000
Coal and delivery	39,426.36	.0081
[illegible]	1,584.83	.0003
Water	1,639.86	.0003
Carbons	1,442.99	.0003
[illegible]	6,178.91	.0013
[illegible]	[illegible]	.0002
Current bought @5 cents	1,625.55	.0003
Total variable generating cost	[illegible]	[illegible]
Total for all operating expenses	[illegible]	[illegible]
Average annual depreciation	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Profit allowed, 5 per cent $1,472,523.06	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

From the above tabulation it is found that the actual cost per kw-hour for this station operated an average of 632.04 hours per year on the connected load of 7721 kw is 5.14 cents, also that the proper average price is 6.65 cents per kw-hour to yield 5 per cent on its total assets. Obviously it would be impossible without overcharging some departments and consumers and carrying others at a loss to the company to establish such a uniform rate for all service. Each consumer should pay an even profit on, and for the depreciation of, that part of the plant set apart for his use. He should also pay his share of the approximately fixed operating expenses and of the cost of the kw-hours consumed by his conected load. The question is, "How shall these items be divided among the consumers?" Shall it be in proportion to the connected load in kilowatts or shall it be in proportion to the kw-hours consumed?

If there could be storage capacity for 24 hours' use at the works, or if each consumer used the same proportion of his connected load for the same number of hours per year or day the problem would be simple and would reduce itself to the fixing of an even price per kw-hour consumed; but such is not the case.

The estimate of the cost and of the proper price for street lighting has heretofore been separately computed and would alter the figures for the whole works as follows:

Whole load connected	7,721 kw
Street lamps	330 "
Remainder	7,391 kw
Kw-hours sold whole amount	4,879,973 kw-hours
For street lamps	1,301,100
Remainder	3,578,873 kw-hours
Total assets	$1,472,523.06
Estimate investment in street lamps	290,000.00
Remainder	$1,182,523.06

This would result in an average investment of $160 per kilowatt connected load instead of $190.72 from the whole plant's assets. It is certainly fair and liberal to this company to use $190.72 per kilowatt, and as there is no opportunity to find the cost of street lighting energy separately, this latter amount ($190.72) will be used in the computation of profits. The assignment of the various items to capacity charge or kw-hours' cost is the problem which will next demand consideration and judgment.

Referring to the tabulation of operating expenses given above it might appear as if the following items are properly assignable to capacity charges:

Annual service charge	$73,935.87
Average annual depreciation	79,441.67
Profit allowed 5 per cent of $1,472,523.06	73,626.15
Total capacity charges	[illegible]

Dividing by 7721 kw $29.40 per kilowatt is the proper service charge against each kilowatt of capacity of each consumer, and in addition to this the cost (2 cents) of each kw-hour consumed by him.

This will be accepted as correct by all who agree with the writer as to the segregation of the items above, which leaves only $97,613.91 out of a total of $324,617.60 as variable with the kw-hours sold. Profit and depreciation can hardly be considered a function of anything else than the capacity and cost of the plant. Heretofore it has practically been shown in 12 separate cases that the depreciation per kw-hour decreases with the increase of the sales of electricity, as also do the annual service charge and the required profit. The relatively small variable generating expense is the only one that increases with the increase of sales in kw-hours.

If an attempt be made to include depreciation in the variable generating cost, the annual capacity charges are:

[illegible]	[illegible]
[illegible]	73,626.15
Total capacity charges	$147,562.02

Dividing this by 7721 kw one obtains $19.11 as the annual capacity charge per kilowatt of connected load, and for the kw-hour cost one obtains:

Variable generating cost	$0.02 per kw-hour
Average annual depreciation	0.0163 "
Total cost electricity	0.0363 per kw-hour

Again the first 20 items of the tabulation, inclusive, might be by some considered as dependent upon the capacity rather than the electricity sales of the station. Then

Annual service charge	[illegible]
Depreciation	[illegible]
Profit [illegible] per cent $1,472 [illegible]	[illegible]
Total capacity charges.	$271,972.71

Dividing this by 7721 kw one obtains $35.22 as the annual capacity charge per kilowatt of connected load and for the kw-hour cost one obtains $52,644.89, or 1.08 cents per kw-hour variable generating cost. Further, if no capacity charges at all are made the cost of energy is 5.14 cents and the selling price 6.65 cents per kw-hour, as shown above.

Thus far the bases of three sliding scales of charges per kw-hour for consumers have been established, each of which yields to the company all of its operating expenses, its depreciation and 5 per cent on its investment, or since the depreciation is given as about 7 per cent on its taxable value a total of about 10.4 per cent on its book assets, $1,472,523.06 for profit and depreciation fund. Since from the company's point of view there would be no difference in the final results to it, the question of sliding scales at once becomes one of expediency and of the public's welfare and convenience. Since the street lighting has been separately estimated, it will be better to reckon a year as consisting of 307 work days of 10 hours each, since factories and business places which usually make up the bulk of consumers are closed on Sundays and legal holidays. Diversity factors are uncertain guesses and produce unfair discriminations.

In reiterating the statement that there is but one judicially fair method of charging, the writer would also state that opinions may widely differ as to the expediency of the assignment of the various items to capacity charge or to kw-hour cost, and so presents the three sliding scales resulting from different segregations for comparison.

The total connected load of each consumer appears to the writer the fair basis in each case, except when by special agreement the maximum measured demand is substituted.

The first sliding scale is based upon an annual capacity charge of $29.40 per kilowatt of connected load and 2 cents per kw-hour meter charge.

[illegible]			[illegible]
[illegible]	[illegible]	[illegible]	
3,070	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
2,456	[illegible]	[illegible]	[illegible]
2,149	[illegible]	[illegible]	[illegible]
1,842	[illegible]	[illegible]	[illegible]
1,533	[illegible]	[illegible]	[illegible]
1,228	[illegible]	[illegible]	[illegible]
921	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Remarks—307 days' use each year. The kw-hours used each month are divided by the kilowatt capacity of the connected load to fix the hours of use and the price per kw-hour. If the connected load is not used at all, the charge will be $2.45 per kilowatt capacity per month.

The second sliding scale is based upon an annual capacity charge of $19.11 per kilowatt of connected load and 3.63 cents per kw-hour meter charges. (See first table in next column.)

The third sliding scale is based upon an annual capacity charge of $35.22 per kilowatt of connected load and 1.08 cents per kw-hour meter charges. (See second table in next column.)

Of these three interchangeable sliding scales, the writer's preference is decidedly in favor of the third for all users of motors, it being his opinion, based on practical experience, that the assignment of factors of cost is more nearly correct in it, and that the clearly proven law of demand (Fig. 3) will result in a great increase of sales and in a reduction of cost of delivery of electricity. It is true that residence customers will be forced to pay a minimum of 15 cents per 50-watt lamp per month for unused lamps. If this is regarded as a serious objection, it can be met by fixing the one-hour-a-day price for all residences and letting it go at that, as not producing a

[illegible]			Price per [illegible]
[illegible]	[illegible]	[illegible]	
3,070	[illegible]	[illegible]	4.25 cts.
2,763	230	9	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
2,149	[illegible]	[illegible]	[illegible]
1,842	[illegible]	[illegible]	[illegible]
1,533	[illegible]	[illegible]	4.88 "
1,228	102	4	[illegible]
921	[illegible]	[illegible]	[illegible]
614	[illegible]	[illegible]	6.74 "
307	25.6	1	[illegible]

Remarks—[illegible] divided by the kilowatt capacity of the connected load to fix the hours of use and the price per kw-hour. If the connected load is not used at all, the charge will be $1.59 per kilowatt capacity per month.

serious loss; while all other sales of electricity, particularly for long-hour motive power in manufacturing towns, will be astonishingly increased at a good profit to the company by the rates offered in the third sliding scale.

Why does not every considerable power user in a city purchase it more cheaply from its electric light company than he

[illegible]			Price per kw hour
Per Year	Per Month	Per Day	
3,070	256	10	2.23 cts.
2,763	[illegible]	[illegible]	[illegible]
2,456	205	[illegible]	[illegible]
2,149	[illegible]	[illegible]	[illegible]
1,842	154	[illegible]	[illegible]
1,533	128	5	[illegible]
1,228	102	[illegible]	[illegible]
921	77	[illegible]	[illegible]
614	[illegible]	2	[illegible]
[illegible]	25.6	1	[illegible]

Remarks—307 days' use each year. The kw-hours used each month are divided by the kilowatt capacity of the connected load to fix the hours of use and the price per kw-hour. If the connected load is not used at all, the charge will be $2.94 per kilowatt capacity per month.

can generate it himself in a smaller plant? The answer is obvious. Because the managers of most of these companies have not understood or ignore the financial laws controlling the cost and price of supplying electricity.

FOUNDATIONS FOR ELECTRICAL MACHINERY.

By [illegible]

Foundations for electrical and all other machinery have two functions: to sustain the machine in alignment and elevation, and to absorb vibrations occasioned by the machine.

With electrical machinery the first function is the important one. It may safely be asserted that any motor, generator or electrical machine of similar type that will not run at its normal speed without excessive vibration is of faulty mechanical construction. Frequently self-contained devices, such as motor-generators and rotary converters, are not bolted to the surface on which they rest, and certain manufacturers have such confidence in their products of this type that they provide no foundation bolt holes in the bed plates.

If a machine drives through a belt or gears it must be held in accurate relation to the driven device by a foundation or other means, otherwise the belt pull or the thrust of the gears will probably move it from alignment. A foundation for such a machine should be of such proportions that the weight of the machine will not cause it to sink into the supporting bed

and that the machine will not be moved by the pull or thrust of the transmitting member.

If a foundation is necessary for a self-contained electrical machine its only duty should be to keep the machine from sinking, and if a floor or other support of sufficient strength is available no foundation should be required.

Where possible, and it usually is with small motors and generators, foundations should, except in power stations, be avoided altogether. A foundation requires floor space, and floor space represents money. Small machines, as a rule, should be carried by side walls, roof trusses or on ceilings. Occasionally it is not feasible to mount machines thus and then foundations become imperative. In Fig. 1 are shown two such cases. It was not possible to mount the motor shown at *A*, Fig. 1, overhead, because of interference with the travel of a bridge crane. If it were mounted on the side wall high enough from the floor to be out of the way, the belt drive would be too short for good operation, hence the adoption of the foundation mounting. Had it been absolutely necessary to mount the motor high on the side wall one of the patented chain drives, which operate well on very short centers, could have been installed. In Fig. 1,*B*, neither the outside wall nor roof construction was sufficiently heavy to sustain the motor and, with a belt drive, a mounting on the brick wall of the main building would not provide a sufficiently great distance

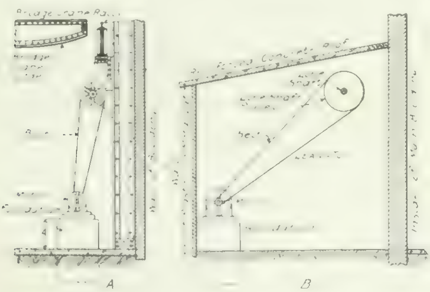


Fig. 1—Unavoidable Foundations.

from center of line shaft to center of motor shaft. The installation of a foundation appeared to be the only simple solution.

There is little definite information available regarding the rational design of foundations for any kind of machinery. The reason for this is, probably, that when a foundation for the average small machine is made of a sufficient area to include all of the foundation bolts of the machine it is to carry and of a sufficient depth to extend to good bottom or below frost line, it has enough mass to prevent thrusts or pulls in the power-transmitting members from altering its position and enough area of base to prevent its sinking. This condition is not true of certain machines of unusual shape which handle great amounts of power or have weights great in proportion to the floor space they occupy.

There are three structural conditions that must be fulfilled by a satisfactory foundation: (1) The foundation must have sufficient area of base to prevent it from sinking into the medium on which it rests. (2) It must have sufficient weight to prevent it from being shifted by belt pulls or gear thrusts, and (3) it must have sufficient weight to absorb the vibrations of the machine it carries, if there are any. The third qualification is of no importance where electrical machinery is concerned, so only the first two will be considered in the order in which they are mentioned.

For all soils there is a certain safe bearing load, and if this is exceeded the structure supported thereby is apt to sink excessively into the soil. The safe loads usually allowed in this country are given in the accompanying table.

It will be noted that the lowest value given is 1 ton per sq. ft. While the given values are doubtless safe and are used daily in the design of foundations for buildings it is considered good practice to use somewhat lower values in designing foundations for machinery. About one-half the tabulated

TABLE I—BEARING POWER OF SOILS

Material	Bearing Power in Tons per sq. ft.	
	Minimum	Maximum
Rock, hardest kind	200	
Rock, equal to Ashler masonry	25	30
Brick, equal to Ashler masonry	15	20
Brick of poor quality	4	7
Clay in thick beds, always dry	4	6
Clay in thick beds, moderately dry	2	4
Clay, soft	1	2
Gravel and coarse sand	8	10
Sand, fine and compact	4	6
Sand, clean and dry	2	4
Alluvial soils and uncertain sand	0.5	1

values is a good working basis which allows a maximum load of about 1000 lb. per sq. ft. on ordinary alluvial soils.

The first step, then, in designing a foundation is to ascertain the total weight, including machine, fittings and the weight of

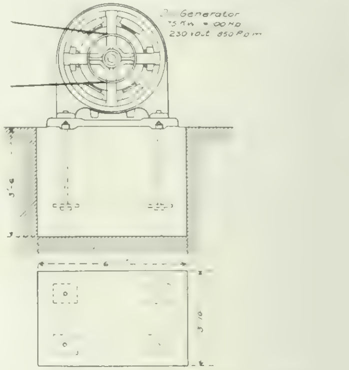


Fig. 2—Foundation Details of 75-KW Generator.

the foundation itself, that will be sustained by the soil and then to provide at least a sufficient number of square feet of area of base to bring the pressure per square foot within one-half of the values tabulated.

In Table II, in the last column, are given the pressures per square foot under the foundations shown in Figs. 2, 3, 4 and

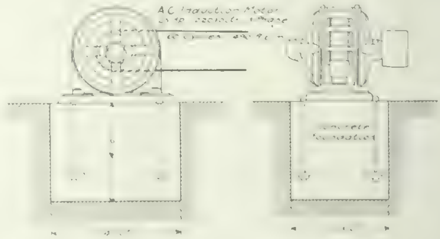


Fig. 3—Foundation for 25-HP. Motor.

5. These are all examples of foundations as erected in actual practice. It will be noted that the pressures all fall well within the safe limit. In these, as in a majority of cases in practice, the base area of the foundations was determined by that necessary to enclose the foundation bolts of the machine rather than by the safe bearing value of the soil. It is only in unusual cases, for electrical machinery, that it is necessary to compute the pressure on the supporting coil. If the foundation is made large enough to include the foundation bolts it

will usually have sufficient base area to render the pressure on the soil a safe one. Until one becomes familiar with the values of pressure that ordinarily occur he should compute each case. The base areas for unusual installations should always be computed.

The weight necessary to prevent lateral displacement is seldom computed except in the roughest way. It is usually the case that if a foundation includes the bolts and extends down

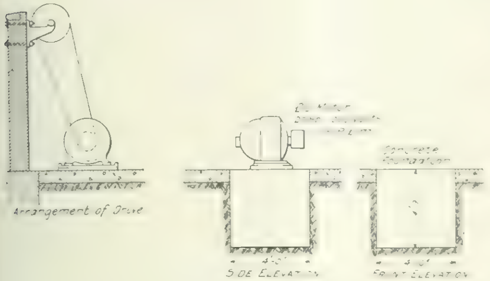


Fig. 4—Foundation for 20 HP. Motor.

to a good bottom or below the frost-line it has enough weight to prevent its shifting. That this procedure is a reasonably safe one is evidenced by the fact that failures of machine foundations, due to a shifting of their position, are rarely heard of.

The usual procedure is to design the foundation on the above basis and let it go at that. There are, as will be shown later, checks which are sanctioned by precedent which can be applied after the design is completed. So far as the writer is aware, no rational rule or equation has ever been proposed whereby the proper weight of a foundation could be computed. The only information that the writer has ever been able to obtain regarding the proper weights for foundations is given in Table III. These items refer to steam-engine foundations, but the methods that they suggest agree to some extent with designs that practice has shown to be safe. Mr. John Young, a Scotch mechanical engineer, states that foundations should

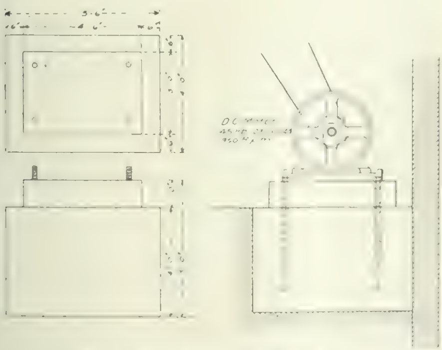


Fig. 5—Foundation for 45 HP. Motor

weigh 2½ to 4 times as much as the engines they carry. The exact weight depends on whether the engines are of the vertical or horizontal type and on the direction of the belt pull and the speed. Mr. B. Beardsley, an American hydraulic engineer, states that the weights shown in Table II represent good practice.

These figures are said to apply, however, only to foundations on soft, shaky soils.

Neither authority takes cognizance of the speed of the supported engine. This is very important, as the tendency of belt pull or gear thrust to shift a foundation is inversely proportional, for a given horse-power, to the speed of the engine or other driver. Therefore the weight per horse-power of a foundation should, for example, be greater for a 100-hp motor running at 600 r.p.m. than for a 100-hp motor running at 1200

TABLE II—WEIGHT OF VARIOUS FOUNDATIONS.

Hp. of Machine	Weight of Machine Pounds	Weight of Foundation. Pounds	Weight of Foundation, and Machine Pounds	Weight of Foundation, Per Hp.	Pressure in Pounds, Per Square Foot on Base of Foundation
100	5,890	12,243	[illegible]	122	[illegible]
25	1,500	[illegible]	[illegible]	[illegible]	725
20	1,850	9,600	[illegible]	480	715
45	3,200	15,225	18,425	340	1025

r.p.m. It is not altogether rational to endeavor to estimate the weight for a foundation without, in some way, considering the speed of the machine it carries.

Mr. Young takes the speed of the engine directly into account, in that a low-speed engine of a given horse-power is heavier than a high-speed one of the same horse-power. It will be noted that the data in the table agree, roughly, with the results that would be obtained through an application of Young's rule. It appears that these four foundations which have not failed in service are from 2 to 5 times heavier than the machines they carry. Very likely the same ratios would approximately hold for larger units. All that is really known about the four foundations is that they have not failed.

Although Beardsley's rule does not consider speed, it furnishes a check whereby one can be sure that a foundation is sufficiently heavy. This rule is proposed for steam-engine foundations and has in practice given satisfactory results. Inasmuch as steam engines are almost invariably of slower speeds than ordinary medium-sized electrical machines (this does not, of course, apply to units that are directly connected to engines), Beardsley's rule will give safe values for generator and motor foundations. Steam engines seldom have speeds exceeding 350 r.p.m. and it is the exception for the ordinary motor or generator to have a speed as low as this.

TABLE III—WEIGHTS OF FOUNDATIONS

HP of Engine	Pounds of Foundation Per HP.
Up to 25	300
25 to 100	200
100 to 500	175

The use of Beardsley's rule does not furnish a very satisfactory basis of design, for, although its user knows that a foundation designed by it will be safe, he does not know what the factor of safety is, and furthermore the rule does not take speed into consideration at all. However, it is the only usable rule that has been advocated by a practising engineer and is the only one that can be suggested until a better one is proposed. In most cases it is merely used as a check, as the weight of a foundation is ordinarily determined by the depth to good bottom or frost-line and its width and length by the positions of the foundation bolt holes in the supported machine.

The procedure, then, after having tentatively designed a foundation and having checked its area to make sure that it is sufficient to prevent settling, is to check its weight also. If the original design did not provide enough weight to meet these requirements more weight should be added, so as to entirely eliminate the possibility of foundation shifting in the most severe service.

STEAM TURBINE TROUBLES.

[illegible] at the Cedar Point [illegible] Electric Light Association, July 26, Mr. F. R. Brosius, of the Columbus Railway & Light Company, described some of the minor troubles encountered with one 1500-kw and two 500-kw steam turbines. These turbines are of the vertical-shaft type. Although trouble has arisen by reason of the failure to maintain pressure for the lubricant of the step bearing, the author expressed the opinion that the bearing as now arranged does not give as much trouble as does the average engine crank. The top, middle and bottom bearings must be kept in perfect condition and alignment and closely fitted, or trouble will be met in the machine vibrating. Other than this, it is only necessary that they be kept properly lubricated. This type of bearing must not be flooded with oil as are the bearings in the reciprocating engine. Trouble was experienced with these bearings throwing oil into the generator, but this has been overcome by fitting felt collars tight around the shaft above the middle bearings and below the top bearing. The expense for packing the pumps for maintaining the pressure in the lubricant is quite high. In three year's operation of the pumps for the 1500-kw unit, the plungers have been packed on an average of about six times per year, the rods have been packed about twice per year and the valves have been reground about twice per year.

When the 500-kw turbines were installed, each one was provided with a triplex motor-driven pump for the lubricant of the step bearings. Later a reserve hydraulic steam pump was installed, being so arranged as to boost up the pressure on the step bearings immediately in case of trouble with the motor-driven pumps. Use is made of an automatic regulator set at a pressure of about 5 lb. lower than the pressure regularly carried on the step bearings. In case either motor-driven oil pump should drop the pressure, the steam pump at once comes into action. This system has operated satisfactorily since installation.

A source of loss of economy with the vertical-type turbine, which might easily be neglected, is the carbon packing rings on the shaft for the purpose of sealing the turbine for vacuum. It is absolutely necessary that vacuum be maintained at a high point on the turbine outfit, if economy is to be expected in its operation. The carbon rings must be constantly watched and refitted to the shaft to overcome the possibility of any leaks at this point. The rings must be brought nearly to size and then scraped and spotted to the shaft, exercising a great deal more care in this work than is necessary with a bearing surface or with boxes. For this reason the water-lubricated step bearing seems preferable to the oil-lubricated bearing, as it does away with one set of carbon packing and there is no danger of air leaks from this bearing. This trouble is overcome in the latest types of horizontal turbines by mounting on the shaft a small centrifugal pump which throws a film of water around the shaft and seals the turbine for vacuum.

THE LOW-PRESSURE STEAM TURBINE.

Mr. W. C. Anderson, of the Canton (Ohio) Electric Company, read a paper before the Ohio Electric Light Association at its annual convention held at Cedar Point, Ohio, July 26, 27 and 28, in which he related briefly experience with a 500-kw low-pressure steam turbine that has been in use for the past two years. The plant was primarily a non-condensing plant, although at a later date a turbine was installed to run condensing on well water obtained on the premises. In addition to operating in part condensing the company maintains an exhaust-steam-heating system taking the steam from the compound non-condensing engines during the winter months. During certain hours of the day and depending on weather conditions, there is [illegible] the heating pressure and to take advantage of every pound of steam generated by the boilers, the turbine is floated in the line all the time, taking all the exhaust steam from the reciprocating engines that is not required for supplying the heating system or heating the feed water. From midnight until morning in very cold weather or during such other hours as the load is lightest and the supply of exhaust least, the turbine is operated non-condensing, in whole or in part. Use is made of an emergency stop so that if, when the turbine is operated from exhaust steam, the load should be accidentally removed, the turbine would be stopped. The regulation is altogether by the electrical load, the turbine and the engines feeding into the same system. This plan has proven very flexible and highly satisfactory, and excellent economy is obtained at all times. To make it successful, the highest vacuum attainable must be carried. After the advent of the turbine radical changes had to be made in the design of the condensing equipment. The condenser manufacturers have responded to the demand and there are now available condensers that will maintain 28 in. of vacuum or even a higher vacuum on a turbine with less trouble than it was to maintain 26 in. of vacuum on an engine.

MAINTENANCE OF ECONOMY IN STEAM PLANTS.

By S. A. Mehaffey.

In the writer's opinion it should not be the height of an engineer's ambition simply to have his plant running smoothly. He should watch everything, and where a little change will reduce expense or increase profit it should be made at once.

In the plant where the writer is employed as chief engineer, the station operating continuously 24 hours a day, three shifts of eight hours each, the plant had a reputation of running on 15 lb. of lignite coal per kw-hour output at the switchboard and was thought very economical. By making a great many changes on feed-water pumps, feed-water heater, feed-water regulator, resetting engine valves, getting turbine in closer regulation, getting rid of scale in boilers, and using dryer steam, in less than a year, the station is operating on less than 8½ lb. lignite coal per kw-hour on an average, and frequently has a record for 24 hours at less than 7 lb. per kw-hour.

RECAPITULATION OF POWER HOUSE REPORTS

	April.		May.	
[illegible]		182		17[illegible]
[illegible] Run	4		56	
[illegible]	91		18	
[illegible]	51		99	
[illegible]		$491.66		$598.05
Labor, Oils and Waste		244.75		256.35
Gal. Water [illegible]		[illegible]		18,589,000
[illegible]		272[illegible]		266
Kw-hours produced		40,605		41,23[illegible]
To Arcs	3,134		[illegible]	
[illegible]	17,2[illegible]		17,938	
To Pumps	20,214		[illegible]	
Cost of Coal, Labor, Oils and Waste per kw-hour		$0.0181		[illegible]
Lb. Coal burned per kw-hour		8.964		[illegible]
[illegible] Water pumped		1.115		1.0893
[illegible]		[illegible]		[illegible]

The equipment consists of one four-valve, high-speed engine, direct-connected to a 75-kw National generator with belt-driven exciter, and one 100-kw Curtis steam turbine, direct-connected to generator and exciter, the turbine operating condensing. In the boiler room there are two old tubular boilers of 170 hp rating at 100-lb. pressure and one Geary water-tube boiler rated at 164 hp at 150-lb. pressure. The steam pressure carried is 138 lb. The old tubular boilers show for the month of April an average of about 8½ lb. of coal per kw-hour and the water-tube boiler shows a higher efficiency.

The city of Fort Morgan, Col., operates a combined water and light plant, doing all pumping by motors and centrifugal pumps. The average volume of water pumped is about 1,000,000 gal. per 24 hours during the sprinkling season. A report showing the results obtained for April and May, 1910, is given herewith. What has been done in this plant is not exceptional and the results can be duplicated in any first-class plant by the use of good judgment and some brain work.

LETTERS ON PRACTICAL SUBJECTS

PARALLEL OPERATION OF GENERATORS WITH COMMUTATING POLES

The parallel operation of direct-current compound generators having commutating poles presents some problems which are not found in machines without the interpole field. In order to explain some of the difficulties which are encountered, a brief description of the means used in paralleling simple compound dynamos will be of use.

In Fig. 1 are shown the connections for two similar generators. If the equalizer connection be omitted, when machine No. 1 begins to take more load than No. 2, more current exists in its series field coils and its voltage begins to rise. This causes it to take more current and the second machine less, and in a very short time machine No. 1 will be carrying nearly all the load. Connecting an equalizer as shown prevents this action. As the voltage of machine No. 1 rises the point *A* becomes of higher potential than *B*, a current is produced from *A* to *B* through the series field coils of machine No. 2 and the voltage of machine No. 2 is therefore increased as the potential of the first machine builds up. The load divides equally between the two, provided the series field-coils are so adjusted by means of the German

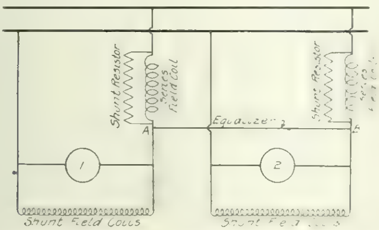


Fig. 1—Parallel Connection of Plain Compound-Wound Generators.

silver shunts that a definite increase of current produces the same rise in voltage in each of the machines.

Consider now two interpole machines connected as in Fig. 2. Suppose that, in a manner which is to be explained later, the interpole field m.m.f. acts with the series field m.m.f. to raise the voltage as the load comes on. If machine No. 1 begins to take more than its share of the load, an equalizing current is produced from *A* to *B* as before. This current exists only through the series field coils of machine No. 2 and does not pass through its commutating field coils. Therefore, the voltage of machine No. 1 will rise faster than that of No. 2, due to the compounding effect of the unbalanced current in its interpole field coils. As a result, the first machine takes all of the load and the generators will not operate in parallel. As a definite instance the following case is stated.

Two 375-kw generators giving 225 volts at no load, and 250 volts at full load, were installed in a certain power plant. Either machine, when operated alone, compounded correctly with good commutation. When both machines were joined to the busses one would begin taking far more current than its share until its circuit breaker opened; it was impossible to load them together.

Measurements of the resistances of the series field coils of the machines showed them to be equal; the German silver shunts were found to be identical. It was noticed, however, that nearly 40 per cent of the load current was being shunted from the series field coils. The interpole field coils and shunts were not exactly equal.

By means of a voltmeter connected to indicate the e.m.f. between commutator bars at the point of commutation it was ascertained that the brushes were set back of the full-load neutral point; that is, in a direction against the rotation from the neutral point. When the brushes were shifted forward from the neutral point the full-load voltage dropped greatly. Instead of compounding from 225 volts to 250 volts the machine voltage fell from 225 to 220. The heavy shunt resistor was disconnected from the series field coils and the interpole field was weakened considerably by shunting more current from it. The machine then compounded from 225 volts to 257 volts

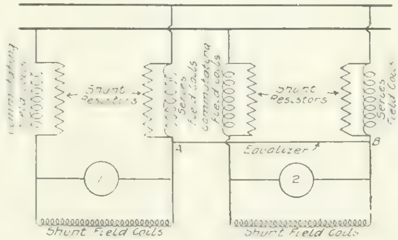


Fig. 2—Parallel Connection of Compound-Wound Interpole Generators.

and a small amount of current shunted from its series field coils brought the full-load voltage down to the correct value.

When the changes had been made on both machines they worked perfectly in parallel and the commutation was excellent.

The manner in which the interpole field affected the compounding is indicated in Fig. 3. At the top is shown the field structure and below this are the field forms produced by, first, the main poles; second, the commutating poles, and, third, the armature m.m.f. The shaded area is the resultant full-load field form, and under this is a diagrammatic representation of the armature coils and brushes.

The voltage between brushes *c* and *d*, among other things, is proportional to the number of magnetic lines cut per second by the conductor between the brushes. It will be noted that when the brushes are set at the point *a* the interpole field is of the right polarity to add its flux to that of the main field and increase the voltage generated between *c* and *d*. On the other hand, when commutation occurs at *b*, the interpole flux tends to produce a voltage counter to that produced by the main field. In the case previously cited, with the brushes at *a*, the interpole and series field fluxes caused a rise in e.m.f. from 225 volts to 250 volts, while with the same field strength and the brushes at *b* the interpole field reduced the e.m.f. from 225 volts to 220

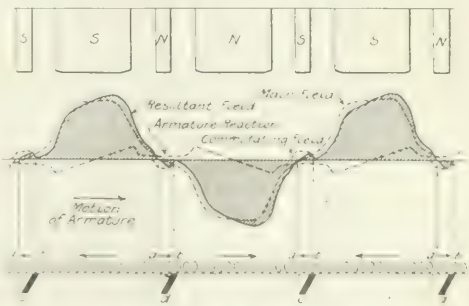


Fig. 3—Components of Field Magnetism

volts in opposition to the compounding effect of the series field coil m.m.f.

Thus, for parallel operation of compound interpole machines, it would seem that the best results will be obtained when the brushes are shifted slightly ahead of the full-load neutral point and the series field m.m.f. is of sufficient strength to give correct compounding.

Schenectady, N. Y. BAYSE N. WESCOTT

SHUNT-WOUND MOTOR ON CIRCUITS OF VARIABLE VOLTAGE.

It is well known that shunt-wound motors do not operate satisfactorily when supplied with energy from circuits whose voltage is subjected to sudden and wide variations, such as are often found on railway circuits. Series-wound motors are not seriously affected by such variations in the supply circuit. A sudden rise in voltage, on a circuit from which a shunt-wound motor is receiving energy, causes severe sparking at the brushes, and very often operates the circuit-breaker or other protective device. However, the opening of the circuit-breaker or blowing of a fuse in the supply circuit is no remedy for sparking at the brushes. This sparking seems to be of a kind that is particularly destructive to commutators. Shunt-wound motors find considerable use in the terminals and repair shops of electric railways, and they are usually supplied with energy from the railway circuit. The device described below is designed to enable the motors to run without sparking, despite the widely varying voltage of the railway circuit.

This device, which is in reality a special type of choke coil, was designed to protect the motors in the terminals of one of New York's large electric railways. The motors in question are compound wound and are used to operate elevators. They start as series-wound machines, a 4000-ohm resistor being connected in series with the shunt-field circuit. As soon as running speed is reached the resistor is automatically shunted and the series field is cut out of circuit. The motor then operates as a straight shunt-wound machine. The nearest feeder taps the third-rail at a point over 4000 ft. away from the terminal, and when a train pulls out there is a large and sudden drop in voltage. On passing over the yard switches before reaching the main line, the controller is thrown to the off position with the result that the voltage instantly rises again.

It is this rise in voltage that causes the trouble, very often causing the circuit-breaker to open and stopping an elevator between floors. Not only does the circuit-breaker open, but every time one of these voltage surges comes in, there is a sharp spit of fire from the brushes. If the voltage rise is very large, sparks sometimes jump from the positive brush holder to the motor frame, a distance of almost 2 in. These voltage surges often cause a motor to flash over and rapidly burn out commutators. It was found necessary to replace several commutators, the insulation between the commutator and the shaft being completely destroyed.

The shunt motor, when looked at from the theoretical side, resolves itself into a divided circuit, one branch of which has a very high resistance and a high reactance, and the other a very low resistance and low reactance. The instantaneous voltage change in a circuit of this kind does not follow the change in the supply circuit directly, but in the low reactance part of the circuit amounts to four or five times the variation, and in extreme cases it may be seven or more times as great. The reason the circuit-breaker or fuse in the supply line fails to protect the motor from the voltage surge, even when it opens, is that the trouble is inherent with the motor itself and is always encountered in circuits of this type.

Assume, for example, a drop in the supply voltage of 10 per cent, or from 600 to 540 and then a return to 600; the instantaneous voltage on the fall will be considerably below 540, but this will not cause any trouble. On the rise the instantaneous e.m.f. may reach 300 volts or more, thereby bringing the total voltage across the armature terminals up to 800 volts or 900 volts for an instant. This is what causes the trouble, and produces the sparking at the brushes. If the change in the supply voltage amounts to 100 volts or 120 volts, which was very often the case in this railway terminal, the total momentary voltage across the armature may easily be 1200 volts, or even higher.

A number of tests were made on one elevator motor and it was found that no matter how heavy the surge no effect whatsoever was produced as long as the motor was operating as a series machine. The effect was only produced when the motor was operating as a shunt machine, which bears out the theory of a divided circuit. A number of tests were made on a 220-volt shunt motor at the laboratories of the Polytechnic Institute of Brooklyn. The tests consisted of placing choke coils of different sizes in series with the motor armature and then switching the motor directly from the 110-volt circuit to the 220-volt supply main. From the results obtained from a large number of tests a coil was designed that would permit of switching the motor at full load from the 110-volt to the 220-volt circuit without producing even the slightest trace of sparking at the brushes.

A coil was then built and placed between one of the armature terminals and the line of one of the elevator motors at the railway terminal. This coil has a very low resistance, and was placed in service during December, 1909. With the device in circuit the circuit-breaker never opened nor was there the slightest trace of sparking even with the heaviest surges. The coil does the work satisfactorily; it contains no moving parts, and has a very small resistance, giving an I^2R loss of very few watts. These coils are positive in their action, and form very simple and reliable means of satisfactory operating shunt motors on circuits where the supply voltage varies widely. The efficiency of a motor with one of these coils in circuit is not reduced by more than 1 per cent, but this is more than compensated for by the increased reliability of operation and by the increased life of the commutator. There is no reason why these coils cannot be designed for use with any size of shunt motor or to meet any change in voltage.

Brooklyn, N. Y. Wm. B. Kouwenhoven.

HIGH TENSION TERMINAL CONSTRUCTION AND TEMPORARY STACK GUYING

In the July number the writer described an overhanging retaining wall for coal storage erected at the power house of the Indiana & Michigan Electric Company at South Bend, Ind. There are several other interesting features connected with the station under discussion which are worthy of emulation. Provision has been made for five high-tension circuits of three wires each, some of which are in use now. To accommodate them there was constructed during the past season the very strong terminal arrangement illustrated in Fig. 1. This, as one

Fig. 1—High Tension Terminal Construction.

of the operators has expressed it, is heavy enough so that if a fire breaks out on it, it will not burn through and let the wires drop until the station attendants have a chance to locate and cut out the defective circuit. Due credit must be given to the mechanics who erected this high-tension terminal arrangement, as well as to the designer of the same, for it is as pretty a piece of pole and cross-arm work as it has been the writer's lot to see. Every line is straight and square to the other lines,

both in the pole and the cross-arm work. The poles are evidently selected ones, for they are also straight and symmetrical. The cross-arm work is all double, as are also the stringers which connect the poles lengthwise of the lines. The insulation is also in duplicate, each double cross-arm also being attached by a separate insulator to the wires supported by it. Three of the four high-tension lines come from the hydroelectric power house at Berrian Falls and are under a tension of 25,000 volts each. The fourth line is for outgoing service and supplies the local street railway demands. This line is operated under 14,000 volts. The handling of the high-tension current is effected by means of remote-control switches and motor-operated steam valves are to be installed in the pipe connections of the steam turbine unit when the new building is completed. Immediately in front of the door, in Fig. 1, will be noted one of the very large atmospheric turbine valves which is to be installed in the new arrangement of the station. A good idea can be obtained as to the dimensions of the turbine which requires a valve like this by comparing it with the two steel oil barrels standing in the same focal plane with the valve. The man was also about the same distance from the camera as the valve. There are many interesting engineering problems in evidence in connection with the rearrangement of this station, and an interesting, although not very important one, is the handling of the guy cables from the four stacks now in evidence at this station. A number of the guy cables were attached to the walls and roof of the old building, which is shown in the distance by Fig. 1. Incidentally, the new steel posts and some other structural work are shown projecting through the pitch roof of the old building. The four large stacks are also shown in the upper left corner of Fig. 1, and all the north-side guys had to be removed from the old building, temporarily only, as the guys can be replaced upon the walls and roof of the new structure after its completion. What to do with these guys was a problem, for a busy street passed close along that side of the buildings and the company had no rights upon the property immediately opposite on the other side of the street. As the heavy stacks needed both middle and top guys, there would be four double sets of guy cables— eight in all to be taken care of. After a good bit of figuring by the engineers, they hit upon the plan which was adopted and the single heavy pole shown at the extreme right of Fig. 1 was erected and all of the eight stack guys were connected thereto. The guys in their new position are far above the high-tension circuits, so high above ground, in fact, that the middle guys appear to run horizontally to the stacks. It may well be imagined how interesting a matter it must have proved to engineer each of these eight wire cables to its new position and to make it fast to the pole without making contact with the high-tension wires. To be sure, the guard wires helped the matter a good deal, but while guard wires prevent falling wires from making contact with the high-tension work, a lineman is never fond of trusting to guard wires when he is running heavy wire cables above and crosswise of said guard wires and high-tension circuits. But the work of the linemen and the engineers did not consist merely of placing the eight stack guys upon the pole as noted. The pole required very heavy guying in turn to withstand the pull of the stacks, and permission was finally obtained from owners of the opposite property to place a stub pole on that side of the street. This was done, as shown by Fig. 2, a heavy 18-in. pole being placed just inside the fence and attached to the guy pole by means of two ½-in. steel-wire cables. Thus the stacks were adequately guyed and no portion of the guy wires or braces was less than 20 ft. above the curb. The pole guy crossed one sidewalk at a less height, but that did not matter as the farmers kept their loads of hay well away from sidewalks and the adjacent mud gutters when coming into town. Fig. 2 also shows a side elevation of a portion of the high-tension terminal, and the method of arranging the double cross-arms and insulators can be seen from another angle than that presented by Fig. 1. Incidentally, the four large stacks are shown by Fig. 2 and the location of the old building, which is being replaced by a new one. Portions of the steel framework for the new building are shown projecting through the roof of the old structure. The new building is to be built to the height of the roof shown in the distance, beyond and above the pitch-roof building, which is to be demolished. Incidentally it may be remarked that the line wires visible in the upper portion of Fig. 2 are all circuits supplied with energy from this station, and are only about one-half of the circuits which leave the building, just as many more wires running toward the east and crossing the St. Joseph River upon the long-distance wire-carrying device illustrated and described in the November, 1909, issue.

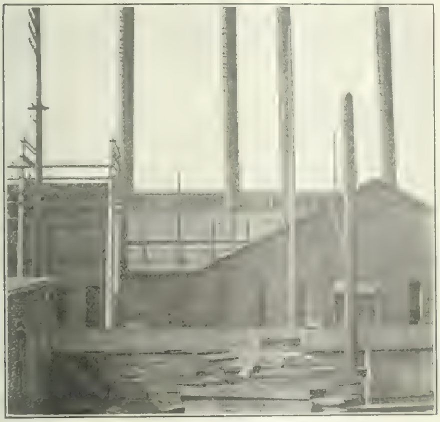


Fig. 2—Temporary Stack Guying.

South Bend, Ind. James F. Hobart.

CONNECTING TRANSFORMERS OF DIFFERENT SECONDARY VOLTAGES IN PARALLEL.

The following problem on paralleling a bank of three transformers with a bank of three other transformers and the solution suggested will doubtless be of interest. It was desired to parallel three 75-kw transformers with three 30-kw transformers on a three-phase, 60-cycle system, the connections on primary and secondary to be in delta. The primary voltage is 2200 on both banks of transformers; but the secondary voltage of the larger bank is 488, while that of the small bank is 460. In studying this problem various questions presented themselves. What would be the effect of paralleling them as they are? Would it be necessary to employ a reactance, and if so how many amperes would it have to be wound for? How many volts would it have to take up, the ratio of the larger bank being 4.5 to 1? Would the reactance have to be connected in series with each line or in one leg of each transformer on the primary of the larger set? These questions could not be answered off hand and the problem was referred to an engineer who suggested the following solution:

The division of load between two transformers in parallel depends almost exclusively upon the voltage regulation of the two units, that is, upon the relative impedances of the two transformers. Even two 30-kw transformers would not divide the load between them equally unless the impedance of one transformer was equal to that of the other, both in their reactive components and their resistance components. A 30-kw transformer would operate satisfactorily in parallel with a 75-kw transformer, provided the impedance of the smaller transformer were larger than that of the larger transformer in the ratio of 75 to 30; that is to say, the voltage regulation under load of the one transformer should be identical with that of the other, in which event the two transformers will divide the load in proportion to their ratings. The above relations exist when the two transformers are designed for identical primary and secondary voltages. When the ratio of transformation of one

transformer is different from that of the other, it is evident that even at no load a certain amount of current will exist in their circuits when both the primary and secondary coils are joined in parallel. In the case just cited, where one transformer has a secondary e.m.f. of 460 volts and the other of 488 volts, when the two transformers are connected in parallel there will be produced a local circulating current which will have a value represented by 28 volts, divided by the sum of the impedances of the two transformers. It may be stated, with a fair degree of accuracy, that this amount of current will exist at all times in the transformers quite independent of the load which each may be carrying. Under load conditions this current will merely be superposed upon the load current. It may be in a direction to be additive with reference to one load current and subtractive with reference to the other; but probably would be largely in time-quadrature with each of these currents, and hence would add at right angles to each one. The 75-kw transformer could be parallel with the 30-kw transformer, and the local circulating current could be kept within proper limits by inserting an impedance between the two transformers. However, if this method were carried out in its simplest form the results would not be highly satisfactory. By far the best method of operating in parallel two transformers which give different secondary e.m.fs. is to place between them a so-called auto-transformer wound for an e.m.f. equal to the difference between the two secondary voltages, and for a current equal to the maximum current which either one of the

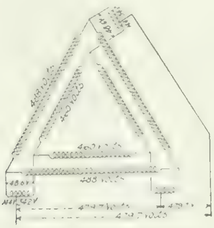


Diagram of Connections.

transformers will be called upon to carry under load conditions. In case three transformers of 75-kw rating are to be operated in parallel with three transformers rated at 30 kw each, it is preferable to use three separate auto-transformers and make such connections to these transformers that the load will divide according to the ratio of the ratings of the several transformers. The proper method of connecting the secondary circuits of the transformers is indicated in the accompanying illustrations. The secondaries of the 75-kw transformers should be joined in delta so as to produce 488 volts between the adjacent wires. The secondaries of the 30-kw transformers should be similarly connected so as to produce 460 volts between the wires. Between the apex of each voltage triangle, that is, between the terminal points of the transformer loads, there should be jointed an auto-transformer wound for 48.6 volts, as indicated in the illustration. By tapping this transformer at an intermediate point located at each place along the winding so as to produce 14.4 volts on one side and 34.2 volts on the other side, the division of load between the 30-kw set and the 75-kw set can be absolutely guaranteed to be in proportion to the ratio of the ratings of these transformers. The active ampere-turns in each section of the auto-transformer is definitely set, so that when the 75-kw set is loaded to 26.8 amp (which means its full load current) the other set will be carrying 11.3 amp, which is its full load output. The e.m.f. between the tapping points on the three auto-transformers will be 479.7 volts at no load and the percentage regulation will be a mean proportion between the regulations on the two transformer sets. An auto-transformer is a single-coil transformer, or is operated as a single-coil transformer. It can be designed with a wire of uniform cross-section, but this is not necessary. It can be designed as a two-coil transformer, one coil being proportioned for 11.3 amp and the turns arranged for 34.2 volts, and the other coil could be designed for 26.8 amp and with turns sufficient for 14.4 volts. These two coils could then be connected in series giving 48.6 volts, and the output current at the tapping point would be 38.1 amp. In each case the small value of the exciting current, which in any event is truly negligible, has been ignored.

New York. HARVEY DUNLOP.

COMMUTATOR TROUBLES.

Owing to the substitution of mica compounds for mica itself in the manufacture of commutators very many commutator troubles arise which are directly traceable to this cause. Of these the most frequent is pitting, especially on railway motors. By undercutting or grooving the commutators, railway companies have been enabled to get rid of a large percentage of these troubles and to secure a much longer life of the commutator. The best micanite plates obtainable are usually composed of the finest selected soft white Indian mica in conjunction with a shellac solution made from the finest shellac. The sheets are subjected to enormous pressure which gets rid of almost all of the shellac solution, leaving just enough for producing the sheet, which when in the commutator will not swell or ooze. This is cut up into sections or punched to any desired pattern. A different grade of mica is chosen for turbo-generators and large machines. However, the best micanite is liable to show weak spots and when these are right on the commutator surface, pitting usually results. Bad pitting is due to inferior micanite, the better grade of material only developing small pits. In not a few cases the cause of the latter in railway service is a flash over. When pitting occurs the usual procedure is to apply commutator dressings, etc., and when these fail to effect a remedy, as they always do, sand papering the commutator is tried, with about the same results. The only remedy is to get rid of the pits. To do this they should be cleaned out by scraping until clean mica shows itself. Numerous mixtures may then be applied. A thick mixture of powdered mica and shellac varnish will serve as a temporary filling, or a mixture of plaster of paris and an insulating varnish. A putty made up of water glass and powdered mica if carefully applied will also answer. The putty must be of the right consistency, neither too sticky nor too dry, and in applying it care must be exercised not to entrain any air. This mixture expands as soon as the commutator heats and usually holds for a number of years if well done.

Closely akin to commutator troubles are troubles with collector rings on alternating-current machinery. For a number of years a large railway company was troubled with the copper brushes on its rotary converters. The brushes cut grooves in the rings and if the rings were not turned down, splinters from them would fall across adjacent rings and short-circuit the rotary, despite the precautions taken in cleaning the machines and blowing out the dust and other accumulation with compressed air. The copper dust from the brushes and rings also caused short circuits at times. Carbon brushes were then substituted for the copper brushes on the collector rings and proved to be quite desirable, although quite a departure, at the time, from standard practice.

Where commutators are grooved as in street-railway work, it will usually be found advisable to employ a high-grade brush and a lower brush tension, thus reducing the wear on the commutator to a minimum. A treated brush will not always give satisfactory results, because the dust given off by the wear of the brush adheres and accumulates in the slots, eventually causing a short circuit. Treated brushes, moreover, have a tendency to become gummy and to stick in the brush holder. Many of the high-grade imported brushes have so little effect on the commutator and the wear on the latter is so slight as to indicate a life of many years. In shutting down generators, it is a good rule to clean off all oil and lubrication from the commutator so that when the latter becomes cold on standing, the oil does not harden and injure the commutator.

Philadelphia, Pa. SCOTT THORNE.

QUESTIONS AND ANSWERS

We have a 75-kw, 110-volt direct-current generator feeding a lamp circuit and a motor circuit in a sawmill. In addition to the five motors ranging in rating from 1 hp to 5 hp, there is in use a home-made 8-ton electric crane equipped with two series and one compound-wound motor, rated at 3.75, 20 and 8 hp, respectively. The crane operates on a 600-ft. track and has a 40-ft. trolley track. Everything is in the open, and at present there are two trolley wires strung on poles. On account of trouble from short-circuits, we wish to eliminate one of these wires. Could the negative be grounded to the rails? The frames of the two series-wound motors have no connection to the ground. P. N. F.

The method of grounding proposed by you for your 110-volt system will give satisfactory results. The only precaution that need be observed is to assure yourself that all electrical circuits not intended to be grounded are kept well insulated.

We have two motors we are at a loss to know what to do with. Both are single-phase machines designed for 60 cycles and 110 volts. They will not run unless started by hand and until they heat up, after which they will operate satisfactorily. The motors have three binding posts. Kindly advise us on the operation of these machines. J. P. C.

The ordinary type of single-phase induction motor is not self-starting from rest, and some auxiliary starting device must be employed with such machines. It is probable that the 60-cycle machine which you are using was designed as a split-phase motor, and in order to render it self-starting it will be necessary for you to use a resistance in series with the third lead on the machine. In this case the machine will exert a weak starting torque and will accelerate to full speed without load.

We possess some three-phase induction motors with wound rotors and internal grid resistance. Owing to the dusty surrounding in which these motors operate, we wish to arrange them to start with an auto-starter. Can you suggest a way to arrange for this method of starting which will cut out the internal resistance? E. A. J.

From your inquiry we are led to believe that the auto-starter which you expect to install in connection with certain three-phase induction motors is of the auto-transformer type. When use is made of a starter of this type it is unnecessary to vary the resistance in the secondary circuit of the induction motor unless the starting conditions are so extreme that an enormous value of starting torque is required. Assuming that a moderate value of starting torque will suffice in your equipments, it should be possible for you to short-circuit the rotor leads upon themselves and convert your machines into the equivalent of squirrel-cage-wound induction motors.

There are in use in our city lighting plant eight direct-current, 9.6 amp, 80-light Wood arc machines which are in good operative condition. Would rewinding these machines for lower amperage, say 6.6 amp or less, increase or decrease the efficiency of the machines? If street series tungsten lamps were used on these circuits, would not the 9.6 amp lamp, in view of its large filament, be stronger and give a better light than one of lower amperage? Considered from every point of view, especially total unkeep and results obtained, is the low-voltage series tungsten street lamp the most practical street-lighting unit?

It is possible to rewind a 9.6-amp arc machine to, say, a 6.6-amp machine without materially affecting the efficiency. In your case it is probable that it would prove advantageous not to rewind the machine, but rather to obtain series lamps, which can be operated at the larger value of current. Tungsten lamps can be obtained for 7.5 amp which are said to give excellent results, and doubtless by communicating with any of the lamp manufacturers you will be able to obtain estimates of the cost of 9.6-amp lamps, which should prove even more satisfactory than the 7.5-amp units.

What is the voltage between the two outer wires of a two-phase, three-wire circuit used for motor service? How should a two-phase motor having four binding posts be connected to such a circuit? W. F.

The voltage between the two outer wires of a two-phase, three-wire system is 1.4 times that between the two adjacent wires. That is to say, if the e.m.f. per phase is 110 volts, the e.m.f. between the two outer wires of a three-wire, two-phase system would be 155 volts. In connecting a two-phase motor to a three-wire, two-phase system the inner wire should be treated as merely a common wire for the two phases. That is to say, one of the phase windings should be connected between the inner wire and one of the outside wires, while the other phase winding should be connected to the inner wire and the remaining outside wire. It might be well in this connection to call your attention to the fact that if, when connected, the motor tends to revolve in the opposite direction from that desired, it will be necessary merely to interchange the connections of the two leads of one of the phase windings on the machine.

What formula is used in calculating a single-phase starting winding—that is, the relation between the turns in the running winding to those in the starting winding? How many degrees is the starting winding connected in advance of the running winding, and what relation should the number of slots in the rotor have to those in the stator of a squirrel-cage machine? C. A. D.

The single-phase induction motor found upon the market today usually consists of either a symmetrically wound three-phase motor or an unsymmetrically wound two-phase machine. The windings of the three-phase motor are identical in every respect to the windings of the ordinary three-phase induction motor, but for the purpose of starting the machine from rest use is made of resistance connected in series with reactance, the two being joined across the main leads of the supply system. The third lead of the motor is drawn to the point of connection between the resistance and reactance. In the two-phase type of machine one of the windings contains considerably more coils than the other. A popular arrangement consists in using about three times as many turns in the main winding as in the starting winding. Under starting conditions the resistance is connected in series with the starting winding; this circuit then being joined in parallel with the main supply system. Under running conditions the resistance circuit is open, and no current exists in either the starting resistance or in the auxiliary starting winding.

What is the advantage of setting three single-phase transformers for a three-phase motor circuit instead of two transformers? How may the rating of the transformers necessary in either case be calculated? G. F. S.

A complete discussion of the relative advantages and disadvantages of polyphase transformation by means of single-phase and polyphase transformers was given in our issue for February, 1907. In transforming from three phase to three phase use may be made of either one three-phase transformer, two single-phase transformers or three single-phase transformers. As a specific example, it may be stated that for the transformation of a total amount of power of 15 kw there could be used either a single 15-kw three-phase transformer; three 5-kw single-phase transformers connected either in delta or star; or two 8.66-kw transformers V-connected, or one 7.5-kw combined with one 8.66-kw transformers T-connected. So far as cost and performance are concerned, the most desirable equipment is the single three-phase transformer. Almost equal to this in performance, but slightly more costly, would be the three single-phase transformers. The most disadvantageous arrangement is that employing two V-connected transformers. Where it is desirable to use two transformers rather than three, it is preferable to connect both the primaries and secondaries according to the T-method. When this connection is used the phase relations are much better balanced than is true with the V-connections.

Central Station
Management, Policies and Commercial Methods

ABANDONMENT OF CONEY ISLAND AMUSEMENT PARK ISOLATED PLANT.

Steeplechase Park, one of the largest Coney Island amusement enterprises, and known all over the world, has just discontinued the use of its 1200-hp private plant and closed a contract with the Edison Electric Illuminating Company of Brooklyn for its supply of electrical energy. The Steeplechase plant was the largest isolated plant on Coney Island and for years was used by its proprietor as a show place. Fire destroyed the

Fig. 1—Steeplechase Park.

park a few years ago and the power plant was not fixed up for exhibition purposes again. The acquisition of this load virtually places all of Coney Island on the Edison circuits.

The Edison Electric Illuminating Company of Brooklyn by reason of the immense lighting load at Coney Island, occupies a rather enviable position. While the load on other central stations usually drops during the summer season, that of the Brooklyn Edison increases, in so much so that the peak load which everywhere else is reached in the winter comes on in the summer on the Brooklyn system, giving it a yearly load factor of no mean proportions. Moreover, the peak lighting load at

Fig. 2—Abandoned Isolated Plant.

Coney Island differs from the ordinary residence lighting peak, and can scarcely be called a peak since it has a duration of from four to five hours.

Mr. Tilyou, the proprietor of Steeplechase Park, found after much experience that the cost of running his isolated plant during the summer and keeping it idle during the winter was not commensurate with its importance as an attraction. The Edison substation in Dreamland was by far a more attractive place. Moreover, the service obtained from the plant was not the best. There were times when the lights flickered and other times when the engines broke down. Over 14 tons of coal were carted daily to the plant, and the six separate generating units were a source of worry during the busy season. The large amount of space taken up by the plant could also be utilized for other and more profitable purposes. These considerations, coupled with the fact that the Edison Electric Illuminating Company of Brooklyn could supply him with energy at less cost than he could make it, induced Mr. Tilyou to make the change. The demand is 800 kw.

CENTRAL-STATION CONSTRUCTION COSTS AT SALEM, MASS.

In connection with a petition filed recently with the Massachusetts Gas & Electric Light Commission for approval of a new issue of capital stock, the Salem Electric Lighting Company filed with the board an unusually complete statement of

CONSTRUCTION COSTS.

[illegible]	[illegible]
[illegible] kw. [illegible]	[illegible]
Two boilers, floor, 51x30 ft.	321
Concrete coal run, 19x10 ft. in boiler house	102
Iron stairs leading from engine to switchboard room	682
Cutting out boiler house door	17
[illegible] switchboard room	[illegible]
Concrete floor around 1000 kw engine, floor, 44x35 ft.	875
Boiler house extension, 56x55 ft., one story high, concrete roof and fireproof construction throughout	7,255
Wooden shed, 60x16 ft., height 12 ft.	232
Coal run. This run is composed of chestnut standards about 30 ft. high, on top of which is a platform for unloading and conveying by barrows the coal supply for the station from vessels. Length of run, 165 ft.	
Cost of run	447

its expenditures for plant construction and improvements during the past nine years. Those expenditures reached a total of $363,762, and were classified under real estate, steam plant,

STEAM PLANT MACHINERY COSTS, SALEM, MASS.

One 400-kw McIntosh & Seymour vertical engine	$17,268
[illegible]	20,105
[illegible]	679
Barr pump and condenser	1,969
One 1000-kw vertical cross-compound engine	25,267
One 1200-hp feed water heater	663
One 350-hp B & W boiler with superheater, less grates	4,419
Warren feed pump, 14x12 in. end suction, rubber valve	440
One special National feed water heater	1.130
[illegible] B. & W. boiler [illegible]	18,880
One 10x10x12-in. single tank pump	256
One vacuum pump for Worthington condenser	1,300
Piping for engines, pumps, boilers, exhaust, feed water, heater and condenser	32,662
Foundations for 400, 600 and 1000-kw engines	8,426
" boilers and pumps	5,880
Engineering and freight	600

electric plant, overhead system, underground system, transformers, meters, arc and Nernst lamps. A brief outline of these expenditures was given in connection with an account of the hearing held by the board on June 15. In the following paragraphs are given a number of selected items from the company's list of expenditures which are suggestive in a general way as to the cost of carrying out definite work in the field. Only such items are printed as are specific in their interest as cost data, omitting cents:

ADDITIONS TO POWER STATION.

This work consisted of the building of two stories on the east end of the station, 60 ft. long and 14 ft. wide, consisting of two floors, both of concrete, the lower room being used for station auxiliaries and apparatus connected with the switchboard in the room above. The upper room contains the com-

plete switchboard, and is provided with fire shutters on doors and windows, with concrete roof.

As stated, these figures are correct to the nearest dollar

APPROXIMATE DETAILED COSTS OF ACCESSORIES (PARTIAL LIST).

Pipe covering	[illegible]
Boiler grates	2,057
Pipe supports, platforms and erection	977
Oil shields for engine units	462
One No. 1[illegible] steam separator	270
Rochester lubricator	[illegible]
Gauge boards for 400 and 600 kw sets	[illegible]
Gauge board and gauges, 1200 kw engine	[illegible]
Relief valve for heater piping	[illegible]
One single cylinder tank pump	[illegible]
One 1-qt. lubricator	[illegible]
Screen in front of canal to condenser	[illegible]
Valve, Warren feed pump	[illegible]
Steam pressure regulator	[illegible]
One American unit oil filter	[illegible]
Damper regulator	[illegible]
Water meters on boiler feed piping	260
Washing machine for waste reclamation	[illegible]
Oil tank, Barr condenser	[illegible]
Canal, 10x6x8 ft., connecting condenser tank [illegible]	[illegible]
Cutting hole in chimney for boiler flue	[illegible]

unit, and include but a portion of the total expenditures filed by the company. Only such items were selected as might be sufficiently complete to be of general interest.

ELECTRIC PLANT PARTIAL LIST OF SELECTED COSTS (TO NEAREST DOLLAR).

Switchboard.			
Twenty panels, 56 ft. long, blue Vermont marble 2 in. thick			$11,5[illegible]
Circuit breaker			[illegible]
Oil switches			460
Exciter rheostat			248
Addition to switchboard, completing panels 3 and 16			3,000
Wiring for Switchboard.			
Cleats	$14.40		
Hollow brick pipe	91.20		
Labor installing brick pipe	65.74		
Rubber covered wire	97.63		
Wire, etc	111.84		
Moulding	43.75		
Labor, etc	7.09		
Cable	179.27	total	$611
Machinery costs.			
One 1[illegible]			$3,600
Compensator			235
One 40-kw 125-volt exciter			2.650
Two 200-kw belted generators			6,200
One 400-kw direct connected generator			7,625
One 600-kw engine driven generator			9.700
One 1000-kw generator direct driven			10,500
Portable Instruments			
Two chronographs			$50
Multiplier for wattmeter			[illegible]
Polyphase wattmeter			[illegible]
Portable voltmeter			[illegible]
Test meter			[illegible]
Frequency indicator			[illegible]
Portable wattmeter and voltmeter			[illegible]
Testing transformer			[illegible]
Wright demand indicator			66
Hydrometer			4

During about 8⅓ years covered by the figures, hundreds of small extensions were made upon the overhead system over the

OVERHEAD SYSTEM INCREASE COST, SALEM.

406 poles, average 35 ft. @ $9.00	$3,654.00
52,240 ft. (5805 lb.) No. 6 wire series lighting @ 13 cts. lb.	754.65
32,908 ft. (5485 lb.) No. 4 alternating mains	713.05
128,640 ft. (32,160 lb.) No. 2 alternating secondary @ 13 cts.	4,180.80
74,040 ft. (12,340 lb.) No. 4 wire, three phase secondary @ 13 cts.	1,604.20
168,342 ft. (75,336 lb.) No. 0 wire, three phase primary @ 13 cts	9,793.68
23,716 ft. (2635 lb.) No. 6 wire @ 10 cts	263.50
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
46 single pole lightning arresters	207.00

entire city. In this period the company took down 30,000 ft. of direct-current lines, and 30,000 ft. of 500-volt, direct-current

COST OF TRANSFORMERS.

Number	Watts	Cost, Each	Volts	Number	Watts	Cost, Each	Volts
[illegible]	1,500	$27.79	[illegible]	[illegible]	20,000	$162.88	104-208
12	2,500	[illegible]		[illegible]	25,000	191.95	
[illegible]	3,000	[illegible]	"	20	30,000	222.57	
[illegible]	4,000	[illegible]	"		75,000	384.00	"
[illegible]	5,000	56.86	"	[illegible]	5,000	63.00	[illegible]
13	7,500	[illegible]	"		7,500	83.25	
[illegible]	10,000	94.91	"	3	15,000	146.25	
[illegible]	15,000	130.82	"	[illegible]	50,000		

[illegible] single pole primary [illegible]	[illegible]
[illegible] hangers [illegible]	205.44
Freight and express on above	[illegible]

power lines, and erected in their place single-phase, alternating-current lines and two-phase, 220-volt, alternating-current power lines. The cost of the increases in the distribution system is given in the tables herewith.

GASOLINE LIGHTING AND THE UNDERWRITERS.

By W. J. Canada.

A total disregard of the fire hazard attendant upon certain types of gasoline lighting systems has recently been very generally imputed to insurance companies by central-station representatives throughout the country. Statements have frequently appeared in the technical press that no recognition of this increased fire hazard is made by fire underwriters either by making rigid inspection of installations to eliminate the more hazardous features or by the application of proportionately increased insurance charges where additional hazard exists due to these systems.

The rigid inspection of electric wiring is being contrasted with this alleged neglect of the gasoline lighting hazard, and the impartiality of underwriters is being questioned. The more thoroughly gasoline lighting is understood the greater will be the degree of safety demanded by the public, and to this degree the present accusations and attendant agitation may be ultimately of value. In this constantly better safeguarding of gasoline lighting, however, the underwriters will be found to have done most of the pioneer work.

In this connection it should be understood that gasoline for lighting purposes owes its development to the demand of small towns and isolated residences which cannot procure service from gas or electric companies. There has also developed a more limited demand in cities and towns where either or both electric light and gas service is available. This sometimes arises from the cheapness of the gasoline lighting or its apparent cheapness because of the lack of monthly bills; but the largest demand comes from persons who for one reason or another have become disgruntled with the lighting companies. Occasionally the service has been unsatisfactory, but more often the management of the lighting company has been unable to convince some particularly stubborn exponent of the existing prejudice against corporations of any kind, and the former customer becomes a blind advocate of any competitive form of light furnished at least apparently by a source within his own control.

In cities limited space has necessitated the adoption of more hazardous arrangement than that first developed, and flame-heated generators for the rapid generation of gasoline gas from small quantities of gasoline have come into use. In an attempt to limit this evident fire hazard, but one of unknown proportions, a system of examination was established for such systems by the Underwriters' Laboratories, and a qualified approval given to systems which, as far as possible, avoided the fire hazard attendant upon handling of explosive fluid. The general public distrust of gasoline and the numerous instances of injuries and fires reported daily in the press have united to restrict the use of gasoline for lighting very considerably. The restriction, as is to be expected, has been more notable in more settled communities than in new and rapidly growing towns.

Unfortunately, very few cities have yet established any censorship over the fire hazard of gasoline lighting systems. Like most other new fire hazards the amount of this one can be even approximately determined only by experience in fire losses. The municipality learns of these losses very rarely, except through underwriters' records; but the insurance charges have varied throughout the country for several years, owing to the fact that one community would have a considerable fire loss from defective gasoline installations, while another territory would be practically without such loss, although possibly with gasoline fires from other causes. Time was necessary to establish a fair measure of this fire hazard, in the face of such a sparse distribution.

To-day, however, a reasonably fair measure of the gasoline lighting fire hazard has been established generally throughout most sections of the country, and at the same time inspection is becoming more rigid as the particular points of fire hazard are becoming better understood and better evidenced by actual fire losses. This process of listing the points of fire hazard in gasoline lighting systems by obtaining actual evidence on fire losses caused by them has necessarily been slow—the more so as the total number of installations has been comparatively small.

During this same period electric wiring—originally in the same chaotic condition of unknown hazard and unregulated installation—has been approaching a condition of permanency in installation and almost perfect safety in operation. The immensely greater number of electric lighting installations, even from the early days of electric lighting, have made the compilation of fire losses from its defects comparatively easy; but, nevertheless, it has taken many years to bring about present standards of wiring at increased cost in the face of the eternal demand for "cheapness at any price."

With this history in view, the progress toward the standardization of gasoline lighting and the elimination of its hazards has perhaps not been so much delayed. The underwriters, in other words, realize that gasoline is a dangerous fluid to handle. The amount of storage in buildings has been limited to constantly smaller amounts, and in connection with lighting systems the elimination of liquid gasoline from the interior of buildings has been regarded for some time as tending toward the least fire hazard.

The uniform recognition of this fire hazard in insurance rates and the presentation of this hazard to building owners, city authorities, commercial bodies and the like are rapidly bringing about a public demand for the elimination of liquid gasoline in connection with gasoline lighting systems. This demand is purely from a standpoint of fire hazard, as must naturally be the case, and not from any desire for fair play for lighting companies. The latter, to be sure, have had the distribution of their product restricted by an increased cost of installation, with the purpose of securing safety; but fair play is rarely imputed to corporations or granted to them. In other words, however equitable may be the contention of electric-lighting companies and gas-lighting companies that gasoline lighting competition should be permitted only on a basis of equal safety, this feature has not been a determining factor and cannot become a determining factor in the municipal restriction of gasoline lighting system to its safest possible forms of construction. The ultimate exclusion of liquid gasoline from buildings is to be expected purely on the grounds of the public's recognition of its bearing on the national fire waste and the community's share in taxation for it. This recognition will result principally from statistics and recommendations of underwriters, since there is no federal bureau to supervise such matters or to promulgate regulations for public safety.

EXTENSIONS IN DES MOINES.

Central Station Improvements Under Way in the Capital City of Iowa.

Extensive improvements and additions are under way for the Des Moines Electric Company, of Des Moines, Iowa. A large addition to the company's steam generating station on the Des Moines River is nearly finished, the work on it having been carried on without interfering seriously with the operation of the existing plant. Fig. 1 is a general-arrangement plan of the station, with the new extensions, the old reciprocating engines and old boilers being indicated merely, while the new machinery is shown in detail. Fig. 2 is a cross-section through the new portion of the plant.

In the boiler room two new Stirling boilers having 4000 sq. ft. of heating surface each have been installed, and in addition two other Stirling boilers of equal size have been remodeled with the addition of superheaters to conform to the new boilers. A new steel stack, brick-lined, 15 ft. 6 in. in inside diameter and extending 200 ft. above the boiler-room floor has been built. Spanning the boiler room is an overhead electric traveling crane built by the Sprague Electric Company and equipped to operate a bucket having 1⅝ cu. yd. capacity. This crane is used in the coal and ash-handling operations. A series of coal pits is provided in the coal-storage space in

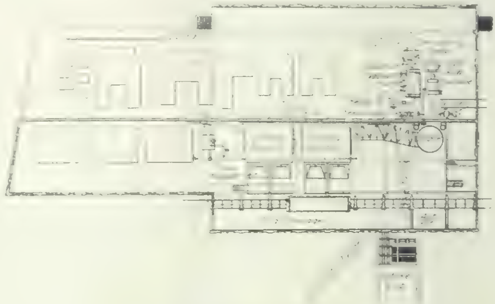


Fig. 1—Plan of Des Moines Station.

the boiler room, and by means of the overhead crane and bucket coal can be taken out of any of these pits, or from coal cars running on a track in the boiler room, and transferred to 10-ton hoppers in front of the boilers.

The boiler furnaces are equipped with chain grates, and the ashes are removed from the ash pits beneath the furnaces by means of small dump cars into the ash pit at the far end of the building, indicated in Fig. 2. From this ash pit the ashes are transferred by means of the crane and bucket to cars on the railroad track.

In the engine room the new equipment consists of a 2000-kw horizontal Curtis four-stage turbo-generator, with accompanying auxiliaries. The electrical end of this unit consists of a General Electric 3-phase, 60-cycle, 4-pole alternator designed to be operated at 1800 r.p.m. and wound for 2300 volts. A steam pressure of 150 lb. is used in the turbine. The steam auxiliaries of this unit are clustered about it or beneath it. These consist of a 6000-sq. ft. Worthington surface condenser; a 14-in. centrifugal circulating pump, engine-driven; a 10-in. x

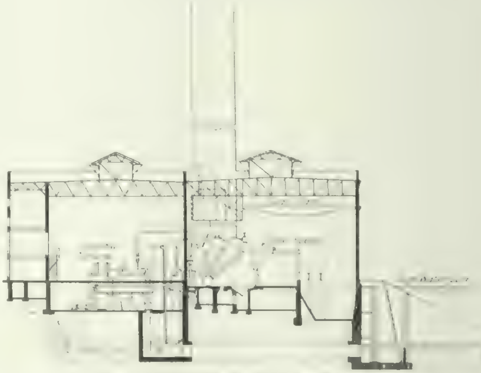


Fig. 2—Cross-Section of New Plant

19-in. x 12-in. dry-vacuum pump; a vertical hot-well pump having dimensions of 6 in. x 8½ in. x 6 in.; a vertical feed-water heater having an area of 1600 sq. ft., and a duplex boiler-feed pump, made by the Warren Steam Pump Company, and having dimensions of 14 in. x 9 in. x 18 in. Electrical excitation is furnished by a 100-kw Westinghouse turbine-driven exciter. Space is left for a future 3500-kw turbo-generator, with its accompanying condenser and other auxiliaries.

The new portions of the boiler room and engine room of the power station are considerably higher than the older portions, but the walls were extended and the new roof put on before the old roof was dismantled, giving the impression that the new building was built over the old one. After the future 3500-kw unit is installed the old reciprocating engines will be gradually replaced by steam turbines, the work of remodeling the station proceeding from the north end of the building, at the right of Fig. 1, and working toward the south.

The station is built on the bank of the Des Moines River, and at the expense of considerable effort a new intake was built for condensing water. The intake tunnel leads to an intake well, from which suction is taken for the circulating pump of the present turbo-generator unit and which will also serve the additional units which may be installed later. The distance from the high-water line in the river to the bottom of the intake tunnel is 28 ft. and it may be remarked that the extreme high-water line in the river also marks the level of the boiler and turbine-room floors. A discharge well and discharge tunnel are provided, the latter being on the same elevation as the intake tunnel.

In the turbine room, but not shown in the drawings, is a 30-ton electric overhead traveling crane built by the Northern Engineering Works.

In the new station the switching operations are conducted on the remote-control principle, the switching galleries or chambers being shown at the left of the building in Fig. 2. The operating gallery is about 10 ft. above the turbine-room floor and is the middle one of the three switching chambers which may be discerned in Fig. 2. Here there is a black slate switchboard of 22 panels. All switches are electrically controlled.

In the upper electrical gallery are the oil switches, which are all solenoid-operated and of the type K of the General Electric Company. Here also are the disconnecting switches and the main buses mounted on pipe framework. All outgoing lines are overhead with the exception of the series-arc circuits and one three-phase feeder circuit. The voltage of transmission is 2300 volts, except in the case of the underground feeder, which transmits electrical energy at 13,200 volts, step-up transformers being placed on the turbine-room floor of the generating station. There is one three-phase series-arc circuit, three three-phase, three-wire circuits for 2300 volts, one three-phase, three-wire feeder circuit for 13,200 volts, and three single-phase feeder circuits for lighting load exclusively.

Underneath the switchboard in the electrical gallery on the level with the turbine-room floor are placed the excitation buses and the electrically operated field switches and rheostats for the generators and the alternating-current motors, which are in use in the older parts of the station. These motors, by the way, drive three-wire direct-current generating sets.

In addition to the power-station extensions the Des Moines Electric Company is making a number of other improvements. It is spending about $70,000 in enlarging its Edison three-wire underground district and is also building a substation on the margin of the underground Edison network farthest from the power station. The new substation building will be large enough for three 1000-kw motor-generator sets, and one of these is now being placed in position. Electricity is transmitted to the substation from the high-potential alternating-current underground feeder and is distributed from it to the 220-volt direct-current circuits of the Edison network, a balancing set being installed to take care of the 110-volt sides. The substation building has two upper floors for storage and shop space. It, together with the land, cost about $50,000.

The Des Moines Electric Company is the successor to the Des Moines Edison Light Company, and it is a progressive and enterprising concern. Mr. W. B. McKinley, of Champaign, Ill., is president of the company, and Mr. P. B. Sawyer, of Des Moines, is general manager. Sargent & Lundy, of Chicago, were the engineers who designed the additions to the power station.

Wiring and Illumination

LOW COST LIGHTING IN CUMBERLAND, MD.

According to the report of the Maryland Water and Electric Light Commissioners Cumberland is the best lighted city in the country, besides enjoying the distinction of paying the least for energy per lamp. The city is lighted by 317 arc lamps of 1200 cp each at a cost of $33.46 per lamp per year. Natural gas is used under the steam boilers at the generating station, which is controlled by the municipality. Prior to municipal ownership of the plant the city paid a private company $97 per lamp per year.

LIGHTING EFFECTS IN A MODERN HOTEL.

Artistic Illumination and Fixtures of the New Blackstone, Chicago.

Thoroughly in keeping with the beautiful design and fittings of the new Blackstone Hotel of Chicago, pronounced to be the most ornamental hotel structure in America, is the tasteful and efficient illumination scheme which combines some of the most artistic creations of the fixture designer with approved principles of light distribution.

A preliminary description of this fine 20-story hotel, at Michigan Avenue and Hubbard Place, was given in the *Electrical World* of November 4, 1909, and included a detailed account of the various complete electrical and mechanical features of the equipment. The plans for this apparatus, as formulated at that time and described in the article mentioned, have been carried out with very minor changes, so that only a brief recapitulation of some of the figures previously printed is given near the end of the present account. The accompanying description and views of the completed hotel will be interesting, however, rather in setting forth these visible evidences of electrical applications in both decoration and lighting, which impress the lay visitor or guest, who is probably unconscious of the elaborate equipment concealed beneath the handsomely appointed apartments.

GENERAL ARRANGEMENT AND EXTERIOR LIGHTING.

As finally completed, the lighting of the Blackstone Hotel employs over 9000 incandescent lamps. Wherever possible, high-efficiency units have been used, in order to attain the minimumof energy consumption consistent with good illumination. A 700-kw direct-current generating plant in the basement supplies electricity for lighting the hotel. Since the final plans were drawn it has been learned that this plant may be called upon to furnish the lighting for a new theater which stockholders of the hotel company are building on the adjoining plot on Hubbard Court. With this later demand now highly probable, the engineers have been able, by revising their lamp schedule and lamping the original installation with high-efficiency units wherever feasible, to leave a considerable block of energy for the theater load. This example serves to illustrate pointedly one of the important results of the introduction of the tungsten lamp, enabling the designing engineer, even after his carefully laid plans have been put awry by some later contingency that could not possibly have been foreseen, to recover the situation and make his former complement of generating equipment perform successfully the increased lighting duty. The hotel proper now contains about 4000 tungsten lamps, 2000 tantalums, and more than 3000 carbon-filament incandescent lamps, the large proportion of the last-named being of the small candelabra-base type used on brackets throughout the guest rooms and corridors. Tantalums have been employed for all portables and other lamps which are subject to possible handling.

The exterior lighting of the Blackstone Hotel building makes it one of the city's landmarks at night. Along the line

of the French mansard roof, 287 ft. above Michigan Avenue, is ranged a row of 30 standards, each carrying an opal ball containing a 60-watt tungsten lamp. The third-floor level carries a line of 36 similar pillars, marking the architectural design at that point. For the sidewalk illumination at the street level there are four flaming-arc lamps housed in massive bronze lanterns hung from brackets of rich design. The principal entrance is on the Hubbard Court side under a porte cochere lighted by four 12-lamp clusters, and ornamented with 84 25-watt tantalum lamps marking the plate-glass leaves of the canopy. A three-figure electric carriage call completes the lamp equipment of this entry.

Fig. 1—Lobby Lighted by Shaded 25-Watt Tungsten Lamps.

USE OF DIRECT AND INDIRECT LIGHTING.

The interior decoration of the hotel has been laid out on the same lavish yet refined scale, after the period of Louis XVI, which characterizes the external architecture. The lighting fixtures are thoroughly in keeping with the elegant quality of the decorations and furnishings. In the lobby, corridors, ballroom, main dining room, and guest rooms, visible light sources have been employed, in appropriate fixtures. The bracket lamps in the lobby and corridors are heavily shaded by rich canopies. For the west dining room, kitchens, buffet, barber shop and business offices the indirect system of illumination by concealed tungsten units with reflectors lends itself gracefully to the scheme of decoration.

Fig. 2—Indirect Illumination of West Dining Room

The lobby is lighted by 25-watt frosted ball tungsten lamps, enclosed in Louis XVI. shaded ceiling fixtures and in brackets mounted on the circassian-walnut pillars and wall facings. This room is approximately 75 ft. square, and contains 375 of these 25-watt tungstens. Directly behind the lobby is the so-called Marble Room or west dining room. This handsome room, 48 x 50 ft., with a 16-ft. ceiling, is lighted by the indirect system from six large bowls of classic design suspended by bronze chains from the ceiling. Each bowl contains 20 40-watt tungsten lamps and reflectors, projecting all light first onto the white paneled ceiling, from which it is reflected down into the room.

CANDELABRA IN MAIN DINING ROOM.

Up half a dozen steps at the east end of the lobby, and overlooking Lake Michigan, is the main dining room, 75 x 60 ft. This is an especially ornate hall, its decorations being inspired, like the ballroom, which is of the same dimensions and directly above, by the Little Trianon palace at Versailles. In keeping with the spirit of the age reflected by the decorations, candle effects have been used throughout in the illumination of these two grand salons. From the ceiling of each are suspended five huge crystal chandeliers, the central one carrying 40 electric "candles" and the other four 20 candles each. The counterfeit candles are tipped with special 16-cp carbon lamps whose coiled filaments enclosed in relatively large spherical globes give a flame effect that is particularly effective when viewed across the room. In the ballroom 100 brackets on the side walls each contain three similar candle units. For the dining room there are 18 six-lamp side-wall brackets, besides the large ceiling fixtures. Each table is individually lighted by a candlestick cluster of three 6-cp carbon lamps. Those around the edge of the room are 110-volt lamps energized through attachment cords from the baseboard outlets of the hotel wiring system. The electric candles on the central tables are 6-volt lamps fed from individual storage batteries mounted under each table.

Fig. 3—Main Dining Room.

An electric "arctic fountain" of artificially frozen ice is to be a feature of the main dining hall, cooling the room in summer, and refreshing the atmosphere at all times of the year. The design has not yet been completed, although several suggestions have had the attention of the architects, and the wiring and refrigerating brine pipes are already in place. One design contemplates a huge sphere of ice on which colored lights will be flashed from within. Another proposes an artificial iceberg with an ever-varying auroral display, and even more elaborate suggestions have been made.

VARIOUS TYPES OF FIXTURES.

The several private dining rooms, finished in French, Colonial and English decorations, are appropriately lighted by fixtures conforming to the periods denoted by the furnishing.

The kitchens have a floor to themselves one flight above the main lobby and the Marble Room, and halfway between the main dining room and the banquet hall or ballroom. The lighting of the kitchen quarters is carried out by 70 two-arm

indirect units each containing two 60-watt tungsten lamps hung with their reflectors 18 in. from the ceiling. The walls and ceiling throughout are finished in white, and lined with blue pencilings which give a tile effect. Cooking is done with gas and steam, although an electric grill is installed in the buffet on a floor below. The kitchen is used for cooking and food-preparing operations alone, no dish-washing or other allied work being done in these quarters. The electrically driven equipment of this department includes a soup-strainer, meat chopper, potato-parer, ice cream freezers, dish-washing machine, silver cleaner, knife polisher, and numerous dumb-waiters and conveyors.

The art hall, on a floor above the lobby level, is a 24-ft. corridor, 100 ft. in length, in which will be hung a number of fine paintings purchased abroad. It is lighted by six central ceiling domes, with loops of cut-glass beads, each lamp cluster comprising 10 25-watt clear round-globe tungsten lamps.

MEN'S LOUNGE AND AN ORNATE BARBER SHOP.

Below the main dining room is a passage to the Michigan Avenue entrance at the street level. Open lamps on torchère brackets surmounted by the French crown, and an illuminated marble fountain, are the principal decorative features of this entry-way, which communicates with shops on the street level.

Another half-flight below is the men's 'club" or lounging room, and at the rear is the buffet with its bar and grill. In these rooms indirect lighting is again used, the ceiling of conventionalized relief pattern being lighted by 109 40-watt clear

Fig. 4—Indirect Lighting of Buffet, Showing Electric Grill.

tungsten lamps which are mounted on stalactites and project into the bowls of silver-plated reflectors of special design. The ceiling is gray-white in color, and is broken up into deep panels. With the dark furniture and fittings of the Elizabethan period provided in this room it was a question whether indirect illumination might be satisfactorily used for lighting under these conditions. The resulting effect, however, is very pleasing, and the illumination afforded is ample. The room is 68 x 44 ft., with an 11-ft. ceiling. The grill at the west end of the buffet is equipped with three electric broiler elements where the finest cuts of meat are cooked to a turn without contact with smoke or gas fumes.

The Blackstone barber shop, which is entered from the men's lounging room, is generally pronounced one of the handsomest and best equipped rooms of its kind in the world. The general scheme is the Greek classic, the mirrored walls being framed by white marble columns, while overhead is a pale-blue domed ceiling bordered by a latticed pattern carrying out the effect of an outdoor pergola. All of the equipment and trimming, except the red-plush upholstering, is of sanitary white, adapting this room well for indirect illumination. The lighting is done from six large bowls of chiseled alabaster design, hung four feet from the ceiling and each containing five 60-watt tungsten lamps and their inverted reflectors. The indirect illumination of this shop enables the barbers to work without attention to shadows, as the general diffused nature of the lighting, aided by the large number of mirrors, makes the illumination practically uniform from any direction at any chair.

LIGHT FEATURES OF GUESTS' ROOMS.

All guests rooms are above the third floor. Decorations and even the furniture in these quarters partake of the French

Fig. 5—Kitchen, Indirect Lighting from 60-Watt Tungsten Lamps.

period denoted by the architectural surroundings. The lighting equipment provided these rooms is probably the most complete of any hotel yet built. The central drop fixtures are of simple, dignified design carrying three and four 25-watt bowl-frosted tungsten lamps, from which the light is utilized directly. Portable reading lamps (25-watt tantalums) are placed on central tables, and special 25-watt sominoles or night lamps are provided in all bedrooms. One and two-lamp bracket wall fixtures are installed in bedrooms and boudoirs, and 16-cp clear-globe carbon dresser lamps are mounted on each side-column supporting the mirrors of the chiffoniers, special attention having been paid to locating these for the practical convenience of the guests.

Another evidence of this care is the arrangement of the

Fig. 6—Barber Shop, Showing Bowl Reflectors.

shaving lamps, for example, on the mirrors over the wash bowls in the private bathrooms. The receptacles of these 16-cup frosted bunghole lamps are fitted with flexible cord from outlets in the framing, and are themselves mounted on clamp carriages which slide on vertical bars 24 in. in length, so that they may be easily adjusted by the guest to the desired height.

Provision is also made for attaching electric curling irons which, like electric fans, are furnished guests on request. The rooms are completely wired with baseboard outlets for attaching reading lamps and fans.

By means of a special switch, the lights in any guest room are automatically extinguished when the door is locked from the outside. The application of the magnet switches by which this result is accomplished is a distinct novelty in hotel wiring. All of the various flush push-switches in each suite are wired under one master-switch mounted in the same flush switch group. This master switch, which must be "on" in order to get light in any of the outlets, is equipped with a magnet

Fig. 7—Private Bath Room Showing Adjustable Side Lamps.

coil, whose armature is arranged when energized to snap the switch into the "off" position. The magnet coil is adapted to be momentarily energized across the 110-volt circuit, through a wiping contact made by a sleeve which is lifted as the bolt is shot in the door, when the key is used from the outside. Thus as the key is turned, the magnet is energized, snapping "off" the master switch, which extinguishes all the lights.

OTHER APPLICATIONS OF ELECTRICITY.

Communication between the various rooms and stations of the hotel, is secured by a complete private branch exchange system of 450 telephones, and for the transmission of orders an elaborate telautograph system of 28 transmitting and 32 recording instruments is in use. There is also an electrically synchronized time-stamp system, with 28 stamps installed, and a pneumatic impulse system for synchronizing the clocks throughout the hotel.

The building is equipped with 72 motors ranging from 1/4 to 40-hp, and aggregating 500 hp.

The power plant on the basement level, three stories below the sidewalk, contains two 200-kw and one 300-kw direct-current engine-driven generators, and four 250-hp boilers with automatic stokers. The basement also contains ice-making and air-cooling machinery, aggregating 170 tons refrigeration daily. The hotel water supply is divided into two services for the upper and lower stories respectively, and is delivered from pumps in the basement plant.

The electric wiring of the Blackstone installation was done by the Arthur Frantzen Company, the fixtures were furnished by T. W. Wilmarth & Company, and the indirect-lighting units were supplied by the Curtis-Leger Fixture Company, all of Chicago.

The Blackstone is owned and operated by the Drake Hotel Company, of which Mr. Tracy C. Drake is president and Mr. John B. Drake is vice-president. Mr. F. K. Boomhower is chief engineer.

Letters to the Editor.

A Peculiar Underwriters' Ruling.

To the Editor of Electrical World:

Sir:—The author of the article entitled "A Peculiar Underwriters' Ruling," which appeared in the July 7 number, does not seem to have referred to the April, 1910, *List of Approved Fittings.* On page 23 of that issue is published a list of cut-out bases for fuses rated 31-60 amp, 250 volts, and designed to take encased cartridge fuses. On page 29 of the same issue is also a list of plug-fuses rated at 31-60 amp, 250 volts.

Mr. Kemery's objections to the open-type cartridge fuse are only too well founded and, as will be found in most cases, the Underwriters have endeavored to meet the difficulty. He has, however, no ground for complaint here, and by writing to the nearest inspection office can obtain not only a quicker solution for his trouble, but a higher opinion and better feeling for the Underwriters as well.

The construction rules were purposely omitted from the 1910 edition of the *National Electrical Code,* partly to induce the contractor to refer to the *List of Approved Fittings* rather than to the rules, to determine whether or not a device is standard. The label reading "N. E. Code Std." should satisfy the most particular, and will be found on encased cartridge fuses rated at 31-60 amp, 250 volts.

Topeka, Kan. Howard Campbell,
Kansas Fire Insurance Inspection Office.

To the Editor of Electrical World:

Sir:—I have read with interest the article by Mr. G. S. Kemery in the July 7 issue, entitled "A Peculiar Underwriters' Ruling." It may be well to point out that 250-volt, 0-30-amp National Electrical Code Standard fuses in plug casings have been limited to 125 volts, for the reason that two-wire plug cut-out blocks have been very largely used for the protection of motors on 250-volt circuits. These blocks were passed upon inspection when they had 250-volt fuses in National Electrical Code Standard plug casings, but upon the blowing of the original equipment, it was found that there was a great tendency to replace the code fuses with Edison fuse plugs, such as shown in Fig. 9 of the article. It was in order to prevent this misuse of Edison plug fuses that the perfectly reliable plug casing, with its National Electrical Code Standard fuse, had to suffer.

I think the writer of the article is mistaken in his assumption that 31-60-amp fuses in plug casings are not approved for 250 volts. In fact, they are so approved and the company with which the writer is connected manufactures them in large quantities. I am glad the article was written, because I think it will bring to the attention of the Underwriters the injustice they have done the manufacturers and users of Edison plug casings.

I agree with many of the arguments advanced, but I cannot see how anyone can receive a shock when pulling out an 0-30-amp or a 31-60-amp, 250-volt fuse, for if the installation is made in accordance with the rules, the current can be cut off by a switch before a removal or replacement is made.

Hartford, Conn. Robert Chas. Cole,
Electrical Engineer, The Johns-Pratt Company.

To the Editor of Electrical World:

Sir:—Some operating men will undoubtedly consider that the reason given in the first paragraph of Mr. Cole's letter is a very good one for withholding approval on 0-30-amp fuses in fuse-plug casings for pressures between 125 volts and 250 volts. It has been suggested that, although the Edison plug-fuse (now approved for 125 volts), which was in its time an excellent device and has given good service, may have its applications, the combination of the fuse-plug casing and a

National Electrical Code fuse is much the better equipment. Many appear to believe that it would be better to withhold approval altogether of the Edison plug-fuse than to permit it to interfere with the installation of the casing-fuse combination, which is a better arrangement, both electrically and mechanically.

Referring to the second paragraph of the letter, if the use of 31-60-amp fuses in fuse-plug casings is approved, it should be so stated definitely in the rules. There are many, including certain inspection departments, who do not seem to understand this point.

Referring to the third paragraph, as we understand it, a cut-out may be placed on either the line or service side of a switch, except at entrances, and thus there are many installations in which it is not feasible to render a cut-out "dead" by throwing a switch. Often in motor installations a cut-out (without a switch) is placed where the conductors to a motor are tapped from a main. The switch is placed near the motor, often on its central panel. Obviously in this case—and there are many such—there is no means for cutting voltage from the cut-out.

Pittsburgh, Pa. G. S. Kemery.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Compounding of Alternators.—A. Blondel.—The author refers to a recent article by Dalemont and Herdt who compound an alternator by compensating for only that reaction due to the wattless component of the current. The problem is to create in the field winding, under load, additional ampere-turns proportional to the wattless component of the current. The present author realized this object as early as 1896 in his reaction exciter, the principle of which is described as follows: "The method consists in the use of an exciter of the Rechniewski type, with a small air-gap; the field windings, constructed in the usual manner, are shunt-connected and excited just enough to produce the excitation required by the alternator on open circuit; the armature, which rotates in synchronism with the alternator by a mechanical coupling, has two windings, the one winding carrying continuous current for exciting the alternator and the other carrying current from the alternator and acting as a compensating winding similar to the alternator winding; the number of turns, and the points at which the current is led into this winding are so adjusted that the reaction field produced by a wattless current has the same direction as that of the main field, and strengthens it in exactly the same proportion that the corresponding armature reaction of

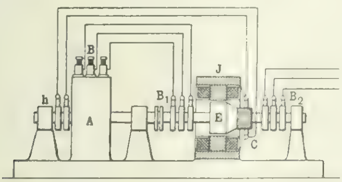


Fig. 1—Compounding Alternators.

the alternator tends to weaken its own field; in addition, the brushes are kept fixed by one of the known methods. Under these conditions, if the alternator and the exciter are both being worked below the knee of their saturation curves it is easy to see that all of the armature reactions, watt or wattless, are compensated automatically. Fig. 1 represents this arrangement for a three-phase machine with rotating field cores. A is the alternator, B the terminals from which the currents are led to B_1, the slip rings connected to the compensating winding on the exciter E, B_2 the main terminals, C the commutator of the main exciter winding and J the shunt winding. Of course, the alternating current can be passed directly through the armature exciter only when the tension is low. With high-tension alternators a series transformer must be inserted. Fig. 2 represents the scheme of compounding as it is actually applied. In addition to the apparatus already described, there is a small direct-coupled dynamo for a new and important purpose. This machine supplies a part of the excitation for the exciter E, and thus ensures the stability of the magnetic equilibrium of the system at all loads. It is a very [illegible] works on the same load. On the other hand, the exciter E and the transformer do not work at constant and complete saturation of the iron. Fig. 3 shows the diagram of connections of the exciter E for a bipolar machine. In reality, it is evidently convenient for this exciter to have the same number of poles as the alternator or else it must be driven by a multi-

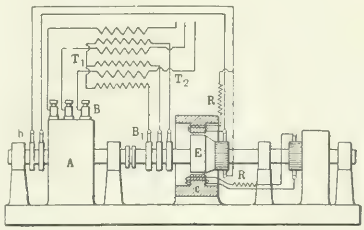


Fig. 2—Compounding Alternators

plying gear. With turbo-alternators the number of poles is, however, almost always either two or four." The author gives the mathematical theory of compounding by means of this reaction exciter and then discusses the methods of voltage regulation by means of the rheostats R and R'. By regulating the rheostat R in the shunt circuit the total value of the alternator exciting current can be adjusted in a certain proportion, but the relative value of the compounding effect is unaltered. By regulating R', and hence the excitation provided by the small auxiliary exciter, the relative value of the compounding is adjusted. It is, therefore, very simple to modify at will the compounding effect as well as absolute voltage of the alternators. Examples of actual installations and test results are finally given.—Lond. *Electrician*, July 15.

Mutual Induction.—J. R[illegible]. The [illegible]

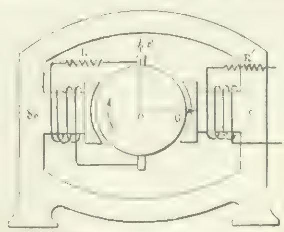


Fig. 3—Compounding Alternators.

mathematical article on the determination of the mutual induction between the external coils of the stator and the rotor of an induction motor.—*La Lumière Elec.*, July 9.

Lamps and Lighting.

Metallic-Filament Lamps.—H. von Loeti.—A paper read before the Vienna Electrical Society on the development of the

1-watt-per-candle-power metallic-filament lamp during the last two years. The author gives reasons for his belief that the metallic filament is at a lower temperature than the carbon filament when operating with the same specific consumption. He then describes in detail the rotary mercury pump of Gaede, which is specially suitable for producing the high vacuum required in metallic-filament lamps. He refers to the progress made in manufacturing high-voltage and low-candle-power metallic-filament lamps and to the reduction in price, which has been about 40 per cent in the last two years.—*Elek. und Masch.* (Vienna), July 10.

Tubular Incandescent Lamps.—A note on a recent British patent of C. O. Bastian (13,228, 1909; June 30, 1910). The tubular lamps described may be of considerable length, and have a terminal cap at each end. The filament is made up of several short lengths in series, connected together with springs. Each spring has its central convolutions of nearly the internal diameter of the tube, so that, although not attached to, it touches the glass. Support is then given to each section of the filament without sacrificing freedom for longitudinal movement.—Lond. *Elec. Eng'ing,* July 7.

Different Methods of Lighting from the Standpoint of the Ophthalmologist.—GARIEL.—A paper read before the convention of the French Ophthalmological Society in which the author reaches the following conclusions. Mercury-vapor lamps are not suitable for lighting except in very particular cases. Electric arc lamps are suitable for lighting in open air and in halls or rooms of large dimensions. They should be placed at a distance of several meters from the point where the people are. These lamps should be enclosed in diffusive or prismatic globes of sufficient dimensions so that the surface brightness is not too high. In rooms of restricted dimensions arc lamps are suitable in connection with a system of indirect lighting which is very satisfactory. Electric incandescent lamps can be used in all cases; they are especially suitable for rooms with restricted dimensions. In school-rooms, studies, and in all work shops where delicate work is carried out, the minimum illumination should be 15 luxes. The use of special colored glasses in special cases is finally discussed.—*La Revue Elec.,* July 15.

Public Lighting.—J. ABADY.—A paper read before the British Institute of Gas Engineers on public lighting from a municipal point of view. The author first considers the different forms of street-lighting contracts which are in vogue and discusses the relative merits of each form, reaching the conclusion that to buy street lighting on the illumination basis is the most advantageous course. He then passes to the question of the position of the lamps and the distribution of the light, emphasizing the fact that street lighting in many cases degenerates into a haphazard scheme of point lighting. He urges the desirability of decreasing the candle-power of light units and placing them closer together.—Lond. *Electrician,* July 8.

Generation, Transmission and Distribution.

Electric Lifting Appliances.—F. HEYM.—An abstract of a paper read before the International Mining Congress at Düsseldorf on the influence of electricity on the development and efficiency of lifting apparatus in mining and steel works. The introduction of electricity as motive power has enabled the working speeds of cranes, etc., to be increased considerably and to extend the applicability of hoisting machines, owing to the convenient transmission and supply of the energy. The result has been an increase of the production and increased demands of the efficiency of the transporting appliances. By electrical driving it is possible to operate the different motions with precision and rapidity from any desired point. On account of the centralization of the generating plant thus made possible, the working expenses are reduced, and it is feasible to adopt mechanically-driven lifting appliances for dealing with work, where their application previously was not economical. Electric winders, circular wagon tips, wagon tipping devices, and loading bridges effect the transport of the material raised from the mines, almost dispensing with the attendance of workmen. Where it would not pay—owing to the small amount of work to be coped with—to adopt large loading bridges for the transport of bulk goods, telpher lines with single traveling trolleys are provided in their place. In blast furnaces the transport of the materials to the mouth of the furnace is almost exclusively carried out by means of inclined electrically driven hoists, which render no workmen necessary on the charging platform. The handling capacity of these hoists has already attained some 2200 tons of coke and ore in a shift of 18 hours. In steel works and rolling mills special types of cranes have been adopted for each sort of work. Special cranes serve for filling and transporting the boxes in open-hearth plants and for charging them into the furnace. The casting cars traveling on the floor are now almost entirely displaced by overhead casting cranes running at high speeds. For stripping the ingots from the molds and transporting them to the soaking pits and reheating furnaces, as well as for loading the half-finished and finished products, special cranes with tongs, lifting magnets, rotary and tilting grippers are now constructed. The use of lifting magnets, which obviate the necessity of sling chains or tongs, has been especially developed. By employing a lifting magnet in handling scrap and similar materials, the manual labor is almost dispensed with and consequently large savings are effected.—Supplement to Lond. *Elec. Eng'ing,* July 7.

Electric Power in Mines.—P. NICOU.—An abstract of a paper read before the International Mining Congress at Düsseldorf on the present situation of the mining industry in French Lorraine. Most of the new winding plants in the Briey mines are electric, and electric power, derived usually from turbine-driven stations, is employed on a large scale for underground pumping, haulage and drilling. Power drills, which are extensively used in the new mines at Briey, enable the mining of the ore to be carried on at a much quicker rate than was possible with hand drilling. Up to the present, electric drills are mainly used, though pneumatic percussion drills are employed in some cases.—Supplement to Lond. *Elec. Eng'ing,* July 7.

Underground Haulage in Mines.—F. TILLMANN.—An abstract of a paper read before the International Mining Congress at Düsseldorf. The author said that continuous-current overhead trolley locomotives have proved their economy, and more lately single-phase and three-phase mining locomotives have come into use. Accumulator locomotives are not quite as economical, but render electrical haulage available where overhead wires are not provided. Locomotives are confined to horizontal galleries, but electrical rope haulage is used either on inclines or on the level, and is just as economical or, in favorable conditions, even more so.—Supplement to Lond. *Elec. Eng'ing,* July 7.

Electric Plow.—H. WALLEN.—In a continuation of his recent illustrated article on the use of electric power in agriculture the author discusses in detail the advantages of the electric plow over the steam plow with respect to savings in wages and horses and gives data on the energy consumption.—*Elek. Zeit.,* July 14.

Heat Transfer Due to Steam Condensation.—S. L. BROWN.—An account of an investigation which shows that the rate of delivery of heat by hot steam to a cold metal surface is at least 40 times as great as the rate of delivery of heat to the cold metal surface by hot air at the same temperature as the steam, and, therefore, assuming superheated steam to be approximately the same as air in its thermal conductivity, it is evident that the elimination of actual condensation on the cylinder walls of a steam engine greatly reduces the exchange of heat between the working fluid and the cylinder walls.—*Phys. Rev.,* July.

Smoke Abatement.—J. B. C. KERSHAW.—An article discussing the work done on smoke abatement by two societies in London and Hamburg respectively. The London society draws its support chiefly from the artistic and cultured classes of London society. The Hamburg society is differently constituted and has more practical aims, since its object is to reduce smoke by educating the fuel user in more efficient methods of combustion.—Lond. *Elec. Rev.,* July 15.

Traction.

Three-Phase Traction on Railways.—W. HEYDEN AND K. VON KANDO.—Two articles, the first of which, by W. Heyden, states that the Italian railways intend to equip electrically 10 different lines and that on all of them the three-phase system as used on the Valtellina road will be employed with 3000 volts at the trolley wire and a frequency of 15 cycles per second. He then gives a review of a recent paper by Kando on the advantages of the three-phase system for trunk-line traction and describes one of the new electric freight locomotives to be used on the Italian roads. He does not agree with the advantages claimed by Kando for the three-phase system, but thinks that according to present experience only single-phase current is suitable for traction on trunk railways. In the second article, K. von Kando replies to these criticisms. He says that in electrical and traction trade journals there are often made statements concerning the three-phase system which are based on purely theoretical considerations, but not on practical experience, and in which the constant speed is often mentioned as a disadvantage of the three-phase motor. He claims on the contrary that the constant speed has great advantages in practice, while, on the other hand, the high output of the three-phase motor per unit of weight renders the three-phase locomotives especially suitable for lines containing considerable grades.—*Elek. Zeit.*, July 14.

Electric Traction in Austria.—A. HRUSCHKA.—His report before the International Railway Congress in Berlin on the work done in Austria with respect to the electrification of the railways. Detailed studies are now being carried out by the Austrian Railway Department on roads having a total length of 1000 km (600 miles). In the first line, the road from Triest to Opcina and the Arlberg road are projected to be electrified. It is the intention to employ the single-phase system with 10,000 volts at the trolley wire, the frequency being 15 cycles per second.—*Elek. Kraft. u. Bahnen*, July 14.

Electric Locomotives on Curves.—K. WIESSINGER.—An article illustrated by diagrams giving calculations on the passing of electric locomotives over curves, with special reference to the effect due to the rotary masses of the locomotive. One of the recommendations made by the author is that in a curve the outer rail should not be raised by the whole amount theoretically necessary, but by only one-half this amount, and that the inner rail should be lowered by one-half the amount. In this case there will be no raising or lowering of the center of gravity of the locomotive while passing the curve.—*Elek. Kraft. u. Bahnen*, July 4.

Interurban Line.—J. R. HEWETT.—A detailed and fully illustrated description of the 1200-volt, direct-current interurban line of the Milwaukee Electric Railway & Light Company, parts of which were formerly operated by 3300-volt, single-phase current.—*Elec. Rail. Jour.*, July 16.

Installations, Systems and Appliances.

Earthing of Coal Cutters.—J. B. ENGLISH.—An abstract of a paper read before the Warwickshire and South Staffordshire Section of the Association of Mining Electrical Engineers. He gave the results of his experiments on the earthing of coal cutters. He used the two-wire, 440-volt, direct-current system. The insulation resistance of the positive main was 110,000 ohms, and that of the negative 55,000 ohms. Between the positive and the machine frame the potential difference was 24 volts. With the positive terminal to frame 7.0 milliamperes passed to earth, and with the negative terminal to frame 4.7 milliamperes. When a special wire was run to earth from the frame, no difference was found in the results given above. A spike 12 in. into the ground afforded an earth of lower resistance than a plate. With the negative cable effectively connected to earth, and the positive joined directly to the frame of the machine, the current passing to earth was 5 amp; with the positive connected to the plate 0.05 amp passed, and with it connected to the spike 7 amp passed. When the positive cable was connected to the frame, the potential difference between the frame and a plate laid in the ground was 390 volts, and between the frame and a spike driven into the ground, 420 volts. He drew the inference that if the insulation of a direct-current system is good there is no need for earthing, but as it is impossible to ensure good insulation throughout a mine, it is advisable to earth both the portable and the stationary machines. As regards the method of earthing, armored cables are advocated by many, the armor being used as the earth wire. In his opinion armored cables are unwieldy and wanting in flexibility; the insulation is also liable to be pierced by the armor. He prefers providing a separate earth wire wormed up with the conductors, the whole being protected by a brading of leather or cord. He has found cord both durable and very flexible.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Buffer Batteries.—K. ZICKLER.—An article describing an analytical and graphical method for predetermining the proper size and the action of a buffer battery operating in parallel with a generator. The article is illustrated by diagrams. The method is based on the knowledge obtained experimentally of the characteristic curves of the behavior of the storage battery and the machine and presupposes the knowledge of the amplitude and duration of the current rushes during which the battery has to act.—*Elek. und Masch.* (Vienna), July 10.

Transformation of Electrical Energy Into Heat.—A. PONZINI.—The author first discusses the disadvantages of transforming the electrical energy of high-tension currents directly into heat by means of the Joulean effect. He recommends the production of heat by means of Foucault currents in a magnetic material. He describes the construction of a magnetic core in which Foucault currents are produced in this way and its application to the heating of liquids. The application of the method for utilizing the surplus power of central stations for heating purposes is discussed.—*Atti della Assoc. Elettrotecnica Ital.*, March, April, 1910; *La Lumière Elec.*, July 9.

Oil-Break Switches.—F. DEHLER.—A translation in abstract with illustrations of his recent German article on the design of oil-break switches.—Lond. *Electrician*, July 15.

Wires, Wiring and Conduits.

Localization of Faults on Underground Mains.—W. A. TOPPIN.—A paper read before the Glasgow Section of the (Brit.) Inst. Elec. Eng. After discussing the causes of faults, and the recording of earth leakages, the author describes a simple method of locating earth leakages and the apparatus he has constructed for facilitating the test. Its operation depends on the fact that when an earth leakage occurs, the earth in its vicinity is charged to a potential above normal earth potential, and this potential will vary at any point in inverse proportion to the distance from the fault. Assume an earth leakage at *E* on a 250-volt three-wire system of distributors (Fig. 4), the current shown on the ammeter with the 10-ohm limiting resist-

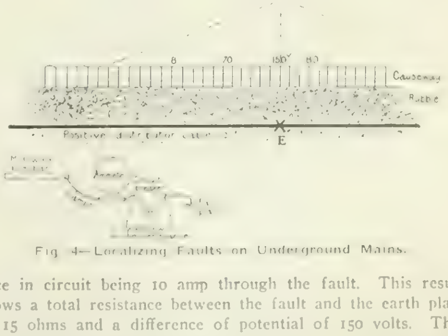


Fig. 4—Localizing Faults on Underground Mains.

ance in circuit being 10 amp through the fault. This result shows a total resistance between the fault and the earth plate of 15 ohms and a difference of potential of 150 volts. This pressure will be highest immediately at the fault and will diminish with the distance from the fault. It can be measured by an ordinary voltmeter, but in most cases a special voltmeter, calibrated to read down to very small pressures, is desirable.

One terminal of the voltmeter is connected to a rubbing contact and the other to a good earth connection, such as a steel rod, pushed into the ground at a distance of 2 yd. or 3 yd. from the cable route. Besides simplicity in operation and accuracy of results, other advantages of this method are that the smallest earth leakages can be expeditiously located without interruption to the supply; the apparatus is cheap and simple in construction, while the test may be made by anyone possessing elementary technical skill. The method is applicable to any system of supply, whether direct or alternating. In the case of a two-wire supply it is necessary merely to earth the unaffected conductor to give the required potential-difference surrounding the fault. In the discussion D. Robertson questioned whether the method would do with three-core cables and advocated the smoke test system. He referred to a method which he had found to answer very well. It was similar to a potential test and is shown in Fig. 5. Calling l the distance between A and C,

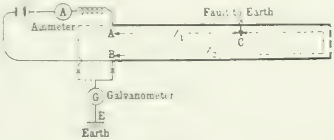


Fig. 5—Localizing Faults in Underground Mains.

l_2 that between B and C, and the total length of cable $L = l_1 + l_2$, then with a galvanometer connected between A and E the deflection d_1 is obtained. By connecting the galvanometer between B and E the deflection d^2 is obtained. Then $l_1 = L \frac{d_1}{d_1 + d}$, and similarly, $l_1 = \frac{d_2}{d_1 + d_2}$. Toppin, in his reply, said that his method had not been tried on three-core cables, but it is quite suitable on lead-covered or drawn-in cables, if the lead has no breaks of continuity in it. It has been successfully tried on cables 2 ft. 6 in. below the surface in the dryest weather. The ohmmeter and generator method is suitable only before the cables are put into commission. He has used a compass near boxes where the position of cables was apparent. Electric tramways had no effect on the test in his experience.—Lond. *Electrician*, July 14.

Electric Cables.—F. FERNIE.—In a continuation of his long illustrated serial the author describes in a general way the methods followed in laying cables in ducts, on the solid system or simply armored; also in the shafts of mines. In conclusion he considers records and the allocation of costs.—Lond. *Electrician*, July 15.

Electrophysics and Magnetism.

Isolation of Ions.—R. A. MILLIKAN.—An abstract of a paper read before the American Physical Society on the isolation of an ion. It is a modification of his former method in which water drops were used; for these he has now substituted drops of oil or mercury which do not volatilize. In addition to furnishing an exact determination of the value of the elementary electrical charge (the result of which is not yet given) the use of the method has shown that Stokes' law in air does not apply for droplets having a radius less than 0.00013 cm; further, that the majority of the ions of ordinary dust-free air, both positive and negative, carry the elementary electrical charge. However, ordinary dust-free air contains some ions of both the positive and the negative sign which carry multiple charges. The method is being applied to the study of ionization in gases other than air.—*Phys. Rev.*, July.

Ions and Electrons.—M. JOLY.—The first part of a review of the development of our present ideas on ions and electrons. The author deals with the conductivity of gases, the mobility of ions, the charge of ions, gaseous suspensions, and disruptive [illegible]. The article is to be continued.—[illegible], July 9.

Absorption of Electrons.—O. W. RICHARDSON and H. C. COOKE.—A preliminary account of an experimental investigation of the heat developed during the absorption of electrons by platinum. The investigation is to be continued.—*Phil. Mag.*, July.

Charge of Electrons.—L. BEGEMAN.—An account of an experimental determination of the charge of an electron by the cloud method. The mean result is 4.668×10^{-10} electrostatic units.—*Phys. Rev.*, July.

Units, Measurements and Instruments.

Portable Weston Cell.—H. TINSLEY.—An article on methods for rendering the Weston standard cell portable without disturbing its contents. The recommendation of the (Brit.) National Physical Laboratory to ensure that the chemicals shall retain their proper respective positions is to crystallize some of the cadmium sulphate solution so as to form a crystalline plug after the cell has been set up. This plug is so arranged as to crystallize just below the constriction shown in Fig. 6, the constriction acting as a further safeguard by preventing the plug

Fig. 6—Portable Weston Cell.

sliding up or down the tube. Special care has, however, to be taken in forming the crystalline plug for cells if they are to be shipped to hot climates. In this case the following method is recommended. When the separate limbs have been filled with their amalgam, small rings of cork are tightly fitted on the inside of the glass limbs, the center hole of these rings being kept as large as possible. Some pure unbleached linen is now carefully freed from its dressing by washing and boiling till no sign of chemical matter can be detected. This is then dried and cut into disks, the same size as the outside diameter of the rings. These disks are then sewn to the bottom of the cork rings, forming miniature drumheads which can be inserted as plugs on the surface of the layered chemicals. These drumheads are now forced firmly on the solid matter and will hold the chemicals in position against even violent handling. In a tropical climate, however, some solid crystals of $CdSO_4$ are sure to be taken up in solution, and the chemicals in the drumhead may become loose, so that it is desirable to add a few crystals of $CdSO_4$ above it to allow for the amount taken into solution. The linen screen does not appear to affect the e.m.f. materially.—Lond. *Electrician*, July 15.

Weston Cell.—S. W. J. SMITH.—His recent London Physical Society paper in full on the limitations of the Weston cell as a standard of electromotive force. This paper contains an attempt to explain F. E. Smith's recent experiments on the cadmium amalgams of the Weston cells in terms of the theory of solutions. An abstract of this paper has already been given in the Digest.—*Phil. Mag.*, July.

Frequency Meters.—O. MARTIENSSEN.—A review of various electric frequency meters. The author first deals with the vibratory frequency meters of Hartmann-Kaempf and of Frahm. He then describes another frequency meter of Ferrie, which is a combined ammeter and voltmeter, both instruments being so arranged side by side that the needles of the two instruments cross each other; the point of intersection deter-

mines the frequency, as recently described in the Digest. In another instrument devised by the author himself, a condenser is connected in series with an inductance coil with closed laminated iron core. A voltmeter is connected in parallel with this inductance coil. If the condenser and inductance are properly chosen the current and the voltage at the terminals of the inductance coil increase with the frequency. On the other hand, if the voltage of the supply circuit changes, while the frequency remains constant, the voltage at the terminals of the inductance coil will nevertheless remain unchanged, if the magnetization of the iron is properly chosen, since the increase of the magnetizing current causes a decrease of the self-induction. It is, therefore, possible to calibrate the voltmeter directly in periods, so that it measures directly the frequency, while it remains independent within certain limits of the voltage of the supply circuit. Experiments have shown that voltage variations of 10 per cent above or below the normal value do not affect the indications of the instrument. Variations of the wave form have only a small effect.—*Elek. Kraft. u. Bahnen*, July 4.

Ten-to-One Ratio of Resistance.—F. Wenner.—An abstract of an American Physical Society paper on a method for measuring or establishing the 10-to-1 ratio of resistance. The resistances whose ratio is approximately 10 to 1 and whose ratio is to be determined are made the adjacent arms (1) and (2) of a Wheatstone bridge. The other arms (3) and (4) are made up of resistances so arranged as to form an approximate 10-to-1 ratio. The bridge is then balanced by the variation of the resistance of one of the arms and a record is kept of the condition producing the balance. The resistances in the arms (1) and (2) are then interchanged while the resistances in the arms (3) and (4) are put into a different combination (usually without a transfer of any resistance from one arm to the other) so as to make the ratio very exactly one-hundredth of its former value. The bridge is balanced as before and from the two conditions of balance the ratio is easily calculated. The ratio of the resistances in the arms (3) and (4) may be made approximately 10 to 1 and then changed to very exactly one-hundredth of the first value by the use of: (a) 11 nearly equal resistances, 10 of which are used in the arm (3) first in series and then in parallel; (b) seven nearly equal resistances, five in the arm (3) and two in the arm (4) first with the five in series and the two in parallel and then with the five in parallel and the two in series; (c) six nearly equal resistances and one resistance of approximately one-third the mean value of the others. In the latter case three of the nearly equal resistances are used in each arm, first with those of the arm (3) in series and those of the arm (4) in parallel and the smaller resistance in with the series combination, and then with the conditions just interchanged. Here, since the smaller resistance is transferred from one arm to the other, a correction must be applied unless it is very exactly one-third the mean of the other six.—*Phys. Rev.*, July.

Telegraphy, Telephony and Signals.

Double Tuning for Wireless Telegraphy.—H. Rau.—The

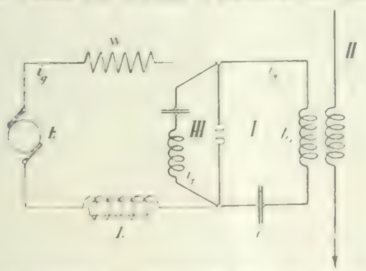


Fig. 7—Diagram of Connections for Double Tuning.

author uses the arrangement shown in Fig. 7. E is a direct-current generator, W is a resistor and L an inductance. C is a capacity and L_1 and i_r are inductances. Three currents pass through the discharge gap: first the direct current i_g from E; second, the low-frequency current i_r of the circuit III, tuned to an audible note; third, the high-frequency current i_{II}, which is impressed on the antenna. The direct current i_g and the low-frequency current i_r of III combined into a pulsating current which changes periodically the resistance of the air-gap in rhythm with the pitch of III. The high-frequency discharge of I is thereby influenced in such a way that at the moments in which the resistance of the discharge gap is a maximum, numerous partial sparks always pass, while at the moments when the pulsating current becomes a maximum the capacity discharge of C ceases. Various photographs show that the tuning can be made quite sharp.—*Phys. Zeit.*, July 1.

Liquid Microphone.—F. J. Chambers.—The author, after expressing some views upon wireless telephony in general, proceeds to describe a novel form of transmitter. The high-frequency current is led through an electrolytic path of small dimensions, so arranged that its resistance is varied considerably by the vibrations of a diaphragm, the liquid being maintained in a state of continuous flow. The advantages include faithful speech reproduction, and constant normal resistance with facilities for adapting this to suit requirements. Models have proved capable of taking energy at rates up to 500 watts.

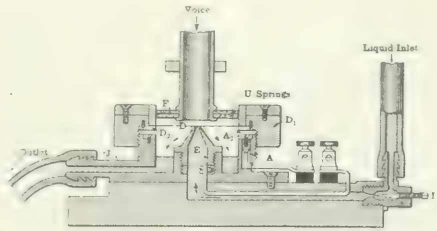


Fig. 8—Section of Liquid Microphone.

Practical results are described. In Fig. 8 a metallic diaphragm D is mounted upon a ring ebonite holder D_1 in contact with a metal ring D_2 secured to the latter. The underside of the holder is turned out and a female thread is tapped into the inner side. The ring is screwed upon A, the body of the apparatus, by means of this thread. Inverted U springs serve the double purpose of taking up the backlash in this thread and making electrical connection between the diaphragm and a second ring A_2, secured to the ebonite body; from this ring a lead is taken out through the wall of the body to one terminal. The diaphragm thus forms one electrode, and the other is shown at E, a tubular piece of metal with an upper nipple. The liquid supply is led through a fine adjustment valve I to the center of the lower electrode, passing through the latter and the constricted portion between the diaphragm and its lip and is collected in an annular reservoir formed in the body of the vessel A, from which it passes by an outlet pipe J. The lower electrode is connected by a lead passing out through the body of the vessel to another terminal. The flow of liquid is controlled by the fine adjustment valve I, and the distance between the diaphragm and the lower electrode is adjusted by revolving the diaphragm holder. A speaking tube concentrates the sound waves upon the diaphragm, and F is a disk of felt which confines these, while allowing the holder to be revolved.—*Lond. Electrician*, July ...

Miscellaneous.

Brussels Exhibition.—A continuation of the illustrated report of the exhibits at the Brussels International Exhibition. The present installment deals with electrical and engineering exhibits.—*Lond. Engineering*, July 1.

New Apparatus and Appliances

ELECTRIC EQUIPMENT OF CHESAPEAKE & OHIO RAILROAD SHOPS AT HUNTINGTON, W. VA.

The machinery in the shops of the Chesapeake & Ohio Railroad Company, at Huntington, W. Va., which was formerly driven by reciprocating engines, has recently been equipped for electric drive.

The new steam station is equipped with turbines, the only reciprocating machinery besides the boiler feed pumps being two two-stage air compressors built by the Ingersoll-Rand Company and the Chicago Pneumatic Tool Company, which furnish compressed air at 100 lb. pressure for the pneumatic drills, hammers and hoists about the shops. Three Curtis steam turbines and one motor generator exciter have been installed.

The turbine equipment consists of the following units: One

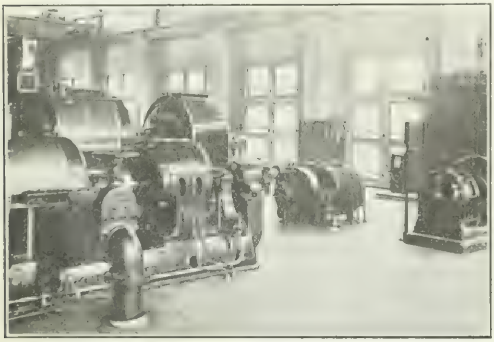


Fig. 1—Turbines in C. & O. R. R. Shops at Huntington, W. Va.

two-bearing, overhung, non-condensing turbine, speed 3600 r.p.m., connected to a 25-kw, 125-volt, direct-current exciter; one four-bearing, three-unit, 100-kw set consisting of one non-condensing turbine, speed 3600 r.p.m., one three-phase, 60-cycle, 480-volt, 100-kw generator and one 4-kw, 125-volt exciter; one three-bearing, four-stage condensing turbine, speed 1800 r.p.m. connected to a 750-kw, three-phase, 60-cycle generator.

All of the turbines are equipped with oil pumps geared directly to the main shaft of the turbine, and the bearings are fitted with oil rings. The 750-kw and 100-kw turbines are equipped with cross-head mechanical valve gear driven directly from the main turbine shaft.

The 750-kw turbine is connected to a Westinghouse-Le Blanc jet condenser, the circulating and rotary air pumps of which are driven by a 75-hp induction motor. The injection water is cooled by a natural draft cooling tower. This arrangement is very satisfactory, as it maintains a vacuum of from 27 in. to 28 in.

The boiler equipment consists of five 275-hp Stirling water-tube boilers, which are equipped with shaking grates and are hand fired. The ash is shoveled from the ash pits into cars and conveyed to a dump. The smoke stack is of reinforced concrete, 200 ft. high, and is provided with a Bushnell damper regulator. Bituminous coal is delivered in railroad cars on a trestle just outside of the boiler room and is dumped into coal bunkers and conveyed through chutes to a point within easy reach of the fireman.

The switchboard is of standard General Electric slate panels, consisting of two machine panels, two exciter panels, four three-circuit feeder panels and one half panel on which a voltage regulator is mounted. The instruments are of the switchboard type.

About 1000 hp of General Electric induction motors is distributed throughout the planing mill, tin shops, pipe shops, machine shop, boiler shop, and round house, ranging from 15 hp to 100 hp each. They are used to drive the different tools, such as band saws, wood planer, lathes, circular saws, drill presses, boring mills, shapers, metal puncher and rolls. Most of the motors are belt-connected. The large planers, turning lathes, drill presses and boring mills are equipped with individual motor drive. The planing mill is equipped with a sawdust and shaving eliminator driven by a 100-hp induction motor which conveys the shavings through tubes into the furnace under the boilers.

The station for charging storage batteries for signals and passenger coaches is equipped with a motor-generator set. The dismantling shop is spanned by a 120-ton four-hook Harris electric crane equipped with four variable-speed induction motors of the slip-ring type.

The buildings are heated by the exhaust steam from the two air compressors, the boiler feed pumps, 25-kw and 100-kw turbines; the condensation from the system is pumped into the boiler feed-water heater. This arrangement puts on the exhaust header a back pressure of from 4 lb. to 8 lb.

The changes made in this plant brought about a saving in coal alone of 50 per cent, which saving will be effected in part by the low steam consumption of the turbines and in part by the obliteration of large shafting and belting losses due to the introduction of a system of motor drive. There was also effected a saving of over 60 per cent in the labor required to operate the plant. This saving is due partly to the improved methods of handling coal and ash and partly to the small number of men required to operate a turbine station. Besides the saving in the cost of coal and labor, there has been a large increase in output of the shops, as 26 locomotives are now being overhauled and rebuilt in one month, whereas 20 was a good month's work previously. During the month of April

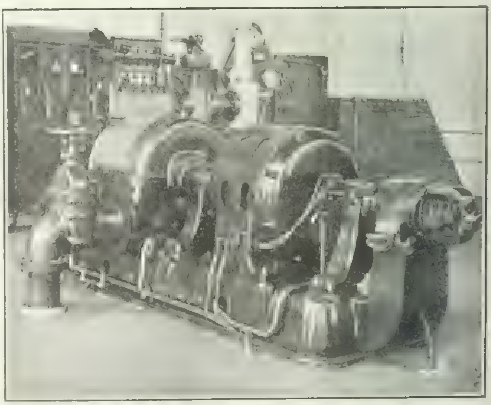


Fig. 2—One of the Turbo-Generating Units.

34 locomotives were turned out, this being the largest number ever repaired in one month. The electric drive has also increased the flexibility of the shops, as any section can be operated independently of the rest. The shops are very well lighted so that the men can work at night to advantage.

The new plant was put in service March 1, 1910. Very remarkable speed was made in installing the switchboard and turbines, as it was just 10 days from the time when they were received until they were placed in continuous service. The engineers were Westinghouse, Church, Kerr & Company.

SMALL ALTERNATORS.

The accompanying cuts illustrate a type of alternator being placed on the market by the Ideal Electric & Manufacturing Company, of Mansfield, Ohio, in sizes from 20 kw to 200 kw. Particular attention in design has been given to wave-form. The wave-form depends, to a large extent, upon the number of coils per phase per pole, and it will be noted in Fig. 1 that the present type has a comparatively large number of slots. Even in the smaller sizes these generators have at least three slots

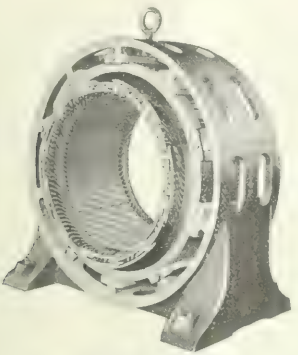


Fig. 1—Stator of Alternator.

per phase per pole in three-phase generators, or four slots in two-phase generators, while in the larger sizes the number of slots is greater. Besides giving more conductors per phase per pole, a large number of slots also has the further advantage that it gives a more even distribution of the flux. This is especially important in small-sized alternators, having open slots. Open slots are used in the generator shown, thus per-

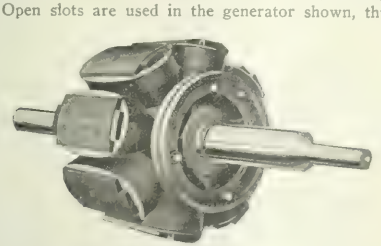


Fig. 2—Rotor of Alternator.

mitting the coils to be form wound and heavily insulated before insertion in the armature. It also has the advantage that in case of a burn-out coils can be easily removed without disturbing the remainder of the winding.

Another cause of poor wave-form is the shape of the field-pole pieces. The lines of force naturally pass from pole to pole through the path of least reluctance, and as the pole tips present the shortest path, the flux will concentrate here, giving an excessive magnetic density unless special pains are taken to prevent this by shaping the pole pieces as shown in Fig. 2. This arrangement is stated to give a practically uniform magnetic path and insure an even distribution of the flux in the pole face at all times.

Another feature in the design of the alternator illustrated is the fact that both bearing boxes are directly bolted to the stator frame. The bearings themselves are of the split, ring-oiled, self-aligning type, which offers a considerable advantage to the user in case it is necessary to remove the rotor for dismantling or making repairs. The oil is contained in large reservoirs, having outside gages to indicate the amount of oil present.

The alternators are designed for continuous operation at 80 per cent power-factor, but their ratings are given on the kva basis of 100 per cent power-factor. It is stated that by the use of carefully annealed and japanned laminations in the armature, and by a liberal use of copper, the machine has been so improved that it gives high efficiencies over a wide range of

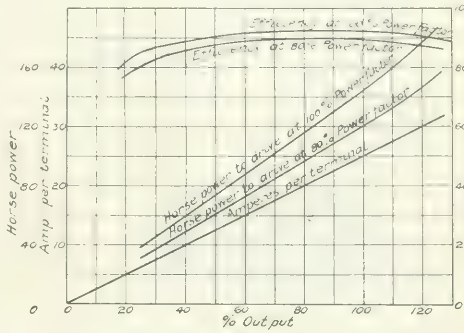
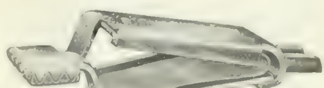


Fig. 3—Performance Characteristic of Revolving Field Alternator.

load. Fig. 3, which gives the test curves of a 100-kva, three-phase, 60-cycle, 2300-volt revolving-field alternator, shows that the efficiency from 50 per cent to 125 per cent load is practically flat, giving a maximum efficiency of 95 per cent at full load. The machines, it is stated, run at full rated load and not less than 80 per cent power-factor without showing a temperature rise of more than 40 deg. C.

TEST CLIP.

A test clip, which although particularly applicable to telephone work is not necessarily limited to such work, is shown herewith. The device is manufactured by R. S. Mueller & Company, Cleveland, Ohio, and may be used for shop work testing, where a ready means of making a test connection is required, or for making pressure tests on electric light circuits. In the latter case it is usual to slip a piece of soft-rubber tubing over the device and leave only the jaws exposed. No brass is used in the clip; the outer members are made of No. 20 semi-hard cold-rolled steel, and the inner members are made of blued spring steel with the point of application near the jaws. A long leverage produces a powerful bite, and there are no projecting parts to catch on things when coiling up the different wires. The clip stands straight without sagging on the round



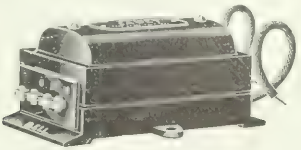
Test Clip.

pins of cable terminals, and the nose is so thin that one may test on telephone distributing frame terminal punches set on 3/16 in. centers without short-circuiting the adjacent punches. The clip is said to be applicable for wire as small as No. 40, and to switchboard or storage-cell lugs 5/8 in. thick. In bare-wire testing the side jaws are used, and often in crowded quarters a contact can be made with the side jaws where there would not be room to apply the nose. The teeth mesh, so that a good test contact can be made on fine wire, and on coarse wire or pin terminals there are always three points of contact. The clips are sherardized so as to take solder freely. In fastening the cord to the clip, the bared end of the conductor is threaded through the small hole in the heel, and the wire is pulled up snug so that the insulation comes up into the trough. After the wire is soldered to the clip, the up-turned lips are pinched down over the cord by pliers.

BELL-RINGING TRANSFORMERS.

Where alternating current is available, bell-ringing transformers may be used to save the expense, care and inconvenience of batteries for the operation of electrical bells and similar apparatus. They not only supply current for bells, but are equally valuable and convenient for operating door locks, annunciator call systems, spark coils, burglar alarms, thermostats for regulating the heating of buildings, electric gas lighting systems, etc. They eliminate all danger encountered by the use of the higher voltages.

The transformer shown in the accompanying cut, known as the "Hawthorn" bell-ringing transformer and made by the



Bell-Ringing Transformer.

Western Electric Company, is compact and rugged in construction, and the windings are insulated so as to withstand many times the voltage to which they are subjected in operation. By an ingenious arrangement of the windings it has been made impossible to injure either the transformer or bells should the bell circuit become short-circuited. The transformer is approved by the National Board of Fire Underwriters. The power consumption of this same type of transformer on test is stated to have proved too small to register on the usual form of watt-hour meter.

FAULT-FINDER.

The Roller-Smith Company, New York City, has brought out two forms of slide-wire bridges for fault-finding work. By winding the wire spirally around an insulated mandrel bent into the shape of a circle, a slide-wire resistor having a resistance of over 200 ohms is obtained. The resistor is mounted underneath the top plate of the instrument, where it and the movable contact, manipulated by turning the central hard-rubber button, are protected from damage and kept free from dirt.

Fig. 1—Instrument for Locating Faults

The fault-finders are made in two styles, the galvanometer model having self-contained batteries and a very sensitive d'Arsonval galvanometer, while the plain model has neither batteries nor galvanometer, but is supplied with terminal posts so that an external current source and external means of detecting balance (generally a telephone receiver) may be employed. In the first type the galvanometer is permanently secured in place within the casing, the top plate in the batteries being removable without disturbing it or touching any wire [illegible] It is [illegible] zero adjuster operable from outside. The plain model has a push-button key in the circuit to the external means of current detection, so that if the telephone receiver is used for that purpose, the manipulation of the key will cause the clicking necessary with this mode of working. The range of resistance measurements covered by both models is from zero to 5000 ohms, and each is equipped with two scales, one giving resistance values and the other percentage values used when locating grounds. In both models the standard 100-ohm resistance coil is adjusted to one-tenth of 1 per cent, and the slide wire tested for uniformity of resistance. The scales are hand calibrated.

Wiring diagrams of the galvanometer model and the plain model are shown in Figs. 2 and 3. In measuring resistances, the terminals of the circuit to be measured are attached to binding posts 1 and 2, and the switch *D* is turned to position *X*. The central hard-rubber button is turned until on depressing the push button *K* no galvanometer deflection is obtained or no click is heard in the telephone receiver. The value of the resistance under measurement is that indicated by the position of the needle relative to the outer of the two scales. In locating grounds, the grounded conductor must be looped or coupled at a distant station to a good return conductor, the two free ends of the circuit thus formed being attached at the home station to posts 1 and 2. The post *G* is also connected to a ground wire. With the switch *D* at the position *X*, the resistance may be measured as already indicated. Having thus found the resistance of the loop, and knowing the size of the wire forming it, the length in feet may be calculated by reference to a wire table. The switch *D* is then thrown to the position *T*, and a galvanometer balance obtained by rotating the central hard-rubber button, and depressing the hard-rubber button *K* as before. When the balance is obtained, the distance from the point of test to the fault is shown by the position of the needle

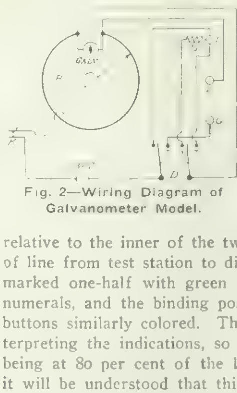


Fig. 2—Wiring Diagram of Galvanometer Model.

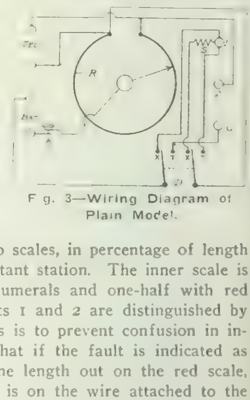


Fig. 3—Wiring Diagram of Plain Model.

relative to the inner of the two scales, in percentage of length of line from test station to distant station. The inner scale is marked one-half with green numerals and one-half with red numerals, and the binding posts 1 and 2 are distinguished by buttons similarly colored. This is to prevent confusion in interpreting the indications, so that if the fault is indicated as being at 80 per cent of the line length out on the red scale, it will be understood that this is on the wire attached to the red post and vice versa. Having the percentage of line length from this test, and the length of the line from the test preceding, the distance in feet to the fault is readily calculated. The galvanometer type of instrument measures 7½ in. x 6½ in. x 5 in. and weighs 7 lb., the plain-type instrument measures 8½ in. x 6½ in. x 3½ in. and weighs 6 lb.

A TON OF PLATINUM.

It is an interesting fact, perhaps not generally known by operating telephone men, that precious metals, such as platinum, gold and silver, and even precious stones, such as diamonds, are used extensively in the manufacture of telephone apparatus. The Western Electric Company, the largest manufacturer of telephones in the world, uses upwards of one ton of platinum each year. When it is considered that the value of platinum is 30 per cent greater than that of pure gold, it will readily be seen that this expensive precious metal would not be used extensively unless results justify it. The contact points of all Western Electric telephone apparatus are made of platinum.

ALTERNATING-CURRENT OIL CIRCUIT-BREAKER.

The Westinghouse Electric & Manufacturing Company, a few years ago, placed on the market a type of oil circuit-breaker designed for potentials not exceeding 600 volts and with a current-carrying capacity of from 10 amp to 300 amp, the breaker being designed for mounting on a wall or post or any location convenient to the operator. Owing to the success of the principles of operation embodied in this circuit-breaker, the line has been extended to include breakers of the same current-

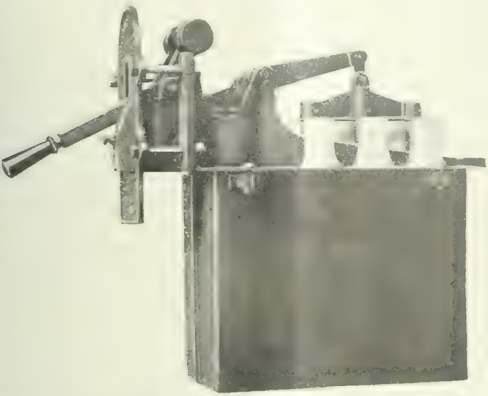


Fig. 1—2500-Volt Oil Circuit-Breaker Complete.

carrying capacity adapted for switchboard mounting and for use on alternating-current circuits having potentials as high as 2500 volts.

The new type, in addition to embodying all the distinguishing features of the old 600-volt type, possesses several new features, the most prominent of which are the inverse time element and the "full automatic overload" release attachment. The overload release trip coils are suspended from the frame of the breaker, immersed in oil and connected directly in series

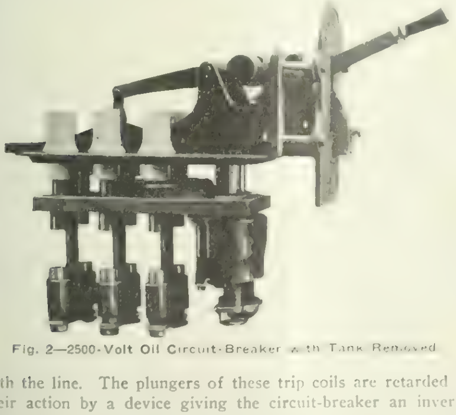


Fig. 2—2500-Volt Oil Circuit-Breaker with Tank Removed

with the line. The plungers of these trip coils are retarded in their action by a device giving the circuit-breaker an inverse time-element. The time-element introduced is sufficient to permit the use of this type of circuit-breaker for motor-starting service.

The mechanism is known as "full automatic overload," that is, it is equipped with a device that renders it impossible to close the breaker or to hold it in the closed position while a continued abnormal overload condition or a short-circuit exists on the line. The time-limit device, referred to above, permits the breaker to be closed under a momentary overload or rush of current such as is incident to starting [illegible] throwing the controller to "running" position.

An under-voltage release attachment which opens the breaker whenever the line voltage falls below a certain predetermined value can also be applied to this type of oil circuit-breakers. It consists of a magnet coil connected directly across the line for voltages not exceeding 600 and through potential transformers for voltages higher than 600. This coil is self-contained, and is so designed that it may be attached to the breaker without any modification in the mechanism.

While the 600-volt style has a single break to each pole, in the 2500-volt style there are two upper and two lower contacts for each pole, thus securing a double break per pole. The contacts consist of cylindrical brass rods, the lower ones being backed up by individual spiral springs to insure good contact and form the well-known "butt" contact type. This method, familiar in the multiple-unit system of control on heavy street-railway equipment, has been adopted with great success in oil circuit-breaker practice. It insures good contact always and prevents any possible failure due to eating away of the contacts by continued arcing. The compression springs mentioned take up any wear that may occur and render the contacts self-aligning.

SOME NEW APPLIANCES EXHIBITED AT THE OHIO CONVENTION.

At the Ohio Electric Light Association convention at Cedar Point, on Lake Erie, last week, some comparatively new appliances were exhibited in addition to a considerable amount of apparatus which has been on the market for some time. The Westinghouse Electric & Manufacturing Company showed a general utility motor which is a small motor for household use. It is provided with a combination chuck to which either an emery wheel or a buffing or polishing wheel may be attached so as to do either grinding or polishing. The motor is provided with a base to fasten it down when it is to be used for miscellaneous purposes. It also has a flexible shaft for grinding and polishing and a massage attachment. By pulling out a plug and revolving it 90 deg. the direction of rotation can be reversed.

The company also showed the new wire type of tungsten lamp which will withstand about the same abuse as a carbon-filament lamp; this lamp was exhibited for the first time at the National Electric Light Association convention. The company established a substation on the boardwalk for converting direct-current supply of the Cedar Point power plant into alternating current for operating a circuit of series-tungsten lamps which were hung on the beach.

Another recent development is a combined oil-switch and circuit-breaker for three-phase motor circuits for electromotive forces up to 2500 volts. This switch is described in detail in the preceding article. This is designed to take the place of switch and fuse otherwise required. The new electric iron for tailors, which takes energy only when placed in its standard, contacts being made through heavy lugs, was also shown.

The Sterling Electric Manufacturing Company showed a number of 400-watt and 500-watt tungsten lamps in connection with enameled iron street hoods and reflectors adapted for such lamps.

The General Electric Company displayed one of its new chafing dishes in which the heating element and base are separable from the chafing dish proper. The base is provided with a regulating switch. A new soldering iron using a General Electric heating element was exhibited.

The Peirce all-steel brackets and pole hardware which are now made by Hubbell & Company, of Pittsburgh, have been extensively used in telephone work and also in electric lighting work in Chicago. These bracket and pole fittings were exhibited for the second time at an electric light convention. They are made from various standard steel sections, being both cheap and reliable. Brackets for attaching to building and for taking off service wires from the ends of cross-arms were shown by the company.

Industrial and Commercial News

THE WEEK IN TRADE.

TRADE was probably even more quiet last week than it has been at any time during the summer season. The wholesalers and jobbers report that orders are fewer and there is less inquiry than is customary even during the midsummer period. Distribution through retailers is disappointing, and while there are many buyers in the central markets, the condition is such that they are extremely conservative. The sharp break in the securities market followed by a quick recovery had an effect of further unsettling the business situation. The extensive drought in some portions of the country and the excessive moisture in others has made the reports as to crops irregular and somewhat disconcerting. While it is generally believed that eventually the average crop yield will be good, weather conditions have been such that many sections are feeling discouraged. Business men generally are inclined at the present moment to await the forthcoming government crop report. Among the industrials, a rather better demand was reported for finished iron, steel, copper and some makes of cotton goods. This improvement is probably based upon the advance in raw material. Pig-iron remains very quiet and prices are still easy. The curtailment of output does not appear to have gone far enough to buoy quotations, and it is said that stocks are accumulating at some points. Orders for railroad equipment continue to come in, but are generally limited in size. The roads appear to be buying only to meet actual necessities. Collections are still slow and renewals are asked in some sections of the South and West. Business failures for the week ended July 28 as reported by *Bradstreet's* were 198, against 215 the previous week; 223 in the like week of 1909; 275 in 1908; 142 in 1907; and 170 in 1906.

THE COPPER MARKET.

SPECULATION was active in copper last week, and at some periods of the week the market was decidedly feverish. Orders for standard were stimulated by continued rumors of curtailment in production, and many orders for electrolytic were received from actual consumers, who became impressed with the opinion that they would not be able to buy copper at such reasonable rates later on. The net results in prices for the week were advances both in standard and electrolytic of about one-quarter of a cent per pound. The figures obtained from market reports indicate that during the week an aggregate of about 35,000,000 lb. was taken, largely for export. A large portion of this was for September and October delivery. Much of the export copper was taken for the purpose of covering speculative transactions in Europe.

	Bid.	Asked.	Change.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	12.15
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

The London market Aug. 1 was as follows:

	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Standard copper, futur[illegible]	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest.	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

The speculative movement was well timed to carry the market upward before the unfavorable statistics, which it is said will be shown when the July report of the Copper Producers' Association is made public, could have their effect upon the market. In the mean time there continues to be a general belief that the producers are actually intending to curtail the production of copper, and it is claimed that some of the largest companies have already signed agreements whereby the smelter output will be reduced about 7,000,000 lb. per month, and that other companies are considering reductions which, if carried out, will make the total curtailment of production about 25 per cent. If this program is adopted the copper market will regulate itself. The average consumption for the nine months of the present year has been about 75 per cent of the production. If the curtailment that is now promised is carried into effect, the production of copper will about equal the consumption, and the distressing accumulation of surplus will cease. The increased buying by domestic consumers during the past week was largely due to their faith in the promises of reduction, for if the mines ever actually quit producing to the extent of 25 per cent, copper will not be obtainable at the present figures. At the same time it is well to mention that quite a number of large copper producers are skeptical as to the good faith of the curtailment program. During the past week several have been reported as saying that they believed that any announcement of the curtailment agreement was intended to strengthen the market, and that eventually as much copper would be produced as ever. The imports continue to be quite heavy, and the indications are that the amount received during July will be about 14,000 tons. Exports for the month were 22,875 tons. The daily call on the Metal Exchange August 1 quoted standard copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Apparatus for New York Central.—The New York Central Railroad Company has asked for bids for four 2000-kw rotary converters. E. B. Katte, chief engineer of electric traction of the company, says that three of these rotaries are to be used in the substation which is now being constructed at Irvington, and one will be placed in the present substation at Glenwood. It is hoped to have them all in service by next spring. He also says that it is the purpose of the company to extend if possible within the present year the electric zone from Yonkers to Hastings, a distance of about 4 miles, for the service of multiple-unit trains. The electric zone will eventually be extended to Croton, and a new substation will be erected at Ossining. When the entire electrification is completed, a transfer station will be established at Croton to accommodate the steam locomotives, and all trains will be brought from that point into the city by electricity. It is not expected that this entire work can be finished for several years.

New Westinghouse Foundry.—The Westinghouse Electric & Manufacturing Company has purchased 70 acres in Trafford City, Pa., adjoining the property owned by the Westinghouse Machine Company. A new foundry will be erected on this property, and will be completed within a year. It is said that when this foundry is ready for operation it will be one of the largest in the world. It will employ at least 2,500 men, and it is said that the foundry at Cleveland and the one on the north side of Pittsburgh will be centralized in the new location, thus placing all of the foundries of the Westinghouse interests in one locality. The new foundry will be connected with the other Westinghouse companies by what is known as the Interworks Railroad. The ground purchased for the new site cost in the neighborhood of $250,000.

Vermont Marble Company.—Contracts have been made by the Vermont Marble Company for the construction of a 35,000-volt transmission line from Weybridge, Vt., to West Rutland. A generating station will be erected at Weybridge which will be equipped with two 800-kw generating units. The Marble company has a 2250-kw hydraulic plant at Proctor and a 500-kw steam plant at West Rutland. Arrangements are being made to parallel these plants with a 10,000-volt transmission line.

More Telephones on the Santa Fé.—The Atchison, Topeka & Santa Fe Railroad, which was one of the first in the West to take up the telephone for train dispatching, has almost completed an installation which will give it in the neighborhood of 7000 miles of line operated under the telephone system. The Western Electric Company instruments and selectors will be used in this service. The railroad recently bought 600 of these selectors.

Philadelphia Rapid Transit Company.—Contracts have been signed between the Delaware County Electric Company, Media, Pa., and the Beacon Light Company, Chester, Pa., both subsidiaries of the Philadelphia Electric Company, and the Philadelphia Rapid Transit Company under which the electric companies will supply all the energy for railway purposes, for the line operating Delaware County.

Sierra Pacific Electric Company.—An offer is being made to the public of the $1,000,000, 6 per cent cumulative preferred and the $550,000 common stock of the Sierra Pacific Electric Power Company. The offer is made in blocks of 10 shares of preferred and five shares of common for the lump sum of $950. This is the recently organized holding company which owns all the stocks of the electric light and power companies of Reno, Sparks, Virginia City and Carson City, Nev. The companies combined control the entire gas business of Reno, Sparks and Carson City and do a large business with mines and mills in that entire section. Concerning the property Stone & Webster say: "The present developed water power amounts to 7300 hp, which is insufficient to supply the increasing demand for electric power. A new plant of 9000 hp rating will be constructed at once, there already being a demand for a substantial amount of this additional power. It is estimated that ultimate developments aggregating 150,000 hp are available." The mining interests in this section have increased very rapidly with the introduction of hydroelectric service, the high cost of generating energy by steam having made it impossible to work many of the low-grade ores. In addition to the mining interests there is a great increase in irrigation in this portion of Nevada. Last year 32,000 acres were reclaimed by irrigation and it is said that 200,000 acres in addition can be put under cultivation, as soon as electric energy for pumping can be obtained.

Allis-Chalmers Company's Business.—According to an official of the Allis-Chalmers Company, the orders being booked by that concern are very satisfactory. The business for last month, it is stated, up to July 25, almost equaled the business for the entire month of June, and it was expected that by the end of the month it would far exceed it. June did not quite equal May, which was the banner month, but July is likely to exceed May. The orders taken in May were at the rate of $29,000,000 per year. "Our recent business," said this official, "has been exceptionally good on large steam turbines and turbo-generator sets. We are not selling as much mining machinery as was sold last year, but we are selling more than enough other apparatus to make up for it. We recently sold the city of Jacksonville, Fla., a 1500-kw steam turbine; to the Mexico Northwestern Railway Company three big units; Flatbush Gas Company, Brooklyn, 3000-hp turbine; Houston (Tex.) Lighting & Power Company, 4000-hp steam turbine, and Firestone Tire & Rubber Company, Akron, Ohio, 2000-hp turbine. These are only a few sample orders which I can remember without looking up the records. We are also selling a large number of small motors; one order we recently booked being from the United States Government for use at the Indian Head, Md., proving ground."

International Steam Pump Company.—The International Steam Pump Company is taking active measures to increase its manufacturing facilities and to effect greater economies in the handling of its western business. It has recently purchased the F. M. Prescott Steam Pump Company of West Allis, Wis., and during the present fiscal year also acquired the Jeanesville Iron Works Company and the Denver Rock Drill & Machinery Company. In addition to this the company is spending $750,000 for construction work at the plant of the Power & Mining Machinery Company in Milwaukee, and $850,000 for general improvement in other plants. The company now has 10 subsidiaries with factories in New York, Massachusetts, Ohio, Pennsylvania and Wisconsin. Officials of the company say that business is very satisfactory and that if it continues at the present rate until the end of the next fiscal year, March 31, 1911, the surplus earnings of the company should amount to at least 7 per cent on the common stock. The last disbursement on this stock was made April 1, [illegible]

Tunnel to Staten Island.—Stephen M. Hoye, president of the New Jersey & Staten Island Junction Railroad Company, announced last week that plans are now in course of preparation for a tunnel under the Narrows to connect Staten Island and Long Island. It is proposed that this tunnel shall be connected with the new Fourth [illegible] Mr. Hoye said that an act of Congress passed in 1890 gave his road a perpetual franchise that authorized [illegible] tunnel under New York Bay between the town of Middletown, Richmond County, and New Utrecht on Long Island. Mr. Hoye said: "We are now in conference with a firm of engineers, who assure us that they can construct a tunnel under the Narrows that will be as wide as Broadway from curb to curb, and large enough for automobiles, carriages and railroad tracks. The distance under the Narrows is less than two miles, and the engineers say the tunnel can be constructed within a year at a cost of $6,000,000.

Cole-Ryan Copper Combine.—It is said that a plan has been formed for the consolidation of the Calumet & Arizona and the Superior & Pittsburgh copper mining properties, both of which are under the management of the Cole-Ryan interests. It is said that the consolidation will be based upon an examination by three disinterested engineers, and there is a belief that such a combination will be on the basis of four shares of Superior & Pittsburgh for one share of Calumet & Arizona, or that this proportion will be carried out in a new company which will take over both properties. Such a consolidation would give the Superior & Pittsburgh an ownership in an up-to-date smelting plant, and would greatly increase the life of the Calumet & Arizona.

International Business Directory.—The Bureau of Manufactures of the Department of Commerce and Labor has in preparation a "World Trade Directory," which will be published by subscription at the price of $50. It will contain about 125,000 names of business houses in foreign countries engaged in foreign trade, which have been selected and classified from lists compiled by consular officers and special agents of the Bureau. A subscription blank will be forwarded upon application to the Bureau of Manufactures, Washington, D. C.

Electric Cranes for Docks and Wharfs.—According to an American consular report an expenditure of $88,703 has been authorized by the Minister of Public Works in a European country for the purchase of electric cranes for docks on a certain river. Tenders will also be received until October 12 for furnishing one 10-ton and seven 5-ton electric wharf cranes for an African port. Detailed information can be obtained from the United States Bureau of Manufactures by referring to the file numbers 5274 and 5284.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Marseilles, Ill.; Baltimore, Md.; Ozark, Ark.; Toluca, Mex.; Franklinville, N. Y.; San Leandro, Cal.; Nashua, N. H.; Proctor, Vt; Brooklyn, N. Y.; Cleburne, Tex.; Estevan, Sask., Can.; Whitesboro, Tex.; Washington, D. C.; Oklahoma City, Okla.; Buffalo, N. Y.; Cheyenne, Wyo., and Canton, Maine.

Financial.

THE WEEK IN WALL STREET.

AFTER the extreme demoralization of ten days ago, the Wall Street market has shown signs of a steady recovery. On July 26-27 there was in evidence an enormous pressure to sell, and more than 110 stocks made new low levels for the year. The liquidation was insistent, and there was apparently no effort on the part of the heavy moneyed interests to check the downward course. Quite a number of

NEW YORK.

	July 25.	Aug. 1.	Shares sold.		July 25.	Aug. 1.	Shares sold.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am. Tel. & C.	71½*	[illegible]	[illegible]	Steel	[illegible]	[illegible]	[illegible]
Am. T. & T.	131½	[illegible]	16,855	Steel, pfd...	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gen. Elec....	139	[illegible]	6,100	West'h., com.	53	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	30,700	West'h., pfd..	115	[illegible]	[illegible]

PHILADELPHIA.

	July 25.	Aug. 1.		July 25.	Aug. 1.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E. S. B'ty, pfd.....	30*	30*	Union Trac.........	42⅝	[illegible]

CHICAGO.

	July 25.	Aug. 1.		July 25.	Aug. 1.
Chi. City Ry.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Met. El. Co.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2⅞	Nat'l Car., pfd......	115	[illegible]

BOSTON.

	July 25.	Aug. 1.		July 25.	Aug. 1.
Am. T. & T.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cum. Tel...........	141*	[illegible]	[illegible]	[illegible]	[illegible]
Edison E., Ill.......	255	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mass. E. Ry., pfd...	79*	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible] exchange floor gave evidences of serious demoralization. The following days the market recovered, and since that time the tone has been fairly strong, although prices have not advanced to any considerable extent. The cause assigned for the sudden panic was the failure of a large syndicate which was operating in Lehigh Valley, Wabash and Missouri Pacific to meet its many engagements. This syndicate was headed by Dr. F. S. Pearson, and according to general rumor had for its purpose the establishment of another great transcontinental line. There was no failure, in a financial way, recorded against the syndicate, but it was made known that the banking firm of Kuhn, Loeb & Company had taken over its enormous holdings. The break in the market occurred when it became known that the Pearson syndicate could not carry out its original program, and the recovery occurred when it became known that such a substantial banking firm as Kuhn, Loeb & Company had taken over the holdings. There was at no time any necessity for throwing any of the syndicate's holdings on the market, and the demoralization was more largely due to the hysterical condition of Wall Street traders than to any real danger. The physical conditions of the country are not in favor of lower prices, but on the other hand the outside public seems to be entirely absent from the market, and outside buying cannot be counted on even when prices for securities are low. The money market continues to be entirely satisfactory so far as rates are concerned, and so far as the financial condition of the banks is concerned. At the same time, bankers are not particularly encouraging small dealers to enter the market. Money seems to be low largely because very few people have any use for it, either in a business or speculative way. Quotations Aug. 1 were call 1½@2 per cent; 90 days, 4 per cent. The quotations in the table are those of the close Aug. 1.

Financial Notes.

Louisville's Power Merger.—The merger of light, heat and power companies in the city of Louisville, Ky., which was referred to in our issue last week, has not yet been completed. The main point of difficulty at the present time seems to be the question of the capitalization of the new company. All of the concerns involved are anxious for the merger. At the present time the Louisville Gas Company has outstanding $3,600,000 stock and $500,000 bonds; the Louisville Light Company has $3,000,000 stock and $2,500,000 bonds; the Kentucky Heating Company has $3,913,600 stock and $100,000 bonds; the Kentucky Electric Company has $600,000 stock and $400,000 bonds; the George G. Fetter Company has $300,000 stock, making the total capitalization for all of the companies $14,913,600. The city authorities are insisting upon a definite schedule of rates, and argue that the union of the companies will so simplify operation that economies will be made possible. The franchise of the Kentucky Electric Company at present stipulates that the rate for lighting be 9 cents per kw-hour and for power 4 cents, and the city has the right to reduce this rate when reduction seems justified. In the proposed charter of the merger company, which is now under consideration, there is no such provision except that rates may be adjusted every three years by a commission. The old charter of the Louisville Light Company provides that the city must be furnished with lamps for public lighting of such capacity and power as the authorities may determine, at a price not to exceed $67 a lamp per year. The officials of the present companies claim that the rates in Louisville are now lower than in any other city of its size in the country.

Chicago Traction Merger.—There appears to be a serious hitch in the program of the syndicate which is attempting to merge the Chicago Railways Company with the Consolidated Traction properties. The holders of Series One certificates of the Railways company have been asked by a protective committee to unite in a protest to the board of directors and trustees of the company, and to Judge Grosscup against fulfillment of the agreement entered into between the Railways company and the holders of the securities of the Consolidated Traction Company. In addition to this, Judge Cutting, of the Probate Court, has denied the petition of the executor of the Yerkes' estate, asking that the claim of that estate be compounded in accordance with a certain arrangement proposed, amounting to about 50 cents on the dollar. The amount of the [illegible] $5,000,000. The judge has upheld the contention of Mrs. [illegible] reorganization plan as outlined. Chairman Blair of the syndicate intimates that at the present time his plans are held up indefinitely, and will continue to be held up until the various interests agree upon a fair basis of valuation. He says that while the New York financiers are willing to furnish the capital necessary for the undertaking, they want assurance that they can get a fair return on their money.

Massachusetts Electric Companies.—The statement of earnings of the operating companies of the Massachusetts Electric Companies for the nine months which ended June 30 was by far the best exhibit for such a period that the concern has ever issued. The surplus applicable to dividends for this period was $338,365 larger than for the same period in the previous year. The remarkable showing, it is claimed, was the result largely of the improved operating efficiency of the system. Although the gross earnings were increased nearly $400,000, or about 7 per cent, operating expenses were increased less than $70,000, or but little more than 1 per cent. Large amounts have been spent upon the properties for construction and reconstruction in the past several years, and it is believed that the companies will be able to continue the good showing made during the past nine months, and thus be in a position to increase their dividends. The Railroad Commissioners of Massachusetts have required that the fiscal year of street railway companies end with June 30, and the figures for this nine months therefore complete the fiscal year for the electric companies.

Charleston (S. C.) Consolidated Railway & Lighting Company.—The recently organized Charleston Consolidated Railway & Lighting Company, which is owned by the United Gas & Improvement Company, of Philadelphia, has taken over under a 99-year lease the property of the Charleston Consolidated Railway, Gas & Electric Company. The lease guarantees rentals sufficient to pay 6 per cent dividends on $500,000 of preferred stock, and dividends on $1,500,000 common stock as follows: Four per cent to July 1, 1911; 5 per cent to Jan. 1, 1913, and 6 per cent thereafter. It also guarantees the interest on outstanding bonds. The officers of the company are: T. H. Gadsden, president; G. H. Waring and Walton Clark, vice-presidents; W. F. Douthirt, secretary, and Lewis Lillie, treasurer. The last three named are officers of the United Gas & Improvement Company.

Illinois Valley Gas & Electric Company.—Russell, Brewster & Company, of Chicago, are offering $500,000 of 6 per cent cumulative preferred stock of the new Illinois Valley Gas & Electric Company at $85 a share, netting 7.06 per cent, with a bonus of 25 per cent of common stock. Samuel Insull is president of the Illinois Valley company, which has acquired a number of gas and electric generating plants and distributing systems located in and near Streator, Ill. The company will be closely affiliated with the Economy Light & Power Company of Joliet, of which Mr. Insull is also president. Charles A. Munroe, manager of the Economy company, occupies a similar position in the organization of the Illinois Valley company.

Steel Earnings Higher.—The report of the United States Steel Corporation for the quarter which ended June 30 last shows net earnings of $40,170,960, as compared with $37,616,876 for the previous quarter. Unfilled orders on the books were for 4,257,794 tons, which is more than 1,000,000 tons less than the unfilled orders on the books on March 1. The Board of Directors decided at the meeting at which the report was made public that the officers shall hereafter on the 10th of each month make public the aggregate tonnage of unfilled orders on hand at the close of the previous month.

Roland Telegraphic Company Receivership.—The Roland Telegraphic Company, of Baltimore, a corporation formed about 10 years ago to exploit the multiplex telegraphic printing machine invented by the late Professor Henry A. Rowland of John Hopkins University, has gone into the hands of a receiver. The assets are given to be $257,621 and the liabilities [illegible]

Safety Insulated Wire & Cable Company.—Official announcement has been made that at a recent special meeting of the stockholders of the Safety Insulated Wire & Cable Company, of New York, the capital stock was reduced from $1,500,000 to $750,000. The stockholders have exchanged their old certificates for the new ones. The control of the company is held by H. E. Huntington, who is chairman of the board.

United Railways of St. Louis.—A report of the United Railways Company of St. Louis for the first six months of 1910 shows a surplus available for dividends of $405,777, as compared with $555,746 for the corresponding period last year. This decrease, the report declares, is attributed entirely to higher operating costs and to a considerable increase in the item "taxes and depreciation." The gross revenue for the six months amounted to $5,605, 501, a gain of 4.3 per cent over last year. The operating expenses, however, increased 10.7 per cent over last year, and taxes and depreciation increased $84,903. At the present time a joint committee of both houses of the St. Louis Municipal Council is investigating the affairs of the Railways company with a view to determining whether its earnings are proportionate to the operating expenses. The Public Service Commission of Missouri is formally appraising the property to determine whether it is earning profits on watered capitalization.

Interborough Rapid Transit Company.—The report of the Interborough Rapid Transit Company for the fiscal year which ended June 30 established a new record for gross income and showed an increase over 1909 of $2,463,253, or about 8.5 per cent. The expenses increased only 2.4 per cent, and the advance in net was about 12 per cent. The total receipts for the year was $28,987,648. The surplus at the end of the year was $2,932,147. The number of passengers carried during the year was 562,788,395, an increase of more than 8 per cent over the previous year. The Interborough company is adding to its equipment as rapidly as possible, and is lengthening all station platforms so as to be able to handle longer trains.

Eastern Illinois Railway Company.—A suburban electric railway, connecting the towns of Harvey, West Hammond, Dolton, Riverdale and Thornton, near Chicago, is projected. The company owning this road will be known as the Eastern Illinois Railway Company. It is said that Thomas E. Mitten, president of the Chicago City Railway Company, will be its president. A deed of trust to secure a bond issue of $5,000,000 has been placed on record. It is planned to have the tracks of the new company cross the tracks of steam railroads by means of steel bridges.

East St. Louis Light & Power Company.—Articles of incorporation have been recently filed for the East St Louis Light & Power Company of East St. Louis, Ill., with an authorized capital stock of $1,000,000. The new company is a consolidation of the old Consumers' Light, Heat & Power Company and its subsidiary, the Citizens' Electric Light Company, with the Southwestern Light & Power Company. L. C. Haynes, vice-president and general manager of the East St. Louis & Suburban Railway Company, will probably be the president of the new company.

Newburg (N. Y.) Light, Heat & Power Company.—The Public Service Commission of the Second District of New York has authorized the Newburg Light, Heat & Power Company to issue $70,500 first mortgage bonds the proceeds of which are to be used for the construction of a high-tension transmission line from Forest Glen to Montgomery, a distance of 15 miles, and distributing systems in the towns and villages along the route for which the company holds franchises.

Kings County Electric Light & Power Company.—In the first half of the calendar year the Kings County Electric Light & Power Company earned $499,250 over and above expenses and fixed charges, which is equivalent to almost 5 per cent on the $10,000,000 capital stock. This compares with an available surplus of $440,190 earned in a similar period last year. The business of the company is continuously growing, not only in electric lighting but also in gas.

United Railways & Electric Company.—It is stated that the United Railways & Electric Company of Baltimore is now practically free from floating debt, the last of it having been paid on the first of the present month. It is also given out that the company has on hand a cash balance of almost $600,000. At the beginning of the current year the floating debt amounted to $375,000.

Sterling-Moline (Ill.) Traction Company.—The Sterling-Moline Traction Company has been incorporated under the laws of the State of Illinois to construct an electric railway from Sterling, in Whiteside County, Ill., through the counties of Lee and Bureau to Princeton, Ill. The principal office will be in Sterling, and the capital stock of the company is $100,000.

Chicago Railway Receivers.—David R. Forgan and John M. Roach have been appointed receivers of the North Side Street Railways and the Chicago & Jefferson Urban Transit Company, at Chicago, by Judge Grosscup. This action practically places all of the underlying lines of the Consolidated Traction Company in the hands of receivers.

DIVIDENDS.

Boston Elevated Railway Company, semi-annual, 3 per cent, payable Aug. 15.

Commonwealth Power, Railway & Light Company, preferred, quarterly, 1½ per cent, payable Aug. 1.

Guanajuato Power & Electric Company, preferred, 2 3/10 per cent, payable Aug. 1.

Kellogg Switchboard & Supply Company, quarterly, 3 per cent, payable Aug. 2.

Metropolitan West Side Elevated Railway Company, Chicago, quarterly, preferred ¾ per cent, payable Sept. 6.

Marconi Wireless Company, Ltd., initial 7 per cent, payable Aug. 1.

New Hampshire Electric Railways Company, Haverhill, Mass., preferred 4 per cent, payable July 30.

North American Company, quarterly 1¼ per cent, payable Sept. 15.

North Shore Electric Company, Chicago, quarterly, 1 per cent, payable Aug. 1.

Sierra Pacific Electric Company, preferred, quarterly, 1½ per cent, payable Aug. 1.

REPORTS OF EARNINGS.

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	$80,634,614	[illegible]	$24,276,781	$5,556,333	$18,720,448
[illegible]	72,112,092	[illegible]	22,728,922	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]		[illegible]		[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Detroit United Railway Company:					
[illegible]	[illegible]	[illegible]	[illegible]	168,530	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	156,997	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
June, 1910	79,291	[illegible]	[illegible]		
[illegible]	[illegible]	63,666	[illegible]		
Interborough Rapid Transit Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	52,214	[illegible]	[illegible]	[illegible]
[illegible]	95,825	48,784	[illegible]	[illegible]	[illegible]
[illegible]usetts Electric Companies:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Company					
[illegible]	[illegible]	[illegible]	[illegible]	18,760	[illegible]
[illegible]	[illegible]	81,046	[illegible]	18,204	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	208,201	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Rapid Transit Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]estern United Gas & Electric Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	68,700
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	56,345

General News

Construction News.

[illegible]

[illegible], ALA.—The [illegible] Steel & Iron Company [illegible] $40,000. The plant will furnish electricity to operate the large pumps and machinery in the mines and for lighting the mines. Contracts for machinery and equipment have been placed with the Allis-Chalmers Company, [illegible] Wis.

HARTSELLS, ALA.—The city has postponed the date for holding the election to vote on the proposition to issue $28,000 in bonds for the construction of an electric light plant and water-works system from Aug. 8 to Aug. 22. Xavier A. Kramer, of Magnolia, Miss., is consulting [illegible]

[illegible], ARK.—The [illegible] Company is reported to be contemplating the installation of an electric light plant.

GRANNIS, ARK.—It is reported that a project is on foot to organize a company to establish an electric light plant in Grannis. John P. Logan, A. Coyle and others are interested in the enterprise.

OZARK, ARK.—We are informed that the Ozark Electric Light & Power Company is contemplating changing its system to two-phase, 60-cycle soon, and will also install producer gas units. R. B. Bryant is manager.

BERKELEY, CAL.—The business men on University Avenue, from Oxford Street to Shattuck Avenue, have submitted a proposition to the City Council offering to pay for the erection of electroliers in that section, provided the city will furnish electricity for same.

BERKELEY, CAL.—The City Council has granted the Great Western Power Company a franchise for a term of 50 years to supply electricity for lamps, heat and motors in Berkeley, under the terms of which the company agrees to pay the city 2 per cent of its gross receipts during the first 10 years; for the third 10 years 4 per cent, and 5 per cent for the remainder of the life of the franchise.

CHICO, CAL.—The new electric power plant of the Diamond Match Company has been completed and is in operation. The entire works of the company will be operated by electricity with exception of the steam hammers, which heretofore have been run by steam power. The steam plant will be kept intact for use in emergencies. About 1000 hp will be required to operate the plant.

COLTON, CAL.—Plans are being considered for extending the ornamental street lighting system in Colton. Earl M. Crilly is manager of the municipal electric light plant.

HANFORD, CAL.—The Hanford & Summit Lake Railway Company has awarded a contract for the construction of its proposed electric railway to extend from Hanford to Summit Lake, via Hanford, Grangeville and Hardwick, a distance of 18 miles, to Libby & Heins, of Santa Cruz. J. B. Rogers, of Hanford, Cal., is chief engineer.

LOS ANGELES, CAL.—It is reported that extensive improvements are contemplated by the Huntington interests in the Agricultural Park district. A contract has been awarded to the Alta Planing Mill Company for the construction of a brick substation to generate and transform electricity for both the Grand Avenue and Redondo Railway systems.

LOS ANGELES, CAL.—The Acton Rock Company, which is increasing the capacity of its crushing plant, has placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for the following equipment: One No. 12, two No. 5 and one No. 2, style "K," Gates breakers; one 48-in. x 14-ft. and one 48-in. x 24-ft. Gates revolving screens, conveyors and 10 induction motors, varying in size from 3 hp to 175 hp.

MARTINEZ, CAL.—It is reported that the Contra Costa Electric Light & Power Company has been absorbed by the Pacific Gas & Electric Company, of San Francisco, Cal.

POINT RICHMOND, CAL.—The Richmond Light & Power Company and the Pacific Gas & Electric Company have come to an agreement in regard to rates to be charged for gas and electrical service. Owing to the dispute over rates the Pacific Gas & Electric Company discontinued work on construction of its new plant, which will now be rushed to completion.

REDDING, CAL.—The Sacramento Valley Power Company is extending its transmission lines in several directions from Corning for the purpose of furnishing electricity in that vicinity. A transmission line is also being erected to Squaw Creek Ferry to furnish electrical service to residents along the river.

SAN FRANCISCO, CAL.—Announcement has been made that the [illegible] plants located in Wheatland, Lincoln, Davis, Roseville, Cordelia, Elmira, [illegible]

[illegible] estate of I. W. Hellman, Jr., in San Leandro, was destroyed by fire recently, causing a loss of about $50,000. The plant furnished elec- [illegible]

COLORADO SPRINGS, COL.—The Grand Junction & Grand River Valley Railroad Company, which has recently completed an electric railway between Grand Junction and Fruita, is reported to be planning to extend the railway the entire length of the Grand River Valley.

COLORADO SPRINGS, COL.—At a special meeting of the stockholders of the Colorado Springs Light, Heat & Power Company held recently bonds to the amount of $3,500,000 were authorized to take over the bonded indebtedness of the three corporations recently consolidated. The companies taken over by the above-named company were the Colorado Springs Electric Company, the Pike's Peak Hydro Electric Company and the Citizens Heat & Power Company.

NEW MILFORD, CONN.—Extensive improvements are being made to the plant of the New Milford Power Company, a subsidiary of the New York, New Haven & Hartford Railroad Company, which will involve an expenditure of about $250,000 and include the construction of a large reservoir and a core dam 700 ft. long.

SOUTH NORWALK, CONN.—Contract has been awarded by the South Norwalk Electric Light Commissioners for the construction of the new extension to the municipal electric light plant to John Driscoll, for $2,828. The new building will be 32 x 23 ft. and will be equipped with a Deisel engine, a Fort Wayne generator and an air compressor manufactured by the Norwalk Iron Works, for which contracts have been placed. The cost of the entire work is estimated at $30,000.

WILMINGTON, DEL.—The E. I. du Pont de Nemours Powder Company is extending the use of electrical power in all of its plants. The company has recently placed orders with the Allis-Chalmers Company, of Milwaukee, Wis., for 11 type "K," direct-current motors for its plant at Wilpen, Minn., and for 15 induction motors for the works at Hillside Junction, Pa.

WASHINGTON, D. C.—It is reported that the power plant of the Great Falls & Old Dominion Railway will be enlarged, work on which has already commenced. The cost of the work is estimated at about $50,000.

WASHINGTON, D. C.—The Capital Traction Company, of Washington, D. C., is making preparations for extensive improvements to its main power plant. It is proposed to rebuild the station and increase the output by 6000 kw, the cost of which is estimated at about $250,000.

WASHINGTON, D. C.—Bids will be received at the Department of the Interior, Washington, D. C., until Aug. 8 for the installation of a vacuum heating system for the pension office building, Washington, D. C., in accordance with plans and specifications, copies of which may be obtained upon application to the chief clerk of the department. Frank Pierce is acting secretary.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until Aug. 6 under proposal 472 for furnishing 70 gun outlet boxes, 85 boxes for time interval bells, 100 hydrometers, type E; 100 hydrometers, type H; 50 bolt connectors and 20 double plugs for cut-off jack sets. Captain A. S. Cowan is disbursing officer.

WASHINGTON, D. C.—The Washington, Berwind & Laurel Railroad, which is owned by the Washington, Baltimore & Annapolis Electric Railway Company, recently placed in the hands of receivers, will be sold at a receiver's sale Sept. 1 at Laurel, Md. The railway extends from Laurel, Md., to Washington, D. C., a distance of 15 miles. Charles F. Gladfelter, secretary and treasurer of the Washington, Baltimore & Annapolis Railway Company, is receiver.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 16 for furnishing to the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 2780, 60 salvo firing buzzers; Schedule 2768, electrical wires and cables, to be delivered at the various navy yards and naval stations. Washington, D. C., Schedule 2773, electrical wires and cables. Brooklyn, N. Y., Schedule 2770, 100 single-phase induction fans; Schedule 2780, 1350 pounds cotton insulating tape. Boston, Mass., Schedule 2780, 300 dry cells, reserve type, 1000 pounds cotton and rubber insulating tape; Schedule 2766, to be delivered to the various navy yards and naval stations, miscellaneous telephone supplies and accessories.

APALACHICOLA, FLA.—The Apalachicola Electric Light & Telephone Company is planning to replace the present arc lamp street lighting system with tungsten lamps at the expiration of its present street lighting contract. The contract expires in the fall. J. F. C. Griggs and R. G. Porter are owners of the plant.

MULBERRY, FLA.—The Florida Mining Company has recently purchased from the Allis-Chalmers Company, of Milwaukee, Wis., a 115-kw, 2300-volt, three-phase, 60-cycle, 900 r.p.m. generator, belted type, and four 250-kva, oil-filled, self-cooled transformers.

ATLANTA, GA.—Bids will be received at the office of the superin- [illegible] Department of Justice, Washington, D. C., until Aug. [illegible] and delivering at the United States penitentiary at [illegible] outlet boxes, etc., for electric light, telephone and

clock outlets for the hospital building, in accordance with specifications, copies of which, with other information, can be obtained on application to the above office. R. V. Ladow is superintendent of prisons.

EASLEY, GA.—The contract for installing electrical equipment for lamps and motors in the Alice Cotton Mills, of Easley, has been awarded to Witman & Mountford, of Macon, Ga.

HAMPTON, GA.—Preparations are being made by the Hampton Cotton Mills to equip its plant for electrical operation, replacing steam power. Contract for electricity for operating the mills, it is said, has been placed.

LAFAYETTE, GA.—The City Council has awarded the contract for the construction of the municipal electric light plant and water-works system to J. B. McCrary & Company, of Atlanta, Ga. Work will begin immediately and is to be completed by November, 1910.

BOISE, IDAHO.—James Lynch & Company have secured the contract for the construction of the power plant and dam of the Snake River Irrigation Company in connection with the Castle Butte project on the Snake River, located about 38 miles south of Boise. The contract provides that the work shall be completed within five months. The project involves the irrigation of about 17,000 acres.

BATAVIA, ILL.—The contract for the installation of two 110-hp boilers in the municipal electric light plant has been awarded to Freeman & Son, of Racine, Wis., for $6,300.

CHICAGO, ILL.—The City Council has granted the Chicago City Railway Company a franchise to build the Riverdale extension from Gardner's Park to the city limits at 138th Street. The company was also granted a franchise for an extension of the Stony Island Avenue line north to Fifty-sixth Street.

EAST ST. LOUIS, ILL.—Arrangements are being made for the reorganization of the Consumers' Light, Heat & Power Company, which has recently filed articles of incorporation under the name of the Southwestern Light & Power Company. It is proposed to consolidate the old Citizens' Electric Light Company, the Consumers' Light, Heat & Power Company with the Southwestern Light & Power Company under the name of the East St. Louis Light & Power Company. The company will be capitalized at $1,000,000. L. C. Haynes, vice-president and general manager of the East St. Louis & Suburban Railway Company, and T. W. Gregory, assistant secretary and treasurer, of the same company will be the principal officers of the new company.

EVANSTON, ILL.—Contracts have been placed by the North Shore Electric Company with the Allis-Chalmers Company, of Milwaukee, Wis., for additional transformers for the new extension which the company is now building. The order calls for 2300-5300-volt, 60-cycle, oil-filled, self-cooled transformers with a rating of 172 kva.

FULTON, ILL.—The contract for the erection of the North-Western power house in the Fulton terminal yards has been awarded to J. J. Jobst, of Peoria, Ill. The building will be 100 ft. x 110 ft. and will be equipped with improved machinery. Steam will be generated by a battery of five 150-hp boilers.

MARSEILLES, ILL.—It is reported that the McKinley system will make extensive improvements and extensions to the Desplaines River power plant, located in Marseilles, recently purchased from W. D. Boyce, which will involve an expenditure of about $200,000. It is estimated that about 4000 hp will be developed.

MORRIS, ILL.—The question of installing electrical pumping machinery in the pumping station is reported to be under consideration.

VERSAILLES, ILL.—The D. H. Allen property in Versailles has been purchased by J. G. Elliott, who proposes to erect an electric light and power plant on the site.

BEDFORD, IND.—The Bedford Power Company, which is planning an extensive hydroelectric development on the east branch of the White River, at Williams, Ind., has recently placed a contract with the Allis-Chalmers Company, of Milwaukee, Wis., for two 750-kw steam turbo-generators, which will serve as auxiliaries for emergency use. The Allis-Chalmers has also recently received an order for the equipment of the initial installation of the hydraulic and electrical apparatus, including two 1050-hp, triplex vertical turbines operating under a head of 17 ft., to be direct connected to a 1000-kva (70 per cent power factor), 2300-volt, 60-cycle, three-phase alternators. Plans are also being made for three larger units to be put in service later.

INDIANAPOLIS, IND.—The Board of Public Works has instructed the Indianapolis Light & Heat Company to install 193 additional lamps, at $74 each per year, which will add $13,232 annually to the cost of the street lighting system.

LINDEN, IND.—The plant and holdings of the Linden Co-operative Company has been purchased by Theodore H. Ristine, H. H. Ristine and J. K. Johnson, directors of the Home Telephone Company, of Crawfordsville. The new owners will make improvements to the property, including the erection of a new telephone exchange and extension of the lines into adjacent territory.

LOWELL, IND.—The capital stock of the Lowell Telephone Company has been increased to $25,000, the proceeds to be used for improvements to the system and service. Clifford O. Hill is secretary.

MIDDLETOWN, IND.—At an election held recently the citizens [illegible] plant. The cost of the plant is estimated at $28,000. F. A. Weischart is town clerk.

MILFORD, IND.—The County Commissioners have granted a franchise to Omar Neff, of Milford, Ind., to construct an interurban railway from Bremen to Mishawka, via Woodland.

SULLIVAN, IND.—The City Council has passed an ordinance providing for the installation of a new electric fire-alarm system.

DES MOINES, IA.—Plans are being prepared by the Des Moines Electric Company for the construction of a new substation on Tenth Street, near Grand. The building will be 33 ft. x 132 ft. and will cost about $25,000. The company is installing conduits to put its wires underground in the business section of the city.

DEXTER, IA.—The construction of an electric light plant and water-works system in Dexter is under consideration. E. J. Frum is city clerk.

MANCHESTER, IA.—Contracts have been awarded by the Manchester Light, Heat & Power Company for a 150-hp boiler and two 15-kw transformers.

MASON CITY, IA.—The Mason City & Clear Lake Railway Company has been granted a franchise by the County Commissioners of Gordo County to construct an electric railway along the highway extending north from Mason City.

MASON CITY, IA.—President Loring, of the Fort Dodge, Des Moines & Southern Railroad Company, has submitted a proposition to the patrons of the railway relative to equipping the line for electrical operation between the towns of Fort Dodge, Junction and Blackwell City. He asks for a bonus of $5,000 if the work is completed by November. Of this amount the citizens of Calhoun County are to pay $3,500 and of Webster County $1,500.

DAYTON, KY.—Proposals will be received at the office of William C. Martin, city clerk, for a franchise to erect and operate a telephone system in the City of Dayton for a term of 20 years.

LEAVENWORTH, KAN.—Sealed proposals will be received at the office of superintendent of prisons, Department of Justice, Washington, D. C., until Aug. 19 for furnishing and delivering at the United States penitentiary at Fort Leavenworth, Kan., conduit, outlet boxes, etc., for electric light, telephone and clock outlets for the hospital building, according to specifications, copies of which, together with other information, may be had upon application to the above office. R. V. Ladow is superintendent of prisons.

MANHATTAN, KAN.—Plans are being considered by the Manhattan City & Interurban Railway Company for extending its railway to Junction City. Surveys have been made at the Fort Riley Reservation in order to make application to the War Department for right of way across the reservation.

McPHERSON, KAN.—Active steps have been taken to reestablish the electric light plant and water-works system. Arrangements have been made to install the new generators in mills until permanent buildings are erected. Both the light and water plants are owned and operated by the city.

GLASGOW, KY.—The Louisville, Lincoln Farm & Mammoth Cave Traction Company, it is reported, will award contracts about Sept. 1 for construction of its proposed railway to connect Louisville and Mammoth Cave, a distance of 60 miles. A hydroelectric power plant will be erected on Green River. J. M. Richardson is president.

CROWLEY, LA.—The City of Crowley is reported to be considering the installation of a 250-hp water-tube boiler, an engine-driven generator with a rating of 175 kw in the municipal electric light plant, bids for which will soon be asked.

FOREST, LA.—A franchise has been granted to H. H. Moorland to construct telephone lines on the highways of West Carroll Parish.

PRESQUE ISLE, MAINE.—The Aroostook Electric Railway Company is reported to be contemplating extending its railway through the towns of Woodland and Perham to Madawaska Lake, a distance of 19 miles.

BALTIMORE, MD.—The Board of Awards has awarded the contract for street lighting to the Consolidated Gas, Electric Light & Power Company for the term of one year. In the past the contract has been given for a period of five years, but owing to the excessive charge of electricity Superintendent of Lamps and Lighting McCuen recommended the one-year contract. Superintendent McCuen will soon file a report on a municipal lighting plant in which he will show that the city can generate energy much cheaper than it can purchase it from the Consolidated Company.

BALTIMORE, MD.—Proposals will be received by the Board of Awards until Aug. 17 for furnishing material and constructing power house for the Bayview Asylum as follows: First—Furnishing materials and erection of power house complete. Second—For furnishing and installing engines, generators, switchboard and electric wiring. Third—For boilers, piping in power house and grounds. Fourth—For constructing water supply system, including water storage tank, pumps, etc., to be furnished for the Bayview Hospital, for the use of the Board of City Charities. Plans can be seen at the office of Edward D. Preston, inspector of buildings. J. Barry McHool is president of Board of Awards.

HAGERSTOWN, MD.—[illegible] Hagerstown [illegible] Railway Company, which operates a street railway system in and around Hagerstown, and the Frederick Railway Company, which operates an electric railway in Frederick and surrounding territory, have decided to [illegible]

for both systems. When the new plant is completed the new company proposes to supply electricity for lamps and motors in Hagerstown and Frederick. It is understood that some of the steam lines will be equipped for electrical operation. The present steam railway between Frederick and Thurmont, it is said, will be equipped to be operated by electricity, and later it is proposed to extend the line to Emmitsburg.

THURMONT, MD.—The Thurmont electric light plant, built as a private enterprise by citizens of Thurmont, has been taken over by the town officials at a cost of $20,000. The plant has an output of 150 hp and is driven by water power. William J. Freeze is Mayor.

CAMBRIDGE, MASS.—The plant of the Cambridge Light & Power Company was offered for sale July 19 by William H. Medford, receiver, and was withdrawn after being bid up to $16,000 by Emerson C. Harrington, representing the Assets Realization Company, of New York, N. Y. The plant was built early in 1909 under a franchise granted William H. Medford and John H. Burgess, Jr., in 1907. It is said that failure to secure the contract for lighting the town was the cause of the failure of the company.

DALTON, MASS.—The Bryon Weston Company has installed a 200-hp motor to operate its plant at the Center. The motor will take the place of the steam plant.

EGREMONT, MASS.—Application has been made to the Council by the Berkshire Street Railway Company for a franchise to construct and operate an electric railway in Egremont. The company will also ask for a franchise in Great Barrington. It is proposed to extend the railway from the terminus at Great Barrington to South Egremont, a distance of about 4 miles.

FOXBORO, MASS.—The Foxboro Electric Company is contemplating the purchase of the power plant of the Standard Gauge Manufacturing Company, of Foxboro, which it proposes to equip for a central-power station. Owing to establishing a 24-hour service recently, the company is obliged to increase the output of its power plant. The company has applied to the State Board of Gas and Electric Light Commissioners for permission to issue additional capital stock to the amount of $43,500, the proceeds to be used to purchase the plant of the Standard Gauge [illegible]

FRANKLIN, MASS.—Preparations are being made by the Union Electric Light Company to change over the present street lighting system as voted by the town last March. Under the present plans it is proposed to change from the present arc-lamp system to part arc and part incandescent lamps. Since the demonstration by the company of the five-cluster and three-cluster incandescent lamps the sentiment seems to be in favor of an entire incandescent system, and it is expected that the Selectmen will call a special town meeting to see if the voters desire to rescind the vote of last March and adopt the incandescent system throughout the town.

MILLBURY, MASS.—Announcement has been made of the plan for the consolidation of the Millbury Electric Company with the Uxbridge & Northbridge Electric Company, of Uxbridge, Mass., the Grafton Electric Company, of Grafton, Mass., the Upton Electric Company, of Upton, Mass., and the Douglas Electric Company, of Douglas, Mass., under the name of the Worcester Suburban Electric Co. The consolidated company will be capitalized at $242,000. The companies have already filed a petition with the State Gas and Electric Light Commission for permission to consolidate.

NEW LENOX, MASS.—At the last special town meeting $500 was appropriated for street lighting in New Lenox. Arrangements are now being made with the Pittsfield Electric Light Company to extend its service to this town.

NEWTON, MASS.—Plans have been decided upon for a new lighting system to be installed on Newton Boulevard from Lake Street to Weston Bridge. The new system will be installed by the Edison Electric Illuminating Company, consisting of 73 magnetite lamps of 800 cp each, to be placed on posts 24 ft. high. The new lamps will cost $42 each for installation and one and one-third cents per kw-hour for electricity used. The old style lamp, of which there were 59, cost $36 each per year and one and one-half cents for energy used.

NORTH ABINGTON, MASS.—The State Board of Gas and Electric Light Commissioners has authorized the Electric Light & Power Company of Abington & Rockland to issue 540 shares of capital stock at $150 each, the proceeds to be used for the purchase of additional equip- [illegible]

REVERE, MASS.—The State Board of Gas and Electric Light Commissioners has granted the Suburban Gas & Electric Company, of Revere, Mass., permission to issue 1190 shares of capital stock at $140 per share, the proceeds to be used for the cancellation of indebtedness and power-plant extension charges.

SPRINGFIELD, MASS.—The City Council has granted the Springfield [illegible] James Avenue line to connect with Chicopee.

[illegible] Company is making extensive additions to its power plant on Emery Street, which will double the output. New equipment, including boiler, generator, condenser and engine will be installed.

WORCESTER, MASS.—Owing to low water, caused by drouth, the Connecticut River Transmission Company is unable to supply the full amount of electricity which it has contracted for to manufacturers in [illegible] service to the American Steel & Wire Company's plant on Grove Street, where it has a contract to supply 1600 kw; it is continuing the service to the south works of the American Steel & Wire Company, which requires 1500 kw. The service at the Lancaster Mills, at Clinton, has been discontinued and other manufacturing plants have had to resume the use of steam power.

WORCESTER, MASS.—The Worcester Electric Light Company has placed contracts for furnishing electricity for motors for several manufacturing plants in Worcester, including the Worcester Slipper Company, which has a contract for 80 hp; William M. Brown, 50 hp; E. T. Smith & Company, 50 hp; the Worcester Brewing Corporation is installing machinery which will require 300 hp eventually; William H. Leland & Company, 100 hp; Baldwin Chain & Manufacturing Company, 350 hp, and Coes Wrench Company, 200 hp. The Worcester company is installing machinery at Crompton & Knowles loom works to utilize 500 hp, which will be equipped for electrical operation by Aug. [illegible] Machine Company will have its plant equipped to be operated by electricity in the near future and will require 300 hp. All the companies mentioned are replacing steam power with electricity, the steam plants being held for auxiliary and emergency purposes.

MINNEAPOLIS, MINN.—Plans are being considered for the erection of a union terminal station for all local and interurban electric railways operating in Minneapolis.

MINNEAPOLIS, MINN.—The Red Lake Power Company has filed an amendment to its charter increasing its capital stock from $150,000 [illegible] The company proposes to furnish electricity in Red Lake Falls, Minn.

MINNEAPOLIS, MINN.—Extensive improvements to the waterworks system have been recommended by City Engineer Andrew Rinker, which includes the construction of four miles of distributing water mains and an additional pump at the Camden Place pumping station. The city engineer favors the installation af an electrically driven centrifugal [illegible]

MINNEAPOLIS, MINN.—Owing to low water in the Mississippi River the Twin City Rapid Transit Company is unable to generate sufficient electricity at its power house to operate its system. The transit company has made arrangements with the Minneapolis General Electric Company for additional service from its steam plant in Minneapolis. W. J. Hield is vice-president and general manager of the Twin City Rapid Transit Company.

MERIDIAN, MISS.—The Meridian Light & Railway Company has filed amendments to its charter, increasing its capital stock to $5,000,000.

CARTHAGE, MO.—It is reported that a new quarry is being developed by Miliard Bryan, near Carthage, Mo. The quarry, it is said, is being equipped for electrical operation, electricity for which will be supplied by the Empire District Electric Company, when its new transmission line is completed. Other quarries in this district are also contemplating using electricity for operating machinery.

SPRINGFIELD, MO.—W. H. Johnson, of Springfield, Mo., is interested in a project to construct a large dam across the White River at Hollister, 40 miles from this city, the power to be utilized to generate electricity for transmission to Springfield. It is proposed to have the City of Springfield apply to Congress for permission to erect a dam across the river at Hollister (under the present conservation laws a private corporation could not secure a franchise to build the dam), where it is estimated that 150,000 hp could be developed, and build a transmission line, for $750,000. Of this amount $225,000 is allowed for the construction of the dam, $225,000 for power plant, $120,000 for transmission line and $150,000 for incidentals. Should the proposition be adopted industrial bonds would be issued to build the plant.

WEBB CITY, MO.—The Southwest Missouri Electric Railroad Company is planning to build a new substation in the near future. The equipment will include a 500-kw, 25-cycle rotary transformer and switchboard. A. H. Rogers, of Webb City, Mo., is general manager.

RENO, NEV.—Stone & Webster, of Boston, Mass., have assumed the management of a new company, known as the Sierra-Pacific Electric Company, which owns all the capital stock of the companies which control the entire electrical business in Reno, Sparks, Virginia City, Carson City and Silver City, Nev., and in the surrounding important mining and irrigation districts of Western Nevada. These companies also own the entire gas business in Reno, Sparks and Carson City and supply water for domestic purposes in Reno and Sparks. They also own four hydroelectric power plants on the Truckee River, having a combined output of 7300 hp. Owing to the increasing demands for electricity, it is proposed to erect a new hydroelectric power plant on Truckee River to develop 9000 hp.

CONCORD, N. H.—A new electric power house is being erected at the Franklin Needle Works. Two turbines, of 60 hp and 30 hp, respectively, are being installed.

MANCHESTER, N. H.—Work has commenced on the construction of the large machine shop to be erected by the Leighton Machine Company. A power plant and coal pocket will also be built in connection with the shop.

NASHUA, N. H.—Plans are being prepared by the White Mountain Freezer Company for the installation of a new power plant, which will be located near the Acton track. The new engine will have a rating of 200 hp. A generator with sufficient output to light the works and for motors will be installed.

MENDHAM, N. J.—The Bernards W[illegible] Company, of Bernardsville, N. J., has applied to the Borough Counci[illegible] to furnish electricity in this borough.

NEWARK, N. J.—A contract has bee[illegible] by the Nairn Linoleum Company with the Allis-Chalmers Company, of Milwaukee, Wis., for a 100-hp, 550-volt, three-phase, 60-cycle, squirrel cage induction motor.

BROOKLYN, N. Y.—The Edison Electric Illuminating Company of Brooklyn is planning to erect a new substation at 864 Madison Street. The building will be 25 ft. x 100 ft., two stories high and will cost about $20,000.

BROOKLYN, N. Y.—The Public Service Commission has granted the Coney Island & Brooklyn Railroad Company permission to issue bonds to the amount of $489,539, the proceeds to be used for improvements, most of which will be used for removal of the tracks in Coney Island Avenue from the side to the middle of the thoroughfare.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until Aug. 10 for installation of electric equipment in addition to and alterations to present equipment in Public School 19, located on Keap Street, between South Second and South Third streets, Borough of Brooklyn, N. Y.

BUFFALO, N. Y.—Sealed proposals will be received at the office of Alonzo G. Hinckley, clerk Board of Supervisors, until Aug. 9 for the construction of a power plant at the Erie County Penitentiary, in accordance with plans and specifications on file at Room 36, City and County Hall, and at the office of the county engineer, 575 Ellicott Square, Buffalo, N. Y.

BUFFALO, N. Y.—The supervisors' penitentiary committee has decided to reject all bids received on the second advertising for the installation of a power plant at the penitentiary and readvertise for bids. This action was taken after receiving a letter from John W. Danforth Company offering to do the work for $9,918 less than the lowest bid received, which was submitted by C. H. Everitt. The amount of his bid was [illegible]

BUFFALO, N. Y.—The Electrolytic Products Company, of Buffalo, N. Y., is reported to have purchased a factory site at Elmwood and Hertel avenues on which it proposes to erect a plant for the manufacture of radiators for automobiles. Copper radiators will be made by an electrical deposit process under patents which the company owns. Plans are now being prepared for the plant. Frank E. Abbott, D. S. Morgan Building, Buffalo, N. Y., is secretary of the company.

BUFFALO, N. Y.—The City Council has adopted resolutions authorizing Francis G. Wood, commissioner of public works, to advertise for bids for machinery and equipment for vocational school in district No. 20, consisting of 25 direct-connected motor head lathes, Oliver No. 53 A, or equal; one direct-connected motor head lathe, Oliver No. 53 E, or equal; one 10-hp motor-generator; one universal saw, with motor; one band saw, with motor; one grinder; one jointer; 26 Sheldon woodworking benches, Sioux City model, or equal.

FRANKLINVILLE, N. Y.—It is reported that plans have been prepared by H. B. Sweet, consulting engineer, of Utica, N. Y., for the installation of a new lighting system and rebuilding the distributing system of the Empire Electric Company, of Franklinville, N. Y. The company, it is said, will be in the market for cedar poles, weather-proof copper wire, cross-arms, line supplies; also transformer, switchboard and tungsten lamps for street lighting system.

NEWBURGH, N. Y.—The Public Service Commission, Second District, has authorized the Newburgh Light, Heat & Power Company to purchase an electric light plant owned and operated by Marion Borden Halliday in Shanangunk. The company has also been granted permission by the commission to operate franchises granted by the Town Board and Highway Commissioners of the Town of Montgomery and the Town of Shawangunk for the construction of an electric lighting system in those places. The commission has also granted the company permission to erect a high-tension transmission line carrying 33,000 volts from Forest Glen in the Town of Gardiner to and through the Town of Shawangunk to connect with the distribution lines in that village and to the Village of Walden, thence to Montgomery, and such other distribution lines as will enable the company to distribute electricity in the territory where it has franchises. The Newburgh Light, Heat & Power Company has also been authorized to issue first mortgage bonds to the amount of $70,500, the proceeds to be used for the construction and equipment of a high tension transmission line from Glen Forest to Montgomery, a distance of 15 miles and for distributing systems in the towns and villages in which [illegible]

RIVERHEAD, N. Y.—The Riverhead Electric Light Company has [illegible] Public [illegible] ict, to exercise a franchise granted by the Town Board of Southampton [illegible] furnish electricity for lamps and motors in that town. The company [illegible] roceeds of $5,000 to be used for the construction and equipment of a ransmission line from its station in Riverhead to the Village of West [illegible] of generating machinery and switchboard.

ROCHESTER, N. Y.—A [illegible] for the construction of a [illegible] mated at $13,000.

ROCHESTER, N. Y.—The M[illegible]

awarded a contract to the Ridgway Dynamo & Engine Company, Ridgway, Pa., for the installation of an engine-driven generating set at the power house on South Avenue, Rochester, N. Y., for $2,175.

ROCKVILLE CENTRE, N. Y.—The New York Telephone Company has been granted permission by the Village Trustees to install conduits on the streets of the village for its telephone wires.

ROCKVILLE CENTRE, N. Y.—The Village Trustees have instructed the village clerk to ask for bids for the installation of a 1,000,000-gal. pump at the pumping station to be operated either by steam or electricity.

SILVER SPRINGS, N. Y.—At a special election held July 19 the citizens voted in favor of the proposition to issue $14,000 in bonds, the proceeds to be used for drilling wells and erecting a pumping station and $6,000 for the installation of an electric light plant.

WALTON, N. Y.—The Public Service Commission, Second District, has granted its approval of the transfer of the electrical plant and distributing system in Walton, owned by Clarence Mulkins, to Carlton A. Graves, for a consideration of $5,000.

WAPPINGER FALLS, N. Y.—After December, 1910, the municipal electric plant will be discontinued and electrical service will be furnished from the new hydroelectric power plant of the Garner Print Works and Bleachery, now under construction. When the new system is installed a 24-hour service will be established. The system will remain two-phase, 220-110-volt, 60-cycle. C. H. Fish, of Wappinger Falls, is superintendent.

CHARLOTTE, N. C.—The City Council has granted a franchise to Paul Chatham to construct an electric railway in Charlotte.

SALISBURY, N. C.—Preparations are being made for the construction of an addition to the weaving department of the Salisbury Mills, 74 ft. x 80 ft., which will be equipped with 80 looms. The machinery in the mills is driven by electric and steam power.

AKRON, OHIO.—The Northern Ohio Traction & Light Company has three sites under consideration for its proposed new power plant, Springville Lake, Cuyahoga Falls and a point near the Tuscarawas River, between New Philadelphia and Canal Dover. The Canton plant furnishes electricity for operating the Canton-New Philadelphia division, the Canton and Massillon city systems and also takes part of the load of the Canton-Akron division. The Midvale plant furnishes power for the Uhrichsville line. Charles Curry is general manager.

CINCINNATI, OHIO.—Sealed proposals will be received at the office of the clerk of the Board of Education, City Hall, Cincinnati, Ohio, until Aug. 15 for furnishing and installing complete electric lighting fixtures, etc., in the Woodward High School building, Cincinnati, Ohio, according to plans and specifications on file at the office of C. W. Handman, business manager, 511 West Court Street, Cincinnati, O.

CLEVELAND, OHIO.—Bids will be received by the Board of County Commissioners of Cuyahoga County at the office of the Cuyahoga County Building Commission, Garfield Building, Cleveland, Ohio, until Aug. 24 for furnishing electricity for lamps and motors and for steam heating for the new court house building for a period of 6, 8 and 10 years from Nov. 1, 1910, in accordance with specifications prepared by H. W. Woodward, of the Cleveland Engineering Company, which may be secured from the clerk of the board. John F. Goldenbogen is clerk.

CLEVELAND, OHIO.—Bids amounting to $376,000 for the proposed power plant for the new court house have been rejected by the Cuyahoga County Commissioners, as well as the bid of John Gill & Son for the building complete. Engineers are now at work on modified plans for a plant to cost about $175,000, on which bids may be called, although the electric companies will probably be asked to submit bids in the meantime. The Cleveland Electric Illuminating Company recently submitted a bid of 3¼ cents per kw-hour for furnishing electricity, which would mean a cost of about $22,000 per year. The commissioners state that they will build a plant of some kind rather than to pay the private companies an exorbitant price for the service.

FREMONT, OHIO.—A mechanic's lien has been filed in the district court in Fremont, Ohio, against the Fremont Power & Light Company, of Fremont, Ohio, by R. S. Fuertado, consulting engineer, 460 Monadnock Block, Chicago, Ill., to collect an account from the company to the amount of $9,000 for engineering work.

PORT CLINTON, OHIO—Preparations are being made by the Colonial Crayon Company for the installation of an electric plant to furnish electricity to operate its machinery. Orders have been placed by the company with the Allis-Chalmers Company, of Milwaukee, Wis., for a 50-kw generator, four induction motors and two lighting transformers.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company is offering its stockholders $100,000 in preferred stock, the proceeds to be used to complete its power plant. The total cost of the plant is estimated at $250,000. The company recently increased its capital [illegible]

YOUNGSTOWN, OHIO.—[illegible] Mahoning County is considering the question of installing an electric light and power plant for the new court house and jail building.

[illegible] municipal power and pumping plant is under consideration, plans for which have been prepared. The equipment will include a direct-acting [illegible] the machinery will be purchased the latter part of this month.

COLLINSVILLE, OKLA.—A company has been formed by J. H. Middleton, H. D. Barndollar and C. L. Goodale to build an electric power [illegible] electricity for lamps and motors in Collinsville. The [illegible] will consist of an Allis-Chalmers, [illegible] kw, [illegible] generator and a [illegible] kw exciter.

GRANDFIELD, OKLA.—Application has been made to the City Council by E. E. Preston and J. E. Fitzpatrick for a franchise to establish an electric light plant in Grandfield. The cost of the plant is [illegible]

HOBART, OKLA.—Extensive improvements are contemplated to the water-works system, including the construction of a large dam, an eight-inch main to Big Elk Creek and the installation of an electric motor to pump water to settling basin.

OKLAHOMA CITY, OKLA.—Preparations are being made by the Oklahoma Gas & Electric Company for extensive improvements to its system, which will involve an expenditure of about $250,000 and will include the construction of a large building to be used for store house, the installation of additional boilers and machinery, which will increase the output of the plant by 3000 hp, and improvements to the distributing system. [illegible] is manager.

ALBANY, ORE.—The City Council has granted the Albany Interurban Railway Company a franchise to construct and operate an electric railway over certain streets in the city. The proposed railway is to connect Albany, Sweet Home, Lebanon, Brownsville and Holley, a distance of 85 miles. P. A. Young is interested in the project.

KLAMATH FALLS, ORE.—Preparations are being made by the Pacific Telephone & Telegraph Company for extensive improvements to the local telephone system in Klamath Falls and adjacent territory, which will involve an expenditure of about $100,000, within the next six months. The company recently purchased the local system from H. V. Gates.

MARSHFIELD, ORE.—Plans are being considered by the business men for the installation of a new lighting system in the business districts in Marshfield. J. W. Bennett is interested in the project.

MARSHFIELD, ORE.—The [illegible] Bay Gas & Electric Company, of Marshfield, Ore., has commenced work on extensive improvements to be made to its systems in Marshfield and North Bend. It is proposed to entirely rebuild the power plant which is located between the two cities.

CARLISLE, PA.—Electricity for operating the Newville electric railway will be supplied from the power plant located at Mt. Holly Springs, which has been enlarged to provide for the increased demands made upon it. A substation will be erected near West Hill, about half way between Carlisle and Newville, where electricity will be transmittd at 33,000 volts.

JERMYN, PA.—The Scranton Electric Company, of Scranton, Pa., is reported to have purchased the electric plant of the Household Electric Light, Heat & Power Company, which was a co-operative company and was owned by the citizens of Jermyn and Mayfield. It is expected that the plant will be dismantled and electrical service supplied in Jermyn from the central power plant of the Scranton Electric Company in Scranton, which supplies many of the valley towns with electricity.

JOHNSTOWN, PA.—The Johnstown & Altoona Railway Company is reported to be contemplating the construction of a new power house, contracts for which, it is said, will be let in the near future. The company, it is said, will call for bids on the construction of its proposed electric railway from South Fork to Altoona, a distance of 48 miles. C. W. G. Holman is general manager.

MONTOURSVILLE, PA.—The Montoursville Electric Light Company is installing a motor generator set in its plant. It is expected to have the improvements completed by Sept. 1, when a 24-hour service will be established. J. Harry Spencer is general manager.

NEW CASTLE, PA.—The police committee of the City Council has recommended to the City Council that instructions be given to City Solicitor Gardner to draw up an ordinance authorizing the Council to proceed with the preliminary work for establishing a municipal electric light plant. The present contract for street lighting with the New Castle Electric Company will expire in December, 1912.

PLEASANT MOUNT, PA.—The Northwestern Pennsylvania Telephone Company has decided to rebuild its telephone line from Pleasant Mount to Poyntelle and to extend the line to Lake Como.

POLK, PA.—Contracts have been awarded for the electric power plant for the new State Home for the Feeble Minded which is being erected at Polk, Pa. The Bruce Macbeth Engine Company is the general contractor for power machinery and the electrical machinery will be supplied by the Allis-Chalmers Company, of Milwaukee, Wis., including two 125-kva, 100-volt, two-phase, 60-cycle generators with separate belted exciters and a complete switchboard.

SCRANTON, PA.—The Scranton Electric Company is reported to be contemplating the construction of a substation on Pike Street, near South Main Street, plans for which are now being prepared.

BRITTON, S. D.—It is reported that the contract for the installation [illegible] has been awarded.

WATERTOWN, S. D.—Plans have been prepared by the Dakota [illegible]

[illegible]

recently incorporated, is contemplating the construction of a telephone line 13 miles in length. John Lacy and others are interested in the project.

HENNING, TENN.—The electric light plant of the Henning Electric Light & Ice Company has been completed and is now in operation.

MEMPHIS, TENN.—Application has been made to the City Council for a franchise by the Clarkesdale, Covington & Collierville Interurban Railway to construct about 9½ miles of track in Memphis. The company has completed its railway to Lakeview.

MEMPHIS, TENN.—The Tennessee Traction Company has completed preliminary surveys and is now securing right-of-way for its proposed electric railway from Memphis to Jackson, a distance of 210 miles. The company, it is said, will increase its capital stock from $50,000 to $1,000,000. George E. Busnell, of Memphis, Tenn., is general manager.

BRYAN, TEX.—An electric light plant is being installed in Dellwood Park, midway between Bryan and the college, by O. E. Gammill, who is building the Bryan-College interurban railway.

CARTHAGE, TEX.—Plans are being considered by the Lacy Telephone Company for rebuilding the entire plant, including the installation of a new switchboard and replacing overhead wires with cables. J. C. Lacy is president of the company.

CLEBURNE, TEX.—The Cleburne Gas & Electric Company is reported to be contemplating increasing the output of its plant by the installation of 300-kw units. The company, it is said, is making preparations to supply electricity for the street railway system.

WHITESBORO, TEX.—The Monarch Mill & Grain Company is reported to be in the market for equipment for an electric light plant with sufficient output to supply from 160 to 200 lamps.

LAYTON, UTAH.—The Layton Milling & Electric Company has recently placed orders with the Allis-Chalmers Company, of Milwaukee, Wis., for one 50-hp and two 10-hp, 220-volt, three-phase, 60-cycle, squirrel cage induction motors, which will be used for driving additional machinery, which is now being installed in the mill.

PROCTOR, VT.—Work has commenced on the construction of a 35-mile, 44,000-volt transmission line by the Vermont Marble Company, which is to extend from Weybridge, Vt., to West Rutland, for which contracts for material have been awarded. A generating station will be erected at Weybridge, which will be equipped with two 800-kw generating units. Besides the generating station and the tie-in station at West Rutland, two intermediate substations will be erected. The company already has a 2250-kw hydroelectric power plant at Proctor and a 500-kw steam plant at West Rutland, and arrangements are being made for paralleling all three plants on the 10,000-volt line. G. H. Davis, of Proctor, Vt., superintendent of the Vermont Marble Company, has charge of the developments, assisted by C. T. Maynard, electrical engineer of the company.

BEDFORD CITY, VA.—Contracts for the construction of the proposed municipal hydroelectric power plant have been awarded as follows: Concrete work, power house and race to James R. Guy, of Bedford City, Va., for $13,680; for electrical equipment to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for $19,898; electric transmission line complete to S. L. Divers, of Grottoes, Va., for $17,800, and to the S. Morgan Smith Company, of York, Pa., for turbine wheel and all machinery connected with the water power for $11,481. F. Weller, of Washington, is engineer in charge of the work.

RICHMOND, VA.—The Virginia Railway & Power Company is reported to have commenced work on the addition to its power plant, which will increase the output by 500 kw. The cost of the work is estimated at about $200,000.

ROANOKE, VA.—It is reported that Stafford G. Whittle and others, of Martinsville, Va., are interested in a project to establish a town site at the junction of Danville & Western and Winston-Salem divisions of the Norfolk & Western Railway, the town to be known as Kolers. It is proposed to construct a dam across the Smith River and develop 450 hp.

COLVILLE, WASH.—The Interstate Telephone Company, of Spokane, Wash., has filed for record a mortgage to secure an issue of $500,000 in bonds, the proceeds to be used for improvements and extensions to its system.

GRANDVIEW, WASH.—The Benton Independent Telephone Company, of Prosser, Wash., has secured a 25-year franchise in Grandview, Wash., to operate a telephone system.

WHITE SALMON, WASH.—The Mount Adams Railway Company is reported to have awarded a contract for surveying its proposed 40-mile electric railway, which is to connect White Salmon and Glenwood and intervening towns, to the Northwest Engineering & Construction Company. Theodore F. Shepler is general manager of the railway company.

ROMNEY, W. VA.—Application has been made to the county court of Hampshire County by Ira V. Cougill and R. P. Monroe for a 50-year franchise to construct and operate an electric railway between Romney, W. Va., and Winchester, Va.

COLUMBUS, WIS.—Messrs. Vaughn & Meyer, of Milwaukee, Wis., consulting engineers, are reported to have been engaged by the City of Columbus, Wis., to prepare plans for remodeling and improving the service of the municipal electric light plant.

MADISON, WIS.—Sealed proposals will be received at the Forest Products Laboratory, Madison, Wis., until Aug. 12 for furnishing and

installing on Forest Service foundations electrical equipment for driving a 500-hp ground wood pulp grinder in the Forest Service Ground Wood Laboratory. Plans and specifications will be furnished on application to the Forest Products Laboratory.

MADISON, WIS.—The State Board of Control of Wisconsin has retained Frank P. Woy, of Madison, Wis., as power plant expert. Mr. Woy will have general supervision of the ten power plants at the different State institutions, which include steam and producer gas plants, commercial gas, electric, water and steam heating plants and electric drive in the box, hosiery, twine and other factories operated by the inmates of the several institutions. This office has been created with a view to economy of operation and consistent improvement throughout the plants and systems.

MANITOWOC, WIS.—The Electric Light Company, of Manitowoc, Wis., has recently purchased an Allis-Chalmers 100-kw, alternating-current generator to provide for the increased lighting load resulting from the extension of the street lighting system.

MILWAUKEE, WIS.—The Wisconsin Railroad Commission has granted the application of the Milwaukee & Fox River Valley Railway Company for a certificate of convenience and necessity for the construction of a street and interurban railway to extend from Milwaukee to Menesha and intervening cities. The company proposes to supply both freight and passenger service.

SUN PRAIRIE, WIS.—At an election to be held Aug. 9 the proposition to issue $12,500 in bonds, the proceeds to be used for the purchase of the local electric light plant, will be submitted to a vote.

CHEYENNE, WYO.—The Northern Colorado Power Company is reported to have appropriated $50,000 for improvements to its plant and service in Cheyenne. Among the improvements contemplated by the company is the power service for irrigation pumps.

WHEATLAND, WYO.—The contract for the construction of the electric light plant, water works and sewerage systems was awarded to P. O'Brien, of Denver, Col., for a total of $68,720.

CAMROSE, ALTA., CAN.—The citizens on July 20 voted in favor of the by-law appropriating $30,000 for the installation of an electric light plant in Camrose.

EDMONTON, ALTA., CAN.—Plans have been submitted by City Engineer Latournel for the east end extensions of the street railway system. It is understood that bids will be called for immediately.

BRACEBRIDGE, ONT., CAN.—The towns of Bracebridge and Huntsville, Ont., have sent representatives to confer with Hon. Frank Cochrane, Minister of Lands, Forests and Mines, in reference to the High Falls water power. The Town of Bracebridge has a lease to High Falls water power with development privileges, but, according to the municipality of Huntsville, has neglected to utilize its privilege, and the Town of Huntsville is anxious to obtain the right to develop the power. The government has promised to look into the matter.

BROCKVILLE, ONT., CAN.—It is reported that the Brockville Light & Power Department has rejected the bids for the construction of the new power house adjoining the pumping station for the purpose of combining the two plants, owing to the bids being too high, and will do the work by day labor.

LONDON, ONT., CAN.—The time for opening tenders for electrical pumping equipment at the Springbank pumping station, London, Ont., Can., has been postponed from July 29 to Aug. 8. H. J. Glaubitz, of Toronto, Ont., Can., is consulting engineer.

OTTAWA, ONT., CAN.—The Ottawa Electric Light, Heat & Power Company has been granted a permit to construct a substation on Slater Street, Ottawa, at a cost of $18,000.

STRATFORD, ONT., CAN.—The municipality of Stratford is reported to have placed an order with the John Forman Company, of Montreal, Que., Can., for 800 75-watt tungsten street lamps.

SHERBROOKE, QUE., CAN.—The Sherbrooke Street Railway Company has awarded the contract for the construction of its power house in Sherbrooke to the Bishop Construction Company, of Montreal, Que. The Jenckes Machine Company, Ltd., of Sherbrooke, has the contract for furnishing hydraulic machinery and the Canadian General Electric Company for electrical equipment. About 2500 hp will be developed. Ross & Holgate, of Montreal, Que., are consulting engineers.

ESTEVAN, SASK., CAN.—Tenders will be received by L. A. Duncan, secretary and treasurer, Estevan, Sask., until Aug. 24 as follows: Contract A—Pipe laying on storm sewers. Contract B—Construction of power house. Contract H—Two return tubular boilers. Contract J—High-speed steam engine. Contract K—Electric lighting system. Contract S—Sewer pipes. Plans and specifications may be seen at the office of Chipman & Power, engineers, Winnipeg, Man., Can., and Toronto, Ont., Can.

MOOSE JAW, SASK., CAN.—A franchise has been granted to A. A. Dixon and Newton J. Kerr to construct and operate a railway in Moose Jaw, 6 miles in length. John B. McRae, of Ottawa, Ont., and H. A. [illegible]on will have charge of construction.

TOLUCA, MEX.—The Sultepec Electric Light & Power Company, of T[illegible]ica, Mex., is preparing to install one 800-kw, 2200-volt, three-phase, [illegible]ycle generator and a 1200-hp turbine at its Temascaltepec station. [illegible] J. M. Danley is manager of the company.

New Industrial Companies.

A. O. SCHOONMAKER COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $100,000 for the purpose of manufacturing and dealing in electrical and insulating compositions. The incorporators are: A. O. Schoonmaker, of New York, N. Y.; F. W. Webster, of Newton, Mass., and W. V. Brown, of Asheville, N. C.

THE ARGO ELECTRIC VEHICLE COMPANY, of Saginaw, Mich., has been incorporated with a capital stock of [illegible] by Theodore Huss, Fred Buck, Benton Hanchett and Otto Schupp, of Saginaw, Mich., and A. M. Marshall, of Duluth, Minn. The company proposes to manufacture electric pleasure vehicles.

THE AUTOMATIC FEED REGULATOR & SPECIALTY COMPANY, of Kittery, Maine, has been incorporated with a capital stock of $200,000 to manufacture and deal in apparatus relating to steam, gas, etc.

THE C. J. ANDERSON COMPANY, of Chicago, Ill., has been chartered by Carl J. Anderson, Andrew Anderson and Gustaf R. Anderson for the purpose of manufacturing and dealing in electrical appliances.

THE ECLIPSE ELECTRICAL MANUFACTURING COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $15,000 for the purpose of manufacturing electrical appliances. The incorporators are: William E. Bodenstab, John Renner and Frederick Kirchhoff.

THE ETHYLIGHT COMPANY, of New York, N. Y., has been chartered with a capital stock of $350,000 by R. E. Taylor, R. C. Shaal and J. V. Usera, of New York, N. Y. The company proposes to manufacture automobile lamps and lighting devices, etc.

THE GARRETSON ENGINEERING COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $100,000 by Albert D. Garretson, Harry D. Garretson and William M. Hoffman, all of Buffalo, N. Y. The company proposes to manufacture engines, boilers, dynamos, etc. This item was published in the issue of July 14, naming H. O. Garretson instead of Harry D. Garretson as one of the incorporators.

THE GRANDJEAN GAS ENGINE COMPANY, of San Diego, Cal., has been incorporated with a capital stock of $1,000,000 for the purpose of manufacturing gas engines under a patent held by Arthur Grandjean. The incorporators are: G. R. Harrison, G. H. Ellerman, R. A. Wood and W. R. Gros.

THE HALLSTONE ELECTRIC COMPANY, of Brockton, Mass., has been incorporated with a capital stock of $10,000 to do a general electrical business. The officers of the company are: Bertrand L. George, president; George N. Hall, vice-president, and Arnold R. Stone, treasurer and clerk.

THE ILLINOIS ELECTRIC PORCELAIN COMPANY, of Macomb, Ill., has been incorporated with a capital stock of $20,000 to manufacture and deal in electric porcelain and in materials for making pottery. The incorporators are: Charles W. Kettron, C. M. Erwin and W. C. Sutton.

THE IN-ER GLOBE LAMP COMPANY, of Boston, Mass., has been chartered with a capital stock of $125,000 for the purpose of dealing in electrical supplies. The officers of the company are: William Hyde, of Boston, Mass.; Samuel Washburn, treasurer, and George H. Wells, clerk, both of Dorchester, Mass.

THE M. S. PALMER COMPANY, of Boston, Mass., has filed articles of incorporation with a capital stock of $15,000 and proposes to deal in electric and gas fixtures. The incorporators are: Charles H. Glidden, of Cambridge, **Mass., president; Marcus S. Pa**lmer, of Malden, Mass., treasurer; Herbert G. Hatch, clerk, and E. Saugus, 185 Summer Street, Boston, Mass.

THE PORT JACKSON ENGINEERING & MANUFACTURING COMPANY, of Amsterdam, N. Y., has been incorporated by R. G. Daye, E. Jackson, of Amsterdam, N. Y., and C. H. Williams, of Rotterdam, N. Y. The company is capitalized at $25,000 and proposes to do a general engineering and manufacturing business.

THE PREMIER ENGINEERING & MANUFACTURING COMPANY has filed articles of incorporation with the Secretary of State at Trenton, N. J., with a capital stock of $100,000, by E. J. Forhan, G. F. Martin and H. P. Jones, of New York, N. Y.

THE REMY ELECTRIC COMPANY, an Indiana corporation, has filed articles of incorporation in Chicago, Ill. The company is capitalized at $1,000,000 and deals in electrical supplies. Fred J. Urhan, 1400 Michigan Avenue, is the Chicago representative.

THE ROCHESTER TROLLEY GUARD & FENDER COMPANY, of Rochester, N. Y., has been incorporated by W. F. Reichenbach, A. A. Pichler and C. W. Henning, of Rochester, N. Y. The company is capitalized at $50,000 and proposes to manufacture appliances for trolley cars, etc.

THE ROYAL [illegible] COMPANY [illegible] has been incorporated by E. L. Jackson, J. P. Murray and F. A. Kuntz, of Camden, [illegible] general electrical contracting and mechanical engineering business.

THE SANITARY ENGINEERING & CONTRACTING COMPANY, of Newark, N. J., has filed articles of incorporation with a capital stock of $100,000 for the purpose of erecting plants for the disposal of waste, refuse, garbage, etc. The incorporators are: P. M. Lynch, F. C. Fowler, A. Guttman, of New York, N. Y., and A. Henig, of Newark, N. J.

THE [illegible] MANUFACTURING COMPANY, of New York, N. Y., has been chartered with a capital stock of $1,000,000 by W. C. Sheu, of Springfield, Mass.; S. D. Webb, of New York, N. Y., and H. D. Dumont, of Brooklyn, N. Y. The company proposes to manufacture and deal in gas and electrical supplies and appliances.

THE STAR ELECTRIC COMPANY, of Binghamton, N. Y., has been incorporated with a capital stock of $300,000 to manufacture electric supplies and appliances by George O. Knapp, of 54 Wall Street, New York, N. Y.; Giles W. Mead, Edgar F. Price, both of 79 Wall Street, New York, N. Y., and others.

THE STEVENS MANUFACTURING COMPANY, of Rome, N. Y., has been incorporated by S. B. Stevens, A. L. McAdam, of Rome, N. Y., and T. J. Wetzel, of New York, N. Y. The company is capitalized at $50,000 and proposes to manufacture and sell carbureters, motor and automobile supplies, etc.

New Incorporations.

SULPHUR SPRINGS, ARK.—[illegible] filed for the Sulphur Springs Telephone Company with a capital stock of $25,000 by Clyde W. Penwell, Le Roy Penwell and Louis Kenworthy.

LAMAR, COL.—The Sylvan Lake Power Company has been organized by H. M. Hogg and associates to develop water power on Fall Creek in San Juan County. The company is capitalized at $500,000.

ORFINO, IDAHO.—Articles of incorporation have been filed for the Clearwater Telephone & Telegraph Company with a capital stock of $40,000 by Samson Snyder, A. O. Anderson and Frank A. Jones.

SALINE, ILL.—The Saline County Light & Water Company has been granted a charter with a capital stock of $5,000 to construct, acquire and operate water works, ice, steam or electric plants. The incorporators are: A. C. Murray, W. L. Murphy and W. M. Timmons.

FARMINGTON, IND.—The Farmington & Chestnut Ridge Telephone Company has been incorporated with a capital stock of $8,000 by William Booth, A. A. Ruddick and B. F. McIntire.

HUNTINGBURG, IND.—Articles of incorporation have been filed for the Huntingburg Electric Light Company with the Secretary of State with a capital stock of $25,000 by Charles Miessner, F. G. Katterhenry and August Miessner. The company proposes to construct and operate an electric plant in Huntingbury.

LIMA, IND.—The Star Milling & Electric Company has been chartered with a capital stock of $10,000 by Oliver P. McKee, Harriet McKee and Emanuel Ritzer. The company proposes to generate electricity for transmission.

WASIOTO, KY.—The Cumberland River Telephone & Telegraph Company has been formed by B. N. Worthington and others. The company is capitalized at $25,000 and proposes to construct a local telephone system and long-distance lines in Cumberland Valley.

CANTON, MAINE.—The Canton Light & Water Company has been organized for the purpose of furnishing electricity in this locality. The company has purchased the water power at East Peru, where 110 hp will be developed. The plant will be located about six miles from Canton. It is said that work will commence on construction of the plant immediately. D. D. Elliot is manager.

AUGUSTA, MICH.—Articles of incorporation have been filed for the Augusta Telephone Company with a capital stock of $6,000 by Nelson V. Bird, Charles Case, H. J. Richardson, H. V. Case, D. J. Bailey and others.

FAIRVIEW, OKLA.—The Fairview & Oklahoma City Railway Company has been granted a charter with a capital stock of $100,000 to construct and operate an electric railway from Fairview to Rusk, a distance of 4½ miles. The officers of the company are: O. E. Snyder, of Oklahoma City, Okla., president; H. A. Noah, of Alva, Okla., secretary, and M. M. Fulkerson, of Alva, Okla., treasurer.

Legal.

NELSONVILLE, OHIO.—In an opinion rendered to C. W. Juniper, city solicitor, of Nelsonville, Ohio, Attorney-General Denman states that municipalities are permitted under the laws of the State to purchase energy to be resold, as well as to generate it with their own plants to be retailed for lamps, heat and power purposes. This right was given when the General Assembly amended an old law relating to the matter some years ago.

Personal.

[illegible]

Electric Company.

MR. CHARLES TABER WALKER, manager of the Cleveland office of the *Electrical World*, was married July 16 to Mrs. Elizabeth Johnstone Bates, at Cleveland.

MR. CLAYTON E. INGALLS, San Francisco, has been appointed manager of the small motor department of the Los Angeles office of the General [illegible]

MR. T. EVANS, for many years purchasing agent for the Cananea Copper Company, has been appointed local manager of the Mine & Smelter Supply Company's branch office at Denver.

MR. M. S. SEELMAN, JR., of the Edison Electric Illuminating Company of Brooklyn, has been appointed editor of the "Question Box" of the National Electric Light Association, to succeed Mr. John C. Parker.

MR. S. N. CLARKSON, of the general engineering department of the Westinghouse Electric & Manufacturing Company, has accepted a position in the new business department of the Union Electric Light & Power Company, St. Louis.

MR. GEORGE VERITY, of the electrical firm of Verity's, Limited, Birmingham, England, and Mr. E. W. Arnold, an associate member of the (British) Institution of Electrical Engineers, are visiting points of electrical interest throughout America.

MR. E. L. PEARSALL, manager of the commercial department of the Altoona Gas Company, has been transferred to a similar position with the Union Gas & Electric Company, Bloomington, Ill. Both companies are subsidiary to the Susquehanna Railway, Light & Power Company.

MESSRS. SAMUEL INSULL, THOMAS E. MITTEN, MASON B. STARRING AND B. E. SUNNY are included in a delegation of 59 citizens of Chicago appointed by Mayor Busse to represent the city at the International Prison Congress, which will be held in Washington, D. C., in October.

MR. C. A. TUPPER, recently in charge of the publicity work of the Allis-Chalmers Company, is now manager of the Reliance Engineering & Equipment Company, 1417 Majestic Building, Milwaukee. This company is engaged in general engineering work and the sale of electrical and other machinery.

DR. AUGUST RAPS, who recently received the degree of doctor of engineering from the Dantzig Technical High School, is a director of Siemens & Halske and general manager of the Werner factory of Siemens & Halske and Siemens-Schuckertwerke, but is not a member of the technical staffs of these firms.

MR. CHARLES F. SCOTT represented Mr. George Westinghouse at the joint meeting of the American Society of Mechanical Engineers and the Institute of Mechanical Engineers in London. He was scheduled to deliver Mr. Westinghouse's paper, "The Electrification of Railways," on July 29, and while abroad will represent Mr. Westinghouse in other matters.

MR. JOHN W. LIEB, JR., associate general manager of the New York Edison Company, returned from Europe, July 25, on the North German Lloyd steamship *Prinz Friedrich Wilhelm*. Mr. Lieb left New York over two months ago in search of needed rest. His health has very much improved in the interim and he returns to his arduous labors reinvigorated and refreshed.

MR. EDWARD J. DOYLE, secretary to President Samuel Insull, of the Commonwealth Edison Company, was married on June 27 to Miss Bertha Katherine Streff, daughter of Mr. and Mrs. E. A. Streff, of 5246 Kenmore Avenue, Chicago. Mr. Doyle's unfailing courtesy and tact has made him many friends, both inside the company and out of it, and they all unite in extending heart'est congratulations.

MR. H. A. STRAUSS, vice-president and chief engineer of the Falkanau Electrical Construction Company, of Chicago, has been appointed consulting engineer by the Davis and Weber Counties Canal Company, of Utah, to undertake the design of the 15,000-hp hydroelectric development of the Davis and Weber counties canal. Mr. Strauss is identified with several other Utah electrical engineering properties, among which are the Salt Lake & Ogden Railway, the Utah & Salt Lake Southern Railroad and the Salt Lake & Los Angeles, the last named being a steam railroad which will soon be electrically equipped.

MR. FRANK P. WOY, consulting engineer, of Madison, Wis., has been retained by the State Board of Control of Wisconsin as power plant expert, with general supervision of the operation of the 10 power plants at the different State institutions. These plants range up to 1000-hp capacity, and include steam and producer gas plants, commercial gas, electric, water and steam-heating plants and electric drive in the box, hosiery, twine and other factories operated by the inmates of the several institutions. Economy of operation and consistent improvement throughout the plants and systems are the objects of the State in creating this office.

MR. JOHN C. RENNARD, formerly assistant chief engineer of the New York Telephone Company, has been appointed electrical engineer of the New York City Fire Department, to supervise the construction of a fire alarm telegraph system for the beginning of which the Board of Estimate has appropriated $420,000. Mr. Rennard graduated from the United States Military Academy at West Point in 1890, and remained there for two years as junior instructor. He then pursued post-graduate studies at Columbia University and received the degree of E.E. from that institution in 1894. Mr. Rennard is a member of the Automobile Club of America and the Riders' and Driver' Club, and is an associate of the American Institute of Electrical Engineers.

MR. PHILANDER BETTS has been appointed chief engineer of the Board of Public Utility Commissioners of New Jersey. Mr. Betts has been practising as consulting engineer and expert in Washington for several years, and is also assistant professor of electrical engineering at George Washington University. He graduated in 1891 from the electrical

[illegible] of Rutgers College, New Brunswick [illegible] entered the employ of the [illegible] Engineering Company, New [illegible] he superintended the electrical equipment of roads in Newark and Philadelphia. In June, 1893, he became associated with the Westinghouse Electric & Manufacturing Company, for which he equipped railway power stations at Hazleton, Pa.; Gloucester, N. J., and other cities. While on this work he carried on many tests on power consumption, the effect of grades, curves, etc., which he embodied in a thesis for which Rutgers College gave him the degree of Master of Science in 1895. While in Washington he has been engaged as expert principally in electric lighting and electric power distribution problems, a large part of it being for the Washington Railway & Electric Company, for whom he has also done expert work in electric traction. He is a member of the A. I. E. E. and chairman of its Washington section. He is also a member of the Illuminating Engineering Society and of the Society for Promoting Engineering Education.

Trade Publications.

SINGLE-PHASE COMMUTATOR MOTORS for stationary applications are described in a bulletin of the Lincoln Electric Company, Cleveland, Ohio.

METAL CONDUIT.—The National Metal Molding Company, Pittsburgh, Pa., is distributing mailing folders dealing with "Sheraduct" rust-proof, non-corrosive conduit.

CONCRETE RAILWAY TIES.—The use of reinforced concrete for railway ties is discussed in detail in an illustrated catalogue issued by Kneedler, Couch & Hanson, Sioux City, Iowa.

WIRE.—Price-lists and much useful data pertaining to bare and insulated wires for electrical purposes are contained in a neatly-executed publication issued by the Rome Wire Company, Rome, N. Y.

ELECTRIC MOTOR FANS.—The Sprague Electric Company, 527 West 34th Street, New York, has issued booklet No. 322-A in which are listed and described desk, wall, ceiling and ventilating fans driven by alternating-current motors.

MOTOR DRIVES FOR PRINTING MACHINERY.—Much valuable information concerning the proper application of electric motors for driving various types of print-shop machinery is contained in Bulletin No. 381 of the Triumph Electric Company, Cincinnati, Ohio.

LIGHTNING ARRESTERS.—In Bulletin No. 4736, entitled "Lightning Arresters," issued by the General Electric Company, are described and illustrated in considerable detail various types of arresters for alternating-current and direct-current, high-voltage and low-voltage circuits.

ELECTRIC LIGHTING FIXTURES.—A 54-page publication issued by the F. W. Wakefield Brass Company, Vermilion, Ohio, as catalogue No. 2, deals with various types of lighting fixtures for ceiling and side wall mounting. Special attention has been given to the requirements of metallic-filament lamps.

ELECTRIC VEHICLES.—The Babcock Electric Carriage Company, 226 West Utica Street, Buffalo, N. Y., is distributing two mailing novelties designed to attract attention to its electric vehicles. A mailing folder with return card attached gives much data relating to the cost of owning and operating an electric car, while an illustrated booklet of envelope [illegible]

INSTRUMENTS OF PRECISION.—This is the fifth edition of the general catalogue of instruments of precision built by E. Ducretet, 75 Rue Claude-Bernard, Paris, France. It embraces apparatus covering general physics, heat, acoustics, optics, mechanics, topography and cosmography and gives brief descriptions and prices of the myriad instruments and parts listed. The catalogue contains 323 pages and an excellent index.

CORLISS ENGINES.—The Providence Engineering Works, of Providence, R. I., builders of Rice & Sargent Corliss engines, have issued Bulletin S-75 illustrating the standard, heavy-duty type of Corliss engines [illegible] regarding floor space, horse-power ratings, etc. The bulletin is well pre- [illegible]

ELECTRIC COOKING APPARATUS.—[illegible] by the General Electric Company, on the subject of electric cooking apparatus for hotels and restaurants, should be of considerable interest to managers of hotels and restaurants. The publication referred to illustrates and describes various appliances designed especially for hotels and restaurant use, for example, broilers, roasting and baking ovens, [illegible]

GRAPHITE.—With the compliments of the International Acheson Graphite Company, there is being distributed a handsome book of 143 [illegible] contains a steel engraved portrait, and is an interesting record of a [illegible]

SPECIAL FEED-WATER HEATER.—[illegible] "Combination Feed-Water Heater [illegible]

[illegible] rane hot process system in that provision is made for heating two separate feed-water supplies independently, and for treating only one with a reagent. The condenser discharge or other returns, after passing over heating trays, pass directly to the pump supply chamber or pure water compartment, whereas the raw water, after heating and mixing with the reagent, falls into a spacious sedimentation chamber and afterward passes through a filter bed before entering the pure water compartment. To insure a continuous supply of water to the boilers in case of clogging of the filters, there is an automatic by-pass which, in case the level of the water in the pump supply chamber should fall below a certain level, will supplement with sufficient hot, treated water to supply the pumps. In a hot process system, the "temporary" hardness, or carbonates, are precipitated by heat, and the only reagent required is that needed for the transformation of "permanent" hardness, such as sulphates, chlorides, nitrates, acids, etc. Due to the use of only one reagent, the management of the apparatus is much simplified, no complicated chemical analyses being required, as where two reagents must be proportioned to the varying requirements of the water. The apparatus has the further advantage over a cold-process system that it performs, in addition, the functions of the feed-water heater which should be installed in any case. For this purpose it can be adapted to any of the various forms assumed by open feed-water heaters; that is, can be used as heater and receiver in connection with an exhaust steam-heating system, etc.

BUSINESS NOTES.

SANCHEZ X-RAY APPARATUS.—The sale in this country of the Sanchez x-ray apparatus has been placed by the Spanish inventor with Mr. Edwin A. Robertson, formerly with the Lord Electric Company, whose present address is 90 Morningside Avenue, New York.

RIDGWAY ENGINES.—[illegible] recently sold by the Ridgway Dynamo & Engine Company, Ridgway, Pa., two (28 in. x 32 in.) were ordered by the Susquehanna Railway, Light & Power Company, of Wilkes-Barre, Pa., and one (12 in. x 16 in.) by the Nittany Light, Heat & Power Company, State College, Pa.

THE AMERICAN LAMP COMPANY has a New England office and warehouse at 184 Franklin Street, Boston, in charge of Mr. A. E. Payne, as New England manager. A large stock of tungsten, tantalum, gem and carbon-filament lamps will be carried, and also a complete line of miniature lamps—carbon, tungsten and tantalum.

THE INTERSTATE SUPPLY COMPANY, of Sioux City, announces the change in its name to the Interstate Electric & Manufacturing Comany, and the consolidation with the Interstate Electric Manufacturing Company, of which corporation it was the owner. There has been no change of stockholders, directors or officers, the change being made for the purpose of simplifying accounting, and to get a more appropriate name for both lines of business.

VULCANIZED FIBER.—J. C. Parker & Son Company, of New Castle, Del., is building a plant for the manufacture of vulcanized fiber, having recently purchased for this purpose the Knowles Woolen Mills, situated on the railroad as well as on the river front at New Castle, a modern, well-constructed building. It is now preparing to make contracts for machinery necessary to produce 5000 to 6000 lb. of fiber a day, and expects to be in operation and have stock to sell before Jan. 1.

CHANGES IN THE HOLOPHANE ORGANIZATION.—A [illegible] of changes in the personnel of the Holophane Company were announced at the company's recent annual conference, held at the Sagamore, Lake George. Mr. W. F. Minor is appointed assistant general manager; Mr. C. Walter Jones, formerly manager of the New York branch, succeeds Mr. Minor as sales manager; Mr. John W. Foster succeeds Mr. Jones as manager in New York, while H. D. Howe takes charge of the fixture department, which will be located at Newark, Ohio. The 1910 Holophane conference was the most successful in the company's history, 102 persons being present. Of these, 28 were guests, including representatives of the National Electric Light Association, the National Electric Contractors' Association and the Electrical Supply Jobbers' Association.

WESTERN UNION [illegible] supervising the large territory under his direction, Mr. T. P. Cook, general superintendent of the western division of the Western Union Telegraph Company, with headquarters in Chicago, has been given a staff of three division assistants, each of whom will head a newly created department. All will be directly responsible to Mr. Cook. Mr. W. J. Lloyd, who has been superintendent of the first district of the western division, with headquarters in Chicago, has been appointed division [illegible] is now division commercial superintendent, and Mr. M. H. Clapp, an engineer and expert in maintenance of line, has been appointed division superintendent of plant. These three men, each a specialist in his respective department, will constitute the executive staff of the general superintendent, and their field of authority will extend over the entire western division. All will have their headquarters in Chicago. Mr. A. B. Cowan, assistant district superintendent, has been promoted to fill the place of Mr. Lloyd. These changes were effective Aug. 1. The western division includes that part of the United States between Buffalo and Cincinnati on the east, the Ohio River on the south, the Missouri River on the west, and the national boundary on the north.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

[illegible] Association. Secretary, Lloyd Lyon. [illegible]

[illegible] York. Next meeting (semi-annual) Chicago, Nov. 14, 15 and 16, 1910.

American Electrochemical Society. Secretary Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, 158 West 176th St., New York City.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July August and September.

American Street & Interurban Railway Accountants' Association. Secretary, H. E. Weeks, Davenport, Ia.

American Street & Interurban Railway Engineering Association. Secretary, John W. Corning, Boston Elevated Railway Company, Boston, Mass.

American Street & Interurban Railway Association. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

Arkansas Association of Public Utility Operators. Secretary, J. E. Cowles, Little Rock, Ark.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 509 Perry-Payne Building, Cleveland, O.

Association of Railway Telegraph Superintendents. Secretary P. W. Drew, 135 Adams St., Chicago. Next meeting Boston, Mass., June, [illegible]

Association of Railway Electrical Engineers. Secretary, George B. Colegrove, 960 Monadnock Building, Chicago. Next annual meeting, Chicago, Oct. 4, 5, 6 and 7, 1910.

Association of Edison Illuminating Companies. Secretary, D. L. Huntington, Spokane, Wash.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allen H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association Secretary, A. L. Neereamer, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Acting Secretary, F. D. Morris, 323 Hagerman Bldg., Colorado Springs, Col. Next meeting, Glenwood Springs, Sept. 21, 22 and 23, 1910.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electric Vehicle and Central Station Association. Secretary, H. T. Sands, 139 Pleasant St., Malden, Mass.

Electric Club, Chicago. Secretary, F. S. Hickok, 824 Marquette Building, Chicago. Meets every Wednesday noon, 303 Wabash Ave.

Electric Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Next meeting, Albany, N. Y., Jan. 17, 1911.

Electric Trades Association of Philadelphia. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Contractors' Association of State of Missouri. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next annual meeting, Chicago, [illegible]

Electrical Supply Jobbers' Association.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York. Next meeting, New York City, Oct. 5, 1910.

Engineering Society of Wisconsin. Secretary, W. G. Kirchoffer, 31 Vroman Building, Madison, Wis.

Engine Builders' Association of the United States. Secretary, C. H. Lembower, Reading, Pa.

Florida Electric Light & Power Association. Secretary, H. C. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., April [illegible]

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in [illegible]

Independent Electrical Contractors' Association of Greater New York. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntington, Ind.

Internal Combustion Engine Association. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Rochester, N. Y., Sept. [illegible]

International Electrotechnical Commission. (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

International Independent Telephone Association. Secretary, A. C. Davis.

Iowa Electrical Association. Secretary, W. N. Keiser, Dubuque. [illegible] Davenport, Ia. [illegible]

Iowa Independent Telephone Association. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Annual meeting, second Wednesday in March each year.

Iowa Street & Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Kansas City, Kan., Sept. 27 and 28, 1910.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October, each year.

Maine Electrical Association. Secretary, Fred D. Gordon, Auburn, Maine.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. P. Biggs, Detroit, Mich. Next meeting, Port Huron, Mich., Aug. 16, 17 and 18.

Minnesota Electrical Association. Secretary, B. W. Cowperthwait, Faribault, Minn.

Mississippi Electric Association. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss.

Missouri Electric, Gas, Street Railway & Water Association. Secretary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

Missouri Independent Telephone Association. Secretary, G. W. Schweer, Windsor, Mo.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National District Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio.

National Electric Light Association. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

National Electric Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

National Electrical Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn. Next meeting, New York, March, 1911.

National Electrical Credit Association. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

Nebraska Electrical Association. Secretary, Frank McMaster, Beatrice, Neb.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Section, National Electric Light Association. Secretary, C. H. Hodskinson, 89 Lafayette St., Boston, Mass.

New Orleans Electrical Contractors' Association. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

New York State Independent Telephone Association. Secretary, R. M. Eaton, Niagara Falls, N. Y.

Northwest Electric Light & Power Association. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, on board steamer *Queen*, leaving Seattle Aug. 26, 1910.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Columbus, Ohio.

Ohio Society of Mechanical, Electrical & Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. [illegible]

Oklahoma Public Utilities Association. Secretary, Galen Crow, Guthrie, Okla. Next meeting, Oklahoma City, Sept. 30 and Oct. 1, 1910.

Old Time Telegraphers' & Historical Association. Secretary, F. J. Scherrer, 195 Broadway, New York. Next reunion, Chicago, Sept. 8, 9 and 10, 1910.

[illegible] Rejuvenated Sons of Jove. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal.

PACIFIC COAST ELECTRICAL SHOW, San Francisco, Cal., week beginning Aug. [illegible], 19[illegible].

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa. Next meeting, Glen Summit Springs, Pa., Sept. 14, 15 and 16, 19[illegible].

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

PITTSBURG ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D. Next meeting, Redfield, S. D., Jan. 11 and 12, 1911.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next biennial meeting, March [illegible].

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Lena M. Owen, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester Center, Vt.

WASHINGTON ELECTRICAL SHOW, October or November, 1910.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill. Next meeting, Omaha, Neb., October, [illegible].

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRICAL ASSOCIATION. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban R[illegible]

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY [illegible]

965,166. ELECTRIC FRICTION-CLUTCH; Leonard Huntress Dyer, Greenwich, Conn. App. filed Sept. 22, 1897. An improved electric friction clutch comprising in combination a trough shaped magnetic member having an energizing coil therein and provided with two tapering pole pieces or rims, and a co-operating armature member having pockets and an overhanging flange substantially as set forth.

965,168. TRANSFORMER; Melville Eastham, Boston, Mass. App. filed Sept. 3, 1909. A resonant circuit comprising the secondary of a closed core transformer characterized by large magnetic leakage, a condenser in circuit with the said secondary, the secondary having an inductive reactance approximately equal to the capacity reactance of the condenser for the alternation-frequency of the supply current.

965,175. SYSTEM OF MOTOR CONTROL; Ernest L. Gale, Sr., Yonkers, N. Y. App. filed Oct. 9, 1907. In motor-controlling apparatus, the combination with an electric motor, of starting resistance therefor, means for controlling said resistance to effect an acceleration of the motor with normal load, and means permitting the operation of said controlling means for overload.

965,185. TELEGRAPH AND OTHER POLE; John F. Hickman, Tampa, Fla. App. filed Aug. 17, 1909. A pole comprising a base, a lower section secured to the base and formed of two plates inclined each [illegible] tween the ends of the plates opposite the base.

965,187. JUNCTION-BOX, RECEPTACLE, AND PLUG FOR ELECTRICAL CONNECTIONS; William A. Hopkins, Decatur, Ill., New York, N. Y. App. filed Nov. 28, 1908. In a device of the character described, the combination of a junction box body, a lid surmounting said [illegible] on said lid within said housing cap and provided with sockets, and [illegible] receptacle and adapted to receive a plug to be inserted into said receptacle.

965,206. INCANDESCENT-LAMP SOCKET; Norman Marshall, Newton, Mass. App. filed Oct. 19, 1908. A key socket provided with means for clamping the socket against a shoulder on a fixture with the key in any predetermined position with relation to the fixture, substan[illegible]

[illegible] ELECTRIC CABLE [illegible] Milton, Ohio. App. filed Nov. 12, 1909. An electric cable for high tension currents, consisting of a multiplicity of straight wires assembled in parallel relation, and a series of bands surrounding said wires, each of said bands having a laterally extended annular rim [illegible]

965,234. ELECTRIC SWITCH; William M. Scott, Philadelphia, Pa. App. filed Oct. 9, 1909. In an electric switch, the combination with main, fixed and movable contacts, of shunt fixed and movable contacts, a pivotal support for the main movable contact member, a loose pivotal support for the movable shunt contact, an operating member for operating the main movable contact member, and means on the movable shunt contact member engaged by said operating member for shifting said movable shunt contact to wipe said shunt contacts upon each other.

[illegible] RECEPTACLE FOR IN[illegible] August Weber, Jr., Schenectady, N. Y. App. filed Dec. 13, 1907. In a receptacle for incandescent electric lamps, and in combination, an insulating-base; a screw-shell mounted upon said base; a shell of [illegible] ing-base and screw-shell, said shell having an integral portion interiorly screw-threaded to receive and fit said screw-shell.

[illegible] ELECTRIC [illegible] Kenney Billings, Habana, Cuba. App. filed May 20, 1909. A plurality of receptacles each [illegible] eptacles to different portions [illegible] sures in said different portions are adapted to [illegible] nductor co-acting with said liquid for indicating any variation in the ratio of the differences of pressures in said different portions of said device.

[illegible] WALL OR SWITCH BOX [illegible] guides movable in relation thereto, attaching lugs carried by and ad[illegible] guides in different adjusted positions.

965,299. RHEOSTAT; Harry Hertzberg and Maurice J. Wohl, New York, N. Y. App. filed May 14, 1907. A rheostat comprising a plurality of heat-absorbing separable metallic masses having exposed corrugated radiating surfaces, an electrical resistance between said metallic masses, keepers extending from one mass into co-operative relation to the other mass, and wedges co-operating with said keepers and with one of the masses for clamping both masses into firm mechanical engagement with said interposed resistance.

965,332. ELECTRIC WATER-HEATER; Frank A. Robinson, Albany, N. Y. App. filed Oct. 27, 1908. An electric water-heater comprising a plurality of independent water conducting pipes, a discharge pipe communicating with a water receiving chamber, and means for opening said discharge pipe simultaneously with the closing of the switch.

965,333. ELECTRIC WATER-HEATER; Frank A. Robinson, Albany, N. Y. App. filed June 7, 1909. An electric water-heater comprising a plurality of water conducting pipes independent of each other, an insulated electric heating conductor extending through said pipes and connected to the binding post carried thereby.

965,368. SUBMARINE-CABLE TELEGRAPHY; Sidney George Brown, London, England. App. filed Sept. 10, 1907. In a system for receiving signals from a cable in cable code the combination with a receiving instrument of means for enabling the discharge currents to be utilized to give amplitude to the signals and a suitably adjusted reaction circuit for modifying such signals to receive increased definition.

965,393. ELECTROCHEMICAL APPARATUS AND PROCESS; Einar Honoratus Meyer and Job Morten August Stillesen, Niagara Falls, Ontario, Canada. App. filed March 20, 1908. A process of making calcium carbid comprising reducing a mixture containing coal and limestone to carbon and lime in a separate chamber by the combustion of a gas containing carbon monoxid in intimate contact with said mixture, feeding the reduced carbon and lime without cooling from said chamber into an electric furnace, and subjecting the same therein to the action of an electric arc.

965,396. AUTOMATIC POTENTIAL-REGULATOR FOR DYNAMOS; [illegible] matic potential regulator for dynamos, comprising an electromagnet connected across the main current lines, a core in said electromagnet, a resistance in the field circuit, contact points on the core of said magnet and insulated therefrom, co-operating with said electromagnet for opening and closing a shunt around said resistance, said resistance comprising an electromagnet connected around said points, and pole pieces on said electromagnet adjacent to said contact points.

965,417. TELEGRAPH INSTRUMENT; Frank G. Slemmer, Goldsboro, Md. App. filed May 12, 1909. A telegraph instrument comprising a frame, a line wire binding post on said frame, a key pivoted on the frame and in electrical contact therewith, a contact point supported on the frame and insulated therefrom, a line wire binding post connected to said contact point, a second contact point on the frame and insulated therefrom, a local circuit binding post connected to the second contact point, a third contact point on the key and insulated therefrom, a local circuit binding post connected to the third contact point, the second and third contact points being aligned for engagement, line wires leading from the line wire binding post, local circuit wires leading from the local circuit binding pos[illegible] closer actuating mechan[illegible] embraced in the local circuit, and [illegible]

[illegible] Natick, Mass. App. filed Feb. 28, 1910. In an electrically heated apparatus, the combination with the part to be heated, of a metal receptacle having electric heating means in heat conductive relation [illegible] space between them for maintaining conditions of maximum heat conduction.

[illegible] Nelson, Chicago, Ill. App. filed Oct. 3, 1908. A circuit controller, a motor mechanism to operate it, a selective mechanism, a clock [illegible]

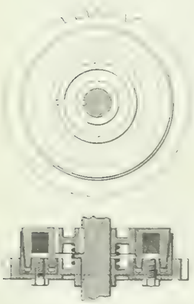
pieces secured to the field frame across its plane of separation, said pole pieces being removable with the armature across the plane of separation when the sections of the field frame are apart.

Louis, Mo. App. filed June 18, 1906. An electric pump governor comprising a pressure cylinder, piston and rod, a collar fixed on said rod, a coiled spring bearing against said collar, a bell-crank

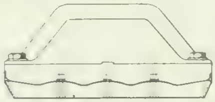
nd a short fixed collar on the piston rod.

965,639. ELECTRICALLY OPERATED SWITCH; John A. Lundeen, Edgewood Park, Pa. App. filed June 30, 1909. The combination of a valve, a stem, a head carried by said stem, a lever connected with said head, lever being provided with a portion serving as an

965,649. STARTER FOR ELECTRIC MOTORS; William C. O'Brien and George H. Whittingham, Baltimore, Md. App. filed April 9, 1907. In an automatic starter for electric motors, two regulating solenoids, having their windings in said circuit, one of said solenoids being wound to release its core when the current falls below a certain value, and the other being wound to support its core with less than the said current, a circuit for shunting the coils of the weaker solenoid and a section of the starting resistance and a portion of the windings of the stronger solenoid, a switch in said shunt circuit adapted to be closed by the movement of the core of said



965,166—Electric Friction Clutch.



Magnetic Brake Shoe.

ing the remaining coils of said stronger solenoid and a section of the starting resistance, a switch in said latter circuit adapted to be closed by the movement of the core of said stronger solenoid when released from its coils, levers engaging the cores of said regulating solenoids, and a holding solenoid having a core adapted to normally bear upon said levers and overbalance the cores of said regulating solenoids, thereby holding the switches normally in open

REVERSING SWITCH; George H. Whittingham, Baltimore, Md. App. filed Nov. 2, 1908. In a reversing switch for electric of two contact members connected to one side of the supply circuit, a resistance connected between said contact members connected to the armature terminals ngaging either of said switch members from said contact members and for connecting

965,672. APPARATUS FOR CONTROLLING ELECTRIC MOTORS; George H. Whittingham, Baltimore Md. App. filed June 7, 1909. The combination with an electromagnetically operated switch, of a pair of circuits extending therefrom, a push-button in each circuit, serving, when actuated, to open or close said switch, and a master controller, adapted, when in one position, to close the circuit in which one of said buttons is located, and thus render the other of said buttons ineffective.

965,673. CONTROLLER FOR ELECTRIC MOTORS; George H. Whittingham, Baltimore, Md. App. filed June 21, 1909. A motor controlling mechanism comprising a switch member, adjustable at will, a regulating resistance governed thereby, an automatically movable member, a starting resistance governed jointly by said two mem-

CONTROLLING DEVICES FOR ELECTRIC MOTORS

controlling apparatus for electric motors having shunt field

means controlled by the starting current arranged to cut resistance out of the armature circuit step by step and to automatically insert resistance in the field circuit step by step while the resistance is being cut out of the armature circuit.

965,675. MOTOR STARTER; George H. Whittingham, Baltimore, Md.

matic starter, a starting resistance, a series of independently movable rods electrically connected to said resistance, guiding means for said rods permitting the rods to slide longitudinally therein a short-circuiting bar for engaging and moving said rods, an electromagnetic device for moving said bar, and means for retarding the movement of said bar.

965,676. MOTOR CONTROLLER; George H. Whittingham, Baltimore,

tric motors, comprising starting and regulating resistances for the

while the motor is starting, and for cutting out the starting resistance,

lated wires, a metallic casing surrounding said cable, a stuffing box having a recess therein, one member of the stuffing box being secured to the junction box and the other member thereof being secured to the end of the cable casing, an elastic member in the recess of the stuffing box having an orifice for each of the wires of the cable, a rigid disk of insulating material on each end of the elastic member and within the recess in the stuffing box, each of the disks having an orifice in line with each of the orifices in the elastic member for the wires of the cable, and means to secure the members of the stuffing box to each other to compress the elastic member to seal and to secure the end of the cable to the junction box.

965,689. PRESSURE GOVERNOR FOR ELECTRICALLY OPERATED PUMPS; Francis L. Clark, Pittsburgh, Pa. App. filed Feb. 24, 1902. In a pressure governor for air pumps, the combination with a controlling device for the pump and a cylinder and piston for operating the same, of a liquid chamber having a sealed passage communicating with said cylinder, a movable abutment subject to pump pressure for supplying air to said chamber and an exhaust valve rigidly connected to said abutment for releasing air from said chamber.

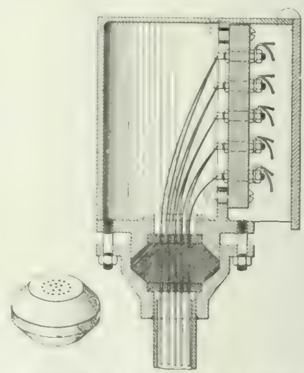
965,710. ELECTRIC-LIGHT FIXTURE; Edwin E. Hayward, Waterbury, Conn. App. filed Jan. 3, 1910. In an electric-light fixture, the combination with a shade holder, of a clamping band of spring metal adapted to extend around a lamp socket and a screw therefor and means extending between and for permanently connecting the clamping band and the shade holder at the upper portion of the latter for the support of the shade holder and which means simultaneously provide freedom for a movement of the shade holder to obtain a concentric and axial relation of said parts.

965,734. PULL SOCKET; Henry T. Paiste, Philadelphia, Pa. App. filed Dec. 22, 1908. The combination in a pull socket of a supporting structure having a transversely extending spindle; a ratchet wheel thereon; a pawl having operating means and placed to act on said wheel; a disk-like structure attached to the ratchet wheel upon the outside face of the supporting structure, and having a projecting contact; with a fixed contact or contacts extending adjacent to said disk-like structure also on the outside face of the supporting structure so as to be alternately engaged by and disengaged from the contact thereof when the pawl is operated.

965,740. TROLLEY DEVICE; William Peterman, Beaver Falls, Pa. App. filed April 12, 1910. In a device of the character described, a trolley wheel, a pair of vertical plates mounted on the axle of said trolley wheel, each of said plates having its upper edge in alignment with the upper edge of the trolley wheel, and having a vertical projection at the top of each plate and a horizontal guard strip at the top of each vertical projection, and spaced above the upper edge of said wheel and located above the trolley wheel.

965,743. ELECTRIC-LAMP SOCKET; Frederick P. Poole, Bridgeport, Conn. App. filed April 15, 1909. An electric lamp key-socket, comprising an insulating body and screw shell and center contact, in combination with wire terminals, a key stem and a switch block mounted on said stem with lost motion, a spring to act on the switch block, a contact carried by the insulating body, and a spring-actuated plate to make connection with said contact, the switch block acting to close the circuit through said contact and to break it with a double break.

965,748. COMBINED TELEPHONE AND TELAUTOGRAPH EXCHANGE SYSTEM; Foster Ritchie, Acton, England. App. filed Oct. 12, 1908. A combined telautograph and telephone exchange system comprising a local battery at each subscriber's station, circuit connections placing these local batteries normally in opposition,



Sealing Ends of Electric Cables.

and means operative when sending a written message whereby the polarity of the battery of the sender is reversed, substantially as described.

965,793. ELECTRIC SELECTOR AND SIGNALING APPARATUS; William W. Alexander, Kansas City, Mo. App. filed May 27, 1908. In an electric signaling device, a rotary cog wheel, suitable axial pel said wheel measured distances in the circle of rotation, and vibrating time-controlling devices acting intermittently and alter- said wheel in rotation.

965,798. MAGNETIC BRAKE-SHOE; Edgar Harry Cockshott, Leeds, and Alfred Walter Maley, West Bromwich, England. App. filed secured to one end of said core, a second pole surrounding the first secured to the other end of said core and of such width as to contact with the rail of the track at the as well as the ends, and a winding adapted to carry current to excite said magnet.

965,810. ELECTRIC CABLE; William Siegel, Southwark, England. comprising bitumen, sulphur, petroleum and an insulating

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A YEAR OF EXPORTS.

The figures of export trade are now complete for the whole year ending June 30, and we are thus able to compare them with those of the preceding year. They have remained to the end true to the characteristics that have been so strongly pronounced during the whole period; that is to say, there has been a steady and marked gain in the export of miscellaneous instruments and apparatus and a falling off in heavy electrical machinery. This differentiation was maintained in June, and there seems to have been no cure found for it yet. The export of smaller stuff during June was $902,593 as compared with $595,044 in June, 1909; while the export of heavy machinery was $586,202 as compared with $687,453. The gain in the one instance and the decline in the other is certainly sharply marked.

Taking the total figures for the year we find that the export of instruments and apparatus reached $8,694,132 against only $6,074,865 in 1909, a gain of $2,619,267. On the other hand, the total for heavy electrical machinery was $6,048,263 against $6,449,526, a loss of $401,263. It follows that the net gain for the year on the whole electrical export trade was $2,211,004, which is comforting and encouraging to say the least. The total for 1910 was $14,742,395, as compared with $12,524,391 in 1909. But 1910 was still somewhat behind 1908 when a total was reached of $15,159,436. That year the importance of the two items was almost exactly reversed from 1910, and heavy machinery then amounted to $8,405,219.

The trade of the year shows British North America to have continued an excellent customer and our best, but Brazil and Mexico come to us with a large demand, while the Japanese trade has shrunk. The United Kingdom seems to be buying again, but is far behind its old figures; and France and Germany are not the customers they were formerly. Evidently we need to vary our exported product, seek the general markets not supplied by their own manufacturers, and take new hope from the new data.

FINANCING PUBLIC UTILITIES.

The decision of the Public Service Commission of the First District of New York rejecting the petition of the bondholders' committee of the Third Avenue Railroad Company is one of the most important handed down by that body since its formation. It presages the attitude of the commission toward reorganization schemes which involve the issuance of securities for the acquisition of property to be conveyed to a new company; and indicates that even though the securities are issued at par for old securities, unless the actual present value is equal to par, "not approved" will be written across the face of the application. Reiterating the policy of probably every other public service commission in existence, it makes physical valuation plus certain intangible values the basis of bond issues; and in order to arrive at just valuations, exhaustive investigations of the property are made. The handwriting on the wall

is plain; public utilities must be managed in the interests of security holders and patrons and not for the enrichment of speculators.

Many persons fail to distinguish between a private corporation and a public-utility company because both are susceptible of capitalization and both dispose of their bonds to the same public. By good management both may be made paying investments, and yet what is permitted to one is denied to the other. The former may net its stockholders 100 per cent or more per annum; but no such dividends can be given to the stockholders of the latter. Little by little the government has assumed to regulate public utilities in the interests of the people, and while not withholding a fair return to investors, it expressly stipulates that the public must not be fleeced. The opponents of such regulation by the State urge that under such throttling influence it is difficult, if not impossible, to interest capital in new undertakings. The records of the commissions, however, tend to disprove this contention, and so long as the public service commission laws remain on the statute books and are honestly and intelligently administered, investments in the bonds of public-utility companies should be every whit as safe as investments in first mortgages on real estate.

ELECTRIC TRANSMISSION AND IRRIGATION.

Much of interest centers around the interrelation between electric transmission and irrigation undertakings by reason of the valuable assistance given by the one to the other. Probably in no two irrigated districts are the conditions identical, so that comments that apply in one locality may have almost no bearing in other places. Certain hydroelectric undertakings that would have been considered commercially impossible when not combined with irrigation prove highly advantageous when irrigation is the prime object sought. On the other hand, there are localities where profitable irrigation would be an impossibility without the existence of electric transmission equipments installed primarily for other purposes. Our columns in this issue contain notes on electric transmission installations and irrigation equipments falling in both of the above classes.

He would indeed be considered bold who would attempt to convey water 200 miles for the purpose of obtaining a fall of several hundred feet for developing, say, 100,000 hp, yet such a scheme is being applied in California with full confidence of meeting with financial success, because the water will be utilized for irrigation after its total travel of 250 miles. In Colorado transmitted electrical energy is employed for operating pumps to raise to the surface certain underflow water that would otherwise be useless for irrigation, and to elevate gravity surface-flow water to points well above the irrigation ditches, thus adding immensely to the value of land previously beyond the irrigated range. Strangely enough, in the Colorado case noted in this issue the energy is not obtained from a hydroelectric installation, but from a generating plant located immediately at a coal mine. The last-mentioned combination is probably thoroughly unique, while the former is typical of a large number of equipments, one of which, in Utah, was mentioned in our issue for last week

Our issues for July 15 and Oct. 28, 1909, contained descriptions of additional electrical transmission systems in Utah and California, where the energy is obtained from water intended for irrigation and is utilized in part for elevating the water for irrigating land above the ditches and for pumping water from the underflow. In our issue for May 19, 1910, was described an electric transmission system used largely for supplying energy for driving irrigation pumps in California, while on June 9, 1910, there was given a description of an installation in Kansas used exclusively for this purpose

In whatever combination they may be found, irrigation and electrical transmission are mutually beneficial. Where the water is intended primarily for irrigation, certain restrictions are placed on the use of the water for developing hydroelectric energy such as the maintenance of constant flow, but the load afforded by pumps for elevating the water above the ditches is constant throughout the irrigating period and compensates largely for the restrictions. It is difficult to conceive of a more advantageous load for a transmission system than that of motors used in irrigation; not only is the daily load-factor almost 100 per cent, but the yearly variation in the pumping load tends to counterbalance the yearly fluctuations in the lighting load. Although perfect results demand a constant flow of water in the irrigation ditches, and this condition provides an excellent character of load for the transmission system, yet a slight interruption to the continuity of service is of no very great importance, and, when desirable, the pump motors can be left idle for several hours at night without detrimental effects upon the crops. For the above reasons, in installing a transmission equipment for supplying energy to irrigation motors many of the expensive refinements commonly introduced solely for the purpose of avoiding momentary interruptions in other services need not be employed. It is safe to state that wherever irrigation can be carried out the electrical transmission company in that neighborhood is neglecting an opportunity for obtaining a highly desirable load unless it is co-operating with the farmers in developing the agricultural resources.

ITALIAN THREE-PHASE LOCOMOTIVES.

In the current issue we give for the benefit of those interested in main-line electrification the facts about the three-phase electric locomotives of the Giovi line in Italy. As is well known, the three-phase system has proved successful on the Valtellina railway for the last seven years and the Government has been so encouraged at the results that there is at present an appropriation of 300,000,000 francs for extension of the system of the Government lines. The interesting features about the locomotives here described is that they are intended chiefly for freight service, freight being the main traffic in some of the lines under electrification. Trial runs have already been made with the locomotives. The construction is especially interesting in that all the drivers, five pairs, are united by connecting rods; the induction motors furnish the torque through connecting rods applied to the two central drivers, which are without flanges. The motors are designed for 3000 volts working pressure at 15 cycles; they are arranged for cascade connection, giving 112½ r.p.m. and 225 r.p.m., intermediate speeds when necessary being obtained by inserting resistance in the secondary. The drive is a beautifully flexible one, all shocks being taken up by springs so that the motor is practically independent of any changes of position while in practice. Particularly to be mentioned is the simple trolley arrangement in use. It is a single bow carrying a steel shaft in ball bearings with two hard-bronze

sleeves insulated from each other and serving to take current separately from the two trolley wires. One interesting feature to ensure safety of working is that the high voltage wiring is so run and interlocked that no access can be had to it save when the trolley bow is pulled down clear of the trolley wire. Control is by air-operated switches.

The Giovi locomotives are particularly designed for work on grades up to 3.5 per cent, handling heavy freight trains, and tests have shown that the power developed rises to 33.2 hp per ton. This is a figure more than double that given by the steam freight locomotives ordinarily in use and also fully double that of the Swiss and German single-phase locomotives. The ability of the three-phase type of motors to carry large overloads is, of course, very well known, but the excess here indicated is an exceedingly important matter when it becomes necessary to haul a heavy freight train over the steep grade. The cost of a locomotive is claimed to be rather more favorable than that of one of the single-phase type, so that in the matter of haulage capacity it presents unusual advantages. The possibility of restoring energy to the circuit by motor braking down grade is one which has always been an attractive feature of the three-phase system, although, in fact, it is rather seldom that any very advantageous use can be made of it. On some of the Italian lines there seems to be a better chance than usual to utilize regenerative control, and it is found by experiment that about 55 per cent of the up-grade energy can be restored on the down grade and in some cases even better results can be obtained. It is generally believed among engineers that the three-phase system is one of special rather than general application, but the recent Italian results are of a character to make one stop and think seriously whether it is wise to turn the system down on reasons which thus far have been chiefly theoretical. Comparisons of this locomotive with the single-phase locomotives of the New York, New Haven & Hartford Railroad would be somewhat odious, because, as is well known, the latter machines have never had a fair chance, being terribly handicapped by the modification and complications necessary to enable them to receive energy from both an overhead catenary alternating-current circuit and an under-running, third-rail, direct-current circuit.

ELECTRIC WAVE RADIATION FROM INCLINED ANTENNAS.

The original type of wireless-telegraph antenna was a vertical mast, supporting a single vertical wire. Attempts were then made to extend this vertical conductor, both in height and in cylindrical area. The increased height was obtained by raising the mast elevation. The increased cylindrical area was obtained by multiplying conductors and spreading them. Finally, a limit was found for the height of the conductor by reason of the expense of construction. A few high elevations are afforded by tall structures, such as the Eiffel Tower in Paris, or the Singer Building in New York, but, except in such favored locations, the cost rises much faster than the altitude. This is true both on ship and on shore. On ships high masts were originally installed for raising and supporting large sail areas. With the advent of steam propulsion, mast heights descended to the levels of mere cargo hoists. Recently, however, cases have occurred in which steamship masts have been raised, solely to support higher wireless telegraph antennas.

When the greatest elevation expedient for a particular station had been reached, and it was desired to extend the power of the station as far as possible within the limitation of that elevation, the most convenient and economical plan arrived at was to employ a pair of supporting masts, and to carry the antenna horizontally between their tops, after reaching the top level. This plan is particularly adapted for use on board ship. The question then rose as to the nature and relative intensity of the radiation emitted from such an inverted L antenna. The theory of the subject has not yet been simplified, but it has been shown by Fleming that the radiation emitted is more powerful fore and aft, or in the direction of the horizontal element, than athwart, or in quadrature thereto. That is, the velocity of an outgoing wave is the same in all directions from the antenna, but the intensity of the wave is greatest along the axis of the horizontal element, and least across the axis.

A communication has recently been presented by Prof. A. Garbasso to the Accademia dei Lincei at Rome on the radiation from a straight antenna inclined at an angle, like the leaning tower of Pisa. The theory of this case is simpler than that of the inverted L antenna. The communication shows that such an antenna oscillates harmonically in a manner resembling that of an upright antenna of the same maximum height, except that whereas the radiation from an upright antenna is manifestly symmetrical and uniform in all directions, that of the inclined antenna is dissymmetrical, being strongest along the line of vertical projection, and weakest at right angles thereto. That is, if we suppose the sun to be shining immediately overhead, the radiation will have maximum intensity in the direction of the shadow of the inclined antenna on the ground, and will have minimum intensity across this direction. The graph of this intensity in the horizontal plane is an ellipse, with its center at the base of the antenna, and its major axis along the shadow line. In the case of an antenna inclined 45 deg. with the vertical, the result shown is an energy intensity twice as great in the major axis as in the minor axis, which means that the voltage intensity in the least favored direction is 70.7 per cent of that in the most favored direction. This solution of the problem accords with that already published for the inverted L antenna, because the latter may be regarded as a first approximation substitute for an inclined straight antenna. According to theory, therefore, the signals emitted by a steamship from an inverted L antenna between the masts should be stronger in the direction of the vessel, or fore and aft, than abeam, provided that the screening effects of the steel masts and smokestacks can be disregarded. Quantitative evidence is still lacking on this question. To answer it requires that such a steamship should send signals continuously of uniform strength while steaming slowly in a circle, the intensity of these signals being measured continuously by an observer at a distant receiving station. In regard to the receiving powers of inclined and bent antennas, it seems clear that the e.m.f. of the received signals is limited by the height of the receiving antenna, but that both the quantity of electricity and the amount of electric power capable of being delivered to the receiving instrument partly depend upon the horizontal element of the antenna, being greatest for the direction of incoming waves along the axis of that element, and least along the perpendicular thereto. The best available conditions of tuning are, of course, here assumed.

Hydroelectric Energy from the Los Angeles Aqueduct.

Progress in the construction of the 250-mile aqueduct being constructed by the city of Los Angeles from Owens River across the Mojave Desert, beneath the Coast Range and into Los Angeles, has been so satisfactory that the engineers report that two-thirds of the work has been completed and one-half of the distance has been covered. The cross-section of the aqueduct is sufficient to convey 35,000,000 cu. ft. daily to two storage reservoirs at its lower end. At three points along its route hydroelectric generating plants will be erected to utilize the energy of the falls, the highest of which is 800 ft. It is estimated that a maximum of 120,000 hp is available, two-thirds of which amount can be developed within 50 miles of Los Angeles. Arrangements have already been made for developing 49,000 hp at the time of opening the aqueduct in May, 1912. It is expected that much of the hydroelectric energy will be utilized in connection with the enterprises brought into existence with the irrigation of desert land made possible by the construction of the aqueduct.

The chief engineer for the Los Angeles aqueduct is Mr. William Mulholland. The electrical engineer is Mr. E. F. Scattergood.

Electric Pumps for Raising Underflow for Irrigation.

Mr. C. H. Williams, general manager of the Northern Colorado Power Company, has called the attention of the people of Colorado to the advantages to be derived from utilizing "underflow" water for irrigation. He claims that the entire territory covered by the system of the Northern Colorado Power Company is underlaid with strata impervious to water, above which lies a loose deposit through which the water finds its way with small resistance. The water lies from 20 ft. to 25 ft. below the surface in dependable quantities, and is being elevated to the surface for irrigation by electrically-driven pumps at a large number of points. The water taken from each well is sufficient to irrigate tracts of from 20 to 120 acres.

With 2300-volt induction motors and well-designed centrifugal pumps the cost of pumping is $2.52 per acre-foot, which depth is sufficient for irrigation through an average season.

One of the districts in which the pumping work is developing most rapidly is that northwest of Greeley. A little over a year ago a substation was built at New Windsor where 60 kw of transformers were installed to change the 44,000-volt high-tension e.m.f coming from the Lafayette power house to the 2300-volt energy used for local distribution in the town and for the work of pumping. Before the town was thoroughly covered by electric wires it was found necessary to increase the transformer equipment to 100 kw and six months later this was again increased to 225 kw.

After the irrigation season closed the farmers found use for their motors for cutting and grinding alfalfa and other farm products for feeding stock. Several new industries located in Windsor, attracted by the cheap energy, and the demands of these, together with those of a very rapidly growing, healthy community, required the installation of transformers as now in use, and the rapidity with which the popularity of the electric pumping is growing has made it evident that the equipment of this substation will soon have to be doubled and 150 kw of transformers installed.

Proposed British Association of Consulting Engineers.

A meeting, presided over by Sir William Preece, K.C.B., F.R.S., past-president of the Institutions of Electrical Engineers and Civil Engineers, was recently held to consider the desirability of forming an association of consulting engineers. The object of the proposed association is to form a recognized group of bona fide independent consultants who would constitute a body for the protection of their interests and the interests of the public generally, and to improve their status and professional position, following the examples of the council of the bar, of the medical council and of the chartered accountants.

Invitations had been issued to a number of consulting engineers at the instance of a provisional committee, and most of the prominent consulting engineers were represented or sent letters expressing regret at their inability to attend and their sympathy with the movement. Mr. Midgley Taylor, who presided in the absence of Sir William Preece at the beginning of the meeting, said that the subject had been before a number of consulting engineers for the past two years or more, and as some initial step had to be taken, the members who originally took the subject up formed themselves into a provisional committee with the result that the meeting was called to pass on the action taken by the committee in the past. The object of the meeting was to see whether the general idea of the formation of the association met with the approval of the consulting engineers in that country. It was considered necessary, in the interests of the public as well as in their own, that the genuine consulting engineer should be distinguishable from those who were not genuine consulting engineers, but had trade interests. He felt that the public also wanted protecting. At the present time, if a municipal authority erected works, even of large magnitude, they were not compelled to employ a qualified man to advise them, and there was nothing to prevent an absolutely unqualified man going to the particular authority, offering his services and being retained. It was an anomaly for this to be possible in matters where public safety and the expenditure of large sums of public money were involved. In matters of health or law, or finance, the safeguard was that the doctor or solicitor or accountant who was consulted was a member of a recognized body, and it was felt that the public should have the same protection in engineering matters.

Under those circumstances he felt they should endeavor to form an association such as would not only protect the bona fide consulting engineer, but would also protect the various public bodies and persons who were anxious to get a properly qualified man to advise them on engineering works. The committee hoped that the meeting would result in the formation of the association, but at the same time they wanted to have an open expression of opinion from everyone whether they were favorable or otherwise.

Mr. Swinburne was then called upon to propose the formation of the association, and formally proposed that the association should be formed and asked the meeting to look at the matter as broadly as possible and for all to work together for the one end. After some discussion, Sir William Preece, as chairman, said that he was in entire sympathy with the movement, and remarked that what was wanted was a very strong committee with a strong chairman to carry the matter to a successful conclusion. He put the resolution to the meeting that the association be formed, and this was carried unanimously. It was then suggested that the following gentlemen should be asked to form a committee: Messrs. Robert Hammond, C. Hunt, B. M. Jenkin, Baldwin Latham, S. R. Lowcock, E. L. Mansergh, W. M. Mordey, W. H. Patchell, Sir William Preece, Henry Rofe, J. F. C. Snell, E. H. Stevenson, James Swinburne, Midgley Taylor and Henry Woodall. This committee was unanimously elected, and Mr. A. H. Dykes, of 1 Victoria Street, Westminster, S. W., was elected as honorary secretary.

Electric Vehicle Progress.

It is claimed that a single electric vehicle manufacturing company is receiving orders at the rate of between 50 and 60 electric trucks per month, the most popular sizes being of from 2 tons to 5 tons rating. On the basis of the increasing use of electric vehicles it is said that the sale of energy for charging vehicle batteries by central stations is on the threshold of a remarkable expansion. It is expected that the charging income of the Rochester Railway & Light Company will be practically doubled in the present year. Mr. E. S. Mansfield, of the Edison Electric Illuminating Company, Boston, stated recently in the Boston *News Bureau* that in Massachusetts alone

the number of registered vehicles electrically propelled increased from 412 on April 1 to 571 July 1. In the Boston Edison territory there are now 55 business and 176 pleasure vehicles with electric motive power, and the sales of energy for charging service bid fair to become an important part of the company's business. A marked increase in interest in this form of transportation is evidenced in central-station circles serving territory with reasonably good roads and fairly level topography. On account of early unfortunate experiences with electric trucks some years ago, before the present grade of apparatus was on the market, Boston has been slower to take up this form of transportation than have many of the smaller cities of the country. Recognizing the possibilities of operation on the superb roads of the Boston metropolitan district, the Boston Edison company has taken up the campaign in vigorous co-operation with the manufacturers, and it is planned to interest men of affairs in the subject in the fall through aggressive meetings of the Electric Vehicle and Central-Station Association. It is probable that the Boston Chamber of Commerce will be asked to co-operate in some campaign of education on behalf of the motor truck as compared with horse-drawn vehicles.

The Japanese Electrical Industry.

By M. Kawara.

A collection of electrical statistics compiled by the Japanese Government, and published in the *Electrician's Friend*, of Tokyo, contains some interesting figures and shows the general trend of the industry in Japan more clearly than anything yet published. The following tables refer to the year 1908:

Generators listed under the head "ordered" were mostly in plants in course of construction. It is to be noted that the new plants are adopting larger generators, and that the size of stations is growing more than their number, as the use of higher voltages becomes more and more common. For instance,

TABLE I.—JAPANESE ELECTRICAL GENERATING STATISTICS FOR 1908.

Source of Power	Generators		Kw. Rating	
	Operating	Ordered	Operating	Ordered
Water	274	81	[illegible]	[illegible]
Steam	857	[illegible]	[illegible]	[illegible]
Gas and oil	69	[illegible]	[illegible]	219
Electricity	18		243	300
Total	1218	[illegible]	156,578	93,085

the average rating of hydraulically driven generators in operation is 220 kw, while the rating of those under construction is 804 kw. The average ratings for steam-driven generators are 110 kw and 260 kw respectively.

Classified according to the voltage adopted the following figures obtain:

TABLE II.—VOLTAGE ADOPTED IN TRANSMISSION SYSTEM.

Limiting Voltage	Generators		Kw Rating		Total	
	Operating	Ordered	Operating	Ordered	No	Rating
[illegible]	800	[illegible]	30,596	[illegible]	[illegible]	37,851
[illegible]	[illegible]	[illegible]	93,502	70,127	501	163,629
[illegible]	2	[illegible]	32,480	15,700	52	48,180
Total...	1,218	199	156,578	93,085	1,417	[illegible]

Table II also confirms what has been said regarding the size and voltage of generating stations.

Classified with reference to direct and alternating current the results are as given in Table III.

Here again it will be noted that the majority of the stations under construction adopted alternating current, which means higher voltage and longer transmission lines.

TABLE III.—TYPE OF GENERATORS.

Kind of Machine	Generators		Kw Rating		Total	
	Operating	Ordered	Operating	Ordered	No.	Rating
Direct current	791	[illegible]	[illegible]	[illegible]	855	39,903
Alternating current	427	[illegible]	126,933	82,827	562	209,760

The following table shows the sizes of generators, including both those already in operation and those in process of erection:

TABLE IV.—GENERATORS ARRANGED ACCORDING TO RATING.

Limiting Size	Generators		Kw Rating		Total	
Kw	Operating	Ordered	Operating	Ordered	No	Rating
10	186	[illegible]	1,017	55	195	1,072
50	481	27	[illegible]	806	508	12,706
100	195	18	12,521	1,145	213	13,666
500	274	80	52,595	16,989	354	[illegible]
1,000	46	35	27,445	23,705	81	51,150
——	36	30	51,100	50,385	66	101,485
Total...	1,218	199	156,578	93,085	1,417	[illegible]

The frequency of the alternating-current generators varies from 50 cycles to 133 cycles. The predominating frequency

TABLE V.—GENERATOR ARRANGED ACCORDING TO FREQUENCY.

Cycles	Generators		Kw Rating		Total	
	Operating	Ordered	Operating	Ordered	No.	Rating
50	71	28	44,811	27,690	99	72,501
60	275	85	64,485	49,547	360	114,032
100	15	1	2,041	30	16	2,071
125	27	2	2,191	120	29	2,311
133	9	—	600		9	600
Others	30	19	12,805	[illegible]	49	18,245
Total.	[illegible]	[illegible]	126,933	82,827	562	209,760

is 60, due largely, perhaps, to the fact that the majority of the generators are of American manufacture, as shown in Table VI.

TABLE VI.—GEOGRAPHIC DISTRIBUTION OF MANUFACTURERS.

Manufacturer	Generators	Kw Rating
United States	[illegible]	87,369
General Electric Co.	277	68,455
Westinghouse Co....	[illegible]	13,736
Stanley............	[illegible]	640
Warren............	[illegible]	345
Others............	[illegible]	4,193
Germany	[illegible]	36,435
Siemens & Schuckert Co	[illegible]	32,970
Allgemeine Elektricitäts-Gesellschaft.	21	3,450
[illegible]	1	[illegible]
England	[illegible]	[illegible]
Bruce & Peebles	[illegible]	[illegible]
Mather & Platt ..	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Brown Boveri	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Belgium		
[illegible]	[illegible]	281
[illegible]	[illegible]	15,605
[illegible]	[illegible]	12,524
[illegible]	[illegible]	[illegible]
Ishikawa Shima shipyard	[illegible]	1,085
Osaka Electric Light Co..	[illegible]	[illegible]
[illegible]	[illegible]	312
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

The high-frequency machines are old and without doubt will soon be replaced by standard low-frequency generators. In recent projects 25 cycles has been proposed, and it is likely that this frequency will be adopted.

Of 787 generators rated above 50 kw, and now in operation, 171 machines, with a total rating of 15,605 kw, are of domestic make; 577 machines, with an aggregate rating of 132,251 kw, are imported, and the remaining 20, with a combined rating of 695 kw, are not clear as to their origin. The manufacturers who supply these generators are given in Table VI.

Although there are a number of home manufacturers, a great majority of generators are of foreign make, especially the larger units. The development of electrical industry is so fast that the home manufacturers cannot keep pace with it. Table VII brings out this point more clearly.

TABLE VII.—IMPORTS OF ELECTRICAL GOODS

Material	[illegible]	1907	[illegible]
Insulated Wires	$103,821	$1,231,356	$933,565
Electrical machinery	952,043	1,271,469	1,860,588
Lamps, Sockets, etc.	118,197	63,395	611,338
[illegible]	[illegible]	52,763	56,531
Electric Traction Machinery	152,876	279,266	231,018
Steam Turbines	[illegible]	502,984	375,207
[illegible]	[illegible]	675,084	883,333
[illegible]	619,181	732,115	665,859
Gas and Oil Engines	109,046	274,739	283,313
Total	$2,619,141	$5,083,171	$5,900,752

The electrical machinery which appears in the second row in the above table was supplied from the following countries, as shown in Table VIII:

TABLE VIII.—VALUE OF ELECTRICAL IMPORTS.

Country	[illegible]	[illegible]	[illegible]
United States	$564,656	$763,437	$1,169,762
England	221,267	353,757	333,518
Germany	99,125	146,741	338,337
Other countries	66,995	7,534	18,971
Total	$952,043	$1,271,469	$1,860,588

From the two last tables it is seen that the home manufacturers are unable to keep pace with the fast growing demand, and consequently the importation of electrical goods is increasing at about an average rate of 50 per cent per year even during times of financial distress, which have been felt over Japan as keenly as in the United States. Among the exporters to Japan, the United States obtains the bulk of the trade, about 60 per cent of the total. Germany seems to be improving rapidly, while England holds its own.

New Generating Equipment for Springfield, Mass.

The United Electric Light Company, of Springfield, Mass., has decided to install an additional Westinghouse-Parsons turbo-alternator in its main steam plant on the Connecticut River at the foot of State Street. The turbine will be of the double-flow type and the generator will deliver energy to the switchboard at 5500 volts. It will be installed in the addition to the station which was completed about two years ago, on the south side of the previous plant. Six 400-hp boilers, with Murphy furnaces and separate stacks, will be installed in connection with the turbine service. The plant already has a 2500-kw unit in service, and in the old station are three 1000-kw turbines. The switchboard will be remodeled to facilitate operation in connection with the company's plants located outside the city, which are run by water-power. For a number of months the scarcity of water has been a decided drawback in the operation of the hydroelectric generating units of the company.

The concentration of power generation in the State Street station will enable the company to handle its local street lighting and motor service to the best advantage, and to cut down various transmission losses which have formerly been encountered in connection with the city service. The arc machines were formerly located mainly at the Indian Orchard plant, about 6 miles [illegible] the city, and operated from switchboard located in Springfield. At times of low water this arrangement involved the supply of energy from Springfield to Indian Orchard for driving motor-generators on the arc service, with double transmission losses. The removal of the arc machines to Springfield has resulted in a much more economical service and the operating flexibility is much improved. The new plant is operated as a part of the original station, although the two are mechanically independent, with separate boiler and turbine rooms. A common coal supply with electric crane service is utilized by the two portions of the plant.

Michigan Electric Association Convention.

The Michigan Electric Association will hold its annual convention at Hotel Harrington, Port Huron, Mich., beginning on the evening of Aug. 16 and lasting until the afternoon of Aug. 18. On Aug. 16 during the evening the president will deliver his annual address, and a general reception will be held.

On Aug. 17 and 18 the following papers will be presented: *Boiler-Room Practice*, by Messrs. Rosenkrans, Durand, Chase and Hart; *Accounting for Central Stations in Small Towns*, by Mr. F. B. Spencer, Sheboygan; *Real Cost of Street Lighting*, by Mr. F. R. Mistersky, Detroit; *Baking Enamel by Electricity*, by Mr. John Cavanaugh, Benton Harbor; *Power Factor of Welding Machines*, by Mr. A. S. Hatch, Cincinnati; *Flat Rates* for Residence Lighting, by Mr. R. S. Stewart, Detroit; *Cost of High-Efficiency Lighting*, by Mr. G. E. Westover, Cadillac; *Maintenance of Meters in Small Towns*, by Mr. R. M. Hemphill, Ann Arbor; *Tungsten Lamps*, by Messrs. Thomas Hinks, Mt. Clemens; C. W. Smith, Lapeer; H. A. Fee, Adrian; Eber Arnold, Marine City.

Among the entertainment features will be a boat ride to the Diamond Crystal Salt Works and a dinner at Stag Island on Wednesday afternoon and evening. During the afternoon of Thursday, Aug. 18, there will be a baseball game between the "Detroit Edisons" and the "Port Huron Independents," and a trip by way of the St. Clair tunnel and the ferry. The secretary of the association is Mr. A. P. Biggs, of the Detroit Edison Company.

Annual Meeting of the Maine Electric Association.

The annual meeting and outing of the Maine Electric Association was held at the Hotel Falmouth, Portland, on July 28 and 29, and a combined program of business and pleasure was enjoyed by a large number of representative central station men in attendance. The social features of the occasion included a steamship trip down Casco Bay to South Harpswell and a clambake at the Merriconeag House, with a baseball game, races and other out-of-door sports. The following officers were elected for the ensuing year: President, J. A. Fleet, Portland; vice-presidents, C. J. Abbey, Skowhegan, and F. D. Gordon, Lewiston; secretary and treasurer, W. S. Wyman, Waterville. The principal feature of the technical session was a paper on "High-Tension Line Construction," by F. H. Mason, engineer of the Central Maine Power Company, Waterville.

HIGH-TENSION LINE CONSTRUCTION.

Mr. Mason emphasized the importance of continuous service in all high-tension line work, and pointed out the advantages of the private right of way, particularly in connection with railroad locations, where material can be most advantageously delivered. A contrast was drawn between line construction 10 years ago and that of to-day, the present tendency being away from glass insulators and wooden pins, and for moderately high potential service employing a galvanized iron pin with a porcelain base and wooden top. Metal pins cemented to the insulator have found favor in locations near the ocean. A 60,000-volt porcelain insulator is about 15 in. high and weighs about 30 lb., which makes it rather bulky for supporting on wooden poles. The added reliability of service in the face of a somewhat larger first cost of steel tower construction was touched upon. The wood pole is well adapted to a single three

phase line which is placed on it in the form of a triangle with apex at the top, where the insulator is supported by a ridge iron. At e.m.fs. above 33,000 volts the spacing for a double line becomes so great that the length of arms where two three-phase systems are arranged in triangles becomes unwieldly. Mr. Mason stated that no pole of less than 7-in. top should be used in high-tension work, a minimum of 8 in. being used at crossings and corner poles. He described standards of line construction in favor with his company, giving various details of pole setting, guying, etc., found advisable in recent line work in Maine and elsewhere.

The most recent practice in steel tower construction was reviewed by the author, who then passed to a discussion of the advantages of the suspension type of insulator in very high-tension work. Illustrations were given of insulators used on various transmission systems, and the benefits of the suspension type on long spans were emphasized. An 800-ft. span is used in carrying the Maine Electric Power Company's line across the Kennebec River at Augusta, and among other recent spans of this type is one of 1200 ft. across the Hudson River at Mechanicsville, N. Y. The Bar Harbor & Union River Power Company has an 800-ft. crossing near Bar Harbor, where two insulators are used at each end of the cable. Regarding sag, Mr. Mason stated that less could be allowed with copper wires than most text-books give without difficulty, but more slack must be allowed with aluminum. He referred to Mr. F. O. Blackwell's papers on "Transmission Line Construction" before the A. I. E. E. in recent years, and also spoke appreciatively of the chart given by Prof. Harold Pender in the *Electrical World* during 1907. Where there are many long spans the best method is to limit a given size cable to a certain strain under a certain temperature. Regarding transpositions, Mr. Mason said that for telephone work on transmission line poles, these should come about every five poles and on a special insulator. An insulated stand for the operator should be provided. In conclusion the author reviewed recent practice in lightning-arrester construction and high-tension crossing protection. In the Central Maine system 44,000-volt insulators are used on crossings instead of insulators designed for the line potential of 33,000 volts. The pins and cross-arm tops are all grounded, and nothing smaller than a No. 0 wire is used. The transmission line deserves a certain amount of protection by the public because it builds up the industries by which the public may live and helps the best conservation by enabling a vast amount of power to be used from sources that would otherwise be left idle. A demonstration of the methods of inside wiring was also given at the technical meeting.

Midsummer Convention of Automobile Engineers.

The midsummer convention of the Society of Automobile Engineers, held at Detroit, July 28 to 30, was chiefly given over to the discussion of structural problems among the gasoline-car designers. Representatives of half-a-dozen of the principal electric vehicles and manufacturers were among the 150 engineers present, but, with the exception of one paper, the work of the convention did not touch upon subjects of battery cars, nor the ignition, or lighting of the other types of automobiles. Mr. T. V. Buckwalter presented a paper describing the experience of the Pennsylvania Railroad with its electric baggage and delivery trucks at Philadelphia, Washington and Baltimore. Prof. W. H. Bristol delivered a classical review of high-temperature-measuring appliances, leading to the development of the modern pyrometer, which is an important aid in the heat-treatment of steels used in automobile construction. Professor Bristol also described a new type of automatic compensator for correcting for the temperature of the cold-couple in a pyrometer outfit. Mr. E. J. Stoddard presented a paper urging the establishment of a court of patent appeals made up of technically qualified judges.

At one of the sessions of the convention much discussion, generally favorable, was accorded the proposal to arrange all cars to be driven from the left-hand seat, departing from the generally established gasoline-machine practice and following a construction that has been embodied in all electric vehicles for a number of years. This arrangement, as the electric automobile men perceived some time ago, permits the driver to watch out for overtaking and passing cars with the least effort, and when applied to the gasoline machines with their bulky steering and controlling devices, will enable the driver and his companion on the front seat to draw up on the right-hand side of the street and alight directly onto the curb.

Gossip about the convention rooms indicated that next year will be an electric lighted one in the annals of the gasoline car, as most of the better-grade automobile manufacturers will equip their 1911 models with electric side and tail lamps, energized from a 6-volt portable storage battery. Oil lamps will be furnished for emergency use. The improvements in low-voltage tungsten lamps and storage cells and the general equipment of vehicles with electric lighting by their owners have led the manufacturers to add this additional feature. Automatic systems employing a generator driven from the engine shaft to keep the battery charged and supply energy to the lamps while running are also successfully used. Where only a tail lamp is to be operated in conjunction with the two gas headlamps, a set of primary cells may be employed to do the work probably as cheaply as the storage battery, and without the bother of recharging.

The Establishment of a Court of Patent Appeals.

An effort to define the social and legal relations of the engineer and the inventor in their increasing importance to the world at large is contained in a paper entitled "The Establishment of a Court of Patent Appeals," by Mr. E. J. Stoddard, which was read before the midsummer convention of the Society of Automobile Engineers at Detroit, July 28 to 30. The following paragraphs are excerpted from this discussion of the need for improved patent laws in the United States:

"It is proposed to create a court of practically final resort to hear appeals in patent cases, to take the place of the 9 or 10 Courts of Appeal now existing, with their conflicting decisions and numerous disadvantages. The necessity of such a court is obvious and pressing. The bill creating it has been favorably reported on by the House committee on patents and by the Senate committee on patents. It has been referred to the judiciary committee of the House, and is now before that committee. The bill provides for the appointment of a chief justice by the President of the United States, in the usual way, and that the Chief Justice of the Supreme Court of the United States shall designate four Federal judges to sit as associate justices for a term of six years.

"There are certain technical difficulties that the establishment of this court will surely cure. There are many complaints of the present administration of our patent laws. Such complaints are in a large measure just, and the faults remediable. But in remedying existing faults one does not want to introduce greater faults or destroy a right that should be the most sacred and firmly based of all rights to property. The change must be gradual. In establishing this court the service of the whole people must be kept in view, not that of any class or profession. It should not be a court in the interest of manufacturers, of engineers, or of lawyers, but a court that shall administer justice intelligently and carry out the will of the people as a whole.

"Our Federal judges are able and honorable men. Many of them are, perhaps, by education, taste and character, not adapted to cope with the mixed questions of law and engineering that arise in patent cases. On the other hand, it is believed that judges can be selected, as provided in the bill, who will be able to understand and decide justly a case that is properly presented to them, understanding and actualizing the spirit of the times."

It is said that a problem, properly stated, is half solved.

When this court has been established, there will be something definite upon which to concentrate influence and to hold responsible. The problem will at least have been stated.

Outing of Chicago Electric Club.

On board a special train and accompanied by a brass band of 12 pieces, 200 members of the Electric Club of Chicago journeyed to Ravinia Park in the beautiful North Shore suburban region, Saturday, Aug. 6, and after enjoying games, contests and a picnic luncheon, closed an ideal day's outing with a splendid Damrosch orchestra concert. The first event upon arriving at the park was a baseball game between the Married Men's and the Unmarried Men's teams, in which the former won by a score of 4 to 2, after playing three or four innings. No record was kept of the errors.

After a basket lunch, served on tables under the trees, the following athletic events were hotly contested: 100-yd. dash, for men; 50-yd. dash, for ladies; three-legged race, for men; potato race, for ladies; ball-throwing contest, for ladies; fat-men's race, and hobble-skirt race for ladies. In addition to these there were guessing contests as to the attendance at the outing, number of beans in a bottle, and identity of authors from puns on their names. A number of valuable prizes, almost 50 in all, had been contributed through the generosity of electrical business firms in Chicago, and these prizes were divided up among the more successful contestants in each of the events. Ten of these prizes were tendered to the winning baseball team and the elected umpire, Mr. J. G. Pomeroy, who drew lots to determine the order in which the more valuable ones were to be appropriated. Following are the names of the winners in the other contests: One hundred-yard dash, first, G. A. Binder; second, T. D. Montgomery. Fifty-yard dash, first, Miss Holland; second, Mrs. C. B. Schmal; third, Mrs. V. A. Sweet. Three-legged race, second, Vose and Rockwell; third, Stanton and Binder. Potato race, first, Mrs. W. H. Coleman. Ball-throwing contest, first, Miss Holland. Fat men's race, third, G. H. Porter. Hobble-skirt race, first, Mrs. Kadie; second, Mrs. C. B. Schmal. Author-guessing contest, first, Miss Lena Taussig; second, Mrs. C. B. Schmal; third, Mrs. L. Gold. Attendance-guessing contest: Mrs. C. B. Schmal, Miss Marjorie Lee, I. L. Quarles, R. T. Hensel, G. W. Cravens, J. Dolliver and R. Mueller. Bean-guessing contest: Mrs. G. W. Cravens, Miss Anna Jones and Mrs. N. W. Lancaster.

Following the concert by the New York Symphony Orchestra, of which Mr. Walter Damrosch is leader, the special train returned the party to Chicago.

The Engineer as a Professional Man.

Mr. Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City, delivered an address at the commencement, June 15, of Clarkson School of Technology, Potsdam, his subject being "The Engineer as a Professional Man."

One of the most valuable assets in any professional or business career is, he said, tactfulness, and to no one is it of greater value than to the engineer. His theory may be all right, his plans may be excellent, his project may be well conceived and carefully thought out, but it may be presented in such a way that it will not appeal to a superior officer, a commission, or a board of directors. Natural difficulties may be overcome by technical skill or by sheer force of energy and persistence, but prejudices and antagonisms may be aroused which will prove insurmountable. In dealing with men as with nature, it is well to follow the lines of least resistance. If incredulity be met with scorn, if irrelevant questions be ignored or answered with contempt, if objections be treated with impatience, the best matured plans are apt to come to naught.

When a moral principle is involved, the man who will stand or fall by it is always to be commended, and the instances are rare in which he will not win. It is well to get the best we can under the circumstances. The man who will do this is an opportunist. Most men who attain results are opportunists. In fact, it may be said that the tactful man is courteous, considerate of others' opinions and even of their prejudices, is willing to go around rather than through an obstacle, and is an opportunist.

To make success substantial and well worth attainment, one other qualification is necessary, and that is integrity. Not honesty which is merely good policy, not a relative degree of rectitude which is measured by that of other professional or business men, but a devotion to the highest ideals of truth, honor and justice.

The engineering profession is an exacting one; he who follows it deals with natural laws, the infraction of which means disaster; his deductions must be based upon premises which are incontrovertible and which can lead to but one conclusion; polemics and casuistry have no place in his mental equipment. His moral nature should reflect his mental habits, and in all his relations there should be no compromise between truth and falsehood—between uprightness and moral obliquity. It may be said that the professional standard implied by the qualities and habits just enumerated is very high and beyond the reach of most men. It is high, but it is not beyond the reach of any man who is determined to attain it.

For the man who would most effectively serve the public and who would emphasize the dignity and importance of his profession, still more is necessary. The engineer with the liberal training, the importance of which is emphatic, will readily appreciate the necessity of making his work as attractive in appearance as is consistent with utility and economy. Symmetry of form, harmony of color, and consistency in detail, do not necessarily involve additional expense. The American people are coming to realize that beauty is a valuable asset. The engineer must train his own taste in such matters, and he should also be willing and anxious to collaborate with the architect and the artist in order to produce satisfactory results.

Proper equipment for the highest usefulness in the engineering profession depends in large degree upon the use a young man makes of his opportunities during his professional course. The results depend chiefly upon the man himself. The student has the best opportunity to gain that inspiration from the teacher which close personal contact is likely to promote.

Thorough preparation is essential to one who would gain the maximum of benefit from his professional course. There was a time, not many years ago, when engineering was scarcely considered as a profession. That time has passed; engineering is now recognized as the great creative profession, and its dignity and emoluments have correspondingly increased. Engineers should insist that it also be classed as one of the learned professions. The profession is an intensely practical one, but there is every reason why the engineer should be an idealist, provided he is not a doctrinaire.

Convention of Acetylene Association.

The thirteenth annual convention of the International Acetylene Association was held in Chicago from Aug. 3 to 5. Among the papers were two of especial interest to electrical engineers.

MECHANICAL SUBSTITUTE FOR SELENIUM CELL.

A mechanical device for controlling gas valves or other apparatus, turning on the low with the advent of darkness and extinguishing the light with returning daylight, was described by Mr. James Pattison, of Philadelphia, Pa., before the thirteenth annual convention of the International Acetylene Association, held at Chicago, Aug. 3 to 5. The device in its present form is of chief utility for controlling acetylene or gas-lighted buoys or harbor lamps, extinguishing the flame during the daytime and thus working a saving of almost one-half in the gas consump-

tion and attendance necessary for replenishing. The principle of its operation is the difference in expansion between rods of the same material, one rod being gold-plated and polished to render it highly reflective, and the other rods blackened to make them absorb all incident rays. As constructed, three blackened copper rods form the frame of the apparatus, in the center of which the gold-plated rod expands against the short arm of a lever fulcrumed on the frame. The expansion of the blackened rods, having their temperature raised due to absorbing more heat or converted radiant energy, is multiplied by the motion of the lever arm which opens and closes a gas valve. As all the rods are of the same material and undergo the same expansion due to the actual temperature of the air in which the apparatus is placed, the "photostat" is equally sensitive winter and summer and is affected only by radiant heat or light. This method of control is now being experimented with by the Government lighthouse service along the Connecticut coast, and buoys are said to remain in operation a year without attention or replenishing.

Evidently, by substituting an electrical contact for the gas valve in the apparatus, the light-controlled operation of any motion could be accomplished in a manner similar to that effected by the selenium cell, without some of the latter's inherent disadvantages due to high resistivity and relatively small resistance change.

AUTOMATIC STREET LIGHTING.

In a paper on "Automatic Street Lighting," read by Mr. W. A. Cochrane before the acetylene men, he expressed dissatisfaction with present methods of automatic ignition of gas street lamps, remarking that the solution of this difficulty would make the brilliant acetylene flame an active competitor with electrical systems. For acetylene lighting, the maintenance of pilot flames has proven too expensive, and an electric spark coil has been resorted to, with a battery, at each lamp. Using the "two-pipe" system, by which the street lamps are supplied with gas from separate mains from those furnishing gas to householders, a liquid-sealed gas bell is provided in each lamp. To ignite the lamps, the pressure is momentarily raised by several inches of water pressure, causing the bell to rise and open a valve to the jet, at the same time bringing together, in its travel, the two contacts of the local kick-spark coil in series with a pair of dry cells. The spark produced ignites the gas. Inventors are seeking to find some way by which such automatic operation can be secured in a system where street lamps and consumers' private lamps receive gas from the same mains without affecting the customers' lamps.

Massachusetts Commission News.

The Massachusetts Gas and Electric Light Commission has issued an order approving the application of the Salem Gas Light Company for authority to issue 1500 shares of new capital stock of the par value of $100 each, at a price of $140 per share, as determined by the board of directors, to meet the cost of plant additions. The commission has issued a finding authorizing the Taunton Gas Light Company to supply gas in the town of Berkeley. The board has approved the application of the Marlboro-Hudson Gas Company for the right to issue 2000 shares of new stock at the price of $100 per share, as determined by the directors, to meet the cost of plant additions. Consumers of the service of the Plymouth Gas Light Company have petitioned the board to reduce the prices of the company. No hearings are assigned for the remainder of the month, but on Sept. 15 the board is scheduled to give a continued hearing upon the transmission of electricity in Massachusetts, in accordance with Resolve 55, Acts of 1910.

The Middlesex & Boston Street Railway Company has petitioned the Railroad Commission to approve an extension of the time during which a charge of 1 cent may be made for a transfer issued on the lines formerly operated by the Newton Street Railway Company. The company maintains that the income from its service is not capable as yet of giving a reasonable and proper return upon the capital actually invested.

The Massachusetts Gas & Electric Light Commission is now making plans for carrying out the provisions of the new Boston smoke law, passed by the Legislature of 1910. By the terms of the act (Chap. 651) the regulation of smoke is placed under the jurisdiction of the commission within a considerable portion of the Boston metropolitan district. Inspectors are to be appointed by the board as may be necessary, and additions may be made to its clerical staff. The new law provides for time limits of smoke emission from classified chimneys, stationary and locomotive, the smoke being graded according to the Ringelmann chart system. The requirements are to be stiffened each year until 1913, when the full force of the restrictions will be imposed. In the law of 1910 the plants of public service corporations are included in the regulation of smoke. It is planned to improve the economy of fuel consumption so far as practicable in connection with the abolition of the smoke difficulty. The board is required to give public hearings upon complaints relative to smoke matters and its orders are to be clothed with full power to improve any unfavorable conditions. The commission also will have authority to grant permits for the emission of smoke for stated periods, in order to facilitate changes in plant design which may be calculated to better the operating conditions. Land, marine and locomotive stacks are included in the regulation specified by the new law.

Maryland Commission News.

Unable, because of lack of funds, to proceed as it would like to do, the Maryland Public Service Commission is now wrestling with the problem of trying to devise an economical method for carrying out the provision of the law which imposes on it the duty of testing, through its own inspectors, the electric meters in use throughout the entire State. Mr. Louis M. Duvall, the secretary of the commission, when asked last week when the commission would begin the inspection of the meters, said: "Because of the sensitiveness of the instruments it is impractical to inspect the meters before they are installed. I do not mean to say that they cannot be inspected or tested as they come from the factory, but they are so delicate that they are always liable to be knocked out of adjustment during transportation. Now, if the commission is compelled to send its inspectors all through the State in order to inspect and seal the thousands of electric meters now in use, the expense will be so great as practically to exhaust our appropriation. Therefore, it seems that some more economical method must be devised. The New York Commission has exactly the same trouble, I was told. There they have solved the problem by compelling the electric companies themselves to calibrate the meters after installation and then make sworn returns to the commission. Later, if any complaint is received, the commission sends one of its own inspectors to ascertain the cause of the trouble. I was told that this method proves very satisfactory and our local commission may adopt the same system."

For the present the various electric companies throughout the State must equip testing plants for the commission. Superintendent of the Department of Lamps and Lighting of Baltimore, Mr. Robert McCuen, has had several inquiries as to the cost of the city's testing plant, which is one of the best in the country. The Consolidated Gas, Electric Light & Power Company has asked about it and so has a company in Cumberland. It will be for sale after all of the work of testing has passed completely out of the hands of Mr. McCuen. About five employees handle the work for the Baltimore department, and the saving of their salaries will help somewhat in the city's share in the expense of the Public Service Commission. Mr. McCuen will simply have charge of the illumination of the streets in the future.

The United Railways of Baltimore replied last week through its attorney, Mr. J. Pembroke Thom, to the complaint of certain residents of Ellicott City filed with the Public Service Commission, that the fare between that point and Baltimore is excessive. It is stated that the leading merchants of Ellicott City are opposed to a reduction in the fare. In its reply the

United Railways does not admit the jurisdiction of the commission to reduce the existing fare. At the same time the company makes a general reply to those seeking a reduction. The maximum fare between the two points is 15 cents, including transfer privileges in Baltimore. The fare was thought to be excessive on account of the 10-cent fare charged on the Catonsville line and on account of the fact that the residents of the latter suburb get the benefit of a commutation book which makes the trip cost about 7.5 cents. It was also claimed that the railroads make the trip to Ellicott City for a smaller fare than the United Railways charge. As to the latter argument, the United Railways informed the c mmission that it operates 10 times as many cars between the two points as the railroad company, and, therefore, it is necessary to make the additional charge. In the reply it was pointed out that the passengers were conveyed to any part of the city by their transfer privilege, which, of course, was not afforded them with the railroad. The railway company also showed that there was no comparison with the conditions on the Catonsville line. The bulk of traffic on the Ellicott City line originates at Ellicott, while the Catonsville line has several points along the line that cause additional traffic. The company admits the sale of commutation tickets to the residents of Catonsville, but claims that the making of this rate has proven to be a mistake.

In general terms the electric railway company says that the revenue per capita is decreasing, while the expense per capita is increasing in the operation of its lines. One item in the increase, it was pointed out, is the increase in the cost of labor and material.

New York Commission News.

After many months of hearings, the Public Service Commission of the First District of New York last week handed down a decision in the matter of the reorganization of the Third Avenue Railroad Company. The application for this reorganization was made by the Bondholders' Committee last December after a previous proposition had been turned down in September. The new application, which is the one that has just been acted upon, proposed a plan of reorganization which scaled down the capitalization several million dollars. The Public Service Commission, through an opinion written by Commissioner Milo R. Maltbie, denies the application and indicates that the reason for the denial is that the proposed new capitalization exceeds by a considerable amount the actual value of the property. In round numbers, the reorganization committee proposed that the new company issue \$15,790,000 first refunding mortgage bonds, \$16,590,000 capital stock, \$22,536,000 adjustment mortgage income bonds. This made a total capitalization of more than \$54,000,000 and the commission held that upon this amount of stock and bonds no adequate return could be made from the earnings of the company. The reproduction value of the Third Avenue property as figured out by Mr. E. G. Connette, transportation engineer of the commission, is \$42,907,816 and the present value of the property, charging off depreciation, is only \$31,100,125. While the commission indicated that a modified plan or one which came nearer in its capitalization to meeting the ideas of the commission would be sanctioned, it decided positively that a plan which contemplated capitalization far in excess of the engineer's estimate of the value of the property would not be approved.

An order was issued last week by the Public Service Commission of the First District directing the receiver of the Metropolitan Street Railway Company and the receiver of the Fifty-ninth Street, Central Park, North & East River Railroad Company to make transfers at points where the two lines intersect. Transfers were formerly made on the Fifty-ninth Street line at every point of intersection with any other surface line, but after the company went into the hands of a receiver these transfers were abolished. Under the present order the Fifty-ninth Street line will transfer to all lines crossing it between First Avenue and Tenth Avenue.

During the past week a communication has been sent to the Public Service Commission by the Citizens' Union advocating the construction of subways by assessment of the property which would be benefited by the construction. In a long letter the Citizens' Union takes the ground that subways through sparsely settled districts are not likely to be remunerative in operation and that, therefore, it is not right that the city should pay for the expense of construction in such districts or for the expense of operation. A letter was also received during the past week from Mr. Samuel Rea, second vice-president of the Pennsylvania Railroad Company, urging the construction of a subway system down Seventh Avenue, and suggesting that it is a much better plan to permit the Interborough Rapid Transit Company to extend its present subway system along the lines which were proposed than to build a separate outside tri-borough system.

Some friction seems to have arisen between the Public Service Commission and the Board of Estimate as to the terms or forms of contracts which are to be advertised for the tri-borough subway system. The engineers of the Board of Estimate are opposed to certain provisions of the tentative form of contract as drawn up by the commission. These objections, while merely technical, may result in delaying the advertisements for bids for an indefinite length of time.

The terms for the extensions and improvements which are asked by the Interborough Rapid Transit Company, involving the third-tracking of the present elevated structures and the connection with the Queensboro Bridge are for 999 years, or in other words, for the life of the present franchise. Mr. Theodore P. Shonts, president of the Interborough company, has indicated that these will be the only terms upon which his company will seek to construct extensions. It is not believed that the commission will approve any such lengthy franchise.

The Public Service Commission has approved an application of the Second Avenue Railroad Company for equipping electrically its line through Worth Street from Chatham Square to Broadway. The franchise for this line has been owned by the Second Avenue Railroad Company for many years, but the road has not been operated since the days of horse cars because the Second Avenue Railroad Company did not need it. When the Second Avenue line was a part of the Metropolitan system a downtown terminal was furnished through Park Row to the Post Office by the use of the Metropolitan tracks. Since the Second Avenue Railroad Company has been under a separate receiver and has no longer anything to do with either the Metropolitan or the Third Avenue systems it has had no downtown terminal and the electrification of this small piece of track is intended to furnish it with such a terminal. In granting the request of the Second Avenue company for this electrification, the commission required that the company abandon quite a number of streets on which tracks are now laid, but which have never been electrified and are not used.

The Public Service Commission for the Second District on Monday, at Albany, continued the hearing upon an order which directed and required the Dwass Electric Company, of Schenectady, to show cause why it violated certain terms and conditions of the authorization to capitalize previously granted by the commission. On Tuesday, at Albany, the commission entertained the petition of the Southern New York Power Company under section 69 of the Public Service Commissions law for authority to issue \$40,000 in common capital stock. The commission has received applications from the Fonda, Johnstown & Gloversville Railway Company for permission to exercise a franchise for the building of a double track along East Main Street in Amsterdam and an extension of a single-track line to the Eighth Ward. Through cars of the petitioner between Gloversville and Schenectady now run on East Main Street, and the double-tracking will facilitate their operation. This company also filed its petition for leave to issue \$463,000 in 6 per cent bonds, the balance of an issue of \$7,000,000 which was authorized by the Board of Railroad Commissioners in 1903. The proceeds are to be issued to pay off existing obligations and the cost of the double-tracking and Eighth Ward extension.

CURRENT NEWS AND NOTES.

Ohio Convention Attendance.—An analysis of the registration of the Ohio Electric Light Association at Cedar Point July 26 recently made by the secretary, shows that 61 central stations were represented, and there were 156 representatives from those stations in attendance. The analysis brings out the point that a larger number of members from each company are attending these conventions than formerly.

Constantinople Electric Railway.—United States Vice-Consul-General Oscar S. Heizer, of Constantinople, has forwarded to the Department of Commerce and Labor specifications and conditions governing a concession to be granted by the Imperial Ottoman Government to the most favorable bidder for a system of electric tramways in Constantinople and suburbs. Bids for this concession will be received at the Ottoman Ministry of Public Works until Oct. 15, 1910.

American Hydroelectric System in Cuba.—All of the equipment for the hydroelectric generating installation on the Hanabanilla River and the distributing system owned by the Cienfuegos, Palmira & Cruces Railway & Power Company, which has started the work of construction in Cienfuegos, Cuba. will come from the United States. The material will include not only the hydraulic and electric machinery, but the cars, rails, iron pipe and vitrified clay pipe to be used in a water works and sewerage system.

Coal Output in British Columbia.—United States Consul Frank C. Denison, of Fernie, in his annual report states that during 1909 there was a decrease of about 200,000 tons in the output of the coal mines of that Canadian district, as compared with 1908, caused by the suspension of operations in the Crow's Nest district during April, May and June, owing to a disagreement between the owners and miners. The total output in 1909 was about 1,750,000 tons. The output at the Fernie and Michel mines now averages about 5000 tons daily.

Trains in Pennsylvania Tunnels.—The Pennsylvania Railroad will inaugurate its New York tunnel service on Sept. 8, at which time the trains on the north shore division of the Long Island Railroad will transfer passengers at Winfield, where they will be carried in electric trains to New York City. On account of certain regrading and retracking not having been completed through trains will not be operated over the division before next year, when an 18-minute express service will be run between Jamaica and New York City.

Electricity Represented on Capitol Bronze Doors.—One of the eight panels of two bronze doors being placed at the west entrance to the Capitol at Washington has for a decorative subject "Iron and Electricity." On each side of a scene of iron and electrical workers are figures of Peter Cooper and Henry A. Rowland, and medallions show Edison and Baldwin, founder of the Philadelphia locomotive works. In the engineering panel one of the medallions shows Roebling, builder of the Brooklyn bridge, and Cyrus W. Field is the subject of a medallion in the naval architecture and commerce panel. The science panel contains a figure of Prof. Oliver W. Gibbs and medallions of Joseph Henry and Alexander Graham Bell.

Derailment of Elevated Train in Boston.—An unusual accident occured on the elevated lines of the Boston Elevated Railway Company at 1:09 a. m., Aug. 4, when a train in charge of an experienced motorman, making a yard movement near Dudley Street terminal, became unmanageable and was derailed near a switch tower at the corner of Washington and Dudley streets. Two of the four cars composing the train fell into the street and the motorman was killed. There were no passengers aboard. The cause of the accident is unknown, but it is possible that the motorman had a fainting attack and fell upon the controller handle in such a way as to keep it in full multiple. All the cars were equipped with multiple-unit control, and the company's system of inspection is most thorough. The damage to the company's rolling stock and elevated structure is estimated at about $25,000.

Comparison of Lignite and Coal for Fuel.—The Canadian Water, Light & Power Company, of Canadian, Texas, is installing two gas producers and two 13-in. x 12-in. three-cylinder vertical gas engines, each belted to a 50-kw electric generator. It is the intention to operate the machines in parallel when the load requires doing so. A Colorado or New Mexico bituminous coal will be used for fuel, as this coal can be purchased for from $4.25 to $4.50 per ton, while the local Texas lignite costs $3.75 to $4 per ton. The freight cost on lignite, however, is higher than on coal from out of the state. Considering the higher heating value of the coal, it is believed that it will be more economical than lignite for fuel. However, after the plant is in operation experiments will be made with a car of lignite in comparison with bituminous coal, continuous records being kept of all quantities, including the amount of water used, in addition to the fuel efficiency. Mr. C. W. Conrad is manager of the company.

American Trade in Hungary.—In a review of trade at Budapest for the year 1909, United States Consul-General Paul Nash describes the various handicaps encountered by all dealers in American goods by reason of the lack of direct communication. He claims that the retailer trying to buy goods from an American manufacturer is almost invariably referred to an export agent in New York or an import agent in Hamburg. If he then addresses himself to the New York jobber he is generally supplied through the Hamburg agents of the jobber. The result of this roundabout way of doing business is that the average retailer prefers to carry German or Austrian goods, which he can secure in small quantities directly from the factories. The profits of the New York exporter and the Hamburg agent often reduce the margin of profit of the retailer to the vanishing point, or make it necessary to sell at such high prices that the disposal of the goods becomes problematical. With the increased facilities for shipping directly from New York to Fiume, Budapest should be the best distributing point for the Balkan States, but now Roumania, Servia and Bulgaria get their supplies of American goods principally from Hamburg.

American Equipment in Japanese Railways.—Four new trolley lines have been opened recently in the Kobe district of Japan. Four miles of the Kobe Electric Company's line, which will be 18 miles in length, have been opened for service. The generator, rails, poles and air brakes are American, the running gear and machinery of cars English, and the woodwork of cars and overhead wires Japanese make. The Minomo-Arima Electric Railway Company's 18-mile line to mountain summer resorts opened recently. The rails, generators, boilers and running gear and machinery of cars are American, the woodwork of cars and overhead wires Japanese make. The Keihan Electric Railway has opened a line 28 miles long, connecting the important cities of Osaka and Kyoto, and running through other large towns. Nearly all of the materials came from England, though the overhead wires came from the United States, while the woodwork of the cars was made in Japan. The Keishin Electric Railway, from Kyoto to Otsu, and the Uji Electric Railway, from Fushimi to Uji, now building, will connect with this line. The Hyogo Electric Railway has opened [illegible]; it will extend 12 miles along the shore of the Inland Sea to Akashi. The material has come chiefly from the United States, the woodwork of the cars and the overhead wires being made in Japan.

Electrification of Bavarian Railways.—For the purpose of installing a hydroelectric equipment at Lake Walchen for generating energy for the complete system of State railways, the Bavarian Diet has voted $1,500,000 as the first installment. Additional appropriations will be made annually.

German-French Cable Deal.—It is reported that the German and French cable lines have entered into an agreement whereby they are to work together intimately, to use each other's lines in case of interruption, and otherwise to enjoy the advantages of a "community of interests."

Baden Hydroelectric Station.—The Diet of Baden, Germany, is planning to expend $6,500,000 for the establishment of a hydroelectric generating station in the Murg Valley above Forbach, to supply electricity for the state railways and for the state harbor at Mannheim.

Decrease in Southern California Edison Assessment.—The Los Angeles Board of Equalization has made a reduction of $100,000 in the assessed valuation of the Southern California Edison Company franchise to do business. The reason reported for the reduction is the unstable character of the company's stock during the past four months.

Wireless vs. Wire Telegraphy.—The Postmaster General of Argentina is reported to have submitted to the Government a scheme to replace the telegraph system of the country by wireless telegraphy, declaring that atmospheric conditions in Argentina are more favorable to wireless telegraphy than in any other country and that messages are transmitted to distances never reached in Europe.

Fast Signal Equipment Work.—A remarkable record for rapid installation of signal lines was reported on the Indiana division of the Baltimore & Ohio Southwestern Railroad last month when 183 miles of block-signal wire was strung by three gangs in seven days. The territory thus equipped extends from Storrs to Vincennes and from North Vernon to New Albany, and includes 62 offices.

Practical Telegraphy Competition.—The Minister of Posts and Telegraphs of Italy has decided upon an international competition in practical telegraphy during the Turin exhibition next year. The competition will be open to telegraphists of the whole world. Morse, Hughes and Baudot instruments may be used. All governments adhering to the International Telegraph Union, the Imperial Chinese Telegraphs, and the principal private telegraph companies will be invited to co-operate.

German Incandescent Lamps.—Germany's exportation of incandescent lamps has steadily increased since 1901, in which year it amounted in value to $664,000; in 1907 to $2,000,000; in 1908, $4,780,000, and in 1909, $7,856,000. The exportation during the first quarter of 1910 was valued at $3,775,000, against $1,737,000 for the corresponding three months of 1909. This increase is due to enlarged shipments to Great Britain, Austria-Hungary, Argentina, Russia, Denmark and Italy.

Electric Fans on Street Cars.—Motor-driven ventilating fans form part of the ventilating equipment of 12 new street cars just put into service on the West Twelfth Street line of the Chicago Railways Company. These cars are the first of an order of 350 which will be similarly equipped. The motor-driven fan forces 20,000 cu. ft. of air an hour up through electric heaters, which will warm it in winter, insuring a fresh supply of pure air in all parts of the car.

Government Control of Wireless.—In his annual report, Rear Admiral Schroeder, commander-in-chief of the Atlantic fleet of the United States Navy, urgently recommends government control of all wireless plants. The Admiral says his flagship frequently took 200 messages a day, but the work was needlessly interrupted by commercial operators and [illegible] with amateur plants on shore. At times the wireless operations of the fleet were completely suspended.

Wireless in Africa.—The extent of wireless communications in north and northwest Africa can be judged from the fact that wireless telegraphy stations have already been established at Oran and Bizerta on the north coast and at Port Etienne, Dakar and Rufisque on the west coast. Additional stations are being constructed at Timbuktu, Konakry and Monrovia. The erection of stations for military purposes at Figuig, Loango, Libreville and Brazzaville and at Abeshr in the Tchad region is planned. All these stations will ultimately be linked up with the Eiffel Tower. It is proposed to establish communications by wireless telegraphy between Port Etienne and the South American continent.

Water Storage Project.—The New York State Water Supply Commission has just completed the survey of a site for a storage reservoir in the Black River at Hawkinsville, a village in Oneida County. This village will be completely wiped out by the reservoir. It is proposed to construct a dam 130 ft. high and 1500 ft. long with foundations upon the solid limestone which underlies the site. The type selected is an earthen embankment with a masonry spillway. The survey shows that such a dam would impound nearly 6,000,000,000 cu. ft. of water, creating a lake five and one-half miles long and two miles wide at its widest point, and extending from Forestport to a point a mile below Hawkinsville. The purpose of the reservoir is to regulate the flow of the Black River and studies by the engineers show that in so doing it would be possible to utilize this flow continuously to produce 11,220 hp.

Wireless Telegraphy in New Zealand.—The New Zealand Government has invited tenders for two high-power and three medium-power wireless telegraph stations. One of the former is to be located near Doubtless Bay, in the northern part of the North Island, and the other near Bluff, at the extreme south of the South Island. These two stations are to have a minimum range oversea of 1250 nautical miles, and are to be capable of signaling with the high-power station that is being installed by the Australian Commonwealth near the entrance to Sydney Harbor, and with each other. They are also to be capable of receiving calls from Fiji, from men-of-war at long and short distances, and from commercial vessels. The high-power station at Doubtless Bay is to be the first to be erected. The three medium-power stations are to be erected at Cape Farewell, Gisborne and at Sumner (near Christchurch). They are to have a range oversea of 500 nautical miles. Systems that may be suitable for wireless telephony as well as telegraphy are to receive consideration. The tenders are to be delivered Dec. 15.

Proposed Tax Basis in Favor of Electric Automobiles.—The results deduced by several engineers who have had considerable experience with automobile trucks and commercial vehicles, as well as with pleasure carriages, as recounted at the recent Detroit convention of the Society of Automobile Engineers, indicate that the wear of tires (also the destructive action on the road surface) follows a law in which it is proportional to the product of the square of the speed of the vehicle, multiplied by its mass: $\text{Wear} = \text{speed}^2 \times \text{mass}$. In conjunction with the American Automobile Association, the engineers' society is endeavoring to formulate suggested laws, to be laid before legislatures having the passage of automobile tax bills up for consideration, in which more nearly due account shall be taken of the rational factors entering into the state's charge for the use of the roads. The society, as well as all automobile users, recognize that it is unfair to tax an electric runabout at the same rate as a heavy 150-hp racer capable of running at 90 miles an hour. If some formula can be worked out for the problem, adjusting the tax to the road wear, which increases as the square of the speed and the first power of the weight of the vehicle, the electric automobile will benefit in its tax proportion, from its lighter weight and limited speed.

ELECTRIC PLANT AT MESSINA, ITALY.

Description of the Station Which Survived the Earthquake of 1908.

THE electric plant at Messina, Italy, is of recent creation and is indirectly controlled by the Società Elettrica della Sicilia Orientale, which owns several waterfalls in the eastern part of the island of Sicily. Of the hydroelectric stations which this company contemplates building two are nearing completion and will be placed in service shortly. These are located on the river Cassibile, some 17 km (10.5 miles) south of Syracuse and on the Alcantara, a river running along the northern base of Mount Etna and fed, in its lower course, by the snows of that volcano. These two generating stations are separated about 150 km (93 miles) from each other and will be run in parallel so as to deliver electrical energy over the whole eastern coast area—the richest and the most densely populated of the whole island.

Messina will be one of the many transforming and distributing centers. Meanwhile a steam-generating station has been built in Messina to supply the town with electrical energy until the water-power stations have been completed, and this will afterward serve as a reserve station. As Messina is not an industrial town and a considerable portion of the load is, consequently, lighting load, it was decided to provide the plant with a storage battery, which would permit the installation of smaller generating units. Inasmuch as it was intended at the same time to distribute electricity to the suburban villages and to use afterward the energy coming from the hydroelectric plants, alternating current was adopted for general distribution and this was converted into direct current for supplying of the central part of the town. The plant therefore comprised an alternating-current generating station near the seashore and a rotary converter substation situated in the higher part of the town at a distance of about one mile from the power house.

GENERATING STATION.

The general outward appearance of the generating station before the earthquake was just as it is shown in Fig. 4 except that the building was not propped up and the chimney was of masonry and not of iron. The boiler-room (Fig. 5) contains two Babcock & Wilcox boilers with automatic stokers. Each boiler has a heating surface of 170 sq. m (about 1860 sq. ft.) and a superheater of 36 sq. m (388 sq. ft.) producing steam at the temperature of 350 deg. C. (392 deg. Fahr.) and a pressure of 12 kg (170 lb.). On their way to the chimney the products of combustion pass through a Green economizer. There is room for a third boiler of similar rating.

The engine-room (Fig. 1) contains two generating sets, each one consisting of a horizontal tandem-compound steam engine driving a three-phase alternator and a belt-driven exciter. The double expansion steam engines, built by Franco Tosi, of Legnano (Italy) are equipped with Woolf valves and have surface condensers. The full-load rating of each engine at a steam pressure of 170 lb. is 505 hp.

The 48-pole, 50-cycle, three-phase alternators, furnished by the Italian Allgemeine Elektricitäts Gesellschaft-Thomson-Houston Company are of the revolving-field type. The weight of the revolving part is 22,400 kg (50,000 lb.) and the diameter 3.64 m (12 ft.). The rating of each alternator is 345 kw, with 80 per cent power-factor. The tension at the terminals is 5250 volts. Each of the 33-kw exciters is an interpole machine, belt-driven from the outward revolving field of its respective alternator, and runs at the speed of 725 r.p.m., generating current at 150 volts. From this generating station a six-wire, 5250-volt line ran around the town to the rotary-converter substation.

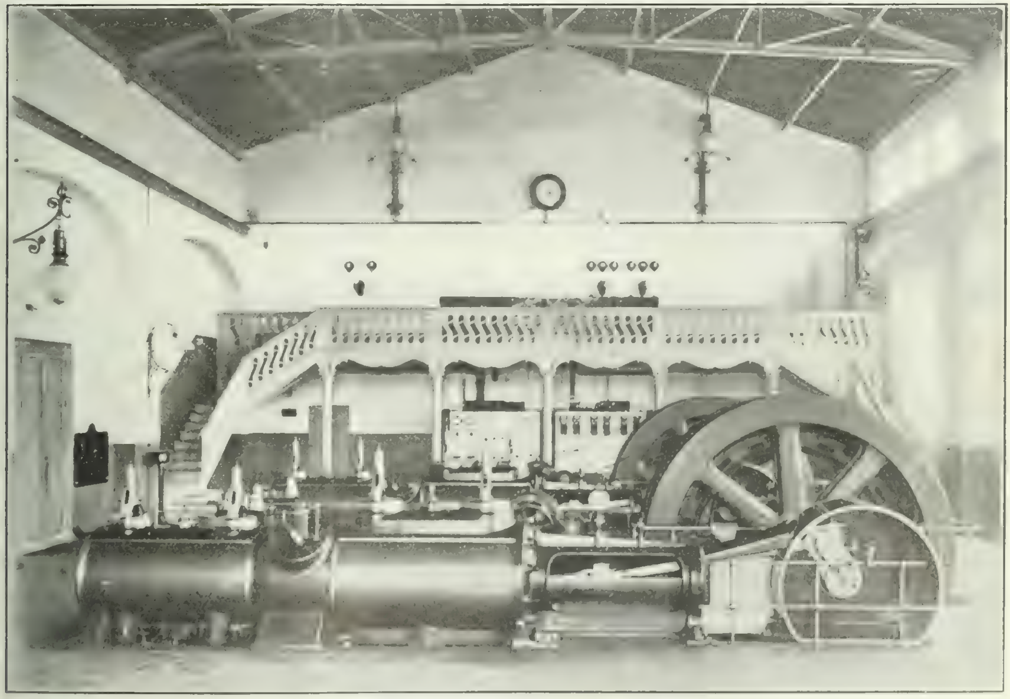


Fig. 1. General View of Generating Room, Messina.

ROTARY CONVERTER SUBSTATION.

The rotary converter substation situated in the high part of the town was a two-story building, the ground floor of which contained a storage battery of 1188 amp-hours capacity with a maximum discharge current of 396 amp, supplied by the General Italian Storage Battery Company of Genoa. It consisted of 276 elements and was connected to a three-wire, 250-volt distribution system. In the small hours of the night this battery supplied the energy for lighting the town, all the machines at the generating station and at the substation being then stopped. Owing to this circumstance no damage was done to the generating station machinery at the time of the earthquake.

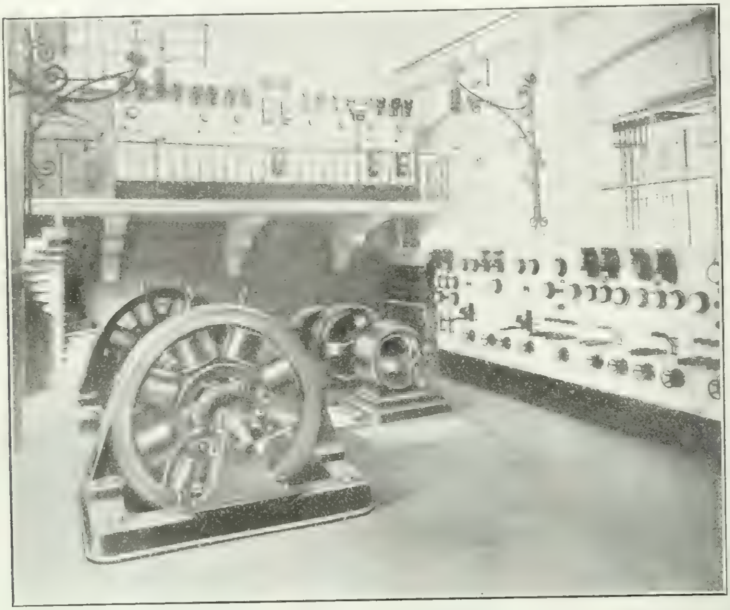


Fig. 2—Rotary Converter Substation.

The electric machinery was situated on the first floor and consisted of two step-down transformers, two rotary converters, one booster set and the switchboard, all furnished by the Italian Allgemeine Elektricitäts Gesellschaft - Thomson Houston Company. The transformers were of the three-phase, oil-cooled type, the rating of each being 240 kw at 5000/330 volts.

The eight-pole rotaries, running at the speed of 750 r.p.m. and generating direct current at a pressure varying from 450 volts to 500 volts, were provided with a special regulating dynamo mounted on the same shaft. The booster set for charging the storage battery consisted of a 100 hp, shunt wound, 450-500 volt motor driving at the speed of 1000 r.p.m. two shunt-wound dynamos, each one able to give 400/400/300/250 amp at 25/50/87/130 volts. Figs. 2 and 3 give a very accurate idea of the substation.

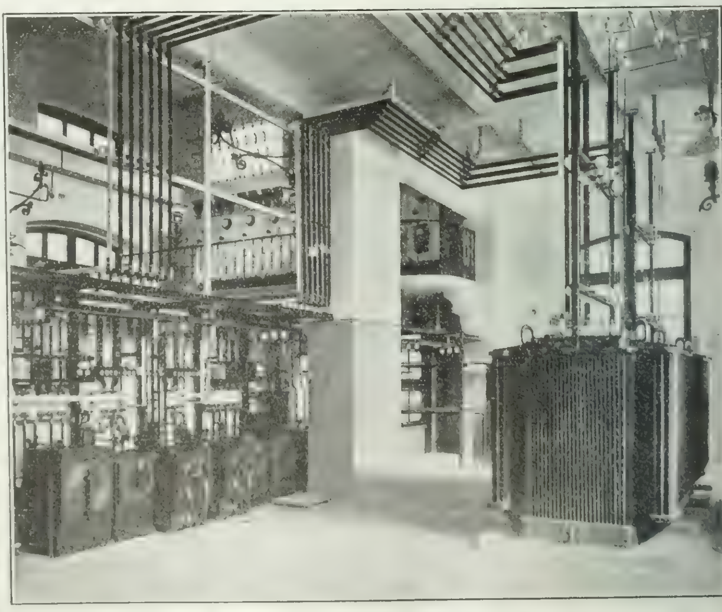


Fig. 3—Rear of Substation Switchboard and Step-Down Transformers.

EFFECTS OF THE EARTHQUAKE.

The plant was put in service in November and was therefore running more than a month, when, early on the morning of Dec. 28, 1908, Messina was completely destroyed by an earthquake and almost the entire population buried beneath the ruins. The distribution network naturally shared completely the fate of the town. The poles, brackets, insulators and wires were either broken, torn, bent and distorted, or buried beneath the huge heap of débris filling all the streets.

The substation was also destroyed in great part. The roof and the floor of the first story collapsed, together with part of the walls. The two rotaries and the booster set fell down on the ground floor, but were not damaged on that account. They suffered seriously afterward, however, having been drenched by heavy and continuous rain before it was possible to take any steps for their protection. The two switchboards, shown in Fig. 2, remained upright, but the marble slabs were broken into small pieces, which were held together by the wiring on the back of the panels. That portion of the building which is shown on Fig. 3 was left with its roof partly in good condition, so that the transformers did not suffer.

In the storage-battery room the elements were upset and lay on their sides still connected up in rows. When one thinks of the great weight of a row of some 90 big secondary cells, all held together by soldered connections and of their slight elevation above the floor level, he can obtain an approximate idea of the enormity of the shock.

Fig. 4—Propped-up Walls of Generating Station and New Iron Chimney.

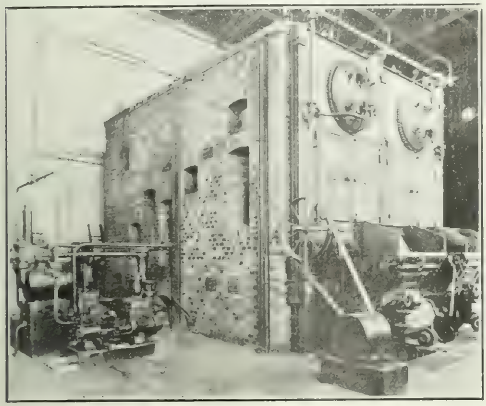


Fig. 5—View of Boilers and Feed Pump.

Fig. 6—Repaired Engine Room.

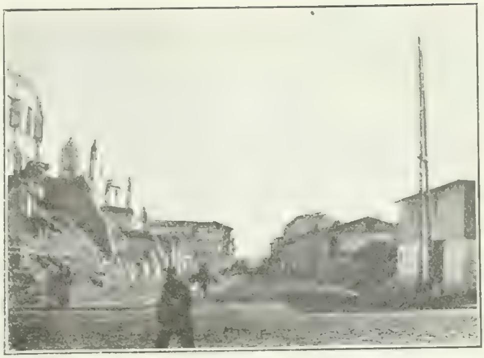


Fig. 7—One of Destroyed Streets Lighted by Arc Lamps.

Fig. 8—Propping Up Cracked Walls.

Fig. 9—Method of Sustaining and Repairing Cracked Walls.

The effects of the earthquake on the generating station were not so destructive. They showed some peculiarities, however, from which some indications might be drawn as to the most rational way of building dwellings in countries subject to earthquakes. The masonry chimney fell to the ground shattered to pieces, as shown on Fig. 11. In falling, the mass of bricks went through the roof of the boiler-room, burying completely the economizer and damaging the feed-water pumps.

The ground under the building showed two longitudinal fissures, and the whole building was badly and very dangerously cracked, as can easily be seen by reference to the illustrations. The doors, whether shut or ajar at the time, jammed so as to make it impossible to move them; many keystones were shaken out of place and hung ominously down, and the walls of the engine-room separated almost entirely from one another at the four corners, although remaining perfectly vertical. Notwithstanding all that, the building stood upright as Fig. 4 shows it, except that it was not then propped up and the iron chimney was not then made.

In the basement of the generating station a curious effect was noted. The steam pipes connecting the engines to the boilers were suspended in the air, while the three supporting brackets (only two of which are seen in Fig. 9) were some 12 cm (4.5 in.) below the pipes. This circumstance, together with the fact that the four walls of the engine-room were cracked and separated from one another at the four corners and the presence of fissures in the soil, shows that the longitudinal walls of the engine room sank about 4.5 in. relative to the gable-end walls.

Fig. 10—Street in the "Wooden" Quarter of New Messina.

Not a single piece of piping between the boilers and the engines was broken or bent, and when the alternators were moved by hand they revolved together with the steam engines quite easily and smoothly, thus showing that there had been no relative displacement in the whole block of foundations. The foundations being made of concrete and being, so to speak, fitted with foundation bolts and other iron pieces, so as to bear some semblance—though a very remote one—to reinforced concrete, it seems to the writer a good inducement to use reinforced concrete in all countries subject to earthquakes.

REBUILT PLANT.

The prospects were gloomy enough for the company. The plant seemed irremediably ruined; the distribution net and the substation existed no more, and though the engines and boilers at the generating stations were still in good condition, the switchboard was damaged, the chimney destroyed and the whole power house so badly cracked as to render ingress and egress dangerous. Above all, the town and a population of about 180,000 inhabitants had disappeared. Therefore, the managing director of the company, Mr. Emirico Vismara, deserves really to be complimented for his farsighted faith in the rapid resurrection of the town, which led him to convince the board not to abandon the field, and for the pluck and energy with which he conducted the work of repairing and reconstruction.

The substation, because of its position which rendered the transportation of machinery quite impossible due to the absolute lack of roads, was neglected for the time being, all the efforts being concentrated on the generating station. In order

Fig. 11—Destroyed Chimney of Generating Station.

to begin the service anew as soon as possible, it was decided to postpone the definitive reconstruction of the power house till after the completion of the hydroelectric plant on the Alcantara, when the Messina plant would become a reserve station and when it would be possible to stop the generating sets for a certain time. Meanwhile the building has been thoroughly propped up; an iron chimney has been set up in the place of the destroyed one; the switchboard, boilers and all accessories put in working order again, and a new distribution network supported on wooden poles has been rapidly spread all over the dead city and the new wooden huts, which were rapidly growing from out the soil, so that in June, 1909, the plant was again working in full swing. It has been working now over a year

Fig. 12—Reconstructed Base of Chimney and Repaired Roof of Boiler Room.

and not a brick in the propped-up building has moved during that time.

The reconstructed plant works exclusively with alternating current, generated at 5250 volts and reduced to 275 volts in four transformer cabins, the distribution being three-phase with a

neutral wire. One thousand incandescent lamps and 215 flame arcs constitute the public lighting load. Besides these there is

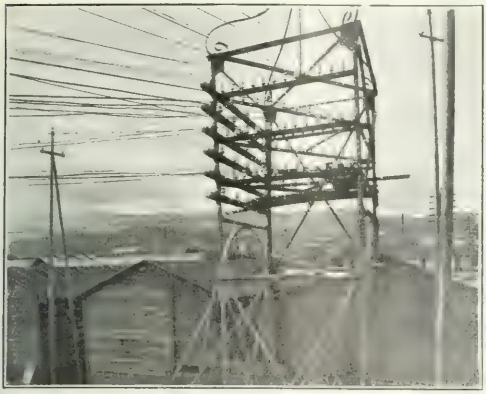


Fig. 13—Tower for Wires at Generating Station.

an ever-growing number of lamps in houses. The distribution network already embraces about 4000 wooden poles, and is steadily growing as the stricken town is gradually waking to new life again. There are now about 60,000 people in Messina. The electric plant has contributed not a little to this rapid development by supplying an easily transportable energy and a safe means of lighting the wooden huts of the new town.

HYDROELECTRIC GENERATING STATION AT TROLLHÄTTAN, SWEDEN.

The Swedish government is carrying out at Trollhättan, a well-known tourist resort, one of the largest power schemes in Europe. After many years of litigation, the government's rights to utilize the waterfalls at that place have definitely been recognized, and by purchasing the interests of a private canal company, which owned considerable sites in the neighborhood of the falls, the government has been enabled to begin the first state power station.

The Swedish government has also obtained control of all the water power available on the Göta River between Lake Vänern

Fig. 1—Trollhattan Falls

and the sea, by purchasing other falls in the district, so that the power aggregates about 200,000 hp. It is thus also authorized to regulate the water level in the Vänern Lake, so that the best possible results of regulation of water overflow and storage can be obtained.

The generating station now under construction at Trollhättan is intended for eight 12,500-hp generators, of which only four are at present being installed. The electrical equipment, including the transformers and exciters, was built by the Allmänna Svenska Company. The generators are rated at 11,000

Fig. 2—Site of Generating Station.

kva, 25 cycles and 11,000 volts, and are the largest generators yet built in Europe. They are designed to run at 187 r.p.m. and

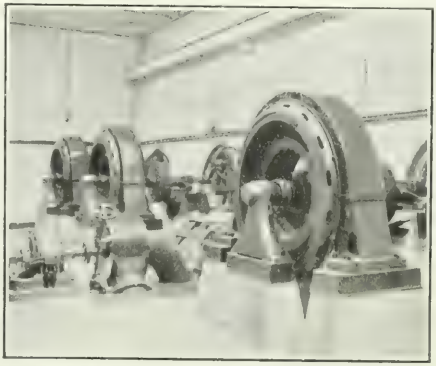


Fig. 3—Small Power Station at Trollhättan.

generate three-phase alternating current. The weight of each rotor will be not less than 65 tons, and the total weight of the

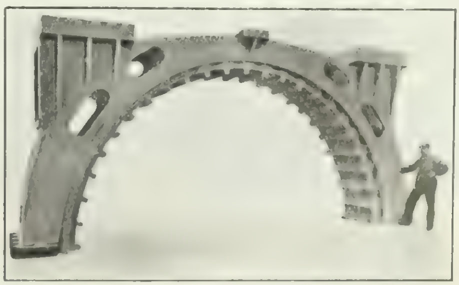


Fig. 4—Lower Half of 12,500 HP Three-Phase Generator.

generator 160 tons. In order to insure noiseless running, and to keep a constant generator room temperature, the alternators are enclosed. The large quantity of heat developed is used partly to heat the feeder and switch house, and partly to prevent the formation of ice on the racks during the winter. The

necessary air is led to and from the generators in closed air ducts. The lower half of the stator of one of these machines is shown in Fig. 4.

The station is built on a plateau blasted in the rock near the gorge. Above it at some 300 m distant is the transformer and switch house. The connection between these two buildings is made through a blasted tunnel 2 m high, allowing ample room for the inspection of the lead-covered cables, which are mounted on side brackets. All of the instruments and control apparatus, with the exception of the oil switches, are placed in

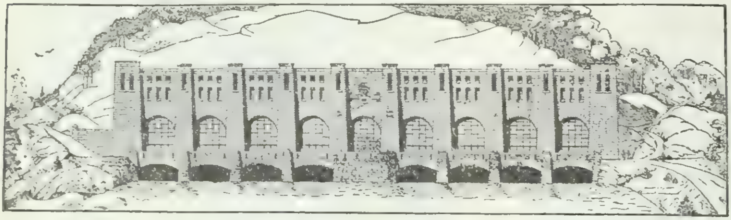


Fig. 5—Exterior of Swedish State Power House.

the switch house and operated from there. The main oil switches for each generator are, however, placed in the power station, but are controlled from the switch house. The transformers are of the single-phase, oil-insulated, water-cooled type, and step-up the potential to 50,000 volts, the highest transmission yet employed in Europe.

From the station, besides the local distribution of 10,000 volts, transmission lines go to Gothenburg, 70 km distant, and an equally long line traverses in an easterly direction to Skara, which will eventually be extended still further east. The eastern line is already built with two transformer stations, one at Hakantorp and one at Skara, for 1755 and 1050 kva respectively.

The electric transformer stations, which were built by the Allmänna Svenska Company, receive energy from a small temporary power station at Trollhättan. As soon as the large station is completed these transformer stations will be fed from

Fig. 6—50,000-volt Transformer Station at Skara.

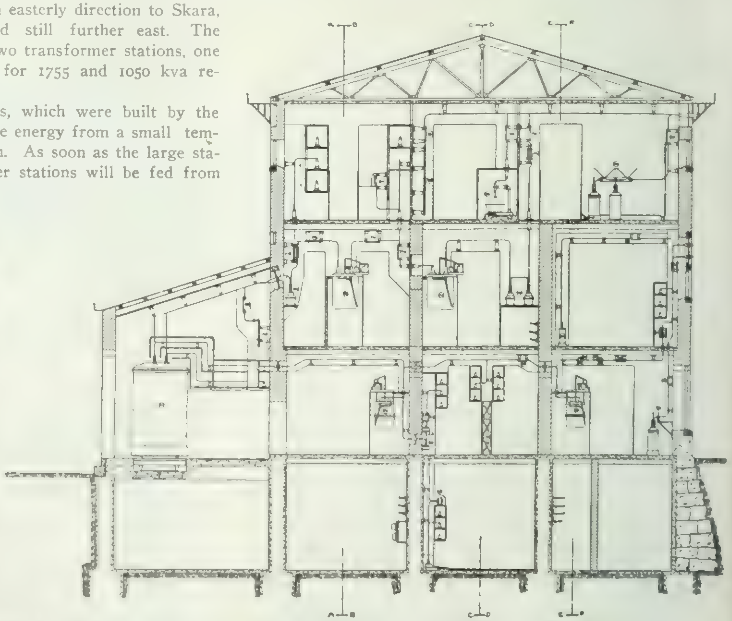


Fig. 7—Sectional View of Trollhättan Switch House.

it. The line to Gothenburg ends in a transformer station rated at 20,000 hp.

The Trollhättan hydroelectric generating station is the very first plant in which the ventilation of the generators has been carried out in such a way as to utilize the heat, representing the losses in the generators for utilitarian purposes. The scheme of heating the racks to prevent their clogging with ice during the winter season is not new; but the heat from electrical machinery has never before been used for this purpose.

ELECTRIFICATION OF ITALIAN STATE RAILWAY.

Three-Phase Freight Locomotives of the Giovo Line.

By Warren H. Miller.

THREE-PHASE electric locomotives have been adopted by the Italian State Railways for new lines in process of construction and electrification, mainly because of the favorable experience with three-phase traction on the Valtellina Railway during the last seven years. The extent of new three-phase traction at present laid out under a parliamentary appropriation of 300,000,000 francs, comprises ten lines as follows: Ponte Decimo-Busalla, Genoa Tunnel, Savona-San Guiseppe, Domodosola-Iselle. Gallarate-Arona, Gallarate-Laveno, Milan-Lecco, Bardonnecchia-Mondane, Naples-Salerno, and Pistoja-Bagni della Porretta.

For two of these lines 40 locomotives, mostly freight, have already been ordered, because freight is the main traffic on them. The first of these locomotives was built by the Italian Westinghouse Company in the shops at Vade Ligure and tested on the Valtellina line, because the Giovi line, for which it is intended, was not at that time ready. Since then the Giovi line has been brought to the first stages of practical operation and trial runs have been made over the Genoa section. The tables and data given herein were very kindly furnished by Herr Karl von Kando, engineer-in-chief, whose work in three-phase traction on the Swiss and Italian State lines is well known.

As will be noted from a glance at the illustrations, the mechanical drive is by connecting-rods coupling all five wheels on a side, the center wheel being without flanges and being driven directly by two induction motors acting on its pin through a solid-beam connecting-rod, which receives the torque directly of both motors. To allow for track curves the pins of the central wheels are spherical. The curves negotiated are of

about 1200 ft. radius. The motors are three-phase, 3000-volt, 15-cycle machines arranged to run in series and parallel, giving two synchronous speeds of 112½ and 225 r.p.m., intermediate speeds being obtained by inserting resistance in the circuit.

A limit of 60 tons was set for the actual weight of the locomotive as built, with provision for increasing this to 75 tons by the addition of ballast. Practical operating tests for the amount of actual friction weight required were called for by the specifications, a train load of 380 tons of loaded freight cars being specified as the amount that two locomotives would have to haul up a 3.5 per cent grade on 1200 ft. radius curves, one locomotive pushing and the other hauling. Allowing 60 tons weight to each locomotive, the total weight hauled would then be 500 tons, and, allowing one-fifth the weight of both locomotives for tractive effort, the total drawbar pull would be 24 tons. Heating specifications for the motors give a maximum allowable temperature of 75 deg. C. above air temperature on 117 amp at 3000 volts at the end of one hour's continuous service. This is considerably hotter than would be permissible for such service, continued hour after hour, but in practical railway service it is not unusually severe. The train service tests call for 400 tons for one locomotive on practically level track, no curves less than 550 ft. radius, with thirty stops per hour at a speed of 22½ km, without any undue heating of the motors.

Fig. 1—Three-phase, 60-ton Freight Locomotive for Giovi Line, Italian State Railways.

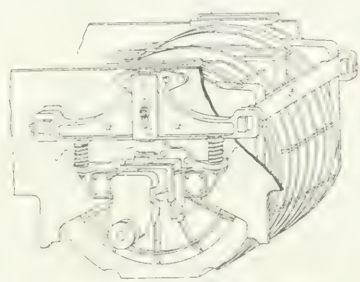


Fig. 3—Three-Phase Induction Motor.

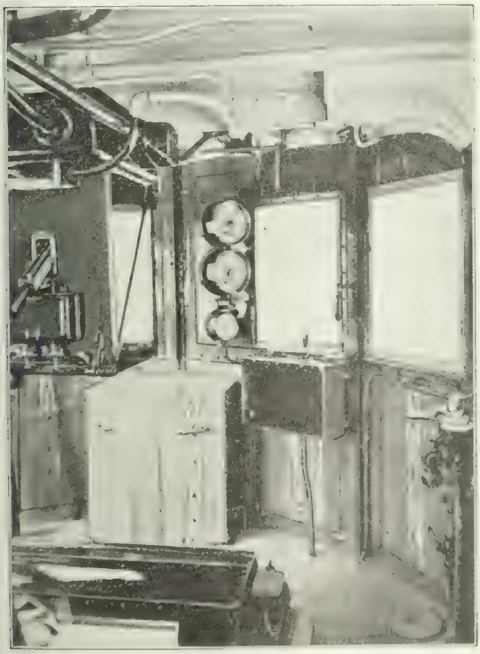


Fig. 2—Interior of Cab—Multiple Control Apparatus.

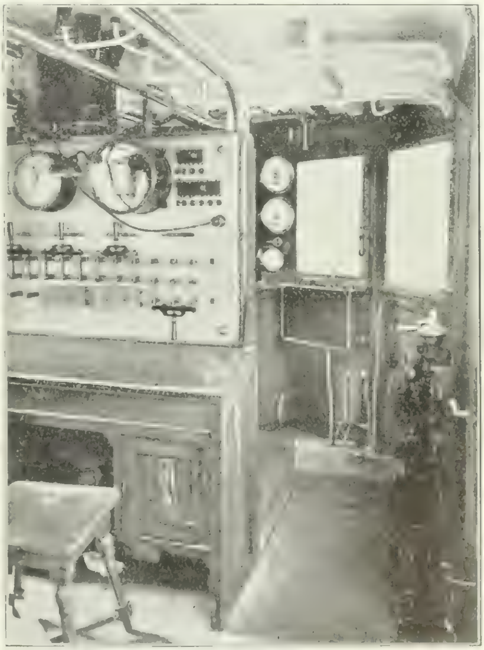


Fig. 4—Interior of Cab—Secondary Circuit Panel.

The arrangement of motors for direct drive is worthy of note. The motors have double frames, the outer of which, built into the main locomotive frame, carries the reactions of the frame, takes the thrust of the connecting-rods, and is provided with springs *ff* (Fig. 3) and yoke *aa* to take up all motion or change of position due to shocks, ballast on locomotive frame, etc. The main frame holds the motor proper and has for its function only the maintenance of air-gap, etc., so that the entire motor is virtually independent of all changes of position with respect to the locomotive frame members, being always free to act on the connecting-rod regardless of load and shocks, by virtue of the springs *ff* and guides *ll*. The motors are slipped into place in their outer frames from below by

means of a hydraulic jack. Taking out a damaged motor, including taking off connecting-rods, is not over a two-hour job.

The trolley arrangements are very simple. A single bow engages both overhead wires, the mechanical part of the bow being a steel shaft running in ball bearings between the two arms of the bow, and the electrical part consisting of two hard bronze sleeves over fiber bushings on the common steel shaft, with a completely insulated section of about a foot in the

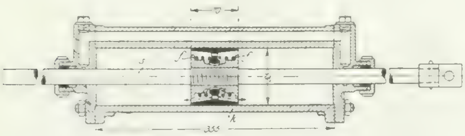


Fig. 5—Oil Damper.

middle of the bow. Energy is taken off each sleeve by suitable brushes and flexible copper leads, and the circuit runs down the motor wires to the insulators as shown in Figs. 1 and 2. The bow arms are double and are hinged at the ends as shown in Fig. 1, so that the bow risers are free to trail in a direction opposite to the direction of motion of the locomotive. The upper stanchion of the bow arm is attached directly to a compressed-air piston, by which it is raised until the bow is in contact with the trolley wire, which varies in height from about 18 ft. to 14 ft. above the track. In maintaining the bow against the wire an oil-damper shown in Fig. 5 is used. As will be seen by a few minutes' study of this device, it will permit a gradual lowering or raising of the bow, because the passage of glycerine through the center of the piston is always free by reason of the small springs on either side of it keeping the piston-rod from closing the valve in the center of the piston. Any sudden jolt or jar liable to knock the bow clear of the wire is resisted by the glycerine, since the small springs are at once compressed in the direction of the disturbance, allowing the piston to lock the glycerine fast, except for the small holes in the web of the piston.

The motor circuit, after leaving the insulators on the roof, passes through lightning-arresters to circuit-breakers and thence to the main oil-switches, which also serve as emergency breakers. From here the circuit leads to a compressed-air-actuated six-point controller, and passes thence directly to the stators of the motors, into each of which is also built a compressed-air-actuated switch, arranged to connect the motors in series or in parallel. This switch also controls at the same time the rotor circuits of both motors, interposing a water rheostat when the motors are operated in parallel, and, when in series, connecting the rotor circuit of one motor with the stator circuit of the other motor. All 3000-volt wiring is run in steel conduit, with cast-iron junction, switch and outlet

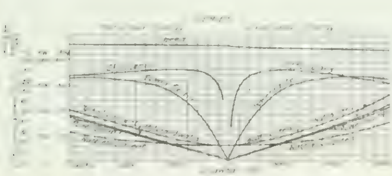


Fig. 6—Performance Curve.

boxes, which are all closed with the same key. This key also locks the trolley-bow mechanism, and cannot be gotten out of the lock except when the bow is down and clear of the trolley wire. By this simple arrangement it is impossible to unlock any of the 3000-volt boxes and get at the wires or fix controller fingers unless the trolley bow is down. Neither can the bow rise to the wire unless the key is back in its lock again. The management of the Italian State Railways considers this simple safety device to be one of the controlling factors in preventing accidents through carelessness on the part of the operating force.

The interposed rotor resistor consists of a kind of variable water and iron rheostat. The resistor bars hang in the upper part of the mechanism, while below them is a tank of water, the level of which can be raised by compressed air. As the level of the water rises higher and higher around the electrodes, the resistor is short-circuited more and more, until, at the highest point, the metal contact keys close, completely shunting the resistor. To control the action of the compressed air, two solenoid mechanisms operate the valves which regulate the entry and exit of the air. The energy supply to one solenoid can be regulated at will, while that of the other is dependent upon the torque of the motors. The water rises or falls as one or the other solenoid has the stronger effect, and thus it is possible to hold the torque and consequently the tractive effort of the motor constant during the acceleration of the train.

The Westinghouse system of air-operated switches performs all the functions of bringing on in regular order all the various switches and resistor controls needed in starting in the desired direction and at the desired final speed, including switching in the motors in series and parallel. A system of multiple control is provided for by a six-wire cable connecting the electromagnetic starting gears for two or three locomotives in tandem, so that one man can start all of them from a single controller which acts on the compressed-air-actuated switches of all the

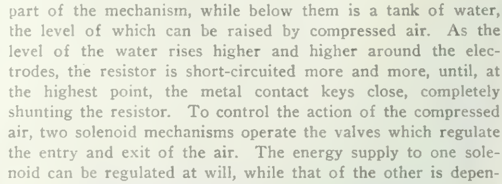


Fig. 7—Performance Curve.

locomotives. It also operates all the resistors by multiple control, a small Stillwell regulator permitting the e.m.f. of the circuits passing through all locomotives to be regulated at will. While the principle of this instrument makes it act equally on all the locomotives in multiple, in practice it is desirable to have some arrangement whereby one locomotive could accelerate at a different rate than the others; for instance, to allow the shoving locomotive to push harder than the hauling one for greater safety of the train couplers. This has been provided for by arranging the regulator transformers with taps.

When the stator of the leading locomotive is in circuit and the rotors short-circuited, the speed of this locomotive becomes the standard of speed for all the others, a very important advantage, because it permits engines of different makes, with old or new tires, or other conditions affecting their speed, to run in multiple control without any one locomotive becoming unduly overloaded, due to reaching its synchronous speed before the others.

To complete the discussion of electrical details mention may be made of the auxiliary compressed-air and air-blast apparatus, located under the front and back hoods of the central cab. There are two compressors driven by 6-hp, 100-volt induction motors, a blast fan rated at 3 hp, and two 6-kw, 3000-100-volt transformers. The latter are independent and either one can run the compressors, blast-fan and secondary starting-gear circuits, so that if the fuse of one transformer is ruptured through any disturbance in the high-tension line, the other transformer is available.

The performance curves in Figs. 6 and 7 show the characteristics of the motors in series and in parallel. Road tests of the locomotives show a development of 2000 hp on a current con-

sumption of 320 amp; the weight of the locomotive with filled sand-boxes and water-resistor being 60.2 tons. This gives a performance of 33.2 hp per ton.

With the Maffei steam locomotives giving 16.2 hp per ton and the Swiss and German electric single-phase locomotives ranging from 12.5 to 18 hp per ton delivered at the draw-bar, the three-phase locomotive seems to have a comfortable margin in its favor. Great haulage capacity per ton of weight is always a desideratum, especially in roads with heavy grades. With the German single-phase locomotives it does not exceed 11 per cent more than the equivalent steam locomotive, but the ratio between steam, single-phase and three-phase locomotives in trainloads hauled per ton of locomotive weight runs 1.9 for the steam, 2.7 for the single-phase, and 5.45 for the three-phase type. As the cost per ton of the electric locomotives is, if anything, in favor of the three-phase type, it is clear that the cost of locomotives per ton haulage capacity of rolling stock is more than twice as great for the single-phase as for the three-phase type.

In the matter of economy, conclusive tests made with these locomotives showed that a return of about 55 per cent of the energy was feasible on the down-grade stretches. Examination of the performance curves shows that in parallel operation an efficiency of 95 per cent is obtained between 3½ tons and 8 tons torque on the wheel rim, and over 90 per cent for loads over 1¼ tons to 3½ tons, and from 8 tons to the limit of the motor. In series the motors show 89 per cent maximum efficiency and over 85 per cent between 2 tons and 10 tons. The latest single-phase motors in locomotive service have a maximum efficiency between 90 and 92 per cent, dropping to 80 per cent with the lower impressed e.m.f.s on starting. These figures alone show that each system has its own best special cases of traffic service, so that no universal rule can be laid down; but without reckoning any return of energy lost in the transformers of the single-phase locomotive, its total energy consumption averages higher for general traffic than the three-phase locomotive.

Possibly the biggest advantage of the single-phase system lies in the absence of the loss in interposed resistance in starting inherent in the three-phase system. Taking the nearest available parallel case, that of a 325-ton train on the Prussian lines against a 412-ton train on the Italian lines, both tested on straight, level track, it is assumed that 10 per cent of the total moving weight will be the tractive effort in bringing the trains up to speed, whence 4 kg per ton will be the average rolling friction. Friction loss in gears of the single-phase and in con-

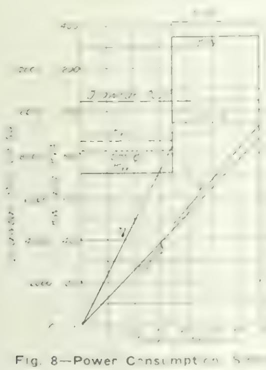


Fig. 8—Power Consumption, Single-phase.

necting-rods of the three-phase are taken at 5 per cent, and the starting arrangements of both types are assumed to be the most efficient that have been devised for their respective types. Then the curves in Figs. 8 and 9 show the energy consumed by the three-phase machine to be 19,200 watt-hours and for the single-phase 13,000 watt-hours in bringing their respective trains up to a speed of 44 km an hour, or for the former 21,350, and for the latter 19,750 volt-amp hours. Reducing both to useful work, the watt-hours per ton for the three-phase induction machine are 54.4, and for the single-phase machine 47.2, or in all 15.2 per cent difference between the two. This takes no account of transformer losses in the equipment, which, of course, would still further increase this difference. In straight, level track, as is noticeable from Figs. 6 and 7,

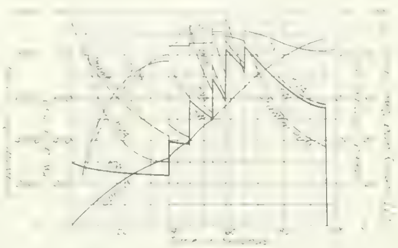


Fig. 9—Power Consumption, Three-phase.

there is no great difference in energy consumption, while under way at full speed; but on alternate up and down-grade for mountain service the advantages inherent in the three-phase system begin to tell heavily in its favor and far outweigh the small losses in starting trains from stations. The returned energy at 45 km and 22½ km per hour speed, at heavy grades such as the 2.6 per cent grade from Biasca to Ariolo on the Gotthard line, reached 55 per cent. On the Giovi line with 3.5 per cent it reaches above 60 per cent. In such cases the energy consumption of the single-phase train without return of energy will rise over 2.6 times as much as the three-phase with this advantage. It is outside the limits of this paper to discuss the effects of this on the power equipment in general, nor indeed the general considerations upon overhead and power-station equipment introduced by the choice of three-phase or single-phase locomotives.

AN IMPEDANCE PARADOX.

By F. M. Denton.

It is a striking fact that the impedance of a circuit consisting of an ohmic resistance in series with either a condenser or an inductance may, under certain conditions, be *reduced* by shunting the condenser or inductance with an ohmic resistance.

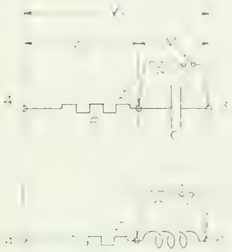
If, in Fig. 1, C represents a 20-mf. condenser, R a 100-ohm non-inductive resistor, and r a non-inductive resistor having a resistance of 250 ohms, then the current produced through R on application of a 60-cycle alternating voltage to the terminals A B will be greater when the switch S is open than when it is closed. The same is also true if C be replaced by an inductor L (Fig. 2) having an inductance of 0.355 henry and of negligible resistance. Fig. 4 is a curve showing the values of the impedance of the circuit AB at 60 cycles, corresponding to various values of the shunt resistance r. This curve is applicable either to Fig. 1 or to Fig. 2, provided the following values be taken: Periodicity of applied voltage, 60 cycles per second; ohmic resistance $R = 100$ ohms; capacity of condenser $C =$ 20 microfarads; inductance of coil $L = 0.355$ henry; resistance of coil L, negligible.

An inspection of the curve of Fig. 4 shows that for all values of the impedance, greater than about 170 ohms, there are two possible values for r. One pair of values is r infinite and r about 99 ohms. Hence, when r is 99 ohms the current passing through R will be the same whether the switch S be open or closed.

A convenient form of vector diagram to represent such a circuit as Fig. 1 or Fig. 2 is shown in Fig. 3, where OV is the

vector of voltage V_1 over DB and VL is the vector of current through C or L (the scales have been so chosen that VL represents also the drop over R due to the current in C or L). When r is infinite the vector of voltage over AB is OL, while VL is the vector of current in R. Lr_1 is the vector of current in r when r is 1000 ohms; Lr_2, Lr_3, etc., are the vectors of current in x corresponding to other values of r, the voltage V_1 being supposed to be constant.

For various values of r the vectors of voltage over AB are Or_1, Or_2, Or_3, etc., while the vectors of current in R are Vr_1, Vr_2, Vr_3, etc. If now the voltage V_3 be supposed constant, while V_1 is allowed to vary, the vectors of current in R will be as follows: VL when r is infinite; VR_1 when r is r_1; VR_2 when r is r_2, etc., where



Figs. 1 and 2—Impedance Circuits.

Fig. 3—Vector Impedance Diagram.

$$\frac{VR_n}{Vr_n} = \frac{OL}{Or_n}$$

The construction for obtaining the points R_1, R_2, etc., is obvious; a circle is drawn with center O and radius OL, and from the points of intersection of this circle with Or_1, Or_2, etc., lines are drawn parallel to OV cutting Vr_1, Vr_2, etc., in R_1, R_2, etc. In applying the vector diagram to Fig. 1, in which the condenser is used, angles of *lead* are measured *counterclockwise*. In order to make the diagram applicable to Fig. 2 angles of lead must be measured *clockwise*.

The actual values used in laying out Fig. 3 were as follows:

$R = 100$ ohms,	$r_1 = 1000$ ohms.
$C = 20$ microfarads,	$r_2 = 500$ ohms,
(or $L = 0.355$ henry),	$r_3 = 333.3$ ohms,
Frequency = 60 cycles,	$r_4 = 250$ ohms,
$V_3 = 125$ volts.	$r_n = \frac{1000}{n}$ ohms.

If a smaller value had been given to the ohmic resistance "R" the curve of Fig. 4 would have been less humped, and for very

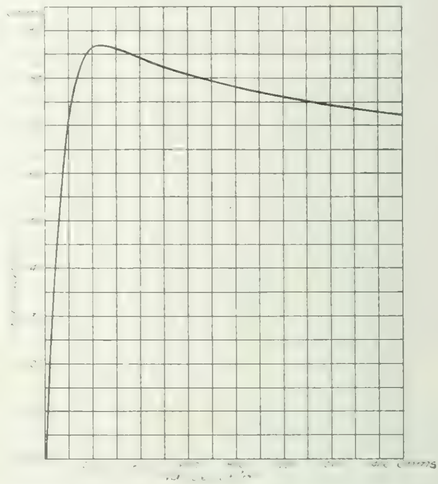


Fig. 4—Variation of Impedance with Shunted Resistance.

small values of "R" the hump would have disappeared entirely. In other words, the phenomenon of increase of impedance due to closing "S" cannot be obtained for very small values of "R."

In the extreme case when $R =$ zero, the circuit AB becomes simply "C" or "L" in parallel with "r," and in such a case it is almost self-evident that the impedance is lowered by closing "S," no matter what be the value of "r." In this case the current that will pass through the system will be the vector sum of the current in "C" or "L," and that in "r," the vectors of which are at right angles; and the sum of two vectors at right angles is evidently greater than either component vector.

Central Station
Management, Policies and Commercial Methods

GROUNDING OF SECONDARIES IN COLORADO.

The practice in Colorado in the grounding of secondaries shows a great advance to-day over its attitude of a year ago. Where only three cities were partially grounded at that time, the circuits in the following cities are either partially or wholly grounded, and those where the grounding of secondaries is only partially completed are proceeding with this form of protection as rapidly as possible: Greeley, Evans, New Windsor, Sterling, Julesburg, Holyoke, Holly, Trinidad, Clovis, New Mexico, Colorado Springs, Denver, Alamosa, Salida, Paonia, Fort Morgan, Golden, Rock Springs, Wyo., and several others. In most of these places the water-pipe type of ground connection has been used exclusively, but in several of the smaller towns which are underlaid at 3 ft. or 4 ft. with water-bearing soil, driven pipes have been used with good result. No case has been reported as yet where lightning has had unusually severe effect due to the grounding of secondaries. The service companies in all of the above cities express themselves as thoroughly satisfied with their grounded secondary systems, and a reduction in the number of electrical fires is looked for.

NEW BUSINESS-GETTING IN LONDON.

The electric lighting system owned by the Borough of St. Marylebone employs a staff of 15 outdoor representatives in its "new-business" department. In the annual report for the year ended March 31, Mr. A. Hugh Seabrook, general manager, states that the object of instituting this department in its present form was to bring electrical service to the notice of every trader and resident in the borough, and to regard every such trader and resident as a prospective consumer. So far as

existing consumers are concerned, the aim is to remove any cause of dissatisfaction and to bring to the attention of each, by demonstration and otherwise, the many uses other than lighting to which electricity at the present moment can be applied—in brief, to cause electrical service to be considered an indispensable factor in the economy of every business house and private residence, and to bring home that the interests of the consumer and of the central station are identical. He adds that it is no part of the policy to take from contractors work which, without interference, would have been carried out by them. On the contrary, many instances have occurred where, after the preliminary work and expense of advising, estimating and planning for new installations or extensions have been freely done by the staff of the station, the order has been given to a private contractor, notwithstanding that, without much effort or appreciable reduction of profits, the sales department could have filled the order. In other cases the staff has been withdrawn when it was found that a contractor was already dealing effectively with the case in hand.

During the year covered by the report the station sold 10,776,459 kw-hours, 743,002 kw-hours being for public lighting. The increase over the previous year was no less than 1,775,598 kw-hours, which is chiefly ascribed to the more active policy initiated in obtaining new business. The average income per kw-hour during the year, including meter rentals, was 7.6 cents. In 1909 the income per kw-hour was 8.2 cents; in 1908, 8.8 cents; 1907, 9.2 cents, and in 1906, 10.3 cents. In 1907-8 the load factor was 13.6 per cent; in 1908-9, 14.5 per cent, and last year, 15.7 per cent.

NEW PLANT OF THE WORCESTER ELECTRIC LIGHT COMPANY.

The Worcester (Mass.) Electric Light Company has begun the construction of its new steam turbine station at Curtis Pond, in the southern part of the city. The new station, which is being erected according to the plans of Westinghouse, Church, Kerr & Company, will contain an initial installation of three 2500-kva Westinghouse-Parsons turbo-alternators, with space for a fourth unit. The turbines are to be of the double-flow type, running at 3600 r.p.m., and the alternators will deliver three-phase current at 60 cycles to the outgoing lines. The station voltage will be 2400, and five 500,000-circ. mil circuits will be installed to form tie lines between the present plant of the company on Faraday Street, Worcester, and the new station. The Faraday Street station will be utilized as a distributing point upon the completion of the Curtis Pond plant.

The new plant will be a brick and steel structure, 149.3 ft. long by 79 ft. wide, and it will be divided into three sections for boiler room, turbine and switchboard service. The initial steam-generating installation will consist of six 600-hp Stirling boilers, set in three batteries of two each, space being left for a fourth battery when the load requires it. The boilers are to be equipped with superheaters which will increase the steam temperature by about 100 deg. for delivery to the turbine equipment. The boilers are to be set in a row on each side of a central firing aisle 18 ft. in width. The boiler room is to be 76 ft. wide and about 56 ft. in height, with a basement 15 ft. deep in which ash cars will be operated in connection with hoppers carried beneath the floor of the boiler room. Above the boilers is to be a coal pocket of concrete and steel having a holding capacity of about 500 tons. Taylor stokers are to be installed in the boiler room.

The natural draft for the plant will be furnished by two reinforced concrete chimneys, each of which will be 175 ft. high and 8 ft. in inside diameter. Mixed fuel will be burned on the grates. Condensing water will be supplied from Curtis Pond, which the company owns, the area being about 80 acres. Each turbine will be equipped with a barometric condenser, the intake and discharge water being handled by two reinforced concrete conduits carried beneath the basement of the turbine room. The turbine room will be 48 ft. wide and will be carried to a maximum height of 58 ft. from the floor, in order to secure proper lighting and ventilation. The entire room will be served by a 50,000-lb. Maris electric crane equipped with operator's cab and trolleys. The plant will be supplied with coal from a spur track of the Boston & Albany Railroad, delivered to a storage yard outside the power house, from which a modern fuel-handling equipment will deliver the coal to the boiler-room bunker.

At one end of the turbine room a switchboard, bus and feeder regulator section will be built with separate roof, the bus section to be 10.8 ft. high and the regulator section 12.7 ft. high. The company is planning to locate an office section at the new station on the switchboard floor level. A controlling reason for utilizing the Faraday Street station as a distributing center is the company's large investment in underground lines, which at present radiate to all parts of the city from this point. The company's business is growing rapidly and within the past year the connected motor load has been practically doubled. The output of the station is now about 1600 kw.

CENTRAL-STATION SERVICE AT PORTSMOUTH, N. H.

One of the largest areas of electrical supply in Eastern New England is that covered by the system of the Rockingham County Light & Power Company, of Portsmouth, N. H. This organization is one of the subsidiary companies of the New Hampshire Electric Railways, with headquarters in Haverhill, Mass., and its generating equipment has been fully described in these columns (Oct. 11, 1902). While the greater part of the service supplied by the company is mainly electric railway in character, the central-station business has not been neglected, and within the past few years has attained a volume represented by annual gross earnings of about $76,000. The total revenue of the company, including its earnings from the supply of electricity to the trolley lines controlled by the New Hampshire Electric Railways, is about $280,000 per annum. An interesting feature of the company's business is the supply of electricity for the use of summer residents of the territory between Hampton Beach and Kittery Point, including a varied pumping load of a long-hour character at scattered points on the distributing system.

TERRITORY SERVED.

The territory served by the company includes the city of Portsmouth, where the generating plant is located, and the towns or communities of Exeter, Hampton, North Hampton, Hampton Beach, Seabrook Beach, Newcastle, Rye, Newington and Kittery. The Exeter & Hampton Lighting Company supplies the distribution service for Exeter, Hampton, Hampton Beach and Seabrook Beach, and the Rockingham County company delivers energy in bulk to this organization at Hampton, having no direct contact with the local customers at these points. The total delivery of energy to the Exeter & Hampton company is now about 500,000 kw-hours a year. The earnings in Hampton and Exeter were not included in the revenue given above.

The territory supplied with energy for railway service extends as far from Portsmouth as Lowell, Haverhill, Newburyport and Lawrence in Massachusetts, and to Nashua, N. H. Nine substations are in operation and about 200 miles of track. The line potential is 13,200 volts for the railway service, and the most remote point where a substation is located is at Pelham, N. H., about 42 miles distant by transmission line from Portsmouth. Electrical energy from the Portsmouth station is actually delivered on the streets of Nashua, N. H., 50 miles distant. While this distance is moderate in the face of what is accomplished in high-potential transmissions, it is interesting to note that the center of gravity of the company's load is at Amesbury, Mass., about 20 miles from the power station. The line voltage is in general high enough to carry the service, split up as it is, without serious drop. The average loss

between the busbars at Portsmouth, on the high-tension side of the station, and the direct-current busbars at the substations is 20 per cent. The actual loss in the railway transmission lines is not much over 5 per cent. If the load on the Portsmouth plant were concentrated at the ends of the more distant line sections, the present voltage would probably have to be materially increased.

Electrical service in Portsmouth dates back to 1887, under the corporate organization of the Portsmouth Gas, Electric Light & Power Company. This company was purchased in 1901 by the Rockingham organization, the present station being placed in service in 1903. The capacity of the Portsmouth station is now approximately 6000 kw. The plant contains both reciprocating engines and turbines of modern design. The lamp and motor circuits are supplied at a frequency of 60 cycles, and the railway load is handled by 25-cycle energy. A frequency changer is installed in the station to facilitate economical operation and to tie the two portions of the electrical system together in times of emergencies.

DISTRIBUTION CIRCUITS.

Three transmission lines are run out of the station, two going to Hampton and one to Dover, N. H. The Hampton lines are carried west to the different substations supplying the territory outlined above. The Hampton circuits consist of two three-phase No. 00 copper lines about 11.25 miles long, and the Dover line runs to a substation between Dover and Somersworth, which is located about 14 miles northwest of Portsmouth. The latter line consists of a single three-phase circuit of No. 2 copper. In general, the poles of the high-tension lines are of chestnut, with an average length of 35 ft. and the spacing is about 100 ft. Porcelain insulators are used in this service.

The local lamp and motor loads of the company are handled mainly by 2300-volt and 6600-volt lines, the potential depending upon the load and distance of the consumers from the Portsmouth plant. The service in the city is supplied by 2300-volt, 60-cycle, single-phase lines run directly from the station busbars to the consumers' premises. The town of Newcastle is supplied by 2300-volt, single-phase service over a line about 4 miles long. Service to Hampton is furnished over a line 11.25 miles long, and at Rye Beach, 9 miles south of Portsmouth, a transformer substation is in operation for the purposes of local distribution. The potential carried on the Rye Beach and Hampton service is 6600 volts. A three-phase line of this voltage is run through to Hampton, while the line to the Rye Beach substation is a single-phase circuit. On account of the small size of the load in the Rye Beach district in the winter season, the company finds it desirable to cut down the voltage to 2300, which gives good regulation with the size of load carried and enables the line to be operated with less trouble under severe weather conditions.

The company's commercial lighting rate starts with a primary charge of 18 cents per kw-hour, and a secondary rate of 8 cents per kw-hour. If the total consumption reaches 500 kw-hours in any one month, the secondary rate is reduced to 5 cents per kw-hour. The following table shows the arrangements for charging at the primary rate, all energy in excess of that indicated in the table being billed at the secondary rate:

CHARGES AT PRIMARY RATES, PORTSMOUTH TERRITORY.

June, July and August....	1	kw per lamp, approximately 20 hours per lamp
April, May and September	1	" " " [illegible] " " "
Feb., March and October	2	" " " [illegible] " " "
Nov., Dec. and January..	2.5	" " " " 50 " " "

The basis of the table is the energy consumed per month per 16-cp lamp connected.

RESIDENCE RATES.

The residence lighting charge at Portsmouth is $1 a month service charge, with a rate of 8 cents a kw-hour in addition. The company recently made a careful study of its residence lighting income and found that under the old rate of about 18 cents a kw-hour the average energy consumption in a residence was 10 kw-hours a month. With the present service charge and 8-cent rate, the consumption now averges 15 kw-hours a month per residence lighted, and the net average rate a kw-hour is approximately 14.6 cents. In the former case the consumer used but two-thirds of the energy which he now takes for his service, and the unit cost was about 3.5 cents higher. Under the present conditions the consumer uses 50 per cent more electricity than he did formerly; his total bill is about 22 per cent larger than before, and yet his unit cost is reduced by the amount indicated. The reduction in the unit rate gives the consumer more for his money than before, and tends to increase the liberality of his uses of electricity on the company's lighting service. The company, on the other hand, suffers no reduction in total income, but makes a gain in the face of a lower unit charge, while the cost of generating, transmitting and delivering the additional energy consumption per residence is proportionally less. This is due to the fact that the fixed charges are but little increased, the fuel consumption is affected but little, and the labor account scarcely altered. The company's practice thus furnishes a good illustration of the response of even that most conservative element in the community—the residence lighting consumer—to a reduction in the kw-hour rate and of the manner in which such a reduction may be made to benefit the company.

RATES FOR MOTOR CIRCUITS.

The motor rates of the company start at 8 cents a kw-hour and run downward in accordance with the consumption. There is at present considerable scattered motor load in Portsmouth and its vicinity, the majority of the loads being carried by alternating-current lines. A small amount of 600-volt direct-current service is in operation in the city of Portsmouth. The company supplies electricity to the famous Hotel Wentworth, in Newcastle, which was the headquarters of the Japanese and Russian plenipotentiaries during the preparation of the treaty of Portsmouth, in 1905, and also furnishes service to the Rockingham Hotel, Portsmouth; Farragut House, Rye Beach, and other hotels of lesser magnitude. On account of the shortness of the season and the distance of the hotel from the generating plant, the company lights the Farragut House mainly off the evening peak, the energy for the service between the hours of 7:30 p. m. and 10 p. m. being supplied by an isolated plant of long standing on the hotel property. A considerable amount of electric pumping by small motors is carried on along the beaches. The motors for this service are mainly of the single-phase type. In a few instances the starting and stopping is automatic, but in general these motors are used in connection with the water supplies of cottages and hotels, and are started and stopped by hand. They vary in size from ½ hp to 1 hp. At Rye Beach a 5-hp motor is installed in a small pumping house which furnishes the water service to a number of grouped cottages between sundown and 10 p. m. Summer residents have a minimum charge of $6 a year.

The company renews carbon lamps free on exchange of burned-out bulbs, and charges a little below cost for tungsten lamps. The consumer pays for the initial installation and can purchase a new 100-watt tungsten lamp for 75 cents, a charge of 50 cents being made for 25-watt and 40-watt lamps. The company supplies energy for window and sign lighting on a flat-rate contract which amounts to about 11 cents a kw-hour, including lamp renewals. The lamps are switched into and out of circuit by means of an out-of-door switch, and the average service is about 19 hours a week. When electricity for electric heating and cooking is supplied on a separate meter the company makes a rate of 5 cents a kw-hour. Electric flatirons are in use in about 50 per cent of the residences using electricity. A 5-cent rate is made for electric vehicle charging, there being a few pleasure vehicles in service in the company's territory.

PUBLIC LIGHTING.

Recently the company secured the contract for lighting Fort Constitution, Newcastle. Thirty one 80 cp tungsten lamps will

be installed for multiple operation on a 110-volt service, superseding oil lamps. A contract has also been secured for the lighting of the streets of Newcastle, the service to be performed by 27 series tungsten lamps of 60 cp each, operating on a 6.6-amp circuit. These lamps will supersede 25 so-called 60-cp Welsbach gasoline lamps, which were burned on a moonlight schedule at a cost of about $28 a year. The new tungsten service will burn 4000 hours a year, or all night and every night, at a cost to the town of $25.45 a lamp. Portsmouth is lighted by about 85 alternating-current enclosed-arc lamps and 200 series incandescents.

The main offices of the company are located in the heart of the city of Portsmouth, at 10 Pleasant Street, where the quarters of the superintendent and clerical department are established. A feature of the office is a well-selected display of heating apparatus, and a special shelf is installed with upward of a dozen motors mounted upon it. The motors are wired with the necessary switches, starting boxes, etc., to enable them to be run in the presence of prospective customers. The windows are also utilized for varying displays, and the company carries advertisements in the local newspapers. The general policy in the solicitation of new business is to utilize as far as possible the personal touch in local relations, and to depend less upon elaborate systems of campaigning. The population of the company's territory varies widely at different seasons of the year. There are two pronounced peaks on the system, one occurring in the summer and the other in the early winter. The officers of the company are: President, Mr. D. A. Belden; vice-president, Mr. S. W. Emery; treasurer, Mr. S. P. Russell, and superintendent, Mr. J. S. Whitaker.

HARVESTING WITH ELECTRIC VEHICLE.

Rochester, N. Y., is in the center of the nursery business, and is known throughout the state as the "Flower City." The nurseries of Brown Brothers are located about four miles from the business section of the city, and during the shipping season the firm employs a 3.5-ton electric truck for delivering trees and shrubs to the depot; the truck returning loaded with fertilizer and supplies for the nursery. During the harvest season this same truck is utilized in harvesting the hay and, as shown in the accompanying illustration, in harvesting the wheat. The truck, which is of the standard type built by the General Vehicle Company, was sold to the firm by the Rochester Railway & Light Company. The vehicle as shown has 617 bundles of wheat, which after being threshed yielded 45 bushels. The regular two-horse load is 260 bundles. Where the time element in getting the wheat to the thresher, due to the variable conditions of the weather, is so important, one can readily perceive how a progressive company availed itself of modern appliances. The company is, however, no more progressive than the local lighting company, whose work in the electric vehicle and other fields is known throughout the country.

Use of Electric Truck in Harvesting.

DEVELOPING DAY LOAD AT WILMINGTON, OHIO.

Mr. J. C. Martin, of the Wilmington (Ohio) Water & Light Company, gave an interesting account of some work in developing day load at Wilmington in the course of a discussion at the Ohio Electric Light convention in July. Five years ago his company began a day service and proceeded to operate at a great loss. Now, out of 20 possible motor users the company has 17. One of these is a flour mill which the company does not want and has refused to serve. One customer operating a planing mill would not take electric service until after the company had persuaded him to keep an accurate account of all his "power" costs for a certain period. The company then got him as a consumer after having helped him to find a market for the shavings which he previously burned. A livery stable owner was found who was glad to take the shavings, and it developed that there was a market for all the kindling wood the concern could turn out. This customer paid for the motor on the installment plan.

Another customer formerly had a gas engine. When he began electric service he was unusually busy and consequently the central-station management perceived that his electric bills would be considerably higher than the average. To avoid scaring him with these unusually large bills the service was allowed to run a number of months without rendering a bill, as his business did not run so heavy in the following months. When at last a collector was sent with a bill he paid it without comment, but confided to one of his neighbors that he had received his bill, and, although it was a little high, he would not go back to the gas engine if the bill had been double the amount. The advantage to his business in being able to start up work on short notice whenever necessary appealed to him strongly when compared to his experience with the gas engine. Mr. Martin stated his policy to look after customers and take care of them in every way possible when in trouble. He also urged treating employees well so that they will stay by the company when it is

in trouble and work until the trouble is over. He said that he had men who had worked 24 hours continuously when necessary in case of power-plant troubles.

A guessing contest was held in Wilmington to raise funds for a home-coming celebration. The company donated electric stoves and other electric appliances, placing them in a booth on display. The cost of these donations had been returned fourfold in sales of similar appliances since that time.

TUNGSTEN LAMPS AND RATES.

At the convention of the Ohio Electric Light Association in July a discussion on tungsten lamps, central-station earnings and rates was opened by a paper by Mr. E. L. Booth, of the Bellaire Light & Power Company, on "Tungsten Lamps Versus Central-Station Earnings," an abstract of which was given in our issue for Aug. 4.

Mr. M. D. Cooper, of the engineering department of the National Electric Lamp Association, agreed with the author that the effect of the high-efficiency lamp on central-station earnings is largely a question of rates. The straight meter rate is slowly but surely becoming a thing of the past. Changing conditions of load have forced some to the conclusion that central stations have too much fixed expense to make a straight meter rate feasible. He quoted statistics collected by Mr. S. E. Doane for his recent National Electric Light Association paper, which showed that for an average station 14.6 per cent of the total annual cost depends on the number of customers served; 55.1 per cent on the size of the plant, and 30.3 per cent on the output in kw-hours.

The present income could be equaled by a rate made up as follows: Demand charge of from $30 to $40 per year per kilowatt of maximum demand; customer charge of from $12 to $15 per year; output charge from 1.5 cents to 2 cents per kw-hour. The demand charge is computed on the basis of a diversity factor of 1.5. The different classes of loads have different diversity factors and hence the demand charges should be based accordingly. Residence lighting has about as high a diversity factor as any class, in some cases as high as 4. Making due allowance for this high diversity factor it is seen that the demand charge could be made as low as $15 for this class of service. Large commercial installations could be supplied with demand meters. With small light customers this would add to the expense per customer and the demand could be estimated as a certain percentage of the connected load; or, better still, could be based on the floor area to be lighted. In figuring up the area to be charged for only living rooms should be considered, leaving out closets, alcoves, pantries, halls, etc. This method of applying the demand charge would not place any restrictions on the connected load.

Mr. Cooper said that Mr. S. B. Hood, in a paper before the Canadian Electrical Association convention, in advocating a rate of this kind, gave statistics concerning the number of residences, showing that very little error would be introduced by basing the demand charge upon the floor area. As the demands of the individual customer become less with the use of high-efficiency lamps the customers' expense assumes relatively more and more importance. The customer charge of $1 or $1.25 per month would be prohibitive for very small customers. The substitution of cheap current-limiting devices for meters will nearly do away with the meter expense and reading, which constitute a large part of the customer cost. This means the adoption of flat rates for this class of service. These need not be feared on a guaranteed-demand basis with customers with whom a difference between a monthly bill of $1.50 and one of $2 decides the question of electricity or no electricity. These would inevitably use high-efficiency lamps to keep down their demand and would be careful about needless burning if they bought the renewal lamps.

Mr. W. C. Anderson, of Canton, discussed the situation to the effect that, although it might look alarming at first sight, customers once accustomed to better illumination will not go back to a lower degree, which fact has a very important bearing on the effect of the tungsten lamp on revenues. He criticised adversely the present scale of lamp prices and maintained that the manufacturer practically puts a premium on the purchase of the 25-watt lamp as against the 40-watt lamp, by selling the 25-watt lamp at a lower figure, although it costs as much to produce as the 40-watt lamp.

Mr. B. H. Gardner, of Dayton, criticised the rate proposed by Mr. Cooper, and showed that the equipment charge of $1.25 per month plus a customer charge of $1.25 per month would make a monthly bill of $2.70 for a customer using only 10 kw-hours per month at the proposed kw-hour rate of 2 cents. This plan is not feasible. He pointed out that in Detroit a large and profitable residence business is done on a rate system which gives an average return of 6 cents per kw-hour. He failed to see much in favor of the use of the flat-rate limiting devices proposed. At Dayton the cost of meter reading per month is 1.25 cents and of billing 2 cents; interest and depreciation at 10 per cent on the meter is 3.5 cents per month in excess of that for a flat-rate controller, making a total cost of only 6.75 cents per month over the current-limiting device. The cost of testing averages 2 cents per month per meter. With a current controller the consumer cannot use electric flatirons or heating appliances without exceeding the specified demand, and cannot hold parties requiring the use of all of the lamps simultaneously. He also pointed out what he considered the fallacy of a much-talked-of plan for charging a flat rate for low-voltage tungsten lamps for residence lighting. Where this plan is used a separate circuit and a meter are needed if the customer wants an electric iron; hence the investment and customer expense are greater than for the usual meter installation. In the latter case there are two bills to be made out instead of one.

Mr. D. L. Gaskill said that the coming of the drawn-tungsten filament in a low candle-power lamp has done away with any necessity for low-voltage tungsten lamps.

Mr. Cooper said that the drawn-tungsten filament cannot as yet be considered as good as the ordinary filament. He thought that where a residence installation is below 250 watts or 300 watts flat rates are best.

Mr. John Gilmartin, of Toledo, pointed out that in Hartford, where low-voltage flat-rate tungsten residential lighting is practised, the revenue per kilowatt is high, but per customer is low.

TURBINE TROUBLES.

Mr. F. R. Brosius, of the Columbus Railway & Light Company, prepared a paper for the Ohio Electric Light Association convention at Cedar Point, July 26 to 28, on the subject of "Turbine Troubles." The object of this paper was to show some of the minor troubles with which the operating engineer has to contend, most of the troubles related having come before the writer's personal observation with two 500-kw and one 1500-kw turbine. An abstract of this paper appeared in our issue for Aug. 4, page 272.

In the discussion of Mr. Brosius' paper Mr. W. S. Townsend, of East Liverpool, reported having four Westinghouse turbines: one of 1000-kw and three of 500-kw rating. One of these runs six months at a time without a shut down. The cost of repairs has been so far almost negligible. He lays their successful operation to keeping these turbines running without repeated heating and cooling due to shutting down. One of the 500-kw units had its blades badly eroded by the sediment carried through in the steam from the Ohio River water used in the boilers.

Mr. W. C. Anderson, of Canton, reported a little trouble from cutting off the buckets by moisture in the steam, due to boilers foaming. However, he does not think that reciprocating engines operate with as little trouble as many hours per year as do turbines.

Mr. John Gilmartin, of Toledo, brought out the importance of cleaning the ventilating ducts through the turbines, because a restriction of these ducts seriously interferes with the ventilation. In this connection Mr. Culver called attention to the large generating output rating which the turbine affords in a small weight of apparatus which makes necessary rapid conducting away of the heat. Therefore, a small film of dirt has a serious effect on the ability to radiate heat. One member asked a question as to the experience of members with exciters directly connected to turbines. Mr. E. H. Beil, of Youngstown, reported having one 2500-kw set with a directly connected exciter on the turbine.

Mr. W. C. Anderson said that a water-lubricated step bearing is much more likely to give trouble than an oil-lubricated one. In answer to a question why his company had installed a steam engine as a recent additional unit in its station after having already installed a steam turbine, Mr. Anderson explained that because of the steam-heating load his company had to have some exhaust steam for this purpose and there was no economy in installing a turbine for operation on from 2-lb to 10-lb. back pressure.

Mr Culver cited the Hudson Terminal Buildings in New York, which have four sources of electric supply: First, a substation supplied with energy from the New Jersey generating plant of the company; second, a storage battery; third, a breakdown connection with the New York Edison Company, and, fourth, an isolated plant having non-condensing engines. This latter plant was for operation during cool weather when all of the exhaust steam would be used for heating. This was a good illustration of the advantage of the non-condensing engine, where exhaust steam for heating is required; otherwise, under such conditions the steam-engine plant would not have been installed.

ELECTRIC VEHICLES IN OHIO.

Mr. J. T. Kermode, of the Cleveland Electric Illuminating Company, in a paper at the recent Ohio Electric Association convention gave some figures on the progress of electric vehicles in Ohio at the Ohio Electric Light Association convention in July. According to the writer a count of the license tags issued up to April 1, 1910, by the State of Ohio, showed that there were in Cleveland 1006 pleasure and 24 trucking electric vehicles in operation, making a total of 1030. In the whole state there were 1796 vehicles of both classes. Had their use been as extensive in other cities as in Cleveland, in proportion, there would have been in the state approximately 4500 vehicles instead of 1796. In Cleveland the ratio of electric to gasoline and steam cars combined is 1:4. In the whole state the ratio is 1:10. In Cleveland there are 596 private charging stations and 14 public charging stations. It is estimated that the central station furnishes energy for 900 vehicles and isolated plants furnish the remaining 130. There are 408 private mercury-rectifier stations in Cleveland, 188 private motor-generator stations and 8 public charging stations. Of the 596 private stations, 460 are connected with the house lighting meter. Mr. Kermode gave a table showing the average number of hours' daily use of the demand to be 2.6 for the separately metered motor-generator sets and 1.46 for the rectifiers separately metered. He also presented a table showing the total number of kw-hours sold per month, which showed a fairly uniform consumption during the entire year. As there are fewer vehicles in operation during the winter the uniformity is due to the increased energy necessitated by winter road conditions.

In connection with mercury rectifiers he called attention to some features to which consideration should be given in the interest of satisfactory service. The mercury rectifier automatically reduces the rate of flow of current as the battery voltage approaches the rectifier voltage and will eventually open the circuit of its own accord. Good line regulation is essential or else the rectifier will either cut out before the battery has been sufficiently charged or it will overcharge. Usually the battery is charged at night and it is good practice to set the rectifier at a point where it will shut off before the battery is overcharged and, if necessary, complete the charging next morning.

A valuable asset to every private charging plant is a discharge rheostat for the purpose of completely discharging the battery occasionally. This should be thoroughly explained to all owners of electric cars so that they may realize the importance of treating their batteries properly.

Successful operation of electric delivery wagons depends on mechanical conditions, systematic inspection, frequent cleaning, oiling and adjustment of all parts. A slight increase in friction may reduce the work of the wagon by 25 per cent or more. As continuity of service is important it is sometimes advisable to keep delivery wagons in public garages where all-night service is rendered, thus permitting inspection and minor repairs being made without delaying the wagon service during the day.

In delivery service covering a large territory, excellent results have been obtained by the use of the Edison battery and also with the high-output lead battery. The latter has a large number of thin plates which, because of their increased number, give a longer discharge and greater mileage per charge. The maintenance, however, is greater than with the ordinary plates.

In discussing Mr. Kermode's paper, Mr. R. E. Russell, of the General Electric Company, emphasized the point regarding the automatic cutting out of mercury rectifiers. On long feeders, where the voltage is boosted to compensate for heavy peak loads, the voltage is likely to be too high during the latter part of the night when charging is being done, which results in overcharging of the battery. It is a simple matter to arrange a time switch to cut out at a certain time.

Secretary Gaskill said he had met a number of members in advance of the convention who were enthusiastic about the electric vehicle, but none of them had done much in that direction. He said that $7 per month is the average gross revenue per vehicle obtaining in Greenville.

Mr. Kermode, in answer to a question, said that he did not think the ratio of electric to gasoline vehicles is increasing. The average annual revenue at the 5-cent rate as obtained in Cleveland from installations connected on the regular lighting meter is $60 per vehicle per year.

Mr. C. W. Chappelle, of the Electric Storage Battery Company, answering questions as to the desirability of an occasional complete discharge of a battery, said that such a discharge allows the lead oxides on the plates to be more completely re-formed than is possible with a partial discharge. In other words, it gets the inner parts of the active material to working, whereas only the outer layer would work if the battery were kept merely charged all the time. He hesitated to give any rule as to how often a battery should be completely discharged, because conditions vary so greatly. If he owned a battery himself, which was well looked after and used daily, he would have it discharged fully once a month. If it is necessary for a battery to stand idle for six months without being taken down it should be charged occasionally. If possible, however, it was advisable to take down a battery under such circumstances and remove the plates from the electrolyte. In answer to a question as to the system of rates for this kind of business at Cleveland, Mr. Kermode explained that the garages of most private users are connected on the same meter as the lighting service. By this arrangement the customer's consumption for lighting usually exceeds the primary high-rate proportion of the bill so that the battery charging all comes under the secondary low rate at 5 cents per kw-hour. However, many people who live in apartment houses have to keep their vehicles in separate garages, so that separate supply meters are required.

Mr. C. C. Custer asked opinions as to the relative advantages of alternating and direct-current service for charging.

assuming that both services are available. He had advocated direct-current service for his customers in such cases.

Mr. Russell thought that direct current would be best if the battery were one having a large number of cells so that the rheostat losses would be small. Where the battery has a small number of cells necessitating considerable rheostat loss the rectifier is better.

Mr. W. C. Anderson, of Canton, said that his company had considered that because of the high cost of vehicles and the work necessary to sell and look after an electric vehicle, better results in the shape of good revenue-producing business could be obtained for the same effort in other directions. He also told of the case of an electric vehicle customer who recently had his attention called to the fact that his battery needed immediate attention. He was much surprised and said he had been told by the salesman that he would have to do nothing in the way of attention or repairs in two years.

Mr. F. M. Tait said when one considered that the sale of energy for charging electric trucks meant more output without any additional expense and generating apparatus, the business looked very desirable. Selling an electric truck is a question of showing that a ton-mile of haulage can be produced cheaper with it than with horses, which fact can be demonstrated. The electric truck is a dependable apparatus.

Mr. W. R. W. Griffin, of East Liverpool, told of the very aggressive policy of the Rochester Railway & Light Company, with which he was formerly connected. The Rochester company sells electric trucks at the list price and maintains and furnishes electric energy for them for one year free. This move had been very successful.

Wiring and Illumination

FIREPROOF WIRING.

A fire in the power plant of the Pueblo (Col.) Suburban & Traction Company on July 24 is of considerable interest as illustrating the danger of congested wiring of inflammable insulation with wood supports, even though contained in concrete pits. This fire originated in an oil-immersed starter located in a concrete pit, and rapidly spread along the cables, breaking up through the floor at the switchboard at several points where small air spaces had been left about the vertical cables. Fortunately, a number of small transformers exposed by this fire withstood the flames, and no considerable amount of oil was fed to the fire. Machines were shut down as rapidly as possible, and within three minutes firemen were flooding the wire pit with water, temporary lines were run and service was resumed by the crippled plant within a few hours. The management is now installing non-inflammable insulation and supports, and is contemplating the complete isolation of oil-bearing auxiliary and transformers.

CENTENNIAL ILLUMINATION IN BUENOS AIRES.

During the recent Argentine centenary celebration held in Buenos Aires the city was brilliantly illuminated, the special lighting for the 10-day celebration costing $5,000 per hour in United States currency. For this occasion the lighting load was increased from 23,000 kw to 33,000 kw, the increase being carried by the Compañia Transatlantica Alemana de Electricidad, an important German corporation; 200,000 lamps of 10 cp each and 400,000 of 16 cp were installed in the streets and squares, the Plaza de Mayo, where the country's independence was declared, and the new Parque del Centenario was particularly brilliantly illuminated; 40,000 lamps of 16 cp each lighted the port and docks for the Venetian festival on the evening of May 28, when the United States steamship *Chester* and the other foreign men-of-war were lit up, making a brilliant effect; 90,000 lamps of 16 cp each were placed in the grounds of the five Centenary Expositions, where several of the illuminating displays used apparatus from the United States. Practically all the lamps and accessories used in lighting the streets, squares and docks came from the United States, the remainder of the material being supplied by Germany.

COMBINED ARC AND INCANDESCENT ELECTRIC LIGHTING POLES IN VIENNA.

The accompanying illustrations show types of tubular iron poles used by the Vienna municipal central station for street lighting with arc lamps and incandescent lamps. There are in use about 1200 poles with one arc-lamp bracket and about 30

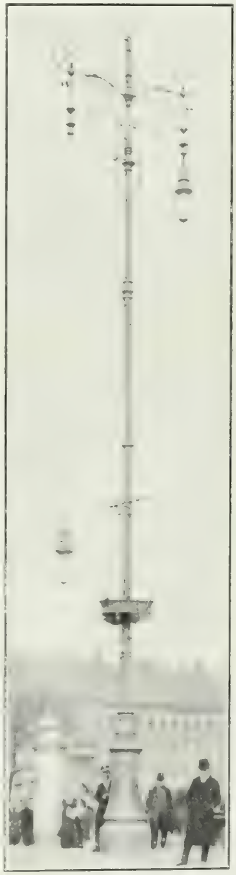


Fig. 1—Pole for Two Arc Lamps.

Fig. 2—Pole for One Arc Lamp.

poles with double brackets for two arc lamps. The tubes vary in diameter from 120 mm (4¾ in.) at the top to 180 mm (7 in.) where the incandescent lamps are mounted, and the bases are 930 mm (36.5 in.) in diameter. The incandescent lamps are placed 3.5 m (11.5 ft.) above the sidewalk, while the arc lamps hang about 4 m (13 ft.) above the incandescent lamps.

The arc lamps use pure carbon electrodes and operate five in series from a 220-volt direct-current circuit. The clusters of incandescents, which serve for lighting after midnight, are ordinary 25-cp, 110-volt carbon lamps. Use is made of a few

50 cp, 110-volt metallic-filament lamps for lighting two bridges. Although designed with particular reference to the lighting service, the poles are used also for supporting the span wires of the Vienna municipal railways.

ELECTRICAL ILLUMINATION IN MEXICO CITY.

The electrical illumination of Mexico City in September in honor of the centennial celebration of Mexico's independence will be on a much more elaborate scale than was originally contemplated by the committee having in charge the arrangements. It is now estimated by the Mexico Light & Power Company that nearly 300,000 additional incandescent electric lamps will be used during the entire month. The great Cathedral edifice will be a blaze of light from basement to dome, the plans for its illumination calling for the installation of 16,000 incandescent lamps. More than 8000 lamps will be used to decorate the front of the National Palace. On each of the other public buildings from 2000 to 6000 lamps will be used. Every business house in the city has made arrangements for the elaborate decoration of its exterior with electric lamps, some of them contracting for as many as 8000 of the lamps. It is announced by the committee on arrangements that it has carefully worked out the street scheme of illumination. The downtown business district will be canopied with light. Triumphal arches will be erected at various street intersections. The main arch of independence will be located at the intersection of Plateros Street and the Zocola Plaza, upon which front the Cathedral and National Palace. It will contain 600 incandescent lamps of 10 cp each and 20 12-amp arcs. At the intersection of each cross street on Avenida San Francisco and Avenida Juarez a double arch, each containing 140 lamps, will be erected. These arches will cross each other, and will consist of two lines of 70 lamps each. In the middle of the block two additional arches will be placed, so that in each block there will be stretched six arches. Many novel electrical decorative schemes for business blocks and private residences have been evolved. A display of the Mexican colors in the decorations will form a part of the decoration of the streets and buildings.

WIRING OF NEW HOME OF INSTITUTION OF ELECTRICAL ENGINEERS, LONDON.

A short time ago the Council of the British Institution of Electrical Engineers took over the building of the Royal College of Physicians and Surgeons on the Victoria Embankment, London, and devised plans for remodeling the interior of the building. This remodeling also included the rewiring of the structure to conform to the new arrangements. The original installation was put in over a quarter of a century ago, and it was quite unsuited for the present purposes of the building. It was decided by the engineers to employ rigid metal conduit throughout, for the mains, and tinned brass tubes for the lamp circuits. The latter is suited for carrying the circuits around the old walls of the building, and with the exception of that in the basement, all of the wiring is concealed.

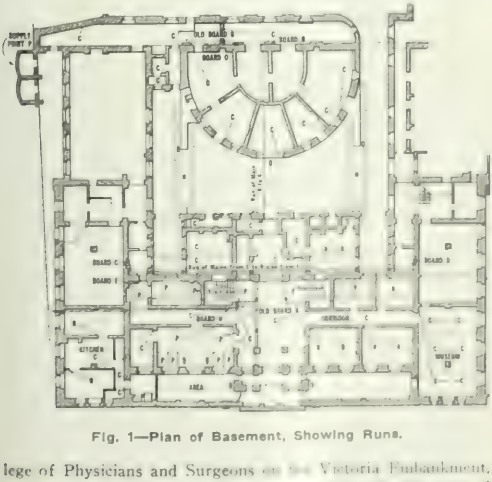


Fig. 1—Plan of Basement, Showing Runs.

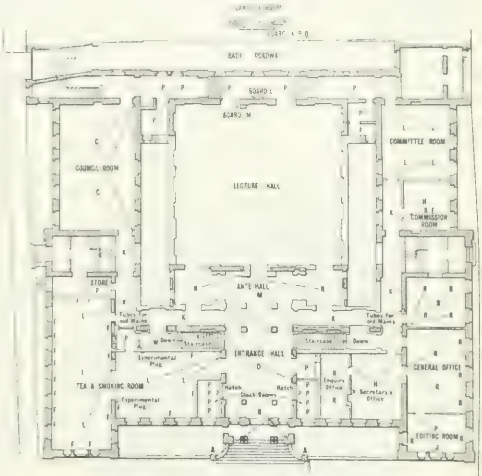


Fig. 2—Plan of Ground Floor.

The system of wiring employing tinned brass tubing is known as the "Kalkos" conduit system, and is coming into use in England as an addition to other wiring systems for branch circuits. The conduit and the fittings follow sudden changes in temperature rapidly, and as all joints are soldered during erection, the system is water tight. It is somewhat cheaper than rigid metal conduit, and is readily installed in chases in plastered walls.

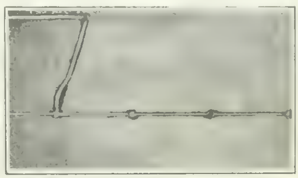


Fig. 3—Example of Ceiling Work.

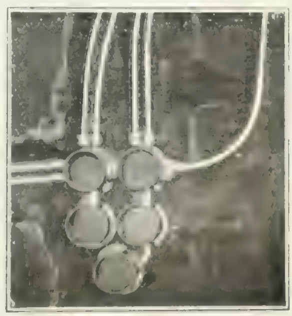


Fig. 4—Close Grouping of Switch Boxes.

The supply of energy for the building is obtained from the Savoy Hotel, whose power house immediately adjoins the Institution quarters. The pressure is 100 volts, and the service is in duplicate. The cables enter the building at two distinct points and comprise in each case two pairs of lead-covered mains, coupled up to the service at the point P (Fig. 1) in the basement.

One pair has been disconnected from the existing control board at B and extended by means of a new pair of cables through a 75-amp fused switch to the new board at N. The other pair has been connected into a new board at the point C to supply a portion of the circuits of the Royal College of Physicians and Surgeons, and also into a board at E which controls the circuits in the front part of the building. The board at N controls the circuits to the lantern room, lecture hall and the corridor back of the lecture hall. The board at E controls the

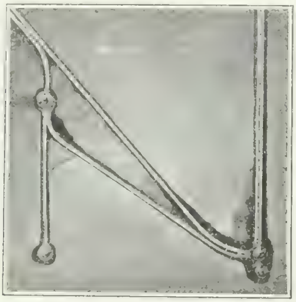


Fig. 5—Grouping of Switch Bracket Boxes.

circuits for the tea and smoking rooms, lecture lantern, basement corridor, first floor, west and east, and two circuits for the cornice lighting in the lecture hall. The layout of the principal circuits in the building is shown in Figs. 1 and 2. In Fig. 1 the letters have the following significance: C = ceiling lamp, H = prismatic glass reflector, and P = plain pendant; in Fig. 2, F = bracket, L = three-lamp electrolier, and R = pendant.

Special circuits have been run for the lecture hall lantern and the lantern room overlooking the lecture hall. In the tea and smoking rooms three experimental wiring points have been provided and these terminate in special cast-iron boxes sunk in the wall. Each box contains two single-pole switch fuses and two heavy terminals with wing nuts to which temporary leads can be quickly attached. Separate motor circuits supply energy to a motor driving a dumb waiter from the basement to the tea room, and to the ventilating outfit.

Figs. 3 to 5 illustrate the manner in which the branch circuits were installed and the application of the Kalkos system of wiring. The standard Kalkos boxes admit of the entry and exit of wires from any point on the side of the box and also through the bottom. The tubes in every case are soldered into special inlet and outlet pieces which are bell-shaped and avoid sharp bends.

NEW TELEPHONE PATENTS.

TELEPHONE ATTACHMENTS.

Much ingenuity has been displayed by inventors of antiseptic apparatus in devising means for attaching them to the transmitter mouthpiece. The peculiar lines of the mouthpiece, upon the one hand, coupled with the requirement that it must not be defaced or permanently changed, on the other, have been responsible for this. A rather clever arrangement is that recently patented by Mr. F. H. Peck, of Galveston. A ring is formed up of sheet metal, being pressed from a flat blank. This has a flange of such size as to slip over the lip of the mouthpiece. The antiseptic membrane is laid against the mouthpiece and the ring is then slipped in place. The back edge of the flange clears the surface of the transmitter mouthpiece because of its taper. The rear edge of the flange is pressed out to receive an internal circular section expanding ring, which, when in position, fills the space between the flange and mouthpiece. A notch is cut in the flange so that one end of the expanding ring will be accessible to facilitate removal.

The invention of Mr. J. A. Perry, of Bidwell, Iowa, consists of a receiver stand with auxiliary sound tubes. The base of the stand has a sound cavity from which the rubber ear tubes extend. The mouthpiece of the receiver covers this cavity, the body of the receiver being held by a clamping prong.

TESTING SET.

Mr. N. Macking, of Wilkes-Barre, Pa., has patented a portable testing set. This includes a magneto, a talking set, a testing battery, a magneto bell, a buzzer and a lamp signal. Various switches and binding post connections are provided to facilitate the manipulation of the circuits and apparatus to give the necessary indications.

TELEPHONE REPEATER.

One of the difficulties with repeaters has been the inertia of the parts and the tendency of the diaphragm to vibrate in its natural vibration periods. It is with a view to decreasing the effect of both these that Mr. L. W. Southgate, of Worcester, Mass., has omitted the diaphragm from his repeater. He uses a light magnetic armature to which the movable electrodes of the transmitting part are connected. The armature is only held in position, against the electrodes, by the pull of the permanent polarizing magnet. It has no hinge or other supports. The power of the permanent magnet may be adjusted to proper sensitiveness and the field is then subjected to the influence of the field of the receiving magnets.

LOADED TRANSMISSION CIRCUIT.

In these days of the frequent use of phantom circuits for long-call business it is evident that if loaded lines be used as the physical circuits, then special coils must be used to load the phantom circuit. This is what Mr. A. W. Ebeling, of Charlottenburg, has done in the system of loading patented by him and assigned to the Siemens & Halske Company. He arranges loading coils non-inductive for the use of the physical circuit as such and inductive when the two limbs are used in parallel as one leg of a phantom. Similarly, the regular loading coils are non-inductive to the phantom. Of course, each circuit is burdened with the ohmic resistance of the coils non-inductive to it.

LETTER TO THE EDITOR.

The Precision of Photometry.

To the Editor of Electrical World:

Sir:—In the editorial on "The Precision of Photometry" in your issue of July 7 you note the results of some experiments which the National Physical Laboratory has been making on the degree of consistency which is obtainable by any one observer comparing together the same lamps on different days. I am in accord with much of what you say, but venture to think that a further examination of the diagram of results which I gave, and to which I take it you refer, will suggest some modification of the conclusions in your article as to the consistency of the results of any one observer obtained on different occasions. You are inclined to the opinion that an observer cannot always come back to lamps previously tested and obtain the same results when other photometric work has intervened. In considering photometry of the highest precision between electric substandards I think we can safely draw conclusions as to the consistency of an observer only from tests on a group of lamps. Observations on a single lamp in a group are liable, as you point out, to vary in some cases by as much as ± 0.5 per cent when measured on different occasions. Such discrepancies do not occur with all observers, but they must, in the main, be put down to the ordinary errors of observation. That is to say, if an observer photometers a lamp twice in the same morning he need not be surprised if his results vary by an appreciable amount. But our experiments go to show that

for any one observer, the mean value obtained for a dozen lamps on one day will agree with the mean value for the same lamps photometered on another day within very narrow limits —even when the color of the lamps is not identical. We have, indeed, found the judgment of different photometrists to remain so uniform that it is possible to apply a small but definite correction for each observer in terms of the average, according to the degree of color difference existing between the lamps under comparison. I do not think it should be difficult to calibrate the observers of one laboratory against those of another with a view to securing international uniformity in a light unit having a whiter tint than those at present in use. This matter is of considerable importance in accurate photometry and is my only excuse for trespassing on your space.

London. CLIFFORD C. PATERSON.
National Physical Laboratory.

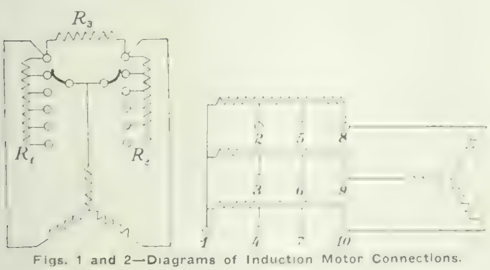
[The above note with reference to the earlier editorial on this subject is most welcome, for it not only confirms some of our doubts but shows the way out of the difficulty. The fact that, as our correspondent says, one can safely draw conclusions as to the consistency of the observer only from tests on a group of lamps, shows very plainly that the errors due to different judgment of balance at different times cannot be considered negligible, but can be in effect eliminated by a sufficient number of observations as regards any one observer. In other words the observer's judgment, while it varies over a very perceptible range will on the whole and with a sufficient number of observations eventually settle to a pretty definite point. However, as our correspondent points out, especially when the lamps compared vary slightly in color, the judgment of one observer as to balance even when his own variations are averaged out of sight may show a consistent small variation from the average results of another observer. It would be extremely interesting to see whether such variations could be traced to slight abnormalities in the color sense, or whether they are purely psychological.—Ed.]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Possibilities of Evolution of the Induction Motor.—J. FISCHER-HINNEN.—The author thinks that the induction motor with stator and slip rings and device for short-circuiting the secondary winding and for removing the brushes is in its latest development really a rather complicated piece of machinery. He thinks that in the future motors with rotating resistors will become of greater commercial importance than heretofore. The difficulty which one meets in their construction is found in providing a sufficient number of resistance-steps. One possibility of reducing this difficulty is not to connect the resistors in the usual way in star, but to connect them in delta and to regulate only two phases, as indicated in Fig. 1. In this case only two-thirds of the contacts otherwise necessary are required. Another method is to short-circuit the resistors of the



Figs. 1 and 2—Diagrams of Induction Motor Connections.

three phases not simultaneously, but one after the other. The arrangement is shown in Fig. 2 for three resistors per phase. To start the motor, connection is first made between 2 and the neutral point 1, then between 3 and 1, then 4 and 1, and so on. This arrangement has about the same effect as an eight-step starter of ordinary construction. In view of the advantages of simplicity there are many attempts still being made to improve the ordinary squirrel-cage induction motor. The author discusses first those methods in which the motor is started unloaded and the load is applied only when the motor has accelerated to full speed. Besides the purely mechanical methods, there are electrical methods in which the rotor is equipped with two windings, one of which, with high resistances, is used at starting, while the other is closed only when the motor has been run up to full speed. The method of Goerges (Fig. 3) employs two windings of different numbers of turns which are connected in opposition to each other for starting and are short-circuited afterward. During starting, therefore, only the difference of the ampere-turns of the two windings is employed, while afterward the windings aid each other. The disadvantage is that the change from one connection to the

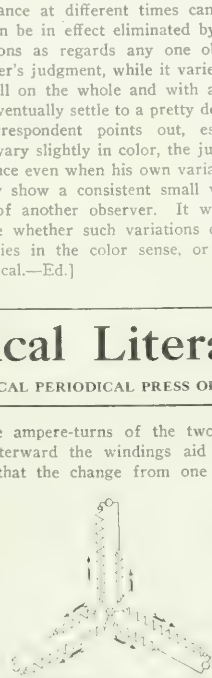


Fig. 3—Induction Motor Connections.

other is too sudden and causes a strong current rush. This disadvantage has been avoided in Boucherot's double motor, which is in no way inferior to the slip-ring motor, and has some other advantages. That it has not become popular is probably due to its expensiveness. To reduce the high starting current, in some cases, the Oerlikon Company has made the short-circuit rings of iron for a double purpose. The first object is to increase the stray field at starting and thus indirectly decrease the starting current. The second object is to produce eddy currents in the ring which consume some power and increase the starting torque. A new type of motor of the Oerlikon Company is shown in Fig. 4, in which, instead of solid rods, use is made of tubes A formed of a material having high specific resistance. These are connected together by means of short-circuited rings B. Within the tubes A there are solid

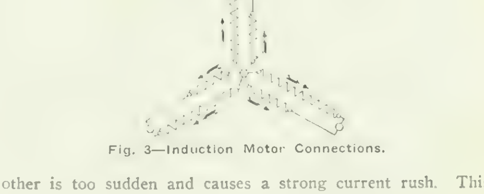


Fig. 4—New Oerlikon Motor.

rods C of a material having very low resistance, held together by means of a disk E in such a way that they can be displaced and pushed more or less deeply into the tubes A. Fig. 4 shows the position for starting when the solid rods C are almost removed out of the tubes A. With this arrangement the current must pass solely through the tubes A, which have a very high resistance. While the motor runs up to full speed the disk

E is pushed further toward the armature so that the hollow spaces within the tubes *A* are filled with the solid rods *C*, which are much better conductors. The resistance is, therefore, gradually diminished and the motor can be brought up to full speed gradually without any excessive current rushes. A motor of this kind was built and tested, together with another motor with ordinary squirrel-cage rotor construction, each motor having a rating of 12 hp, the results being as follows:

	Squirrel Cage	New Motor
Normal current, amp	34	35
Starting current, amp	[illegible]	[illegible]
Starting torque, syn. hp.	[illegible]	12.4

According to these tests the new motor seems to be quite as good as the ordinary slip-ring motor, but has the advantage of greater mechanical simplicity.—*Elek. Zeit.*, July 14.

Windings.—G. I. STADEKER.—A continuation of his discussion of the different windings of dynamo-electric machinery. The author deals, first, with threaded-in coils for small direct-current motors, discussing the construction of the core, winding of the coils and method of inserting them, and banding. He then takes up the discussion of open-slotted windings for small direct-current machines.—*Elec. Jour.*, July.

Lamps and Lighting.

Laboratory Arc Lamp.—E. F. NORTHRUP.—An illustrated description of a very simple, cheap, self-regulating arc lamp giving highly actinic light for laboratory work and operating with great steadiness. The construction is shown in Fig. 5. The upper electrode can be either carbon or steel and has a vertical adjustment. The lower electrode, which can be moved vertically, is clamped in an iron tube which floats in a well of mercury. Around the well of mercury is a solenoid of three layers, of 36 turns each, of No. 13 B. & S. gage copper wire. The current enters the upper electrode, goes in series through the two electrodes into the mercury, through the solenoid and out to the negative binding post. The lamp may be operated on a 110-volt circuit with a very small resistance in series. As soon as the current starts, the electrodes are drawn apart by the action of the solenoid on the iron tube in which the lower electrode is held and the arc is maintained with extraordinary steadiness. The best material to use for the well holding the mercury is manganin in the form of a tube. This material is not acted upon by mercury, and it is easy to maintain the well free from leaks. If the upper electrode is of steel and is made positive, the light of the arc has a bluish cast and has very strong actinic properties. It is necessary to use colored glasses when looking at the iron arc. If the two electrodes are made of carbon, the arc is very convenient for use in welding together platinum wires or making other experiments where a high temperature is needed.—*Phys. Rev.*, July.

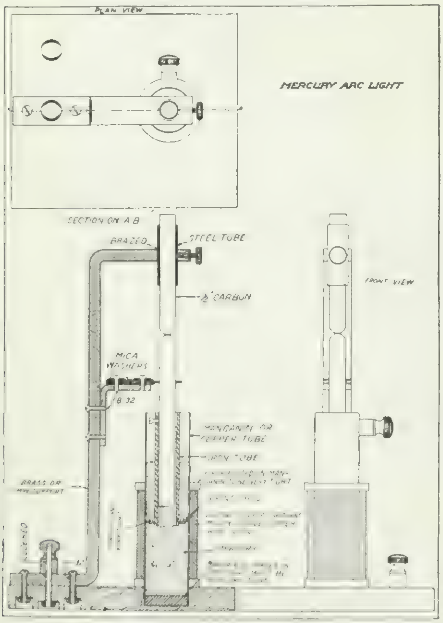


Fig. 5—Diagrams of Laboratory Arc Lamp.

Incandescent Lamps.—A. BAINVILLE.—The conclusion of his review of new incandescent lamps. The author gives results of tests, especially efficiency tests and life of tantalum and tungsten lamps. He considers the single-filament lamp of the French Welsbach Company to represent a great advance in tungsten-lamp construction.—*L'Industrie Elec.*, July 10.

Acetylene Lighting Plant.—A note stating that an acetylene station is to be erected in the city of Platten, in Bohemia. Acetylene gas will be furnished for "56 cents per cubic meter" ($15.85 per 1000 cu. ft.) "for private consumption and 48 cents per cubic meter for public lighting, and 33.6 cents for the operation of motors." Another method of charging is as follows: 8.4 cents per hour for a 60-cp lamp, 5.6 cents per hour for a 40-cp lamp, and 2.8 cents per hour for a 20-cp lamp.—*La Revue Elec.*, July 15.

Train Lighting.—An illustrated description of the Brown-Boveri system of train lighting.—Lond. *Electrician*, July 15.

Generation, Transmission and Distribution.

Cost Curves.—R. WHEELER.—An article on a method of separating the "standing charges" from "running charges" in central-station practice with regard to such items as coal, water, etc. In the case of coal, there is a more or less constant quantity of coal required to keep the plant "ready to supply," that is, "standing charge," and also a more or less constant quantity required to generate each unit, that is, "running charge." The "units generated" and "pound per unit" curve should satisfy the equation $xy = Kx + k$, where $x =$ number of units per week, $y =$ total coal consumed per unit, $K =$ coal required to generate each unit, $k =$ quantity of coal required to keep the plant "ready to supply." A simple way of obtaining the constants of the equation is to plot a rough curve from actual working results, and to correct it where necessary to a smooth curve satisfying the equation. In Fig. 6 the points are taken from the results obtained in practice, and the curve is found to satisfy the equation $xy = 3.6\,x + 53{,}900$. From this it will be seen that, roughly, 24 tons of coal per week are required to keep the plant "ready to supply," that is, "standing charge," and that 3.6 lb. is the quantity required to generate each "unit," that is, "running charge." The straight line gives the total coal consumption per week in tons, set out from the pound per unit curve. Analogous curves may be plotted for oil, water and similar items.—Lond. *Elec. Rev.*, July 15.

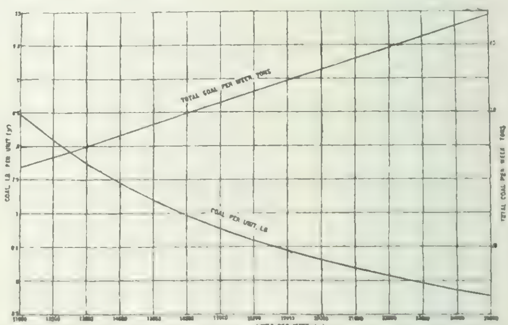


Fig. 6—Cost Curves.

Gas Producers.—J. Hofmann.—An abstract of a paper read before the International Metallurgical Congress in Düsseldorf on recent progress made in gas producers. It is now possible to utilize very poor fuel, such as is often thrown on the waste heap at the mines, to reduce it to ash or slag. In June, 1910, the Compagnie des Mines Blancy, at Montceau, began to gassify culm-heap residue containing 20 per cent carbon, 15 per cent volatile matter and 65 per cent ash. Coke breeze is mixed with this material, and thus utilized. The complete utilization of the available coal supplies is only possible by the manufacture and use of producer gas, which is, therefore, of the highest economic importance. The production of tar-free producer gas is discussed in another paper by H. Braune and E. Hubendick.—*Met. and Chem. Eng'ing,* August.

Steam Turbines.—E. J. Berg.—A paper, illustrated by numerical calculations, on the effect of superheat, vacuum, initial pressure and feed-water temperature on the water rate and coal consumption of steam turbines.—*Gen. Elec. Rev.,* August.

Condensers.—M. LeBlanc.—The first part of a description and mathematical article on his condensers. In the present installment the author deals with rotary air pumps for condensers. —*La Lumière Elec.,* July 16. The development of the LeBlanc condenser in America is discussed by R. N. Ehrhart in *Elec. Jour.,* July.

Installations, Systems and Appliances.

Central Stations of Belgium.—Statistical tables of the central stations of Belgium. The table covers 93 different stations and the data given as to equipment, rate of charging, etc., refer generally to the end of 1909. No summary of the figures is given. The largest station is in Brussels with a rating of 15,000 kw. The next largest stations are in Morlanwerz with 11,350 kw and in Anvers with 5000 kw. There are 11 stations with rating between 1000 kw and 5000 kw. Six thousand six hundred volts in the highest transmission e.m.f. used on any transmission line. Most of the stations use direct current, but these are, in general, the smaller stations, while the larger stations use almost exclusively three-phase currents. Steam power is used in general, and in most cases reciprocating engines, although in some of the larger stations steam turbines are employed; this is the case in Brussels and Anvers. There were sold in 1909 in Brussels for lighting, 5,488,466 kw-hours and for motor service 1,163,802 kw-hours. The rate of charging in Brussels is for the four months in winter 11 cents per kw-hour for lighting and 4 cents for motor service, and for the rest of the year 9 cents for lighting and 4 cents for motor service. In Morlanwerz there were sold 10,000,000 kw-hours in 1900, the rate for lighting being 10 cents per kw-hour and for industrial purposes 5 cents.—*L'Industrie Elec.,* July 10.

Austrian Central Station.—A note on a new municipal central station in the city of Gablonz, in Bohemia. It will use 260 hp from water and 1820 hp from steam and will maintain a 520-hp storage battery. In the suburbs, where the central station is located, direct current will be distributed at 2×150 volts. For transmission to the city of Gablonz six three-phase currents at 5000 volts are employed. Conversion to direct current is made in a substation.—*Elek. Zeit.,* July 14.

Wires, Wiring and Conduits.

Aluminum Lines.—Comparative figures are given for aluminum and copper as to tensile strength, electric conductivity, specific weight and a calculation is made of the cost of a certain line constructed either of copper or aluminum in which case the copper line is found to be 20 per cent more expensive than the aluminum line.—*L'Industrie Elec.,* July 10.

Crossings.—F. Schauer.—An illustrated article on methods of construction of overhead transmission lines at points where they cross a traction system. The article is illustrated by numerous diagrams.—*Elek. Kraft. u. Bahnen,* July 14.

Electrophysics and Magnetism.

Physics and Metaphysics.—H. Crew.—His presidential address to the American Physical Society on the debt of physics to metaphysics. The author deals first with the mechanical postulate, the energy postulate, and the causal postulate, and further shows that metaphysics has rendered distinct service in giving certain helpful preliminary discussions and in pointing out to the experimental inventor the paradox that his greatest strength lies in his confessed limitations.—*Phys. Rev.,* July.

Radio-Activity of Rocks.—A. L. Fletcher.—An account of determinations of the radium content of a series of volcanic rocks from the Andes of South America. The determinations were made upon a series of rock-specimens taken at various points during the working of the Transandine Tunnel. The striking feature of these results is their poorness in radioactive matter.—*Phil. Mag.,* July.

Electric Waves.—J. W. Nicholson.—A second mathematical paper on the bending of electric waves round a large sphere.—*Phil. Mag.,* July.

Electrochemistry and Batteries.

Electric Steel.—B. Neumann.—A paper read before the International Metallurgical Congress in Düsseldorf in which the author gave notes on recent progress made in the electric steel furnaces of Héroult, Stassano, Girod, Chaplet, Keller, Levoz, Nathusius, Kjellin, Frick, Hiorth and Ischewsky. The first stage of the development of electric steel making was in the production of high-priced material making sharp competition with the costly crucible process. The electric furnace furnishes much larger quantities of uniform material; it is not dependent on the purity of the material charged; it works cheaper and deoxidizes the metal at least as well as the crucible will; it enables the adjusting of the carbon, silicon and manganese much more accurately, and additions can be made that are impossible to be made in the crucible. Further, high-quality material can be made by refining scrap and other impure materials; this is a field in which the crucible cannot compete. The second stage of the development of electric steel has begun; namely, the use of the electric furnace for producing a mean quality of steel to fill in the gap between ordinary steel and a crucible-quality steel. The electric furnace can be used in combination with the previous steel refining processes to still further refine their product at quite a small cost; there is thus produced a nearly sulphur-and-phosphorus-free product, free from segregation, and of great homogeneity, which is particularly suited for high-class rails, tires, axles and springs. A large quantity of electric steel is being made up into steel castings. The electric furnace is a convenient melting apparatus in foundries which are not large enough to run a Bessemer or a small open-hearth furnace. It will also be useful in malleable-casting foundries.—*Met. and Chem. Eng'ing,* August.

Alloys of Electrolytic Iron and Monel Metal.—C. F. Burgess and J. Aston.—An account of their extended investigations on the properties of alloys of pure electrolytic iron (free from carbon) with nickel or copper or with a nickel-copper alloy in the form of the monel alloy. The results show that for the carbon-free alloys, at least, the combined addition of nickel and copper in the proportions found in commercial monel metal does not result in any deterioration of the good qualities obtained from nickel alone, and that the copper has inherent beneficial qualities of its own. If the same should prove to be true for the addition of monel metal to commercial steels containing carbon, this would represent an important progress for nickel-steel making, since monel metal is cheaper than nickel. The same issue contains an article by G. A. Roush on hardness tests on alloys of nickel and copper from electrolytic iron.—*Met. and Chem. Eng'ing,* August.

Design of Electric Furnaces.—Carl Hering.—An outline of the elementary principles of the designing and proportioning of electric furnaces and of the proper sequence in making the calculations so as to get the best results in the most direct and rational way. The author also points out the ideal conditions which the designer should strive for, even if he can only approach, but never reach them.—*Met. and Chem. Eng'ing,* August.

Units, Measurements and Instruments.

Non-Vibratory Types of Frequency Meters.—C. E. Hiatt.—Fleming and Pierce have mentioned the fact that the deflecting

moment acting on the suspended ring of the former's alternating-current galvanometer is a function of the frequency. The present author has used a modification of this instrument (Fig. 7) as a frequency meter. It is a core-type transformer with a secondary free to turn about an axis perpendicular to the plane of the core. The reaction between the field due to the current in this short-circuited secondary and the inducing field gives the

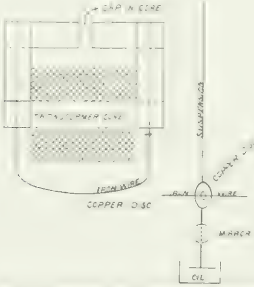


Fig. 7—Diagram of Frequency Meter.

turning moment. The instrument is, however, still essentially a Fleming galvanometer, the Fleming instrument being merely an application of an air-core alternating-current transformer with a short-circuited and movable secondary. The author's modification differs from it merely in the fact that it has an iron core. The results obtained with this instrument show that for lower frequencies it is quite sensitive. It is very easy and cheap to construct, but otherwise it has nothing to recommend it, especially as the indications of the instrument seriously depend upon the variation of wave-form and voltage. The second part of the paper deals with the author's bolometric frequency meter, which depends for its action on the rise in temperature of a thin iron wire subjected to cyclic reversals of magnetic flux. This seems more satisfactory and has a far more extended range. It seems that a single instrument can be made which will measure any frequency from 10 cycles to 1,000,000 cycles per second with a fair degree of accuracy. The instrument and testing equipment are shown diagrammatically in Fig. 8. The iron-work bridge, of which *A*, *B*, *C* and *D* are the arms, is enclosed in a tight box of insulating material, which shields it from external temperature changes. Two opposite arms of this bridge are mounted on thin rectangular strips of mica, as shown on the right side of the figure. Each arm consists of an iron wire 0.0513 mm in diameter and about 0.5 m long, strung zigzag fashion through holes in the mica strips. The two rows of holes in the mica are about 4.6 cm apart. As adjacent lengths of wire are separated by the mica sheet, short-

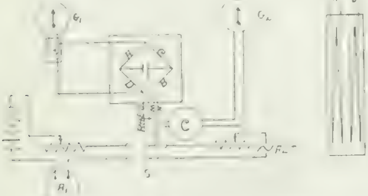


Fig. 8—Connections of Bolometric Frequency Meter.

circuiting of portions of the wire is effectively prevented. The stringing of such fine-springy wire on such a frame is a rather delicate and tedious process. Two frames are made containing the arms *A* and *B* and *C* and *D*, respectively. *C* and *D* are then placed in a solenoid of 1740 turns of double silk-covered copper wire 0.508 mm in diameter and wound on a wooden spool. *A* and *B* are placed in a solenoid containing the same amount of wire and exactly like the first except that it is wound non-inductively. These two solenoids are permanently connected in series and attached to the wires *M* and *N* coming from the switch *S*, which furnishes the exciting current. When alternating current is supplied to these solenoids the bridge arms *C* and *D* get hotter than *A* and *B* and, due to the high temperature-resistance coefficient of iron, the bridge becomes unbalanced. This is indicated by the mirror galvanometer *G*. The current in the coils is kept constant by means of a resistor of variable resistance and the thermo-comparator *C* used in conjunction with the galvanometer G_2, to form a thermo-ammeter. The most valuable feature of the instrument is its high sensibility. The curves given show that the deflections are proportional to the frequency. Each instrument must be calibrated empirically.—*Phys. Rev.*, July.

Ampere-Hour Meters.—A description of various recent modifications in the construction of ampere-hour meters. A device is first described for compensating for friction. A small positive torque is given to the meter even if there is no consumption of power to be measured, in order to compensate for friction, but without the danger of the meter running without load. The arrangement is shown in Fig. 9, in which *a* is the armature of an ampere-hour meter which is in series with one or several thermo-elements *b*. *a* and *b* are in parallel

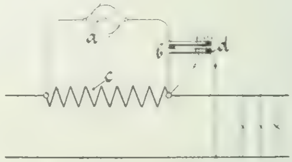


Fig. 9—Ampere-Hour Meter.

with the shunt *c*. One joint of the thermo-element is heated by means of a resistance *d* connected across the mains and is thus kept continually at a higher temperature than the other end of the thermo-element. The connections are so made that the thermo-e.m.f. produced generates a current in the same direction through the armature as the voltage drop in the shunt so that this constant additional torque compensates completely for the friction. The difficulty of this arrangement is the mechanical execution, as it is necessary to reduce the power consumption in the heating wire *d* as much as possible and nevertheless get a sufficient effect. A suitable arrangement is described in detail, iron-constantin or copper-constantin thermo-elements being used. Another improvement of ampere-hour meters described is the construction of the brush holder of two different metals, iron and zinc, so that it changes somewhat its form with varying temperature due to the different temperature coefficients of elongation of the two metals, the brushes being thereby displaced on the commutator. An attachment for indicating the maximum demand is also described.—*Elek. Anz.*, July 10.

Potentiometer Design.—F. WENNER.—An abstract of an American Physical Society paper on a device for the lower decades of a potentiometer to be used in the measurement of

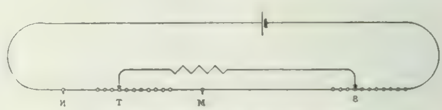


Fig. 10—Principle of Potentiometer.

small e.m.fs. From Fig. 10 (which shows the arrangement of one decade) it will be seen that a part of the circuit, including the potential point *M*, is shunted by a comparatively high resistance. By means of a double dial switch, both branch points between the shunt and the main circuit may be shifted in steps of equal resistance so as to introduce a larger or smaller resistance between *T* and *N* while keeping the resistance shunted constant. The shifting of the switch then produces a change in

the potential difference between M and N equal to the change in the resistance between T and N times the current in the shunt. The device works out well in the design of a low-range two-circuit potentiometer having a low resistance between potential terminals.—*Phys. Rev.*, July.

Instruments.—C. D. Haskins.—The first part of an article on appliances for electrical measurements. In the present installment the author deals with switchboard instruments and describes their construction, methods of installation and uses. The different types of the switchboard instruments are discussed separately.—*Gen. Elec. Rev.*, August.

Recording Meters.—C. W. Drake.—With the aid of examples from the practice of a small wagon works, a saw mill and a paper mill, the author shows how manufacturing operations can be advantageously investigated and controlled by means of recording meters.—*Elec. Jour*, July.

New Apparatus and Appliances

GERMAN EQUIPMENT IN HAVANA.

Some unusual features have been embodied in the 4500-hp generating station recently constructed by the Allgemeine-Elektricitäts Gesellschaft, Berlin, Germany, for supplying electrical energy to the City of Havana. The power house, situated outside the city immediately on the sea, shows some striking constructive features dependent on the extraordinarily favorable climatic conditions in a country where the temperature never falls below 16 deg. C. In fact the boiler-house is completely open on the side turned towards the stoker's stand, the sheet-iron flue being carried above the boiler-house to the chimney. On account of this arrangement the economizer serving to preheat the boiler feed-water has been installed on the roof of the boiler-house. The latter, as well as the engine house, and its accessory rooms, are mainly made of iron structures, while the outward walls are built up of cement blocks formed on the spot. All of the materials, inclusive of the bricks used for the stack, have been imported from Germany.

The boiler-house contains four marine type water-tube boilers designed by Messrs. Babcock and Wilcox of London, each of which has a heating area of 300 sq. m. (3200 sq. ft.) in contact with water, and is fitted with a superheater raising the temperature to 350 deg. C.

The generating plant comprises four 1100-hp, 6000-volt, three-phase generator sets, which are excited from a small storage battery, or a 48-kw motor-generator.

The switchgear, which is shown in Fig. 2, is designed on transformers located in underground cabins of 2160 kw total rating, where the e.m.f. of the high-tension energy is lowered

Fig. 1—Generating Station with Open-Air Boiler Room.

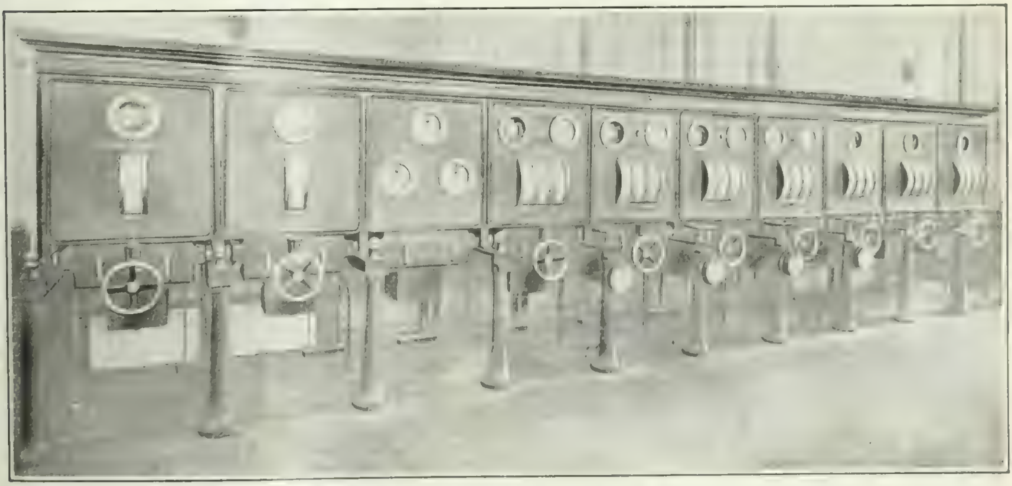


Fig. 2—Switchboard and Switch Gearing

the transportable switchboard system. The three phase energy is supplied through a cable system about 50 km (30 miles) in length, laid partly in clay pipes, to a number of oil insulated to the working value of 220 volts. The low tension conductor system which is likewise designed as a cable system then distributes the energy to the various centers of consumption

HIGH-FREQUENCY INDUCTION GENERATORS.

The firm of Hartmann & Braun, Frankfort, Germany, has recently developed a line of high-frequency generators for use in making capacity and inductance measurements, producing pure sounds of any desired intensity, etc. The machines are all of the induction type, and, therefore have no moving electric

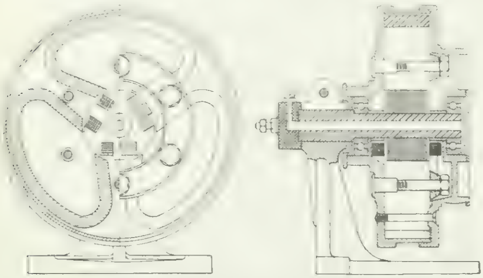


Fig. 1—Tachometer Generator.

contacts. Fig. 1 shows the construction of a six-pole machine, and is typical of the arrangement of the magnetic and electric circuits used in all these machines. It will be noted that there are only half as many armature coils as pairs of field poles. It is claimed that this arrangement of coils is very advantageous. It leaves an un-

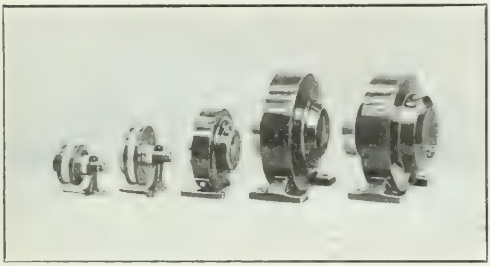


Fig. 2—Tachometer Generators.

broken magnetic path between the coils and tends to preserve uniform and constant distribution of the magnetic flux, and generate a sine wave e.m.f. The armature and bearings are mounted rigidly on the base and the field frame is mounted on ball bearings and finished as a three-step pulley. This type of machine generates a voltage almost exactly in direct proportions to the speed and is, therefore, well adapted to use in connection with voltmeter tachometers. Fig. 2 shows a line of

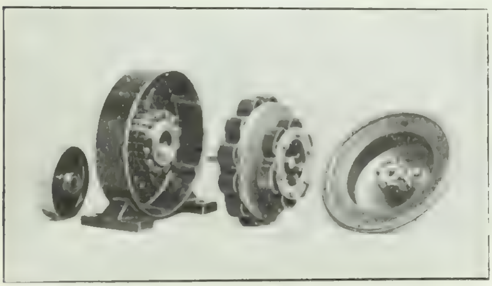


Fig. 3—Composite Frequency Generator.

these machines built for continuous service. In Fig. 3 is shown a composite type with two units in one frame. This machine is especially designed for physicists in studying acoustics. It is used in connection with a telephone receiver for the production of simple and composite sounds of absolute purity.

Fig. 4—Sound Vibrations.

Fig. 4 shows an interesting case of resonance. The telephone received is excited by the generator and the sound vibrations are

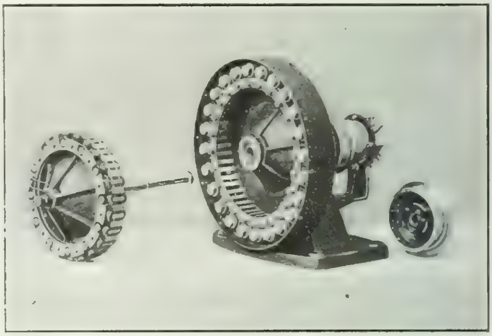


Fig. 5—Double Rotor High-Frequency Generator.

of such intensity and constant frequency that a strip of paper clamped as shown is set into vigorous vibration.

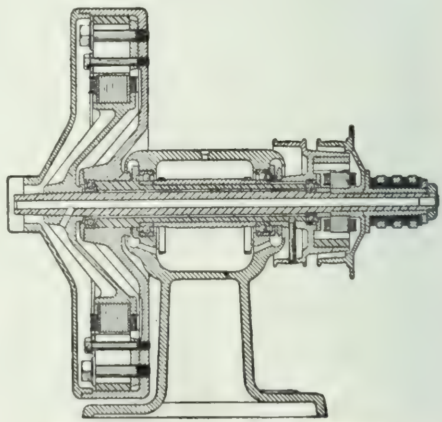


Fig. 6—Section of High-Frequency Generator.

For extremely high frequencies suitable for capacity and inductance measurements machines are built with both the armature and the field poles revolving. Fig. 5 shows a generator of

this type, and Fig. 6 shows the construction. The two parts are driven in opposite directions, thus permitting the attainment of extremely high relative speeds between the two moving members. The spiders that carry the main revolving parts also carry in their opposite end a small generator, which is used

Fig. 7—Effect of Load and Induction on Curves.

in connection with an electric tachometer in order to be able to measure the speed and therewith the frequency of the high-frequency machine.

The diagram at the right of Fig. 7 shows how, by the addition of a small inductance, the e.m.f. wave may be made to approach a sine curve.

WATCH-CASE BATTERY GAGE FOR TELEPHONE WORK.

The battery gage recently developed and placed on the market by the Western Electric Company is a compact instrument for measuring the strength of telephone dry batteries used in connection with the company's transmitters. It is designed for connection to three cells in series, duplicating conditions of the local battery subscribers' set. It contains apparatus for gaging current through two resistances, corresponding to high- and low-resistance transmitter.

The gage is manufactured in the form of a watch-case, as shown in the view herewith. It contains no scale, but is designed merely to indicate the point at which batteries should

Watch-Case Battery Gage.

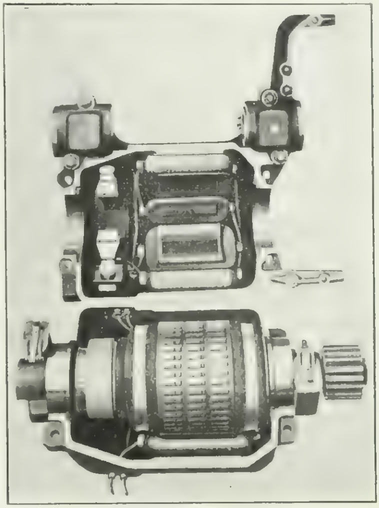
be put out of service. For a high-resistance transmitter a mark above the arc on the face of the gage is used to denote the cut-off point. This means that current from the three cells is being sent through 20 ohms resistance. The cut-off point is 140 milli-amperes, a point which conforms with the best telephone practice. When the stem of the watch-case is depressed 15 ohms is cut out, leaving only 5 ohms of resistance in circuit.

This produces the conditions of the low-resistance transmitter, and the cut-off point, which is indicated below the arc, is 420 milli-amperes.

INTERPOLE RAILWAY MOTOR.

In extending its line of railway motors, the Allis-Chalmers Company has recently placed on the market an interpole motor developed to meet severe conditions of operation, especially on lines which use a potential of 600 volts or over. This motor also has desirable features for use where a lower voltage is employed.

As is seen by the accompanying illustration, the motor is sturdy and strong with ample provision for wearing surface in the bearings. The field frame is constructed of high-quality cast steel and is split horizontally through armature and axle



Interpole Railway Motor.

bearings so that it may be opened downward. The main pole-pieces are of soft steel punchings, securely clamped between malleable-iron end plates, to which they are riveted. The interpole or commutating pole-pieces are of solid steel. The field coils are of the mummified type, insulated and impregnated with a moisture and waterproof compound. The coils are firm and have excellent heat-conducting properties which assist in the cool running of the motor. The bearings are bronze with a thin lining of babbitt and are carefully fitted to the bearing housings.

The armature core is built up of soft-steel laminations carefully annealed and varnished after punching. They are securely clamped between end heads, which also have rims to support the coil ends a uniform distance from the shaft. The laminations are built up on a cast spider, which also carries the commutator so that shaft renewals can be made without disturbing the windings. The coils are wire-wound and insulated in the usual way, but after being pressed in steam-heated molds are cooled under pressure, which gives each the same dimensions. This process makes the coils absolutely interchangeable and greatly reduces the labor whenever it becomes necessary to rewind the armatures.

[illegible] volts. These loads can be carried for one hour with a temperature rise not exceeding 75 deg. C. above the surrounding air. It has a continuous carrying capacity of 36 amp at 400 volts. The motors are designed for either double or four-motor equipment, and standard gear ratios are employed

GASOLINE-ELECTRIC PASSENGER VEHICLE.

The Daimler Motor Company, of London, England, has brought out a gasoline-electric 'bus, seating 34 passengers and combining many interesting features. In this vehicle there is no chassis frame in the ordinary sense, the frame being formed by the bottom or well of the body. This is built up of sheet steel rolled into a deep channel section the whole width of the base of the body. At the points of load application on the springs, cross members shaped and riveted to the steel well are fitted, these adding the necessary stiffening at the points required. To obtain torsional rigidity to meet all winding and

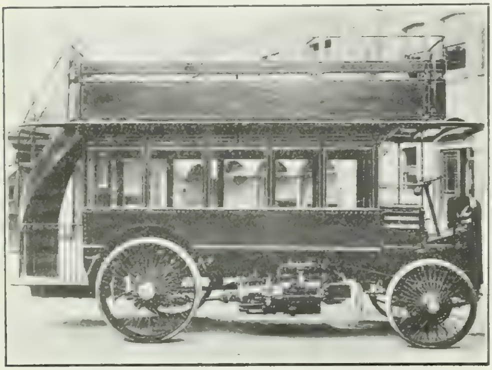


Fig. 1—Gasoline-Electric Passenger Vehicle.

twisting strain on the frame a large rectangular steel tube is fitted in between the two sides of the steel well under driver's seat, and firmly riveted to it. This member also forms the gasoline tank, and has a capacity of 25 gal.

At each side of this sheet-steel frame, and under the top horizontal webs or seat line, are fitted the power units, these on the present 'bus comprising two 12-hp engines of the new Daimler type, the crankshaft and frames of which are extended, and on this the dynamotors are fitted, the whole forming complete and compact self-contained units. Each dynamotor is nominally rated at 3 kw, but has a "give-and-take" capacity of three to four times this rating. The drive from each unit is taken directly from the engine and dynamotor shaft to a worm drive fitted to each wheel, through a tubular cardan-shaft, no differential gear being used. Built up directly on the sheet-steel frame is the body, the framing of which is made entirely of sheet steel; the side posts come straight down from top to bottom, no reduction of width taking place, thus giving a base at bottom the full body width. The side posts carrying the top weight are mounted directly over the spring supports. It will be plainly seen that, besides taking off considerable body weight due to having no "well" as part of the body, the whole superstructure is made much lighter than is possible with the ordinary method. The body and frame, together with the parts, such as steering gear, dashboard, brake levers, etc., mounted on the frame, are slung on the axles at each end with no overhang other than is entailed by the spring lengths. The front axle, consisting of a steel tube, has the steering pivots welded in at each end; these pivots being co-axially in the wheel center, the well-known advantages of central pivot steering are obtained. Front wheel brakes are fitted, these being operated by a foot pedal, and also by a hand lever for standing purposes. The road wheels are mounted on the extremities of a tubular cranked axle tree, and are driven by short live axles coupled direct to the worm wheels on the right- and left-hand sides of the vehicle respectively. The axle tree is so designed that each road wheel and the worm gear by which it is operated are carried directly off the spring bracket—that is, the portion of the axle tree directly supporting the weight of vehicle. Between the wheel and worm casing are fixed the rear springs, and this method of construction enables a maximum spring base to be used, the spring requiring to clear the wheel rims only.

In view of the fact that one of the principal objects in design has been to reduce weight to a mimimum, the employment of wheels of a larger diameter than hitherto used might appear a retrograde step; but by the employment of specially designed suspension wheels, the company has been enabled to use 40-in. diameter wheels on the front axles, and 48-in. diameter wheels on the rear axles; and, besides obtaining the great advantages due to large-wheel diameters, have actually not only reduced the weights of the wheels, but also secured a much larger factor of safety. The unsprung weights have been reduced to a very low figure, that below the rear springs being somewhat under 10 cwt. and that below the front springs about 5 cwt. Special attention is called to the lateral distance between the springs both back and front, the minimum police regulations being exceeded by as much as 9 in. on front axle and 15 in. on the rear axle. By the disposition of the mechanism adopted, the height of the platform inside the body above the ground has been reduced to 27 in., and the ground clearance with the large wheels employed amounts to 15 in. The power units are slunk in the track of the wheels, hence their ground clearance does not enter into consideration; however, a 12-in. clearance is given here. The battery and control board are carried underneath the driver's seat. Four separate methods of braking are possible: (1) By bringing the lever on the steering gear to the strongest field position, when the momentum of the 'bus is absorbed by charging the battery; (2) by a magnetic brake operating on both cardan-shafts actuated by one foot lever which simultaneously declutches the engines; (3) by a foot lever operating the brake on the front wheels; and (4) by a hand lever also actuating the front wheel brakes.

For the control of the 'bus there are two levers placed on the top of the steering wheel—one connected up to the dynamo field controller, this lever entirely controlling the speed, which varies between 3 miles and 14 miles per hour; the other is connected to the two engine throttles. For running in a forward direction, the two dynamotors are in parallel with the battery: the field regulation is controlled by a common rheostat. For reversing, the dynamotors are placed in series, and so an efficient low-speed combination is obtained, giving a high torque and a perfectly balanced reverse drive. The parallel-series position is obtained by a single controller, the operating lever for which is within easy reach of the driver, but is not touched

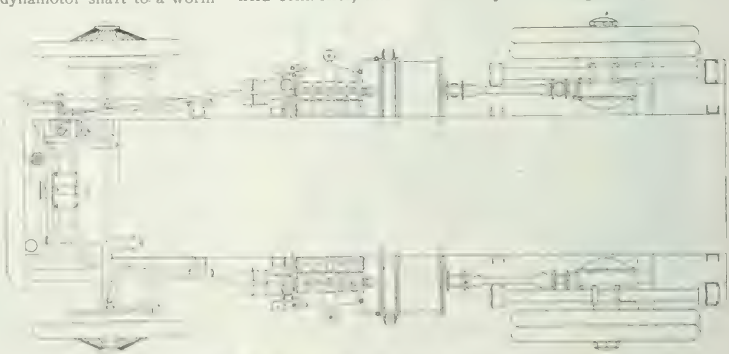


Fig. 2—Plan of Gasoline Electric Vehicle.

by him until change of direction is required. The magnetic brakes and clutches on both power units are in parallel with a single controller operated by a pedal. The radiator, placed in

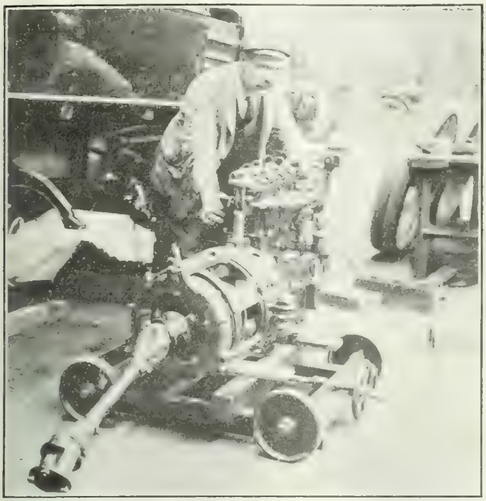


Fig. 3—Engine and Dynamotor.

front of the vehicle, is connected with both engines, the circulation pump serving both units in common. The pump is driven by a small ½-hp electric motor, this also driving a fan of ample capacity arranged in the customary position behind the radiator.

The total unladen weight, including 5 cwt. of accumulators, complete ready for the road, is 3 tons 9 cwt., the regulations allowing 3 tons 10 cwt.

MOTOR-DRIVEN CENTRIFUGAL PUMPS FOR GENERATING STATIONS.

The centrifugal pump is now so well known as to require no general explanation. Its simplicity of action; freedom from water hammer and shock; the absence of valves or running

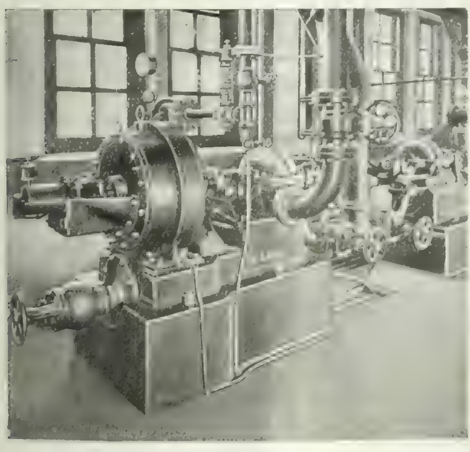


Fig. 1—Motor-Driven Centrifugal Pumps.

parts; its compactness and simplicity; its adaptability to various drives and its general flexibility, enabling it to meet varied conditions of service, have been brought repeatedly to the notice of the engineering public. In the ordinary centrifugal pump the power consumed increases steadily from no delivery up to the maximum. This means that if the head on the discharge of the pump be relieved the amount of energy consumed will be excessive, and perhaps sufficient to overload and burn out the electric motor, or to require the use of an unnecessarily large and expensive motor, as in this type of unit the motor is the more costly part. In the pumps manufactured by the De Laval Steam Turbine Company, Trenton, N. J., the design is such that the horse-power required reaches the maximum at about the delivery corresponding to the maximum efficiency, which delivery is that for which the pump is designed. After this the power taken by the pump becomes less as the flow increases, so that should the head on the pump be diminished, as through breakage of the pipe line or other causes, the brake horse-power will actually decrease, rendering overloading of the motor impossible. This automatic protection of the motor is secured not by the addition of governing apparatus or other contrivances, but by the shaping of the pump passages so that these qualities are retained under all conditions, and at all

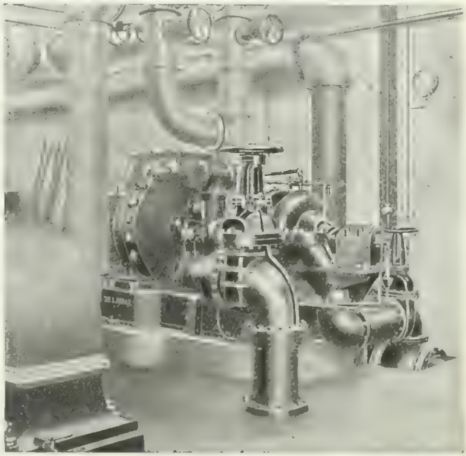


Fig. 2—Motor-Driven Centrifugal Pumps.

times. This property of the De Laval centrifugal pump makes possible the use of smaller and less expensive motors, and permits of the selection of a motor having maximum efficiency at the output coinciding with the demands of the pump under normal operating conditions.

Because of its many admirable mechanical features, the De Laval centrifugal pump is well adapted for pumping water for all purposes in power house operation. Where the pumps are to be directly connected to electric motors it is important that the speed should be adapted to the speed of the motor. In general, high speed motors weigh less and cost less than low speed motors, and the De Laval pump being designed to meet any speed conditions imposed by motors, this feature in connection with its high efficiency and drooping power characteristic renders it particularly adapted to electric drive. When centrifugal circulating pumps are used to supply barometric condensers, the sloping characteristic curve peculiar to the De Laval pump is highly valuable, since a circulating pump must start from no flow against a comparatively high head, without the assistance of vacuum to lift the water, and after the condenser is in operation handle the much larger volume of water demanded by the condenser against a lesser head. For this purpose the pump is therefore designed with a characteristic curve considerably steeper than usual, the curve being proportioned so that the flow of water can be started through the condenser without the aid of the air pump, and so that the pump will subsequently work efficiently when delivering the larger volume at the lower

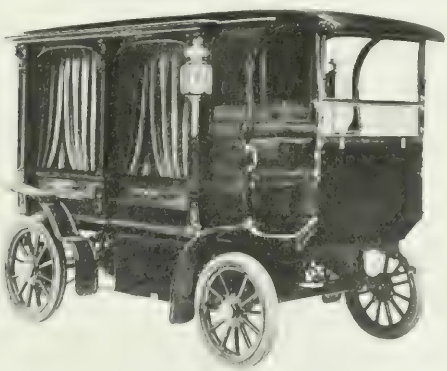
head. It is claimed that it will also meet a falling vacuum with an increased head preventing the entire dropping of vacuum.

For boiler feed purposes the centrifugal pump has pre-eminent advantages, as it does not endanger the pipe line by vibration and shock, and the entrance of water to the boiler can be regulated without reference to the pump. The De Laval steam turbine driven boiler feed pump can be operated in connection with any standard pump governor to maintain either a fixed pressure or a fixed excess pressure in the feed line, in which case the turbine governor operates only as a maximum speed limit device. Where the highest steam economy is not required as in the case of plants where the exhaust can be used in feed water heaters, the company recommends its gearless turbine driven pumps for their compactness and simplicity. In such units the pump impeller and the steam turbine shafts are connected directly together by a flexible coupling. The pumps can also be fitted with low pressure turbines, or where the steam from other sources is sufficient for heating the feed water the pumps may be driven by electric motors with resulting high economy. These pumps also lend themselves for handling oil, seepage, etc., in large power houses.

ELECTRIC HEARSE.

For the purposes of a self-propelled hearse, there can be no gainsaying the fact that the electric vehicle, with its silence, reliability and dignity of operation, is the only appropriate motive power. What is said to be the first battery-propelled hearse to be constructed has recently been put in commission by a Chicago firm of undertakers, A. L. Bentley & Son, who placed a special order for the vehicle more than twelve months ago. The hearse body is mounted on a regular one-ton Waverley truck chassis, fitted with a single large motor connected to the rear wheels through a double-chain silent drive. The body is carried on three-quarter elliptic springs forward and semi-elliptic springs in the rear.

The battery equipment comprises 42 11 MV Hycap Exide cells, mounted in an underslung battery box, so that the body can be removed from the chassis without interfering with the cells. For efficient operation at low speeds, the controller is arranged to cut the battery into sections, paralleling these to supply energy at diminished voltage to the motors. The steering wheel acts through a worm-and-gear to control the front



Electric Hearse.

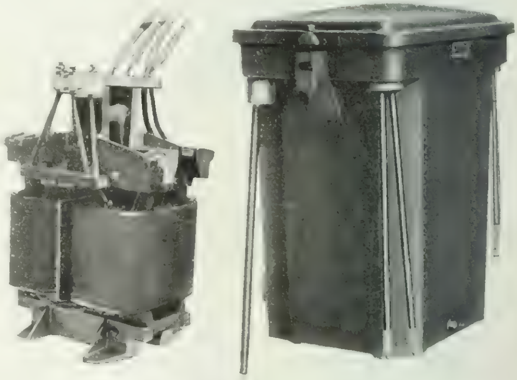
wheels. A head-lamp, tail-lamp and two side lamps are provided. The hearse body, finished inside in mahogany, and having its black exterior ornamented with a chaste design, was built by the James Cunningham & Son Company of Rochester, N. Y. The vehicle complete was furnished by the Waverley Company, Indianapolis, Ind. The design of the mechanical parts and of the body itself has been so carefully planned that the complete hearse appears little heavier than the standard horsedrawn vehicle.

This electric hearse is designed to run 50 miles or more on one charge. While it has never been called upon to make such long trips, it is frequently in continuous service both morning and afternoon for making trips to the outlying Chicago cemeteries, and in a month of practical use has earned the praise of both the undertakers and persons in attendance at the funerals.

NEW TRANSFORMER.

The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has recently brought out a new outdoor distributing transformer, designed especially for 6600 to 16,500 volts. The case of the transformer, as well as its external appearance, is similar in a general way to that of the 2200-volt transformer of the same company; the same general methods of construction are followed and all of the special features of the latter are embodied in the new transformer.

Elbow-shaped bushings, which are made larger to take care of the higher voltages, hold the leads securely both inside and



Figs. 1 and 2—Transformer

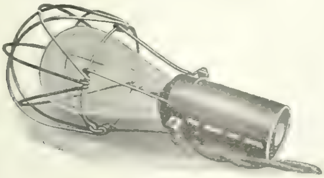
where they issue from the case. An insulating compound is poured into the bushing through a hole in the top to make an absolutely weather-proof joint. An impregnated gasket between the case and cover of the transformer prevents the "breathing" action that is often the cause of the absorbing of moisture into the case under certain conditions of service. Beside the oil plug at the bottom of the case, there is a smaller water-drain plug, through which any slight accumulation of water can be drawn off without appreciably affecting the volume of oil in the case. The contour of the case is very symmetrical and the corners are well rounded, which feature and the impregnated gasket make for an excellent joint between the case and cover.

Both high and low-tension terminal boards are kept under oil, thus precluding the possibility of grounding to the case. Special pains have been taken to prevent the syphoning of oil from the case. From where the low-tension leads come out of the oil, they are bared for several inches and soldered into one solid piece. The high-tension leads from the terminal board are covered with treated cloth tubing, which extends into the high-tension bushing. For a short distance in this bushing, the insulation is entirely removed, and the cable is soldered. Thus, the syphoning of oil from the case is effectively prevented on both the high and low tension leads.

The iron losses, copper losses, regulation, and exciting current are stated to compare favorably with the guarantees made on the 2200-volt type of transformer. The position of the magnetic-circuit gaps is such as to give a minimum exciting current, and the number of gaps is reduced to only two, by means of L plates.

MAGNETIC LAMP SOCKET.

A very convenient device consisting of a cylindrical socket 2¾ in. long and 1½ in. in diameter, fitted with a lamp socket in one end and an electromagnet in the other, is manufactured by the Federal Electric Company, of Chicago, and is illustrated herewith. The magnet is of sufficient strength to hold the socket firmly at any angle on any iron or steel body. It is wound separately from the lamp circuit, so that in the event of



Magnetic Lamp Socket.

accidental breakage, or burning out of the lamp, the energy still operates to hold the socket in place. With this magnetic socket a lamp can be located in the most convenient position, and while it is held firmly as long as it is needed, it can be removed by a slight pull when the user so desires. The socket is furnished wound for use on 110-volt circuits with standard base lamps, and for use on 40-volt and on 6-volt circuits with candelabra-base lamps. The 40-volt type is adapted for use on electric automobiles, while the 6-volt type can be used on sparking batteries of gasoline machines.

POLYPHASE MOTORS IN A WOOD-WORKING SHOP.

The accompanying illustrations show interior views of the wood-working shop of the Murray-Hill Company, New York City. This factory is designed according to the latest improved practice and is constructed throughout of reinforced concrete. It has been laid out so as to obtain good lighting and ventilation and with special reference to economy in the handling of work.

All of the machines in the shop are driven by means of Hawthorn polyphase induction motors, and most of them are equipped with individual drives. Energy is supplied for the

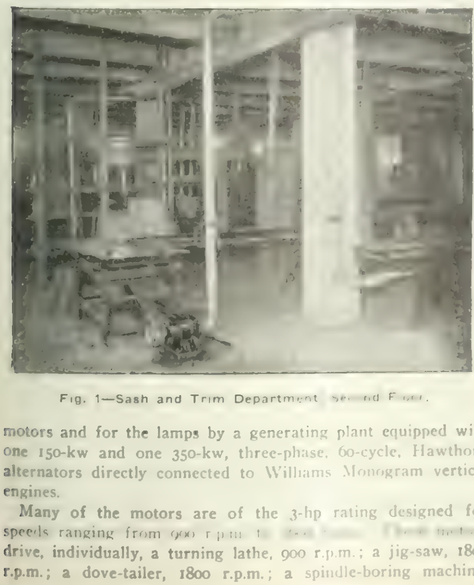


Fig. 1—Sash and Trim Department, Second Floor.

motors and for the lamps by a generating plant equipped with one 150-kw and one 350-kw, three-phase, 60-cycle, Hawthorn alternators directly connected to Williams Monogram vertical engines.

Many of the motors are of the 3-hp rating designed for speeds ranging from 900 r.p.m. to [illegible]. [illegible] drive, individually, a turning lathe, 900 r.p.m.; a jig-saw, 1800 r.p.m.; a dove-tailer, 1800 r.p.m.; a spindle-boring machine, 1800 r.p.m.; a key machine, 1800 r.p.m.; a joiner, 3600 r.p.m.; a band saw, 1800 r.p.m.; sash stitcher, 900 r.p.m.; tenoning machine, 1800 r.p.m.; sash dovetailer, 1800 r.p.m.; boring machine, 1800 r.p.m.; and a record joiner, 3600 r.p.m. Motors rated at 3.5-hp drive the following machines: A cut-off saw, 1200 r.p.m.; a dado saw, 1200 r.p.m.; a swing saw, 1200 r.p.m.; a mortise machine, 1200 r.p.m.; a window-sash pocket machine, 1800 r.p.m.; a miter saw, 1200 r.p.m.; a cut-off saw, 1200 r.p.m.; a group of four swing saws, 1200 r.p.m., and a feeder for a

Fig. 2—Sash and Wardrobe Department, Third Floor.

48-in. sander, 1200 r.p.m. Among the 5-hp motors are three on the drums of the 48-in. sander, and one on a broom sander. Five-horsepower motors also drive individually two rip saws, 1200 r.p.m., and two window-sash pulley machines, 1800 r.p.m. There are two 7.5-hp motors, one of which drives a 7-in. molder at 900 r.p.m., and the other of which drives four rip saws at 1800 r.p.m. There are two 10-hp motors driving individually a planer at 720 r.p.m. and a rip saw at 1800 r.p.m.

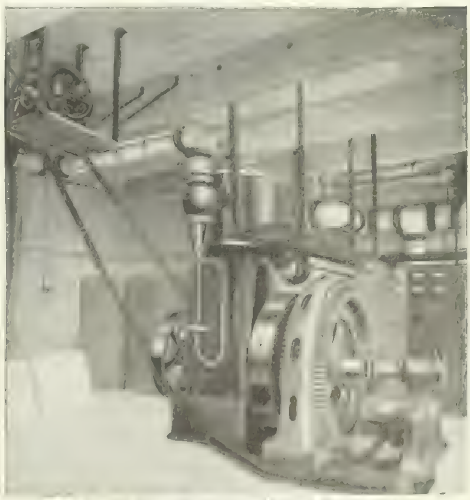


Fig. 3—150-KW. Generating Unit in Power House.

The 15-hp motors installed are used for driving four 10-in. molders, two 9-in. molders and one 26-in. surface planer; these machines are designed for 1200 r.p.m. A single 16-hp, 900-r.p.m. motor has been installed for driving a 12-in. molder. There are two 25-hp, 900-r.p.m. motors, one driving a 24-in. molder and the other a blower. The largest motor in use is a 50-hp machine directly connected to a forge-type blower running at 900 r.p.m.

Industrial and Commercial News

THE WEEK IN TRADE.

REPORTS of trade for the past week as received by financial papers indicate that there has been a slight improvement in the general condition of trade throughout the country. In actual business the improvement has not been sufficient to cause any great enthusiasm but there certainly has been a betterment of sentiment. Some of this improvement undoubtedly is due to the fact that much needed rains have fallen in many sections of the West where crops were suffering. The season has now progressed to a point where the crop question is practically settled. The wheat crop is made and the corn crop is so far advanced that only the question of maturing is to be considered. Among the jobbers and wholesalers there is still every evidence of that remarkable conservatism which has marked the buying for the past six months. Many buyers are in the central distributing markets but they are placing orders very sparingly. There is plenty of money in the country and plenty of prosperity, but there seems to be a feeling of fear among consumers and retailers as to what may happen. Without any particular reason for alarm there is a general disposition to go slow. In the industrial world conditions are practically unchanged. There is still curtailment in cotton and woolen manufacture and many of the iron and steel mills are not operating full time. There continues to be, however, considerable business in structural material and quite a number of orders for traction equipment are being received. In fact the traction companies are buying much more liberally than the steam railroads and are doing much more in the way of extensions and development. There has been very little improvement in the matter of collections. They are still slow or only fair. Business failures for the week ended Aug. 4, as reported by *Bradstreets'*, were 166, as against 198 for the previous week, 184 for the same week in 1909, 205 in 1908, 157 in 1907, and 137 in 1906.

THE COPPER MARKET.

STIMULATED by the evidence of a curtailment in the output, there was a stronger tone in the copper market last week. The buying, however, was only for immediate requirements, and there seems to be no desire to stock for future consumption. This attitude is attributed to the large surplus on hand, which is considered a guarantee against a runaway market. Cables report a large and increasing foreign consumption, and there are indications of curtailment in production abroad. The production of some of the large mines in this country has been curtailed for some months past and in not a few cases smaller mines have shut down. Better prices for copper may result on this account; but not until the business of the country has shown improvement and railway expenditure is back to normal. Electrolytic was quoted at 12½ to 12⅝ cents and Lake ¼ cent higher. Producers are hopeful, and the fact that consumers are bare of stock should prove a strong factor in maintaining any advance that is made later on. The copper share market shows a better tone since the published interview of Mr. J. D. Ryan, president of Amalgamated Copper, who was one of the leading figures in the recent conferences which were held with a view of arriving at some understanding regarding the question of diminution of copper production. The general opinion expressed is that production is in excess of consumption on an unprecedented scale. It is said that the Calumet and Hecla has established a minimum price of 13 cents for copper and that other leading copper interests look for improvements in the price of the metal. The monthly report of the Copper Producers' Association for July, published Monday, showed that over-production of copper was still in progress last month, although not to so great an extent as earlier in the year. Output exceeded deliveries by 2,254,661 lb. as compared with a similar excess in June of 7,961,000 lb. and in May of 18,441,817 lb. An excess of at least 10,000,000 lb. had been looked for, but the returns showed that output had been curtailed nearly 9,000,000 lb. last month, while an increase in domestic deliveries had partly offset a falling off in exports. Following are the July returns compared with those of June and with July last year, figures representing pounds:

Stocks	168,386,017	160,425,973	122,596,607
Production	118,370,003	127,219,188	118,277,603
Total	286,756,020	287,645,161	240,874,219
Domestic deliveries	56,708,175	53,363,196	75,520,083
Exports	59,407,167	65,895,948	75,018,974
Total deliveries	116,115,342	119,259,144	150,539,057
Stocks remaining	170,640,678	168,386,017	122,596,607

Although no definite statements from the leading copper interests have been made, the general opinion is that the output will be materially reduced, and if this is carried out on a fairly large scale, the present surplus will be quickly reduced and the immediate effect would be to raise the selling price

STANDARD COPPER.

	Bid.	Asked.	Settling price.
Spot	12.10	12.30	.....
August	12.15	12.25	12.20
September	12.17½	12.20	12.20
October	12.20	12.25	12.22½
November	12.20	12.25	12.22½

The London market August 8 was as follows:

	Highest. £ s d	Lowest. £ s d
Copper, spot	55 1 3	55 0 0
Copper, futures	55 16 3	55 15 0

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.70c
London, spot	£62 0 0	£52 15 0
London, futures	65 18 9	53 7 6
London, best selected	65 10 0	57 15 0

of the metal. This feature is the dominating influence in the share market. Lake copper advanced easily on good buying; but it has still a long way to go before it again reaches its high mark for the current year. Daily call on the Metal Exchange August 8 quoted standard copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

General Electric Sales.—The contract for the four 2000-kw rotary converters required by the New York Central Railroad Company for its new substation at Irvington, and the substation at Glenwood, which were referred to in our issue of Aug. 4, has been placed with the General Electric Company. This apparatus will be installed and be ready for operation by next Spring.

Empire District Electric Company.—The 20,000-hp steam station of the Empire District Electric Company, at Joplin, Mo., is practically completed and ready for operation. The work of constructing this station occupied less than six months, and with its completion the Empire District Company will be able to serve the entire mining section of Joplin and the adjacent territory.

Electric Furnaces for Noble Electric Steel Company.—Taking advantage of the shut-down caused by the inability of the Northern California Power Company to furnish the necessary energy to operate its smelter owing to drought, the Noble Electric Steel Company will erect five more furnaces at a cost of $30,000. The electric process smelter of this company is located at Heroult, Cal.

American Gas & Electric Company.—At a recent meeting of the American Gas & Electric Company, New York City, the following officers were elected: President, Mr. R. E. Breed, succeeding Mr. H. L. Doherty; vice-presidents, Messrs. George N. Tidd and A. M. Young; secretary-treasurer, Mr. F. B. Ball; assistant secretary, Mr. F. P. Hunter; assistant treasurer, Mr. A. E. Smith. The company has sold to the United Gas Improvement Company of Philadelphia, the Conshohocken Electric Light Company of Conshohocken, Pa., and has acquired the Household Electric Light, Heat & Power Company of Jermyn, Pa.; the Hartford City Lighting Company, Hartford City, Ind.; the Jonesboro Light & Water Company, Jonesboro, Ind.; Dunkirk Lighting Company, Dunkirk, Ind., and the Redkey Lighting Plant of Redkey, Ind.

I. P. Frink.—The old firm of I. P. Frink, which has been manufacturing reflectors, and installing lighting plants for many years, will move from its present location, 551 Pearl street, which it has occupied for fifty-three years, some time in September, to a new factory, 239 Tenth avenue, at the northeast corner of Twenty-fourth street. In the new location the firm will occupy an entire five-story building which it has recently purchased. The building is being renovated and made over, and when it is occupied will be as complete a manufacturing establishment as there is in the city. George F. Spencer, manager of I. P. Frink, says that business in the line of that firm has been very good within the past two months Among the recent installations which are worthy of note are those of George W. Benjamin's show windows at Twenty-fourth street and Broadway, New York; the First National Bank of Denver, one of the largest banks in Colorado; the Higbee Drygoods Company of Cleveland; Elliott-Taylor-Woolfenden Company of Detroit; the Old Colony Trust Company of Boston; the New England National Bank of Kansas City, and the new Methodist Church of Gloversville, N. Y. The last-mentioned installation is particularly interesting from the fact that it is one of the first instances in which a church has adopted the concealed lighting system. In addition to those mentioned, the Frink firm has done a considerable amount of work for libraries, schools and other institutions where desk lighting and case lighting are demanded.

Gas & Electric Securities Company.—Henry L. Doherty & Company have completed arrangements for a holding company which, it is promised, will acquire a number of attractive properties and will offer to exchange stock of the holding company for the stocks of the Denver Gas & Electric Company, Empire District Electric Company, of Joplin, Mo., and the Lincoln (Neb.) Gas & Electric Light Company. The new company will have a capitalization of $1,000,000, 7 per cent cumulative preferred stock and $1,000,000 common stock. Doherty & Company announce that they will act as bankers and syndicate managers, and will receive their compensation in the form of a block of common stock of the holding company. They announce that they will turn over this common stock to the treasury of the Gas & Electric Securities Company, and will also assign a contract which they have with the Spokane Gas & Fuel Company for a stock bonus. These gratuities will be used as a bonus with the sale of the preferred stock The right of subscription will be offered to the public for the preferred stock with a bonus of 40 per cent of common stock, or, in other words, 100 par value of preferred stock and 40 par value of common stock will be sold for $100 cash. This company will issue no bonds, and is in no sense a holding company. It simply holds the stocks owned by Doherty & Company and those associated with that firm in their many business ventures.

Railroad Power Plant at Concord, N. H.—The Boston & Maine Railroad has contracted with the Stone & Webster Engineering Corporation, of Boston, for the design and construction of a 1200-kw hydroelectric plant at Franklin, N. H. Double transmission lines along the right of way of the railroad will carry the energy at 22,000 volts to three substations. Electricity will be used in the railroad shops and for lighting the yards and stations. Electrical energy will also be supplied to the Concord & Manchester branch, and to the Concord Street Railway and to Contocook Park. Additional converting apparatus rated at 300 kw, together with step-down transformers and control switches for a 2300-volt lighting system, will be installed at the South End substation. Converter, transformer and switch equipment, rated at 300 kw, and now mounted in a portable substation at West Concord, will be removed and erected in the engine room of the steam-generating station. A new substation, known as Hookset Substation, with an output of 600 kw, will be erected to supply the Manchester branch. New step-down transformers of 500-kw rating will be installed in the engine rooms of the shops, and improvements will also be made in the West Concord steam plant, including new boilers and a 200-kw generator.

Second Avenue to Electrify.—The Public Service Commission has authorized the Second Avenue Railroad Company, George W. Lynch, receiver, to electrify that portion of its lines in Worth street from Chatham Square to Broadway. The lines have not been in use for a number of years. The electrification of these lines had been authorized by the old State Board of Railroad Commissioners in 1898 when the electrification of the main line was approved, but the management of the Metropolitan Street Railway Company, which then controlled the Second Avenue, preferred to send the cars down Park Row to the Post Office. After the roads were put in the hands of separate receivers, the Second Avenue cars were not permitted to run on the Metropolitan lines, and consequently the Second Avenue Company had no downtown terminal. The new line will be double-tracked from Chatham Square to Lafayette street, but will only be single-track from there to Broadway, owing to the large amount of trucking in that locality. The commission authorizes this change on condition that the company abandon various other lines of track which have long been unused, and the receiver has informally agreed to these terms.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Fairfield, Ia.; Fillmore, N. Y.; Cheyenne, Wyo.; Fort Scott, Kan.; Pueblo, Col.; Superior, Neb.; Houghton, Mich.; Hudson, Ohio; South St. Paul, Minn.; Boca, Cal.; Enosburg Falls, Vt.; Sac City, Ia.; Concord, Mass.; Pennsburg, Pa.; Bridgeport, Neb.; Toledo, Ohio; Dalton, Ga.; Kansas City, Mo.; Racine, Wis.; Monticello, Ga.; Warren, Ind.; Pulaski, Tenn.; Opelika, Ala.; Crandon, Wis.; Sanford, Fla.; Colorado, Tex.; Helena, Ark.; Charleston, S. C.; Crosby, Minn.; Jacksonville, Ill.; Montgomery, Ala.; Grand Rapids, Mich.; Fort Totten, N. D.; South Norwalk, Conn.; Ellensburg, Wash.; Falls City, Ore.; East Point, Ga.; Youngstown, Ohio; Thibodaux, La.; Logansport, Ind.; Jackson, Ohio; Athens, Ala.; Pryor Creek, Okla., and Lakefield, Minn.

Mexican Electric and Irrigation Plant.—The preliminary work for the construction of a large dam across the Conchos River, about 20 miles from Santa Rosalia, has been commenced by Messrs. S. Pearson & Son, Ltd., of Mexico City, for the Mexican Northern Power Company. A new town, La Boquilla, is springing up near the dam site, and although the rainy season has interfered with the progress of the work, the contractors are assembling large quantities of material upon the ground preliminary to rushing the work as soon as the dry season sets in. The dam will impound water enough to irrigate about 200,000 acres of land in the valley of the river. The cost of the work is estimated at $7,000,000, and the main line of the Mexican Central Railway is now connected with the works of the power company by a branch line. The company has franchises for lighting numerous cities, and the dam is expected to be complete by the fall.

Decision in Montgomery (Ala.) Muddle.—Judge Thomas G. Jones, of the Federal Court of Alabama, has held that the stock of the Citizens Light & Power Company, of Montgomery, must be delivered to the H. L. Doherty interests. This is the action in which certain of the Citizens company stockholders were up for contempt for making sale of their stock after the Doherty interests had secured a federal injunction based on a prior contract. The contempt proceedings were dismissed on the ground that actual personal knowledge of the injunction had not been sufficiently shown. The court handed down a decree which will protect the Doherty interests in the property until the final trial of the case Full details of the controversy between Doherty and the leading stockholders of the Citizens company were published in the ELECTRICAL WORLD of June 23, 30 and July 7.

United Gas & Electric Company.—The pipe lines of the Richmond Natural Gas Company, of Richmond, Ind., have been purchased by the United Gas & Electric Company from Mr. C. W. Hooven, of Andersonville, Ind., who purchased all the securities of the Natural Gas Company on July 27. The Natural Gas Company owns the Richmond Light, Heat & Power Company, which furnishes artificial gas and electricity in Richmond. Some of the pipe lines acquired will be used by this company, and others will probably be taken up. The Natural Gas Company will go out of existence on Sept. 1, when it will stop furnishing gas to its subscribers, due to the failure of the natural gas in Indiana. Within the last few years the company has had to curtail its service greatly because of this fact. The franchise does not allow it to manufacture gas.

Montgomery (Ala.) Water Pumping Contract.—The Montgomery Light & Water Power Company, of Montgomery, Ala., which is operated by H. L. Doherty & Company, has been awarded the contract by the city of Montgomery for pumping

all of the water at the Public Water Works by electrical energy. Heretofore this pumping has been done by steam, but now the city of Montgomery will install a new equipment and the Montgomery Light & Water Power Company will furnish the necessary energy for its operation. It is estimated that the electric drive for this work will save the city in the neighborhood of $10,000 a year for the cost of coal. The hydroelectric plant owned by the company now is furnishing about 6000 hp, but it is claimed by Doherty & Company that with a very slight additional expense the power can be increased to 9000 hp.

Financial.

THE WEEK IN WALL STREET.

TOWARD the close of the week the Wall Street market showed a distinct tendency on the part of the larger financial interests to view both securities markets and the financial situation generally with something akin to cheerfulness. Stocks gained ground last week on the average; but business did not show much material gain over the final figures of the preceding week. The influence of a number of unsettled elements in the situation continued to exert from time to time a feeling of disquietude, and this was reflected in the quieter and narrower movements of securities in the stock market. Aggressive speculation has been checked by the willingness of banking interests to render some support by the extension of relief to weak holders of large blocks of securities. Further contraction of trading in the price movements is anticipated. Using the trend of the country's iron and steel trade as a guide to general conditions, the figures of July's iron production show a fall of some 20 per cent in the daily output of pig iron as compared with the daily output of February, when production was the heaviest of the year. Reports of cuts in steel prices were used with some effect in the last two days of the week, and some heavy selling of United States Steel followed statements of a reduction of $1.50 per ton in the price of steel rails. The volume of bank clearings throughout the country, however, does not forecast any drastic trade reaction. The money market showed further imports of gold and additional engagements of the metal in London, bringing the movements thus far not much short of $1,500,000. Currency from the interior still finds its way into the Eastern money market, despite an almost negligible demand. Quotations August 8 were call 1½@1¾ per cent; 90 days 4½ per cent. The quotations in the table are those at the close of August 8.

NEW YORK.

	Aug. 1.	Aug. 8.	Shares sold.		Aug. 1.	Aug. 8.	Shares sold.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All. Ch., pfd.	28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	71	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T.	130	132	8,800	Steel, pfd...	[illegible]	114¾	[illegible]
[illegible]	[illegible]	[illegible]	17,675	W. U. T...	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	12,300	West'h., pfd..	115*	105	——

PHILADELPHIA.

	Aug. 1.	Aug. 8.		Aug. 1.	Aug. 8.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elec. Co. of A......	11¼*	11⅜	Phila. R. T.........	18	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E. E. B'ty, pfd.....	30*	——	Union Trac........	43	44

CHICAGO.

	Aug. 1.	Aug. 8.		Aug. 1.	Aug. 8.
[illegible]	[illegible]	——	Chi. Tel. Co........	117	[illegible]
[illegible]	[illegible]	60	Met. El. Co.........	20*	[illegible]
Chi. Rs., Ser. 2....	15*	15	Met. El., pfd......	60*	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Nat'l Car., [illegible]	[illegible]	[illegible]

BOSTON

	Aug. 1.	Aug. 8.		Aug. 1.	Aug. 8.
Am. T. & T.......	130⅛	[illegible]	Mex. Tel.	[illegible]	[illegible]
Cum. Tel...........	140	[illegible]	Mex., Tel., pfd.....	6*	[illegible]
Edison E., Ill......	253	255	N. E. Tel..........	130½	[illegible]
Gen. Elec..........	140	142⅜	W. T. & T.........	15½	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mass. E. Ry., pfd..	79*	[illegible]			

FINANCIAL NOTES.

Sierra Pacific Electric Company.—Stone & Webster, Boston, are offering $1,100,000 6 per cent cumulative preferred stock and $550,000 common stock in blocks of 10 and 5 shares respectively of the Sierra Pacific Electric Company of Nevada and California. The company owns all the stock of the companies doing the entire lighting and power business in the cities and towns of Reno, Sparks, Virginia City, Carson City and Silver City, Nevada. The local companies at present own and operate four hydroelectric stations on the Truckee River with a combined capacity of 7300 hp; 135 miles of high-tension lines and complete distribution systems in the territory served. The companies controlled include the Reno Power, Light & Water Company, the Washoe County Power & Development Company, the Hunter Creek Water Company, and the Sparks Water Company, all of which passed under the control of the Union Light & Water Company, and the Truckee River General Electric Company and its subsidiary, the Carson Electric Light Company.

Balsas Power & Irrigation Company.—A company by this name has been incorporated under the laws of Delaware for the purpose of erecting a hydroelectric plant on the Balsas River, Balsas, State of Guerrero, Mex. The project is being promoted by A. B. Adams, New York, and is capitalized at $8,000,000 in gold. The concession for the enterprise was obtained from the Mexican government by Francisco Alfaro, of Mexico City, attorney for the company. It is the purpose of the company to erect a 20,000-hp station initially, which will subsequently be enlarged to 75,000 hp. The head available is 150 ft. Electrical energy will be used in the mines in the vicinity and will also be employed to a very large extent for operating motor-driven irrigation pumps. The office of the company is at Dover, Del., but the permanent organization of the company has not yet been effected.

Gas Securities Company.—The Gas Securities Company, of New York, has issued a statement of its condition as of June 30, 1910, which shows a surplus available for dividends on the common stock of $1,509,003. This company was organized by H. L. Doherty & Company some years ago as a holding concern for certain investments which that firm and its allied interests possessed. According to the balance sheet, the company now owns $1,915,554 of stock in operating companies; $55,795 in bonds, and has on hand $57,580 in cash. The pool holdings and accrued profits on June 30, 1910, amounted to $256,882. Cash dividends have been paid to the stockholders in this company on both the preferred and common stock at ½ per cent per month. The surplus will probably be distributed in the shape of a stock dividend.

West Penn Traction Compannny.—A special meeting of the stockholders of the West Penn Traction Company has been called for Sept. 1 for the purpose of voting on an increase in the indebtedness of the company to $25,000,000. If such an increase is authorized, a general mortgage will be made and bonds issued. Action will also probably be taken at this meeting upon the proposed agreement between the West Penn Traction Company and the West Penn Railways Company. The stockholders of the latter company will also meet Sept. 1 to vote on a proposed bond issue of $6,000,000.

Hammond, Chicago Heights & Southern Traction Company.—A mortgage has been filed with the Western Trust & Savings Bank Company, of Chicago, by the Hammond, Chicago Heights & Southern Traction Company for $650,000 to secure a 30-year issue of 5 per cent bonds of like amount. This company was recently incorporated with $1,000,000 capital, and proposed to build an electric railway from the state line near Hammond, Ind, to Momence, Ill, a distance of 35 miles.

New York, Westchester & Boston.—The Public Service Commission, of the Second District of New York, has been applied to by the New York, Westchester & Boston Railroad Company for authority to issue $5,000,000 50-year, 5 per cent first mortgage bonds. The proceeds of these are to be used for general expenses of right-of-way and construction. They will be especially applied to the construction of the branch line which extends from Mt. Vernon to White Plains.

Mexico Tramways Company.—The annual report of the Mexico Tramways Company (Compania de Tranvias de Mexico, S. A.), which has just been made public, shows that the net revenues for the year, after paying all expenses and fixed charges, were $922,457, which is an increase of $462,808 over the previous year. The sum of $2,066,278 gold was spent during the year in the construction of extensions of the lines of the system and for betterments.

Hydraulic Power Company Bonds.—Spencer Trask & Company of New York are offering $650,000 first and refunding mortgage 5 per cent gold bonds of the Hydraulic Power Company of Niagara Falls, N. Y., due July 1, 1950, and dated July 1, 1910. All of the bonds, which are issued in coupon form, at $1000 each, are redeemable at 110 and accrued interest on any interest date after July 1, 1920, upon six months' prior notice. The Commonwealth Trust Company of Buffalo, N. Y., is trustee and transfer agent. The Hydraulic Power Company was incorporated early this year to acquire the plant, properties, water rights and all other assets of the Niagara Falls Hydraulic Power & Manufacturing Company of Niagara Falls, and the outstanding bond issue of the Cliff Electrical Distributing Company. The outstanding bonded mortgage debt of the company amounting to $2,500,000, including the present $650,000 first and refunding mortgage 5 per cent bonds, is at the rate of approximately $20 per hp of development. The present rated capacity of the power stations of the company is 104,000 hp, which will be increased about Sept. 1 to 124,000 hp. The water is taken from the Niagara River above the falls through a canal about one mile long, which gives a head of 210 ft., the highest at Niagara Falls, between the canal and the gorge. The company owns approximately 1000 acres of land at Niagara Falls, which is rented to various manufacturing concerns on long term leases. These tenants purchase the greater part of the electrical output of the company, which is utilized chiefly for electrolytic purposes.

Forty-second Street Railroad Sale.—The foreclosure sale of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railroad Company, having been set for Sept. 1, as referred to in the issue of June 30, it now appears that there may be more than one bidder for the property. One cause of the delay in this sale was the determination as to whether the 75 new pay-as-you-enter cars bought by Receiver Whitridge at a cost of $350,365 should be included in the foreclosure. The United States court has now decided that they should be and this fact, taken in connection with the announcement that for some months the line has been earning more than its fixed charges, makes the property more attractive to purchasers. It is said that not only the receiver of the Third Avenue company, but also the receivers of the Metropolitan Street Railway Company will bid for the property. The line runs through a section which is rapidly increasing in population and apparently has great possibilities as a feeder of either the Metropolitan System or the Third Avenue Railroad. The Third Avenue company is the owner of the majority of the $2,500,000 capital stock of the company and the Union Trust Company was the trustee for the bonds.

New York Taxicab Merger.—The Cab & Taxi Company of New York was incorporated last week with an authorized capital of $2,500,000 This new company, it is said, is a merger of the following concerns operating taxicabs in New York. The New York Livery & Auto Company, the Taxi Service Company, the Club Taxi Company, the Union Taxicab Auto Service Company and the Moulton Stable Company. Allan Lexow, of the New York Livery & Auto Company, is the president of the holding company. He said that the merger of the various companies was an absolute necessity under present conditions, and that it had been arranged with the object in view of cutting down operating expenses by concentrating all of the taxis of the various companies in one headquarters. He said that the average mileage per tax in New York City was from 50 to 60 miles, but that only about 35 miles of this mileage are paid for, the lost balance being necessitated by the geographical formation of the city.

New York Electric Lines Company.—Decision was reserved by Justice Bischoff in the Supreme Court, on Aug. 2, on the application of the New York Electric Lines Company for a peremptory writ of mandamus to compel the Empire Subway Company to lease space to it in order to install its electric conductors. The judge gave the counsel for the Empire Subway Company until Sept. 1 to submit a brief on the law points raised by the latter. Mr. A. B. Parker, on behalf of the New York Electric Lines Company, claimed it had a valid franchise granted in 1883, and had therefore the right to string its wires in the ducts of the Empire Subway Company, for which it had tendered $5000, besides offering to give a bond for the space to be leased by it. It was the contention of the Empire Subway Company that this franchise had been revoked by the Board of Aldermen in 1906, that the company never exercised any rights it possessed under the franchise for more than 25 years, that it never had a bona fide office, and that it had its taxes sworn off showing that it was not now a legally established corporation. A full account of the mandamus proceedings was outlined in our issue of July 14.

Federal Light & Traction Company.—The Federal Light & Traction Company has organized as follows: Messrs. James C. Colgate, Harrison Williams, Anson W. Burchard, Samuel McRoberts and Edwin N. Sanderson, executive committee; Mr. W. S. Iliff, president; Mr. Edwin N. Sanderson, vice-president; Mr. Craig Colgate, vice-president; Mr. H. H. Porter, secretary;; Mr. H. N. Wadham, treasurer; Mr. A. Seaton Post, Jr., assistant treasurer; Mr. Richmond Talbot, assistant secretary, and Mr. Charles K. Durbin, general manager. As noted in our issue of June 9, this company has acquired practically all of the stock and bonds of the following properties: Gray's Harbor Railway & Light Company, Aberdeen, Wash.; Sheridan (Wyo.) Electric Light & Power Company; Rawlins (Wyo.) Electric Light & Fuel Company; Montrose (Colo.) Electric Light & Power Company; Hobart (Okla.) Light & Power Company; Albuquerque (N. M.) Electric Power Company; Albuquerque Gas, Electric Light & Power Company; Las Vegas (N. M.) Light & Power Company; Las Vegas Transit Company; Tucson (Ariz.) Gas, Electric Light & Power Company and Tucson Rapid Transit Company.

Third Avenue Reorganization Not Approved.—The Public Service Commission of the First District of New York has given two fundamental objections to the reorganization plans of the bondholders' committee of the Third Avenue Railroad Company. The commission claims (1) that the value of the property does not, in its estimation, justify the proposed capitalization, and (2) the probable earning power of the system would for 1909 barely meet the interest ($631,600) on the 4 per cent refunding bonds, and in 1910 and 1911 would be only 2 per cent or 3 per cent on the income bonds, with no evidence that the stock would receive even a small dividend for many years to come; 5 per cent on the incomes calling for $1,126,800 and 6 per cent on the stock, for $995,400. The reorganization committee is reported to have taken issue with the commission on both the foregoing conclusions.

Coney Island & Brooklyn Railroad Issues Bonds. — The Public Service Commission of the First District, New York, has authorized the Coney Island & Brooklyn Railroad Company to issue $489,539 of 4 per cent consolidated mortgage bonds of 1904, which, if sold at 80, would net $391,631, applicable as follows: Coney Island Avenue improvements, $213,-777; property abandoned pursuant to legislative enactment, $79,717; other expenses, $62,051; balance of cost of 10 new cars, $16,000; cost of constructing vestibules for 100 cars, $7242; new approach to Brooklyn Bridge, $13,444.

Meridian Light & Railway Company.—The Meridian Light & Railway Company of Meridian, Miss., has increased its capital stock from $1,400,000, of which $400,000 was preferred stock, to $2,000,000 common stock, all outstanding.

REPORTS OF EARNINGS

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Light & Traction Company:					
Year ended June 30, 1910	[illegible]	[illegible]	[illegible]	.....	.....
Year ended June 30, 1909	[illegible]	[illegible]	[illegible]	.....	.....
Cumberland Telephone & Telegraph Company:					
June, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June, 1909	[illegible]	[illegible]	[illegible]	41,540	[illegible]
Man[illegible] Light & Heat Company:					
Six months ended June 30, 1910	3,090,660	[illegible]	1,661,297	[illegible]	[illegible]
Six months ended June 30, 1909	2,802,699	[illegible]	[illegible]	[illegible]	1,367,290
Mexican Light & Power Company:					
June, 1910	567,560	[illegible]	[illegible]	.....	.....
June, 1909	[illegible]	[illegible]	[illegible]	.....	.....
Ontario Power Company:					
Year ended June 30, 1910	[illegible]	[illegible]	522,688	429,588	118,873
Year ended June 30, 1909	[illegible]	[illegible]	172,888	310,346	*1[illegible]8,020

* Deficit.

General News

Construction News.

ATHENS, ALA.—Preparations are being made for extensive improvements and extensions to the municipal electric light and water plant, bonds for which have been voted. The work will include the installation of a new battery of boilers and other machinery and reconstruction of lines. A new engine and pumps may be installed to replace the ones now in use. C. D. White is superintendent of the municipal light and water plant.

CULLMAN, ALA.—A new 200-kw generator and an 18 x 36 Corliss engine are now being installed in the municipal electric light plant. It is expected to have the plant completed by Sept. 1. B. Keil is superintendent of light and water plant.

MOBILE, ALA.—It is reported that the capital stock of the Mobile Electric Company will be increased from $3,000,000 to $7,000,000. R. J. Graff is secretary of the company.

MONTGOMERY, ALA.—Extensive improvements are to be made to the plant of the Citizens' Light, Heat & Power Company, the control of which was recently purchased by Richard Tillis, of Montgomery, Ala., owner of the Montgomery Traction Company. J. G. White & Company, of New York, N. Y., have been engaged to prepare plans and supervise the work, which will include extensive additions to the power house and extension of the transmissions lines to all sections to the city. Large steam turbines and other equipment will be installed.

OPELIKA, ALA.—Bids will be received until Aug. 31 by the Mayor and Council for furnishing all material and constructing an electric light plant and water-works system. Plans are on file at the office of the city clerk, Opelika, Ala., and at the office of J. B. McCrary & Company, of Atlanta, Ga., Empire Building, Atlanta, Ga.

HELENA, ARK.—The Helena Gas Company is contemplating enlarging its electric plant and also proposes to increase the capacity of its water-gas plant. The company is reported to be considering an issue of $50,000 in bonds.

HOT SPRINGS, ARK.—The Otis Elevator Company, of New York, N. Y., has been awarded the contract for installing an electric elevator for invalids in the hospital at Hot Springs, Ark., for $9,984.

TEXARKANA, ARK.—Plans are being considered by the Texarkana Telephone Company for extensive improvements to its system, which will involve an expenditure of about $10,000, and will include rebuilding the line between Texarkana and Clarksville, Tex. F. G. Cook is superintendent of construction.

ALAMEDA, CAL.—Bids have been submitted to the City of Alameda by the Great Western Power Company and the Pacific Gas & Electric Company for supplying the city with electricity for day service. The Great Western Power Company offers to furnish the municipality with a minimum amount of 175 kw at the rate of 1 cent per kw-hour, and all in excess of that amount at 1½ cents per kw-hour. The Pacific Gas & Electric Company offers to furnish the service at the rate of 1 cent per kw-hour and 3 cents per kw-hour for emergency service.

BERKELEY, CAL.—The Great Western Power Company, which was recently granted a franchise to operate in this city west of Sacramento Street, for the distribution of electricity in large quantities, has applied to the City of Albany for a similar franchise. It is expected that the feed wires erected in Sacramento Street will be extended to Albany.

BOCA, CAL.—Surveys are being made along the Truckee River in the vicinity of Boca with a view of constructing a large power plant, to cost about $750,000. It is proposed to tap the Truckee River above Boca; a long tunnel will be built through the mountain south of the river to carry the water, which will be turned back to the river about a mile below Boca. It is estimated that 10,000 hp will be developed, which will be transmitted to Reno and other cities along the Truckee River, for lamps and motors. E. W. Hopkins, president of the Union Ice Company, is interested in the project.

HEROULT, CAL.—Plans are being considered by the Noble Electric Steel Company for the installation of an additional furnace in its plant. Electricity for operating the plant is furnished by the Northern California Power Company. C. B. Morgan is secretary of the Noble Steel Company and H. H. Noble is president of the Northern California Power Company.

MERCED, CAL.—Preparations are being made by the San Joaquin Light & Power Company to rebuild the entire electric lighting system in Merced. An agreement has been made whereby the San Joaquin Company is to extend its transmission lines throughout the Hartley Colony for the distribution of electricity for lamps and motors in that section.

OROVILLE, CAL.—Notice of application of 2000 cu. in. of water in Coldwater Creek, below Buck's ranch in Plumas County, has been filed by John A. Hall, of Plumas County, and George H. Sparks, of Oroville. It is proposed to develop the water power to generate electricity.

SAN FRANCISCO, CAL.—The contract for the construction of an electric light system at the Presidio, San Francisco, Cal., has been awarded to the Decker Electric Company, of San Francisco, for $46,000.

SOUTH PASADENA, CAL.—The Board of Trustees has entered into a contract with the Pacific Light & Power Company whereby the company is to install a tungsten series street-lighting system, which calls for the installation of 550 lamps of 40 cp to replace the present 16-cp incandescent lamps now in use. The rate for energy is to be 7 cents per kw-hour, with a minimum charge of $200 per month.

FRUITA, COL.—Owing to J. M. G. Beard having failed to complete an electric light plant in Fruita in accordance with the terms granted him, the Council is contemplating granting a franchise to the electric railway company.

MONTROSE, COL.—Plans are being considered by capitalists of Montrose and Delta for the construction of an electric interurban railway between Montrose, Olathe and Delta. Electricity for operating the proposed railway will be supplied from the plant at the falls of Gunnison. Steps have been taken to acquire the right-of-way and it is expected that work on construction will begin by fall. The railway will provide for both freight and passenger traffic.

PUEBLO, COL.—The Pueblo-Rocky Ford Land Company, recently incorporated, is building reservoirs and ditches, which when completed will irrigate about 30,000 acres between Pueblo and Rocky Ford. The company also proposes to construct and operate electric light and power plants, to build and maintain telegraph and telephone lines, tramways and railroads. P. J. Dugan, W. J. Lester and J. E. Shoemaker are interested in the enterprise.

STERLING, COL.—The Great Western Sugar Company is constructing a large alfalfa meal mill covering an area of 125,000 square feet in Sterling, which will be equipped for electric drive throughout. The equipment will include four motors.

NEW BRITAIN, CONN.—The contract for installing electrical underground conduits for the City of New Britain, Conn., has been awarded to the Construction Department of the Safety Insulated & Cable Company, of New York, N. Y.

SOUTH NORWALK, CONN.—Plans are being prepared by the Housatonic Power Company for improvements to its plant to be made this fall, which will include replacing the present single-phase alternators with two-phase machines and the erection of a 12-mile transmission line to Georgetown, Conn., passing through South Wilton, Wilton and Cannon Station. J. K. Punderford, of New Haven, is manager; George H. Caffrey, of South Norwalk, Conn., is superintendent.

WASHINGTON, D. C.—The contract for the installation of a heating and power system for the Catholic University of America, in Washington, D. C., is reported to have been awarded to T. C. Basher Company, of Baltimore. The equipment will include a Skinner automatic, high-speed engine, direct connected to a 275-kw generator and water-tube boilers.

SANFORD, FLA.—We are informed that the Sanford Light & Fuel Company expects to install another 100-kw gas-driven unit in its plant in the near future. W. W. Fry is superintendent.

TALLAHASSEE, FLA.—At an election held recently bonds to the amount of $15,000 were voted, the proceeds to be used for the extensions to electric light plant and water-works system.

ALBANY, GA.—C. W. Rawson and associates, of Albany, Ga., are reported to be interested in a project to establish an electric railway in Albany.

ATLANTA, GA.—The Middle Georgia Interurban Railway Company has been authorized by the State Railroad Commission to issue $100,000 in capital stock and $50,000 in bonds, the proceeds to be used for the construction of its proposed electric railway, which will connect Griffin and Social Circle, a distance of 70 miles.

CAIRO, GA.—Preparations are being made to install one 100-kw generator and a 150-hp. engine in the municipal electric light plant within the next three months, for which bonds to the amount of $6,000 have been voted. W. A. Clifford is superintendent.

DALTON, GA.—Plans are being prepared for the construction of an electric-light plant and water-works system in Dalton. The equipment of the electric plant will include compound-condensing engines direct connected to generators with a rating of about 500 hp. The water-works system will include a pumping plant having a capacity of 4,500,000 gal. daily, including a steam pump, an electric pump, filter tank, etc. The H. S. Jaudon Engineering Company, of Savannah, Ga., has charge of construction of the plant.

EAST POINT, GA.—S. T. Maupin, manager of the municipal electric light plant and water-works system, writes that it is proposed to install a duplicate of the present generating unit in the municipal electric light plant before next winter and establish a day service. Plans are also being considered to supply electricity in College Park and Hopeville and also to light the streets in both towns.

MONTICELLO, GA.—Negotiations have been closed whereby the City of Monticello will purchase electricity from the Central Georgia

Power Company, of Macon, Ga., to operate the municipal electric light system. The contract calls for 300 hp. Improvements will be made to the system, including the installation of an electric pump for water-works and other machinery. C. H. Jordan is city treasurer.

CHESTER, ILL.—The capital stock of the Chester Water & Power Company has been increased from $7,000 to $25,000.

CHICAGO, ILL.—The Eastern Illinois Railway Company, which proposes to construct an electric railway from West Hammond to Harvey, Riverdale and the city limits of Chicago, 15 miles in length, has filed a mortgage to secure a bond issue of $5,000,000, of which the proceeds of $400,000 will be used for construction and equipment and $4,600,000 will be held in reserve for construction and other purposes. The proposed route has not yet been definitely decided upon. T. E. Mitten, president of the Chicago City Railway Company, is president of the new company, and A. L. Drum, 125 Monroe Street, Chicago, Ill., engineer.

JACKSONVILLE, ILL.—Sealed bids will be received by the Commissioners of the Meredosia Lake Drainage and Levee District at the office of C. W. Brown, Jacksonville, Ill., until Aug. 30 for furnishing and installing in the district in the west part of Morgan County one simple condensing, four-valve engine with a rating of 114 hp; one 72-in., horizontal tubular boiler, 18 ft. in length; one single suction, 24-in. volute pump, with a capacity of 15,000 gal. per minute; one surface condenser, with not less than 400 sq. ft. of condensing surface, together with suction and discharge pipe and other necessary auxiliaries. Plans and specifications can be seen at the office of C. W. Brown, engineer, Jacksonville, Ill.

PRINCEVILLE, ILL.—Bids will be received by the President and Board of Trustees of the Village of Princeville, Ill., until Sept. 5, for the purchase of the municipal electric light plant, including dynamos, engine, switchboards, transformers and all accessories, poles, wire, lamps and all other appliances pertaining to the above plant. Bids should be addressed to F. W. Cutler, village clerk.

VANDALIA, ILL.—At an election held recently the citizens voted in favor of the proposition to issue $10,000 in bonds, the proceeds to be used for repairs to the municipal electric light plant and extensions to the water-works system.

FORT WAYNE, IND.—The Fort Wayne Electric Works has erected 25 new Woods magnetite arc lamps, invented by J. J. Woods, on the streets in Fort Wayne with a view of giving them a test. The new lamps have been installed on the regular circuits and are burned under the same conditions as the other street lamps.

LOGANSPORT, IND.—Bids are being received by the City Light Department for a 750-kw steam turbo-generator set, contract for which will soon be awarded. The city is erecting a transmission line two and one-half miles into the country to furnish electrical service to the county infirmary and to farmers along the line. Plans are also being considered for the installation next spring of three 500-hp water-tube boilers, with mechanical stokers, and the construction of a smokestack 6 ft. in diameter and 185 ft. high. A tramway is now being built across Eel River to convey coal to the power house. J. H. Stewart is superintendent of the City Light Department.

MUNCIE, IND.—The American Sheet Steel & Tin Plate Company, it is reported, contemplates remodeling and enlarging the local factory. A large amount of new machinery will be installed and the plant equipped for electric-motor drive.

NEW ALBANY, IND.—It is reported that the property of the New Albany Woolen Mills, located on Vincennes Street, has been purchased by a syndicate of New Albany, Ind., and Louisville, Ky., men for $35,000. It is said that a power plant will be installed in one of the large buildings and space rented to small manufacturers with power service. James A. Duffin, of New Albany, Ind., is at the head of the project.

ROCKVILLE, IND.—The City Council has decided to change the municipal street lighting system from direct to alternating current, which will involve an expenditure of about $2,000. The old arc machine will be discarded.

RUSHVILLE, IND.—Sealed bids will be received by A. T. Mahan, superintendent of the municipal water and light plant, until Aug. 23, 1910, for pumping machinery, tank and tower. A 300-hp. boiler, together with heater and stack will soon be installed in the municipal water and light plant.

SOUTH BEND, IND.—Preparations are being made by the Indiana & Michigan Electric Company to place its wires underground in Washington, Colfax and La Salle avenues, South Bend, which will involve an expenditure of about $75,000.

WARREN, IND.—We are informed that the installation of an additional dynamo in the municipal electric light and water plant is under consideration. W. H. Hickerson is superintendent of water-works.

FAIRFIELD, IA.—Plans are being considered by the City Council for improvements to the municipal electric light plant, including the installation of new equipment. As yet the city has not engaged a consulting engineer. W. L. Loring is city clerk.

GRISWOLD, IA.—It is reported that the Griswold Milling & Light Company is preparing to change its plant from direct to alternating current, at a cost of about $3,500. J. W. Daily is superintendent.

SAC CITY, IA.—The Sac City Electric Company is planning to install a steam-heating system, and the installation of a new street-lighting system, using lamp standards. The company has the contract for furnishing electricity for pumping the city water supply for a period of 10 years, beginning June 1, 1910. The equipment is furnished by the company and consists of one 7 x 8 Dean vertical triplex pump, belt driven from 1 to 15-hp, 4400-volt, 60-cycle, two-phase, Westinghouse motors; one 5 x 8 duplex pump; one 10-hp Triumph, 60-cycle, two-phase, 4400-volt motor, operated from central station. R. W. Richardson is manager.

WEST LIBERTY, IA.—Extensive improvements are being made to the municipal electric light plant, which will include the installation of a 200-hp Corliss engine and new generator. A new smokestack will be built and a deep well pump installed.

BAVARIA, KAN.—The Citizens' Telephone Company is reported to be contemplating the construction of a new exchange building in Bavaria in the near future.

FORT SCOTT, KAN.—The Fort Scott Gas & Electric Company is reported to be contemplating extensive improvements to its system, which will involve an expenditure of about $75,000. The company is now asking for bids for machinery to be installed in its plant.

STAFFORD, KAN.—Plans are reported to be under consideration for the installation of electric light, water-works and sewerage systems in Stafford, to cost about $75,000. G. Mibesell is city clerk.

WICHITA, KAN.—The Arkansas Valley Interurban Railway Company, which is building an electric railway between Wichita and Newton, Kan., 30 miles in length, will erect two substations along its railway, which will be equipped with motor-generator sets with a rating of 200 kw each. The Kansas Gas & Electric Company, of Wichita, will furnish energy at 33,000 volts to operate the system. O. A. Boyle is vice-president and general manager of the railway company.

THIBODAUX, LA.—Arrangements are being made for the construction of a new municipal electric light plant. The town has extended its corporate limits and proposes to extend the municipal lighting service and the present plant is inadequate to meet the demands for electrical service. The street arc lighting system was destroyed by the storm last September and since that time the streets have been lighted by incandescent lamps.

BANGOR, MAINE.—The Bangor Railway & Electric Company, it is reported, is extending its transmission lines to Northern Maine Junction to supply electricity for lamps and motors. If satisfactory arrangements can be made, it is said that the company proposes to extend its railway to that place, a distance of three and one-fourth miles.

CANAAN, MAINE.—The question of constructing an electric railway from Canaan to Hinckley, a distance of five miles, is reported to be under consideration. It is stated that there is sufficient water power in Canaan, which could be developed to furnish power to operate the proposed railway.

PRESQUE ISLE, MAINE.—The Maine & New Brunswick Electric Power Company is extending its transmission line from its plant at Aroostook Falls to Aroostook Junction, a distance of four miles, to furnish electricity for the Canadian Railway shops there.

BALTIMORE, MD.—It is reported that negotiations have been closed between the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., and the Pennsylvania Water & Power Company for electrical power from the McCall Ferry power plant. The contract, it is said, calls for 12,000 kw.

BALTIMORE, MD.—The report submitted to Mayor Mahool and Superintendent of Lamps and Lighting McCuen by H. Kent McCay, president of the McCay Engineering Company, who was engaged to prepare an estimate and make report of the cost of a municipal lighting plant for the city, shows that a plant capable of furnishing electricity for all the city buildings, within a half-mile radius of the old central police station, can be built and put into operation for $35,000. Mr. McCay recommends that the old central police station, on North Street, be used as a site for the proposed plant. If the city would change the building to suit the needs of the plant, he estimates that the cost would be reduced to $30,000. In case the city decides to install its own plant, the engineer recommends that the present plant in the courthouse be retained for use in emergencies. It is estimated that the cost of electricity for lighting the public building would be but 1½ cents per kw-hour, while the present cost is 3 cents per kw-hour for lighting the city hall and courthouse, and for the other buildings, 6 cents per kw.-hour.

BLOOMINGTON, MD.—It is reported that an electric transmission line is being erected from Piedmont, W. Va., to Bloomington, Md. G. C. Patterson, of Bloomington, is interested in the project.

CAMBRIDGE, MD.—The plant of the Cambridge Light & Power Company was offered for sale July 19 by William H. Medford, receiver, and was withdrawn after being bid up to $16,000 by Emerson C. Harrington, representing the Assets Realization Company, of New York, N. Y. The plant was built early in 1909 under a franchise granted William H. Medford and John H. Burgess, Jr., in 1907. It is said that failure to secure the contract for lighting the town was the cause of the failure of the company. Through error this item appeared under Cambridge, Mass., in the issue of Aug. 4.

WESTMINSTER, MD.—The County Commissioners of Carroll County have granted the Baltimore & Pennsylvania Railway & Power Company, of Annapolis, Md., the right-of-way to construct its proposed railway along the Reistertown and Hanover turnpike. At Reistertown the railway will connect with the Emory Grove line of the United Railways of Baltimore, and will connect with the Hanover and York systems near Melrose. J. Pierce Burns is president of the company.

BEVERLY, MASS.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Sept. 8

for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring for the United States post office at Beverly, Mass., in accordance with plans and specifications, copies of which may be obtained from the custodian of site at Beverly, Mass., or at the above office. James Knox Taylor is supervising architect.

CONCORD, MASS.—We are informed that contracts have been placed for equipment for the municipal electric light plant, all to be installed within the next two months as follows: One 300-kw, turbo-generator set and La Blanc condenser to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.; the Power Specialty Company for three superheaters to be installed in three horizontal return tubular boilers and the Condit Electric Manufacturing Company for a seven-panel switchboard. The primary voltage will also be changed from 1100 to 2200 volts. A. W. Lee is manager.

FAIRHAVEN, MASS.—The New Bedford Gas & Edison Electric Light Company has been awarded a contract for street lighting for a period of five years, under the terms of which the company is to furnish incandescent street lamps for the first three years at the rate of $14.25 each per year, and $13.25 each for the next two years; this is a reduction of $1.35 per lamp per year for the first three years and $2.35 for the next two years.

NORTH ADAMS, MASS.—Negotiations have been closed between Commissioner of Public Works F. B. Locke and the North Adams Gas Company whereby the city has secured a reduction in the rates of electricity for street lighting and public buildings. The contract is for a period of two years, beginning July 1, 1910, under the terms of which the company agrees to furnish not less than 200 luminous arc lamps at $80 each per year, and 50-watt tungsten lamps at $25 per lamp per year; electricity for lighting the municipal building at 6 cents per kw-hour and 4 cents per kw-hour for motors. Under the old contract the city paid $82.13 each per year for arc lamps and $39.40 for incandescent lamps and 7.2 cents per kw-hour for lighting the interior of the municipal buildings and 5 cents per kw-hour for energy for motors.

WATER VALLEY, MASS.—Plans are being considered by the City Council for extensions to the municipal electric light plant, which will include the rebuilding and extensions to the transmission lines during the summer and fall. T. M. Early is superintendent of light and water plant.

WEBSTER, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 14 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, for the United States post office at Webster, Mass. Plans and specifications for which may be obtained from the custodian of site at Webster, Mass., or at the above office. James Knox Taylor is supervising architect.

ADRIAN, MICH.—The Adrian Telephone Company and the Michigan State Telephone Company are to be consolidated under the name of the Lewanee County Telephone Company. The company is capitalized at $250,000. It is expected that other telephone lines will be absorbed by the new company.

ALLEGAN, MICH.—Improvements are being made to the dam in the Kalamazoo River at Allegan. The sluice boards are being removed and two steel and cement gates installed, which will be operated by a motor. The cost of the work is estimated at about $10,000.

ESCANABA, MICH.—Plans have been completed by T. W. Orbison, of Appleton, Wis., for the construction of a new dam two miles above the city.

GRAND RAPIDS, MICH.—Sealed proposals will be received at the office of the Board of Public Works, Grand Rapids, Mich., until Aug. 25 for furnishing and installing two 300-kw turbo-generator sets, two surface condensers, one turbo-exciter set and one motor-generator exciter for the city of Grand Rapids, Mich., according to plans and specifications on file at the office of the board. Proposals must be made upon blanks that will be furnished upon application to the office of the board. Henry J. Klevorn is president of the board.

HOUGHTON, MICH.—The Houghton County Electric Light Company has secured a contract to furnish electricity for lighting the shaft houses of the Isle Royale mine. The company will erect a transmission line through Hurontown to connect with the mining company's system, work on which will begin at once. The installation will include 24 arc lamps and incandescent lamps. The electric company is now erecting a transmission line from Dollar Bay to the Dupont powder plant at Senter, where a substation will be built.

SANDUSKY, MICH.—At an election held recently the citizens voted in favor of bonding the town for water works, sewers and electric lights.

CROSBY, MINN.—Preparations are being made by H. F. Pearce, of Crosby, Minn., who was recently granted a franchise to operate an electric light plant and water-works system, to commence construction work on the same in the near future. The cost of the plants is estimated at about $30,000.

DULUTH, MINN.—The Minnesota Canal & Power Company has been granted permission by the Department of the Interior to the use of public lands in the Birch Basin drainage system in the Duluth land district for power purposes. The project contemplates the development of about 30,000 hp near Duluth. The water will be stored in large reservoirs near Eli, Minn., and will be used to develop electrical energy. The license issued to the company is revocable.

FAIRMONT, MINN.—The City Council is considering the question of [illegible] electric light plant and water-works system. It is proposed to call an election in the near future to vote on the proposition to issue $30,000 in bonds, the proceeds to be used for the proposed improvements.

GILBERT, MINN.—The local business men, it is reported, are contemplating the installation of an electric light plant in Gilbert, and a franchise will soon be applied for.

LAKEFIELD, MINN.—It is reported that extensive improvements are contemplated to the municipal electric light plant, including the installation of a gas-producer engine.

MONTEVIDEO, MINN.—The installation of an electric light plant in the Chippewa Roller Mill is reported to be under consideration.

OWATONNA, MINN.—The City Council is reported to have granted a franchise for the installation of an electric light plant in Owatonna.

SOUTH ST. PAUL, MINN.—H. M. Byllesby & Company, of Chicago, Ill., are reported to have purchased the controlling interest of the South St. Paul Electric Light, Heat & Power Company. Extensive improvements and extensions are contemplated to the plant and system of the South St. Paul Electric Light & Power Company, including the installation of an emergency connection with the power plant owned by H. M. Byllesby & Company on the St. Croix River. The South St. Paul company recently secured the contract for street lighting in West St. Paul and is planning to extend its transmission lines from Packington to furnish electrical service in that city. E. W. Erick, of South St. Paul, is manager.

KANSAS CITY, MO.—Preparations are being made by the National Biscuit Company, of New York, N. Y., for the construction of a new seven-story factory building in Kansas City, Mo., which will be equipped for electric-motor drive throughout. An electric power plant will be installed in the basement.

ST. CHARLES, MO.—Application has been made to the City Council by O. J. Martin for a franchise to construct and operate a 5-mile railway over certain streets in St. Charles.

BOZEMAN, MONT.—It is reported that preparations are being made by the Gallatin Valley Electric Railway Company for extending its system to Three Forks.

LAUREL, MONT.—Bids will be received by William L. Quesh, city clerk, until Aug. 16 for the construction of a water-works system, including one steel water tower, 150 ft. in height, with a capacity of 75,000 gal.; 5600 ft. electric transmission line, one pump house, one 6-in. two-stage centrifugal pump, one 100-hp motor, together with all necessary appurtenances; also wooden pipe of different dimensions and hydrants. Plans and specifications may be seen at the office of the town clerk, Laurel, or at the office of Henry Gerharz, Billings, Mont.

BRIDGEPORT, NEB.—The Bridgeport Electric Light & Power Company, recently incorporated, with a capital stock of $50,000, is planning to install an electric plant in Bridgeport, work on which will begin immediately.

OMAHA, NEB.—Plans are being made to equip about 150 miles of the Union Pacific Railroad Company's line between Omaha, Neb., and Ogden, Utah, for dispatching trains by telephone, which will complete the telephone system between Omaha and Ogden.

SUPERIOR, NEB.—The Superior Electric Light Company is reported to be preparing plans to make improvements to its plant and reconstruct its distributing system.

BINGHAMTON, N. Y.—It is expected that the report of Alton D. Adams, consulting engineer, employed by the City Council to make a report on the feasibility of establishing a municipal electric plant, will be ready to be submitted to the Council the last of this month. It is said that the report will favor the construction of a municipal plant.

FILLMORE, N. Y.—The Genesee Valley Power Company is contemplating increasing the output of its power plant and extending its transmission lines to some of the neighboring villages in the near future. New equipment will be installed, including a water wheel and new switchboard. E. E. Peake is treasurer and manager.

GLOVERSVILLE, N. Y.—The Fonda, Johnstown & Gloversville Railroad Company has petitioned the Public Service Commission, Second District, for permission to issue $463,000 in bonds.

GOLAH, N. Y.—Application has been made by the Livingston-Niagara Power Company for permission to erect an electric plant in Golah to supply electricity to cities and towns in Monroe and Livingston counties.

JAMESTOWN, N. Y.—The Jamestown, Chautauqua & Lake Erie Railroad Company has applied to the Public Service Commission, Second District, for permission to equip its railway extending from Westfield to Jamestown, N. Y., for electrical operation. The railway is 37½ miles in length and is operated by the Buffalo & Lake Erie Traction Company.

NEWARK, N. Y.—The New Light, Heat & Power Company has begun work on extensive improvements to its plant and system, which will involve an expenditure of about $25,000.

NEW YORK, N. Y.—The New York, Westchester & Boston Railroad Company has applied to the Public Service Commission, Second District, for permission to issue $5,000,000 in bonds, the proceeds to be used for general expenses, right of way and construction of branch lines extending from Mount Vernon to White Plains.

NEW YORK, N. Y.—The Public Service Commission, First District, has authorized George W. Linch, receiver of the Second Avenue Railroad Company, to equip for electrical operation the railway lines from

Chatham Square to Broadway, running two tracks through Pearl and Worth Streets to Lafayette Street, one block east of Broadway, and one track through to Broadway.

NEW YORK, N. Y.—Bids will be received by J. K. Paulding, acting president of the Board of Trustees of Bellevue and Allied Hospitals, Twenty-sixth Street and First Avenue, New York, N. Y., until Aug. 15 for furnishing and installing electric and gas fixtures in the pathological department and male dormitory of the new Bellevue Hospital. Blank forms may be obtained at the office of the contract clerk, 411 East Twenty-sixth Street, New York, N. Y.

NEW YORK, N. Y.—Bids will be received by George McAneny, borough president, City Hall, New York, N. Y., until Aug. 18, for furnishing and installing new electric elevators in the county court house building, City Hall Park, Borough of Manhattan, New York, N. Y. Blank forms and specifications may be obtained and plans examined at the office of the auditor, office of the Commissioner of Public Works, Room 1807, 13-21 Park Row, New York, N. Y.

NIAGARA FALLS, N. Y.—The City Council has granted the Frontier Electric Railway a franchise to construct and operate an electric railway over certain streets in Niagara Falls. The company has also asked a similar franchise in North Tonawanda.

NORTH TONAWANDA, N. Y.—The Tonawanda Power Company, of North Tonawanda, has been awarded the contract for lighting the streets of the city for a term of three years, at the rate of $55 per arc lamp per year.

ROCHESTER, N. Y.—The Bell Telephone Company is making extensive improvements to its system in Rochester, which will involve an expenditure of about $105,000 during the current year.

ROCHESTER, N. Y.—Preparations are being made by the Rochester Railways & Light Company for the installation of a new storage battery of 2000 hp. capacity in its No. 3 station, to be used for emergency purposes.

SALINA, N. Y.—The Syracuse & South Bay Electric Railway Company has applied to the Town Board for a franchise to construct an electric railway over certain streets in Salina.

RUTHERFORDTON, N. C.—At an election held recently the citizens voted in favor of issuing bonds to the amount of $35,000, the proceeds to be used for the purpose of installing an electric light plant and waterworks system.

CASSELTON, N. D.—It is reported that the Union Light, Heat & Power Company, of Fargo, N. D., is contemplating the installation of an electric light system in Casselton. Electricity for operating the system will be transmitted from Fargo.

FORT TOTTEN, N. D.—Bids will be received at the office of Indian Affairs, Washington, D. C., until Aug. 23 for furnishing and installing a heating and lighting system for the grey nuns departments of the Fort Totten School, North Dakota, in accordance with plans and specifications, which may be seen at the above office, the United States Indian Warehouses, Chicago, Ill., St. Louis, Mo., and Omaha, Neb.; the Builders' and Traders' Exchanges at St. Paul, Minn., Minneapolis, Minn., Omaha, Neb., and at the Fort Totten School, Fort Totten, N. D. C. P. Hauke is second assistant commissioner.

WOLFORD, N. D.—Preparations are being made by the Juniata Farmers' Telephone Company for the erection of a telephone line to Rolette, via Pleasant Lake, Rugby and Nanson, a distance of 31 miles.

ATTICA, OHIO.—The municipal electric light plant is reported to have been partially destroyed by fire recently, causing a loss of about $5,000. The plant is able to continue part of its service.

FOSTORIA, OHIO.—The County Commissioners have granted the Fostoria & Fremont Electric Railway a 25-year franchise to construct a railway across the public highways connecting the Lake Shore Electric Railway and the Ohio Western Railway, 21 miles in length. The railway will eventually extend from Fostoria to Amsden. J. D. McDonel is secretary of the company.

HUDSON, OHIO.—Plans have been prepared by D. M. Hosford, 615 Caxton Building, Cleveland, Ohio, for the proposed municipal electric light plant, the equipment of which will include a 100-kw, three-phase, 2300-volt generator direct connected to producer-gas engine, together with complete producer equipment.

JACKSON, OHIO.—Plans are being prepared for extension to the municipal electric light plant, bids for which will be called for. It is proposed to install two 100-kw alternators, one direct-current arc machine with sufficient output to provide for 150 lamps. W. A. Dallas is clerk of Board of Public Works.

TOLEDO, OHIO.—The Macomber Brothers Company is reported to be contemplating the erection of a power building on West Woodruff Avenue, between Twelfth Street and Woodruff Avenue, in Toledo, for the accommodation of small manufacturers. [illegible] ft. x 23[illegible] ft., three stories high, containing a power plant; provision will be made to install additional units later.

YOUNGSTOWN, OHIO.—The County Commissioners of Mahoning County have decided to build an electric light and power plant for the new court house and jail. The cost of the plant is estimated at $31,000. Judge Kennedy and William Smith were appointed to consult with the Bruce-McBeth Company in connection with awarding contract for same.

LAWTON, OKLA.—The Pioneer Telephone Company is contemplating the erection of a telephone exchange building to cost about $75,000.

PRYOR CREEK, OKLA.—Plans are being prepared by E. T. Archer, 426 Beals Building, Kansas City, Mo., consulting engineers, for the erection of an electric light and ice plant in Pryor Creek, Okla., to be owned and operated as a private enterprise. The equipment will include one 50-kw and one 100-kw directly-connected alternating-current units, together with a 10-ton ice plant, bids for which will be called for in about 30 days.

WOODWARD, OKLA.—At an election to be held Aug. 17 the proposition to issue $30,000 in bonds, the proceeds to be used for the construction of an electric light plant in Woodward, will be submitted to a vote. J. H. Hopkins is Mayor.

EUGENE, ORE.—The Council has granted the Oregon Electric Railway Company, of Portland, Ore., a franchise for the construction of an extension of its system through Eugene.

FALLS CITY, ORE.—Preparations are being made by W. E. Newson, proprietor of the Falls City electric light and power plant, for the construction of a new power house.

OREGON CITY, ORE.—G. Clarence Fields is reported to be interested in a project to construct an electric railway from Oregon City through the Molalla Valley.

BEAVER FALLS, PA.—It is reported that W. J. Coursin, H. L. Tucker, J. W. Humphrey, R. A. Todd and Fred C. Johnston will soon apply for a charter for a corporation to be known as the Park Gate Street Railway Company.

COLLEGEVILLE, PA.—The City Council is reported to be considering the question of granting a franchise for the installation of an electric light plant.

ERIE, PA.—Application has been made by T. Sherman Clark, Edward G. Germer, Hugh Neely Fleming, Frank M. Wallace and Harry L. Moore to Governor Stuart for a charter for the Erie Light & Power Company. The company proposes to generate gas and electricity for lamps, heat and power purposes.

ETNA, R. D. ALLEGHENY, PA.—At an election held recently the proposition to issue $75,000 in bonds for the construction of a municipal electric light and pumping plant was defeated. It is expected that the borough will soon be annexed to Pittsburgh.

PENNSBURG, PA.—Bids will be received by the Pennsburg Electric Light Commission until Aug. 14 for furnishing and installing a 150-hp boiler equipment for the municipal electric light plant, plans and specifications for which can be seen at the office of H. C. Wickert, secretary.

PITTSBURGH, PA.—The Westinghouse Electric & Manufacturing Company has purchased the controlling interest in the Interworks Ra[illegible] road, which extends from East Pittsburgh to Trafford City, a distance [illegible] 7 miles. It is said that the Westinghouse company proposes to improve the road. When the foundry plant is completed the railway will be equipped with passenger cars for the accommodation of workmen and visitors to the various Westinghouse plants.

FORT GREBLE, R. I.—The contract for installing an underground electric system at Fort Greble, R. I., has been awarded to the Whitehall Electric Company, of Westerly, R. I., for $2,800.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has been granted permission by the Board of Harbor Commissioners to lay a cable from a point above Conimicut Point to a place in Nayatt, a distance of about two miles.

PROVIDENCE, R. I.—It is reported that the Rhode Island Company, which is owned by the New York, New Haven & Hartford Railroad Company, will sell its electric railway in Massachusetts to the Worcester & Blackston Street Railway Company for $42,059, subject to approval by the State Railroad Commission.

CHARLESTON, S. C.—Plans are being prepared by the Charleston Consolidated Railway & Lighting Company for the construction of a new power house in Charleston. Paul Spencer, of Philadelphia, Pa., is consulting engineer, and George H. Waring, vice-president and general manager.

ROCK HILL, S. C.—The Board of Public Works, appointed by the Town Council to investigate the question of building or acquiring an electric light and water plant, has reported that the Rock Hill Water & Electric Company, which owns and operates the local water and light plants, is open to a proposition. The company has suggested that a committee, consisting of three men, one to be appointed by the city, one by the company and the third to be appointed by these two men, place a value on the property and holdings of the company. The Board of Public Works has recommended that the proposition be accepted. A. P. Maloney, of Philadelphia, Pa., is president of the company.

BONESTEEL, S. D.—Application has been made to the Council by E. A. Bullock, president of the Norfolk Electric Light & Power Company, of Norfolk, Neb., for a franchise to install an electric plant to supply electricity for lamps and motors in Bonesteel.

LESTERVILLE, S. [illegible] Lesterville is under consideration by the local business men.

[illegible] electric light plant would like to purchase a good second-hand Corliss [illegible] 60-cycle generator. E. L. Anderson is chairman of light committee.

[illegible] considered for increasing the output of the municipal electric light plant in the near future. H. M. Grigsby is chairman of light committee.

COLORADO, TEX.—Plans have been prepared by the [illegible] Company for the construction of a steel and concrete power house, bids for which will be received until Aug. 15. Plans and specifications are on file in the office of the company in Colorado, and in the office of the [illegible].

CORPUS CHRISTI, TEX.—The City Council has refused the application of H. H. Reed for a blanket franchise to operate an electric street railway over all streets of the city.

COTULLA, TEX.—Preparations are being made by D. A. Walker for the installation of a hydroelectric plant on his farm, located in the valley of the Nueces River, a few miles south of Cotulla. Electricity generated at the plant will be used in connection with plant growing, and tungsten [illegible].

FLATONIA, TEX.—T. M. Spinks and F. C. Bolton are contemplating the construction of a combined electric plant, water-works system and ice plant in Flatonia. The electric plant will have an output of about 50 kw. For further information address F. C. Bolton, of College Station, Tex.

OWENTON, TEX.—John Smith and associates are reported to be contemplating the construction of a power plant in Owenton to supply electricity to operate the proposed railway.

PALESTINE, TEX.—It is reported that work will soon commence on the construction of the proposed interurban electric railway from Palestine, Corsicana and Dallas, for which a greater part of the right-of-way has been secured. William Nathan, of Dallas, Tex., and J. V. Watkins, of Corsicana, Tex., are interested in the project.

SAN MARCOS, TEX.—Surveys are being made by C. E. Metcalf, of San Marcos, for the proposed electric street railway in this city, work on construction of which will commence soon. It is expected to have the [illegible].

SAN MARCOS, TEX.—The plant and holdings of the San Marcos Telephone Company has been sold to a company organized by local people. The new owners will take over the property in about 30 days and will make extensive improvements to the system. The officers of the new company are: G. G. Johnson, president; D. C. Johnson, secretary and [illegible] manager.

SPUR, DICKENS COUNTY, TEX.—Work has commenced on the construction of the new electric light plant in Spur. Contracts have already been placed for machinery.

TAYLOR, TEX.—The International & Great Northern Railway Company is planning to erect three cement buildings in Taylor, to cost about $15,000, one of which will be used for a power house.

TEXAS CITY, TEX.—The Texas City Transportation Company, which is installing an electric light system in Texas City, has commenced work on the erection of the distributing system. It is expected to have the system completed and in operation within three months.

PROVO, UTAH.—Application for water rights has been filed by F. W. C. Hathenbruch, of Provo, Utah, asking for 8 cu. ft. per second of the flow of water in Slate Canyon to be used to generate electricity at a plant to be erected in the mouth of the canyon, a short distance from Provo, where it is proposed to develop 325 hp.

ST. GEORGE, UTAH.—J. M. Lauritzen, of St. George, Utah, has filed two applications with the State Engineer, one appropriating 10 cu. ft. per second of the flow of Le Virkin Creek in Washington and Iron counties to be used for the irrigation of 11,250 acres of land; the other for 10 cu. ft. of the flow of Virgin River, for irrigating 5120 acres.

ENOSBURG FALLS, VT.—A company is being formed in Enosburg Falls, to be known as the Domina Manufacturing Company, by Mr. Domina, F. W. Draper and A. A. Aseltine. The company has purchased the water power at Samsonville and mills owned by Mr. Domina and proposes to operate a lumber mill, grist mill and an electric light plant. The company will be capitalized at $25,000.

FAIRMONT, VA.—The Fairmount & Clarksburg Traction Company is reported to be installing additional equipment in its power house in Jayenne. It is said that a new building will soon be erected and four new generators installed.

EDMONDS, WASH.—Application has been made to the City Council by Martin Kramer and G. E. Theusen, of Seattle, Wash., for a 30-year franchise to construct and operate an electric light plant in Edmonds.

ELLENSBURG, WASH.—It is reported that S. P. Whipple, chairman of the electric light committee, has recommended to the City Council to call for bids for a 300-hp boiler for the municipal electric light plant. It is also understood that other improvements to the plant are under consideration, which involve an expenditure of about $25,000.

IONE, WASH.—A franchise has been granted to the Ione Water & Light Company to supply this city with light and water.

LACEY, WASH.—A complete hydroelectric power plant is being installed at St. Martin's College, in Lacey. The work will include a storage dam, power house, turbine and generator. The system is being installed by Fairbanks, Morse & Company, of Seattle, Wash. The plant is for the exclusive use of the college and will cost from $6,000 to $7,000.

RITZVILLE, WASH.—The City Council has granted C. A. Lee a franchise for a term of 50 years to contruct and operate an electric system for the distribution of electricity for lamps and motors along certain highways in this township.

CRANDON, WIS.—It is reported that bids are now being asked for [illegible] of a municipal electric light plant in Crandon, the cost of which is estimated at $10,000. August H. Meyer is city engineer.

FORT ATKINSON, WIS.—Preparations are being made to install a new street-lighting system on Main Street, consisting of lamp standards, each carrying three multiple tungsten lamps. The lamp standards were built in the shops of the City Water and Light Commission, and arrangements can be made to supply other cities with standards of the same design. H. G. D. Nutting is manager of the water and light plant.

MADISON, WIS.—Preparations are being made by the Chicago & Wisconsin Valley Railway Company, of Madison, for the construction of an electric railway to connect Janesville and Merrill, via Friendship, Easton, Portage, Lodi, Middleton and Madison. The company will apply to the City Council for a franchise to construct an electric railway in Madison. Allen T. Russell, of Chicago, Ill., is manager.

RACINE, WIS.—Plans have been prepared by the Racine Tool & Machine Company for the construction of a new plant, 40 ft. x 100 ft., which will be equipped for electrical operation. The equipment of the power plant will include a gas producer, gas engine, dynamo and motors, etc.

WEST ALLIS, WIS.—The Sternburg Manufacturing Company, it is said, will erect a power house in connection with its new manufacturing plant. It is understood that contracts for equipment of the power plant have already been placed.

CHEYENNE, WYO.—Plans are being considered by the Cheyenne Light, Fuel & Power Company for the installation of a 500-kw, 2300-volt, three-phase, 60-cycle generator, direct connected to a Corliss engine. A. G. Langenbach is manager.

BLYTHE, ONT., CAN.—We are informed that the Blythe electric light plant was taken over by the Molson Bank, of London, Ont., June 1, and is for sale, together with a sawmill.

COBALT, ONT., CAN.—A. Ferland, Charles A. Richardson, W. C. Chambers, A. J. Burdett and W. A. Gordon have been granted permission by the Government to build a railway into Porcupine as a feeder to the Temiskaming & Northern Ontario Railroad. The proposed railway will be about 40 miles in length and will be operated by electricity. Power will be obtained from High Falls on the Mattagami River, for which surveys are now being made.

LANARK, ONT., CAN.—It is reported that T. B. Caldwell, of Lanark, has purchased the water power at Playfair, Ont., which he proposes to develop and transmit to Lanark to operate his factory. It is estimated that 500 hp can be developed.

ST. CATHERINES, ONT., CAN.—The ratepayers on July 29 voted in favor of the by-law granting the Ontario Power Company, of Niagara Falls, Ont., a franchise to furnish electricity in St. Catherines.

STRATFORD, ONT., CAN.—At an election held July 29 the by-law to acquire the local electric light plant was carried. The ratepayers also voted in favor of the by-law granting a franchise for the construction and operation of a local street railway service.

CHARLOTTETOWN, P. E. I., CAN.—Sealed tenders will be received at the office of W. W. Clarke, city clerk, Charlottetown, until Sept. 10 for supplying electricity for lighting the streets of Charlottetown and for commercial purposes. Bidders are to state price and illuminating capacity per lamp for street lamps and rate per kw-hour for commercial lighting. For further information apply to the city clerk.

BALSES, GUERRERO, MEX.—The Balses Power & Irrigating Company, recently organized with a capital stock of $200,000, proposes to erect a hydroelectric power plant on the Balsas River in this State. The concession for the enterprise was obtained from the Mexican Government by Francisco Alfaro, of Mexico City, attorney for the company. The company proposes to furnish electricity for mines and other industries, covering a large territory, and will also irrigate a large tract of land in connection with its electrical project. A. B. Adams & Company, of New York, N. Y., are said to be interested in the enterprise.

TETELA, HIDALGO, MEX.—Application has been made to the State Government by Dr. M. D. Shaw, of Puebla, for a concession to install a large hydroelectric power plant on the Rio de Tonalapa, near Tetela. A company will be organized to promote the enterprise.

New Industrial Companies.

THE AMERICAN AUTOMATIC BOILER FEEDER COMPANY, of Waterville, Maine, has been incorporated by George W. Boynton, president; Matthew S. Goodrich, treasurer, and James H. Murray, of Waterville, Maine. The company is capitalized at $100,000 and proposes to deal in automatic boiler feeders.

THE AMERICAN ELECTRIC & MANUFACTURING COMPANY, of Hallowell, Maine, has been organized with a capital stock of $50,000 to deal in electrical appliances. The incorporators are: G. W. Boynton, president; A. Armstrong, C. E. B. Walker, of Waterville; W. W. Wyer, of Fairfield; C. H. O'Brien and Fred E. Beane, of Hallowell, Maine.

THE C. & W. ELECTRIC COMPANY, of Huntington, W. Va., has been chartered with a capital stock of $10,000 to manufacture and deal in electrical supplies. The incorporators are: E. P. Connell, C. L. Waller, W. O. Reckard and others.

Personal.

MR. H. G. L[illegible] has [illegible] [illegible]ent of the Gardner (Miss.) Electric Light Company to accept a similar position in Colorado.

MR. E. V. EARDLEY, formerly with the General Electric Company, has been appointed electrical engineer of the Knight Power Company, Salt Lake City, Utah.

DR. HOWARD L. BRONSON has resigned as assistant professor of physics at McGill University, Toronto, to become professor of physics at Dalhousie University, Halifax.

DR. JOHN TROWBRIDGE, Rumford professor of applied science at Harvard University, has tendered his resignation, to take effect on Sept. 1. Prof. Trowbridge is 67 years old.

MR. WILLIAM M. EGLINGTON, formerly chief constructing engineer and manager of the Compania Electricia de Concepcion, Chili, has joined the firm of A. Lincoln Eglington & Co., New York.

MR. CYRIL M. SHAW, city electrical engineer of Worcester, England, is in this country, visiting the low-head hydroelectric installation. The plant at Worcester operates at a head of 10 ft.

MR. J. HERMANN has resigned as electrician with the Potosina Electric Company, San Luis Potosi, Mex., to become operating engineer for the Cia Hidroelectrica E Irrigadora del Chapala, S. A.

MR. H. A. FOSTER, consulting electrical engineer, has opened an office at 521 San Fernando Building, Los Angeles, Cal., and will no longer maintain offices in Detroit, Mich., and Pittsburgh, Pa.

MR. J. F. ADAMS, formerly manager at Reno, Nev., for the Pacific Telephone & Telegraph Company, has been appointed general manager of the Nevada-California-Oregon Telephone & Telegraph Company.

MR. HARRY BINDEMANN, formerly of the Siemens-Schuckert Werke, Berlin, has been placed in charge of the engineering equipment of the Electra, a company organized to distribute energy in Madrid, Spain.

MR. ANDREW CARNEGIE.—The Pan-American Congress, in session at Buenos Ayres, on Aug. 4, passed a resolution praising Mr. Andrew Carnegie as a benefactor, and voting him a medal for his services to the cause of humanity.

MR. GEO. WESTINGHOUSE.—Mr. George Westinghouse is the subject of an interesting article in the *New York Times* of Aug. 7. The article is highly complimentary to Mr. Westinghouse as an inventor, organizer and manager.

MR. K. NISHIKAWA, chief electrical engineer for Saiga & Co., Osaka, Japan, has been appointed consulting engineer for the Okayama (Japan) Tramway Company, and chief engineer of the Keisen Electric Railway Company, which is building a line between Kyoto and Otaw, Japan.

PROF. A. M. BUCK, formerly assistant professor of electrical engineering of the New Hampshire College, Durham, N. H., has accepted an appointment to the chair of electrical engineering at the Thomas S. Clarkson Memorial School of Technology. Prof. Buck is a graduate of Cornell University.

MR. A. T. RUTTENCUTTER, who has been with the Rio de Janeiro Tramway Light & Power Company for the past four years, has returned to this country for a visit. Before his departure for Brazil, in December, Mr. Ruttencutter will examine several of the high-tension transmission systems in the United States and Canada.

MR. P. R. OWENS, vice-president of the American Z Electric Lamp Company, left for Europe on the steamship *Oceanic,* on Aug. 10. Mr. Owens, while abroad, will look carefully into the general tungsten lamp situation, and will complete arrangements with the Z lamp interests in Europe for the manufacture of lamps in the United States.

Obituary.

MR. JAMES B. WATT, the oldest telegrapher in point of service of The Associated Press, died at his home in Nashville, Tenn., on Aug. 4, aged 62 years. It is said that he had handled the stories of the assassination of three Presidents—Lincoln, Garfield and McKinley.

MR. STEPHEN ROWE BRADLEY died at his home in Nyack, N. Y. on Aug. 6 in his seventy-fifth year. Mr. Bradley was born in Brattleboro, Vt. and went to Nyack thirty-six years ago. He was a director of the Nyack National Bank, president of the Nyack Hospital, and for years was president of the Rockland Light & Power Company. He is survived by two sons and two daughters.

DR. A. H. GOELET.—Dr. Augustin H. Goelet, of New York, one of the leading authorities in electrotherapeutics in the world, died in New York last week. He was born in Wilmington, N. C., April 1, 1854. Dr. Goelet was a prominent member of the medical profession and held professorships in various medical institutions at various times. He was the author of the Resuscitation Chart issued by the Electrical World in 1894, and which is still recognized as standard.

MR. [illegible] [illegible] Company, the Hudson Electric Company, and the Athol Gas & Electric Company, died suddenly on Aug. 3 at his summer home in Wareham, Mass., after a brief illness, from heart failure. Mr. Webber was for many years actively connected with Boston banking and investment circles, and in more recent times was much interested in Massachusetts public service corporations. He [illegible], Mass., and in 1888 was elected a member of the governing committee of the Boston Stock Exchange, which was considered a high honor, as he was at that time the youngest man ever elected to that position. For many years he was an active partner in the firm of Paine, Webber & Company, Boston, and later retired to engage in the lumber manufacturing business in his native town. Under Mr. Webber's administration the business policy and technical conduct of affairs in the electric lighting companies at Marlboro and Athol have been placed on a thoroughly modern basis, and he was instrumental in securing the recent consolidation of the Orange and Athol companies, with a view to centralized management and co-operation in service from the established plants. Mr. Webber was a prominent Congregationalist. He is survived by a wife and four children.

Trade Publications.

THE REVOLVING FIELD GENERATORS made by the Lincoln Electric Company, Cleveland, Ohio, are described in a bulletin recently issued by that company.

ELECTRICAL SUPPLIES.—Hibbard, Spencer, Bartlett & Company, Chicago, have issued Catalog No. 111 containing a list of standard electrical supplies, appliances and tools for electric light and telephone use.

SWITCHBOARD TYPE WATT-HOUR METERS.—The Columbia Meter Company, Indianapolis, Ind., has issued Bulletin No. 5, devoted to its astatic shunted switchboard type of watt-hour meter. The armature of this meter consists of six small coils placed parallel and equidistant around the shaft with a separate magnetic core for each coil; each core extending radially outward from both ends of the coils. A six-part silver commutator is employed in connection with the coils, and the armature being somewhat heavier than that of meters of the house type, is equipped with diamond bearings. The meter is not affected by stray fields.

TUNGSTEN LAMPS.—Bulletin No. 4753 of the General Electric Company describes 400-watt and 500-watt tungsten lamps for standard lighting service. These lamps are suitable for large stores, armories, factories, etc., and are economical substitutes for other building units of high candle-power and clusters of small lamps of low candle-power. They have the simplicity, reliability and convenience of the ordinary incandescent lamp of low candle-power. The bulletin contains data regarding cost of lamps and service at various voltages, and illustrates also the fixtures suitable for use in connection with these lamps.

BUSINESS NOTES.

I. P. FRINK, the fixture and reflector manufacturer, will move from 551 Pearl Street to 239 Tenth Avenue, at the northwest corner of Twenty-fourth Street, New York, on Sept. 1.

PITTSBURGH MOTOR VEHICLE COMPANY.—The Pittsburgh Motor Vehicle Company's factory is now located at St. Mary's and Concord streets, Borough of the Bronx, New York City.

THE ELECTRIC DAYLIGHT COMPANY, 74 Cortlandt Street, New York, has purchased the entire business of the Star Electrical Concern, and is preparing to put all types of star flaming arc lamps on the market.

MR. ARTHUR L. MULLERGREN has opened an office as consulting electrical engineer at Poteau, Oklahoma. He is desirous of obtaining from manufacturers catalogs and price-lists of engines, boilers, generators and power-plant apparatus.

THE GARWOOD ELECTRIC COMPANY reports having taken a number of orders recently, among others one for two 100-kw and one 75-kw engine-type generators for the Germania Life Insurance Building, New York City, and a number of slow speed motors for ventilating work in various buildings.

THE WISCONSIN ENGINE COMPANY, Corliss, Wis., has just erected one of the high-speed Corliss engines in the new factory of the Weinbrenner Shoe Company, Milwaukee, Wis. The engine will drive a 200-kw generator at 150 r.p.m. The flywheel is only 11 ft. in diameter and the whole unit occupies very little space for one of its rating.

THE FAIRMOUNT ELECTRIC & MANUFACTURING COMPANY, of Philadelphia, Pa., is now represented in New York State, excepting New York City, by G. E. Bennett & Company, 237 Vermont Street, Buffalo, N. Y. The company manufactures electrical specialties, comprising station pot-heads, ground-clamps, conduit fittings, fixture hangers and test connectors.

DOSSERT & COMPANY, of New York, have opened a western office at 617 West Jackson Boulevard, Chicago, with Mr. George W. Armstrong, as western manager for the territory included in the States of Minnesota, Wisconsin, Iowa, Indiana, Illinois, Missouri and Michigan. A large stock of standard sizes of solderless connectors will be maintained at the Chicago branch to take care of the company's increasing business in the Middle West.

MR. WILLIAM J. A. BAILEY, who recently returned from a trip around the world representing a number of American manufacturers, is now preparing for another business tour. He expects to leave this country early in the fall and will be gone about a year, visiting the leading commercial centers of the world. Mr. Bailey markets his lines in conjunction with permanent sales offices in the different countries, so that this trip would no doubt be of interest to manufacturers seeking foreign trade. His address is 32 Broadway, New York City.

Weekly Record of Electrical Patents

[illegible]

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

965,876. TELEPHONE SYSTEM; O. C. Dennis, Chicago, Ill. App. filed [illegible] eliminating the line signal when the exchange operator responds to a call by means of a combined relay, including a line signal switch, a cut-out switch and a pair of inductively opposed helices for operating [illegible]

965,877. RELAY; O. C. Dennis, Chicago, Ill. App. filed Dec. 11, 1905. Relay for alternately operating a number of switches consisting of a [illegible]

965,884. APPARATUS FOR STRENGTHENING ELECTRIC VIBRA-[illegible] For producing vibrations by a Duddell singing arc by means of a variable resistance in series with the arc, which automatically increases as the current decreases and an auxiliary vibratory circuit shunted around the resistance and the arc so as to reinforce the vibrations.

965,891. COIN FREED PREPAYMENT MECHANISM; W. Hamilton, Hollinwood, England. App. filed June 21, 1909. For gas and electricity meters by means of a train of gearing which coact with the holding means for reducing the force required to hold the controlling means in the operative position.

965,900. ELECTRODE FOR VAPOR LAMPS; P. C. Hewitt, New York, N. Y. App. filed April 16, 1904. Consists of an amalgam of lead, tin and mercury.

965,925. ROTOR OF DYNAMO-ELECTRIC MACHINES; R. S. McLeod, Didsbury, near Manchester, England. App. filed June 15, 1909. End rings for short circuiting the conductors of rotors, each ring having a plurality of lugs twisted at right angles to the plane of the [illegible]

965,973. TELEPHONE TRUNK CIRCUIT; C. S. Winston, Chicago, Ill. App. filed Dec. 22, 1904. Signaling devices and apparatus for trunk circuits for making connections between magneto exchanges and common battery exchanges.

965,976. TELEPHONE EXCHANGE SYSTEM; J. L. Wright, Washington, D. C. App. filed April 12, 1906. Semi-automatic system in which the work of interconnecting subscribers is done by machines controlled by the operators by means of number of wheels operating springs connected to push-buttons before the operator.

965,992. ELECTRICAL CONDENSER; W. W. Dean, Elyria, Ohio. App. filed Jan. 28, 1909. Consist of a plurality of strips of paper, one of which is coated on one side with finely divided conducting material which is dissipated by electrical discharges, and a strip of low-resistance metallic foil, the strips being wound together in the form [illegible]

966,001. SUPPORT FOR THIRD RAILS; L. W. Fox, Norvell, Mich. App. filed April 12, 1909. A rail-supporting clamp having a longitudinally slotted body portion with an arm at right angles and a rail-supporting arm with its free end bent to form a shield support.

966,013. TELEPHONE EXCHANGE SYSTEM; C. E. Hague, Rochester, N. Y. App. filed April 24, 1907. Central trunk line system in which the local exchange operator making use of the trunk line controls the application of ringing current to the calls of the subscriber connected [illegible]

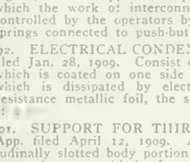
966,025. APPARATUS FOR PURIFICATION OF SEWAGE AND OTHER WATERS; L. G. Lautzenhiser and C. P. Chandler, Los Angeles, Cal. App. filed Aug. 20, 1908. A cast-iron plate electrode with a copper cap or strip secured along one edge.

966,026. COMBINED BOX AND SOCKET FOR ELECTRIC LAMPS; H. W. Lawrence, Denver, Col. App. filed Jan. 17, 1910. An electric lamp socket box which surrounds the lamp socket and has wire entrance aperture with lugs on the box fitting recesses in the socket.

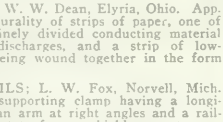
966,033. ELECTRIC ACCUMULATOR; L. Marseille, Paris, and P. Gouin, Lavallois-Perret, France. App. filed July 1, 1909. To prevent the dropping of active material by making the electrode of a cylinder with perforated walls filled with a porous deposit and surrounded by a coil of wire, the nickel deposit cementing the wire to the cylinder.

966,038. CLOCK; F. W. Moore, Austin, Ill. App. filed May 22, 1909. Weight-operated clock reset by an electromagnet at short intervals.

966,086. INSTALLATION OF ELECTRIC CONDUCTORS; E. H. Faile, New York, N. Y. App. filed April 25, 1910. Conduit system with a cap detachably secured to the free end of the conduit, the cap having an extension of small cross section and plaster covering the conduit through which the extension projects.



[illegible] ening Electric Vibrations.



[illegible]

966,097. MANUFACTURE OF SILVERED GLASS MIRRORS; E. Hoorickx, Brussels, Belgium. App. filed June 22, 1909. A frame for immersing mirrors by a swinging action obliquely into a bath, thus immersing the mirrors before the anode enters the bath and avoiding [illegible]

966,102. INSULATING SUPPORT FOR OVERHEAD ELECTRIC RAILWAY CONDUCTORS; W. H. Kempton, Hartford, Conn. App. [illegible] branches so as to support the section insulator against sidewise swing, but permitting the ends to rise and fall together with a messenger cable.

966,139. CIRCUIT-CLOSING PLUG FOR ELECTRICAL CIRCUITS; C. H. Thordarson, Chicago, Ill. App. filed April 9, 1910. A tubular metal body having spring arms engaging the plug and having angularly spaced lugs, the lugs being bent outwardly.

966,203. VAPOR-LAMP WITH CONCENTRATED RADIATION; P. C. Hewitt, New York, N. Y. App. filed March 19, 1903. A vapor lamp [illegible] a reflector and hood, so that the radiation starts from a concentrated source.

[illegible]33. — Electric Accumulator.

966,204. INDUCTION LAMP; P. C. Hewitt, New York, N. Y. App. filed July 20, 1904. The lamp is rendered [illegible]inous by the influence of a transformer coil which [illegible] the lamp bulb.

966,205. APPARATUS FOR TRANSFORMING ELECTRICAL ENERGY; P. C. Hewitt, New York, N. Y. App. filed Oct. 9, 1905. A discharge device consisting of a vacuum receptacle with means for causing two independent currents to flow therein and other means for causing a [illegible]

966,207. ELECTRIC SWITCH; H. R. Hirst, New Bedford, Mass. App. filed Feb. 15, 1909. Snap make-and-break, two push-button switch. Details.

966,239. ELECTRIC LAMP SOCKET; J. G. Peterson, Hartford, Conn. App. filed May 13, 1910. For securing the shell and cap together by means of a telescoping skirt and sharp-edged ring within the skirt.

966,240. ELECTRIC LAMP SOCKET; J. G. Peterson, Hartford, Conn. App. filed May 27, 1910. For detachably securing shell and cap together, the shell having latching projections and the cap having a flange and ring with holes engaging the projection.

966,243. WIRE CLAMP; H. R. Ritter, Madison, Wis. App. filed Jan. 29, 1909. A clamp with two lugs, a hole in each lug, a second clamp-plate grooved on its inner face and a clamp screw.

966,246. DYNAMO-ELECTRIC MACHINE FOR THE PRODUCTION OF CONTINUOUS AND ALTERNATING CURRENTS; J. Schurch, Bruchsal, Germany. App. filed May 15, 1908. A field magnet having a series of [illegible] of alternate polarity and a base of considerable length, the edges of the poles being inclined and meeting at an apex and two successive portions of the periphery of the poles being offset.

966,247. TELEPHONE RECEIVER; E. Schwartz, Antwerp, Belgium. App. filed April 20, 1907. A continuous integral thin metallic shell with a flared end, a reinforcing ring metal cap and a ring on the cap with insulating material molded over the shell.

966,252. ELECTRIC SWITCH; J. F. Smiley, Louisville, Ky. App. filed April 27, 1910. For electric scoreboards in which the switch includes a plurality of radial arms and adjustable extensions carrying contact shoes.

966,255. TROLLEY; S. H. Smith, Pittsburgh, Pa. App. filed March 14, 1910. The harp has an angular end with parallel arms in a horizontal plane carrying the trolley wheel by means of a rectangular bearing.

966,286. ELECTRIC SWITCH; J. H. Wright, North Fort Worth, Tex. App. filed March 6, 1909. Combination lock switch including a rotatable shaft with fixed and loose arms thereon and controlled by a combination lock system.

966,301. TROLLEY SAFETY LOCK; J. L. Blair, Butler, Pa. App. filed July 2, 1909. To prevent trolley wheels from leaving the wire by means of spring-pressed fender jaws carried by the trolley pole.

966,311. FASTENING DEVICE FOR INSULATORS; W. G. Clark, New York, N. Y. App. filed July 27, 1906. A slotted insulator with filling devices to fit between the wire and the walls of the slot.

966,328. LAMPLIGHTER; C. A. Hacker, Fairhaven, Mass. App. filed Feb. 11, 1909. For lighting a kerosene lamp by means of a sparking circuit, the elements of which are carried in a base below the lamp.

966,355. LAMP SOCKET; C. D. Platt, Bridgeport, Conn. App. filed May 31, 1910. Keyless lamp socket with an interior groove with walls projecting inwardly and a body part fitting the shell and having a lug projecting within the groove.

966,360. CIRCUIT BREAKER; W. E. Richards, Portage, Pa. App. filed March 5, 1910. For trolley lines in coal mines, including a knife switch which automatically opens and closes the circuit between the trolley and a section of the wire.

966,361. RECORDING TARGET; S. A. M. Rose, Richmond, near Melbourne, Victoria, Australia. App. filed Aug. 3, 1908. For company or volley firing and firing of single shots. Combines with a target a copy of the target with electrical means for indicating the permanent marks on the copy the places where bullets strike the target.

966,368. ROTARY SNAP SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed Feb. 14, 1908. A rotary snap switch with a spindle and rotary blade carrier in two parts, one loosely mounted on the other whereby the blade is self-adjusted.

966,382. ELECTRIC WELDING APPARATUS; A. E. Buchemberg, Toledo, Ohio. App. filed Sept. 25, 1909. A work support with two relatively movable work supporting arms, one of them being reciprocatory and actuated by a spring in one direction.

966,399. PROCESS OF PURIFYING ELECTROMETALLURGICAL PRODUCTS; F. W. Higgins, Niagara Falls, N. Y. App. filed Feb. 28, 1907. For carbide of silicon and the like by digesting the material in an oxidizing bath containing hydrofluoric acid.

966,400. TEST COUPLING FOR ELECTRIC CONDUCTORS; P. J. McDonald, Rochester, N. Y. App. filed June 20, 1908. A coupling for avoiding the destruction of the joint between two sections of a railway conductor when locating a leak. Makes use of a base of insulating material into which the conductor sections lead.

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A REMARKABLE UTILIZATION OF WATER.

Long-distance energy transmission systems are now so common that it takes something very much out of the ordinary to make really interesting reading. A case of this exceptional class, however, is surely that of the Arizona Power Company, an account of which appears elsewhere in this issue. The power plant on Fossil Creek is remarkable both on account of the source and character of the hydraulic supply and the skill with which the utilization has been carried out in spite of great topographical difficulties. The source of power is the overflow from fossil springs, which pour from unknown subterranean depths in Hegila County, Ariz. These springs are heavily mineralized, so that a deposit from them coats the surroundings in a way that suggested to the discoverer the name. The springs on investigation proved to yield a flow which, except when temporarily interfered with by one of the rare rainfalls of the region, remains absolutely constant year in and year out at 43 cu. ft. per second. This is not a large amount from the standpoint of Eastern hydraulic engineers, but backed by a possible drop of 1600 ft., it makes a project which has proved to have large possibilities. In the present development the whole of the head has not been utilized, since by employing the lower 1100 ft. it was feasible to utilize a small basin having an area of about 28 acres as a storage reservoir. On this plan the power-house site, which, while hydraulically speaking, is upon Fossil Creek, is actually on the Verde River at a point where it was more convenient to drop the water into the river than at the actual confluence of Fossil Creek with the Verde. At the west and southwest, at a distance of 50 or 60 miles, are Prescott, Ariz., and an important mining district which proved to be suitable markets. To get the water from the head works to the power house required covering a distance of 38,000 ft., of which 12,000 ft. was of re-enforced concrete flume, 10,000 ft. of concrete tunnels, 7500 ft. of steel gravity syphon, part of it on four long steel bridges, 2200 ft. of wooden flume on trestles, the rest being in re-enforced concrete and steel piping, taking up the pitch downward to the power house. The power house itself contains three 1800-kw generating units with the customary electrical equipment for a line voltage of 45,000, which is carried over 75 miles of steel tower transmission line.

One of the interesting features of the plant is the use of a large amount of re-enforced concrete flume, to which the constructors were driven by the rocky nature of the ground, which precludes comfortable ditching. Special arrangement of forms enabled the work to be very economically done in spite of the large cost of labor and material. When completed the smoothness of the flume is a very material advantage, particularly where the flow is rapid, inasmuch as the coefficient of friction is reported to be a good deal less than for ordinary ditches or the wooden flumes so extensively used on the coast. The storage reservoir before referred to is a very important feature of the undertaking. It is located five miles from the head works and on the line of the concrete flume, and can be drawn

off at an average depth of 10 ft. over its 28 acres, yielding sufficient capacity to run the entire plant three and one-half days at the average steady flow of the stream. This reservoir is then not only sufficient to be of great value in carrying the peak of the load, but also is amply able to handle the plant in case the upper hydraulic works should in any way require overhauling. Below the lake the hydraulic ways are remarkably well protected, the 56,000 ft. next the lake being a concrete-lined tunnel through the mountain and the rest re-enforced concrete and steel pipe. The lower 2400 ft. of the pressure pipe, which varies in thickness from ½ in. at the top to 11/16 at the bottom, is all welded steel imported from Germany, the upper half being the ordinary form of riveted pipe.

The station itself is extremely simple. Each generator is coupled to a 3000-hp impulse wheel with needle-valve regulation, which form, we are happy to note, has very successfully replaced the old and wasteful deflecting nozzle. The generator connections are simplicity itself, each generator and its transformers being taken as a unit, and the only switches those on the high-tension side of the transformers. This is an absolutely logical treatment of the situation in such a station, for the generators cannot be overloaded to any serious extent on account of the limitations imposed by the water wheel, and if anything happens it is a perfectly simple matter to open the high-tension switches on the generator feeders, leaving the unit out of business. There is a complete double transmission line on one branch, on one line of towers, one line feeding to Prescott with a couple of intermediate mine stations, and the other to the territory of the United Verde Copper Company and neighborhood mines. The handling of a plant so arranged is simplicity itself. Altogether the system is a very simple and beautiful example of high head hydroelectric development, and as such well worth the space which we have devoted to it.

EMPLOYERS' LIABILITY.

In its report to the National Electric Light Association, the Committee on Public Policy outlined the trend of sentiment on the subject of the relative rights and responsibilities of employers and employees in the matter of accidents. The committee was unanimous in the opinion that member companies should favor the amending of liability laws, so as to substitute for them a reasonable basis of compensation for injuries, and felt that anything that can be done to facilitate the maintenance of confidence and good feeling between employers and employees ought to be encouraged. Two laws which affect materially the statutes governing employers' liability will go into effect in New York State on Sept. 1. Both the liability of employers and the amounts of damages if accidents occur will be largely increased.

One of the acts amending the labor law in relation to employers' liability creates liability when personal injury is caused to an employee who is himself in the exercise of due care and diligence at the time, by reason of the following: Defect in the condition of the ways, works, machinery or plant which arose from or had not been discovered owing to the negligence of the employer or of any person in the service intrusted with the duty of seeing that proper conditions prevailed; negligence of any person intrusted with superintendence or negligence of any person intrusted with authority to direct, control or command any employee in the performance of duty of such employee. The employee has the same right of compensation as if he had not been an employee. The necessary risks of the occupation or employment are those inherent in the nature of the business which remain after the employer has exercised due care in providing for the safety of employees and has complied with laws promoting safety. In an action for damages owing to any cause, including open and visible defects, for which the employer would be liable, but for the hitherto available defence of assumption of risk by the employee, the fact that the employee continued in the service, or after he had been informed of the danger, is no longer an assumption of the risk of injury therefrom, but an employee is not entitled to compensation in any case where he knew of the defect or negligence and failed to give information thereto to his employer or to some person superior to himself in the service unless such defect or negligence was already known to such employer or superior prior to the injury; or unless such defect could have been discovered by the employer by reasonable care, tests or inspection. If employer and employee consent to a compensation plan the plan shall govern compensation except where injury is caused by the failure of the employer to obey an order of the commissioner of labor or other authorized public authority or where the injury is caused by the serious or willful misconduct of the employee. This plan does not apply to a railroad corporation, and it is inoperative if the period of disablement is less than two weeks, or if the injury is caused by the serious and willful misconduct of the employee. The compensation for death is based on earnings and on the extent to which the family, if any, are dependent, but is limited to $3,000. The compensation for injury is based on the extent of the incapacity and on the average earnings, but shall not exceed $10 per week or extend over more than eight years.

The act to amend the labor law in relation to workmen's compensation in certain dangerous employments provides that it shall apply only to workmen engaged in manual or mechanical labor in certain employments, including the following: "Construction, operation, alteration or repair of wires, cables, switchboards or apparatus charged with electric currents. The operation on steam railroads of locomotives, engines, trains, motors or cars propelled by gravity or steam, electricity or other mechanical power, or the construction or repair of steam railroad tracks and roadbeds over which such locomotives, engines, trains, motors or cars are operated." The right of action for damages caused by injury is not affected by the compulsory compensation established by the law. The death and the injury compensation provisions are substantially the same as those outlined in the foregoing under the law providing for compensation by contract between employer and employee. The laws will doubtless be used as a basis for others to be enacted in other States, and they directly affect electric light companies.

THE LEAKAGE IMPEDANCE OF TRANSFORMERS.

In an article appearing elsewhere in this issue Mr. K. Faye-Hansen reports the results of tests showing a considerable change in the local magnetic leakage impedance of certain transformers when the main core flux was varied from a moderate to a high value. In view of the fact that it is the universal practice to treat the leakage impedance as constant, and to assume that the value observed under one set of conditions can be employed in calculations relating to widely differing

conditions, it might seem that the tests of the author would throw doubt upon the accuracy of the methods of calculation now in common use. However, attention should be particularly directed to the fact that the conditions under which the author's tests were conducted were very extreme.

In a constant-potential transformer the magnetic leakage impedance consists of the combined equivalent series resistance of the primary and secondary windings and the local reactance produced by the flux formed between the two windings by the magnetomotive forces of the primary and secondary currents. The path of the latter flux is largely in air, although a certain short length is within the main magnetic core. Evidently in any chosen transformer the leakage flux varies directly with the magnetomotive forces tending to produce it and inversely with the reluctance encountered in its path; the leakage reactance, therefore, varies directly with the permeance of the total path of the leakage flux. When an overwhelmingly large part of the reluctance is subject to no change whatever and the remainder changes only slightly, as is true in the constant-potential transformers as usually constructed and operated, the leakage reactance and the leakage impedance may well be considered constant. The part of the reluctance subject to change is that within the magnetic core of the transformer, which carries the main flux upon which the leakage flux is superposed. Only when the total core flux reaches a high density does the reluctance change appreciably, and even when the density approaches the saturation point the part of the total reluctance which does change is so small in comparison with the total that the final effect upon the leakage reactance is unimportant. Seldom indeed was the saturation density reached in the earlier types of high-frequency transformers, but the introduction of silicon steel with low specific loss has resulted in a general increase in the density from a low-reluctance value at, say, 6000 lines per square centimeter to a high-reluctance value at probably 10,000 lines per square centimeter. The significance of this relation is that while the core portion of the path of the leakage flux in the earlier transformers was of low reluctivity, in the later designs it is of high reluctivity; however, in standard designs of transformers the reluctance in the core is a minor part of the whole reluctance of the leakage path.

In the tests reported by Mr. Faye-Hansen, not only were the transformers operated at extremely high densities, reaching values as great as 15,000 lines per square centimeter, but that portion of the leakage path ordinarily in air was formed by interposed iron liminations. The value of the leakage flux was greatly augmented by the presence of these laminations, but to what extent any variation in the value of the leakage impedance with the main flux density was due to the use of the extra laminations we are unable to judge from the recorded data. The tests are of value in showing results to be expected under extreme cases and in pointing to the desirability, in designing modern silicon-steel transformers, of considering certain features that could well have been neglected in the earlier plain-steel transformers.

A STUDY IN PHOSPHORESCENCE.

A brief paper by Vivian and Huey elsewhere in these columns contains a novel application of phosphorescence to photometry, which should stimulate theoretical investigation of such phenomena, even though it seems unlikely to lead to practical results. It is an attempt to obtain that Will o' the Wisp of photometry, a simple portable standard of comparison, and is based on the use of a phosphorescence screen initially subjected to standard excitation. The particular substance used for the screen was Balman phosphorescent paint, which, like the majority of phosphorescent materials, is essentially calcium sulphide. The phosphorescence of calcium sulphide is a very curious, long-known phenomenon, the vagaries of which have so far eluded complete investigation. Particularly singular is the variation in the properties of the material and even in the color of its phosphorescence, due to little understood differences in the method of preparation. The paint employed in this investigation is that commercially used for phosphorescent articles and its uniform production must be a matter of considerable technical skill.

The most interesting point brought out in the experiments is the indifference of the material to length of exposure to light, very likely due to the thinness and fine subdivision of the layer involved, which seems capable of full excitation after about 10 seconds' exposure to sunlight. Extension of this period up to an hour appeared to produce no effect. The fundamental fact which determines the brilliancy of the phosphorescence appears, other things being equal, to be the actual light intensity in which it is exposed, although the phosphorescence appears to have a very high temperature coefficient. This gives rise to the one forbidding feature of the method undertaken, inasmuch as it was found necessary to keep the phosphorescent surface at constant temperature by making it form one side of a can filled with melting ice. Given this uniformity the rate of decay of phosphorescence proved to be sufficiently uniform to enable it to be actually worked in an experimental way as a secondary standard, the time since excitation being, of course, one of the chief data in the photometric computation.

The color of the phosphorescent screen being bluish and the intensity low renders comparisons with ordinary forms of light somewhat difficult, but the apparatus utilized by the authors enabled fairly satisfactory measurements to be obtained in the laboratory. An interesting feature of the results is that the phosphorescent screen seemed to work when at constant temperature with a very surprising degree of regularity. Just what the result of time and continued use would be on the activity of the calcium sulphide is undetermined, although slow changes would certainly have to be anticipated. It would be interesting to know how nearly such a screen would hold its calibration after being laid aside for some weeks in the dark. Its inconveniences, owing to temperature co-efficient, low intensity and bad color, are such as can hardly commend it to the practical photometrist; but for purposes of investigation there are not a few cases in which a surface of very low and known brilliancy could be made useful in the laboratory where the inconvenience of constant temperature need not be severely felt. Even the comparatively rapid decay of the light for this use need not be a serious matter, inasmuch as the screen could then be used at a point in the decay curve where the falling off of brilliancy is relatively slow. From the data given, the fall in brilliancy after perhaps an hour and a half follows nearly a straight line law and is remarkably regular. The investigation is at least an interesting study of comparatively little known phenomena, and, as such, is well worth doing aside from any possible practical usefulness.

Joint Meeting of the A. S. M. E. and the I. M. E.

For the joint meeting of the American Society of Mechanical Engineers and the (British) Institution of Mechanical Engineers, held in London on July 29, five papers dealing with the general subject of railway electrification were prepared by Messrs. George Westinghouse, W. B. Potter, L. R. Pomeroy, H. M. Hobart and C. W. Carter. The paper by Mr. Westinghouse was abstracted in our issue for June 30, while an abstract of Mr. Potter's paper appeared in our issue for July 7.

In his paper, Mr. Pomeroy stated that the rapid development of suburban passenger traction by electricity will require large generating stations at large cities which can gradually be made sufficient for working the line on further stretches in each direction until it may be desirable to equip the whole division electrically. Electrical operation in comparison with steam shows to the greatest advantage in urban and suburban passenger service, where it makes possible a schedule speed quite unattainable by steam, as well as a more frequent service without a proportional increase in expense.

Mr. Hobart's paper dealt with the cost of electrically propelling trains in suburban service. His conclusions were based on data said to refer to the Piccadilly Tube Railway in London and the Heysham, Morecambe & Lancaster Branch of the Midland Railway. The engineers of both of these railways called attention to errors in the data assumed and threw doubt upon the conclusions based thereon.

In his paper, which dealt with the electrification of suburban railways, Mr. Carter said that at least in England the commercial advantage of electrification of existing steam lines is demonstrable in general only in the cases of heavy suburban service. The case of entirely new railways is different and much more favorable to electrical operation, because cheaper roadbeds and steeper grades may be used.

DISCUSSION.

Mr. H. F. Parshall, of the Central London Railway, remarked that the cost of transmission is not a controlling factor in the choice of a system in England, the Board of Trade regulations being such as to render the operation very expensive. On the Central London Railway the energy lost in the system costs 15 per cent, maintenance 45 per cent, and the operation of the generating station the balance of the cost of working the system, which showed that the cost of maintaining and running an elaborate system is out of all proportion to transmission costs. He stated that after a recent visit to America he was led to believe that either the direct-current or the single-phase system could deal with dense traffic better than steam working, but certainly the New Haven system could never have been installed in England, as everything which could have been done contrary to the Board of Trade regulations appeared to have been done. The single-phase system is generally more expensive to work and install, but the choice of a system depends on many different circumstances. Distance is a factor only in so far as the transmission system is concerned, and the transmission system in the case of a single-phase system is heavily handicapped. Further, owing to the compensating properties of the rotary converter, in a general system it would justify its existence, considering the material economy effected in having unity power-factor in the transmission system. Mr. Parshall did not attempt to analyze detailed figures, but pointed out that these naturally would be prepared with reference to conditions that could not be taken into consideration in a general discussion of the kind. In conclusion, he stated that the direct-current system is the only one known in the present state of the art that can compete with steam in the classes of installation to which electricity is generally applicable—that is, to urban, suburban and dense interborough traffic.

Mr. J. Dalziel, of the Midland Railway Company, expressed the belief that main line electric working in England is not only commercial, but comparatively imminent, and it is unquestionable that—other things being equal—to design to fit in with those future conditions is more important than anything else in scheming any electrification, and that, therefore, the finding of a generally applicable all-round system is the most important traction problem of the day. He pointed to results of tests showing that the single-phase system is burdened with few, if any, of the disabilities attributed to it, more particularly in suburban work and that—other things thus being equal—it emerges as the desired generally applicable system. In view of the widenings that have taken place it is clear that some lines are approaching their maximum haulage capacity, and the necessary addition to the haulage capacity can be obtained more cheaply by electrification than by double-tracking or regrading. Mr. Dalziel expressed the opinion that in the case of the Midland Railway Company's Derby-Manchester and Sheffield-Manchester sections electrification would be overwhelmingly cheaper than regrading. He said that the single-phase equipment has suffered only four break-downs in 2.5 years of service; the failures were due to a lightning arrester, a badly made high-tension joint, a circuit-breaker trip-coil and a motor armature, and they could hardly be attributed particularly to the single-phase equipment.

Mr. Sidney Stone called attention to the excessive track wear on electric railways in England and expressed the belief that the effect is caused by the pushing action of the rear motors in a multiple-unit train when the leading motors meet extra resistance in the form of grades or curves. Probably the wear can be lessened by causing the leading motor always to exert a greater pull than the trailing ones.

Mr. C. F. Scott, of the Westinghouse Electric & Manufacturing Company, pointed to the fact that the reason for using electric motors is not so much the saving in cost for fuel, but the increased flexibility of speed control, readiness of operation, reliability and convenience. He compared these subsidiary advantages with the similar advantages obtained by electrifying a railway, such as the possibility of double or treble-deck tracks, requiring less ground area, and the opportunity of building over tunnels, etc. It is true that the single-phase equipment is more costly than the direct current, but the latter equipment requires about 25 per cent more energy for the same work at the car. He stated that the New York, New Haven & Hartford Railroad is the only real electrical trunk line in America, and that called particular attention to the fact that this is a single-phase line, which is soon to be much extended.

Mr. H. M. Hobart expressed his approval of most of the conclusions derived by Mr. Potter. In one case, however, where Mr. Potter had selected a direct-current equipment Mr. Hobart would have selected the single-phase system. From calculations made in this case he believed the single-phase system to be better than the direct current, but steam traction is much preferable to either.

Mr. A. Sinclair expressed the opinion that the chances for electric haulage of freight trains are very small, indeed. There are many difficulties to be overcome before introducing electric freight service.

Mr. J. G. Wilson, of the Great Eastern Railway, said that it is not practicable to select one universal system of electrical traction to the exclusion of all other systems; moreover, it is not necessary, though desirable, and it is not economically sound. For instance, it could be shown that the cheapest system for dealing with the Great Eastern suburban traffic is the direct current, but in the case of the adjoining Great Northern line, with its mineral traffic, it seems probable that a single-phase system would be preferable. Now, which of these companies should give way in the interests of a common system of working? He could not see how a uniform system could be used. To delay is wrong, because the advantages of waiting are problematical, while the present advantages of electrical working are real.

Dr. F. R. Hutton, honorary secretary of the American Society of Mechanical Engineers, remarked that where there are many cities close together, as in England, electrification is of much importance, but in America the conditions are quite the reverse.

Mr. H. H. Barnes, Jr., of the General Electric Company, said that the cost of maintenance of brushes for alternating-

current motors is 100 times as much as that for direct-current motors for the same service. Moreover, the actual number of men employed for a given service on alternating-current lines, even though they are not in substations, is as great, or greater, than on the corresponding direct-current lines with their substations. The amount saved in the substations is needed in the barns.

Mr. J. A. F. Aspinwall, general manager of the Lancashire & Yorkshire Railway, and president of the (British) Institution of Mechanical Engineers, said that on the Liverpool & Southport line it was soon realized that if heavy electric trains were to be hauled and that if the cost of repairs to the motors and motor trucks was to be kept down it would be necessary to revert to the large bearing surfaces used in locomotive practice, which experience had shown to be necessary in any hauling machine. The experience of four or five years' running on the Liverpool & Southport line had shown that the electrical system is perfectly satisfactory. One speaker had touched upon the great diversity of opinion between electrical engineers. As a general manager of one of the English railways, he thought that no general manager could afford for one moment to close his eyes to the possible utilization of either one or the other system, whichever might prove to be commercially right, and the utilization of the rolling stock to its greatest possible capacity is one of those items to which much greater attention must be paid than to almost anything else.

Montreal Lighting Controversy.

The arbitrators hearing the matter between the city of Montreal and the Montreal Light, Heat & Power Company reconvened in the City Court House in Montreal on Wednesday, Aug. 11 and held morning and afternoon sessions for three days. The hearings were then adjourned until the 16th instant to permit the defendant to examine the testimony and exhibits and complete the cross-examination of the engineer of the plaintiff company, Mr. W. M. Wilson.

The session on Wednesday was entirely occupied with the cross and re-direct examination of Mr. Arthur Parent, the city's superintendent of lighting. Mr. Parent produced by request and filed as exhibits copies of earlier contracts for city lighting in which the prices varied from $60 to $116. Mr. Parent explained these contracts and the conditions under which they were taken, also referring to the fact that in 1891 only two companies, the Royal Electric Company and the Standard Light & Power Company, had franchises in the city of Montreal. The attorney for the company endeavored to bring out that the low bids made for lighting about that time by the companies, which had no franchises in the city, were made for the purpose of obtaining the right to erect poles and lines within the city limits, which would thus enable them to do commercial business.

Thursday and Friday's sessions were mainly occupied with the direct and cross-examination of the company's engineer, Mr. Wilson, who offered statements in writing, which were filed as exhibits, showing how the monthly bills submitted by the company had been made up.

The monthly bills submitted to the city for arc lighting service, which average about $7.50 per lamp per month, were made up in detail along lines suggested in a proposition made by the city previous to the expiration of the last lighting contract. These bills are for service, without profit, but based on the expectation that a reasonable profit would be agreed upon and allowed.

Interest and depreciation are each figured at 5 per cent on an investment of $650,000 claimed to be used in the city lighting service; this averages $350 per arc lamp. Maintenance and repair, based on actual figures taken from the company's books, including a proportionate part of amounts expended on buildings, tools, machinery, reserve steam plants and pole, line and lamp repairs, aggregate $1.57 per lamp per month, divided as follows: Repairs, 83.9 cents; proportion of wages in substations, 25.6 cents; maintaining steam reserves, 28.8 cents; general salaries and miscellaneous, 18.2 cents; total, 156.5 cents per lamp per month. Distribution expenses are found to be as follows: Carbons, $0.144; globes, $0.075; wages, $0.765; incandescent lamps, $0.007; sundries, gloves, etc., $0.099; total, $1.09 per lamp per month. Stable expenses, including wages, repairs to wagons and harness, feed of horses, licenses and cost of new horses, average $25.25 per horse per month, or 14 cents per lamp per month. Store expenses, 3 cents per lamp per month. General salaries and office expenses, $2,924.70 per annum, or 13.4 cents per lamp per month. Heating and lighting the buildings, $676.69, or 3 cents per lamp per month.

Insurance for employees and the public is carried by the company itself, but taking as the reasonable cost the rate charged by reputable insurance companies, plus legal expenses, that is 10 per cent of the wages paid, the insurance would amount to $3,075.92 per annum, or 14 cents per lamp per month. The cost of electrical energy per lamp per month was estimated as follows, the conclusions being based on the cost of a block of 20,000 hp purchased from the Shawinigan Water & Power Company at $14 per hp-year—probably the cheapest electrical service in any large city in North America—averaged with the base cost of energy produced by a modern and recently installed hydroelectric plant, known as the Soulanges, controlled by the Montreal company:

The Shawinigan power is delivered at 2400 volts, in a substation at the city limits, for $14 per hp-year. To this expense must be added substation expenses of $3,516.46, which divided by 20,000 hp, the total power, gives 18 cents per hp-year, making the total cost $14.18. The current delivered passes through a regulating transformer having an efficiency of 94 per cent, then through a step-down transformer with an efficiency of 97.5 per cent, is transmitted 15,000 ft. at an efficiency of 98.5 per cent, passes through a regulating transformer having an efficiency of 92.5 per cent. The total efficiency of these various transformations aggregates 81.4 per cent, which makes the cost for energy delivered on the busbars of the Mentana Station $23.35 per kw-year.

As only a small portion of the energy at the Shawinigan sub station is distributed locally for arc-lighting purposes, and as some of the energy from the Shawinigan substation is delivered at the central station for use there in arc service, with greater loss of energy in transmission and transformation than has been determined as above for the Mentana station, it is assumed that the cost of Shawinigan energy delivered at the Mentana station may be taken as fair for all Shawinigan energy wherever used in arc service.

Disregarding investment actually made for franchises, stock control, etc., in the property of the Provincial Light, Heat & Power Company (the Soulanges plant), and considering only the $1,500,000 of bonds outstanding on this property (these being issued only for actual cash expenditures as per certificates of engineers) and considering interest at 5 per cent per annum and depreciation at 5 per cent per annum, the figures proposed by the city, the fixed charges amount to $150,000 per year. The operating expenses of the station are $19,500, making an aggregate cost, without any profit whatever, of $169,500 per annum. The maximum load delivered by the Provincial Light, Heat & Power Company's plant for 1909 was 7200 kw, making the cost per kw-year $23.60.

With an efficiency of 98 per cent for transmission to central substation and 97.5 per cent for the efficiency of step-down and 92.5 per cent efficiency of regulating transformers—an effective efficiency of 88.4 per cent—the cost of Soulanges energy delivered on the 2400-volt busbars at the central station is $26.70 per kw-year.

Taking Shawinigan and Soulanges as being by far the cheapest sources of energy (the investment in Chambly and Lachine being very much higher per horse-power delivered), and figuring the average of their costs—that is, $23.35 and $26.70—the cost of energy delivered at Mentana substation or the central station is $25 per kw-year, or $1.14 per arc lamp per month.

In view of the fact that the above cost of energy is figured

from the stations which produce it more cheaply and [illegible] the arc load is sometimes carried by the other power stations, Chambly and Lachine, where the cost of producing is very much higher than the above figures, it seemed proper to charge a percentage of the cost of maintenance of these last-named plants to the maintenance account of the city arc service, which is included under another charge. The cost of energy per arc-lamp-year is based on the following: Recent tests of arc-lamp regulators and transformers at Montreal showed an average efficiency of 93 per cent. Figuring the I^2R losses the average line loss per lamp was found to be practically 20 watts. The city contract calls for 480 watts at the lamp. Taking 480 watts, adding line loss 20 watts, gives 500 watts output from the arc transformers; this at 93 per cent efficiency gives 538 watts input. Allowing 2.5 per cent, or 13.5 watts, for switchboard and cable losses, the total power consumption per arc lamp delivered at the station transformers is 551.5 watts.

The total number of arc and incandescent lamps involved in the present dispute is as follows: 1666 arc = 1666 arcs; 127 65-cp incandescents = 63.5 arcs; 341 32-cp incandescents = 85.25 arcs; total, 1814.75 arcs.

These, taken at 551.5 watts per lamp, make a total load of 1000 kw on the substation busbars.

Plans of Canadian Pacific Railway.

The Canadian Pacific Railway Company is considering plans for the electrification of a portion of its old steam line to Prescott and the formation of an electric railway belt line around the city in connection with the Hull Electric Railway controlled by the Canadian Pacific Railway, for the purpose of creating at Ottawa a large industrial area for manufacturing sites.

Briefly the plans include the electrification of the old Prescott line from the Union Station to the Sussex Street station, connecting the Sussex Street station with the mouth of the proposed tunnel by a surface electric line, connecting the Hull electric line with the line thus formed, which would create an electric belt line giving access to a large area of suburban residential property, and create an industrial district along the old Prescott line from Hurdman's bridge into the city, along the banks of the Rideau Canal.

In an interview, Mr. N. Cauchon, consulting engineer of the Canadian Pacific Railway Company, at Ottawa, on Aug. 8, is reported as saying that the promotion of the district adjacent to the Prescott line through the city of Ottawa is a matter to which Mr. H. P. Timmerman, industrial commissioner for lines east on the Canadian Pacific Railway, had given considerable attention. Mr. Cauchon stated that the company realizes the great industrial possibilities of Ottawa, and is preparing to develop them. At the present time manufacturers on the Sussex street line are at a great disadvantage in getting cars in and out. The freight yards are located on the flats and there is a haul of 11 miles around to Sussex Street. In connection with the development of the district is a proposal from the Ottawa & Morrisburg Electric Railway which is now before the Canadian Pacific Railway, which contemplates turning over the Prescott line from Ridgemount, near the Chaudiere Junction, to the electric traction company, thus providing it with an entrance into the city.

Should the scheme with the Morrisburg Company fail to materialize a plan has been suggested to the Canadian Pacific Railway to connect the Sussex Street branch with the proposed tunnel from the Central station, and, with the electrification of the tunnel and the Prescott line, to form an electric belt line around the city from the Union station to the Central station, then to the Sussex Street station and around to the Union station by way of the Prescott line. The territory along the Prescott line is suitable for factory sites for 2.3 miles up to the crossing with the Canadian Pacific Railway short line at Hurdman's bridge.

Mr. Cauchon declared that the Canadian Pacific Railway is anxious to electrify its Prescott line, and its industrial commissioner is convinced of the industrial possibilities of the district. He has placed the plans for the development of the district before the management of the railway company.

The old Prescott line runs from the cut-off to the Union station near the experimental farm, along the east bank of the Rideau River, through Hurdman's bridge and Cummings' bridge, across the St. Patrick Street bridge over the Rideau River to and across King Edward Avenue to the old station on Sussex Street. It is the original railway entrance to the city of Ottawa, and its construction was hastened in order to bring in stone for building the east and west blocks of the Parliament Buildings. At the present time its traffic consists of freight trains at infrequent intervals.

Central-Station Results at Springfield, Mass.

The United Electric Light Company, of Springfield, Mass., has filed with the Gas and Electric Light Commission its return for the year ending June 30, 1910. The return shows that the company's capitalization is now 12,500 shares of stock with a par value of $1,250,000, and of this issue 10,938 shares are held in Massachusetts. The company has a total of 3999 customers, of which 3834 are located in Springfield. The total cost of plant as of June 30, 1910, is $2,058,606, the larger items being underground lines, $698,660; steam plant, $391,518; buildings, $300,241; electric plant, $257,257; overhead lines, $104,771; and transformers, $101,028. The total cost of plant in the previous year was $1,884,397, so that the company's plant has increased in value by about $174,000 during the year. The total liability for capital and loans is $1,812,000, which is about $246,000 less than the actual cost of the plant to date.

The company's total income for the year was $547,898, compared with $496,438 in 1909, showing an increase of 10.3 per cent. The revenue was derived as follows: Commercial arc lighting by contract, $6,616; commercial incandescent lighting by contract, $3,171; commercial arc and incandescent lighting by meter, $324,584; public street arc lighting, $87,949; public street incandescent lighting, $4,722; and energy for motors, $120,856. The income from sales of energy for motors a year ago was $97,779. The company's total operating expenses were $291,757, including cost of manufacture, $141,950; distribution, $70,139;

MANUFACTURING COST, SPRINGFIELD, MASS., 1910.

Fuel	$61,110	Coal cost $4.00 per ton
Real estate rentals	550	
Water power rentals	34,560	
Oil and waste	901	
Water	306	
Station wages	26,609	
Plant repairs	17,371	
Tools	541	
Total approximate	$141,950	or 0.83 cts. per kw hour

office expenses and management, $37,323; taxes, $34,958; insurance, legal and incidental expenses, $7,388. The cost of operation in 1909 was $269,382. The company declared four 2½ per cent dividends during the year, amounting to $125,000. Its total assets on June 30 were $2,573,604, and its total liabilities, $2,422,192. The total assets on June 30, 1909, were $2,405,871, the liabilities then being $2,292,723. The total energy output at the switchboard was 17,156,328 kw-hours, compared with 16,583,186 kw-hours in 1909. The sales of energy were: Street lighting, 1,996,800 kw-hours; lighting by meter, 4,877,860 kw-hours; contract lighting, 241,026 kw-hours; motor service, 4,911,475 kw-hours; and total sales, 10,030,361 kw-hours. The company used 534,894 kw-hours in its own lighting and auxiliary service. The energy unaccounted for on the system was 4,594,273 kw-hours, representing a loss of 26 per cent. The maximum load occurred on Dec. 2, 1909, the value being 5912 kw, and the maximum load on the day of least output, July 4, 1909, was 2075 kw. The average return for energy sold for motor service is about 2.46 cents per kw-hour.

The company's equipment tabulation shows a total boiler capacity of 5300 hp; engines and steam turbines, 7770 hp; water wheels, 2835 hp; arc generators, 840 kw; alternators, 7950 kw;

other machinery, 1940 kw. At present six 400 hp boilers are being added, with a 3600-kw Westinghouse turbine with auxiliaries and high-tension switchboard.

The cost of manufacture at the company's generating plants, exclusive of fixed charges, in round numbers was:

The company reports that it now has 346,206 ft. of duct in its system, containing 1,502,070 ft. of cable, the more frequent sizes being No. 6, 511,598 ft.; No. 0, 329,705 ft., and No. 4, 301,011 ft. The company installed 38,723 ft. of duct during the year. It now has 1,702,641 ft. of overhead wire, 2978 poles, and a total connected power load of 7660 hp. The return, according to the new form for 1910, shows the following subdivision of connected load in kilowatts:

CONNECTED LOAD IN KILOWATTS, SPRINGFIELD, MASS., 1910.

Municipal arc lamps	[illegible] kw
" incandescent lamps	[illegible]
Commercial "	[illegible]
A.c. arc lamps	284 "
Total connected lighting load	7,875 kw
" " motor "	[illegible]
Total connected load	13,583 kw

There are now 917 electric motors on the circuits, the average size being 8.35 hp. The company has 1128 transformers and 4489 meters in service, the most common size of transformers being 1 kw, and of meters, 5 amp. The municipal lighting is done with 1187 5-amp, 400 watt arc lamps; 10 50-watt carbon and 348 40-watt tungsten lamps. The connected incandescent load for commercial service is 141,231 50-watt equivalents. There were 1795 enclosed arc lamps in service on June 30, and the company used 73,247 carbons during the year.

Employers' Liability and Compulsory Compensation Laws.

On Sept. 1, two laws enacted at the last session of the Legislature of New York State will go into effect. These laws have to do with the liability of the employer for accident sustained by employees at work, either through the inherent danger in the occupation, or through negligence upon the part of the employer or upon the part of a fellow employee. One law, Chapter 674 of the Laws of 1910, adopts the principle of compulsory compensation for workmen accidentally injured in certain specified dangerous occupations. It is the first state law in this country on this line, and it blazes the way for other states to follow. The other law, Chapter 352, provides for a plan of agreement, by which employers and employees are to be bound in case of accident, and sets forth the rate at which compensation is to be paid.

The compulsory compensation plan embodied in Chapter 674 applies only to workmen engaged in manual or mechanical labor in employments determined by law to be especially dangerous, in which from the nature, conditions or means of prosecution of the work, extraordinary risks to the life and limb of workmen engaged therein are inherent, necessary or substantially unavoidable.

The new law states that it is deemed necessary to establish a new system of compensation for accidents to workmen engaged in each of these dangerous occupations. Eight classes of occupation are then enumerated to which the compulsory system shall apply. These are: (1) The erection or demolition of any bridge or building in which there is, or in which the plans and specifications require, iron or steel framework. (2) The operation of elevators, elevating machines or derricks or hoisting apparatus used within or on the outside of any bridge or building for the conveying of materials in connection with the erection or demolition of such bridge or building. (3) Work on scaffolds of any kind elevated 20 ft. or more above the ground, water, or floor beneath in the erection, construction, painting, alteration or repair of buildings, bridges or structures. (4) Construction, operation, alteration or repair of wires, cables, switchboards or apparatus charged with electric currents. (5) All work necessitating dangerous proximity to gunpowder, blasting powder, dynamite or any other explosives, where the same are used as instrumentalities of the industry. (6) The operation on steam railroads of locomotives, engines, trains, motors or cars propelled by gravity or steam, electricity or other mechanical power, or the construction or repair of steam railroad tracks and road beds over which such locomotives, engines, trains, motors or cars are operated. (7) The construction of tunnels and subways. (8) All work carried on under compressed air.

The compensation for damages or death under both the compulsory and optional sections of the two laws is fixed according to a scale set forth in the law. In the dangerous occupations listed above the amount of compensation in case death results from injury is to be computed according to the amount of wages received by the man and the relatives left dependent by his death.

If the workman leaves a widow or next of kin at the time of his death wholly dependent upon his earnings, a sum equal to 1200 times the daily earnings of such workman (about four years' pay), but in no event to exceed $3,000, shall be paid to the family.

If such widow or next of kin is in part only dependent upon the wages of the workman at the time of his death, then a proportionate sum, to be determined by agreement or arbitration as provided in the code of civil procedure, or by a suit at law, shall be paid, depending upon the amount of injury suffered by them on account of the death of the workman.

If the workman leaves no dependents, then the reasonable expenses of his medical attendance and burial, not to exceed $100, are to be paid by the employer.

Where total or partial incapacity for work at any gainful employment results to the workman in one of the "dangerous" occupations, a weekly payment, commencing at the end of the second week after the injury and continuing during such incapacity, with certain exceptions, shall be paid to the workman. In case of total incapacity, one-half the weekly wage shall be paid, but not to exceed $10 per week, and not longer than a term of eight years. If the injury is only partial, and the workman can earn something, he is to be entitled to one-half the difference between what he earns and what he was earning before the accident.

However, if the workman in a hazardous occupation chooses, he may sue in a court of law for damages, disregarding the damages which he would receive under the compulsory act. This act, therefore, is compulsory only on the employers in the list of dangerous occupations.

But there are certain other changes in the law which go to help the workman. One in Chapter 674 provides that the principal contractor shall be liable to pay the compensation, even though the principal contractor has employed a sub-contractor, and the employee who was injured was working for the sub-contractor.

The new provisions place the burden of showing the contributory negligence on the employer, instead of requiring the injured workman to show that his employer was negligent and that he did not contribute to his injury himself. The technical defenses under the "fellow servant" principle and the "assumption-of-risk" rule are greatly modified by the new law. They are practically wiped out, and the employer is held to a much stricter accountability as to safety of machinery and competency of fellow workmen.

In all other lines of work which are not specifically classed as dangerous a new plan of providing for compensation for injury through no fault of the workman, but through negligence on the part of the employer or any other person in charge of the workmen for the employer, is provided for in Chapter 352.

The plan is for the employer and his employees to file an agreement in writing with the county clerk to abide by the scale of compensation as fixed in the law. This scale is the same as that fixed for the "dangerous occupations." Such an agreement is a bar to the bringing of an action in a suit at law.

in case of death or injury, unless death or injury was due to wilful misconduct of the employer or to the employer's failure to obey an order of any official authorized to require him to safeguard his employees.

The purpose of these provisions is to prevent, as far as possible, expensive law suits, and to give the employee a chance to obtain compensation for damages without a lot of legal complications and delay. No claim of an attorney for a fee for collecting under the plan shall be enforceable unless approved by a justice of the Supreme Court in writing. Weekly payments due under the plan shall not be assignable, or subject to attachment, levy or execution. This is to insure the receipt by the workman injured or his family.

Undeveloped Hydroelectric Power in Ontario.

Mr. L. V. Rorke, inspector of surveys for the Ontario Government's Department of Lands, Forests and Mines, has compiled statistics which show that there are 2,000,000 hp on the northern slope toward Hudson Bay within a distance of 100 miles from the route of the National Transcontinental Railway, which would be amply sufficient for the electrification of this important section of the Canadian national railway line.

The largest of the rivers, the power of which can be used, are the Abbitibi, the Mattagami and the Missinabi, tributaries of the Moose River, the Kabinakagami and Ogoke rivers flowing into the Albany, and the Winnipeg and Rainy rivers.

On the Mattagami River there are 15 important waterfalls, the largest being the Long Rapids Falls, with a natural head of 150 ft. and a minimum flow of 5000 cu. ft. per second, which would give, under proper drainage control, over 200,000 hp for 24 hours. On the same river, the Grand Rapids, with a fall of 100 ft., is capable of developing 135,000 hp under drainage control, and the Little Long Falls, with an 80-ft. head, would develop 100,000 hp. The 12 other falls on the river range from 56,800 hp down to 4500 hp.

On the Abbitibi River there is a series of falls above New Post with a total head of 100 ft. and an estimated minimum flow of 4000 cu. ft. per second, yielding under drainage regulation 124,000 hp.

On the Missinabi River within the available area at Conjurer's Chute and Hell's Gate there is a fall of 250 ft. and a minimum flow of 2600 cu. ft. per second, the minimum 24-hour horse-power would be 75,000 hp. The White Dog Falls, on the Winnipeg River, with a head of 50 ft. and a flow of 11,000 cu. ft. per second, can develop 60,000 hp.

According to Mr. Rorke, the estimates, which give an aggregate of 2,000,000 hp, are careful and conservative and are based on surveys and measurements of the flow of water and the sustaining drainage area.

Candle-Power of Gasoline Street Lamps.

Some interesting figures as to the candle-power obtained from gasoline street lamps in actual service in Chicago were brought out at a public hearing before the Council Commission on City Expenditures (commonly known as the Merriam Commission) at Chicago on June 30. These figures are of interest to electrical men as showing what candle-power has to be met in competition with gasoline lamps. The gasoline street lamps in Chicago, which are located mainly in the outlying districts, are operated under contract with a firm called the American Development Company. The control of this and all other street lighting comes under the department of electricity. The Merriam Commission, which has attracted considerable attention because of its thorough methods, has been investigating all branches of the city government involving the expenditure of money. For the investigation of the electrical department of the city the services of W. H. Zimmerman & Company were secured as engineers. These engineers in turn secured the services of Mr. J. R. Cravath as illuminating engineer to make photometric tests on street lamps in service.

At the public hearing mentioned it was brought out that, although under the contract the gasoline street lamps are to be maintained at 60 cp, and rebates are given from the contract price if the candle-power falls below 60, no lamps were found in service in these tests which gave as much as 60 cp. The engineers for the commission conducted two sets of tests, one set being termed preliminary tests and the other official tests. In the first or preliminary tests no attempt was made to measure directly the horizontal candle-power. A Sharp-Millar universal photometer was placed at some convenient point at a measured distance of from 10 ft. to 20 ft. from the lamp post, the height of the burner above the test plate of the photometer being also measured. The readings were taken in foot-candles. From the distance from the lamp post and the height of the burner, the angle below the horizontal at which the illumination reading was taken was calculated, as was also the distance of the test plate from the burner. Multiplying the foot-candles observed by the square of distance of the test plate from the burner gave the candle-power of the lamp at the angle at which the observation was taken. From this candle-power the probable horizontal candle-power was computed by reference to a curve giving the distribution of light about a gas-mantle burner with a clear chimney, as made in the Electrical Testing Laboratories. While this method might be open to some error because of possible changes in light distribution caused by the glass lantern which surrounds the burner, it was considered sufficiently accurate for rough preliminary tests.

The official tests were later made by the engineers for the commission in the presence and with the co-operation of Mr. F. V. Westermaier, of Philadelphia, as a representative of the American Development Company, and Mr. E. M. Tompkins, electrical engineer of the Chicago department of electricity. In these tests a kind of portable photometer support was provided by which readings could be taken of the horizontal candle-power. It was agreed by all concerned that in the absence of any stipulations to the contrary, it would be assumed that the horizontal candle-power was meant in the contract. The photometer support, which was devised by Mr. Tompkins, had two legs standing on the ground and the third support extending horizontally and fastening to the lamp post. The legs were adjustable as to height. A stepladder was used by the observer in taking readings on the photometer. The distance

TABLE I.—PRELIMINARY TESTS OF LAMPS.

Test Number	Estimated Horizontal Candle-power	Remarks	Test Number	Estimated Horizontal Candle-power	Remarks
11	21.2		24	16.0	
11	17.8	90 deg. apart	25	24.2	
12	17.8		26	19.0	
12	16.2	90 deg. apart	27	1[illegible].9	
16	16.9		28	16.9	
18	29.6		29	17.3	
19	31.2		30	6.7	
20	20.9		31	11.7	
21	27.4		33	15.6	
21	30.8	Lantern door open	34	16.4	
22	22.0		34	19.8	Lantern door open
23	18.1		35	19.9	

of the photometer from the lamp was about 7 ft., and the device was so arranged that either the foot-candle or the direct candle-power readings on the photometer could be ascertained.

During the progress of the official tests the photometer was calibrated by means of a standard incandescent lamp. In Table I are given the results of the preliminary tests, made as already described. In Table II are given the results of the official tests made by measuring the horizontal candle-power directly, as already described. It will be seen that in only two cases—that is, in tests 38 and 39—were candle-powers even approaching 60 obtained. In these two cases the burners were equipped with high chimneys giving a better draft than in most of the other cases.

One of the objects of the public hearing at which these results were given was to determine upon a new form of contract for use after Sept. 1, 1910, when the present gasoline light-

ing contract expires. No provisions being made in the present contract as to how tests shall be conducted or rebates determined, the engineers for the commission and Mr. William Carroll, city electrician, are anxious to provide specifications which can be lived up to, and which will make it possible to obtain a higher standard of illumination in the future. It was suggested tentatively that a horizontal candle-power of 45 for the lamp and lantern in service on the street be allowed as a mini-

TABLE 2.—OFFICIAL TESTS OF LAMPS.

Test Number	Horizontal Candle-power	Remarks	Test Number	Horizontal Candle-power	Remarks
36	21.1		42	24.0	
37	19.3		43	17.0	
38	54.0		43	24.5	Lantern door open
39	58.4		44	17.0	
39	64.2	Lantern door open	[illegible]	19.8	
40	27.1		46	[illegible]	
41	16.8		[illegible]	[illegible]	

mum limit, for which the regular rate should be paid, below which rebates should begin, and that lamps giving less than 16 cp be counted as out.

From the results being obtained in Chicago, as well as from the testimony of representatives of the gasoline lighting company at this hearing, it is apparent that it is no easy matter to maintain the high normal candle-powers claimed for mantle burners in street service. The gasoline lighting company's representatives present made no claim that 60 cp could be maintained in actual service on the street, including the loss in the glass of the lantern or head, and in the dirt on the glass. They cited the practice in some cities of testing for candle-power by removing the burner from the street to the laboratory. The engineers for the commission point out, however, that it would be almost impossible to remove a mantle burner intact from a street lamp post to the laboratory, and that this method would take no account of the cleanliness of the glass lantern maintained by the contracting company. Tests on the street would be much more accurate as to actual existing conditions, although, if the tests are to be so made, liberal deduction must be allowed from the nominal 60 cp for the protection of the contracting company; and provision should probably be made for the protection of the company that tests should not be conducted with the lantern covered with ice or snow, or under abnormal conditions due to dust storms.

In the tables giving the tests it will be seen that a number of tests were made with the glass door of the head or lantern closed as in service, after which the door was opened and another test made to determine the absorption caused by the lantern glass and the dust thereon. In most cases the glass on these lanterns was found in comparatively good, clean condition, except in test 22, where considerable dust was noticeable

Moving 370 Feet of Conduit Intact.

A job of moving intact 370 ft. of conduit was accomplished in Chicago on August 6. The conduit was a 42-duct line of National cement lined iron pipe. It contains the cables of the Commonwealth Edison Company, and is located on Washington Street, at the east approach to the Washington Street tunnel. Mr. George W. Jackson is the contractor for the alterations in the Washington Street tunnel under the Chicago River. To enlarge this tunnel for the wide street-cars now used in Chicago, it was necessary for him to move over one of the tunnel walls which was directly against this line of conduit. It was at first proposed to abandon this conduit temporarily and build a temporary line by another route. The contractor and the Commonwealth Edison Company had practically agreed on this course, the work to be done at the expense of the contractor. Mr. D. W. Roper, assistant chief operating engineer of the Commonwealth Edison Company, who has charge of underground conduit lines for that company, however, felt that this was going to unnecessary expense and trouble, and would consume much time of the company's underground gang, which was needed elsewhere. He accordingly proposed the plan of moving the entire length of conduit over in one piece by means of jacks. The distance to be moved was about 3 ft. at one end and 9 ft. at the other. His plan was decided upon, as it involved much less expense than the rerouting, which was estimated to cost $8,000. Preparations were made and the actual moving of the line of conduit consumed only about two hours, on the date mentioned. Fig. 1 shows

Fig. 1—Conduit Before Moving, Jacks in Place.

the conduit line ready to be moved, with jacks in place. The conduit was supported on timbers and the moving was done on rollers, consisting of short pieces of iron pipe, as shown in the illustration. Fig. 2 is a view after the moving was accomplished, with braces substituted for the jacks, to keep the conduit from swaying while the filling-in and concreting was being carried on. To insure the conduit remaining in line

Fig. 2—Conduit After Moving.

sight sticks were fastened on top of the conduit, as seen in the foreground in Fig. 2. A man stationed at the end of the line of conduit, sighting along these sticks could tell at a glance whether one of the jack-screws was being tightened too rapidly. This line of conduit terminates in manholes at either end and the brick-work of the manhole around the conduit was removed before the moving of the conduit began. The work was done under the supervision of the Commonwealth Edison Company, by the contractor.

Many predictions of failure by cracking apart of the concrete were made before the work was begun. Some of the experience of the Commonwealth Edison Company with con

duit lines, however, indicated to Mr. Roper that cracking was not greatly to be feared where the movement was under control, as in this case. In one case of the sinking away of a street for a new building excavation, a line of conduit was bowed out a distance of 1 ft. in about 85 ft. without any apparent detriment to the ducts. In another case, in a distance of about 200 ft., a line of conduit was bowed out by slumping into a sewer excavation. It was about 7 ft. out of line in this distance before cracking of the cable insulation occurred.

Wisconsin Commission News.

The Wisconsin Rate Commission has authorized the Green Bay Gas & Electric Company to issue $103,000 par value of bonds, to bear interest at the rate of 5 per cent per annum, and to mature May 1, 1933, unless sooner redeemed. These bonds are to be issued for money only and for not less than 75 per cent of the par value. The funds derived from the sale are to be used for the payment of certain additions and extensions to the company's property in the city of Green Bay, Wis. The bonds are secured by a trust deed issued to the Wisconsin Trust & Security Company.

The Badger Railway & Light Company has been authorized to issue 100 shares of common stock having a par value of $100 each. The stock will be issued for money only and for not less than par value. The stock is to be issued and sold for the purpose of defraying the ordinary expenses of its organization and for making the necessary surveys of a line of railway which it proposes to construct from the city of Whitewater to the city of Lake Geneva, and for the doing of other things necessary for making an application for a certificate of public convenience and necessity.

An action of more than passing significance is the application of the Menominee and Marinette Light & Traction Company for permission to put into effect a new schedule of rates for electric lamp and motor service, in which the rates applied for are, as a rule, material reductions from the rates ordered by the commission in its decision relative to the Menominee & Marinette Light & Traction Company a few months ago. As a reason for this reduction the company states that its water-power plant will be completed during the summer and it will then be in a position to generate energy cheaper than heretofore.

In the rates for electric lighting the primary rate is reduced from 13 to 11 cents; the secondary rate, from 8 to 7 cents, and the excess rate from 4.5 to 4 cents per kw-hour.

The motor service schedule contained in the decision above referred to gives a service charge of 50 cents per month per horse-power, and a rate of 3.5 cents per kw-hour consumed. The proposed schedule, while retaining the service charge, scales the lighting charge according to the size of the installation, beginning with a rate of 3.5 cents for installations of 20 hp or less and dropping to a rate of 0.75 cent for installations of over 500 hp. While the proposed motor service rates are material reductions, the commission makes the objection that the schedule fails to recognize the fundamental principle that rates should be based on demand as well as upon connected load. There is nothing to prevent a consumer with an installation larger than another consumer, and who uses less energy in a month than the latter, from receiving a cheaper rate per kw-hour consumed. It was suggested by the commission that a much more satisfactory schedule of rates could be devised by following the method of unit costs as laid down by the commission in several of its previous decisions. The flat rates contained in the proposed schedule are open to the same objections.

Massachusetts Commission News.

The Boston Transit Commission has completed the plans for the construction of a station in Boston at Park Street in connection with the entrance of the Cambridge subway, which is now being built by the Boston Elevated Railway Company between the Charles River and Harvard Square. The Boston Transit Commission is building the Boston section of the subway, according to the law authorizing the work. The station will be built below the present subway station at Park Street, and six stairways will be provided to connect the two. Escalators driven by electric motors will be used for upward service. The Cambridge subway trains will be loaded at a central island platform and unloaded upon side platforms. The plans of the commission provide for an extension of the Cambridge subway under Winter Street to the South Station and also for the entrance into the terminal of the new Riverbank subway, which will shortly be built between Park Street and the outer Back Bay district. Contractors will be asked to bid upon the construction of the new station as soon as possible, and it is hoped to complete the work by Sept. 1, 1911. The Boston Elevated Railway Company is making such rapid progress in Cambridge subway construction that it is probable that the tube in that city will be completed before the Boston end of the work.

The Massachusetts Gas and Electric Light Commission has issued an order approving the issue by the New Bedford Gas & Edison Light Company of 2150 shares of additional stock at a price of $200 per share. The proceeds of the sale of 1410 shares are to be used in the cancellation of indebtedness incurred by the company in recent enlargements of its system, and the proceeds of the sale of the remaining 740 shares are to be applied to the cost of plant extensions.

The commission has applied to the Massachusetts Civil Service Commission for the appointment of a smoke inspector under Chap. 651 of the Acts of 1910, Massachusetts Legislature. The latter board will hold a competitive examination for the position on Sept. 2. The salary named by the Gas & Electric Light Commission is $2,500, subject to the approval of the Governor and Council. The examination will contain the following subjects: (1) Training and experience; (2) writing of report or letter; (3) arithmetic; (4) knowledge of fuel and its handling; combustion, causes of smoke nuisance and methods of abatement; (5) knowledge of law relating to smoke nuisance. The possession of a license and thorough training as fireman or engineer, while not required, will be given special consideration, and applicants will be given a physical examination and a specially rigid test of eyesight.

The Massachusetts Railroad Commission has approved the extension for another year of the practice of the Middlesex & Boston Street Railway Company of charging 1 cent for each transfer issued on the lines formerly operated by the Newton Street Railway Company. At a hearing before the board on Aug. 8 General Manager Sylvester presented figures showing that the company's earnings do not as yet warrant a resumption of free transfers. There was no opposition to the continuance of the 1-cent charge, and on the next day the board approved the company's petition.

New York Commission News.

The Public Service Commission of the Second District has granted the petition of the Black River Traction Company for permission to extend its line within the city of Watertown. The new line as authorized will extend from the present terminus at the intersection of Pearl and Water Streets in the city of Watertown through Pearl Street, a distance of 3150 ft., to a point opposite the plant of the Massey Machine Company. The traction company has obtained the necessary consents of property owners and a franchise for such construction from the city of Watertown, which franchise has been approved by the commission according to law. There is a public demand and necessity for the proposed extension which will accommodate a large number of employees of the New York Air Brake Company and the Massey Machine Company.

The Public Service Commission, Second District, has received a complaint from John Snyder, who operates a garage at 72 Dove Street, Albany, against the Municipal Gas Company, which alleges exorbitant and unreasonable charges for electric service. Mr. Snyder states in his complaint that he installed one 15-hp elevator motor about May 15 and that the company at that time quoted a flat rate of $10 per month on this motor. He further

states that on Aug. 1 he received a bill from the Municipal Gas Company which called for $1 per month per horse-power minimum charge on the installation in addition to 10 cents per kw-hour for energy used, which bill amounted to $22.50 for one and a half months for the 15-hp motor in addition to $1 for 10 kw-hours, making the bill $23.50. Upon protest to the company $1 was deducted from this bill. An order has been issued by the commission in the matter which directs the Municipal Gas Company to satisfy the complaint in question, which was made as above stated, or to file an answer in writing to the allegations within 10 days with the secretary of the commission and to serve a copy of same upon the complainant.

The commission has received a petition from James S. Whipple, forest, fish and game commissioner, asking it to make an order requiring the Brooklyn Cooperage Company to use oil for fuel upon its lines of railroad in the Adirondacks and the adoption of such other devices and precautions against setting fires as the public interest requires. Up to the present time the commission had no power in the matter, but by a law passed this year the Public Service Commission of the Second District may require the use of oil for fuel upon locomotives used upon the lines of railroad of this company. The commission has appointed a hearing upon the matter at its Albany office on Monday, Aug. 22, at which the Brooklyn Cooperage Company is required to show cause why it should not use oil-burning locomotives as demanded in the petition.

The commission has received a petition from the Rochester Belt Line Railroad Company for a certificate of convenience and necessity and for permission to construct its road, 15 miles in length, operated both by steam and electricity, and to be mainly a freight belt line connecting all railroads at Rochester.

The commission has served upon the New York State Railways the complaint of Morris Manson, of Rochester, as to the alleged refusal of that company to carry certain newspapers in packages upon its cars in the city of Rochester for the complainant.

The commission has received an application from the Fonda, Johnstown & Gloversville Railroad Company for leave to issue the balance of its unissued bonds under its 50-year first consolidated general-refunding mortgage of Jan. 1, 1903, the proceeds of the proposed issue of bonds to be used to pay for additions, extensions and improvements to the company's line.

CURRENT NEWS AND NOTES.

I. E. S. Membership.—As the result of a vigorous campaign by a committee on membership, the roll of members of the Illuminating Engineering Society has been increased by 25 per cent during the past few months.

Town in Darkness by Court's Order.—The city of Mount Carmel, Ill., was without water, gas or electric light on the night of Aug. 5, because of an order issued from the Federal Court at Danville, Ill., to the receiver of the Mount Carmel Gas & Electric Company to stop the operation of the plant if the Council should not agree to pay $3,500 alleged to be due to the company from the city.

Electric Railway Accidents.—The New York Public Service Commission of the First District has issued a report of the accidents occurring during the month of June, 1910, on the electric railways of New York City. Altogether there were 5086 accidents—27 killed, 232 seriously injured, and 3259 slightly injured. Of the 3518 total injuries, 2423 were passengers, 485 not passengers and 610 employees. These figures show an increase over last year, but a decrease over the year before. A comparison of these figures with those of previous years is of little value unless considered in conjunction with the volume of traffic handled.

Annual Meeting of Vermont Electrical Association.—The annual meeting and outing of the Vermont Electrical Association will be held at Brandon, Vt., Sept. 28 and 29, 1910. The association is planning, in conjunction with the N. E. L. A. and the Vermont Historical Society, on the observance of Davenport Day, to commemorate the invention of the electric motor, and expects to unveil a suitable tablet. Exercises will be held and speeches will be made by prominent men in the electrical fraternity at Forestdale, a suburb of Brandon, in the shop where Mr. Davenport invented the motor. Some of Mr. Davenport's descendants will attend the function, which will be held Sept. 28. Sept. 29 will be devoted to a barbecue at Lake Dunmore.

Niagara Energy for Detroit.—The city of Windsor is advertising for sale the surplus of the Niagara power which it expects to receive, but not to require for the use of its own people. It is proposed to purchase 15,000 hp from the Hydro-electric Commission, not over 2000 hp of which it will require for its own use. The rest it would like to sell to the Tunnel Company for international use and to Detroit manufacturers. Permission to carry out this project has not yet been granted by the Government; however, a vote was authorized to be taken, and was carried by a large majority, providing for the issue by the town of bonds to the amount of $100,000 for the construction of a municipal transmission plant. The city has purchased 20 acres for factory purposes.

Western Electric Chicago Plant's Assessment.—The Western Electric Company has obtained a substantial reduction in this year's assessment figures from the board of reviewers. Last year the company was assessed $3,250,000 on its plant at South Clinton and West Harrison streets and $1,500,000 on its Hawthorn plant, a total of $4,750,000. This year the assessors placed a $4,000,000 assessment against the Hawthorn plant and one of $3,000,000, with a $1,500,000 penalty for alleged failure to schedule, against the West Harrison Street plant. The reviewers cut the Hawthorn assessment in two and reduced the other valuation to $2,500,000 and the penalty to $1,000,000, or a total reduction in the $8,500,000 to $5,000,000. This $3,500,000 tax reduction is the largest granted by the tax reviewers thus far.

Telephone Convention at Boston.—The second annual convention of the district managers of the New England Telephone & Telegraph Company was held at the Hotel Somerset, Boston, Aug. 11 to 13, inclusive. Mr. H. E. Hughes, district manager at Pittsfield, presided. The following papers were read: *How to Obtain the Development Estimated by the Commercial Enquirer,* by Mr. Edward Shattuck, Jr.; *How to Develop Small Exchanges,* by Mr. H. W. Worthley; *The Development of Pay-Station Revenue,* by Mr. R. L. Bronson; *The Development of Toll Revenue,* by Mr. C. F. West, and *Private-Branch Exchange Sales* by Messrs. H. W. Emerson and W. I. Mellen. The social features of the meetings included a trip down Boston Harbor and a banquet at the hotel. About 100 telephone managers attended. The chairman of the convention committee was Mr. L. P. Lanthier, Boston.

Convention of Municipal Electricians.—The International Association of Municipal Electricians will hold its fifteenth convention at Rochester, N. Y., on Sept. 6 to 9. The headquarters will be at the Powers Hotel and the meetings will be held in Convention Hall. Among the papers to be presented are the following: *Wireless Telephone and Telegraph,* by Mr. John W. Kelly, Jr., Camden, N. J.; *Lightning Protection,* by Mr. Walter M. Petty, Rutherford, N. J.; *Mercury-Arc and Other Rectifiers,* by Mr. H. G. Kennedy, Rochester, N. Y.; *Relation of the Telephone to the General Organization of Fire-Department Service,* by Mr. H. C. Bundy, Watertown, N. Y.; *Underground Work,* by Mr. J. B. Yeakle, Baltimore, Md., and Clarence R. George, Houston, Tex.; *Modern Police Signal System,* by Mr. Joseph B. Smith, Rochester, N. Y.; *City and National Code Rules, and the Relation of the City and Underwriters' Inspectors,* by Mr. R. A. Smith, Norfolk, Va., and *Inductive Loads of Low Power-Factors,* by Mr. A. S. Hatch, Detroit, Mich. Mr. Frank P. Foster, Corning, N. Y., is secretary.

Milwaukee Engineers.—The following men have been elected officers in the Engineers Society of Milwaukee: Mr. L. L. Tatum, president; Mr. Fred. M. Prescott, vice-president; Mr. M. A. Beck, treasurer; Mr. R. H. Pinkley, secretary.

Government Testing of Fuel.—The United States Bureau of Mines of the Department of the Interior has issued a leaflet calling attention to 31 bulletins that have been published for free distribution. These bulletins consist largely of reports of investigations relating to the official tests of fuels.

Railroad Accidents.—During the first quarter of the year the steam roads of the United States killed 1100 persons and injured 21,232, while the electric roads killed 19 and injured 669. The total figures show an increase over the same period a year ago, which is partly due to two great catastrophes in which 141 persons were killed and 52 injured.

Electric Fans in Subway Cars.—Following the example of the Chicago Railways Company the Interborough Rapid Transit Company has arranged to place electric fans in the New York subway cars. It is expected that at least 1000 cars will be thus equipped by next summer. The company is reported to have spent $900,000 in an attempt to ventilate the subway. Next year, with additional trains in service, the conditions will be even more disagreeable than at present.

Paris Railroad Terminal Electrification.—Increasing traffic is responsible for a move by the French Government to relieve the congestion in the St. Lazare station and on the belt line about Paris to equip the system for electric train operation. Experience has shown that the capacity of a terminal for handling trains may be increased by about 33 per cent when multiple-unit trains are substituted for steam-operated ones. The Government has appropriated $40,000,000 for the carrying out of this project.

Telegraph Pole in Peculiar Fatal Auto Accident.—When an automobile party returning to Milwaukee, Aug. 11, attempted to round a curve in the road without slackening speed, the machine skidded and left the grade, plunging into a telegraph pole at the side. The automobile did not upset nor was it badly damaged, but the pole was broken off at a point 3 ft. above the ground and fell over onto the occupants of the machine, injuring three seriously and crushing the fourth to death outright. One of the injured men may also die.

Water Powers in Maine.—A study recently made by the Commissioner of Industrial and Labor Statistics to determine the present status of the unused water-powers in the state resulted in the compilation of a large amount of statistical data. Most reports on powers were incomplete, but the few that gave the amount of power available, indicate the great field for the development of electric stations to furnish energy to industries of all sizes that is still undeveloped in the State of Maine. There were 256 sites which reported powers ranging from 10 hp to 20,000 hp, the average being a few hundred hp.

American Society of Engineer Draftsmen.—The first meeting of the recently organized society for draftsmen was held July 27. The membership is made up of competent draftsmen from all branches of engineering. Besides promoting fraternal feeling and stimulating professional interest it is intended that the society will assist its members to find suitable employment by keeping in close touch and co-operating with manufacturers. The officers of the American Society of Engineer Draftsmen are: Mr. E. Farrington Chandler, president; Mr. Wm. B. Harsel, vice-president, and Mr. Henry L. Sloan, secretary and treasurer, with headquarters at 116 Nassau Street, New York.

Coal in Alaska.—According to bulletin No. 442, of the United States Geological Survey, coal is widely distributed in Alaska, but the only fields which can yield coal for export are those in the Pacific Slope province. The coal in these fields includes the lignitic or bituminous coals of southeastern Alaska, Cook Inlet, the Susitna basin, and the Alaska Peninsula, as well as the high-grade fuels of the Bering River and Matanuska fields. About 40 per cent both of the area known to be underlain by coal and of the estimated area of the total coal fields of the territory falls in this province. It includes also at least 90 per cent of the known bituminous and higher-grade coals of the territory.

Large Electric System in Northwest.—The Columbia Light & Power Company has recently purchased the electric plant of the Wasco Warehouse Milling Company and has reorganized the business. The new company contemplates an entire reconstruction of the station, which is located at White River Falls. When the reorganization is complete it is said that the plant will be turned over to the Pacific Power & Light Company, which was recently organized by the American Power & Light Company, of New York. The interests represented by these companies now control a chain of plants which supply electric energy to 15 cities in Washington, Oregon and Idaho. It is contemplated to extend the transmission and distribution lines to cover the entire Columbia River Valley.

Prevention of Loss by Fire.—The Commercial Club, of Boulder, Col., at its weekly lunch, on Aug. 10, listened to an address by Mr. W. J. Canada, electrical engineer of the Rocky Mountain Fire Underwriters' Association, on fire waste and fire prevention, with special reference to the conditions in Boulder. Water works and fire department were commended, and the lack of suitable ordinances was criticised. The improvements recommended were freely discussed, and the Commercial Club voted to present these recommendations to the City Council with its endorsement. Among the ordinances suggested are one requiring conduit in fire limits, and the grounding of secondaries throughout the city, and one regulating gasoline lighting systems, their installation and operation.

Electric Railway Travel in New York City.—The New York Public Service Commission, in a report given out on Aug. 12 relative to the traffic receipts of the railroads of New York City for the month of May last, said that the Hudson & Manhattan Company carried in that month 1,335,660 passengers, and had a net revenue of $226,163. Transportation companies of the city were: Interborough (subway) fares paid, 22,077,744, net revenues, $835,930; elevated lines, fares, 24,770,440, net revenue, $804,939; Brooklyn Rapid Transit System, fares, 35,770,852, net revenues, $812,809; Metropolitan Street Railway, 21,807,606, net revenue, $231,790; Third Avenue Company, fares, 4,162,943, net revenue, $171,055. The total number of fares paid in May on all the railroads of the city amounted to 126,900,788. The total net revenue derived was $3,349,428.

Wireless False Alarm of Burning Lake Vessel.—The Chicago waterfront was thoroughly alarmed, Aug. 11, when a wireless message was received from somewhere out in Lake Michigan, "Look out for burning boat. Christopher Columbus. Look out for burning boat." With visions of a terrible calamity on board the great excursion steamer, the *Columbus*, bound for Milwaukee with several thousand passengers, the Chicago turbine-electric fireboat *Graeme Stewart* was dispatched in the direction of the excursion vessel's course, and life-saving crews from the various shore stations were summoned. No trace of any burning vessel could be found, and when the *Columbus* returned to Chicago in the evening her captain explained that during the morning he had sighted unaccounted-for smoke in the northeast and asked his wireless operator to inquire if other vessels noticed the same thing. The captain was thoroughly angry at the careless wording of the wireless message, which caused the greatest apprehension on shore. Meanwhile the wireless operator had disappeared.

THE ARIZONA POWER COMPANY—I.

Description of Hydroelectric Development including Novel Intake, Concrete Flume, Tunnels, Syphons and Concrete Pipe Line.

By R. S. Masson.

One dry season about 30 years ago a Yavapai County cattleman told his partners at the old army post, Camp Verde, that the biggest springs he ever heard of gushed forth from under the rocks 100 yd. or so below where the Apache Trail crossed "that biggest canyon" on the way to Strawberry over in Gila County. He told them the water from these springs covered sticks and stones, ferns and roots with a formation which made them look like fossils, and they named the creek, Fossil Creek.

Welling up from mysterious depths at a temperature of 72 deg. Fahr., winter and summer, dry season or wet season, rain or shine, the flow of Fossil Springs never changes. Wherever the waters of these springs have a chance to rest or cool outside of the rushing current of midstream, they fertilize a fine moss which grows on all surfaces, and in this moss the water deposits minerals forming a white incrustation. Once in nearly every year, when an extra heavy rainfall occurs in the country, far back beyond the springs, this deposit takes a new color and the entire creek bed for miles below the springs becomes a bright sky blue, only to be bleached out to its regular white color within a few weeks.

HISTORY OF THE DEVELOPMENT.

Twenty years later, when the use of water for power by electric transmission became general, the discoverer drove a stake at the springs and appropriated the use of its water for himself and his assigns forever. After several years of work on the springs, known as "assessment work," interlapped with work on capitalists to try to induce them to build a water-power plant, he succeeded in interesting capitalists early in the year 1902. The engineers of these capitalists made accurate measurements of the waters of this spring and found that there were 43 cu. ft. per second flowing in the creek below the springs when no rainwater was coming from above. Gagings were taken daily for more than two years and at the end of this time the gager gave up in disgust, as he had repeated the same figures three times a day throughout the entire time, excepting as it was varied by the word "rain" at intervals.

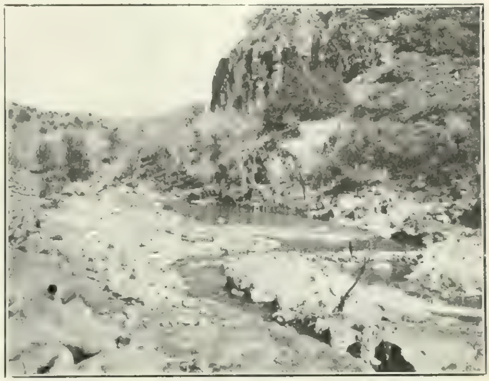


Fig. 2—Intake and Rock Channel.

These engineers reported that a total head of 1600 ft. in a distance of 10 miles could be obtained where the water would drop into the Verde River, about two miles above its confluence with Fossil Creek. Engineers reported in the same year that there was a large market avilable for electrical energy in mines and cities nearby. Not until 1907, however, did the organization take actual form and in February of that year definite plans for the various features of the plant were formu-

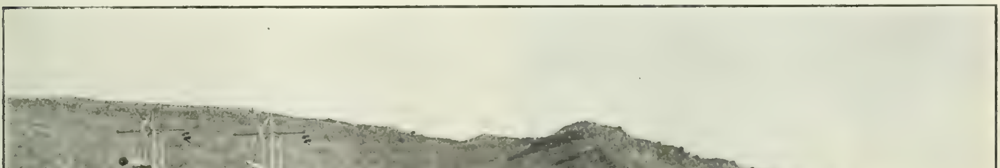


Fig. 1—Power House and Lightning Arrester Houses, Arizona Power Company.

lated. Financial arrangements were made to construct the so-called "lower plant," using 1100 ft. of the total head. The adoption of this particular fraction of the total head was due to the location of a small flat—formerly a lake—having an

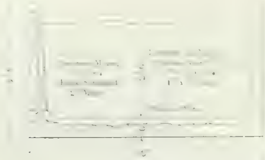


Fig. 3—Section of Reinforced Concrete Flume.

area of 28 acres. The flat, now Stehr Lake, was within two miles of a possible power-house site on Verde River and six miles below the point where the hydraulic grade of the water onduit met the level of the stream in Fossil Creek Canyon.

Fifty miles to the west and 3000 ft. higher in the air is Prescott, the popular summer resort of Arizona. Forty miles north of the power house and [illegible] ft. higher up in the air is

Fig. 4—Sand Box at Intake Showing Beginning of Concrete Flume.

the town of Jerome, where Senator W. A. Clark, of Montana, operates the United Verde mine and smelter. Fifty miles south and west of the power house and 4000 ft. higher in the air are the tops of the great Bradshaw Mountain range. In these mountains, between Jerome on the north and Crown King on the south, a distance of more than 60 miles, lies the richest mineral belt in Arizona. Senator Clark quickly saw

Fig. 5—Concrete Flume Below Tunnel No. 6.

the advantages of water-power in a place where fuel had to be hauled more than 1500 miles over mountains and slippery road-beds, and immediately contracted for more than one-third of the generating capacity of Fossil Creek.

PRELIMINARY WORK.

From the railroad station of Blue Bell, the nearest point to the then proposed power plant, it was necessary to build 50 miles of wagon road through a continuous pile of boulders

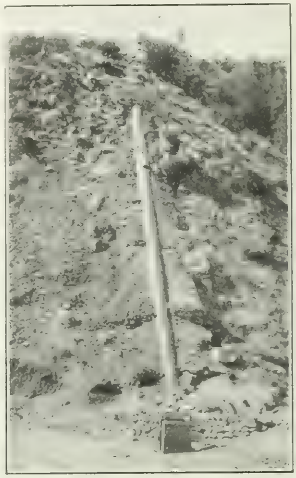


Fig. 6—Syphon from Low Point Towards Tunnel No. 7.

and malapais, over more than half of which there was not even a trail. In order to reach the power plant it was necessary to go over the so-called Rim of the Verde Mountains, at an elevation of 6600 ft., while the power house was located at 3300 ft. The air-line distance from this Rim to the power house was only four miles and the canyon into which the road drops bears a close resemblance to the famous Grand Canyon of the Colorado. Work on the road was begun in April, 1908, and on July 1 an automobile dipped its wheels into the Verde River at the power-house site. The road was quickly pushed 11 miles beyond the power-house site to the intake, and about Sept. 1 a 150-hp water-turbine plant was running with Fossil Creek flowing through it at a head of 55 ft. The energy from this was used to operate rock crushers, air compressors, tunnel ventilating fans, machine and blacksmith shops, electric drills and for illuminating 20 tunnel faces; while 600 men and 400 mules, hauling more than 150 wagons, undertook to build a power plant which was to be completed within 12 months. To do this it was necessary to construct a water conduit 38,000 ft. in length composed of 10,000 ft. of concrete tunnels—(one single tunnel between adits being 2600 ft. long)—12,000 ft. of

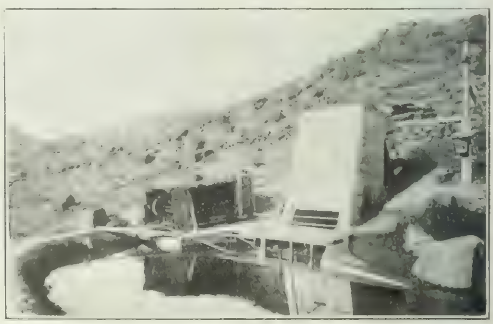


Fig. 7—Intake Gate at Entrance to Pressure Tunnel.

reinforced concrete flume on a bench excavated in the mountain side; 2200 ft. of wooden flume on trestles over gulches and boulders; 7500 ft. of steel gravity syphon, mostly covered in trenches, but passing over four long steel bridges; 1400 ft.

of reinforced concrete pipe to operate under a head of from 20 ft. to 30 ft.; a reinforced concrete standpipe 36 ft. high and 30 ft. in diameter; 4800 ft. of steel pressure pipe; made to hold 1100 ft. head at its lower end; a power house with three 1800-kw generating and transforming units; 75 miles of steel-tower transmission lines, with double circuits for 45,000 volts; substations at seven points, houses, stables, camps, warehouses, all to be built in a romote region, miles from a railroad and never approaching the habitation of mankind excepting at the two termini of the transmission lines—in Prescott and Jerome. There were less than a dozen houses along the route of the transmission line. Four miles of pipe lines and three gasoline engine pumping stations were necessary to bring water from tiny springs to points along the road for watering the stock. A telephone line on wooden poles was built and completed by the time the work at the plant was begun, and this feature has been retained permanently at a remarkable advantage over the usual custom of having a telephone in some way mounted with the transmission line.

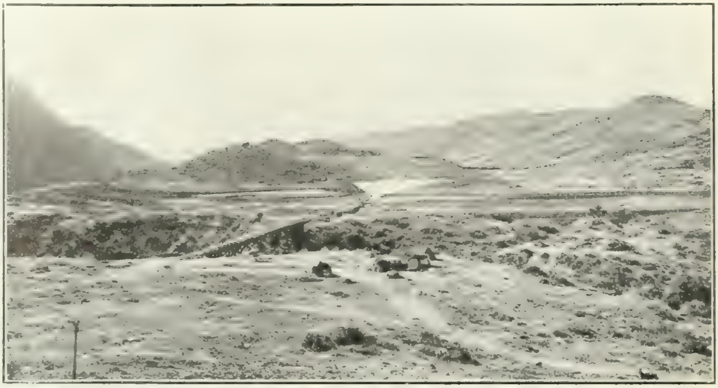


Fig. 9—Reservoir (Stehr Lake) from Tunnel No. 4.

INTAKE.

Just at the point where the slope of the hydraulic conduit running up from the proposed "full lake" level met the creek bed, the stream flowed over a wide spreading black volcanic rock ledge 20 ft. to the pool below.

No dam was constructed and the entire intake was formed by blasting a channel in this rock to a point where its level came under the stream. A neat sand box, 15 ft. deep and 30 ft. long and 20 ft. wide, was formed by cementing up a gash in this rock about 300 ft. below the intake, and from this box the flume starts on a rock ledge, safely located 30 ft. above the low-water level of the stream.

REINFORCED CONCRETE FLUME.

The rough, rocky nature of the ground in this forbidding land made a necessity which turned out its proverbial invention. The engineers abandoned the usual cement-lined ditch before 50 yd. of the excavation [illegible] completed. More than half of the material of the excavated bench was composed of boulders as large [illegible] reinforced concrete flume was substituted, to be constructed on a bench, with the result that this form of water conduit will hereafter, without the least doubt, replace all other forms of permanent surface gravity conduits.

The arrangement of forms devised by Mr. H. A. Barre is the key to the success of this manner of constructing conduits. The design is unique and so successful that it has become the subject of an application for a patent. The drawing of the cross-section of the flume is shown in Fig. 3, and Fig. 5 shows a photograph of the conduit. The friction coefficient for this form of conduit is considerably lower than that for a wooden conduit of the same size made of dressed red-wood lumber in 16-ft. lengths and a value of the factor "n" in Kutters' formula is probably as low as 12. This result was produced without any dressing of the concrete inside excepting to paint it one coat with neat cement as soon as the forms were removed. At a velocity of the water from 4 ft. to 4½ ft. per second in this flume, and a slope of 1 ft. in 1000, the surface does not "wave" or surge more than 1 in. above the average depth even in curves with a radius as low as 50 ft. The growth of moss on the sides and bottom of the flume raises the water level from its normal depth of 24 in. to a depth of 34 in. The water of Fossil Creek is prolific in this moss, but the moss is so soft and feathery that it disintegrates at the first touch of a wire broom and flows away in the passing flood. The same moss grows in the wooden flume, and here the advantage of the concrete flume in the absence of cross pieces over the top is most effectively noted. A man can walk in the concrete flumes with his wire broom unimpeded, and the entire 12,000 ft. of flume is cleaned in two weeks by one man. This is done by the regular gate tenders and no extra expense is incurred.

Fig. 8—Concrete Flume from Tunnel No. 8 Toward Syphon.

The concrete for this flume was mixed in proportion of 6-in. "run of the crusher rock" passing through a 2-in. screen, three parts of sand and one part of cement. This mixture was persistently tamped with solid tampers. The sides and bottom were all done in the same operation and the inside bottom, as well as the top edges of the sides of the flume, were finished with a trowel in the concrete itself without any extra finish whatever. A mixture with more mortar and less rock would

no doubt reduce the amount of labor necessary to construct this flume, but in this instance cement cost from $8 to $12 per barrel delivered on the work, and extraordinary tamping was, therefore, justified in order to use a higher proportion of rock. The average labor cost of installing this flume in a continuous

[illegible] COST OF INSTALLING CONCRETE FLUME

[illegible]	[illegible]
[illegible]	[illegible]
Placing reinforcing metal (3 men at $2)...	[illegible]
[illegible]	[illegible]
Wheeling concrete material (2 men at $2)	[illegible]
Wheeling concrete mixed (5 men at $2)...	[illegible]
Shoveling into forms (3 men at $2).......	[illegible]
Tamping (7 men at $2).................	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Timekeeper...........................	[illegible]
	[illegible]

stretch with sand, cement and rock delivered on the bench in piles from 300 ft. to 400 ft. apart, and without cement-mixing machinery, other than shovels and wheelbarrows, and with a water-supply pipe following the bench, was $1 per foot, including all incidental expenses, divided about as given above.

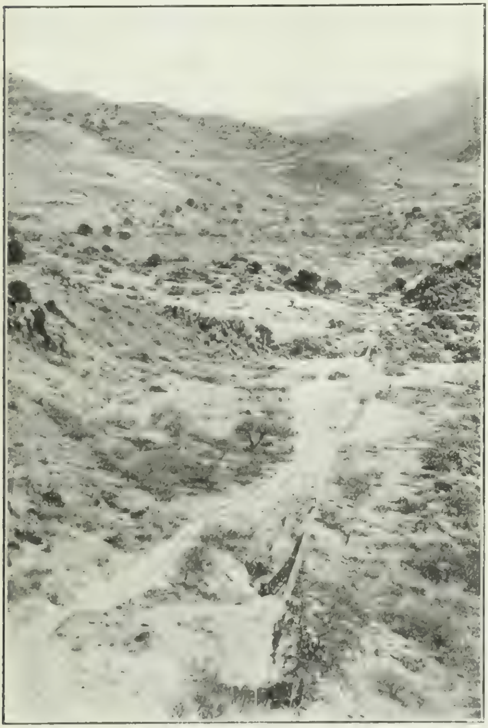


Fig. 10—View of Syphon Looking Towards Concrete Flume.

A construction crew organized as above constructed from 120 ft. to 150 ft. of flume on good days in 10 working hours when no unforseen interruption occurred, but the average amount of flume during the entire job was 100 ft. per working day for the said crew. All of the men employed were Apache and Mojave Indians, excepting the foreman, sub-foreman and timekeeper.

Present indications show this flume to be absolutely permanent; the only precaution necessary is to keep floods from undermining it. Cross drains were constructed under the flume at low-grade points in the surrounding country to prevent water from standing behind the flume, thus possibly soaking up the dirt underneath, which would allow the flume to slip. Expansion joints were provided in the flume at intervals, in this case by putting a 1-in. board across the entire structure at the end of every day's work and leaving this board in position until the flume on either side had set. A concrete batten

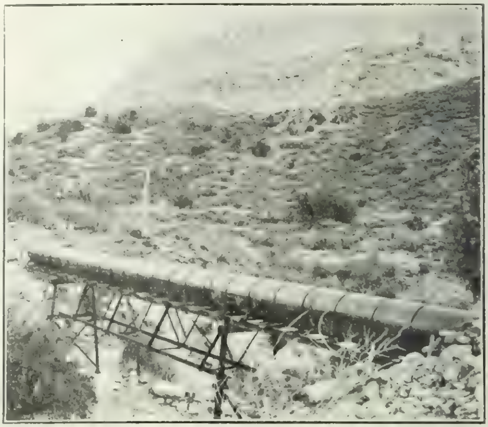


Fig. 11—Four-Foot Syphon on Steel Bridge.

with cement finish top underneath the flume, a wooden batten composed of 2 x 12 planks on the outside bolted through the 1-in. joint space itself, formed a most effective cover for the expansion joint. The necessity of these joints, however, is not apparent, as observations made do not show that any one of them has moved.

TUNNELS.

All tunnels were excavated, timbered where necessary and concreted throughout with a minimum of 6 in. of concrete on bottom and sides and, approximately, 10 in. in the top arch. The finished sizes of the gravity tunnels were 3 ft. wide and 6 ft. high, while the pressure tunnels were 3 ft. 6 in. wide and 6 ft. high. The concrete in these tunnels varied from this thickness to as high as 2 ft. of full strength concrete and sometimes 3 ft. or 4 ft. additional of lower grade concrete backing,

Fig. 12—Temporary Spillway at Junction of Pressure Tunnel and Concrete Pipe.

according as the ground varied or tended to press upon the structure. The concrete mixture in the tunnels was the same as for the flume, and this was painted over with neat cement when the forms were removed. A convenient feature of the work was the use of peculiar floor forms which made not only

the groove in the bottom for the side walls, but made indentations to hold the side form posts, and these were later plastered up when the sides were done. Much of the tunnel roof was made with concrete blocks. These blocks were made of such size as to make one longitudinal foot of the entire roof in one piece. The blocks were taken into the tunnel on a derrick car which carried four blocks, in a position at an angle to their final position. The derrick car was arranged so that each block was elevated and turned to its position with a single move of the lever, and the reverse movement of the lever put up the next block. Meanwhile the lever at the other end of the car placed the two blocks on that end. The cost of the work was not reduced by this method, the only advantage being in the assurance of the arch thickness.

Fig. 13—Four-foot Concrete Pipe Line.

A remarkable feature is that the moss which grows so plentifully in the sunlight of the open flume does not grow at all in the tunnel or any covered flume, or pipe.

The relative elevation of the tunnels is an interesting feature. It was calculated that if the center of the cross-sectional area of the stream was maintained at the same level in flume and tunnel, that there would be no backing up at the entrance to the tunnels. Accordingly, as the stream was expected to be 5 ft. wide and 3 ft. deep in the flume and 3 ft. wide and 5 ft. deep in the tunnels, the tunnel floor was dropped below the flume level, and in order to be more than safe, was placed 2 ft. lower than the flume bottom. The change was made in a 25-ft. section of the flume, the bottom sloping 2 ft. toward the tunnel while the sides narrowed from 5 ft. to 3 ft. The forms at the tunnel inlet and outlet were [illegible] reverse directions. The resulting effect is that the top surface of the water does not ripple at all where the water flows from the tunnel to the flume and there is a slight rush of water from the flume into the tunnel. It is also interesting to note that sand does not accumulate where the up slope of the tunnel floor rises to the flume floor.

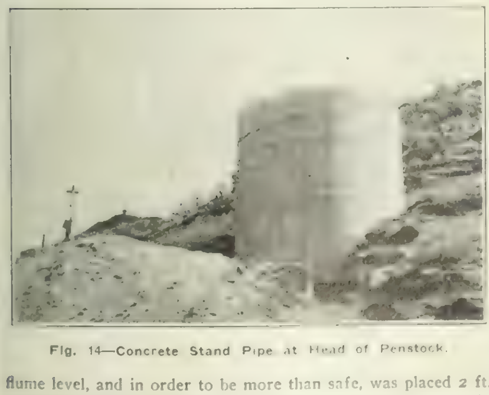


Fig. 14—Concrete Stand Pipe at Head of Penstock.

SYPHON.

A depression in the country where the hydraulic grade would have carried the gravity line more than 3½ miles was crossed by 7500 ft. of pipe forming an inverted syphon. This riveted pipe is 3/16 in. x 42 in., 3/16 in. x 45 in. and ¼ in. x 48 in. in diameter respectively. The maximum head is 250 ft. All of this is buried in the ground excepting where it crosses over water courses in four places on steel bridges. The pipe was made by the William B. Pollock Company, of Youngstown, Ohio.

STORAGE RESERVOIR.

Stehr Lake is located five miles from the intake along the gravity water conduit. This lake has a draw-off capacity of 280 acre-feet, or enough to run the entire plant three and one-half days at the average equivalent flow of the stream. Seventy thousand yards of earth fill were required to reconstruct the old walls of the lake, and this was easily done with wheel scrapers removing the mixture of adobe and granite refuse which had settled in the former lake.

Fig. 15—Concrete Pipe Ready for Jointing.

Leading out through a gate in the side of this lake, 17 ft. below the incoming flume, a pressure tunnel pierces the mountain a distance of 5000 ft. to Verde Valley. This tunnel, 3½ ft. wide and 6 ft. high, is constructed in the same manner as the gravity tunnel.

REINFORCED CONCRETE PIPE.

At its western portal this tunnel is connected directly to a reinforced concrete pipe, 4 ft. inside diameter and 1400 ft. long, which carries the water to a reinforced concrete stand pipe, 36 ft. high and 30 ft. in diameter. The concrete pipe is made under the design and patent of the Reinforced Concrete Pipe Company, of Los Angeles, Cal., who furnished the forms and reinforcing steel for it. Their method of pipe construction was so efficient that out of the 470 pieces of pipe made for this work, only one piece was "lost" and this was caused by a rolling boulder from the hill above breaking the pipe when it was still very green. Each piece of pipe (3 ft. long) has four pieces of ½-in. square twisted steel running around it, and

five pieces of ¼-in. x 1-in. flat steel running longitudinally through it, and the ends of these are hooked to take the joint bars in assembling.

The cost of making this pipe on the ground was as follows: With sand, cement and "run of the crusher" rock passing a 1½-in. screen, delivered on the bench, eight men at $2 per day and a foreman at $4 per day made an average on all working days of eight pieces of pipe, each 3 effective feet in length. One extra man at $2.50 per day tipped and seasoned the pipe. Four men on the pipe and three grouting the joints with hand tools and chain blocks completed the work of laying 20 pieces of pipe in one day. This represents a cost of about 25 cents per foot for laying. The bench was too small to allow teams or wagon derricks.

In this case, as in the case of the flume, extraordinary tamping was employed in order to save cement. In this way the pipe was made with ¼ bbl. of cement per foot, and yet the forms were filled twice every day. The forms which were filled in the morning were taken off and again filled in the afternoon. The bases on which the pipe rested were used every fifth day. The tipper began removing the pipes four and one-half days after they were filled.

The top of the stand pipe rises to a level 3 ft. above the surface of the lake, and is provided with a spillway to take off the excess water if surges arise from suddenly stopping the stream at the power house.

PRESSURE PIPE.

The pressure pipe is 4800 ft. in length, varying in diameter from 48 in. at the top to 36 in. at the bottom. The upper half of the pressure pipe is riveted, made by the Pelton Water Wheel Company of New York at its Harrisburg, Pa., works. The lower half of the pressure pipe, which varies in thickness from ½ in. to 11/16 in., is all welded pipe, made in Germany for the Pelton Water Wheel Company. All of this pipe is buried in the ground and securely anchored with concrete abutments, above and below each vertical or horizontal angle.

A special feature of the construction of both pressure pipe and the syphon is the installation of concrete water guards. These guards are built to fill the entire bell hole up to a point well above the middle of the pipe. They are located as close as 50 ft. apart on heaviest slopes. The wall is 12 in. in thickness lengthwise of the pipe and is provided with a blind drain, level with the bottom of the bell hole. This drain is carried far out from the pressure pipe trench and forms an effective means of diverting any water which may tend to flow underneath the pressure pipe, avoiding consequent undermining which so frequently occurs on steep slopes, from possible pipe leaks or storm water.

A description of the power house, simple switching arrangements and transmission system will appear in next week's issue.

DESIGN OF DRUM RHEOSTATS.

By L. W. Rosenthal.

A PORTABLE and adjustable rheostat is a common and desirable adjunct of electrical laboratories and test floors. An acceptable form has a single layer of wire wound around an iron pipe, with insulating material between. A slider of metal strip makes contact with any turn of the winding, and has a binding post for a connecting lead. At each end of the pipe there is a single binding post, the two forming the terminals of the winding. A fuse is inserted at one end.

With other conditions fulfilled, an economical design is based on temperature rise under normal conditions of operations. Consider a pipe with winding space of length L and diameter D, both in inches. The radiating surface is considered to be,

$$S = \pi DL \tag{1}$$

The total power expended in heating the drum and, therefore, radiated by it after a constant temperature is reached, is,

$$W = \frac{E^2}{R} \tag{2}$$

W = watts dissipated in the winding;
E = drop in the winding, in volts;
R = resistance of the winding, in ohms.

But
$$R = \frac{K_1 l}{d^2} \tag{3}$$

l = total length of the wire, in inches;
d = diameter of the wire, in mils;
K_1 = resistance per circular mil inch of the wire, in ohms.

Since the length of one turn, without appreciable error, may be assumed to be πD,

$$l = \pi DN \tag{4}$$

N = total number of turns.

But
$$N = \frac{L}{pd} \tag{5}$$

wherein p is a constant such that its product with d gives the distance in inches along the pipe taken up by one turn and one free space between wires. For ordinary close winding with various sizes of wire, p is practically constant at 0.00123, as shown in Table I.

TABLE I.—WINDING CHARACTERISTICS.

B. & S. Gauge No.	Diameter in Mils	Turns Per Inch	Values of p
8	128.5	6.5	.00120
16	50.8	16	.00123
18	40.3	20	.00124
19	35.9	22	.00127
23	22.6	36	.00127

From (4) and (5), $$l = \frac{\pi DL}{pd} \tag{6}$$

From (3) and (6), $$R = \frac{\pi K_1 DL}{p\ d^3} = \frac{K_2 DL}{d^3} \tag{7}$$

From (2) and (7), $$W = \frac{E^2 d^3}{K_2 DL} \tag{8}$$

The watts radiated per square inch is given by the quotient of (8) and (1), or,

$$\frac{W}{S} = \frac{E^2 d^3}{\pi K_2 D^2 L^2} \tag{9}$$

The temperature rise of the drum is,

$$T = \frac{HE^2 d^3}{\pi K_2 D^2 L^2} = \frac{HE^2 d^3}{K_3 D^2 L^2} \tag{10}$$

where H is the radiation coefficient, or the final rise in temperature for each watt radiated per square inch. The value of H must be determined experimentally. For a cast-iron drum with a winding space about 56 in. long and 6.5 in. diameter, H was 90 deg. Fahr. rise per watt per square inch. For adjustable drums the temperature must be defined for a specified position of the slider. With all the winding in circuit, the current is a minimum while the radiating surface is then a maximum. If only half the winding is active, the resistance is halved, the current doubled and the I^2R loss doubled; but as a radiating surface is also halved, the watts radiated per square inch is four times as great. In fixing the radiating coefficient it should be remembered that the inactive part of the drum also aids somewhat and that the allowable temperature rise, reckoned on continuous operation, should be increased for intermittent service.

Ordinarily the unknown quantities are the dimensions of the pipe and the kind and size of the resistance wire. The given data are allowable temperature rise, voltage drop and current. The total resistance is ascertained from the last two. Solving for the size of wire,

from (7), $$d = \sqrt{\frac{K_2 DL}{R}} \tag{11}$$

from (10), $$d = \sqrt[3]{\frac{K_3 T D^2 L^2}{HE^2}} \tag{12}$$

In (11) the size of the wire is based on the resistance, while in (12) it is based on the total drop and temperature rise. Now

for each size of drum there is only one size of each wire that gives the required resistance and only one size that gives the required drop and temperature rise. Therefore, there are only one size of drum and only one size for each kind of wire which fulfill all requirements of resistance, voltage drop and temperature rise. Equating (11) and (12) and substituting in (2),

$$DL = \frac{K_1 HE}{K_3 IR} = \frac{HE}{\pi I} \qquad (13)$$

Either D or L may be chosen at will, but the two must have the product shown. This product should then be substituted in (11) to determine the required size of wire.

It is often desirable to ascertain directly the weight of resistance wires, for then by considering the cost per pound of each the minimum outlay for wire is readily determined. Since the weight is directly proportional to cross-section and length,

$$P = K_4 d^2 l. \qquad (14)$$

where K_4 is the weight in pounds of a wire 1 circ. mil in cross-section and 1 in. long.

Substituting (6) in (14),

$$P = \frac{\pi K_4}{f} dDL. \qquad (15)$$

Substituting in (15) with d from (11) and DL from (13),

$$P = \frac{\pi K_4}{f} \sqrt[3]{\frac{K_2}{\pi}} \sqrt{\frac{HE}{T}} = K_5 \sqrt{\frac{HE}{T}} \qquad (16)$$

Table II gives the constants for various wires at 200 deg. Fahr., corresponding to a temperature rise of about 125 deg. Fahr. In order that the table may be conveniently extended, the inter-relation of the constants is shown below:

K = ohms per circ. mil inch of wire.

$$K_2 = \frac{\pi K_1}{f} = 2560\,K_1. \qquad (17)$$

$$K_3 = \pi K_2 = 8030\,K_1. \qquad (18)$$

K_4 = pounds per circ. mil inch of the wire.

$$K_5 = \frac{\pi K_4}{f} \sqrt[3]{\frac{K_2}{\pi}} = 23{,}800\,K_4 \sqrt[3]{K_1}. \qquad (19)$$

TABLE II.—WIRE CONSTANTS.

Metal	K_1	K_2	K_3	K_4	K_5	Ratio K_5
Aluminum	2	5,120	16,100	.000000076	.0023	1.00
Copper	1.2	3,070	9,600	.00000025	.0063	2.74
Brass—Ordinary	4.0	10,200	32,100	.00000024	.0091	3.96
Iron	6.9	17,700	55,400	.00000022	.0099	4.31
Galv. Iron, "E. B. B."	[illegible]	13,600	42,600	.00000022	.0091	3.96
Galv. Iron, "B. B."	[illegible]	16,100	50,600	.00000022	.0097	4.22
Galv. Iron, "Steel"	7.4	18,900	59,400	.00000022	.0102	4.44
[illegible]	14.2	36,300	114,000	.00000022	.0126	[illegible]
German Silver, "18%"	15.8	40,400	127,000	.00000026	.0155	[illegible]
German Silver, "30%"	22.1	56,500	177,000	.00000026	.0173	[illegible]
[illegible]	25.0	64,000	201,000	.00000025	.0174	[illegible]
[illegible]	46.4	119,000	373,000	.00000023	.0196	[illegible]

Now consider a pipe of definite length and diameter which is to be wound completely with resistance wire. Varying the wire diameter inversely varies both the total length and the resistance per unit length. Hence a small change of wire diameter considerably changes the total resistance of the winding, as shown by (7). However, there is always one size of wire of any metal that will produce the desired resistance, as shown by (11). Hence, if the radiation coefficients of the different metals be sensibly equal, the temperature rise of the assumed drum with the proper size of wire will be the same no matter what metal is used.

For the same power loss, radiation coefficient and temperature rise, the weight required of any kind of wire is solely dependent on the value of K_5, as shown in (16). From (19) it is seen that, for metals of the same unit weight, that wire which has the least resistance gives the minimum total weight.

In the last column of Table II are ratios of K_5, with aluminum considered as unity. If this ratio for each metal be multiplied by its cost per pound, then that metal having the least product will be the most economical to buy. However, winding expense, temperature coefficient of [illegible] efficient of resistance, temperature of softening and the radiation coefficient are all matters which must be considered in each case and with degrees of influence that are more or less special.

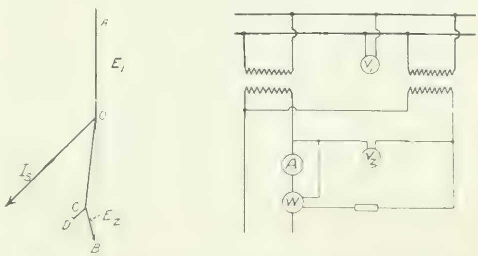
TRANSFORMER CHARACTERISTICS.

The Voltage Drop of Transformers Having Poor Regulation.

By K. Faye-Hansen

By the "voltage drop" of a transformer is understood the alteration of the secondary voltage due to the load when the primary voltage remains constant. When we speak simply of voltage drop we mean the algebraic difference between the secondary voltage at no load and at full load, and not the vectorial voltage drop, or as it is also called, the geometrical voltage drop or the impedance voltage.

The vector diagram, Fig. 1, which is a modification of the well-known transformer diagram, will more clearly show the meaning of the expressions used above. In this diagram the following notations are employed: I_s = the secondary current; $OA = E_1$ the primary terminal voltage; OB = the secondary terminal voltage at no load; OC = the secondary terminal voltage at full load; BD = the vectorial voltage drop due to the reactance; DC = the vectorial voltage drop due to the ohmic resistance; $BC = E_z$ = the total vectorial voltage drop; $OB - OC$ = the algebraic voltage drop. From the point of view of the voltage delivered to the lamps or motors the algebraic voltage drop is the more important, while the banking of transformers is dependent upon the vectorial voltage drop.



Figs. 1 and 2—Vector Diagram and Circuit Connections.

Three test methods have been used to determine the voltage drop of transformers:

(1) The secondary voltage is measured at different loads and power-factors, while the primary voltage is kept constant.

(2) The primary voltage required to force the full-load current through the windings when the secondary is short-circuited is measured as are also the losses which then take place. By means of the ordinary transformer vector diagram the voltage drop is then calculated for different loads.

(3) The magnitude of the vectorial voltage drop is directly measured when two identical transformers are connected in parallel on the primary side, while one of them is loaded and the other unloaded. By means of a wattmeter the time-phase of the vectorial voltage drop can be determined, and the algebraic voltage drop can then be calculated.

The diagram of connections, Fig. 2, shows, for instance, that the phase difference between the secondary current (measured by the ammeter A) and the vectorial voltage drop (measured with the voltmeter V_2) can be determined by means of a wattmeter W. The reading of this wattmeter gives also the copper losses just as in the normal short-circuit test. If the secondary voltage is zero, the test described above is the same as the ordinary short-circuit test with the one difference that a shunt transformer is used for the measurements of the voltage.

The first method has the disadvantage that only the algebraic voltage drop is measured, the measurement being made [illegible] the observations may be

taken, because it is determined as a difference between two nearly equal voltages.

The second method is in this respect very much better, but it rests on the assumption that the magnetic conditions for the leakage lines are independent of the voltage—that is, of the flux density in the iron of the main magnetic circuit.

The third method is without doubt the best, and is absolutely correct so long as the high harmonics are not sufficiently predominant to make it unallowable to work with the ordinary vector diagrams. So far as the writer is aware this method was first proposed by Professor Bragstad in 1901. It can with

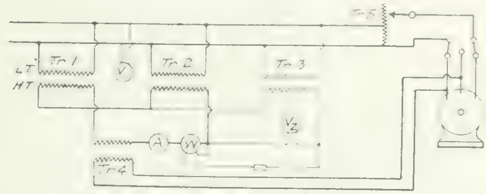


Fig. 3—Load Test on Two Transformers.

small modifications be used for nearly any conditions. With this method it has been found that the flux density in the iron of the main magnetic circuit has some influence on the voltage drop of transformers. This result is due to the fact that the leakage flux has partly to go through the iron carrying the main flux and the magnetic reluctance offered to this part of the leakage flux will alter with the flux density. For ordinary transformers, however, having less than 5 per cent reactance this influence is too small to be of any practical value.

During the last years, however, the author has designed a number of transformers having reactances of from 10 per cent to 30 per cent, and has made some similar tests on these. These transformers (being of both the core type and the shell type) were designed to work in conjunction with rotary converters and were provided with a high reactance to enable a voltage regulation on the commutator side to be obtained by altering the excitation of the rotary converter without the use of boosters, etc. The measurements were made in the ordinary transformer test room, and it was not possible to keep the conditions absolutely stable, so that the measurements are not claimed to be very exact, nor was there sufficient time to make them as complete as one would wish. Nevertheless they very clearly show the voltage drop conditions of transformers having a very high reactance.

The tests hereafter described were made with three 100-kva single-phase transformers of the shell type, having a ratio of turns corresponding to 149 volts to 6600 volts, at 50 cycles and no load. At this voltage the flux density in the iron was about 12,500 lines per square centimeter (special alloyed iron was used); the short-circuit e.m.f. at full-load current (15.15 amps) was, for the transformer on which the measurements were made, 1584 volts on the high-tension side (that is, 24 per cent, and the loss measured on the short-circuit test was 1450 watts). The copper loss calculated from the resistance measurements was 1150 watts, while the iron loss during short-circuit was calculated to be about 140 watts, so that the actual eddy losses only were about 160 watts, or about 12 per cent of the copper loss. The high reactance in this case was obtained by subdividing the coils only once (*H-L-H*) and putting iron laminations between the primary and secondary coils, leaving an air-gap between the main core and these laminations to prevent them becoming magnetically saturated.

The connection during the test was as shown in Fig. 3. Transformers Nos. 1, 2 and 3 are all similar, No. 2 being the one under observation. Different time-phase angles between current and voltage were obtained by connecting the primary side of the regulating transformer No. 5 to the different phase leads of the three-phase generator, while the time-phase and magnitude of the current through transformers Nos. 1 and 2 were kept practically constant. The diagram of connections shows that the regulating transformer, No. 5, was delivering the current and output required for the magnetization of all three transformers, while transformer No. 4 was delivering the current and output required to force the full-load current (15.15 amp) through the (high-tension) windings of transformers Nos. 1 and 2. Tests with six different time-phase angles were made in the manner described above, giving the results shown in the following table:

Low Tension Voltage E_1	Phase Diff. between Low-Tension Volt. and Vect. Voltage Drop (deg.)	Vect. Voltage Drop E_z	Wattmeter Reading W	Phase Diff. between High-Tension Current and Vect. Voltage Drop (Power-Factor)	Flux Density Inside the Low-Tension Coils Calculated from E_1	Flux Density Inside High-Tension Coils
0	0	1590	1400	0.058	180	3000
25	0	1584	1400	0.058	2100	5100
149	0	1364	1250	0.0605	12500	15100
0	180	1584	1400	0.058	180	3000
25	180	1584	1410	0.058	2100	900
149	180	1580	1200	0.050	12500	9500
0	60	1584	1490	0.0615	180	3000
25	60	1584	1470	0.0605	2100	4400
73.5	60	1560	1600	0.068	6150	8000
127	60	1500	2200	0.100	10650	12400
149	60	1456	2450	0.111	12500	14150
0	120	1584	1440	0.060	180	3000
25	120	1584	1450	0.060	2100	2700
149	120	1550	1800	0.077	12500	11300
0	60	1580	1450	0.0605	180	3000
25	60	1574	1440	0.0605	2100	4400
73	60	1562	1310	0.055	6100	8000
127	60	1530	590	0.025	10650	12450
149	60	1500	380	0.017	12500	14200
0	120	1586	1460	0.0605	180	3000
25	120	1580	1450	0.0605	2100	2700
73	120	1576	1450	0.0605	6100	5350
127	120	1560	1180	0.050	10650	9600
149	120	1504	1011	0.044	12500	11350

The time-phase difference between the high-tension current A and the vectorial voltage drop E_z was determined from the equation $\cos\Theta = \frac{W}{A \times V_z}$. The time-phase difference between the low-tension voltage E_1 and the vectorial voltage drop E_z, was determined from the connection and checked by means of measurements of the high-tension voltage. The flux density within the low-tension coils is calculated from the measured low-tension voltage E_1, taking the ohmic resistance of the low-tension winding into account.

The flux density within the high-tension coil was determined from the high-tension voltage calculated from the low-tension voltage, the vectorial voltage drop and the phase angles. For the calculation of the flux density sine waves were assumed.

The high-tension voltage, which was in several cases checked, proved within the limits of accuracy to be the same as that determined from the measurements of the low-tension voltage and the vectorial voltage drop.

The vectorial voltage drop is shown in Fig. 4 as a function of the average flux density within the high-tension and the low-tension coils. Average flux density is taken as the mean be-

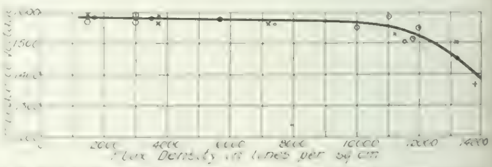


Fig. 4—Variation of Leakage Impedance with Main Flux Density.

tween the flux density within the high-tension and the low-tension coils as given in the table. It will be seen that for a flux density up to 10,000 lines per square centimeter the vectorial voltage drop remains about the same as the short-circuit voltage. At higher densities, however, the voltage drop is comparatively rapidly reduced.

The method of drawing the curve, shown in Fig. 4, has been chosen because if the vectorial voltage drop were shown as a

function of the flux density calculated either from the high-tension or the low-tension voltage, or as a function of the highest of these two flux densities the curves would not be so good.

Of further interest is the alteration in the wattmeter reading and, therefore, in the time-phase difference between the high-tension current and the vectorial voltage drop, dependent upon the flux density in the iron and the time-phase difference between the voltage drop and the no-load voltage. The differences in the wattmeter reading are much too large to correspond to a real difference in losses, especially as this would in some cases mean negative eddy losses; the cause must, therefore, be that the watts taken from the low-tension side alter with the magnitude and the time-phase of the leakage field.

Unfortunately the conditions made it impossible to confirm this in the tests here reported. It was ascertained, however, that the current taken for all three transformers on the low-tension side, which must be considered as a sum of the three no-load currents, increased when the current through the windings of transformers Nos. 1 and 2 were increased.

The writer hopes that other engineers who have time and opportunity to make similar tests on transformers with a high reactance in a more complete manner will not fail to do so; in ordinary transformers, of course (as well as in induction motors) the same conditions prevail, but to so small an extent that it is very difficult to obtain good test results. It would also be of great interest if similar tests were made on slip-ring induction motors, as such tests would show how the reactance and the losses due to the load current alter with the flux density in the iron, and also how the "no-load current" and the "no-load losses" are altered with the load currents. In this way it would probably be possible to find an explanation for differences in the results which are obtained with measurement of the no-load and short-circuit currents and of the brake tests on induction motors.

Central Station
Management, Policies and Commercial Methods

USE OF CINDERS TO STOP LEAKS IN DAMS.

The porous friable structure of cinders is well known, and they are commonly employed as the foundation for walks and other surfaces where it is desired to get good drainage. It will be a bit surprising, then, on first thought, to learn that this material is of service in stopping leaks in dams, and has been used effectually after all other materials experimented with proved unsuccessful. Credit for the discovery of this curious fact belongs to the Economy Light & Power Company, of Joliet, Ill. Mr. E. E. Themes, chief electrician for the company, writes that, on account of the absence of headgates in this plant, it is necessary, when repairing the water-wheels, to shut the water off from the wheel-bags by sliding 2-in. planks down through the frames of the trash-racks. Such leaks as then remain are filled by scattering a few sacks of cinders along the planks. Before the use of the cinders was hit upon, straw, canvas, sacks of sand and clay, and almost everything that could be thought of, were tried in the effort to close the leaks, but without success. Finally, cinders were tried and they closed the apertures completely. It is explained that the large pieces of cinders seem to find the openings, into which they are drawn by the force of the water, and stick tight in them, while the smaller pieces fill in the remaining cracks until the openings are entirely closed. Cinders, of course, will not be of any use where the openings are very large.

The Rocky Ford Power & Milling Company, of Manhattan, Kan., has employed cinders to close small cracks and openings in its concrete dam with good success, after a fruitless trial of other materials for the purpose. Dr. C. K. Raber, president of the company, learned of this practice from the Joliet plant and though at first doubtful of the probable efficacy of the method, has proven to his satisfaction its entire success.

ELECTRICITY IN GAS PLANTS.

At the recent Schenectady meeting of the Empire State Gas and Electric Association, Mr. Caryl D. Haskins presented a paper relating to the use of electricity in gas plants, an abstract of which is given herewith.

"Good practice demands that an open flame should never be used in a gas plant. Failure to regard this rule has probably resulted in more fires and explosions in gas plants than any other cause," thus wrote one of the most prominent gas men in the country, and this statement of fact in a nutshell explains why modern gas works are equipped with electricity for illumination.

In the purifying houses where the slightest spark or open flame engenders great danger of explosion, the incandescent electric lamp, with approved form of enclosing globe, is practically the only one which fulfills the conditions necessary for safe operation. In other parts of the works and in the yards, which are often of considerable magnitude, either arcs or incandescent lamps may be used.

For motor service the usual arguments for electric drive carry great weight. Not only may numerous small and inefficient steam units be replaced by electric motors, but also long runs of steam piping, with all their attendant losses, may be superseded by efficient electrical transmission, the losses of which are negligible as compared with steam distribution.

The gangs of unskilled labor which are necessary in the older and more primitive plants for unloading coal, transporting it in small dump cars to retorts, and carrying away coke, ashes, etc., are replaced by electrically driven conveyors, doing the same work more quickly, more cheaply, and better. In one plant delivering 1,500,000 cu. ft. of coal-gas and 750,000 cu. ft. of water-gas per day manual labor was reduced to a minimum. In this plant the coal is carried from the cars to storage by electrically operated conveyors. From the storage it passes to crushers, which are also electrically driven. After passing through the crushers another conveyor driven by a 10-hp, 750-r.p.m. induction motor carries the coal to the bins in the retort house. The coal and ashes are removed from the retort house to the dump by one conveyor. The ashes are removed on the lower floor and discharged at one end of the building, and the coke is taken care of on the return trip of the conveyor chain on the upper floor and discharged at the other end. From the dump the coke is carried to the water-gas house, boiler house, or coke pile, as the case may be, by a telpher and a 3600-lb. grab bucket. In the telpher, use is made of a 25-hp, direct-current motor for hoisting and a 15-hp motor for traveling.

One of the most striking examples of the advantages of electric drive is found in the machines for charging the retorts. Two machines, each equipped with one 5-hp and two 10-hp induction motors charge 20 retorts of 600 lb. of coal each in 15 minutes. The old method of hand firing required several men and frequent shifts, as the extreme heat above the retorts made it impossible for them to work for more than a short period at a time. With the new machinery all operating is done from a distance, and the operator is not subjected to the direct heat from the retorts. The blowers and pumps, formerly driven by steam or gas engines, as well as the machinery in the repair shop, are electrically driven. In the purifying house, the most dangerous place in the works, the traveling crane, equipped with

a grab bucket, is operated by a 40-hp induction motor. The starting compensator for this motor is located in the generating station, and the three motions of the crane and the grab bucket are controlled by clutches in order to avoid any danger of sparking. This is an example of only one of many plants that are now electrically equipped.

The rating of equipment, of course, depends upon the daily output of the plant. For general guidance it may be stated that from 0.1 kw to 0.125 kw of generating equipment will have to be installed for every 1000 cu. ft. of gas generated per day, but as a large proportion of the service demanded from this generating equipment is of intermittent character, a considerable part of this equipment may be regarded as "standby." In existent electrified gas plants the energy consumption averages between 0.885 and 1.0 kw-hour per 1000 cu. ft. of gas produced. This figure includes the energy for lighting and the complete motor equipment.

To-day many public service companies that sell both gas and electricity have installed electric lighting and motor equipments, at least to some extent, in their gas plants. The independent gas companies, however, are only now beginning to realize the economy which is to be derived from such installations.

Every gas plant, whether it generates coal or water gas, possesses boilers, the existence of which materially reduces the first cost of the electrical equipment if the company is to generate its own energy. The fact that those gas plants which have already installed electricity report savings of from 25 per cent to 50 per cent, with even a greater percentage decrease in repairs, shows the desirability of equipping existing gas plants with electrical machinery.

With the increasing realizations of the necessity for efficient and economical production of gas so that it may compete widely as a household fuel, it is safe to state that within 5, or at least, 10 years, one will scarcely find a gas plant in the country which does not use electricity for both motor service and illumination throughout, and many independent gas companies will find it both expedient and economical to purchase their energy from the local electric light company.

CENTRAL-STATION CONSTRUCTION COSTS AT SALEM, MASS.

In connection with a petition filed recently with the Massachusetts Gas & Electric Light Commission for approval of a new issue of capital stock, the Salem Electric Lighting Company filed with the board an unusually complete statement of its expenditures for plant construction and improvements during the past nine years. Those expenditures reached a total of $363,762, and were classified under real estate, steam plant, electric plant, overhead system, underground system, transformers, meters, arc and Nernst lamps. A brief outline of these expenditures was given in connection with an account of the hearing held by the board on June 15. In the accompanying tables are given a number of selected items from the company's list of expenditures which are suggestive in a general way as to the cost of carrying out definite work in the field. Only such items are printed as are specific in their interest as cost data, omitting cents.

CONSTRUCTION COSTS.

[illegible]	[illegible]
[illegible]	[illegible]
Two boilers, floor, 51x30 ft.	321
Concrete coal run, 19x10 ft. in boiler house	102
Iron stairs leading from engine to switchboard room	682
Cutting out boiler house door	17
[illegible]	[illegible]
Concrete floor around 1000 kw engine, floor, 44x35 ft.	875
Boiler house extension, 56x55 ft., one story high, concrete roof and fireproof construction throughout	7,255
Wooden shed, 60x16 ft., height 12 ft.	232
[illegible]	[illegible]

Coal run. This run is composed of chestnut standards about 30 ft. high, on top of which is a platform for unloading and conveying by barrows the coal supply for the station from vessels. Length of run, 165 ft.

STEAM PLANT MACHINERY COSTS.

One 400-kw McIntosh & Seymour vertical engine	$17,268
[illegible]	[illegible]
Erecting above engines	679
Barr pump and condenser	1,969
One 1000-kw vertical cross-compound engine	25,267
[illegible]	[illegible]
[illegible]	[illegible]
Warren feed pump, 14x12 in. end suction, rubber valve	440
One special National feed water heater	1,130
[illegible]	[illegible]
[illegible]	[illegible]
One vacuum pump for Worthington condenser	1,300
Piping for engines, pumps, boilers, exhaust, feed water, heater and condenser	32,662
Foundations for 400, 600, and 1000-kw engines	8,426
Engineering and freight	600

ADDITIONS TO POWER STATION.

This work consisted of the building of two stories on the east end of the station, 60 ft. long and 14 ft. wide, consisting of two floors, both of concrete, the lower room being used for station auxiliaries and apparatus connected with the switchboard in the room above. The upper room contains the complete switchboard, and is provided with fire shutters on doors and windows, with concrete roof.

APPROXIMATE DETAILED COSTS OF ACCESSORIES (PARTIAL LIST).

Pipe [illegible]	$1,534
Boiler grates	2,057
Pipe supports, platforms and erection	[illegible]77
Oil shields for engine units	462
One No. 10 steam separator	270
Rochester lubricator	43
Gauge boards for 400 and 600 kw sets	102
Gauge board and gauges, 1200 kw engine	68
Relief valve for heater piping	16
One single cylinder tank pump	215
One 1-qt. lubricator	26
Screen in front of canal to condenser	129
Valve, Warren feed pump	26
Steam pressure regulator	50
One American unit oil filter	107
Damper regulator	80
Water meters on boiler feed piping	200
Washing machine for waste reclamation	143
Oil tank, Barr condenser	13
Canal, 10x6x8 ft., connecting condenser tank with river	500
Cutting hole in chimney for boiler flue	16

ELECTRIC PLANT PARTIAL LIST OF SELECTED COSTS (TO NEAREST DOLLAR).

Switchboard.			
Twenty panels, 56 ft. long, blue Vermont marble 2 in. thick			$11,500
Circuit breaker			200
Oil switches			160
Exciter rheostat			248
Addition to switchboard, completing panels 3 and 16			[illegible]
Wiring of Switchboard:			
Cleats	$14.40		
Hollow brick pipe	91.20		
Labor installing brick pipe	65.74		
Rubber covered wire	97.63		
[illegible]	111.84		
Moulding	43.75		
Labor, etc.	7.09		
Cable	179.27	Total	$611
Machinery costs.			
[illegible]			$3,600
Compensator			235
One [illegible]-kw 125 volt exciter			2,650
Two 200-kw belted generators			6,200
One 400-kw direct connected generator			7,625
One 600-kw engine driven generator			9,700
One 1000-kw generator direct driven			10,500
[illegible] Instruments.			
[illegible]			$50
Multiplier for wattmeter			15
Polyphase wattmeter			80
Portable voltmeter			[illegible]
Test meter			[illegible]
Frequency indicator			[illegible]
[illegible] wattmeter and voltmeter			74
Testing transformer			40
Wright demand indicator			66
Hydrometer			4

OVERHEAD SYSTEM INCREASE COST, SALEM.

406 poles, average 35 ft. @ $9.00	[illegible]
52,240 ft. (5,805 lb.) No. 6 wire series lighting @ 13 cts. lb.	[illegible]
32,908 ft. (5,485 lb.) No. 4 alternating mains	[illegible]
128,640 ft. (32,160 lb.) No. 2 alternating secondary @ 13 cts.	[illegible]
74,040 ft. (12,340 lb.) No. 4 wire, three phase secondary @ 13 cts.	[illegible]
188,342 ft. (75,336 lb.) No. 0 wire, three phase primary @ 13 cts.	[illegible]
23,716 ft. (2,635 lb.) No. 6 wire @ 10 cts.	[illegible]
21,816 glass insulators @ 5 cts.	1,090.80
7,270 pole steps @ 3 cts.	[illegible]
[illegible]	[illegible]
46 single pole lightning arresters	[illegible]

As stated, these figures are correct to the nearest dollar unit, and include but a portion of the total expenditures filed by the company. Only such items were selected as might be sufficiently complete to be of general interest.

During about 8⅓ years covered by the figures, hundreds of small extensions were made upon the overhead system over the entire city. In this period the company took down 30,000 ft. of direct-current lines, and 30,000 ft. of 500-volt, direct-current power lines, and erected in their place single-phase, alternating-current lines and two-phase, 220-volt, alternating-current power lines. The cost of the increases in the distribution system is shown in the above table.

COST OF TRANSFORMERS.

Number	Watts	Cost, Each	Volts	Number	Watts	Cost, [illegible]	[illegible]
7	1,500	$27.79	104–208	14	20,000	$162.88	104–208
12	2,500	36.34		8	25,000	191.95	"
30	3,000	40.61		20	30,000	222.57	
8	4,000	[illegible]		3	75,000	384.00	
26	[illegible]	56.86		4	5,000	63.00	2080–550
13	7,500	76.95		7	7,500	83.25	
[illegible]	10,000	94.91		3	15,000	146.25	
18	15,000	130.82		6	50,000	355.50	

856 single pole primary switches @ 67½ cts. each	$575.66
856 hangers @ 24 cts. each	205.44
Freight and express on above	139.44

ELECTRIC SOLDERING COPPER FOR TINNERS.

As everyone knows, soldering plays an important part in the tinner's business and the tinner of the past and of to-day has always had to carry with him a small charcoal stove to heat his soldering coppers. Many inventors have attempted to find a soldering tool which would hold its heat in the open air; but all failed until the electric soldering copper was invented and placed in use. Such coppers are very widely employed in canning factories and it was with a view to testing its heating power and durability, as well as to show that it would hold its heat in the open air, that an experiment was made by the Penn Central Light & Power Company, of Altoona, Pa. As the tin roof of the Wright School was being repaired recently, the school authorities permitted the company to give their demonstration on the roof of the building. The tool proved that it could hold its heat as well in the open air as indoors, and so pleased was the tinner in charge of the work of repairing that he requested the electric light company to leave their wires connected for the rest of the day. As the result of the new device, the tinner reported one of the best day's work ever done.

Fig. 1—Soldering in a Difficult Place.

Fig. 2—Soldering on Flat Roof.

The accompanying engravings show the work in progress. Where electricity is available the electric soldering copper should be a welcome substitute for the old charcoal stove and overheated copper; on flat roofs and on gables where a stove is out of the question and where the soldering copper must be handed back every few minutes to be heated, the electric soldering copper is without an equal.

Wiring and Illumination

ORNAMENTAL STREET LIGHTING AT FORT ATKINSON, WIS.

The City Water and Light Commission of Fort Atkinson, Wis., is installing a new street-lighting system on the main street. This system employs three-lamp standards of the type illustrated herewith, fitted with multiple tungsten lamps. The posts are built after the commission's own ideas and in the city shops, the idea of the commission being to obtain a pole of good appearance suitable for small cities which cannot afford the more expensive and ornamental designs on the market.

Tungsten Lamp Post at Fort Atkinson, Wis.

LONG LIFE OF TUNGSTEN SERIES STREET LAMPS.

We are indebted to Mr. H. S. O'Neill, superintendent of the Bel Air (Md.) Electric Company, for the following data showing the remarkable life of tungsten series street lamps. In January, 1908, the new management of the Bel Air Electric Company installed within the town a series street system comprising 50 40-watt, series tungsten lamps. Radial reflectors are used with the lamps and the system is controlled by an 8.8-kw constant-current transformer.

1.	[illegible]	[illegible]
2.	Broken " " "	480
[illegible]	[illegible]	[illegible]
6	Burned " " " "	2868
[illegible]	[illegible]	[illegible]
13.	Burned out by lightning after life of 5508 hours	
[illegible]	[illegible]	[illegible]

[illegible] and 5.5-amp range. The system was started Feb. 22, 1908, and the improvement over the old carbon lamps in favor of the new

system was immediately remarked. A record of each lamp was kept, and also a record of the number of hours the system was in use, which averaged 12 hours per day. The table on the preceding page gives a record of the life of the lamps up to July 1, 1910.

Of the original 50 lamps installed Feb. 22, 1908, but 13 have burned out up to the present time (July 1, 1910). Thirty-seven have burned steadily 10,308 hours and are still burning with no apparent diminution of light, although the glass is slightly blackened in some instances. Additional lamps have been added to the circuit until there are now 64 in all.

A PORTABLE PHOSPHORESCENT PHOTOMETER.

By W. J. V[illegible] and G[illegible] W. H[illegible].

The portable photometer which is described below is the practical outcome of a series of photometric investigations which were carried out in the Department of Electrical Engineering of the University of Nebraska. The problem undertaken was the utilization of phosphorescent substances as photometric standards of comparison.

After considering numerous substances of the above class of illuminants, including both those which shine by virtue of the energy derived by exposure to light and those in which chemical change is the seat of activity, Balman's luminous paint was chosen as the most feasible for the purpose in hand. However, it is presumed that a substance of the chemically phosphorescent sort, such as lophin ($C_{21}H_{16}N_2$) might prove desirable.

The sample of Balman's paint used was manufactured according to the inventor's patents by F. W. Devoe & Company, New York City. A rough qualitative analysis showed calcium sulphide to be the principal ingredient. Photometric experiments with this paint developed the rather surprising fact that the intensity of the luminous discharge depended directly upon the intensity of the source to which it was exposed. It did not depend upon the length of time of exposure to the light source, since it was found that the intensity of discharge, after 10 seconds' exposure, was as great as for any length of time of exposure up to one hour.

As was to be anticipated from results derived by other investigators (Ralph Cusak, *Nature*, June, 1897) conditions of temperature during both the acts of charging and discharging the phosphorescent with luminous energy were found to be important factors in determining the light intensity produced. In fact, the present writers found it necessary to apply a special expedient whereby the temperature of the phosphorescent film might be kept sufficiently constant in its action to serve as a practical standard of illumination, since the rise in temperature of 10 deg. sometimes gave as high an increase in light intensity as 150 per cent. As will be seen, the expedient referred to was the introduction of a tin receptacle *R*, Fig. 1, which has one exterior side covered with two coats of Balman's paint, while the interior is filled with chipped ice and water. Not until this principle was applied did we find it possible to secure photometric curves of decay of light intensity which showed uniform and concordant results.

Fig. 2 shows curves which were obtained from a film kept at constant temperature in the above manner. The apparatus employed was arranged as shown in Fig. 1, with the exception that the screw control of the area opening *V* is a refinement since proposed. The photometer, as shown in Fig. 1, is an adaptation of parts of a portable photometer manufactured by Elliott Brothers, London, England, which was found in the laboratory equipment of the department. The original photometer was equipped with a storage battery and small incandescent lamp as photometric standard. These parts were removed and the tin receptacle substituted therefor, its exposed side *S* being covered with two coats of luminous paint. The photometer box is composed of wood with one side hinged, as shown at *H*, and the interior is painted a dull black. The chamber *C*

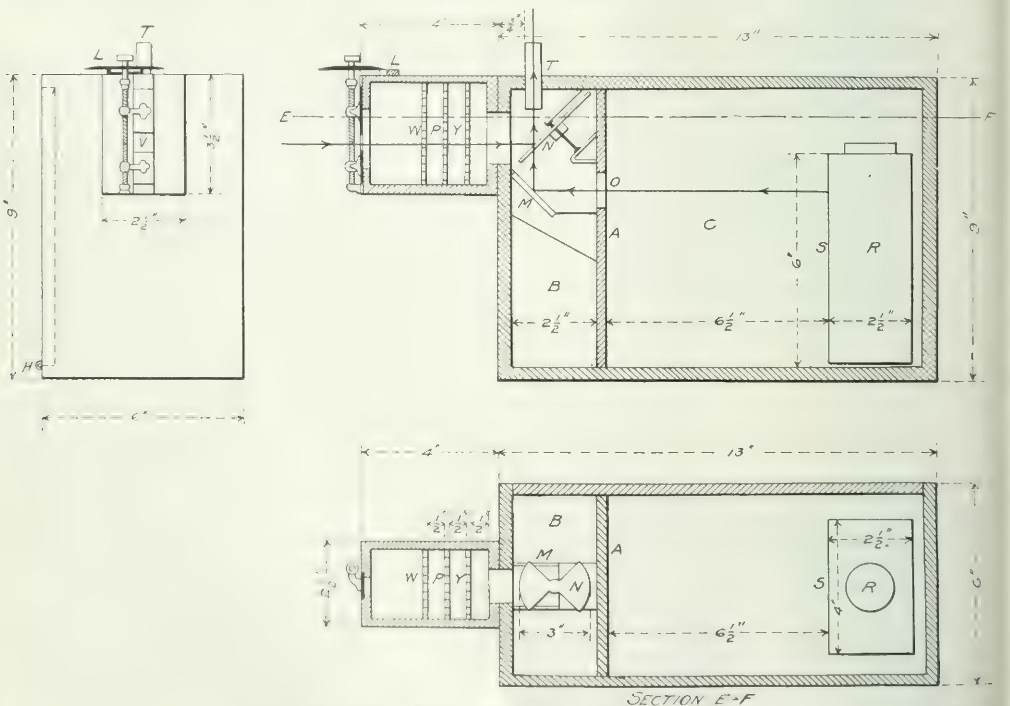
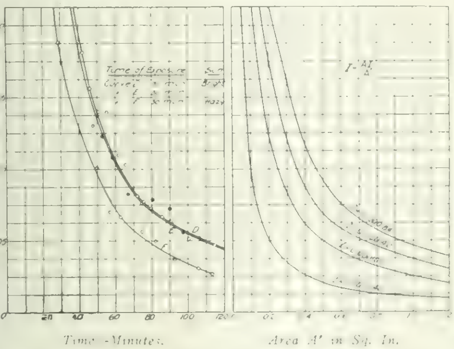


Fig. 1—Construction Details, Portable Phosphorescent Photometer

is separated from chamber B by the partition A, through which there is a hole O 1 in. square. In the chamber B is placed a small mirror M with its center in a horizontal line with the center of hole O, the plane of the mirror being inclined at an angle of 45 deg. to the horizontal. Directly above the center of the mirror, through the top of the photometer is an open tube T through which the reflected light from S through O may be seen in M. The light, of which the intensity is to be measured, is received through the variable opening V and is then diffused by the two ground-glass plates P and W. It then passes through the blue-glass plate Y, of medium intensity, onto the rotating member N. It was found necessary to employ blue glass in this manner in order to adapt the color of the light to be measured to the color of that emanating from the phosphorescent surface S. The rotating part N consists of a circular disk, half of which is cut away, thus leaving two opposed segments of 90 deg. each. The upper surface of these segments is painted a dull white. The disk is mounted at an angle of 45 deg. with the horizontal so that during a part of the rotation the segments do not interrupt the view of M, through T, while during the rest of the rotation this view is intercepted by the segments, themselves illuminated by the incoming light from V. N is caused to rotate by a jet of air blown through a tube (not shown) onto five fan blades attached to the under side of the segments. It revolves at a speed of about 1500 r.p.m. for the best results. This speed was estimated by means of the musical tone produced when a card was held in such a position as to be vibrated by the passing segments. It is proposed to substitute for the air blast a clock mechanism to produce the rotation of N.

To illustrate the manner of using this photometer, the method employed in obtaining Curve D, Fig. 2, will be described. The



Figs. 2 and 3—Test Results Obtained with Photometer.

ice receptacle was removed from the box and its sensitive surface exposed to bright sunlight for 30 minutes. Having returned this element to its place in the photometer, and closed the latter, the opening V was opposed to the light coming from a carbon-filament electric lamp, which had previously been standardized as to candle-power. The area of the opening V was, throughout our experiments, maintained constant at about one-fourth of a square inch. The distance of the standard lamp from the opening V was now varied until the outline of the image of the opening O, as viewed in M through T, was at its point of disappearance, due to the effect of the passing segments of N, illuminated by the blue light received from the outside through V; or, speaking more precisely, a mean position for the photometer was determined between the points at which the outline of O appeared and disappeared as the distance between the opening V and the lamp was increased or decreased. The readings taken were those of time after exposure ended and the distance from V to the standard lamp, and from this data was calculated the necessary intensity of the illumination received at V expressed in centimeter-candle units (for that opening at V which was used in this calibration), required to give a balance at the observed time. Curves E and F were obtained in the same way as Curve D; the lower values obtained in Curve F being ascribed to the fact that during the 30 minutes' exposure to the sun the atmosphere was somewhat hazy, although no regular clouds intervened. Points which in Curves D, E and F are found off the curves are believed to owe this peculiarity mostly to slight fluctuations in the voltage of the circuit to which the standard incandescent lamp was attached. All exposures were made between the hours of 10 a. m. and 3 p. m., the sensitive surface being kept normal to the sun's rays.

It will be noted that the above curves are plotted beginning at about 30 minutes after completion of the exposure. This is because prior to this time the decay of luminous intensity is too rapid for satisfactory observation or for purposes of practical utility as a standard.

The experiments seem to show that the history of a discharge of luminous energy does not affect the intensities secured in a subsequent experiment, although the least period of time which intervened between discharge and charge was, in this work, about three hours. In the application of this photometer to practical purposes a curve, such as D, of Fig. 2, is first derived using any convenient area of aperture V as read off the verner head at L; a standard lamp being chosen, the chromatic qualities of which, as regards percentage of blue rays, are about the same as those of the light which it is intended later to measure. In this operation of calibration, since aperture V remains constant, the position of the photometer with reference to the standard lamp must be varied to obtain a balance at each successive period of discharge. The curve is then produced from the data thus obtained.

While no calibration curves were obtained from luminosity of the phosphorescent film produced by exposing it to an artificial light, nevertheless a film was exposed by placing it at a distance of about 1 ft. from a 45-watt tungsten lamp for a period of 10 minutes. The luminosity thus produced seemed comparable to that derived from sunlight and lasted about as long.

After calibration the phosphorescent is recharged and the photometer may be set up in any locality where it is desired to ascertain the value of the illumination present. The vernier head is then turned until a balance is obtained, as already described, and the area of the opening noted, together with the time elapsed since exposure of the film to the charging medium. Now, by reference to the calibration curve D, the observer determines the intensity of the illumination about V, which, with the standard opening used during calibration, would be required to obtain a balance at the time of the present observation. Let the area of the standard opening be denoted by A and the intensity as just obtained by reference to Curve D, by I. Let the area of the opening obtained in the present observation be denoted by A' and the intensity of the illumination around it at the observed time by I'. It is desired to determine the value of I'. The relations which exist between these four quantities are expressed by the following formula:

$$I' = \frac{IA}{A'},$$

it being understood that I and I' refer to similar time intervals after exposure referred to calibration and present experiment, respectively. The above formula is, of course, based upon the assumption that the diffusion of the light as it enters through the ground-glass plates will cause the luminous intensity on N from the source which is being measured to be proportional to the area of the opening at V. I' may, therefore, be calculated or it may be found graphically by reference to such curves as are shown in Fig. 3. Each of these curves refers to a certain value of I, its co-ordinates being A' and I', the curve having been derived from the formula above given. As an example, in determining a certain illumination by means of an observation taken 40 minutes after exposure, balance is obtained for opening A' equal to 0.5 sq. in. Now by reference to Curve D it is found that after 40 minutes I

0.000142 centimeter-candle units. Then, from the curve in Fig. 3 marked $I = 0.000142$, is obtained $I' = 0.000071$ centimeter-candles, since A' was found to be 0.5 sq. in. in the observation under consideration.

Assuming the phosphorescent body to be constant in its behavior when kept at a constant temperature of 0 deg. C. by the application of melting ice, the maximum probable error due to observation under the circumstances imposed by this photometer, namely, low intensity and a filtered component of blue light, was computed from data received from 26 observations. It was found that this error was not in excess of 8 per cent. This figure also includes the effect of an unavoidable fluctuation in voltage in the circuit which supplied the standard lamp used for purposes of calibration, which were of sufficient magnitude to somewhat influence all of the results.

NEW TELEPHONE PATENTS.

TELEPHONE REPEATER.

In perfecting the telephone repeater one of the requirements has been to devise a receiving part accurately sensitive to minute incoming power to drive a transmitter capable of handling the large reinforcing currents. This has in reality been found a rather narrow margin to work to, and to advance the limits of successful working Mr. N. G. Warth, of Columbus, Ohio, has patented what might be called a "two-stage" repeater. He proposes to use as first-stage instrument a sensitive receiving element coupled to a low-power transmitter. This is a very accurate but low-current transmitter approaching the old Blake type. A diaphragm is dispensed with, the metallic button carrying a magnetic mass within the field of the receiver. This accurate transmitter is connected to the receiving element of the second-stage instrument through an intermediate battery. The strong motions of this receiver drive the retransmitting transmitter with its heavy parts. Fig. 1 shows the two elements side by side.

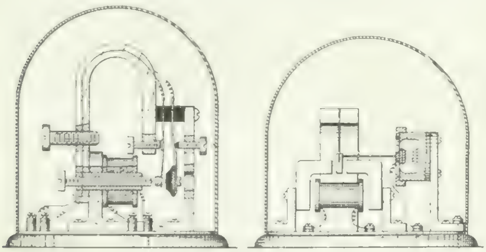


Fig. 1—Warth Repeater.

SEMI AUTOMATIC SYSTEMS.

Under this heading fall the call-distributing system of Mr. L. D. Kellogg, whose patent has been assigned to the Kellogg Switchboard & Supply Company, and the call-distributing apparatus and system of Mr. P. V. Christensen, of Copenhagen.

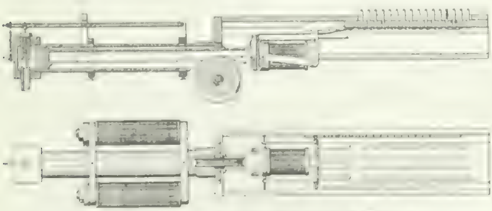


Fig. 2—Christensen Call Distributing Switch.

In this latter system the apparatus shown in Fig. 2 is employed. As shown in the sectional view, an air cylinder is used as the driving mechanism, and a coil spring as the return power. When a call arrives, the line relay, the lower of the two magnets, closes the cylinder exhaust and opens the inlet, and the contact springs are rapidly driven forward until an idle extension circuit is found. This is evidenced by its circuit conditions as found when the spring connected with the upper or search magnet winding reaches it. The result is an energization of this latter magnet, which drops its pawl into the corresponding tooth and draws the line contact springs down upon the contacts. At the completion of the call the line relay releases, the cylinder exhausts and the spring returns the carriage home.

In Mr. Kellogg's system, similarly the call distributer starts from zero and selects the first idle cord circuit. The cord circuits are arranged by positions and a predetermined number of positions is associated with a predetermined number of subscribers' lines. Each distributer traces its way over the cords of the first position of the group, and then the second, and so on till it finds an idle one to which to connect the call. It will be seen that by this means one position is loaded until busy and only straggling overflow calls reach the second. As the load increases the working positions must be covered one after another. To provide for emergency loads an overflow position is arranged as the final one.

RECEIVER.

Mr. W. F. Taylor, of Brookline, Mass., is the patentee of a receiver having within itself the hook-switch elements to perform the necessary circuit changes. A small manually operated lever arm serves to drive the switch blades. The Holtzer-Cabot Electric Company has been assigned Mr. Taylor's patent.

LETTER TO THE EDITOR.

The Radiation Laws of Metals.

To the Editor of Electrical World:

SIR:—In an article in your issue for May 19 attention was called by the undersigned to the fact that in the visible spectrum it has thus far been impossible to detect a variation in the optical constants of metals with a variation in temperature.

In the interesting contribution by Dr. E. P. Hyde, in your issue for June 25, the observed constancy of the ratios of the candle-powers of tungsten against carbon was taken as showing no temperature coefficient of emission, while for osmium the ratios are not quite constant, thereby indicating a probable temperature coefficient, which is in accordance with the results of other observers. The danger of a too free indulgence in mathematical deductions, in which the physical facts seem to be overlooked, is indicated by the derivation of two values of σ depending upon the radiation formula (Wien or Planck) employed. Experimentally there can be only one value of σ for a black body, which is $\sigma = 5.3 \times 10^{-12}$ watt per square centimeter. For a metal, which has a high temperature coefficient of emissivity, the σ (emissivity per unit area) will depend upon the temperature, and will require a rigid definition, just as is true of the resistivity. The suggestion is made that the constant, C_2, might be considered variable, which is reasoning in a circle for $C_2 = {}^a\lambda_{max} T$ experimentally, and since C_2 did not enter into the equations used by the writer, that constant was not discussed. Of course, C_2 varies if the above equation is true. In the equations used by the writer, the constant ^{a} is the only one not involving the temperature, and other factors difficult to determine.

For metals the physical facts are:

(1) An extraordinary variation in their reflectivity from the visible to about 2μ, beyond which point the reflectivity increases but slowly with wave-length.

(2) A small temperature coefficient of emissivity from the visible to 3μ, beyond which point the temperature coefficient increases rapidly with wave-length.

(3) For the black body the position of maximum emission in the spectral energy curve shifts, with rise in temperature, toward the short-wave lengths by a fixed amount, because only

the temperature enters the problem and $\lambda_{max} T =$ constant. Furthermore, the height of the maximum emission increases by a fixed amount, $E_{max} = BT^{a}$. The total radiation progresses as $S = \sigma T^{a}$. The constants a and C_2 are concerned in the slope of the spectral energy curve, while σ defines the total emissivity per unit area of the radiator.

In the pure metals the variation in E_{max} and λ_{max} will be affected by (1) and (2), and, as already mentioned in a previous communication, these formulas just mentioned must be modified to take account of these facts.

The cause of the constancy of ^{a}, as found by Dr. Hyde, and of its variability as found by myself, is probably due to the fact that the former worked in a very limited region of the visible spectrum, with λ_1 and λ_2 close together (and the *same at different temperatures*), and where no temperature coefficient of emissivity has yet been definitely established. On the other hand, the writer worked in the infra-red, where λ_1 and λ_{max} are far apart, and where λ_{max} is *different for different temperatures.* Furthermore, the λ_{max} is affected by a temperature coefficient of emission, and by a rapid change in emissivity due to a rapid variation in reflecting power, especially in the region of 1 to 1.5 w. It seems to the writer that the constancy (or variation) in the ratios on the color-match test, is really a test of the constancy of the optical constants with variation in temperature.

It does not appear that we are contributing anything new to what was found in Germany from 10 to 15 years ago, when it was concluded that the Wien equation does not apply to the black body, in which the composition of the energy emitted is independent of the material forming the radiating enclosure; and if these spectral radiation formulas do not apply to such a radiator, we can hardly expect them to apply (except perhaps at some one temperature, which does not appear very probable) to substances affected by the conditions (1) and (2) mentioned in the preceding paragraph.

Washington, D. C. W. W. Coblentz.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Dynamo Brushes.—In a description of British exhibits at the Brussels exposition the "Morganite" dynamo brush is noticed. The material is purest plumbago, which is not subjected to a high temperature, and the brush is made in layers in such a way as to ensure high conductivity "in the direction of the external circuit," but a resistance eight times as great in the cross-direction. Metal tops and flexible leads can be embedded during the manufacture, since the material is not exposed to a high temperature. The flexible after being drawn through the filleted hole in the metal top is spread out and pressed into intimate contact with the metal top through a thin sheet of copper, no solder being employed. In the "link-three" brushes the resistance is high on the one side and low on the other to facilitate sparkless commutation. Lightning arresters made by the same company consist of fireproof insulating material, grooved in zigzag on the surface, the grooves being filled with a special grade of carbon powder and the terminals being connected with carbon blocks having copper flexibles embedded in them.—Lond. *Eng'ing,* July 22.

Transformers.—E. G. Reed.—An illustrated article on some features in the design and application of transformers. Large low-voltage units should be built of the shell type and small high-voltage units of the core type. The dividing line in each voltage class comes at larger and larger sizes as the voltage increases. Each class, therefore, has a perfectly legitimate field and neither is adapted for universal application. In a comparison of transformers that have magnetic circuits without gaps with those having magnetic circuits made up of a number of segments and different relative positions of the gaps, it is shown that a very careful study of these points is highly important. Since the effect of the number of joints and their position becomes most important at the point of saturation, the most advantageous positions must be secured. This is especially important with modern special grades of steel which, while giving a lower iron loss, are "more prone to eccentric behavior." Impregnation of transformer windings is now quite general, and the successful operation of modern transformers is largely due to the improved quality of the gums used. Uniform penetration and thorough drying are absolutely necessary. —*Elec. Jour.,* August.

Reluctance of the Joints in Transformers.—Künziger.—If the laminated iron core of a transformer is formed alternately of layers of stamped iron sheets arranged according to diagram 1 and diagram 2 respectively of Fig. 1, it is often assumed that the whole magnetic flux passes in each layer longitudinally through each stamped iron piece, then through the air-gap λ of the joint into the next piece, etc., so that the combined reluctance of the joints of the transformer core is assumed to be $4\lambda/n\,t\,l$, when n is the number of layers, l the width of each iron piece (see Fig. 1) and t its thickness. Since the denominator represents the cross-section of the iron core, it would follow that for a transformer of given dimensions the reluctance R_1 depends only on λ, but not on the number of layers making up

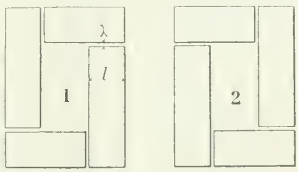


Fig. 1—Arrangement of Transformer Joints.

the iron core. However, this number has an important effect, since part of the magnetic flux can avoid and pass around the air-gap λ by passing from one layer into the adjoining layer, thus forming $n - 1$ side paths having a total reluctance R_2 in parallel with the magnetic circuit of the reluctance R_1. Thus the total reluctance of the iron core is $R = R_1R_2/(R_1 + R_2)$. It is easily seen that for a transformer of given dimensions this value becomes very nearly R_2 when n decreases; the flux passing through the air-gap λ is then negligible and it is useless to try to reduce λ by special construction.—*Bull. de l'Inst. Elec. Montefiore,* No. 2, 1910; abstracted in *La Technique Moderne,* July.

Leakage Reactance.—J. Rezelman.—A further mathematical article in which the author continues his investigations into the leakage of the windings of alternating-current machines. Certain corrections are made in his former formulas to make the results more general. The leakages of numerous machines have been carefully analyzed and the results are given. Bar windings are also dealt with. The article is to be continued.—Lond. *Electrician,* July 22.

Rotary Converters.—A note on a recent British patent (11,956, 1909; July 14, 1910) of Miles Walker (British Westinghouse Company). In order to admit of rocking the brushes over a wide arc without sparking, so as to vary the pressure on the direct-current side, the main poles are divided into two portions by cutting away the pole-face for a short portion of the arc. At this part, where the gap is large, a uniform weak field is obtained, proportional to the load, owing to the effect [illegible] good commutation

The brushes are so placed that the e.m.f. generated by this flux assists or opposes the main e.m.f.—Lond. *Elec. Eng'ing*, July 21.

Motor-Generator for Searchlamps.—An illustrated description of a motor-generator, brought out by a British company, for operating searchlamps, cinematograph projectors, etc. The generator is of special design; the current is taken from brushes displaced 90 deg. from the ordinary brushes which are short-circuited. The connections are such that the arc current is the sum of the generator and motor currents, and the reactions between the armature and the field are so adjusted that a practically constant current is delivered under all conditions of the arc.—Lond. *Elec. Eng'ing*, July 21.

Windings.—G. I. Stadeker.—In a continuation of his long illustrated serial on windings of dynamo-electric machinery the author deals with small induction motors, both single phase and polyphase, of the skein-wound type.—*Elec. Jour.*, August.

Lamps and Lighting.

Osram Lamps for Street and Station Lighting.—Remane.—Letters of inquiry were sent to 1600 German electricity stations. One thousand, two hundred and ninety replied and of these 484 used osram lamps for street lighting, the total number of osram lamps being 33,643, with an aggregate candle-power of 1;640,000 hefner candles. Fifty per cent of these are 220-volt lamps. As to the candle-power of the lamps 1.9 per cent are 16-cp lamps, 10 per cent 25-cp, 20 per cent 32-cp, 2.1 per cent 40-cp, 60 per cent 50-cp, while the balance are lamps of higher candle-power. For the lighting of railway stations, etc., the "intensive osram lamp" of from 100 to 1000 hefner candles has entered into competition with arc lamps. In the station of Charlottenburg 36 alternating-current arc lamps of 12 amp were formerly used; they have been replaced by 90 osram lamps, of which 86 have an output of 100 hefner candles and four of 200 hefner candles. The saving of power is 5 kw, and if the savings in electrodes, repairs, wages, etc., are taken into account, there is a total saving of $700 per year. In another railway station, in Erfurt, 91 arc lamps, consuming 32 kw, were replaced by 89 osram lamps of 50 cp, 70 of 100 cp, 20 of 200 cp, and one of 400 cp, all being 220-volt lamps. The power consumption is now 16 kw, so that the saving is 50 per cent. Even in mines where it is subjected to strong vibrations the osram lamp has proven very successful. The author finally gives data from practical experience to show that the use of small transformers and low-voltage metallic-filament lamps (14 volts) does not result in a saving of energy.—*Bull. di Schweiz. Elek. Ver.*, No. 6, 1910; abstracted in *Elek. und Masch.* (Vienna), July 17.

Alternating-Current Flame Arc Lamps.—P. Högner.—An account of experiments in which the author studied the effect of voltage wave form and of frequency on candle-power and specific power consumption of alternating-current flame arc lamps. He finds that alternators with a steeply ascending voltage curve are advantageous for the operation of flame arc lamps, since the candle-power is higher and the watts per candle-power less than with a slowly ascending voltage curve. In a similar way the higher the frequency, the higher the candle-power and the smaller the specific power consumption. For a certain 110-volt machine with steeply advancing voltage curve operating two flame arc lamps ("yellow electrodes" in series with an inductance coil) the lower hemispherical candle-power was 1880 cp for 25 cycles, 2300 cp for 50 cycles, 2660 cp for 100 cycles, the specific power consumption was 0.217 watt per lower hemispherical candle-power for 25 cycles, 0.18 for 50 cycles, and 0.16 for 100 cycles.—*Elek. Zeit.*, July 21.

Searchlamps.—Bochet.—In modern searchlamps metallic parabolic mirrors plated with gold are used. With mirrors 1.5 m (5 ft.) in diameter, it is possible to make observations to a distance of 5 km (3 miles). The illumination is 21 lux at a distance of 3 km (1¾ miles) and 7 lux at a distance of 5 km (3 miles). Details are given of the two systems of Breguet and Sautter-Harle & Company which are used in the French navy.—*Bull. Soc. Internat. des Elec.*, May, 1910; abstracted in *Elek. und Masch.* (Vienna), July 17.

[illegible] *Lamps.*—E. K[illegible].—An illustrated tr[illegible]lation of his German paper, recently noticed in the Digest, on an improved method of sorting incandescent lamps, by testing at a certain voltage and making use of the characteristic curves giving the candle-power and the watts per candle-power as functions of the voltage.—Lond. *Electrician*, July 22.

Generation, Transmission and Distribution.

French Hydroelectric Station.—P. Bourguignon.—A description of the water-power plant of Montcherrand, which utilizes the falls of the Orbe River between the towns of Cléens and Montcherrand, with some additional water-powers. The hydraulic and electric equipment is described at great length, with numerous detail drawings. There are four 2000-hp alternators with stationary armature and rotary field. Three of them are designed to give either three-phase currents with a power factor of 0.75 during 24 hours for power purposes or single-phase current with unity power factor for four consecutive hours for lighting. The voltage is 13,500, whether single-phase or three-phase. The switchboard and wiring arrangement is described in detail. A large part of the load is electrochemical.—*La Houille Blanche*, July.

Electricity in Mines.—W. Philippi.—An abstract of a paper read before the International Mining Congress at Düsseldorf. After a short introduction regarding the extension of the application of electrical machinery in mines in Germany, attention is first paid to the question of the most economical generation of electrical energy, and the ways of reducing the generating costs in mines are mentioned. In connection with the details of electric mining machinery, the small underground installations, such as for lighting, boring, coal cutting, and, further, for small hoists, are first treated. The advantages of the electrically driven boring machines as compared with those using compressed air as motive power are gone into to some extent. The chief part of the paper deals with pumping plants, ventilators and large winding engines. Under the first-mentioned subject, special attention is given to the sinking pumps, on account of the particular advantages which electricity possesses as motive force for these. The stationary pumps are divided into electrically driven plunger pumps and electrically driven high-pressure rotary pumps. The advantages and disadvantages of the two types are shown in detail. As regards the ventilators, the chief attention is now given to the problem of finding means of regulating the quantity of air, and in connection with this problem the interest centers about the method of regulating by means of converters, whereby the energy at present wasted in regulating by means of a resistance inserted in the rotor circuit is utilized. A considerable improvement in the efficiency, combined with reduced rotative speed, is hereby obtained. The important subject, the main shaft winding machine, is viewed from the point of safe working, first cost and running expenses. In spite of the endeavors to find other arrangements, only installations after the Ward Leonard system can as yet be regarded as in every respect irreproachable. The most important details in connection with the question of safe working are mentioned, and some particulars are given demonstrating the reliability hitherto attained in this direction. As regards the first cost, it is important that a thorough comparison be made with other systems. The points which hereby come in question are discussed to some extent, and, at the same time, the question of placing the winding engine in the hoisting framework is particularly treated. Under running expenses particulars are given illustrating the degree of efficiency attained by Ilgner installations, whereby the most important facts are the average yearly results obtained on the basis of reports from the managing departments of mines. The reasons of the economical superiority of the electrical winding engines, particularly those of the Ilgner type, are pointed out and explained.—Supplement to Lond. *Elec. Eng'ing*, July 7.

Use of Low-Grade Fuels.—Dobbelstein.—A paper read before the International Metallurgical Congress in Düsseldorf in which the author considered the question of burning coal of the following kinds: 1. Coarse coal, with up to 50 per cent ash and up to 20 per cent water, (a) with high volatile matter, (b)

with small volatile matter. 2. Fine coal, with up to about 40 per cent ash and up to 30 per cent water, (a) with high volatile matter, (b) with small volatile matter. 3. Coke breeze (fine coke) with up to 30 per cent ash and up to 20 per cent water. The Essen Boiler Inspection Society with the Dortmund Mining Society contributed a fund to investigate the possible use of these materials. The projected gas-producer tests have not yet been made, but the boiler tests have been completed with valuable results. A simple rule for comparing the values of different fuels was arrived at; namely, the values in pfennigs (1 pfennig = 0.25 cent) per ton equals the calorific power divided by the per cent of ash plus half the per cent of water in the coal. The quotients express with satisfactory accuracy the relative industrial values of the respective fuels. If briquetted, they should be pressed into small cylinders 2 in. in diameter by 2 in. long, which quickly become ignited and stay together, while larger briquettes warm up so slowly that the pitch escapes as they fall to pieces. Use should be made of tar-pitch residues, which can be bought in Germany for about 9 marks ($2.25) per ton. Coke breeze was likewise burned on a perforated grate with blast and by the Praesto firing. The Praesto firing showed up cheapest and most effective, giving 1 ton of steam for 0.98 mark (24.5 cents), and evaporating nearly 23 kg of water per hour per square meter (4.5 lb. per square foot) of heating surface. Experiments with the poor, coarse fuels or ordinary grates showed that in many cases it was more advantageous, regarding cost per ton of steam produced, to use the poor fuel rather than ordinary good fuel.—*Met. and Chem. Eng'ing*, August.

Austrian Hydroelectric Stations.—The complete utilization of the power available from the Traun Falls plant and the plant of St. Wolfgang has led to the development of two additional water-powers on the Offensee and Schwarzensee. The total rating of these four hydroelectric plants is at present 9200 hp. They are operated in parallel on a distribution network 456 km (275 miles) in length, of which 350 km (210 miles) are high-tension line with a 25,000-volt transmission e.m.f. This is the most extended transmission system in Austria. The total connections at the end of 1909 were 1760 hp in lamps and 6300 hp in motors. During 1909 the four works produced 20,641,523 kw-hours (against 11,571,216 in 1908). The capital invested is $1,200,000 and a dividend of 7.5 per cent was paid last year. Details are given of the equipment of the two new plants.—*Elek. und Masch.* (Vienna), July 17.

Installations, Systems and Appliances.

Electricity in Agriculture.—H. WALLEM.—In a continuation of his long illustrated paper the author discusses accessories of the electric plow (wiring, feeder points, transformers, etc.). Illustrations are given of the electric plow and of the transportable transformer. A discussion of farm railroads and of the conditions of their advantageous use follows, with notes on the use of the electric motor for hoisting, drying and irrigation. Finally, the total power requirement of a farm of 2000 morgen (1260 acres) is estimated and a diagram is given showing the distribution of the power requirement over the whole year. The load is very high in October and November, has two lower maxima about April and August, and is otherwise very low. The total annual energy requirement per morgen (1 morgen = 0.63 acre) for farms about 1000 morgen is from 25.1 to 29.5 kw-hours, when electricity is used for threshing and plowing (besides lighting and small motor operation); it rises to from 28.1 to 33.5 kw-hours when an electric road of 5 km (3 miles) total length is built, and to from 38 to 60 kw-hours when a drying plant is erected. The article is to be concluded.—*Elek. Zeit.*, July 21.

Convention.—An account of the recent eighth annual convention of the Association of Electrical Installation Firms in Germany. It was held in Leipzig from July 25 to 29, Mr. G. Montanus being president. At present 450 German installation firms are members of the association. One of the chief discussions dealt with the monopolistic tendency of transmission and distribution stations in agricultural districts, which was pointed out to be antagonistic to independent installation firms. —*Elek. Anz.*, July 17.

Wires, Wiring and Conduits.

Underground Conduit Construction for Large Transmission Lines.—E. N. LAKE.—A paper read before the Western Association of Engineers. The author discusses many details of conduit construction and manhole fittings and finally makes the following recommendations for any new underground conduit construction in any large distribution system. Absorption tests should be made upon the ducts and an absorption requirement included in the duct specification. Square-bore single duct should be used for the standard construction. A rigid adherence to a definite plan of staggering the joints should be enforced. All voids between ducts, especially at corners, should be thoroughly filled with mortar and concrete. It is recommended to order all future duct without outside corners made on not greater than ¼-in. radius, and to install present form of duct in longitudinal tiers, separated by a substantial layer of concrete for important lines. For extra important lines, or high-tension lines, round-bore duct with horizontal and vertical concrete separation is recommended. All lines of 16 ducts or more should be constructed in the duplex form. For laterals use should be made of fiber protected with iron pipe on the vertical run up the pole, and protected with concrete at the bend and on the horizontal run. In manholes reinforced cement shelf barriers are recommended for small groups of cables of minor importance, while for larger groups of important cable the split duct should be used in addition to the shelves. An account of the extended discussion which followed the paper is also given.—*Jour. Western Soc'y Engineers*, June.

Aluminum Conductors.—E. SOLERI.—A comparison between aluminum and copper for electrical conductors, giving first data on bare lines and then on cables. For low-tension cables practical considerations should decide whether copper or aluminum is preferable. For medium e.m.fs. (from 1000 volts to 10,000 volts) a special calculation must be made in every case, while for high voltages the author finds that aluminum is preferable. Finally, coil construction is discussed and it is shown that a saving of space is possible with aluminum whenever the difference in e.m.f. between adjoining turns is not above 0.5 volt, since no special insulation is required, the oxide film (which is always present on aluminum surfaces) being sufficient. Aluminum coils can withstand higher temperatures, up to 400 deg. C. or 500 deg. C., when suitable insulating materials are employed. [The abstractor in *Elek. Zeit.* thinks that these figures are too high, since at these temperatures the metal loses its mechanical strength; he gives the limiting temperature as 200 deg. C.]—*Il Elettricista*, 1909, Nos. 10 to 13; abstracted in *Elek. Zeit.*, July 21.

Pole Construction.—O. RIEGER.—An article discussing with the aid of a numerical example a method of calculating the necessary thickness of wooden and iron poles at places where a transmission line crosses a street, etc., and where a higher degree of safety is required. The depth to which the poles must be buried in the ground is also calculated. Both graphical and analytical methods of calculation are given.—*Elek. und Masch.* (Vienna), July 17.

Electrophysics and Magnetism.

Hysteresis in a Rotating Field.—G. VALLAURI.—After reviewing the work of other investigators of this subject, the author gives an account of his own experiments. A horseshoe magnet of considerable size was mounted on the shaft of a motor and fitted with pole-shoes formed to embrace a cylindrical space in which was arranged the specimen under test, consisting of a number of iron armature stampings. Owing to the magnetic attractions, due to slight and unavoidable defects in the centering of the specimen, it was necessary to support the end of the shaft which carried the specimen in a small bearing fixed to the magnet frame. This, of course, introduces a friction couple, which has to be allowed for. This couple was balanced by means of a pair of adjustable weights sliding on a bar. The

flux passing through the specimen for different values of the magnetizing current was measured ballistically by means of a coil of thin wire wound on a diameter of the specimen. Measurements were made at 104 r.p.m., 208 r.p.m. and 312 r.p.m.; the curve for hysteresis + friction + eddy-current loss in Fig. 2 refers to a speed of 208 r.p.m. It shows a well-marked maximum corresponding to the point of maximum hysteresis. The separation of the eddy-current losses was accomplished by taking

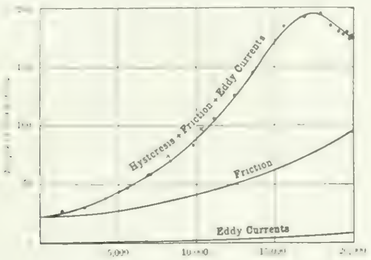


Fig. 2—Hysteresis in Rotating Field.

measurements at the three speeds mentioned. Subtracting the couple exerted at 104 r.p.m. from that at 312 r.p.m., and assuming the proportionality of the eddy-current loss to the square of the frequency, the mean couple at 208 r.p.m., due to eddy currents only, was obtained. From this was deduced the value of the coefficient β which had to be inserted in the equation $w = 2\beta\delta^2 n^2 B^2$, where w is the loss, δ the thickness of the laminations and n the frequency, the factor 2 being introduced to take account of the fact that the eddy-current loss is twice as great for a revolving flux as for an alternating one. This gave a value of $\beta = 0.000228$, which agrees well with Epstein's figure of 0.000224. From this the curve of eddy-current torque was obtained. The torque due to friction was separated by means of tests made on the starting friction with the magnet system stationary. This was observed with various values of the flux density. The running friction was also measured with the field magnet revolving, but de-energized. The starting friction was found to be equal to 1.52 times the running value and this relation was assumed to hold good throughout the series. The friction was found to follow a relation of the form $y = a + b\,B^2$. Having determined the eddy-current and friction torques, that due to hysteresis was found by subtraction. As

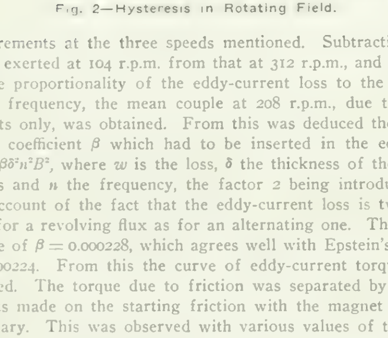


Fig. 3—Hysteresis in Rotating Field.

shown in Fig. 3 the hysteresis loss has a well-marked maximum [illegible] B = 16,000. For comparison [illegible] hysteresis loss was determined for the same iron and the curve plotted. Finally, since the existence of hysteresis in a rotating field reveals itself by a couple tending to oppose the rotation of the field, the vector of the intensity of magnetization will lag behind the vector of the magnetizing force. This angle of lag was both calculated and experimentally measured and the curve plotted. It has a maximum value at about $B = 4000$ and tends to a zero value at saturation.—Lond. *Electrician*, July 22.

Elementary Charge of Electricity.—F. Ehrenhaft.—The author thinks that in view of the great differences between the experimental determinations of the electronic charge the justification of taking a mean value and basing on it an atomic theory of electricity is doubtful. He describes experiments of his own in which he used the ultramicroscope and from the results of which he concludes that if there exists really an elementary indivisible quantity of charge of electricity it must be less than 1×10^{-10} absolute electrostatic units, hence less than what is now called the charge of an electron. Especially for gold particles he found a charge of an order of magnitude of 5×10^{-11} absolute electrostatic units, which is about one-tenth of the charge of the hydrogen ion. There are also deviations from the law of simple multiples for larger charges. "The author is unable to explain his experiments on the basis of the fundamental hypotheses of the theory of electrons," although he does not deny that others may find an explanation. The same issue contains a paper by K. Przibram on determinations of the charges in phosphorus mist, leading to similar conclusions.—*Phys. Zeit.*, July 15.

Electrochemistry and Batteries.

Edison Iron-Nickel Storage Battery.—F. Foerster and V. Herold.—The third paper of the authors on the Edison battery, dealing especially with the different steps or stages of the discharge curve. An electrode consisting of powdered iron discharges in a 2-to-4 normal potassium hydroxide solution in two successive steps, separated from each other by a voltage drop of at least 0.1 volt. During the first step the reaction is the change of the metallic iron into the bivalent ionic state; during the second step the bivalent ferrous ions are changed into trivalent ferric ions. In the operation of the Edison accumulator it is of utmost importance that only the first of these two steps or reactions occurs at the iron electrode. An excess of iron oxides in the active mass reduces seriously the capacity of the first step; even the presence of smaller quantities of iron-oxygen compounds may diminish considerably the capacity of the first step if higher discharge current densities are employed. This trouble is overcome by Edison by adding finely divided mercury to the iron mass. The mercury addition permits one to get from the iron electrodes always the same capacity corresponding to the first step, however much the current density may be varied. The mercury addition is, therefore, of great practical importance. Since it is necessary that the only reaction at the iron electrode during the discharge of the battery is that corresponding to the first step, the capacity of the iron electrode must be made considerably higher than that of the nickel peroxide electrode, so that the latter determines the capacity of the whole battery. During charging the bivalent ferrous ions must be changed back to metallic iron, but this is possible only with hydrogen evolution and this means a considerable waste of energy so that the efficiency of the battery is not very high.—*Zeit. f. Elektrochemie*, July 1.

Formation of Lead Accumulator Plates with Phosphoric Acid and Phosphates.—F. Fischer.—The surface of the lead plate is first formed to a depth of 1 mm (40 mils) into lower lead oxides. This is done in a solution of 1 kg of Na_2HPO_4 crystals in 9 kg of distilled water at a temperature of 80 deg. C., the plates to be formed being placed between cathodes of equal surface at a distance of 10 mm (0.4 in.). The current must be chosen so that the voltage, which may be 2.2 at the start, does not reach 2.6 volts. The current decreases during the time of formation gradually, since the lead oxide layer which is being formed is a poor conductor. The time of formation is 24 to 36 hours. The plates are then reduced to spongy lead at ordinary temperature in so-called storage battery acid (specific gravity 1.18) with a current density of 1 amp per square decimeter (9.3 amp per square foot) until there is a free evolution of hydrogen gas. The plates are then washed in water for 12 hours to remove the phosphoric acid, and if they are to be changed to lead peroxide plates they are treated as anodes with

a current density of 1 amp per square decimeter continually—that is, without interruption, in acid of specific gravity 1.09 until the evolution of oxygen is complete. The reduction takes about as much time as the formation, while the oxidation requires twice this time. The whole process requires, therefore, four or five days.—*Zeit. f. Elektrochemie*, May 15.

Units, Measurements and Instruments.

Pyrometry.—R. S. WHIPPLE.—An illustrated paper, read before the Birmingham Metallurgical Society, on recent advances in pyrometry. The author deals with gas thermometry, electric resistance thermometry, thermo-electric thermometry, and radiation pyrometry. As to standardization, the tendency of recent workers is to adopt the melting points of pure metals as the standards of reference. Unfortunately, the metals cannot be obtained commercially sufficiently pure to guarantee an accuracy of 1 deg. C. at the higher temperatures, but if an accuracy of from 1 deg. to 3 deg. is sufficient, then Kahlbaum's best materials will answer the requirements. It is suggested that institutions like the National Physical Laboratory should undertake to supply small quantities of pure metals, the melting points of which have been carefully studied. The following temperatures are given as the most satisfactory standardization points:

Freezing point of tin	231.92° C.
" " " cadmium	321.01
" " " lead	327.43 "
" " " zinc	[illegible]
" " " antimony	[illegible]
" " " silver	[illegible]
" " " copper	1083.0 "
" " " nickel	1452.2 ± 2° C.
" " " cobalt	1489.8 ± 2 "
" " " palladium	[illegible]
" " " platinum	[illegible]
Boiling " " sulphur	[illegible]

The black-body temperature of the crater of the electric arc is 3700 deg. C., this value being constant even when the current through the arc is varied between large limits.—Lond. *Eng'ing*, July 22.

String Galvanometer.—At the Brussels exhibition several forms of string galvanometer of British make are shown. In a special form of the Einthoven string galvanometer, due to W. Duddell, the chord or string is a silvered quartz fiber, 0.002 mm or more in diameter. Einthoven himself designs his galvanometer for physiological work and great importance is attached to the instrument for cardiac diagnosis. In another string galvanometer, due to T. H. Laby, a silvered quartz fiber is stretched midway between two vertical plates of invar steel, one charged to + 40 volts, the other to — 40 volts. Any change of potential of the fiber which is originally at zero potential causes a lateral deflection.—Lond. *Eng'ing*, July 22.

Mica Condensers.—H. L. CURTIS.—An abstract of an American Physical Society paper. The apparent capacity of a mica condenser depends on the method by which the capacity is determined. In general, the alternating current values are less than those determined by direct-current measurements. By determining the apparent capacity at different periods of alternating current and plotting a curve, this curve may be extrapolated to zero frequency, which will give the true or geometric capacity. Moreover, if the direct-current capacity is determined with different times of discharge, the time of charge being the same, there may be obtained a curve which will give the geometric capacity by extrapolation to zero time of discharge. The values of the geometric capacity by these two methods are identical. An investigation was also carried on to determine the constancy of a mica condenser under different conditions. The results show that those condensers which are maintained at constant temperature and pressure may be depended upon to remain constant to 1 part in 10,000, those which are kept at constant temperature vary by only 2 or 3 parts in 10,000, while those which are exposed to the changes of room temperature may vary by several parts in 10,000. Hence by keeping condensers under the most favorable conditions, the accuracy which can be obtained by their use is nearly ten times that which can be obtained when the condensers are left at room temperature and corrections applied to reduce to a standard temperature.—*Phys. Rev.*, July.

Measurement of Reactances and Mutual Inductances.—G. GRASSI.—A description of a method of measuring the reactance and mutual inductance in alternating-current circuits by means of an electrodynamometer which is used as a zero instrument. The principle of the method is based on the action upon the electrodynamometer of two currents in perfect time-quadrature. Neither high accuracy nor great sensitiveness is claimed for the method, but it is believed to be quick and convenient for approximate measurements.—*Comptes Rendues de l'Acad. de Naples*, Fasc. 3, 4, 1910; *Elettricista*, Feb. 15, 1910; *La Lumière Elec.*, July 16.

Magnetic Tests.—C. W. BURROWS.—An abstract of an American Physical Society paper. This is a preliminary report on the results of an investigation of the nature and magnitude of the errors in magnetic measurements on comparatively short, straight rods, as used in the methods and apparatus in common use in this country and abroad, including the Picou, Koepsel, Esterline and double-yoke permeameters. These errors are due in part to the formation in the magnetic circuit of local poles which exert a magnetic field in the space occupied by the test specimens, and in part to the fact that the device for measuring the induction may indicate a considerable flux which does not pass through the specimen.—*Phys. Rev.*, July.

Oscillograph.—At the Brussels exposition three types of the Duddell oscillograph are shown. The first, for high-frequency and research work, has a period of vibration of 0.0001 second and is accurate for frequencies up to 300 cycles per second. The vibrators, with their attached mirrors, are fixed side by side in an oil bath (brass case) between the solid steel poles of a powerful electromagnet which is excited from a 100-volt or 200-volt circuit. A plano-convex lens is mounted in front of the mirrors slightly inclined, so as to avoid reflection from its own surface. The second type has a period of 0.00033 second, is provided with a permanent magnet, and is more robust and portable; it is also easily insulated, as it does not require direct-current excitation, and is insulated for 50,000 volts. The third type is for general use and for the lecture hall. The instruments are combined with falling plates or cinematograph cameras.—Lond. *Eng'ing*, July 22.

Meters.—An official announcement of the Reichsanstalt by which a modification of the former direct-current motor meters of Mix & Genest is admitted for calibration, with description and illustration of the improvements.—*Elek. Zeit.*, July 21.

Instruments.—A review of the exhibits of scientific instruments of British make at the Brussels exposition. They are chiefly optical, astronomical and electrical instruments. Some of the latter are separately noticed in the Digest.—Lond. *Eng'ing*, July 22.

Telegraphy, Telephony and Signals.

Telephony and Telegraphy in the United States.—MAJOR W. A. J. O'MEARA.—The author gives an account of the various telephone and telegraph installations visited by him on a recent trip to the United States. Comparisons are drawn between American and English practice, especially as regards the commercial and engineering organizations. "From the day I investigated the organization of the New England Telephone Company in Boston and the methods adopted by its officers in handling telephone propositions, to the last day I spent at the offices of the American Telephone & Telegraph Company in New York with Mr. J. J. Carty, I was struck by nothing more than the broadmindedness of the officials engaged in the telephone and telegraph industries of the New World and the orderliness in the management of these undertakings." . . . "On the North American continent the telephone and telegraph systems are ranked among the engineering enterprises of the land." . . . "While I was in New York I had many opportunities of closely watching the working of the great deliberative machine so ably presided over by Mr. T. Vail, and so well

managed by Mr. H. B. Thayer, one of the vice-presidents of the company. The first thing which naturally attracted attention was the complete absence of the huge files of correspondence so familiar to those who work in Government offices. The functions of the various departments of the American Telephone & Telegraph Company are very clearly laid down, and since decentralization exists in its completest form, the business of the company is transacted by the heads of departments in personal interviews with the president and vice-president." . . . "Another point which came under my observation was the close personal relationship which exists between Mr. Carty and the chief engineer of the Western Electric Company, Mr. C. Scribner. When one considers the character of the problems which telephone and telegraph engineers have to handle nowadays it is not difficult to realize how great must be the advantages which cannot fail to result from the close personal intercourse of the chief engineers of the manufacturing and operating departments of the American Telephone & Telegraph Company." . . . "In my young days it was frequently impressed upon me that the best results would always follow if subordinates, however lowly in rank, were given an opportunity to do at least one thing on their own responsibility. This idea has been made a principal feature in the functional organization in the form in which it has been introduced in America. Every effort is made to push responsibility down the line, and hence it is that, in every grade, officials know that there are always certain things in which no further authority than their own judgment is required for the execution of prescribed works. I could not help noticing the spirit of enthusiasm which is thus engendered, and I readily believe that this results in work of so superior an order that the cost of the mistakes which may be made from time to time is paid for many times over by the greatly increased output of work of every official in the great telephone organization of the Bell interests." Some brief notes are added on various telephone engineering problems, and on automatic and semi-automatic exchanges.—Lond. *Electrician*, July 22.

Loaded Telephone Cable.—A note on experiments made on the new telephone cable from Dover to Cape Grisnez (connecting London with Paris). It is loaded with Pupin coils spaced 1 mile apart and each having an inductance of a little over 100 millihenries. As no cable of this length had formerly been loaded with Pupin coils, the undertaking was looked upon as an experiment and the same construction was otherwise chosen for the new as for the old cable (namely, each core, per mile, consisting of 160 lb. of copper and 300 lb. of guttapercha), so that if the new cable should prove a failure the loading coils could have been cut out. In the recent experiments, the object of which was to compare the old and the new cables, the cables were looped at the French end and observations were made at the English end by speaking through the looped cable, the speaker being in one room and the listener in another room. There were four different observers. Lengths of standard cable were added on until the limit was reached at which speech became uncommercial. The results show that on the average 25 miles of standard cable could be added to the old unloaded cable and 42 miles to the new loaded cable. The gain by the new cable is therefore 17 miles of standard cable. Some of the observers noticed a very marked improvement, as regards clearness of speech, in the new cable over the old cable, when the cable above was in circuit.—Lond. *Electrician*, July 22.

Wireless Telegraphy.—An illustrated description of the Balsillie system of wireless telegraphy and telephony, the principal features of which are a rotating discharger, a magnetic receiver, and a transmitting key obviating the necessity for using a change-over switch for receiving and sending. The rotating discharger gives a pure musical note, and is claimed to work successfully with high powers, while the magnetic receiver is said to be particularly reliable and constant. The connections of both the transmitting and receiving circuits are shown in Fig. 4. A step-up transformer T supplies the oscillating circuit with alternating current at 15,000 volts, and at a f[illegible] per second. The oscillating circuit comprises the condenser D (12 Moscicki glass jars with a total capacity of 0.01 mfd), the inductance M (the usual solenoid of bare copper tubing), and the rotary discharger C. The latter consists of an aluminum cylinder with eight curved teeth rotating between two fixed brass electrodes at a speed of 30 or more revolutions per second. The discharge from the condenser is thus interrupted 240 or more times per second. By adjusting the constants of the circuit, the fre-

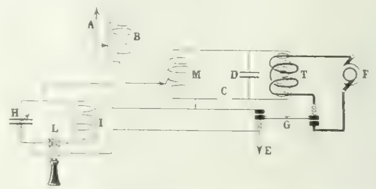


Fig. 4—Balsillie System of Wireless Telegraphy.

quency of the oscillations is regulated so as to give a normal wave length of 600 m. The frequency of the discharges can be varied from 200 to 1500 per second and a clear musical note is obtained in the receiving telephone. This "group" frequency is independent of the frequency of the alternating current supplied to the circuit. The effect of the curved teeth of the discharger is to produce a strong air-blast across the two gaps, thus cooling the sparking tips and preventing the formation of arcs. The transmitting key G obviates the necessity of using a change-over switch for receiving and transmitting. When it is depressed to energize the transformer, the receiving circuit is short-circuited and the aerial is directly connected to earth, but when the key is raised, the aerial is earthed through the receiving apparatus. The receiving circuit consists of a variable condenser H and inductance I, a special magnetic detector L and a device (not shown) for varying the coupling between the primary and secondary circuits. For wireless telephony a special form of rotary disk discharger has been developed, consisting of an aluminum disk with a large number of curved teeth. It is rotated at a speed of 12,000 r.p.m. and a group frequency giving a note of so high a pitch that it is inaudible is obtained. The speech vibrations are superposed on the waves generated by this discharger by means of a suitable microphone, and the variations in the received oscillations reproduce the speech in the receiving telephone.—Lond. *Elec. Eng'ing*, July 21.

Copenhagen.—The subscribers to the main Copenhagen telephone exchange have been transferred to a new exchange on the central-battery system. Previous to the change-over condensers were added to the subscribers' instruments, but were left short-circuited with a copper wire, which the subscribers were directed to cut on the day of the transfer.—Lond. *Elec. Eng'ing*, July 14.

Wireless Telegraph Station.—L. H. Walter.—A detailed illustrated description of the equipment of the new wireless telegraph station of the French post-office at Boulogne. A directive equipment of the Bellini-Tosi system is provided, as well as a non-directive arrangement. With a wave-length as short as 600 m, communication is kept up daily with Algiers with an expenditure of only 500 watts. The directive system is found to give much greater range than can be obtained with the non-directive aerial and to enable interference of other stations in the neighborhood to be largely avoided when receiving.—Lond. *Elec. Eng'ing*, July 14.

Wave Detector.—W. H. Eccles.—His London Phys. Soc'y paper in full, an abstract of which was recently noticed in the Digest, on an oscillation detector actuated solely by resistance temperature variations. It is a galena detector similar to the author's former iron-oxide detector and its superiority over other detectors is, according to the author, to be ascribed chiefly to the large negative temperature-coefficient of resistivity of galena. By direct measurement of a cube of galena clamped between pieces of tinfoil the resistance was found to

fall from 0.33 ohm at 12 deg. C. to 0.10 ohm at 99 deg. C., thus indicating a negative resistance-temperature coefficient of 0.0079 per degree Centigrade. Pyrites has a coefficient about 0.006. Iron oxide has a coefficient somewhat lower than this last.—*Phil. Mag.*, July.

High-Speed Telegraphy.—Devaux-Charbonnel.—A paper giving a review of the different methods of high-speed telegraphy. The Pollak-Virag system is considered to be simplest and most in accordance with theory, with respect to speed of transmission. But besides this, it is necessary to consider the facility of practical working, and in this respect the Bandot system, although far from perfect, has particular advantages, which, it is believed, will ensure for it a great success for a long time. —Supplem. to *La Technique Moderne*, July.

Telephone Exchange in Hamburg.—Janzen.—The first part of an illustrated description of the new long-distance telephone exchange in Hamburg, giving technical details of the system employed.—*Elek. Zeit.*, July 21.

Miscellaneous.

Assorting Goods.—A fully illustrated account of the means proposed by A. W. Gattie and A. G. Seaman for the handling and sorting of goods and parcels mechanically. The means adopted consist essentially of two moving belts and an electric controller which ensures the goods being transferred from any point to any other desired point. The method of control is described in detail. Gattie proposes this method for handling all London goods in a single building, which, by analogy with the method followed by bankers, he calls a goods clearing house. This would replace the present slow and inefficient system of sorting and resorting goods and parcels at different freight stations.—Lond. *Electrician*, July 22.

Book Reviews

Dynamos and Motors: A Text-book for College and Technical Schools. By W. S. Franklin and William Esty. New York: The Macmillan Company. 497 pages, 319 ills. Price, $4.

This book appears to have been compiled from other works of the authors and especially arranged to meet the demand of certain schools that teach electrical engineering to students matriculated in other branches of engineering. It should also be well adapted to use as a preliminary course for purely electrical engineering students to give them a general view of the subject and enable them to continue their studies with a proper sense of the relative importance of the various phases of the subject. The subject-matter of the book is treated under the following principal heads: Introduction treating general characteristics of electric circuits and electric quantities; direct-current generators and motors, description of machines and their characteristics; elementary theory of alternating currents; alternating-current generators and motors; station arrangements and operation, which includes switchboard and apparatus used to control the distribution of electric energy.

Strikes. When to Strike—How to Strike. A book of suggestion for the buyers and sellers of labor. By Oscar T. Crosby. New York: G. P. Putnam's Sons. 202 pages. Price, $1.25.

This book, by a writer who for many years was a prominent figure in the electrical field, gives a fair and sane treatment of the labor question and can be read with profit by all identified with either side. The arguments summed up show the following conclusions: That the strike is moral, is, or ought to be, legal and may be profitable; that arbitration cannot be considered as a universal cure for labor troubles, but that it is generally favorable to workmen; that any desire not illegal or immoral may be sufficient reason to strike; that the more proper causes for strike are higher pay, shorter hours and better general conditions; that the sympathetic strike does not pay; that the piece-work system, properly applied, will go far toward solving labor questions; that efficiency of workmen largely supplies the fund from which higher pay must be drawn; that the boycott and picket are, or ought to be legal, and should be resorted to when necessary, but violence and lying are to be excluded from all programs. In order that the workman may see better the other side of the question and in fact be made a party to that side, the author suggests that labor unions become building and loan associations with a tendency to building homes for their members and furnishing a means of investment of their savings.

New Apparatus and Appliances

TELEPHONE EXCHANGE INSTALLATION IN A SMALL CITY.

The city of Kalispell, Mont., has recently installed a complete new equipment for its telephone exchange, which is operated by the Northern Idaho & Montana Power Company. The installation is interesting in that it provides an up-to-date, efficient telephone system, giving service comparable in every way to that of the larger cities. The new telephone system is common battery and was installed by the Western Electric Company.

The installation comprises a subscriber's switchboard, wire chief's desk and chief operator's desk, toll equipment for completing long-distance connections, plant for supplying energy to the system, and outside construction, including poles, lead cable, wire and subscribers' sets.

The subscriber's board consists of two standard section equipments, having seven panels and three operators per section. Four operator's positions are used for taking care of the local subscribers' service, while one operator handles the toll and rural calls. The switchboard is capable of accommodating 4600 subscribers' lines, 50 rural lines and toll and pay station lines.

The power plant consists of a 24-volt storage battery for the local supply and 48-volt storage batteries for the toll supply, with a gas-engine-driven charging generator for supplying energy to the batteries. This charging generator is of special construction, designed for the charging of storage batteries without

Chief Operator's Desk and Subscribers' Switchboard, Kalispell, Mont.

introducing magnetic and commutating noises on the telephone circuits. In the event of any accident to the storage batteries

the exchange may obtain energy directly from the machine without any noise interfering with transmission. The storage battery is of sufficient size to operate the exchange for a number of hours in case anything should happen to disable the generator. Duplicate ringing outfits were furnished for the telephone system and connected to separate circuits.

In laying out the telephone equipment extra precautions were taken because of the network of wires carrying electric energy of both high and low potentials in and around Kalispell. It is necessary to protect the apparatus, subscribers and employees against the high voltages as well as against lightning. A wall-type frame is furnished, and on this the subscribers' lines terminate, continuing through the cable to the main distributing frame. Entering the main distributing frame on the horizontal side, the lines are carried through the frame by means of jumper wires to the switchboard or arrester side, where they are further protected from sneak currents and heavy lightning discharges by means of heat coils and lightning arresters. This arrangement gives effective protection against any outside disturbing voltages, whether static or dynamic in character.

PLUG TESTING-SET.

There has recently been produced and put upon the market a plug testing-set designed for engineers who do not care to go to the extra expense of a switch-type set. In the new set the resistance-coil blocks and plugs are arranged in numerical order, so that when looking at the set with the plugs out, the total resistance measured would read as a column of figures; thus the results may be seen at a glance.

The "A" bridge-arm has values of 1, 10 and 100 and the "B" bridge-arm 10, 100 and 1000. A commutator is provided for reversing the position of the bridge-arms, thus making the range from 0.001 part to 1000 times the value of the resistance unplugged in the rheostat. The rheostat has coils of 1 ohm, 2 ohms, 2 ohms, and 5 ohms; 10 ohms, 20 ohms, 20 ohms and 50 ohms; 100 ohms, 200 ohms, 200 ohms and 500 ohms; 1000 ohms, 2000 ohms, 2000 ohms and 5000 ohms; thus any combination may be used and very accurate readings obtained. The accuracy of adjustment of the rheostat coils is said to be 0.1 per cent and of the bridge-arm coils "A" and "B" 0.05 per cent.

Plug Testing Set.

The set is equipped with a quick make-and-break switch, to change from the Wheatstone bridge measurements to the Murray loop test. Provisions are made for connecting to an outside battery in case a higher e.m.f. is required than that furnished by the cells in the set.

The galvanometer is of the D'Arsonval type. It is said to have a very high sensibility and be very quick and positive in its action. The construction is such that it is extremely dead-beat. The galvanometer key is arranged with a short-circuiting device, which helps to bring the needle to rest promptly. The galvanometer scale has 30-mm divisions with zero center, is well lighted, the scale is uniform and the set well adapted for insulation measurements.

The batteries are of the regular commercial type in which the cell block can easily be removed by loosening four small screws in the bottom of the case without disturbing the rest of the set.

The set is 8.25 in. long by 5.5 in. high by 6.0 in. wide and weighs only 7.5 lb.

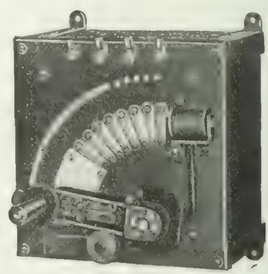
By means of the set the following tests can be made quickly and accurately: Measuring resistance by the Wheatstone bridge method; measuring insulation resistance by the direct-deflection method; comparing e.m.fs. by the fall-of-potential method; checking up voltmeters; measuring battery resistance; making the Murray-loop test; checking up ammeters by using a shunt of known resistance; making the Varley-loop test, and testing out grounds.

The above-described plug testing-set has been put upon the market by Thompson-Levering Company, 244 Arch Street, Philadelphia, Pa.

MOTOR SPEED-CONTROLLERS.

The speed-controlling rheostat shown in the accompanying illustration, and made by the General Electric Company, is so designed as to combine in a single box both armature and field regulating rheostats, and all speed changes are effected by movements of a single rheostat arm, which is automatically held in position by a mechanical device. The line includes rheostats designed for machine-tool service where full-load current is taken at the lower speeds in order that the motors may maintain a constant torque, and also for fan service, where the load increases with the speed. They permit of a 50 per cent reduction in speed by armature control and a 25 per cent increase by field control.

For protection from failure of voltage and the consequent danger of power being again thrown on the line without resistance in series with the motor armature, they are provided with a no-voltage release attachment. Upon failure of the voltage, the retaining magnet is demagnetized, releasing the arm, which is then instantly returned by a spring to the off position,



Motor Speed-Controller.

making it absolutely impossible to close the armature circuit without cutting in all the armature-controlling resistance. The no-voltage release coil is connected directly across the line in series with a resistance, and is thus independent of the current of the motor field and will protect any motor with which this rheostat may be used.

The contact segments, which are of liberal size, are so designed that they may be very easily and quickly renewed. The resistance units are of an improved design so constructed as to be non-fragile and thoroughly ventilated. Fig. 2 shows the rheostat described with the addition of an overload release coil.

NEW HEATING DEVICES.

The General Electric Company early realized that the success of heating devices would depend largely on the superior qualities of the resistor or heating element and the supervision of its manufacture. To meet this condition the resources and facilities of its research laboratories were called into requisition, and after an investigation of hundreds of combinations of metals, the discovery of a new alloy resulted. This alloy,

Fig. 1—Leaf Unit Flatiron.

which has been called "Calorite," has a high resistance, a high melting point and is non-oxidizing. It is ductile and malleable, but not in the least degree brittle. The design of the heating element is based on a careful consideration of thermal conductivity, convection and radiation, also of electrical and thermal insulation, of resultant temperature, and of heat storage.

Fig. 3—Celluloid Heater.

Following are some new heating devices in which the new alloy is used:

An 8-lb. leaf-unit electric flatiron, shown in Fig. 1, is the result of a systematic study of the requirements and the gradual evolution of a design which fulfills them. It is well suited for light, medium and heavy laundry purposes, and so will give excellent satisfaction in both domestic and commercial work. It is provided with a leaf-heating unit which is spread over a broad path around the edges of the bottom surface so that the heat is delivered most directly to the parts of the iron which first come in contact with the damp material. Rapid heating and ample heat storage have been combined in proper proportions to make a very efficient iron.

Three standard forms of connections are provided, the plain attachment plug, the indicating switch plug and the permanently attached cord. With light or medium work it is advantageous to control the heat regulation by turning the current on or off as required, depending upon the nature of the work. This may be most readily accomplished by means of the indicating switch attachment plug. For very wet or heavy goods it is generally necessary to keep the current on continuously. The plain attachment plug may be used where there is an occasional demand for continuous heat, as in the ordinary household. The flatiron with the permanently attached cord is especially recommended for laundries and similar establishments where controlling switches and pilot lamps are located conveniently near the ironing board.

The electric flatiron is made for one heat only. Wherever heat regulation is required it may be obtained by turning the current on or off from time to time, as previously referred to.

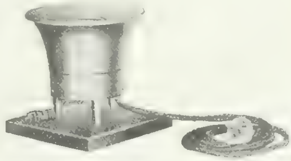


Fig. 2—Sealing Wax Heater.

About three minutes is required for the iron to heat up sufficiently for light work. These irons may be attached to any lighting circuit, either alternating or direct current, where the pressure does not exceed 125 volts, and consume 650 watts.

The electric sealing-wax heater, shown in Fig. 2, is designed for use in express offices, banks, shipping departments, stores and business establishments of all kinds where sealing wax is used for making seals, sealing packages, etc. It is fitted with a removable sheet-metal cover, the surface of which slopes downward to a center hole which provides access to the melted sealing wax. This feature of design also allows all drippings to drain back into the pot. This type of heater is most useful for continuous service where large quantities of sealing wax are required. It has a maximum capacity of 3 lb., and is arranged for three degrees of heat control, "Off," "Low," "Medium" and "High" points, consuming 65 watts, 100 watts and 200 watts respectively. The maximum heat is used for quick heating and the minimum heat then maintains a constant operating temperature.

The electric celluloid heater, shown in Fig. 3, is designed to meet the condition that since celluloid is molded while hot, the necessity of constant and exact temperatures is imperative in order to avoid accidents because of its inflammable nature. These requirements are claimed to be well-fulfilled by the 16-in. x 30-in. electric celluloid heater shown. By the use of

Fig. 4—Soldering Iron Heater.

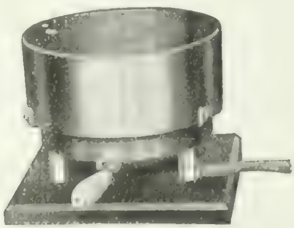


Fig. 5—Melting Pot.

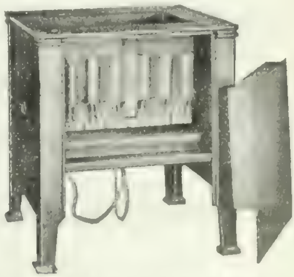


Fig. 6—Oil Tempering Bath

this device the product is made uniform in quality, as the same degree of heat is always produced and the work can be duplicated without variation. It is portable and can be easily installed wherever convenient. The heat is instantly available and readily controlled. It replaces high-pressure steam with its attendant danger of explosions, leaky pipes and transmission heat losses.

The standard electric celluloid heaters are available for

operation on 100-volt, 110-volt, 120-volt and 240-volt circuits. They have three degrees of heat regulation, consuming 90 watts, 225 watts and 450 watts respectively. The maximum heat is used for quick heating, as it requires only about 10 minutes to attain the proper temperature. The minimum heat then maintains a constant operating temperature of 150-165 deg. Fahr.

The electric soldering iron heater, shown in Fig. 4, is a new design, a novel feature of which is the use of a mass of molten

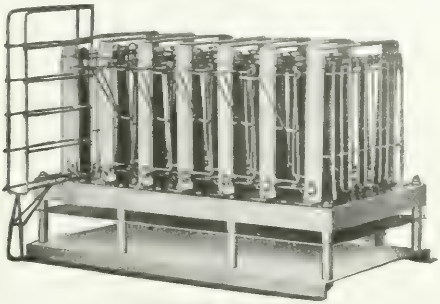


Fig. 7—Slice Toaster.

metal in which the soldering tool is immersed to be heated. Lead is the metal which is used for this purpose because of its low melting temperature and corresponding minimum length of time required for initial heating. The device consists of a small cast-metal pot of 2¾ lb. capacity, with an electric heating unit, and is furnished in two styles so that it can be inserted in the work bench, or, mounted on legs, can be used as a portable device. The employment of this device eliminates the fire risk attending the use of pots heated by other methods, and permits its use where pots heated by a naked flame are prohibited. No odors, soot, smoke, etc., attend the use of this iron heater.

Three degrees of heat-control, consuming 80 watts, 160 watts and 320 watts respectively are provided by means of the switch. The maximum heat is always used for first heat, the medium or minimum heats being then used to keep the contents in proper working condition. The device is supplied for operation on circuits of 100 volts, 110 volts, 120 volts, 220 volts and 240 volts.

The electric soldering pot, shown in Fig. 5, eliminates the use of coal, gas, gasoline, oil and other dangerous and unhealthful heat producers; it is clean, sanitary, without odor or fire risk, and very convenient, and the heat is very easily regulated so

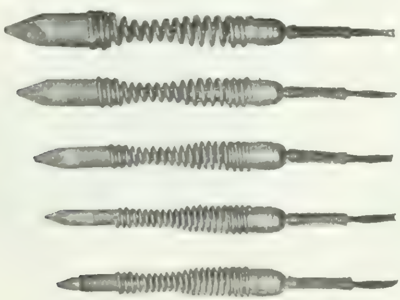


Fig. 8—Soldering Irons Without Guard Rings.

as to maintain the molten metal at the proper temperature for best results. It finds extensive application, being suitable for melting lead, solder, babbit metal, for tinning, dipping, and soldering wires and other small articles, for telephone manufacturing establishments, electrical repair shops, etc.

In construction it is a shallow circular vessel of cast iron, the cup being assembled on top of the heating disk. The heating unit is readily accessible. There are three degrees of heat regulation, consuming 200 watts, 400 watts and 600 watts respectively. This device is designed for attaching to electric circuits where the voltage is 100, 110 or 120, by means of a standard attaching plug.

The oil-tempering bath, shown in Fig. 6, enables the use of hardening and tempering processes which produce absolutely reliable results. The tempering process involves two steps, hardening and drawing. The first step consists in heating the steel to a temperature of from 600 deg. C. to 700 deg. C., depending on the amount of carbon in the steel, and then chilling it by plunging it into a cold bath. The temper of the tool is then "drawn" by heating it to a certain predetermined temperature, after which it is allowed to cool gradually. It has been customary for the workman to judge this temperature by the color assumed by the metal, which introduced the liability to error of judgment on the part of workmen. Realizing the shortcomings of this process, the General Electric Company has designed the device shown, which eliminates this uncertainty and ensures absolute uniformity in tempering. The steel is suspended in an oil bath, which is provided with a thermometer of precision for registering the temperature. The workman is supplied with a table of temperatures corresponding to certain degrees of hardness in the steel. He places the steel in the bath, brings the latter to the required temperature and maintains it as long as necessary. This device allows one person to temper a larger quantity of steel than is possible by other methods.

The six-slice toaster, shown in Fig. 7, has been designed especially for hotels and restaurants. The heating units consist of vertical coils such as are used in the two-slice toasters, and the toasting is similarly accomplished by means of radiant

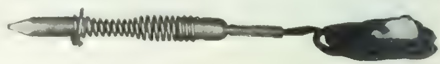


Fig. 9—Soldering Iron With Guard Ring.

heat. The maximum temperature is almost instantly available after the current is turned on. It is not necessary to turn the slices of bread, as the heat acts upon both sides of each slice at the same time, accomplishing the toasting of all simultaneously. The advantages of the radiant toaster in producing crisp, brown toast are already too well known to need further mention.

It has a maximum capacity of six slices, each slice being placed in a hinged wire rack, which is located between two rows of heating units. There are thus seven rows of heating units, each row consisting of four vertical heating elements and consuming 500 watts. These are in two sections of three and four rows each, either section of which may be operated alone or in conjunction with the other, so that two, three or six slices may be made at the same time. This toaster permits toast to be made as fast as one can put in and take out the slices; with it the chef can make six slices of toast per minute and the annoyance and expense of maintaining fires to supply an occasional demand for toast is eliminated. It is designed for attachment to lighting circuits by an indicating snap switch. Each toast rack has a wire handle projecting from the top edge which, when depressed, swings the rack upward and out from between the units.

In the electric soldering irons, shown in Figs. 8 and 9, all the heat is generated in the tip, where it is available for work. They require only a small current and little attention, and there is no accumulation of soot or burning off of the tin at the tip. Being furnished with flexible connectors, they are handy and portable. Work is therefore improved in quality and increased in quantity where the electrically heated irons are used. The irons of the different sizes consume 75 watts, 100 watts, 150 watts, 225 watts and 325 watts respectively. The irons shown in Fig. 8 are not provided with guard rings, while the one shown in Fig. 9 is so provided.

Industrial and Commercial News

THE WEEK IN TRADE.

FINANCIAL papers view the present situation with a better feeling than records for the month would appear to warrant. Crop prospects are brighter than anticipated and while the official reports show a probable harvest of wheat under the average of recent years, very large crops of oats and corn are indicated which go far toward counterbalancing reduction in other crops. Purchases in nearly all important branches of trade are still conducted on a conservative basis. operations for immediate needs being more important than for future requirements. The news of general merchandising over the country average up more cheerfully than for some time and manufacturers apparently are warranted in the belief that there is an increase of trade in sight. In the East there is a better feeling and more business; the South is cheerful and even in the West there seems to be little worry about the Fall, only a disposition to wait a little longer is apparent. The Eastern banking market is pessimistic and is even charged with holding back accommodation to business. The bank clearings outside of New York compared with last year's show a normal downward swing; but with larger totals than last year. The advance of the Fall season has benefitted wholesale and jobbing trade; but there are feelings of disappointment visible in some lines. The steel trade's output is not up to the capacity of the mills, and one of the car manufacturers was quoted as saying that the car business is at a complete standstill. This state of affairs is attributed to the poor investment market conditions. The improvement in monetary conditions is marked. The Clearing-House banks of New York have accumulated a surplus well over $50,000,000 which is quite large for this time of year. Collections are still only about fair. Money has been easy for call loans; but time money displays all its previous firmness. Business failures for the week ending Aug. 11 as reported by *Bradstreets'* were 231 against 166 last week, 219 in the like week of 1909, 249 in 1908, 146 in 1907 and 143 in 1906.

THE COPPER MARKET.

DURING the past week there was an increased demand for copper with lake at 13 cents and electrolytic three-eighths of a cent less. A number of producers announced during the week that they would turn out less than the average amount of the metal in addition to those concerns that had already curtailed their outputs; but the full effects of the curtailment are not likely to be shown for two or three months to come. The increase in the surplus since the first of the year has been at the rate of about 1,000,000 lb. per month and there is a belief that with the revival of business the consumption of copper will absorb all that can be produced next year. So long as the hand-to-mouth policy of buying prevails, rapid fluctuations in the price of the metal will not obtain, and the market will remain quite steady. The copper share market which was quite dull exhibited a quick upward turn with the publication of the Copper Producers' statement; but this upward movement continued only two days. Consumers purchased a little more freely of electrolytic and lake copper; both on domestic account and for export. The total sales for the week were estimated at 15,000,000 lb., the deliveries extending from August to November inclusive. The advance in copper abroad was one pound sterling for standard, while electrolytic advanced 10 shillings. In the domestic market the advance was about one-eighth cent per pound; but there was some reaction at the end of the week. Amalgamated interests are still offering electrolytic in Europe at 58 pounds sterling which is equivalent to a little less than 12.5 cents f. o. b., New York. Independent interests are offering electrolytic at 12.575 cents to 12.625 cents delivered 30 days, 12.5 cents cash New York or slightly under. The exports of copper during the month of July, according to the Metal Exchange report, including all ports, was 23,018 tons, and for the first seven months of this year 152,242 tons. During July last year the total exports were 35,046 tons, and for the first seven months of 1909 aggregated 182,526 tons. But according to Copper Producers' statement, the July exports this year were 26,521 tons. Since the first of August the exports, according to the Metal Exchange, have been 11,888 tons, of which 9,634 tons has already been reported exported in the July statement of the Copper Producers' Association. Imports since the first of August have been 2900 tons, 350 tons of matte and 3540 tons of ores. Daily call on the Metal Exchange, Aug. 15, quoted standard copper as per the accompanying table.

STANDARD COPPER

	Bid.	Asked.	Settling price
Spot	[illegible]	12.5[illegible]	....
August	12.20	12.50	12.35
September	[illegible]	[illegible]	12.35
October	[illegible]	[illegible]	12.35
November	[illegible]	[illegible]	12.3[illegible]

The London market Aug. 15 was as follows:

	Highest. £ s d	Lowest. £ s d
Standard copper, spot	56 3 9	55 15 0
Standard copper, futures	57 0 0	56 10 0

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.7[illegible]c
London, spot	£62 0 0	£52 15 0
London, futures	65 18 9	53 7 6
London, best selected	65 10 0	57 15 0

INDUSTRIAL AND COMMERCIAL NOTES.

Rio de Janeiro's New Electric Company.—The Electrical Power Company of Brazil has signed a contract with the Federal District of Rio de Janeiro for the installation in the streets of that city and in the rural zone of canalizations, for the supply of electrical energy in general. The contract is for a term of 90 years and provides that service shall begin June 7, 1915, with the provision that electricity not of hydraulic generation may be supplied earlier than that date, if the company's works are by that time completed. The concession is granted according to the contract under the condition that the rights of third parties must be considered, especially the privileges enjoyed by the Rio de Janeiro Tramway, Light & Power Company, Ltd. The company will get the same technical conditions from the Federal community as granted to the present company and will be permitted to install its own canalization providing no damage is done to the property of the tramway company. The Electrical Power Company of Brazil will grant a 20 per cent rebate on electrical energy needed by the municipality. The company at present has a water power plant about 100 miles from Rio de Janeiro and for some time past has been trying to obtain a foothold in Rio de Janeiro.

Penn Central Light & Power Plans New Plant.—What will probably be the largest electric lighting plant in Pennsylvania outside of Philadelphia and Pittsburgh is being planned by the Penn Central Light & Power Company for Altoona, Pa. The exact location of the station has not yet been selected; but it is announced that the buildings will be in Altoona or adjacent to it and that an order for a portion of the equipment has already been placed. The Penn Central Light & Power Company in consolidating the old stations of the Edison Electric Illuminating Company and the Citizens Electric Light, Heat & Power Company of Altoona found that the equipment of the two companies was not only inadequate but unsuited to the needs of a modern station. Since the company has taken over the properties the business increase has made new construction imperative. A 3000-hp Curtis unit has already been ordered from the General Electric Company.

Canadian Steam-Heating Plant.—Operations have been commenced on a new steam heating plant of the Brandon Electric Company of Brandon, Manitoba, Canada. This will be the first venture of its kind in the Canadian West and considerable interest is evinced in utility circles in that section over the project. The agreement between the company and the City Council dealing with the granting of powers to the company to construct and operate a public steam heating plant specifies the rates to be $1 per 1000 lb. of condensation on a monthly consumption up to 10,000 lb. with a graduated reduction to consumers using an excess of 10,000 lb. per month. The minimum charge per month is to be $3 net.

Allis-Chalmers Business.—The bookings of the Allis-Chalmers Company for the month just closed are stated to be the largest yet recorded for July, while the June record, with the exception of the year 1906, was also the best for that period. Operations are said to be now from 10 to 15 per cent above the level at this season in 1907; but the average for the fiscal year ending June 30, however, was about 15 per cent less than three years ago. Of recent orders received by the company the most important were for steam turbines as follows: Mexico Northwestern Railway Company, three 1500-hp units; The Flatbush Gas Company, of Brooklyn, one 3000-hp unit; the Houston Light, Heat & Power Company of Houston, Tex., one 4000-hp turbine set; and the Firestone Tire & Rubber Company, one 2000-hp turbine and a large quantity of electrical machinery.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Hudson, Wis.; Frankstown, Pa.; Tellico Plains, Tenn.; Tacoma, Wash.; Redmond, Ore.; Princeton, Minn.; Kingfisher, Okla.; Thibodaux, La.; East Troy, Wis.; Fairview, Okla.; Coleman, Tex.; Cottonwood, Idaho; Vancouver, B. C., Can.; Fargo, N. D.; Cambridge City, Ind.; McPherson, Kan.; Franklin, N. H.; Sylvan Beach, N. Y.; Frederick, Md.; Columbia, Mo.; Wamego, Kan.; Medicine Hat, Alta., Can.; Clearwater, Fla.; Athens, Ohio; Middletown, Ind., and Buffalo, N. Y.

Electric Road to Connect Helena with Butte.—It has been authoritatively announced that former Senator Clark has subscribed $3,000,000 of the proposed bond issue of the Helena & Butte Electric Line, construction work on which is to begin this fall. The line will be 75 miles long and will cross the main divide of the Rocky Mountains. Energy for operating it will be generated in a water power plant on the Missouri River near Helena and in addition to furnishing transportation between the two cities, the road will supply transportation facilities to a number of mining districts whose operations have been retarded by lack of it.

Large Westinghouse Order.—The Mexican-Northwestern Railway Company, of 25 Broad Street, New York City, has recently placed a large order for motors with the Westinghouse Electric & Manufacturing Company. The order includes 168 induction motors, aggregating 3736 hp, ranging in rating from 3 hp to 200 hp. These motors will be shipped to the company's property at Madera, Chihuahua, Mex., to be used in the operation of the saw and planing mills.

New Traction System in Oklahoma.—A State charter has been granted to the Oklahoma Public Service & Interurban Lines, a corporation which intends to build and maintain steam and electric railroads in Oklahoma and Kansas. The total estimated cost of the proposed system is $6,000,000 and the company is capitalized at $100,000. Among the directors are Messrs. L. L. Brullard, A. C. Lampke, G. W. Tucker and H. C. Lytle of New York

General Electric Sales to Southern Pacific.—The General Electric Company has sold to the Southern Pacific Railroad Company 12 four-motor, 75-hp equipments; six 500-kw motor-generator sets and one 300-kw motor-generator set. This new apparatus is intended for the Oakland substation. A large portion of the energy of this station is received from the Great Western Power Company.

Consumers' Electrical Company, of Wheeling.—The Consumers Electrical Company, of Wheeling, has engaged engineers to plan its electrical station, the cost of which is estimated to be from $[illegible] to $[illegible]

Financial.

THE WEEK IN WALL STREET.

OPINIONS regarding the future of the stock market are widely divergent. Cross-currents in finance and trade explain the conservatism with which the underlying optimism of the financial community is just now strongly tempered. The Government's crop report, the statement of the Copper Producers' Association and the success of bankers in securing gold abroad without real competition were all cheering. Against these were the first monthly report of the Steel Corporation on unfilled tonnage showing at the close of July a decrease of 286,000 tons in orders as compared with the figures for the end of June; the July statement of our exports of domestic products putting the total at only $30,063,000, a loss of $14,000,000 as compared with June, and $6,300,000 as compared with July a year ago, shipments as a whole falling below any July return since 1904, and the unbroken drought over a large section of the Texas cotton belt forcing reductions of earlier estimates and leading directly to much higher prices for all options in the cotton market. Wall Street, however, is not alarmed because the steel trade is going through a period of reaction and is taking a hopeful view of the year's harvests. It also feels better over the copper market outlook. Contributing factors to the poor showing of steel are a decline of 26 per cent in building permits throughout the country and the economies which the railroads are putting into effect everywhere while awaiting the decision of the Interstate Commerce Commission on the appeal for higher transportation rates. According to one authority the conditions now surrounding the railroad operations in the country present an element of uncertainty and apprehension. Many conservative interests say they cannot become enthusiastic over the stock market so long as the political situation is susceptible of so many radical changes as they now believe possible. Money is still piling up in bank vaults and quotations Aug. 15 were: call, 1½ @ 1¾ per cent; 90 days, 4¼ per cent. The quotations in the table are those at the close of Aug. 15.

NEW YORK.

	Aug. 8.	Aug. 15.	Shares sold.		Aug. 8.	Aug. 15.	Shares sold
[illegible]	8	9¼	400	Int.-Met., pfd.	46⅞	37¼	8,780
All. Ch., pfd.	28	35	[illegible]	Mackay Cos.	84	85¼	200
Amal. Cop.	64	65⅝	137,900	Mackay Co., pf.	71	72¼	100
Am. D. T.	15	15	——	Man. Elev.	127	128	5
Am. Loc.	36	37	2,600	Met. St. Ry.	——	——	——
Am. Loco., pf.	103	104	200	N.Y.&N.J. Tel.	——	——	——
Am. Tel. & C.	71	71	——	Steel, com.	68⅞	70½	475,2[illegible]
Am. T. & T.	132	135	5,545	Steel, pfd.	114¾	116	6,700
B. R. T.	75	76½	25,675	W. U. T.	64¾	63	1,135
Gen. Elec.	141⅞	143	15,100	West'h., com.	50	58	1,000
Int. Met.	17	17	——	West'h., pfd.	115	110	——

PHILADELPHIA.

	Aug. 8.	Aug. 15.		Aug. 8.	Aug. 15.
Am. Rys.	42½	41	Phila. Elec.	14⅝	15⅝
Elec. Co. of A.	11⅜	11⅜	Phila. R. T.	19⅛	19½
Elec. St. B'ty.	47¾	49	Phila. Trac.	82½	——
E. S. B'ty, pfd.	——	——	Union Trac.	44	45⅛

CHICAGO.

	Aug. 8.	Aug. 15.		Aug. 8.	Aug. 15.
Chi. City Ry.	——	——	Chi. Tel. Co.	115	118
Chi. Rs., Ser. 1	60	70	Met. El. Co.	15	——
Chi. Rs., Ser. 2	15	16½	Met. El., pfd.	60	——
Com. Edison	111	110	Nat'l Carbon	115½	——
Chi. Subways	2⅝	6	Nat'l Car., pfd.	115½	117

BOSTON.

	Aug. 8.	Aug. 15.		Aug. 8.	Aug. 15.
Am. T. & T.	132¼	133¾	Mex. Tel.	5¼	5⅞
Cum. Tel.	139⅛	——	Mex. Tel., pfd.	——	6¼
Edison E., Ill.	255	257	N. E. Tel.	130½	130
Gen. Elec.	142⅜	144	W. T. & T.	15	15
Mass. E. Ry.	15½	16¼	W. T. & T., pfd.	85	84
Mass. E. Ry., pfd.	81	81½			

*Last price quoted.
Shares sold for six days, Aug. 8 to Aug. 13.

FINANCIAL NOTES.

Ontario Power Leases Transmission Company.—The Ontario Power Company, of Niagara Falls, N. Y., which owns $1,000,000 capital stock of the Ontario Transmission Company and guarantees its bonds, has leased under agreement dated April 20, 1910, the properties, franchises and future undertakings of the latter company from May 1, 1910, to April 1, 1950. The agreement embodies the privilege and option to acquire and purchase at any time after the bonds of the transmission company, issued or to be issued, have been bought and retired by the power company. A clause in the agreement provides that should the power company not exercise its option during the life of the present lease the transmission company will grant it a renewal lease for a further term of 40 years under like terms as to rent and with a like option as to purchase. The power company agrees to pay to the transmission company by way of rent the sum of $2.50 per annum for each electrical horse-power transmitted over the transmission company's lines, and stipulates that payments in any year shall not be less than the amount required by the transmission company to pay interest on such of its bonds as are outstanding, or to pay its taxes, administrative and operating expenses. The Ontario Power Company has $5,621,000 capital stock outstanding, $5,768,000 first mortgage fives, and $3,100,000 debenture fives. The transmission company's capitalization consists of $1,000,000 capital stock and $1,466,000 first mortgage fives. For the year ending June 30, 1910, the combined earnings of the two companies show gross receipts from the sale of energy of $704,000, an increase over [illegible] per cent The net earnings show an in-

crease of over 200 per cent. The surplus after charges were paid was $118,873, as [illegible] $[illegible]28,-020 last year. In the figures for 1909 appears a deduction of $134,657 on account of flood damages, and excluding these deductions the improvement in surplus amounted to $112,236. The company's sale of energy now aggregates 61,500 horse-power per month, and installations now in progress will increase this output to 82,000 horse-power per month before the end of the year. The second conduit is now practically completed, and the eighth generating unit will be in service by September, and the power house for units 9 and 10 will be completed during the autumn. The secretary of the company states that the output of these additional units will be called for under existing contracts as soon as they are installed. The company's head works are equipped for an ultimate capacity of 200,000 horse-power.

Increase in Western Union Gross Earnings.—For the fiscal year ended June 30 Western Union gross receipts were approximately $33,000,000, which is an increase of almost $3,000,-000 or 10 per cent over the previous year. This is stated to be the biggest aggregate of income that the company has ever piled up in a single 12 months and coming as it does when American Telephone control is but nine months old is looked upon with pleasure. The net earnings however will not vary materially from the previous year and may be approximated at $5,800,000 or 5.8 per cent on the $100,000,000 capital stock. The company is endeavoring to popularize the use of the telegraph so that hundreds of thousands of miles of wire in use but 33 per cent of the time may be made to become producers of revenue two-thirds to three-quarters of the time. The night letter service recently inaugurated is producing between 20,000 and 25,000 daily messages which are handled, practically speaking, at the cost of the paper and ink required for the writing and transmission of the messages. An official of the company is quoted as saying that so far as financial results of the night letter messages are concerned, the company has not had an opportunity yet to demonstrate exactly what they may be. The financial results according to this official are but secondary to the effort of the company to determine whether the service meets a real and growing demand of the people and if so, he believes, the company may be able to offer further advantages along similar lines.

American Telegraph & Telephone Company Finances Construction Out of Earnings.—During the first six months of the current year the American Telegraph & Telephone Company has demonstrated its ability to finance 80 per cent of its construction requirements out of earnings. The management is confident that during the second half of the year a still better record will obtain, and that by 1911 the company will easily pay for 95 per cent of new construction out of current earnings. During the first six months of the current year the American Telegraph & Telephone Company gained 308,000 stations, including those of Bell lines proper and connected licensees or affiliated independent stations. This is at the rate of 616,000 per annum compared with a total increase in stations last year of 778,000. This decrease in the face of the fact that the company is spending this year at the rate of $28,000,000 per annum in new construction compared with $28,000,000 in 1909, is explained as follows: Last year the company connected with 405,061 sublicensees of independent telephone stations. In the first six months of this year there were only 73,000, or at the rate of 146,000 per annum. At the same time the increase in Bell stations proper was 234,935, as against 167,691 for the six months ending June 30 last. This means that the gain in stations of the Bell lines proper upon which only American Telephone money is spent is running at a rate 40 per cent greater than in 1909.

United Service Company.—A new holding company, known as the United Service Company, was incorporated by Messrs. Brooks & Company, of Scranton, Pa., under the laws of the State of Delaware on June 25, 1910. The company has an authorized capital stock of $2,500,000 in $50 shares, consisting of $1,000,000 preferred and $1,500,000 common. Of this, $183,-000 of preferred and $375,000 of common stock will be issued. No new bonds will be floated, and the only underlying bonds in the hands of the public aggregate $127,000. The following properties are among those already operated or financed by the United Service Company: Tuscarawas County Electric Light & Power Company, serving New Philadelphia and Canal Dover, Ohio; New Philadelphia Heating Company, United Electric Company, serving Denison, Ohio, and Urichsville Street Railway Company, connecting these towns. The office of the company is in the Traders' Bank Building, in Scranton, and the officers are as follows: President, Thomas R. Brooks; vice-president, L. H. Conklin, recently manager of the Scranton Electric Company; secretary-treasurer, G. G. Brooks. The directors include Messrs. Thomas R. Brooks, A. H. Stores, C. F. Conn, F. J. Platt, G. G. Brooks, F. L. Smith, M. J. Murphy and W. N. Pyle.

Detroit Edison Company Bonds.—Messrs. Spencer, Trask & Company, New York City, are offering at a price to yield about 5¼ per cent income a portion of the present issue of $1,500,000 10-year, convertible debenture, 6 per cent gold bonds of the Detroit Edison Company dated April 1, 1910, and due April 1, 1920; the bonds convertible between April 1, 1912, and April 1, 1918, into capital stock of the company at par, and redeemable on or after April 1, 1915, at 105 and interest, upon 60 days' notice. Until April 1, 1918,, if called for redemption, bonds may be converted into stock at any time before date named for redemption. These convertible debenture bonds are a direct obligation of the company and were issued to provide for the extension of its generating plants and distributing systems. The company does all the commercial lighting and industrial power business in the city of Detroit, and the present total capacity of its station is 45,300 horse-power. During the year the total effective capacity of both stations will be brought up to 64,000 horse-power. The Detroit Edison Company owns the controlling capital stock of the East Michigan Edison Company, and the latter in turn owns all of the securities of the Washtenaw Light & Power Company, except the outstanding $129,000 first mortgage 5 per cent bonds due Aug. 1, 1930.

Toronto Electric Light Company.—The report of the president of the Toronto Electric Light Company, Ltd., for the fiscal year ending Dec. 31, 1909, shows gross receipts from all sources of $1,292,545, an increase over last year of $136,963. The operating expenses, including interest on bonds, amounted to $761,838, leaving a balance of $530,707. Of this $315,404 has been paid out in dividends, leaving a balance of $215,213, of which $200,000 has been transferred to the reserve fund bringing that account up to $1,000,000, and the balance of $15,213 carried to the credit of profit and loss. Despite the increase in the market value of material and labor, the percentage of operating expense, including taxes to gross receipts, has been only 55.4 per cent, as against 58 per cent for the previous year. Records of installed load on the company's system to the end of the year show an equivalent of 779,263 16-cp lamps. This includes both the lighting and motor circuits of the company. The number of customers has been increased during the year by 2323, making the total number to the end of the year 12,717, with 14,931 meters installed.

The Consolidated Gas Company of New York Pays Notes.—The $5,000,000 4 per cent notes of the Consolidated Gas Company, of New York, due Aug. 10, which were placed by Messrs. N. W. Harris & Company a year ago, are being paid off at the Farmers' Loan & Trust Company. It is said that the company has arranged with one or more banks for a new one-year loan of $5,000,000 due August, 1911, the Farmers' Loan & Trust Company and two private parties having been appointed trustees for a new note issue secured by the same collateral as the old note issue; that is, $6,250,000 New York Edison Company stock. It is doubtful if any of the new notes will be offered to the public.

Brooklyn Edison Earnings.—The July statement of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn has just been issued and shows gross receipts for the month of $341,590 as compared with $300,068 for the same month a year ago. The operating expenses were $170,765 leaving net earnings for the month of $170,825. The gross receipts for the seven months of the year total $2,448,650 and the operating expenses $1,167,877 leaving net earnings for the seven months of $1,280,773, an increase of $164,523 over the net income for the similar seven months last year.

Burlington County Traction Company.—The New Jersey Public Utilities Commission on Aug. 8 refused to approve an issue of $166,250 bonds of the newly reorganized Burlington County Traction Company, [illegible] that the road was sold under foreclosure for only $120,000, and that while a fair value of the property purchased undoubtedly exceeds the latter figure, the capital stock issued to purchasers must be limited to that sum. Later the Burlington County Traction Company requested the approval of the commission on an issue of $120,000 bonds in compliance with its decision, which approval was granted.

Boston Edison Earnings Show Gain.—The July statement of the earnings of the Edison Electric Illuminating Company of Boston indicates the company's growth and also reflects the wisdom of purchasing nearly a year ago the electrical properties in Newton, Chelsea, Watertown, Brookline, Brighton and Waltham. When the properties were taken over it was expected that the operating expenses would be heavy until the Edison Company could obtain the full benefits of the plants it had built to replace those purchased. The most important of these old plants, that at Brookline, was replaced by a new station on May 15, and the plants at Waltham and Lexington were completed about Feb. 1, since which time they have been in operation and giving good service. The gross earnings of the company for July show an increase of more than 21 per cent as compared with the corresponding month last year. The operating expenses were maintained at a ratio less than 47 per cent and the net earnings increased over 38 per cent. The gross earnings for the past four months were $1,443,445; the operating expenses $654,732, and the net earnings $788,712. On this basis of earnings and with the present rate of business maintained, the fiscal year 1911 promises to be a record one. The gross earnings are estimated at $4,300,000; operating expenses $2,000,000 and net earnings $2,300,000. The present market price of Edison stock is $256.

Montreal Railway & Power Merger.—It is reported that the Canadian Power Company is now in control of the Montreal Street Railway Company. It is said that interests friendly to the movement to merge the companies have recently acquired over 30,000 shares of street railway stock which with previous holdings is enough to give them control. The likely merger proposal will consist of an offer to exchange Street Railway at 250 and Canadian Power at 150 for securities of the holding company which will in turn endeavor to place low yield debentures in London.

Mexican Power Company.—At the annual meeting of the Mexican Power Company the managing director explained that the storage capacity of the Mexican Light & Power Company, Ltd., had been extended and that at the present time the company had over 20,000,000 cu. m. of water in storage. Mr. H. M. Hubbard of London was added to the list of directors and at a subsequent meeting of that body Dr. F. S. Pearson of New York was re-elected president and Messrs. Miller Lash and Walter Gow of Toronto, vice-presidents.

General Chemical Company Issues Additional Preferred Stock.—At a special meeting of the stockholders of the General Chemical Company an additional $2,500,000 6 per cent cumulative preferred stock was authorized; increasing the capital of the company to $27,000,000 of which $12,500,000 is common.

Vulcan Electric Heating Company Increases Capital.—The Vulcan Electric Heating Company, 540 West Jackson Boulevard, Chicago, has increased its capital stock from $100,000 to $125,000.

DIVIDENDS.

Laclede Gas Light Company, of St. Louis, Mo., quarterly 1¾ per cent, payable Sept. 15.

Pacific Gas & Electric Company, San Francisco, Cal., quarterly, $1.50 per share, payable Aug. 1.

Philadelphia Electric Company, quarterly, 1.5 per cent, payable Sept. 15.

General Electric Company, quarterly, 2 per cent, payable Oct. 15.

El Paso Electric Company, $2 per share, payable Sept. 15.

Galveston-Houston Electric Company, semi-annual, $3 per share preferred; $1.50 per share common, payable Sept. 15.

American Telegraph & Cable Company, quarterly, 1¼ per cent, payable Sept. 1.

Northern Texas Electric Company, $3 per share preferred; $1.25 per share common, payable Sept. 1.

REPORT OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Baton Rouge (La.) Electric Company.					
June, 1910	$8,942.13	$5,824.53	$3,117.60	$1,944.82	$1,172.78
June, 1909	7,747.93	6,171.24	1,576.69	1,223.38	353.31
Blackstone Valley Gas & Electric Company:					
June, 1910	78,078.65	38,472.10	39,606.55	29,290.76	10,315.79
June, 1909	72,262.56	38,914.13	33,348.43	29,811.47	4,536.96
Columbus (Ga.) Electric Company:					
June, 1910	37,294.67	17,859.32	19,435.35	17,615.15	1,820.20
June, 1909	30,910.85	18,011.84	12,899.01	12,837.59	61.42
Dallas Electric Corporation:					
June, 1910	114,514.11	81,445.06	33,069.05	26,604.64	6,464.41
June, 1909	103,593.44	67,710.61	35,882.83	28,832.55	7,050.28
Edison Electric Illuminating Company of Brockton:					
June, 1910	21,948.66	12,585.63	9,363.03	3,787.12	5,575.91
June, 1909	18,201.35	10,243.04	7,958.31	3,314.58	4,643.73
Electric Light & Power Company of Abington & Rockland:					
June, 1910	7,537.08	5,186.57	2,350.41	799.21	1,551.20
June, 1909	4,458.86	3,023.96	1,434.90	375.35	1,059.55
El Paso Electric Company:					
June, 1910	45,223.97	27,409.27	17,814.70	8,195.19	9,619.51
June, 1909	47,075.32	27,700.63	19,374.69	7,942.61	11,432.08
Galveston-Houston Electric Company:					
June, 1910	109,083.15	67,027.45	42,055.70	17,629.20	24,326.50
June, 1909	105,802.81	57,805.87	47,996.94	21,418.46	26,578.48
Houghton County Electric Light Company:					
June, 1910	18,289.74	11,065.83	7,223.91	4,333.34	2,890.57
June, 1909	17,055.83	9,421.08	7,634.75	4,129.17	3,505.58
Jacksonville Electric Company:					
June, 1910	46,408.79	24,592.32	21,816.47	9,344.31	12,472.16
June, 1909	38,391.40	21,447.08	16,944.32	9,288.18	7,656.14
Lowell Electric Light Corporation:					
June, 1910	33,093.19	19,196.61	13,896.58	4,561.99	9,334.59
June, 1909	25,694.13	16,014.32	9,679.81	4,135.15	5,544.66
Minneapolis General Electric Company:					
June, 1910	93,049.59	38,475.08	54,574.51	30,724.17	23,850.34
June, 1909	82,416.36	37,855.03	44,561.33	29,546.79	15,014.54
Paducah Traction & Light Company:					
June, 1910	19,739.90	11,685.10	8,054.80	6,989.32	1,065.48
June, 1909	18,101.20	10,613.50	7,487.70	6,631.21	856.49
Pensacola Electric Company:					
June, 1910	21,762.84	12,807.55	8,955.20	5,052.73	3,902.56
June, 1909	20,126.06	11,291.60	8,834.46	4,263.20	4,571.26
Savannah Electric Company:					
June, 1910	53,609.91	35,595.76	18,014.15	18,007.62	6.53
June, 1909	52,134.13	33,385.93	18,748.20	17,342.84	1,405.36
Seattle Electric Company					
June, 1910	447,675.63	261,337.00	186,338.63	109,704.34	76,634.29
June, 1909	522,469.76	313,013.80	209,455.96	105,092.71	104,363.25
Tampa Electric Company:					
June, 1910	49,895.28	29,308.18	20,587.10	4,533.01	16,054.09
June, 1909	46,638.69	28,473.34	18,165.35	4,708.74	13,456.61
Whatcom County Railway & Light Company:					
June, 1910	30,460.29	18,219.92	12,240.37	8,472.71	3,767.66
June, 1909	30,605.38	18,039.41	12,565.97	8,085.37	4,480.60
Cape Breton Electric Company, Ltd.:					
June, 1910	25,754.77	14,989.72	10,765.05	6,143.70	4,621.35
June, 1909	22,788.19	15,022.51	7,765.68	6,143.94	1,621.74
Northern Texas Electric Company:					
June, 1910	120,964.04	64,700.85	56,263.19	20,161.82	36,101.37
June, 1909	103,307.99	57,027.72	46,280.27	17,189.60	29,090.67
Sierra Pacific Electric Company.					
June, 1910	44,518.81	14,544.41	29,974.40	5,640.17	24,334.23
June, 1909	42,719.01	15,657.59	27,061.42	6,110.04	20,951.38

General News

Construction News.

CARBON HILL, ALA.—A 35-kw, 2300-volt, three-phase, direct-connected unit is being installed in the municipal electric light plant. Fifty 250-watt street series lamps were recently put in service. O. P. Ivie is superintendent of the water and light plant.

HELENA, ARK.—The Helena Gas Company has recently made extensive additions to its power plant, including the installation of a 20-in. x 42-in. Wisconsin-Corliss engine, one 300-kw, single-phase alternator and two generating units for railway service, with rating of 100-kw and 150-kw respectively, which will supply electricity to operate the system of the Interurban Railway Company recently built. Water-gas machinery is being installed in the gas plant; the manufacture of coal gas will be discontinued. W. J. O'Brien is general superintendent.

HOT SPRINGS, ARK.—Bids will be received by Major G. D. Deahon, Quartermaster, U. S. A., until Sept. 10 for furnishing and installing one triple motor-driven pump and two motors, one alternating and one direct current.

PINE BLUFF, ARK.—The Citizens Light & Traction Company is reported to be contemplating the rebuilding of its street railway in Pine Bluff.

HEMET, CAL.—It is reported that preparations are being made for the construction of a large reservoir and hydroelectric power plant to supply electricity for the proposed electric railway and for the city of Hemet.

LODI, CAL.—The Board of Trustees is contemplating the installation of a series luminous arc lamp circuit in the business district of the town and possibly a series tungsten circuit in the residence section. John C. Henning is superintendent of the water and light department.

ONTARIO, CAL.—Preparations are being made by the Ontario & San Antonio Heights Railroad Company for building a double-track railway from Pomona to Ontario and Upland, via Claremont, a distance of seven miles.

POMONA, CAL.—All rights of way have been practically secured for the proposed electric railway between Claremont and Pomona.

QUINCY, CAL.—Notice of appropriation of 50,000 cu. in. of water of Juniper Lake has been filed by Aleward D. Thorne, 403 Fillmore Street, San Francisco, Cal., with the county recorder. The water is to be used for power, mining, irrigation and domestic purposes.

RICHMOND, CAL.—The Richmond Light & Power Company has applied to the Board of Supervisors of Contra Costa County for a franchise to construct and operate transmission lines over the roads and highways of the county for the distribution of electricity for lamps and motors. Sealed bids will be received by the Board of Supervisors for the above franchise until Sept. 6.

SAN ANDREAS, CAL.—Plans are being prepared by the General Electric Power Company for the development of the power sites and water rights owned by the company. It is estimated that 60,000 hp can be developed. Le Grand Brown, of New York, N. Y., is consulting engineer.

SAN BERNARDINO, CAL.—The City Council has declared in favor of a municipal lighting plant. A committee, consisting of Councilmen Oweger, Irving and Holmes, has been appointed by the mayor to look into the matter.

SAN FRANCISCO, CAL.—Orders have been placed by Atchison, Topeka & Santa Fé Railroad Company for apparatus to equip 460 miles of its railroad with telephones for train dispatching. At present the company has 2275 miles of its system equipped with telephones for dispatching trains.

SAN FRANCISCO, CAL.—Orders have been given by the Federal agents to stop the work of the Hydro-Electric Company now in progress near Bodie. The company is erecting a hydroelectric power plant for the purpose of furnishing electricity to the mines. The company attempted to run its transmission lines across a portion of the Mono national forest without securing the consent of the Government. The company insists that it is within the law and intends to proceed accordingly. William H. Metson, of San Francisco, Cal., is interested in the project.

STOCKTON, CAL.—The Stockton Gas & Electric Company has filed application in the superior court for dissolution of the corporation.

STOCKTON, CAL.—The Board of Supervisors of San Joaquin County has instructed Frank C. Quaill, county engineer, to prepare plans and estimates of costs for the installation of an electric light plant to supply electricity to light the court house and jail.

WHITTIER, CAL.—The committee appointed by the Board of Trustees to make investigations in regard to establishing a municipal electric light plant has submitted a report prepared by C. W. Koiner, general manager of the Pasadena municipal plant, which estimates that a generating and distributing plant could be built in W[illegible] a [illegible] of $[illegible], and could furnish electricity at the rate of 9 cents per kw-hour. The plans provide for a duplicate generating plant. In the meantime the Southern California Edison Company has offered to reduce the rate for electricity for lamps from 12½ cents per kw-hour to 10 cents per kw-hour and to make all renewals with "gem" lamps, which will make a reduction of about 25 per cent in the service. The committee has reported to the Board of Trustees that it would be advisable to accept the reduced rate offered by the company in preference to building a municipal plant at this time.

WOODLEAF, CAL.—The Forbestown Ditch Company is reported to be contemplating the installation of an electric plant in Woodleaf.

BOULDER, COL.—The large power plant of the Central Colorado Power Company, located in the Middle Boulder Canyon, was put into operation Aug. 4. The plant has been in the course of construction about 3½ years and cost about $2,500,000. G. H. Walbridge, of New York, N. Y., is general manager.

GOLDEN, COL.—Surveys have been completed for the construction of an electric railway for the Golden smelter of the North American Smelting & Mines Company, to connect the plant in this place with the lime quarries, located 6 miles north of Golden. About 2 miles of track will be built to a junction with the Colorado & Southern at the pressed brick works, from which point the cars will be hauled to the smelter by the engines of the Colorado & Southern.

BRISTOL, CONN.—Plans are being prepared by the C. G. Garrigus Machine Company, of Bristol, Conn., for the construction of a new power house and equip its works for electrical operation. The plant will have an output of 100 hp.

NORWICH, CONN.—Preliminary arrangements have been nearly completed by the Norwich, Colchester & Hartford Traction Company for the construction of its proposed interurban railway, work on which will begin in the near future. It is expected to have 10 miles completed before the first of the year.

WATERBURY, CONN.—The stockholders of the Waterbury & Milldale Tramway Company have voted to issue capital stock to the amount of $150,000. The company proposes to build an electric railway from Waterbury to Milldale, for which practically all of the right of way has been secured. Charles H. Clark, of Milldale, Conn., is president.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 30 for furnishing at the various navy yards and naval stations the following supplies: Las Animas, Col., Schedule 2808—cross-arms, pins and 10,000 ft. bare copper wire, etc. Schedule 2792—11 sets 5-kw turbo-generator sets and accessories to be delivered at various navy yards.

CLEARWATER, FLA.—Bids will be received by the Clearwater Ice Factory, J. M. & J. N. McClung, proprietors, until Sept. 1 for one 100-kw, engine type, 60-cycle, 2300-volt, three-phase generator with exciter; one 150-hp simple engine, 277 r.p.m.; one 60-kw, engine type, 60-cycle, 2300-volt, three-phase generator with exciter, direct connected to one 90-hp simple engine, 300 r.p.m. Proposals will be received for either complete sets or generator and engines seperate.

ALBANY, GA.—The Electric Light and Waterworks Commission is contemplating placing 2100 ft. of cable in underground conduit as an experiment. William Lockett is manager.

ALBANY, GA.—The Albany Power & Manufacturing Company has nearly completed its 1000-hp steam plant. The plant will be used as an auxiliary to its hydroelectric power plant. The company furnishes electricity to operate the municipal electric system in Albany.

MACON, GA.—The Cherokee Brick Company is reported to have entered into a contract with the Central Power Company, of Macon, Ga., by which the latter is to supply electricity to operate its entire plant. S. T. Coleman is president of the Cherokee Brick Company.

ROYSTON, GA.—D. W. Brooks is reported to be contemplating the construction of a hydroelectric plant on the Broad River, at Brook Shoals. It is proposed to furnish electricity for lamps and motors.

STATESBORO, GA.—The Ogeechee River Electric Company, which was organized for the purpose of constructing three hydroelectric plants on the Ogeechee River, to develop 16,000 hp for transmission by electricity to Statesboro, Oliver, Millen, Rocky Ford, Scarboro, Stillmore and Savannah, has completed preliminary surveys. The cost of the plants is estimated at $1,500,000. A. J. Brinson, of Oliver, Ga., is president; D. G. Zeigler & Company, of Savannah, Ga., and Jacksonville, Fla., are engineers in charge.

COTTONWOOD, IDAHO.—It is reported that the local electric light plant has been purchased by the Grangeville Electric Light & Power Company, of Grangeville, Idaho. It is understood that improvements will be made to the system and a high-tension transmission line, 18 miles in length, erected.

GOODING, IDAHO.—The contract for the construction of two miles

[illegible]
Company, of Faribault, Minn.

REXBURG, IDAHO.—A movement is reported to be under way for the construction of an electric railway in Fremont County, encircling a large farming area. The proposed railway will be about 40 miles in length and would pass through Rexburg, Salem, Sugar City, Teton, Wilford, St. Anthony to Park, Elgin, Plain, Hibbard, Burton and thence to [illegible] N. Y., offering to form a company capitalized at $1,000,000, the Fremont County business men and farmers to subscribe to $100,000.

BRAIDWOOD, ILL.—The municipal electric light plant in Braidwood [illegible] a consideration of $10,000. The company has taken over the plant and will continue to operate it until the transmission line from the hydroelectric plant at Wilmington is erected, when the local steam plant will be discarded. The Council has entered into a five-year contract with the company to supply electricity to pump the water into the elevated tank at the rate of 5 cents per 1000 gal. A contract for street lighting will be drawn up at the next meeting of the Council. Charles A. Munroe, of Joliet, Ill., represented the company.

CARTHAGE, ILL.—The Mississippi Valley Telephone Company is reported to have secured the right-of-way along the Chicago, Burlington & Quincy Railroad for its proposed telephone line from Dallas to Adrian. Work on construction of the line, it is said, will commence at once.

CHATHAM, ILL.—The Village Board has granted the Springfield, Peoria & St. Louis Interurban Railway, a subsidiary of the Illinois Traction System, a franchise to construct a track through the village paralleling the Chicago & Alton Railroad track. Under the terms of the franchise the company must maintain lamps at each street corner along the new right-of-way. The company proposes to build a new power house on the Thayer property in Chatham.

CHICAGO, ILL.—Preparations are being made by the South Park Commissioners for the installation of about 75,000 ft. of No. 6, single-conductor lead and paper covered cable; 5000 ft. of four-conductor, No. 6 lead and paper covered cable and 10,000 ft. of six-conductor lead and paper covered cable, work on which will begin at once. W. I. Bell is electrical engineer.

DECATUR, ILL.—Bids will be received until Aug. 25 for surface condensing equipment for the municipal electric light plant. For further information address D. W. Mead, of Madison, Wis., consulting engineer.

FREEPORT, ILL.—The stockholders of the Freeport Railway, Light & Power Company have voted to consolidate with the Freeport Railway & Power Company, the latter being the holding company. An issue of $1,200,000 in capital stock has been authorized by the stockholders. As soon as the certificate of merger is filed with the Secretary of State it is expected that bonds to the amount of $2,000,000 will be authorized, of which sufficient amount will be issued to refund the existing bonds of the Freeport Railway, Light & Power Company and to purchase the property of the Pecatonica River Power Company and Highland Park and also to erect a new power house and for other improvements, the cost of which is estimated at $100,000.

HINSDALE, ILL.—Extensive improvements are being made to the municipal electric light plant, consisting of the installation of one 300-hp Erie City engine direct-connected to a 200-kw Westinghouse three-phase generator with switchboard and regulator. It is expected to have the new equipment ready for operation by Nov. 1. The old carbon street lamps have recently been replaced with tungsten lamps and 50 additional lamps will be installed. H. H. Bristol is superintendent.

MOUNT CARMEL, ILL.—Owing to the City of Mount Carmel having refused to pay the water rental, amounting to $3,500, the Federal Court at Danville issued an order on Aug. 5 directing J. M. Mitchell, receiver of the Mount Carmel Gas & Electric Company, to discontinue the water and light service immediately, unless the amount due for water rental was paid at once, which the Council refused to do. The Council refuses payment, claiming that the water is not as pure as the contract stipulated. A resolution has been adopted by the Council to declare the franchise of the company forfeited, because of inoperation and announced that the city will take steps to confiscate the water and light plants and operate them.

NEW BURNSIDE, ILL.—The capital stock of the Johnson County Mutual Telephone Company has been increased from $10,000 to $25,000.

PEORIA, ILL.—It is reported that plans are being prepared by Thomas & Clarke, of Peoria, Ill., for the construction of a new cracker factory. The plant will be equipped for electric motor drive. Electricity for operating the plant will be supplied by the Peoria Gas and Electric Company.

WAUKEGAN, ILL.—Announcement has been made by the Waukegan, Rockford & Elgin Traction Company that it will soon award contracts for the grading of its proposed railway between Waukegan and Rockford, a distance of 12 miles. Most of the right of way has been donated and nearly $100,000 has been raised to build the road.

WHEATON, ILL.—The owners of the Aurora, Elgin & Chicago Traction System are reported to have decided upon the construction of an [illegible] surveys are now being made. Wheaton is to be the center of the proposed railway. A line now being built between Joliet and Gary is to be the connecting link [illegible] Lake Michigan. It is said that a separate company will be formed to build the railway, of which L. Wolf, president of the [illegible]

BLOOMINGTON, IND.—The City Council has passed an ordinance providing for the installation of ornamental cluster lamps for the central district of the city.

CAMBRIDGE CITY, IND.—The Town Trustees are contemplating making improvements and extensions to the municipal electric light plant, the cost of which is estimated at $15,000.

COLUMBUS, IND.—N. B. Brandenburg, of Columbus, Ind., is reported to be interested in a project to construct an electric railway from Columbus to Mount Vernon, a distance of 14 miles. It is said that the old roadbed of the Baltimore & Ohio Southwestern Railway, which is graded and ballasted, will be used.

DECATUR, IND.—Announcement has been made that City Council will soon place a contract for 30 ornamental lamp standards, each carrying three arc lamps, to replace the present posts in the business district.

GARY, IND.—Application has been made to the City Council by A. F. Knotts, of Hammond, Ind., for a franchise to furnish electricity, gas, water and steam heat in the city of Gary.

LAFAYETTE, IND.—The West Side Town Board has awarded the contract for street lighting to the Merchants Electric Light Association for a term of 10 years, beginning Oct. 1, 1910. The company agrees to furnish arc lamps at the rate of $43 each per year. The town pays $45 per lamp per year under the present contract.

LOGANSPORT, IND.—The Board of Public Works has awarded the contract for a 750-kw steam turbo-generator set for the municipal electric light plant to the General Electric Company, of Schenectady, N. Y. The new machine will nearly double the output of the plant.

MARION, IND.—The Marion Light & Heating Company has submitted a proposition to the City Council offering to supply arc lamps for street lighting at the rate of $57.50 each per year and to reduce the price of electricity to private consumers from 10 cents to 8 cents per kw-hour. It is said that the arc lamps supplied by the municipal plant costs the city about $75 each per year. The City Council has taken the proposal under consideration.

MAUCKPORT, IND.—The Eureka Telephone Company has filed a certificate with the Secretary of State increasing its capital stock from $25,000 to $50,000, the proceeds to be used for improvements and extensions. E. P. Windell is president.

MIDDLETOWN, IND.—We are informed that A. McWilliams, of Chicago, Ill., consulting engineer, has been engaged to take charge of the construction of the proposed municipal electric light plant. The cost of the plant is estimated at $10,000. F. A. Wischart is town clerk.

NASHVILLE, IND.—Preparations are being made for beginning within 30 days the construction of an electric railway to connect Nashville and Fruitdale, a distance of 16 miles; A. J. Johnson and associates of Indianapolis, Ind., are promoters.

PERU, IND.—Sealed bids will be received by the Board of Commissioners of Miami County until Sept. 7 for gas and electric fixtures for the new court house. Plans and specifications can be seen at the office of Charles Griswold, county auditor, and Lehman & Schmitt, architects, Cleveland, Ohio.

TERRE HAUTE, IND.—The Big Four Railroad Company has installed telephones for dispatching trains between Terre Haute and St. L[illegible]

UNION CITY, IND.—Negotiations have been closed whereby the Union City Independent Telephone Company will take over the plant and holdings of the Central Union Telephone Company, including toll lines and exchanges. Announcement has been made that the new owners will make extensive improvements to the system.

CLARION, IA.—We are informed that negotiations are under way for the sale of the municipal electric light plant; an offer for the same [illegible] City Council, which will be submitted to a vote of the people. G. J. Mack is chairman of light committee.

JEWELL, IA.—It is reported that the Ames Engineering Company, which has a franchise to erect an electric light plant in Jewell, will soon commence work on construction of same.

MUSCATINE, IA.—The City Council is considering the question of submitting the proposition to establish a municipal electric light plant to a vote. It is proposed to utilize the building formerly used by the water-works company. The cost of the system is estimated at $100,000. Last year the city paid $15,087 for street lighting, covering the cost of 50 electric arc lamps and 422 gas and naphtha lamps.

ELLENWOOD, KAN.—An additional generating unit, consisting of a 50-kw, 2300-volt, three-phase, 60-cycle, Fort Wayne generator and Erie City engine has just been installed in the municipal electric light plant, and a day service established. R. K. Heagler is superintendent.

EMPORIA, KAN.—J. H. Dyer, of Dayton, Ohio, is reported to be interested in a project to establish a street railway system and power plant in Emporia, Kan.

HUMBOLDT, KAN.—The contract for erecting an electric light plant in Humboldt, Kan., and wiring the city is reported to have been awarded to the Stevens Electric Company, of Coffeyville, Kan

MANHATTAN, KAN.—The Manhattan City & Interurban Railway Company has applied to the City of Manhattan to vote a subsidy of $20,000 in [illegible] to assist in the construction of the proposed railway to Fort Riley. It is understood that a similar request will be made to the Ogden Township. The cost of the railway is estimated at $[illegible], for which

surveys have been made. Joseph [illegible] Kan., is president.

McPHERSON, KAN.—The City Commission is reported to have engaged Kelso, Mann & Kelso, architects, to prepare plans and specifications for the new power house, 60 x 100 ft., for the electric light plant to replace the one recently destroyed by fire. The new plant will cost about $20,000.

NEWTON, KAN.—We are informed that the City of Newton has recently purchased a 300-hp engine from the Murray Iron Works Company, of Burlington, Ia., and a 250-kw generator from the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., which are being installed in the municipal electric light plant. E. G. Finch is city clerk.

SENECA, KAN.—We are informed that preparations are being made to install an oil-burning system in the municipal light and water plant at once. H. W. Graham is superintendent.

SYLVIA, KAN.—The local light plant, owned by J. B. C. Cook, of Stafford, Kan., was entirely destroyed by fire Aug. 8. It is expected that the plant will be rebuilt.

WAMEGO, KAN.—Plans are being considered for enlarging the municipal electric light plant, which will include the installation of a 150-kw or a 200-kw generator. Steam turbines are under consideration. Two 150-hp horizontal tubular Murray boilers have recently been installed in the plant. D. A. Course is superintendent of the light and water plant.

HOPKINSVILLE, KY.—The City Council is considering the question of calling an election to vote on the proposition to issue $50,000 in bonds for the construction of an electric l ght and power plant.

LONDON, KY.—It is reported that the London Telephone Company is planning to erect a telephone line from London to Barbouraville, a distance of 35 miles; connections will be made with Lily and McWhorter. The local lines in London are to be overhauled.

RITHCIE, KY.—It is stated that preparations are being made by Henry Callahan and others for the erection of a telephone line from Ritchie and Hazard to connect with the system in Hazard; also to erect a local system in Ritchie.

CROWLEY, LA.—The Electric Light and Water Committee of the Council has awarded a contract to the Skinner Engine Company, of Erie, Pa., for a 240-hp, high-speed, automatic engine, direct connected, to be installed in the municipal electric light plant. The committee reently purhased a new Casey-Hedges water-tube boiler.

HAMMOND, LA.—The Hammond Interurban Railway Company has applied to the Town Council for a franchise to construct and operate an electric railway on certain streets in Hammond.

THIBODAUX, LA.—We are informed that plans are being prepared for the erection of a new municipal electric light plant, for which an appropriation of $45,000 will soon be made. The equipment of the proposed plant will include three 60 or 75-kw, alternating-current units, driven by oil engines, direct connected. G. U. Borde, consulting engineer, will have charge of the construction of the plant. A. R. Staunton is superintendent.

CAMBRIDGE, MD.—The plant and holdings of the Cambridge Light & Power Company have been purchased by Edward C. Carrington, of Carrington & Carrington, 110 East Lexington Street, Baltimore, Md. It is understood that the property was purchased by Mr. Carrington for clients who propose to extend the service and supply electricity for manufacturing purposes.

FREDERICK, MD.—It is reported that [illegible] have been made between the Frederick Railroad Company and the Hagerstown Railway Company for the construction of a joint power plant to furnish electricity to both companies. The proposed plant is to be located near Frederick, on the Monocacy River, or near Hagerstown, on the Antietam River. It is proposed to incorporate a company under the name [illegible] Power Company, the stock of which will be held jointly by the Frederick Railroad Company and the Hagerstown Railway Company. The power company is to furnish service to both companies on equal terms. It is expected to have the plant completed by May, 1911.

MIDDLEBORO, MASS.—A movement is under way to extend the municipal electric lighting service to the Rock village.

OXFORD, MASS.—The substation of the Webster & Southbridge Gas & Electric Company, of Webster, Mass., in Oxford, was destroyed by fire recently. Arrangements have been made to furn sh electrical service direct from Webster for the present.

PALMER, MASS.—It is reported that the Massachusetts Lighting Company is negotiating for the purchase of the woolen mill of the Holden & Fuller Company. It is understood that the property will be used for power station purposes.

DETROIT, MICH.—The promoters of the Detroit & Bay City Electric Railway are contemplating the construction of a branch from North [illegible] to Marlette and [illegible] The proposed railway will [illegible]

DETROIT, MICH.—It is [illegible] by the Detroit Show Case Company, of Detroit, Mich., for the construction of a manufacturing plant. [illegible] plant, it is said, will be equipped [illegible]

ESCANABA, MICH.—Arrangements [illegible] Escanaba & Gladstone Railway [illegible]

Kip'ing and Masonville, for which surveys will be made at once by D. A. Brotherton, engineer.

NORTHVILLE, MICH.—The village of Northville will be in the market about Sept. 1 for lead covered cable and conduit for 2500-volt service. A day service for lamps and motors has been established. Samuel Wilkinson is superintendent of the plant.

PETOSKEY, MICH.—We are informed that the city has just installed 50 Westinghouse series metallic flame arc lamps in connection with the municipal street lighting system and is planning to install 35 additional in the fall. John W. Lovelace is city electrician.

BRECKENRIDGE, MINN.—The generating machinery of the municipal electric plant has been closed down and electricity for operating the municipal electric lighting system is now supplied from the plant of the Otter Tail Power Company, located at Fergus Falls, Minn., 25 miles distant. D. J. Jones is city clerk.

BROWN VALLEY, MINN.—It is reported that the construction of a hydroelectric power plant on the Little Minnesota River, west of the town, is under consideration. W. J. Potts is said to be interested in the project.

FAIRMONT, MINN.—The City Council has passed an ordinance providing for an issue of $30,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant and water-works system.

FARMINGTON, MINN.—The installation of an electric light plant in Farmington during the coming year is reported to be under consideration.

FERGUS FALLS, MINN.—The City Council has authorized the City Water and Light Commission to engage L. P. Wolff, consulting engineer, of St. Paul, Minn., to make investigations and report as to repairs to the old dam.

HOKAH, MINN.—Plans are being considered for rebuilding the dam in Hokah, which was washed away about a year ago. It is proposed to organize a company to carry out the project. A. Foster, of La Crosse, Wis., is reported to be interested in the project.

PRESTON, MINN.—It is reported that plans are being prepared for the construction of a hydroelectric power plant in Preston by O. H. Case & Son, of Florence, Minn. G. A. Love is Mayor.

PRINCETON, MINN.—Plans are being considered for the erection of a storage battery substation for day service and also to carry load from 12 o'clock. A 160 amp-hour battery will be installed. O. B. Randolph is superintendent.

ROCHESTER, MINN.—The Board of Public Utilities has been instructed to secure estimates and plans for placing all electric wires under ground and erecting ornamental posts for streets lamps. The board would like to communicate with parties interested in that line of work. John C. Crabb is secretary of the board.

ST. PAUL, MINN.—Preparations are being made for the construction in the near future of the power building to be erected on Eighth Street, between Wacouta and Sibley Streets. The proposed building will be 300 ft. x 87 ft., seven stories high, and when completed will be rented with power to small manufacturing establishments; either gas or electricity will be provided. The cost of the building and power plant, exclusive of site, will be about $300,000. Oscar Claussen, of St. Paul, Minn., is engineer.

VIRGINIA, MINN.—The plant and holdings of the Virginia Electric Power & Light Company, which the city proposes to purchase, is valued at $300,000.

COLUMBIA, MO.—Plans are being considered for rebuilding both the water and light plant and extending the electric service and water mains all over the town. The proposition to issue $125,000 in bonds to pay for same will be submitted to a vote at an election to be held Sept. 27. James M. Sherman is superintendent.

GALLATIN, MO.—Additional machinery is being installed in the power [illegible] municipal electric light and water plant, including [illegible] kw and one 50-kw generator and engine. Preparations are being made to establish a 24-hour service within a short time. Penn Love is superintendent.

HIGGINSVILLE, MO.—The question of enlarging the municipal electric light plant and establ shing a day service is under consideration.

INDEPENDENCE, MO.—Contracts have been awarded by the Missouri & Kansas Telephone Company for the erection of a telephone exchange building, in Independence, to cost about $40,000. Equipment costing about $80,000 will be installed in the bu lding.

KANSAS CITY, MO.—A certificate has been filed by the St. Louis & Kansas City Electric Railway with the Secretary of State showing an increase in the capital stock of the company from $5,000,000 to $10,000,000. The company proposes to construct and operate an electric railway between Kansas City and St. Louis, for both passenger and freight traffic. D. C. Nevins is president of the company and H. F. Insley, secretary.

ROLLA, MO.—Preparations are being made to extend the municipal electric lighting system to the part recently taken into the corporate limits, for which several miles of wire will be required and large number of poles. [illegible]

ST. LOUIS, MO.—The Valley Park Telephone Company has petitioned the St. Louis County [illegible] to erect a new telephone line on the streets of Valley Park and then extend to the Sunset Road, Fen[illegible] Road, Denny [illegible] Road

and Quinette Road, Meremac Heights and through the streets of that subdivision. Hugh D. Winer is interested in the company.

[illegible] electric light plant this fall is under consideration. E. P. Weaver is superintendent.

THREE FORKS, MONT.—It is reported that a syndicate of Spokane capitalists is contemplating the construction of a hydroelectric power plant, which will eventually involve an expenditure of about $200,000. The initial installation will cost about $50,000.

ALLIANCE, NEB.—The City Council is reported to have decided to purchase the local electric plant owned by the Alliance Electric Company.

NORTH PLATTE, NEB.—The State Railway Commission has authorized the Tri-County Telephone Company to issue $3,000 in capital stock.

RED CLOUD, NEB.—The State Railway Commission has granted the Amboy Telephone Company permission to issue $3,000 in capital stock.

SEWARD, NEB.—[illegible] applied to the state engineer for water rights in the Blue River, to be used in connection with the construction of a hydroelectric power plant on the river, 3 miles below Milford. The proposed plant will supply electricity in Milford and Seward. The cost of the enterprise is estimated from $60,000 to $80,000.

TEKAMAH, NEB.—Plans are being considered by the Electric Light and Water Works Department for substituting series tungsten lamps for [illegible] present use. The [illegible] work will be done by the department. [illegible] is city electrician.

FRANKLIN, N. H.—The Stone & Webster Engineering Corporation, of Boston, Mass., has been engaged by the Boston & Maine Railroad Company to prepare plans and construct a 1200-kw, hydroelectric power plant at Franklin, N. H., about 20 miles north of Concord, N. H. Double transmission lines will transmit the energy at 22,000 volts to the three substations. Electricity generated at the plant will be used to operate the railroad shops and light the yards and station at Concord. Power will also be supplied to the Concord and Manchester branch of the Concord Street Railway and Contoocook Park. Rotary converters with a rating of 300 kw, together with step-down transformers and switching apparatus for a 2300-volt lighting system, will be installed at the South End substation; the rotary converters, transformers and switching apparatus now in the portable substation at West Concord will be removed and erected in the engine room of the steam generating station. A new substation with an output of 600 kw, to be known as the Hooksett substation, will be built to supply the Manchester branch. New step-down transformers with a rating of 300 kw will be installed in the engine room at the shops. Improvements will also be made to the steam plant at West Concord, including the installation of a new generator with a rating of about 200 kw and new boilers.

BLOOMFIELD, N. J.—The question of organizing a company to furnish electricity to light the municipality until such time as the Legislature may grant towns the privilege given to cities to operate municipal lighting plants is under consideration by residents of Bloomfield. James M. Walker is chairman of lighting committee.

NEWARK, N. J.—The public buildings committee has adopted a resolution to recommend to the Board of Freeholders that the contract for the installation of an electric light and power plant in the court house be awarded to the Watson Flagg Engineering Company, for $20,495.

ALBION, N. Y.—The plant and holdings of the Albion Home Telephone Company, operating in several towns in Orleans County, were sold at auction Aug. 5 to J. P. McDonnough, of Newark, N. Y., for $25,000. The property was sold under a foreclosure obtained by the Fidelity Trust Company, of Rochester, N. Y.

BUFFALO, N. Y.—Plans have been completed by Henry L. Spann, 38 Pascal Street, Buffalo, N. Y., for construction of power house and installation of equipment for the Mother House of the Sisters of Charity, now being erected at Abbott Road and Red Jacket Parkway, at a cost of about $350,000.

BUFFALO, N. Y.—Sealed bids will be received at the office of the Department of Public Works, City and County Hall, Buffalo, N. Y., until Aug. 24 for electric wiring and installing lighting fixtures in the new school building, known as School No. 11, located on West Delavan Avenue, near Brantford Place. Francis G. Ward is commissioner of public works.

ITHACA, N. Y.—Sealed bids will be received by E. E. Williams, treasurer, Cornell University, Ithaca, N. Y., until Aug. 25 for construction, including plumbing, heating, ventilating and electric work for addition to the northeast wing of the New York State Veterinary College building, Cornell University, Ithaca, N. Y. Plans and specifications can be seen at the office of E. E. Williams, treasurer, Ithaca, N. Y., and at the office of Franklin B. Ware, state architect, Albany, N. Y.

ROCHESTER, N. Y.—The Belt Line Railroad Company, of Rochester, N. Y., has applied to the Public Service Commission, Second District, for permission to construct and operate a belt line 15 miles in length, which will be used mainly as a freight belt line, connecting all railroads in Rochester. The proposed railway will be operated both by steam and electricity.

SYLVAN BEACH, N. Y.—It is reported that the citizens have voted to appropriate [illegible] for the installation of an additional generator, engine and about [illegible] miles of wire.

SYRACUSE, N. Y.—The Syracuse, Lake Shore & Northern Railroad Company has awarded the contract for the construction of a substation south of Ellen Street, Oswego, N. Y., to the Burns Contracting Company, of Syracuse, N. Y.

THERESA, N. Y.—The Theresa Telephone Company is reported to be making arrangements for the erection of a new telephone line in Orleans and for rebuilding the line extending from Theresa to Lafargeville. The main line will be entirely rebuilt. Two wires will be erected, one for toll service and the other for local. Fred S. Rodenhurst is president and general manager.

UTICA, N. Y.—Plans are being prepared by the Utica Gas & Electric Company for the construction of a new building at its gas plant. The output of the gas plant will be greatly increased and a purifying plant installed.

CHARLOTTE, N. C.—The Charlotte Power Company, operating under the franchise of the Southern Power Company in this city, it is reported, will soon apply for a local franchise to do a general lighting and power business and also to erect a gas plant. The company made an application for a similar franchise some time ago, but withdrew the petition.

DURHAM, N. C.—Preparations are being made by the Durham Traction Company to build an addition to its power house, 35 ft. x 100 ft., for which machinery and equipment has been purchased. R. L. Lindsey is general manager.

GREENVILLE, N. C.—The Water and Light Commission has recently purchased a new 200-kw, three-phase, General Electric generator, belt driven, with exciter and switchboard panel, to be delivered about Sept. 15. E. G. Gouch is superintendent.

KINGSTON, N. C.—The city is making extensions to the municipal street lighting system, material for which has been purchased, and is installing 60 series tungsten lamps of 80 cp. H. H. Hodges is superintendent of the electric light and water department.

RALEIGH, N. C.—Negotiations have been closed between the Board of Aldermen and the Carolina Power & Light Company for lighting the streets of the city for a term of 10 years. The contract is to take effect May 1, 1911, but the Carolina Power & Light Company agrees to furnish the service until May 1, 1911, at the rate of $55.75 per lamp, and after that date at $60 per lamp per year.

SILER CITY, N. C.—It is reported that an electric light plant will be installed in Siler City. Joseph L. Wren is said to be interested in the project.

ENERGY (P. O. UNDERWOOD), N. D.—It is reported that an electric light and power plant will be installed in Energy by the North Dakota Heat & Power Company.

FARGO, N. D.—The Union Light, Heat & Power Company is reported to be contemplating making improvements to its steam heating distributing plant, which will involve an expenditure of about $15,000. The company also proposes to erect an addition to its power station and install a new engine and generator, at a cost of about $10,000.

GRAND FORKS, N. D.—The City Council has granted the Grand Forks Street Railway Company a 50-year franchise to construct and operate a street railway system in Grand Forks.

ATHENS, OHIO.—Sealed proposals will be received by the Board of Trustees of the Ohio University, at Athens, Ohio, until Sept. 7 for furnishing materials and erecting an addition to the power house, the mechanical equipment, and the heating of Ellis Hall and for the Science Hall building, in accordance with plans and specifications prepared by Frank L. Packard, architect, Columbus, Ohio, which are on file at the office of I. M. Foster, secretary board of trustees, Athens, Ohio, and at the office of the architect, New Hayden Building, Columbus, Ohio. Alston Ellis is president of board of trustees.

BOWLING GREEN, OHIO.—Arrangements are being made by the Lake Erie, Bowling Green & Northern Electric Railway Company for extending its system eastward to Elmore and Grand Rapids, giving about 35 miles of additional service.

CLEVELAND, OHIO.—The plant of the Cuyahoga Light Company, it is reported, is to be closed down and dismantled within a few months. It is understood that the plant has been purchased by parties interested in the Cleveland Electric Illuminating Company, for a consideration of $185,000. The company was formed about four years ago. John C. Keyes was president and treasurer.

COLUMBUS, OHIO.—The municipal electric plant is now supplying electricity for operating the greater portion of the plants of the Kilbourne-Jacobs Manufacturing Company and the Union Fork & Hoe Company. It is expected to secure other contracts before the end of the year. Herman Gamper, superintendent of the municipal plant, hopes that after next year the city plant will be self-sustaining. An appropriation of only $30,000 has been asked for the maintenance of the plant this year, as against $75,000 previously required for the plant.

GREENVILLE, OHIO.—The citizens have voted to grant a 50-year franchise to S. A. Price and associates, of Dayton, Ohio, to construct and operate an electric railway system in Greenville, to cost about $200,000. Under the terms of the franchise 5 miles of track are to be in operation in 18 months.

FAIRVIEW, OKLA.—J. N. Voorhees, city clerk, writes that the citizens on July 19 voted to appropriate $50,000 for extensions to the water and lighting systems. The work will include the extension of transmission lines and water mains, power equipment and erection of water tower, etc. Bids will be asked for the proposed work as soon as bonds are sold.

KINGFISHER, OKLA.—The Water and Light Department is contemplating the installation of a new street lighting system. At present arc lamps are used and it is proposed to use [illegible] new and improved arc lamps. V. H. Francis is superintendent of the municipal light and water plant.

MOUNTAIN VIEW, OKLA.—Application has been made to the City Council by an Oklahoma City company for a franchise to construct and operate an electric light system in Mountain View. The proposed plan includes the construction of a dam across the Washita River.

STILLWATER, OKLA.—The Oklahoma Public Service & Interurban Lines, which was recently organized with a capital stock of $1,000,000, is promoting an extensive system of electric interurban railways in Oklahoma, with Stillwater as the proposed center of the system. The present plans call for the construction of an electric railway from Stillwater to Morrison, a distance of 14 miles; from Stillwater to Perkins, 10 miles; from Stillwater to Glencoe, Merrimac, Jennings and Sapulpa, 79 miles, and from Stillwater to Goyle, Langston and Guthrie, 45 miles, making a total of 148 miles. The cost of the entire system is estimated at $6,000,000. It is said that work will commence on construction of the proposed system as soon as rights of way and franchises can be secured. The directors of the company are: Harry G. Lytle, of Brooklyn, N. Y.; H. L. Drullard, George W. Tucker, Jr., and L. G. Lempke, of New York, N. Y.; Claude Powell, R. A. Sturgeon and Louis James Lampke, of Stillwater, Okla.

WENOKA, OKLA.—We are informed that the town of Wenoka is building an electric light plant and water-works system. The electric plant will be equipped with the three-phase system. George F. Brockman is superintendent of construction.

ASHLAND, ORE.—At a special election held recently the citizens voted to grant a street railway franchise to J. R. Allen in Ashland, Ore. It is understood that Mr. Allen represents the Southern Oregon Railway & Power Company, which proposes to build an electric railway through the Rogue Valley and Southern Oregon.

CRESCENT, ORE.—Surveys are being made in connection with the construction of an electric light and power plant a short distance north of Crescent, where the company headed by Dr. N. E. Winnard has filed on a power site. The company proposes to erect a dam in the canyon where the head of the Deschutes narrows to about 60 ft. It is estimated that about 5000 hp can be developed.

KLAMATH FALLS, ORE.—The application recently filed by W. K. Brown for a water power site on the Klamath River, near Klamath Falls, has been approved by John H. Lewis, State Engineer. The cost of developing the power is estimated at about $250,000.

OREGON CITY, ORE.—An ordinance has been passed authorizing the City Council to enter into a contract with the Portland Railway, Light & Power Company to furnish electricity for lighting the streets of the city for a term of five years, beginning Sept. 1, 1910.

PORTLAND, ORE.—Negotiations have been completed whereby a large number of electric, gas and power plants in Oregon, Washington and Idaho have been merged under the name of the Pacific Power & Light Company, capitalized at $7,500,000. The properties consolidated include the former holdings of the Northwest Corporation, part of the holdings of the Strahorn interests in the Yakima Valley and the power and lighting system formerly owned by the Wasco Warehouse & Milling Company, of The Dalles. To bring the numerous plants and public service systems under the control of the Pacific Power & Light Company, temporary corporations were organized including the Yakima-Pasco Power Company, the Columbia Power & Light Company, the Astoria Electric Company and the Walla Walla Valley Railway Company, all of which have now deeded all their holdings to the Pacific Power & Light Company and will go out of existence, with the exception of the Walla Walla Valley Railway Company, which will be continued as a subsidiary company. The Pacific Power & Light Company has also taken over the hydroelectric generating plants on the Walla Walla River, one on the White River in Oregon, near its confluence with the Deschutes, and one on the Uaches River, near North Yakima, Wash. The combined generating capacity of the three plants is 15,000 hp, which, it is understood, will be enlarged. The company, it is said, has options on several other properties in the Northwest, which are likely to be taken over soon. The head offices of the company will be located in Portland, Ore.

REDMOND, ORE.—Application has been made to the City Council by the Odin Falls Power Company for a franchise to supply electricity in Redmond for lamps and motors.

ROSEBURG, ORE.—Preparations are being made by the Coos Bay Traction Company for the construction of an electric railway between Roseburg and Coos Bay, work on which will begin within 60 days. The company was recently incorporated with a capital stock of $1,000,000. George T. Averill is president of the company, and W. P. [illegible] field, Ore., secretary and manager.

CRESSON, PA.—The plant of the Cresson Electric Light Company is reported to have been destroyed by fire Aug. 5, causing a loss of about $100,000. The town will be without electrical service for a month or six weeks. In addition to the electric plant, which was owned by the Pennsylvania Coal & Coke Company, the offices [illegible] other mine equipment were destroyed.

FRANKSTOWN, PA.—It is reported that the Penn Central Light & Power Company has decided to build its new power plant in Frankstown, where the company has taken [illegible]

MILTON, PA.—The power plant of the Lewisburg, Milton & Watsontown Electric Railway Company was destroyed by fire on Aug. 2, causing a loss of about $30,000. The company is now constructing a new plant, which it expects to have completed about Sept. 1.

PHILADELPHIA, PA.—The contract for constructing the power house for the Stephen Girard estate at Twentieth Street and Oregon Avenue, Philadelphia, is reported to have been awarded to the Pomeroy Construction Company. The plant will supply light and heat for the model residences now under construction. The cost of the plant is estimated at about $20,000.

SCRANTON, PA.—Preparations are being made by the Scranton Electric Company to furnish the steam heating service from its plant on the river bank, making the Dix Court plant a substation. Contracts have been awarded by the company amounting to about $50,000. Of this amount about $20,000 will be expended in the reconstruction of the boiler plant of the river bank station; the remainder will be used for the construction of laying a new main through the central part of the city. The contract for the work has been awarded to Ludwig Stipp.

TITUSVILLE, PA.—The Petroleum Telephone Company is contemplating extending its telephone line from Pleasantville to Tidioute, connecting with the Forest Telephone Company's central exchange in that place.

WASHINGTON, PA.—Plans are being considered by the Wellsburg & Bethany & Washington Traction Company, of Wellsburg, Pa., to extend its railway from Bethany to Washington, via Independence, Avella and other points. Thomas E. Cramblett, of Bethany College, is president of the company.

MANILA, P. I.—The Municipal Council in Zamboanga is reported to have awarded a franchise to Patrick J. Moore to erect an electric light plant in that place. The franchise is now awaiting the approval of the Commission.

WINNSBORO, S. C.—Owing to the plant being overloaded, 35 arc lamps have been replaced with 150 tungsten lamps, which are giving very satisfactory service. The Board of Public Works expects to secure electricity from the Southern Power Company as soon as its transmission lines are extended to Winnsboro, which place it is expected to reach in about 18 months. J. E. McDonald, of Winnsboro, is chairman of Board of Public Works.

BOWDLE, S. D.—The establishment of a municipal electric light plant in Bowdle is reported to be under consideration.

BLUNT, S. D.—The construction of an electric light plant in Blunt is under consideration. It is understood that contracts for equipment have been awarded and part of the machinery delivered.

MARYVILLE, TENN.—The Council has granted the East Tennessee Telephone Company a franchise to erect and operate a telephone system with an exchange in Maryville, which will give this place two exchanges.

TELLICO PLAINS, TENN.—The Tellico Power Company, recently incorporated, is contemplating the construction of a power plant, bids for construction of which will be called in October. The cost of the plant is estimated at $240,000, and will include the construction of a concrete flume and steel pipe line. J. C. Knight has charge of the work.

AMARILLO, TEX.—It is reported that contracts have been placed for material and for rolling stock for the proposed street railway to extend from Polk Street to San Jacinto Heights.

ASHERTON, TEX.—Carl A. Albrecht is reported to be interested in a project to develop the coal properties near Asherton. It is proposed to organize a company to be known as the Carla Land & Irrigation Company; to establish a town under the name of Carla, and install an electric power plant to supply electricity, especially for various irrigation projects.

BROWNSVILLE, TEX.—Contracts have been awarded by the City Council for additional equipment for the municipal electric light plant and water works system, consisting of dynamos, pumps and engine, to cost about $18,500. The contract for electrical machinery was awarded to the Westinghouse Electric & Manufacturing Company and machinery for waterworks to the Harrisburg Foundry & Machine Company.

CLEBURNE, TEX.—The Cleburne Electric & Gas Company has awarded the contract for the construction of its new power station in this city to D. N. McCoy, of Cleburne, Tex. Two 250-hp engines will be installed. Oil will be used as fuel.

CLEBURNE, TEX.—It is reported that preparations are being made by Daniel Hewitt, promoter of the proposed street railway in Cleburne, to begin work on construction of the system in the near future. The construction of a power plant to supply electricity [illegible] also under consideration.

COLEMAN, TEX.—Preparations are being made [illegible] the municipal electric light plant, for which bonds to the amount of $20,000 have been voted. W. Z. Champion is manager.

LEAGUE CITY, TEX.—The Galveston-Houston Electric Company is reported to have decided to locate its main power plant on Clerk Creek, about one half mile from League City. [illegible] kw turbine, one 500-kw turbine with necessary condensers, water heaters, feed pumps, air compressors, etc. The Stone & Webster Corporation, of Boston, Mass., has charge of construction of the plant.

SAN ANTONIO, TEX.—Preparations are being made by the San Antonio Traction Company to extend its South [illegible] line from its

[illegible] the suburb of Harlandale, a distance [illegible] miles. W. B. Tuttle is manager.

SAN MARCOS, TEX.—Owing to the City Council and the San Marcos Utilities Company being unable to come to an agreement over the renewal of the company's franchise, the company has signified its intention of withdrawing from this place. The franchise expired over a year ago.

TAYLOR, TEX.—Preparations are being made by the Williamson County Independent Telephone Company for improvements to its system, including the installation of a switchboard, etc.

VICTORIA, TEX.—The Victoria Manufacturing Company has entered into a contract with the city of Victoria to install and operate an electric street lighting system for a period of 10 years, under the terms of which the company is to furnish 150 tungsten lamps of 60 cp and seven 6-amp arc lamps. It is expected to have the system installed by [illegible] 1.

SALT LAKE CITY, UTAH.—Application has been made to the State engineer by William Thorton and W. R. Burdett, of Salt Lake City, for 20 sec-ft. of water of the stream in Little Cottonwood Canyon, the water to be used to operate a power plant, which will supply electricity to several mines in that district. The water will be taken from the stream at the point of confluence between the Cottonwood and the Toledo Spring.

LYNCHBURG, VA.—The contract for installing the heating system, boiler, power and lighting plant at the Virginia State Epileptic Colony has been awarded to the Morrison Machinery & Supply Company, of Richmond, Va., for $7,000.

COLFAX, WASH.—The Washington Power Company, of Spokane, Wash., is reported to have submitted a proposition to the City Council to remodel the entire electric lighting system in Colfax. Henry M. Richards, of Spokane, Wash., is vice-president of the Washington Water Power Company.

COLVILLE, WASH.—The contract for the erectiou of the transmission line from the power plant at Meyers Falls to Colville is reported to have been awarded to Paul La Plant.

SPOKANE, WASH.—Negotiations are reported to be under way between the Washington Water Power Company and the Lewiston-Clarkston Investment Company, of Lewiston, Idaho, for the erection of a transmission line between Spokane, Wash., and Lewiston, Idaho.

TACOMA, WASH.—Plans are being considered by the Valley Improvement Company for the construction of a large power plant at the outlet of Packwood Lake. The company proposes to transmit electricity generated at the plant to Tacoma and other cities on Puget Sound and to Portland. The main offices of the company will be located in the Couch Building, Portland, Ore.; a branch office will be maintained in Tacoma. J. Lewis, of Portland, Ore., is president.

ROMNEY, W. VA.—Plans have been perfected whereby the Mutual Telephone Company, which owns and operates the telephone systems in Romney, Martinsburg and Cumberland, and the Burlington, Keyser and Moorefield lines will be consolidated.

ASHLAND, WIS.—A deal has been closed whereby A. E. Appleyard has secured a tract of land including the Mellen Rapids on Sand River, which are located three miles up Bad River from Copper Falls. It is said that Mellen Rapids have been purchased by Mr. Appleyard for the purpose of extending a pipe line from the rapids across to Copper Falls, a distance of one and one-half miles, where the main dam will be located. It is understood that the power will be developed in connection with the proposed project for Chequamegon Bay and the range towns.

CHIPPEWA FALLS, WIS.—Machinery in the power plant of the Chippewa Falls Water Works & Lighting Company was badly damaged recently by the breaking of a main shaft, causing a loss of about $10,000.

EAST TROY, WIS.—The local business men and residents are considering a proposition submitted by O. Werwath and William Borgess, of Milwaukee, Wis., for the installation of an electric light plant in East Troy. It is estimated that a plant with sufficient output to supply 1250 incandescent lamps can be established at a cost of about $18,000. A. Smith, of East Troy, offers to supply the water power to operate the plant at a low price and to donate the land for the power house. A committee has been formed to look into the matter of forming a company to construct and operate the plant.

HUDSON, WIS.—The contract for the construction of a hydroelectric power plant at Clifton Hollow has been awarded to Robert Lang, of Eau Claire, Wis. Electricity generated at the plant will be transmitted to Prescott, Wis., and Hastings, Minn. B. W. Utman, of Hudson, Wis., and others are interested in the project.

NEW HOLSTEIN, WIS.—It is reported that an election will be held to vote on the proposition to issue $8,000 in bonds, the proceeds to be used for the installation of a municipal electric light plant.

SHEBOYGAN, WIS.—Contracts have recently been placed by the Sheboygan Light, Power & Railway Company for equipment for its power plant as follows: One 750-kw, mixed pressure turbine to the General Electric Company, of Schenectady, N. Y., to the Wheeler Condenser & Engineering Company, New York, N. Y., for surface condenser, circulating pump, air pump, etc.; for one 250-hp Stirling boiler to the Babcock & Wilcox Company, of New York, N. Y.; to the General Electric Company for electrical equipment for snow plow and passenger cars, and the Underfeed Stoker Company, of Chicago, Ill., for "The Jones" stokers. Ernest G[illegible]enbach is president and general manager.

WESTBY, WIS.—The question of establishing a day service next season in connection with the municipal electric plant is under consideration. L. D. Ingham is electrician.

WHITEWATER, WIS.—The Wisconsin Rate Commission has authorized the Badger Railway & Light Company to issue 100 shares of capital stock having a par value of $100 and to be issued at not less than par, the proceeds to be used for the purpose of defraying the expenses for its organization and for making the necessary surveys for its proposed railway from the city of Whitewater to Lake Geneva.

CALGARY, ALTA., CAN.—The ratepayers on July 28 passed the by-law appropriating $125,000 for the construction and equipment of a power plant in Calgary.

MEDICINE HAT, ALTA, CAN.—Bids will be received by the city of Medicine Hat until Sept. 1 for two 125-kw, alternating-current, direct-connected gas engine driven units, each engine to be capable of delivering not less than 200 b.hp on natural gas of 100 b.t.u. per cu. ft. Specifications can be obtained from D. Milne, Mayor. M. A. Maxwell, of Medicine Hat, is consulting engineer.

VANCOUVER, B. C., CAN.—The Western Canada Power Company, it is reported, will soon award contracts for 40 miles of ⅜-in. steel cable to be used in connection with the erection of the transmission between Vancouver and the Stave River Falls.

VANCOUVER, B. C., CAN.—The contract for the installation of ornamental street lamps has been awarded to the Electrical Construction Company for $15,940. The Ross & Howard Iron Works secured the contract for lamp standards at $45 each.

CAMPBELLFORD, ONT., CAN.—Negotiations have been closed between the town of Campbellford and the Seymour Power Company whereby the Seymour company will install a pair of turbines and one 1000-kw generator and all accessories in the municipal electric plant, for which the town is to receive a rental of $12,000 per year, and at the end of five years the town is to own the machinery installed. The new power house has been in operation about a year and has an output of about 1000 hp, which is used for lighting the streets, commercial and industrial purposes, etc. The plant when completed will have an output of about 5000 hp. The town is offering liberal inducements to manufacturers requiring power to locate in Cambellford. About 50,000 hp is being developed on the several dams in connection with the Trent Canal, at or near Cambellford, and it is expected that large orders for machinery will be placed within the next few months. W. J. Boxsee is Mayor.

OTTAWA, ONT., CAN.—The Board of Control is reported to have decided to secure 1500 hp additional from the Hydro-Electric Power Commission, making a total of 4000 hp. It is understood that bids will soon be asked for material for the construction of a conduit.

PETERBORO, ONT., CAN.—Bids will be received until Sept. 1 by R. S. Armstrong, city clerk, for the following work: Contract A—(1) Laying 2000 ft. sanitary sewer. (2) Laying 4200 ft. storm drains. Contract G—Electrically operated air compressors and ejectors. Contract P—Sewage pumping station. Contract S—Tile sewer pipes, 30-in. to 8-in. Plans and specifications, etc., may be seen at the office of T. S. Hay, city engineer, Peterboro, and at the office of Chipman & Power, Toronto, Ont., consulting engineers.

SEAFORTH, ONT., CAN.—The by-laws authorizing the town of Seaforth to secure electricity from the Hydro-Electric Power Commission was carried by a large majority on Aug. 8.

TILSONBURG, ONT., CAN.—A by-law to appropriate $25,000 for the purchase and construction of the receiving and distributing system in Tilsonburg in connection with electrical energy purchased from the Hydro-Electric Power Company, will be submitted to the ratepayers on Aug. 23.

TRENTON, ONT., CAN.—The Railway and Canals Department has come to a decision regarding the water-powers along the route of the Trent Valley Canal. Parties to whom the powers have been assigned have secured them subject to the conditions that certain lands necessary for the canal purposes are to go to the department and there will be no damages for flooding. The power at dam No. 2 has been granted to the Trent Power Company or to the Seymour Power Company, to be settled by themselves, the rate yet to be determined; 500 hp is to be reserved for the town of Trenton. At dam No. 1 the power is to be allotted free to the Trenton Power Company, the Trenton Electric Light & Power Company and the town of Trenton. The Trent River dams are being built by the Dominion Government, which is also constructing the canal.

WESTON, ONT., CAN.—The Village of Weston has made arrangements with the Hydro-Electric Power Commission for energy from Niagara Falls and will eventually discard the present steam plant. It is proposed to change the present 125-cycle system to 25 cycles. The village is installing a water-works system at a cost of $57,000 and it is expected to operate the pumps by electricity. It is expected to have the system completed by fall. J. H. Taylor is town treasurer.

WINDSOR, ONT., CAN.—The City Council has directed the city clerk to advertise for tenders for the surplus power transmitted to Windsor by the Hydro-Electric Power Commission. The city proposes to take 15,000 hp and to sell the surplus in Detroit, Mich., until there is a demand for the full amount in Windsor. It is estimated that not more than 2000 hp will be used here. The town has voted to issue $100,000 for the construction of a municipal transmission line. The consent of the Dominion and Provincial Governments will have to be obtained to effect the power. The Electric Distributing Company has submitted a proposition

to the Council offering to endorse the city's contract for the entire amount and agreeing to take the surplus not required by the city.

SASKATOON, SASK., CAN.—The contract for a 250-hp water-tube boiler for the municipal electric plant, bids for which were opened July 25, has been awarded to the Robb Engineering Company, of Amherst, N. S., Can., for $4,200.

YORKTON, SASK., CAN.—At an election held recently the ratepayers passed the by-law appropriating $35,000 for the installation of an electric light plant.

TAMPICO, TAM., MEX.—Steps have been taken to organize a company for the purpose of taking over the franchise and holdings of the local street railway. It is proposed to convert the railway into gasoline traction and extend it to the town of La Barra, a distance of 6 miles.

TORREON, COAHUILA, MEX.—Manuel Campos and associates, of Torreon, have secured an option on the electric street railway concession owned by the Chinese syndicate Compañia Bancaria y de Tranvias Wah Yick and are planning to organize a company with a capital stock of $200,000 to take over the system and make extensive improvements. The company suspended operation about two years ago. It is understood that extensive improvements will be made and new equipment purchased and a much better service inaugurated.

New Industrial Companies.

THE AMERICAN RAILWAY ADVERTISING COMPANY, of Evansville, Ind., has filed articles of incorporation with a capital stock of $250,000 for the purpose of manufacturing and selling machinery, devices and appliances for continuous motion advertising in street and interurban railway cars and other places. The directors are: E. C. Henning, G. T. Henning and Frank A. Larkin.

THE CHAPIN MANUFACTURING COMPANY, of Indianapolis, Ind., has been chartered with a capital stock of $20,000 by George F. Quick, Frank A. Chapin and D. J. Derthick. The company proposes to manufacture carburetors and other automobile and electric parts.

THE DREW-WEMLINGER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 by G. F. Drew, J. R. Wemlinger, of New York, N. Y., and J. J. Lawrence, Jr., of Brooklyn, N. Y. The company proposes to do a general engineering and contracting business.

THE ELECTRIC DAYLIGHT COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000. The company has purchased the entire business of the Star Electrical Concern and proposes to manufacture and sell all types of the Star flame lamp. The officers of the company are: W. H. Gardiner, president; A. W. Young, secretary and treasurer, who will also act as manager.

THE EUREKA SMOKE CONSUMER COMPANY, of Rochester, N. Y., has filed articles of incorporation with a capital stock of $50,000 for the purpose of manufacturing and dealing in smoke consumers. The incorporators are: J. R. Armstrong, F. Rish and G. Simmons, of Rochester, N. Y.

THE HOLT ENGINE COMPANY, of Burlington, N. C., has been incorporated with a capital stock of $300,000 by Lafayette Holt, J. M. Cook, W. W. Brown and others. The company proposes to manufacture and deal in electric apparatus, turbines and other engines.

THE HYDRAULIC ENGINEERING COMPANY, of Portland, Maine, has filed articles of incorporation with a capital stock of $500,000 to construct and operate hydraulic works, water, gas and electrical works, etc. C. E. Eaton is president and A. F. Jones, treasurer, both of Portland, Maine.

THE INDIANA ELECTRIC COMPANY, of Gary, Ind., has filed articles of incorporation for the purpose of doing a general electrical construction and engineering business; also to manufacture and deal in electrical supplies and equipment of all kinds. The incorporators are: George F. Quick, Frank A. Chapin and D. J. Derthick.

THE JAMES JOHNSTON MANUFACTURING COMPANY, of Utica, N. Y., has been chartered by C. A. Powell, of Whitesboro, N. Y.; J. S. Johnston and L. A. Johnston, of Utica, N. Y. The company is capitalized at $100,000 and proposes to manufacture machinery, electrical supplies and appliances.

THE MARYLAND CAHILL TELHARMONIC COMPANY, of Baltimore, Md., has been incorporated with a capital stock of $50,000 by Thomas Hildt, 1720 Bolton Street, Baltimore, Md., and others.

THE SANFORD HERBERT COMPANY, of Syracuse, N. Y., has been chartered with a capital stock of $25,000 by J. F. Dunston, C. G. Herbert and F. F. Sanford, of Syracuse, N. Y. The company proposes to manufacture and deal in motors, engines and machinery

THE UNITED MOTORS COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $5,000,000. The incorporators are: C. A. Bates, J. P. Geerloofs and W. O. Cook, all of New York, N. Y.

THE UNITED STATES TUNGSTEN [illegible] articles of incorporation under the laws of the [illegible] The company is capitalized at [illegible] Megrity, J. G. Gray and M. B. F. [illegible]

New Incorporations.

RED BLUFF, CAL.—Articles of incorporation have been filed by the Glenn County Telephone Company. The officers of the company are: J. P. Tate, of Paskena, Cal., president; H. P. Andrews, of Red Bluff, secretary and treasurer.

SAN FRANCISCO, CAL.—The Home Telephone Companies of San Francisco and Alameda Counties, Cal., which have been operated under a common management, have been consolidated under the name of the Bay Cities Home Telephone Company. The merger necessitated the taking up of the bond issues of the two companies and the issue of $20,000,000 in new securities.

SAN FRANCISCO, CAL.—The Central California Power Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are: S. D. Woods, C. J. Kuchel, R. W. Dennis, W. F. Postal and L. B. Doe.

COLORADO CITY, COL.—Articles of incorporation have been filed for the Canon Light & Power Company with the Secretary of State by P. H. Dodge, attorney, of Colorado Springs. Mr. Dodge states that the company proposes to construct a reservoir, pipe lines and power plant at a cost of about $80,000. The new company proposes to utilize the water power in the South Cheyenne Canyon.

BOLTON, CONN.—The Bolton & Coventry Telephone Company has filed a certificate of incorporation with a capital stock of $2,000 to construct and operate rural telephone lines. The incorporators are: Myron W. Main, of Bolton, Conn., and Robert W. Pitkin, of Coventry, Conn.

SARASOTA, FLA.—Articles of incorporation have been filed for the Sarasota Ice & Electric Company with a capital stock of $50,000 by J. G. Lewis, R. E. Ludwig and Walter Robinson Howard.

EDWARDSVILLE, ILL.—Articles of incorporation have been filed for the St. Louis & Eastern Traction Company by A. W. Crawford, J. J. Frey and A. M. Crawford, of Hillsboro, Ill.; C. C. Hoiles, of Greenville, and C. C. Terry, of Girard, Ill. The company is capitalized at $2,500 and proposes to construct an electric railway from Granite City through Collinsville, Troy, St. Jacob, Highland, Pierron, Pocahontas to Greenville. The proposed railway will serve as a feeder to the Illinois Traction System and the East St. Louis and Suburban lines.

SPRINGFIELD, ILL.—Articles of incorporation have been filed for the Valley Park, St. Louis & Eastern Railway Company by William C. Plass, Armond R. Plass, of St. Louis, Mo.; Charles Neustadt, John Suess, of East St. Louis, and Henry Schrader, of Belleville, Ill. The company is capitalized at $100,000 and proposes to construct a railway starting from the Mississippi River, opposite St. Louis, Mo., and extending to a point on the Indiana State line in Iroquois County.

STERLING, ILL.—The Sterling-Moline Traction Company has been incorporated with a capital stock of $100,000 by Joseph Wright, of Rock falls, Ill.; A. R. Lewis, of Morrison; C. P. Sturtevant, of Erie; W. McNeil, of Prophetstown, Ill.; George A. Allen, J. W. Harpham and Augustus G. Van Petten, of Sterling, Ill. The company proposes to build a railway from Sterling to Prophetstown.

LEWIS, IA.—Articles of incorporation have been filed for the Lewis Electric Light & Power Company with a capital stock of $5,000. W. B. Davis is secretary.

NEW ORLEANS, LA.—The Southwestern Traction & Power Company has filed articles of incorporation with a capital stock of $1,500,000.

PORTLAND, MAINE.—The United Light & Railway Company has been incorporated with a capital stock of $30,000,000 to supply electricity and gas for light, heat and power, etc. Clarence E. Eaton is president and Albert F. Jones, treasurer, both of Portland, Maine.

Legal.

APPLICATION FOR RECEIVER FOR THE BALTIMORE ELECTRIC LIGHT & POWER COMPANY.—A petition has been filed in the circuit court of Baltimore, Md., asking that a receiver be appointed for the Baltimore Electric Light & Power ompany. The petition was filed for Richard B. Fentress, one of the partners of the company and also part owner of the Fentress-Mediary electric light franchise. The defendants in the case are Charles H. Burr and John W. Van Dyke, both of Philadelphia, Pa. The company was formed to furnish electricity to a few con[illegible] Refrigerating Company. Mr. Fentress claims to have been hampered in his work by the defendants and in order to have his interests conserved has asked that a receiver be appointed.

Personal.

MR. E. C. JOHNSON, formerly with the Southern Pacific Railroad, has [illegible]

[illegible] general manager of the Atlanta Telephone & Telegraph Company, to succeed Mr. C. J. Simmons, Jr.

[illegible] in the storage battery industry in this country, has returned to his birthplace, Graz, Austria.

MR. WILLIAM G. McADOO, president of the Hudson & Manhattan [illegible] trip to Europe.

MR. WILLIAM SPALDING has severed his connection with the Portland (Ore.) Railway, Light & Power Company to become general manager of the Tillamook (Ore.) Electric Light & Fuel Company.

MR. H. ASKIN has resigned his position as superintendent of the Atkinson (Kan.) Railway, Light & Power Company to become general manager of the Bartlesville (Okla.) Interurban Railway Company.

MR. H. M. HIRSCHBERG, president of the Excello Arc Lamp Company, has returned to this country after his annual visit to the lamp works thoroughly enthusiastic over the outlook for the flaming-arc lamp.

MR. FRANCIS V. T. LEE, formerly assistant general manager of the Pacific Gas & Electric Company, San Francisco, has left this country for a visit of about one year and is now at his old home in Manchester, England.

MR. R. W. KEELY, who has been with the Southern Bell Telephone & Telegraph Company for the past two years, has been appointed manager of the Pensacola, Fla., office to succeed Mr. A. C. Hobson, who has been appointed district commercial manager at Columbia, S. C.

MR. M. S. SLOAN, a graduate of the Alabama Polytechnic Institute, has been made assistant to the president of the Birmingham Railway, Light & Power Company. Mr. Sloan has been with the company since graduation, occupying various positions from electrician to head of the business department.

MR. FRANK KOESTER, of New York, at the recent convention of the Society for the Promotion of Engineering Education, held at Madison, Wis., presented a paper discussing in detail the educational system of the German technical universities. He also analyzed the conditions and standing of the German engineer as compared with our own.

MR. B. E. SUNNY, president of the Chicago Telephone Company, and chairman of the political action committee of the Union League Club, of Chicago, called on Theodore Roosevelt in New York on Aug. 12 to extend an invitation on behalf of the club to the former President to make the Washington's Birthday address in Chicago, February 22, 1911. Col. Roosevelt has accepted the invitation.

Obituary.

MR. CHARLES PAIGE CARTER died at his home in Kingston, N. Y., Aug. 13, at the age of 81 years. He was well known as an inventor especially along mechanical lines. He was the originator of the apple parer. In 1872 he constructed a phonograph which reproduced the sound of the human voice after it had been recorded on tin foil, but the device was not patented. Mr. Carter was married three times and is survived by seven children. One of his sons is Mr. Charles Carter, superintendent for Blackall & Baldwin, manufacturers of electrical supplies, New York.

MR. ALEX. HENDERSON.—The many friends of Mr. Alex. Henderson will be grieved to learn of his sudden death on Aug. 11 while on his country place near Boston. Beginning in 1905, Mr. Henderson has occupied the position of electrician for the American Circular Loom Company, Boston. He was born at Edinburgh, Scotland, in 1859, and spent much of his early life in traveling, having encircled the globe twice before the end of 1881. He first became identified with electrical engineering in 1882, when he entered the employ of the Weston Electric Light Company, New York, in its Centre Street station. Subsequently he became associated with the Brush Electric Illuminating Company and engaged actively in much of the early electric lighting enterprises in New York City. Beginning with 1883 and for about seven years thereafter, Mr. Henderson represented the parent Brush company as superintendent of construction at many places in the United States, Canada and Mexico. In 1890 he became chief inspector for the Manhattan Electric Light Company, and in 1895 was appointed first chief inspector of the Bureau of Fire Alarm Telegraph and Electrical Appliances of the New York Fire Department. In 1898, Mr. Henderson joined the forces of the Sprague Electric Company to take charge of the introduction of the company's heavily-armored conduit. His next position was that held by him at the time of his death. Mr. Henderson was active in the affairs of the electrical contractors' associations, having served as master of transportation for several conventions. He was an associate of the American Institute of Electrical Engineers and a member of the Engineers' Club, New York City.

MR. ALEX. HENDERSON

MR. GEORGE RILEY, JR., manager of the *Pacific Miner*, was killed in a railroad wreck on the Northwestern Pacific Railroad near San Rafael, Cal., on Aug. 8, while on his way home to Petaluma. For a num- [illegible] manager for the Engineering *and Mining Journal*, leaving that position about five years ago to enter the service of the Calkins Newspaper Syndicate, as advertising manager for technical papers. Afterward he was manager of the *Pacific Rural Press* and only a week before his death took charge of the *Pacific Miner*. Mr. Riley was very well known and liked by the engineering and technical fraternity and was a prominent man in his home town where he was president of the Petaluma Chamber of Commerce. He leaves a widow and two children.

MR. GEORGE FLETT, best known in his capacity of managing director of Dick, Kerr & Co., Ltd., of London, was killed on July 27 by being thrown out of a motor car in which he was returning to Birmingham from a board meeting of the Metropolitan Amalgamated Railway, Carriage & Wagon Company, at Walsall. Mr. Flett was one of the best known and most popular men in the electrical business in Great Britain and was also well known to a large number of people interested in electrical affairs in the United States, having visited this country on several occasions. He was undoubtedly the first Englishman to grasp the fact, about a dozen years ago, that English manufacturers were not ready to produce electrical apparatus to satisfy the growing demand for electric tramway and railway business in England, and he it was who, after visiting America, inaugurated the English Electric Carriage Works (now the United Electric Car Company) at Preston and afterward the English Electric Manufacturing Company, now merged into the business of Dick, Kerr & Co. In carrying out these works and in the subsequent conduct of these two businesses he naturally came in contact with everyone of importance in electrical circles, not only in Great Britain but also in the far East, Japan and South America. Mr. Flett had the happy faculty of inspiring not only his own staff, but every one with whom he came in contact, with his absolute integrity and honesty of purpose. Mr. Flett was born in January, 1855, in the town of Wick, Scotland. He received his early training in Glasgow and entered into active life in London some 28 years ago, when he became associated with Dick, Kerr & Co., Ltd. From his early days in London he had been intimately connected with tramway contracts in England and saw the gradual extinction of the horse tramways, the partial adoption of cable traction and the general use of electric traction. While his early experience was chiefly gained in contracting, he had been for the last 12 or 13 years closely concerned with the manufacturing side of electrical engineering, and in this connection had been associated with some very notable developments. One of the most important schemes in which he was deeply concerned was the electrification of the Liverpool and Southport section of the L. & Y. Railway, while contracts for electric tramways and railways at home and abroad were constantly engaging his attention. In addition to being managing director of Dick, Kerr & Co., Mr. Flett was a director of the Metropolitan Amalgamated Railway Carriage & Wagon Company, Ltd.; Patent Shaft & Axletree Company, Ltd.; the Projectile Company; British Aluminum Company, Ltd.; the Rio de Janeiro Tramway, Light & Power Company, Ltd.; Mexican Light & Power Company, Ltd.; Monterey Light & Power Company, and the British Engineering Company of Egypt. Mr Flett is survived by one daughter.

Trade Publications.

MOTORS AND GENERATORS.—The Lincoln Electric Company, Cleveland, Ohio, has recently issued a bulletin describing and illustrating the detail construction of a line of direct-current motors (1.5 kw to 100 kw.)

VENTILATION OF ALTERNATORS.—Bulletin No. 4756, issued by the General Electric Company, gives a graphic description of the ventilation of horizontal steam turbine alternators, which will be instructive, as well as interesting, to those connected in any way with the operation of these machines.

POLYPHASE INDUCTION MOTORS.—Bulletin No. 4751 issued by the General Electric Company is devoted to various types of induction motors. The bulletin contains illustrations and descriptions of the design and construction of the skeleton frame motor of different sizes, and describes a vertical motor which can be furnished when this form is advantageous. Brief descriptions are given of mill type induction motors specially adapted for such exacting service as is encountered in steel mill operation. The bulletin contains illustrations of starting devices for use with these motors, and also of various parts composing the motor.

BUSINESS NOTES.

THE GREEN ENGINEERING COMPANY, manufacturer of coal and ash handling machinery, has taken offices in the Steger Building, 39 Jackson Boulevard, Chicago, where it will occupy the entire thirteenth floor.

THE ELECTRIC MANUFACTURING COMPANY, 127 North Tenth Street, Brooklyn, N. Y., is making extensive additions to its plant for manufacturing insulators. The present plant is kept busy working overtime filling orders.

THE WESTERN ELECTRIC COMPANY REPORTS ENORMOUS SALES OF RURAL TELEPHONES.—The Western Electric Company reports that during the past 20 months it has sold over a quarter of a million rural telephones.

THE GOULD COUPLER COMPANY.—Mr. W. M. Lalon, formerly manager of the railway department of the United States Light & Heat-

ing Company, has been appointed sales engineer [illegible] the electrical department of the Gould Coupler Company with offices in Chicago.

THE ILG ELECTRIC VENTILATING COMPANY, Chicago, has moved from 20 W. Kinzie Street, to its new six-story building at 154 Whiting Street, where much improved machinery has been installed to meet the increasing demands for its fans, blowers, automatic louvers, etc.

THE E. P. MORRIS ELECTRIC SUPPLY COMPANY has opened new offices and factory at Elizabethtown, N. J. The new factory is twice as large as the older one at Newark, N. J. The company reports a bright outlook for the future, the orders on hand being sufficient to keep the factory busy for some time.

THE WESTERN ELECTRIC COMPANY has opened new offices in Milwaukee at 378 East Water Street, to conform to the increasing business in that locality. The new store is a four-story and basement building devoted exclusively to displaying and storing telephone and power apparatus and electrical supplies of every description. The offices are in charge of Mr. A. C. Keene.

THE FEDERAL SIGN SYSTEM.—The first annual convention of the Federal Sign System (electric) was held at the Hotel Moraine, Highland Park, Ill., Aug. 4, 5 and 6. A very enthusiastic gathering of the company's officers and branch office managers was the result. Business sessions were held on each day, and a banquet was given on Friday evening, at which nearly 50 persons were seated at the table.

THE SPRAGUE ELECTRIC COMPANY.—Mr. Alfred E. Braddell, who has been with the Sprague Electric Company since December, 1905, first in the Philadelphia office and for the last two years in Chicago, has been transferred to the general office of the company at 527 West 34th Street, New York City. Mr. Braddell will act in the capacity of specialist, visiting different sections of the country as occasion requires.

THE ELECTRO-MECHANICAL ENGINEERING COMPANY, Manhattan Bldg., Chicago, which is now engaged in the preparation of the plans and specifications for the remodeling and enlargement of the electric lighting and water works plant of Bremen, Ind., reports a very busy and prosperous season. This company has devoted its attention to consulting and designing engineering along electrical, mechanical and chemical lines, in connection with the preparation of plans and specifications, reports, development of processes, design of special apparatus and machines, and tests on power plants and materials. Recently the company has branched out into the contracting field and, in addition to the above, is prepared to contract for the complete installation of electrical and industrial plants.

LEA RECORD COMPANY.—Mr. Charles G. Norris, Lea Recorder Company, Manchester, England, is on a visit to this country to present to American manufacturers the advantages of the Lea recorder in measuring boiler feed water, air pump discharges, discharges from pumps, wells, sewage, etc. The recorder is said to be employed extensively abroad in power stations and electrical works for these purposes, among the users being the London County Council, which has eight of them; the Corporation Electrical Works at Manchester, Glasgow, Edinburgh, Belfast; the Great Eastern Railway; J. G. White & Company, Limited; Worthington Pump Company, etc. Mr. Norris has engaged temporary headquarters at Room 823, Engineering Societies Building, 29 West 39th Street, New York, where the apparatus is on view.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. [illegible]

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

965,424. TROLLEY GUIDE; F. C. Vogan, Philadelphia, Pa. App. filed Nov. 15, 1909 (issued Aug. 2). Trolley guide consisting of curved bars on opposite sides of the pole, guide members [illegible] the trolley journal and connected by a spring with the pole and curved arms on the guide members, with a trolley operating rope connected with the curved arms, which is manipulated by the conductor so as to guide the wheel to the wire.

966,421. PORTABLE ELECTRICAL MEASURING INSTRUMENT; W. E. Beede, New York, N. Y. App. filed Dec. 21, 1909. Pocket instrument in which a flattened solenoid coil and flat core actuate a shaft carrying a pointer and counter balance.

966,456. CONTROLLING MEANS FOR ELECTRIC CIRCUITS; J. K. Lux, St. Louis, Mo. App. filed April 3, 1906. Opposite spring pressed contacts with a co-operative contact having a portion in the path of movement of the movable contacts and oscillating longitudinally and transversely.

966,457. OPERATING MEANS FOR CIRCUIT CONTROLLING DEVICES; J. K. Lux, Washington, D. C. App. filed Aug. 25, 1906. For indicating the positions of the movable contact of a rotary snap switch by means of an indicator detachable from the switch and positioning means therefor having coacting inclines.

966,467. TELEPHONE RECEIVER; K. and I. Nichols, Newark, N. J. App. filed Sept. 5, 1908. Telephone receiver with an extra ear piece and a tube between the receiver and the ear piece so as to utilize both ears.

966,475. SPACE TELEGRAPHY; C. R. Saffell, United States Navy. App. filed Aug. 12, 1909. The speed of the alternating current generator which energizes the oscillation circuit is kept constant by a motor and connection from the transmitting key for increasing the torque of the motor.

966,490. TELEGRAPH REPEATER; R. H. Tudor, Corinth, Miss. App. filed May 2, 1910. Telegraph relay including two relays of the standard type with connections so arranged that when the main line circuit on the one side of the repeater is broken a circuit through the other main line is maintained closed.

966,526. SYSTEM OF ELECTRICAL DISTRIBUTION; W. H. Clarke, Chicago, Ill. App. filed June 15, 1907. A main circuit, a subsidiary circuit, translating devices in parallel to the latter, a variable resistance in series therewith, a sectional solenoid for varying the resistance and means for automatically varying the energized portion of the solenoid with the variation of the resistance.

966,534. SOUND TRANSMITTER; F. M. Durkee, Newton, Mass., and J. B. Millet, Boston, Mass. App. filed Oct. 29, 1904. For submarine signaling in which the transmitter diaphragm responds to high pitch only, thus cutting out disturbing noises, by heating the diaphragm, soldering it at its edges and allowing it to cool and become taut.

966,539. TRANSMITTING APPARATUS; Lee DeForest, New York, N. Y. App. filed Aug. 24, 1908. For maintaining a uniform length of arc in a vapor of ethyl alcohol and methyl alcohol supplying carbon to the electrode.

966,542. METHOD OF MAKING CALCIUM CARBID, Herman L. Hartenstein, Constantine, Mich. App. filed Nov. 30, 1906. Calcines calcium carbonate in a thin stream with a flame of a burning mixture of carbid furnace gases and producer gas.

966,555. VARIABLE SELF-INDUCTANCE COIL; J. R. Jesse, Birmingham, Ala. App. filed Dec. 7, 1909. For wireless telegraphy, one coil sliding within the other forming primary and secondary, together with sliding contacts to make the connection.

966,560. ARC MECHANISM FOR SPACE SIGNALING; R. Kent, New York, N. Y. App. filed Aug. 24, 1908. Electrodes, a drip pan beneath and means for dripping a vaporizing fluid into the pan.

966,583. INSULATOR PROTECTING APPARATUS; L. C. Nicholson, Buffalo, N. Y. App. filed Sept. 10, 1909. An electric conductor, an insulator therefor, and an electrode opposite the insulator and electrically connecting with the conductor formed of two members clamped to the conductor on each side [illegible]

966,584. PROTECTING APPARATUS FOR INSULATORS; L. C. Nicholson, Buffalo, N. Y. App. filed Sept. 10, 1909. For high potential work in which an electrode is spaced from the insulator and electrically connected with the conductor and the arc is diverted away from the insulator when a flash-over occurs.

966,623. SOCKET SUPPORT FOR ELECTRIC LAMPS; W. C. Tregoning, Cleveland, Ohio. App. filed March 5, 1910. For signs, the socket consisting of two separable members with a conducting shell and screw to clamp them upon plates of different thicknesses, an electrical contact on one member in slidable contact with the shell.

966,640. GARMENT-CREASER; R. K. Aseltine and G. W. Langdon, Ottawa, Canada. App. filed Jan. 17, 1910. The rotary irons are heated by resistance coils and may be used to crease garments.

966,644. ELECTRIC CABLE; G. Bartels, Nippes, Germany. App. filed Aug. 26, 1908. When the cable is crushed or injured contact is made between two auxiliary conductors so as to actuate a cut-out switch.

966,655. ELECTRICAL PROTECTIVE APPARATUS; F. B. Cook, Chicago, Ill. App. filed July 15, 1909. For telephone switchboard protectors, making use of a thermo wire or fuse which is associated with the heat coils and the lightning arresters in a single piece of apparatus.

966,681. SERIES LAMP RECEPTACLE; C. D. Gervin, New York, N. Y. App. filed Feb. 20, 1909. A cluster receptacle with a flat annular base carrying threaded shells with stamped bottoms forming tongues and having recesses and center contacts engaged by the tongues.

966,690. ELECTRICAL GAS LIGHTING DEVICE; E. R. Joseph, Elkhart, Ind. App. filed Dec. 18, 1909. Two contact arms between which the spark passes, one connected to a support attached to the burner and the other mounted on an insulating holder projecting from the support.

966,694. ALARM ATTACHMENT FOR BRAKE VALVES; E. S. Lewis, Jr., Denver, Col. App. filed March 31, 1909. For sounding an alarm in a street car when attached to the engineer's valve of an air-brake system, the operator of the car automatically sounding the alarm when reducing the speed and releasing the brakes.

966,696. METHOD AND APPARATUS FOR MAKING X-RAY NEGATIVES; W. H. Merrill, Washington, D. C. App. filed June 21, 1909. A frame of aluminum carrying characters of copper amalgam serving to print upon the X-ray plate to identify it.

966,702. DOOR SWITCH OPERATOR; J. G. Peterson, Hartford, Conn. App. filed Nov. 3, 1909. Details in the construction of a door switch which can be inserted into the hanging stile of the door, regardless of the exact location of the switch.

966,703. ELECTRIC SAD IRON; J. W. Phelps, Detroit, Mich. App. filed Oct. 21, 1909. A removable resistance unit consisting of pair of enclosing plates with a perforated non-conducting member between and a resistance element passing about and through the perforations.

966,705. SIGNALING BY WIRELESS TELEGRAPHY; V. Poulsen, Copenhagen, Denmark. App. filed March 8, 1907. A generator supplying an arc connected with a self-induction and capacity, with means for damping the oscillation so that they may be caused to cease periodically.

966,708. AUTOMATIC MAGNETIC CIRCUIT BREAKER; W. M. Scott, Philadelphia, Pa. App. filed June 8, 1901. Electrical switch, a latch for locking the actuator and operating member together and a second latch engaging the actuator, and an electromagnet for unlocking the actuator from the operating member.

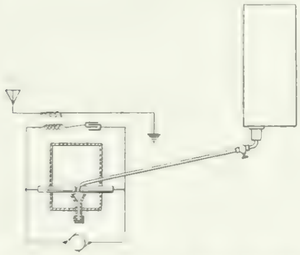
966,728. TEST DEVICE; A. H. Adams, Antwerp, Belgium. App. filed May 31, 1907. For temporarily connecting a conducting cord to an [illegible] with clamping jaws and spring-pressed plunger contacts on the plate.

[illegible] CIRCUIT FOR TELEPHONE EXCHANGE SYSTEMS; [illegible] M. Bullard, New York, N. Y. App. filed Aug. [illegible], 1906. For automatic systems in which the line terminals include a test [illegible] current of opposite polarity are associated with the connecting cord.

[illegible] RELAY; H. P[illegible], Herrsdorf, Germany. App. filed Sept. 2[illegible]. [illegible] A [illegible] relay with two armatures for telephone system, the latter operating under different degrees of energization and having two coils, one for small current sufficient to attract the supplemental armature. The other coil plugs in enough current also to attract the [illegible].

966,783. MULTIPLE FUSE CUT-OUT; C. Almas, Toronto, Ontario, Canada. App. filed Oct. 12. 1907. A filament carrier with holes containing filament and a contact piece connected to the filament, the fusible filaments being individually operated, and a plurality of the filaments carrying the current.

[illegible] CAR SIGNAL SYSTEM; P. [illegible], St. Louis, Mo.



[illegible] Arc Mechanism for Space Signaling

App. filed April 5, 1909. A normally closed electric circuit on a frame including a solenoid surrounding an axle with a stationary paramagnetic bar arranged transversely below the path of the vehicle and a controlable circuit including a solenoid surrounding the bar.

966,799. CONDUIT THREADING DEVICE; F. Crawford, Pasadena, Cal. App. filed April [illegible], 1909. A frame, a reel thereon, wire coiled on the reel with means to prevent it from slipping around the reel and for holding the coil flat at right angles to the axis of the reel.

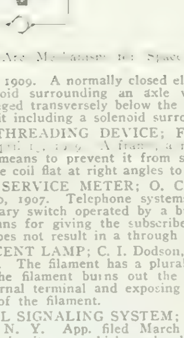
966,809. ELECTRIC SERVICE METER; O. C. Dennis, Chicago, Ill. App. filed June 20, 1907. Telephone systems including a normally opened supplementary switch operated by a button which registers a call, and with means for giving the subscriber credit for every call registered which does not result in a through connection.

966,812. INCANDESCENT LAMP; C. I. Dodson, Pittsburgh, Kan. App. filed April 9, 1909. The filament has a plurality of external connections so that if the filament burns out the lamp may be used by removing one external terminal and exposing another leading to the unbroken portion of the filament.

966,822. ELECTRICAL SIGNALING SYSTEM; A. Goldstein and C. H. Pool, New York, N. Y. App. filed March 9, 1910. A normally energized metallic circuit over which a plurality of current impulses are transmitted and selectively translated, and when an abnormal disturbance occurs the effect of the disturbance on the operation of the selective devices is neutralized.

966,823. ELECTRICAL SIGNALING SYSTEM; A. Goldstein, New York, N. Y. App. filed March 9, 1910. Metallic circuit with a source of current with means for transmitting current impulses and translating them and a second source of current together with means actuated by the failure of the first source for cutting in the second source and the circuit is then adjusted to suit the second weaker source.

966,824. ELECTRICAL SIGNALING SYSTEM; A. Goldstein, New



966,640.—Garment Creaser

York, N. Y. App. filed March 9, 1910. A central energy signaling system using code signals from a plurality of transmitters which are timed and made successive by electrical means consisting of thermostatic switches heated and controlled by the current in the circuit.

966,825. ELECTRICAL SIGNALING SYSTEM; A. Goldstein, New York, N. Y. App. filed April [illegible], 1910. When an accidental ground occurs in one or more loops of the system means are provided for cutting the loop out of a circuit and connecting it to a separate translating means in a local circuit.

[illegible] BRUSH HOLDER FOR DYNAMOS; E. C. Ketchum, Boston, Mass. App. filed [illegible]. A [illegible] [illegible] keep the brushes [illegible].

966,840. AUTOMATIC MERCURY DROPPER; E. C. Ketchum, Boston, Mass. App. filed June 25, 1909. Dynamo with a high speed armature [illegible] of the armature.

966,847. TROLLEY REPLACER; D. L. McBride and H. A. Fiske, Pasadena, Cal. App. filed Nov. 11, 1908. The replacer is actuated by a fluid pressure cylinder with piston and valve cylinder.

966,855. ELECTROMAGNET SEPARATOR; F. J. Phillips, Chicago, Ill. App. filed March 28, 1910. Includes an iron basket which is magnetized by a current in a coil located between members of the basket, the basket including two forked members.

966,882. ATTACHMENT OF TELEGRAPH AND SIMILAR WIRES TO INSULATOR; W. E. Bandfield, Wolverhampton, Eng. App. filed Dec. 13, 1909. A clip having wire receiving leads on its terminals with retaining devices engaging the wire and a member coupling the devices together.

966,897. CENTRAL ENERGY ALARM SYSTEM; J. C. Francis, West New York, N. J. App. filed Nov. 12, 1906. For translating impulses so that the abnormal disturbance will not render the translating device inoperative, means being provided on the occurrence of a ground for connecting the leads through the ground to the batteries with a transmitter operated through one of the leads to actuate the indicator.

966,901. ALARM SYSTEM; A. Goldstein, New York, N. Y. App. filed March 9, 1910. Alarm system of which the transmitter is controlled by energy from the central battery as long as the line wire leading from the transmitter is intact.

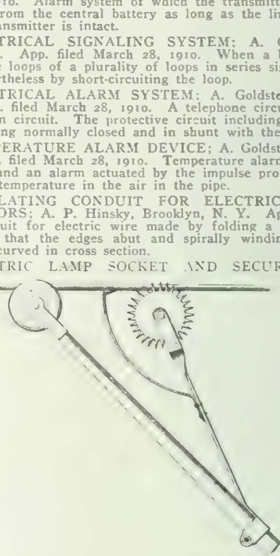
966,902. ELECTRICAL SIGNALING SYSTEM; A. Goldstein, New York, N. Y. App. filed March 28, 1910. When a break occurs in one or more loops of a plurality of loops in series signals are transmitted nevertheless by short-circuiting the loop.

966,903. ELECTRICAL ALARM SYSTEM; A. Goldstein, New York, N. Y. App. filed March 28, 1910. A telephone circuit is used as a burglar-alarm circuit. The protective circuit including the doors and windows being normally closed and in shunt with the main line.

966,904. TEMPERATURE ALARM DEVICE; A. Goldstein, New York, N. Y. App. filed March 28, 1910. Temperature alarm device including a pipe and an alarm actuated by the impulse produced by a rise in external temperature in the air in the pipe.

966,917. INSULATING CONDUIT FOR ELECTRIC WIRES OR CONDUCTORS; A. P. Hinsky, Brooklyn, N. Y. App. filed Feb. 1, 1910. Conduit for electric wire made by folding a strip of fibrous material so that the edges abut and spirally winding around it a metal strip curved in cross section.

966,966. ELECTRIC LAMP SOCKET AND SECURING MEANS



967,051.—Ice Cleaner for Trolley Poles.

THEREFOR; W. C. Tregoning, Cleveland, Ohio. App. filed Feb. 12, 1908. For removably mounting the socket for signs, dispensing with screws and using a spring-like locking member.

967,051. ICE CLEANER FOR TROLLEY POLES; J. C. Poe, Rosedale, Kan. App. filed Sept. 23, 1909. A resilient arm bifurcated at its upper end to form a pivot for the wheel journaled in the end, having toothed rims; and a curved scraper secured to the arm.

967,058. ELECTRIC WATER HEATER; H. N. Roche, San Francisco, Cal. App. filed Dec. 21, 1909. A receiver, inlet and discharge connections, and electric heating unit, a rotatable snap switch and means including a rack and pinion associated with the inlet connection for actuating a water valve.

967,059. RAILWAY SWITCH OPERATING MECHANISM; E. D. Rose, Marshburg, Pa. App. filed May 14, 1909. An electric device connected with a switch tongue for operating it, controlled by mechanism upon the car.

967,084. PROCESS FOR MANUFACTURING THE HOOKS INTENDED TO SUPPORT THE FILAMENTS OF INCANDESCENT LAMPS; P. G. Triquet, Paris, France. App. filed Feb. 4, 1910. Unites a bundle of thin wires which receive carrying hooks and a thicker wire to form the spring of the pivot rod, solders the ends together and connects to the central rod of the lamp, shortens and folds the thin wires to receive the hooks.

967,113. COMBINED TELEPHONE AND ALARM OR KINDRED SERVICE SYSTEM; W. W. Dean, Chicago, Ill. App. filed April 30, 1903. Makes use of individual registers for the lines and operates a system from a common battery source, the alarm transmitter being arranged to permit reversal of the line wires in installing without affecting the operation. Also makes use of visual alarm system and a mechanical lock for the alarm receiving devices at the exchange, so that current over one side of the line prevents the operation of the receiver.

967,118. DEVICE FOR DETECTING WAVES IN WIRELESS TELEGRAPHY; G. C. Ellwood, Arbuckle, Cal. App. filed June 18, 1909. A variable inductance with indicators and means for connecting the inner and outer coils to give the desired inductance.

967,138. SYSTEM FOR MOTOR CONTROL; S. H. Keefer, Plainfield, N. J. App. filed Nov. 8, 1909. A motor controlling system with a reversing switch including two solenoids, a blow-out magnet and contact controlled by the solenoids and means for preventing closing of the switch until the magnetism of the blow-out magnet has fallen to a predetermined point after the deenergization of one of the solenoids.

[illegible] LIGHTNING ARRESTER; P. P. H. Knight, Keokuk, Ia. App. filed [illegible]. A discharge path, a path for normal current, the [illegible] of the paths being such that lightning never passes [illegible] current path, the discharge path having air gaps and being shunted by a magnet coil, which interrupts the flow of the ground.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday of the week of issue.

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THE INTERNATIONAL ELECTROTECHNICAL COMMISSION AT BRUSSELS

On another page we print an account of the proceedings of the recent "réunion amicale" of the International Electrotechnical Commission at Brussels. The reason for holding a reunion this year, instead of a plenary convention, was that at a convention the proceedings are necessarily of a formal and rigid character, in which definitely prescribed resolutions are either voted or rejected; whereas, at a reunion, the resolutions are not final, so that much greater freedom of discussion and of proposals naturally exists. The reunion just held has been a great success for all parties concerned, and especially for the electrical engineering institutions of the United States. Four subjects were discussed by the reunion, namely, nomenclature, symbols, vectors, and rating of machinery. The suggestions for the last three emanated, in considerable measure, from the United States committee, which fortunately was represented at the meeting by Dr. A. E. Kennelly, its president. All four subjects were dealt with in a definite and satisfactory manner, constituting a basis not only for a final vote in plenary session next year, but also for steadily maintained advance along the lines selected.

In the matter of nomenclature, a list of some 80 equivalent terms in the German, French and English languages has been recommended; while a committee of three delegates has been ordered for continuing the work. In the matter of symbols, the list submitted by the United States committee has been recommended for international adoption, with only minor modifications. As regards the direction of rotation in vector diagrams, the reunion voted to undertake an examination of the question, with a view to arriving at a final vote next year as to which direction should be internationally adopted. This will be a boon to a great number of technical men and electrical engineering students, by bringing to a close, in all probability, the useless and wasteful existing dissension between different textbooks on alternating-current phenomena. It is expected that the central office of the commission in London, will shortly invite all of the local committees to communicate briefs on either side of this vexed question, and that these briefs will be mutually interchanged in such a manner that the delegates at the next plenary convention may meet fully prepared to vote upon the subject. Assuming that this decision is satisfactorily reached, it will probably carry sufficient weight to bring all subsequent publications into conformity, a benefit that would alone justify the existence and organization of the commission.

With regard to the rating of machinery, no great advance in detail can be expected internationally for the present, because the subject is so involved, and because the sets of standardization rules adopted by the various national electrical engineering bodies differ so materially in minor matters. A great step has, however, been made in arriving at a resolution that the output [illegible]

pressed in watts. Hitherto, it has been customary for engineers in all countries to express generator outputs in watts, but motor outputs in horse-power, cheval-vapeurs, poncelets, or watts. It is not to be expected that a resolution of this kind will instantly take effect, or that we shall see the rating of moors in horse-power speedily disappear from the electrical engineering industry; but it is to be expected that, if this resolution is ratified next year, there will be a tendency on the part of engineers everywhere to drop the term horse-power in motor ratings, so that in time this term will disappear. There can be no doubt that from an electrotechnical and engineering standpoint, outside of the domain of the physicist, the Brussels reunion will be regarded as the most important international event since the international electrical congress of St. Louis in 1904; and it is to be hoped that even better success will by this reunion be insured for the plenary convention of 1911.

THE MICHIGAN ELECTRICAL CONVENTION.

The convention last week of the Michigan Electrical Association was, as usual, marked by excellent discussions on the floor, and a social atmosphere that conduced to the exchange of experience among the attendants. The subject of rates at any electric light convention never fails to stir up a discussion. At Port Huron the usual animation with which this subject is taken up was increased by the injection of certain ideas favorable to flat rates, which were vigorously opposed by some members. A few years ago it would have been difficult to find anyone who would get up and defend the flat-rate system of charging for anything but a central-station operating by water-power with an ample supply of water. In recent discussions, however, it is notable that some of those most favorable to flat-rate ideas are among those who have given intelligent thought to the rate question. The truth is that the advent of the tungsten lamp has utterly unsettled former opinion as to rate systems, and the subject has reverted to the stage that existed 15 years ago. We are now in a transition period, and while the current proposals and discussions of rate systems are of the highest interest, the central-station man should for some time to come reserve final judgment as to which of the numerous proposals constantly being made really shadows a permanent solution.

The real point at issue in the discussion which took place in the Michigan convention was not whether it is advisable to go back to the old flat-rate system of charging for all customers, but whether there is not a certain field for a flat rate alongside systems using watt-hour meters. It is well known that consumers on the flat-rate basis are likely to abuse their privileges, not only by waste of electricity, but by substituting larger lamps than those they have contracted for. To overcome these difficulties it is contended by some that the rate must be high enough to leave a profit for the company even with considerable waste of energy; and if the system is put into extensive use among small consumers, some appliances for controlling the maximum demand should be used, which cannot be tampered with by the consumer without detection. With carbon lamps a rate high enough to make the company safe against loss would necessitate a cost too high for the small consumer whom it is desired to attract by means of the flat-rate proposition. With tungsten lamps, and especially with the tungsten lamps of 16 watts to 25 watts consumption, a rate may be made high enough to protect the company and at the same time low enough to attract the small consumer. In fact, to the central station the attractive feature of the controlled flat rate as it is now being tried in a number of the cities is the high gross revenue which it brings per kilowatt of maximum demand. A rate of 1 cent per month or 12 cents per year per watt of demand contracted for is the equivalent of $120 per kilowatt of demand per year. There are very few consumers on the average lighting company's mains who yield as high a revenue as this, the average usually falling between $65 and $75 per kilowatt of station capacity, in which allowance should be made for losses between the consumer and station busbars.

It has been proposed frequently of late that rates be readjusted in anticipation of the menace of low-candle-power tungsten lamps so as to require higher fixed charges per consumer and per kilowatt of maximum demand, at the same time lowering the kw-hour rate. It is but a short step from this with small residences to wiping out the kw-hour rate altogether and basing the charge on maximum demand entirely, the latter being, of course, the controlled flat-rate system. The question thus set for companies to decide is whether the flat-rate system will not be sufficiently accurate for the class of small residence consumers from whose business companies fear loss of revenue with the introduction of low-candle-power tungsten lamps. As far as the larger consumers are concerned, the use of heating appliances and the more liberal use of light and motors will doubtless counteract any bad effect on the revenue. In passing it may be remarked that the entry into the field of low-candle-power tungstens has plainly aggravated a situation which was being satisfactorily settled on the basis of "more illumination for the same money." It has been well demonstrated that the old-fashioned flat-rate system is not satisfactory or equitable for general application over a central-station company's entire system, because it ignores the variable kw-hour expenses. On the other hand, the uniform meter rate of so much per kw-hour, which originally took its place, is unfair and unsatisfactory because it ignores the element of fixed charges which are dependent on the size of the consumer's installation and the number of hours per year he uses it. It would appear that the coming successful system of rates must take into account both these elements. As President Marshall said in closing the discussion at Port Huron, those building rate systems should first of all recognize the three factors—kw-hour, maximum demand, and consumer costs—which enter into the expense of serving any consumer; and if once these are fully recognized and reckoned with, the exact form or name of the rate system is not of so much consequence. It is quite possible that for some conditions a flat rate with suitable control of the maximum demand will approach near enough to an equitable rate to be advisable. Under other conditions it is manifestly impracticable.

SAFE ILLUMINATION.

Of late much attention has been directed to the problems of ocular hygiene, and attention should be directed to a long investigation recently brought to the attention of the French Ophthalmological Society by Professor Gariel. It is a study of the effects of artificial light upon the eye, with special reference to the ultraviolet radiation to which many injuries to the eye have been ascribed, perhaps with some lack of discrimination. There is no doubt that certain radiations of very short wave-length may do serious mischief to the visual organs, but it is hardly clear as yet that one can definitely assign to a par-

ticular region of the spectrum all the troubles to which the eye falls victim. In drawing up an indictment of the ultraviolet, some counts against the visible spectrum may probably be found. There is no doubt at all that serious damage may also follow too long or too energetic exposure of the eye to ordinary light. After every solar eclipse oculists have occasion to treat a certain number of cases of grave injury due to overexposure of the eye to the solar rays, either directly or with intensity enhanced by the use of telescope or field glass. Some of these cases involve merely inflammation and temporary scotoma; others a permanent scotoma, the retina being locally damaged beyond repair by the violence of the photochemical action produced. Now such injuries must be charged to ordinary light, since in the first place a telescope objective presents a sufficient thickness of usually dense flint glass to block the ultraviolet rays, and, second, the permanent damage is retinal, while there is considerable evidence ably marshalled by Dr. Gariel to show that the media of the eye themselves absorb the ultraviolet rays. Moreover, there are numerous cases in which serious permanent damage has been done by the persistent glare of an incandescent lamp filament, the light from which is notoriously weak in the ultraviolet, and, moreover, is already filtered through the lamp bulb. It is unsafe to work long about an electric arc, even when the eyes are protected by glasses quite competent to cut off totally the extreme ultraviolet. In other words, there is not the slightest doubt that the eye can be injured or ruined by too great access of energy in the form of ordinary light, and that the damage thus done is quite as much to be feared as that produced by any other form of radiation. We lay special stress on this phase of the matter since the tendency of some of the recent literature has been so to accentuate the dangers of the ultraviolet as to withdraw attention from the ever-present risk of injury from ordinary glare.

Professor Gariel in taking up the study of the effect of the shorter radiations directs especial attention to the way in which they are absorbed by the crystalline lens of the eye, an absorption which is very plausible and believed to lead to its damage. He gives a résumé of the very interesting studies of Chardonnet, Gayet and others on the aphakic eye—that is, lacking the crystalline lens—indicating how this lens strongly absorbs the rays transmitted by a thin silver film while the other media of the eye transmit them. For this reason the aphakic subjects could see the ultraviolet rays from the electric arc. Gayet in particular went further and showed that the young eye of a ten-year-old subject possessed still a lens transparent enough to see the arc through the silver filters. In later life the lens grows yellow, so that in the case of the old it is not easy to see the H and K lines of the solar spectrum. In this case, nearly the whole ultraviolet must be absorbed, so that the rays of wave-length just outside the visible spectrum may still be culpable. Glass workers' cataract, for example, seems quite as likely to be due to these supposedly harmless rays as to those further in the ultraviolet, which must be relatively weak at the temperature of molten glass. Too great an access of energy to the eye is dangerous to a high degree, whatever its wave-length.

There is undoubtedly, however, a type of injury somewhat resembling an X-ray burn which is specifically due to rays in the extreme ultraviolet, probably of wave-length 300 $\mu\mu$ and below. The effect is a very characteristic one in that it comes on violently some hours after exposure; and while producing great pain and severe inflammation, it affects the frontal media of the eye, rather than the retina, and in all but the severest cases ends in complete recovery. It is this type of injury that has in a number of cases been received from the quartz mercury lamps. Slightly colored spectacles seem competent to cut off the injurious radiations and to enable the patient to go back to his occupation under the quartz arc with impunity. Save for some cases of injury to the eyes from the tremendous flash of lightning or an electrical short circuit, in which cases there is good reason to believe the action to be very complex, the quartz arc seems to be the sole source of injury from extreme ultraviolet radiation. As such arcs are in very limited use at present and can be readily guarded against, the practical danger chargeable to the ultraviolet seems very slight indeed. It probably requires a considerable integral of ultraviolet energy concentrated on the eye to do harm, since in some of the recorded cases the victim had worked for many hours alongside an Arons lamp before experiencing any trouble. If the danger came in any material degree from any but the very short wave-lengths, we should be in continual trouble from sunlight, which is far richer in the ultraviolet than ordinary artificial illuminants.

In short, looking over all the evidence, it appears that there has been a rather needless scare over ultraviolet rays. That a particular class of them, very weak in all ordinary illuminants and easily stopped, does produce a peculiar and easily recognized type of injury to the eye is beyond dispute; but from a practical standpoint there is immensely greater danger from too great concentration of energy in the form of ordinary light. Indeed, if one follows the ordinary matter-of-fact rule of screening all sources of high intrinsic brilliancy to avoid glare, there is nothing to be feared from the ultraviolet. Professor Gariel, indeed, classifies the commercial illuminants in the following order as regards proportion of ultraviolet rays: Oil lamps, petrol lamps, electric incandescents, Welsbachs, acetylene, mercury arcs, ordinary arcs. He finds that the ultraviolet is practically cut off by medium shades of yellow glass used as shades or spectacles, and advises the free use of the former in shading very brilliant lights. As regards the general requirements for illumination, Professor Gariel is quite in accord with the trend of present practice. He advises an illumination of at least 15 lux as a minimum for good lighting, and strongly advises the effective diffusion of the light from intense sources. He strongly favors the electric incandescent as the basis of interior lighting, and incidentally gives an example of the psychology of illumination with which we may appropriately close this notice. It seems that the Paris Opera House changed from gas to incandescent in 1889, and the change had been widely advertised to take place on a certain evening. Next day appeared a patient, otherwise intelligent, who complained of troubles of vision and severe headache, following his attendance at the first performance given by this devilish electric light. A couple of hours later Dr. Gariel ascertained that, owing to an accident to the machinery, the opera on that evening had been lighted by gas, as usual. We have a strong feeling that when this is conscientiously done, cases of injury from artificial light will generally turn out to be due far more to the improper use of the source than to any peculiar quality inherent in it. Keep lights steady, and screened to a reasonably low intrinsic brilliancy, and there will be few complaints.

The Reunion Amicale of the International Electrotechnical Commission at Brussels.

The last meeting of the International Electrotechnical Commission was held at London in October, 1908. The next meeting is scheduled to be held in 1911. It was decided, however, to hold an unofficial meeting or "réunion amicale" this summer, in preparation for next year's meeting, and the Belgian committee offered a cordial invitation to all the national committees that they should hold the reunion at Brussels Aug. 8 to 11. The Brussels Exposition being open this summer offered additional attractions to the plan, which was entered into very heartily.

The following national committees were represented at the reunion:

Austria.—Herr Seidener.

Denmark.—Prof. A. Larsen.

France.—Mm. A. Armagnat, P. Boucherot, E. Brunswick, J. Blondin and Ch. David.

Germany.—Dr. E. Budde.

Great Britain.—Major W. A. J. O'Meara, Messrs. W. Duddell, K. Edgcumbe, R. Hammond, W. H. Patchell and P. F. Rowell, secretary of the Institution of Electrical Engineers.

Holland.—Mm. C. H. Julius and W. B. Smit.

Italy.—Mm. C. Clerici, G. Semenza and S. Verole.

Japan.—Prof. H. Nagaoka.

Switzerland.—M. Täuber.

United States.—Dr. A. E. Kennelly and Mr. C. F. Scott.

The Belgian committee, acting as hosts, were represented by the following delegates: Mm. Prof. Eric Gerard, Armand Halleux, Léon Gérard, G. A. L'Hoest, Omer De Bast, Albert Hanssens, Louis Mettewie, A. Briffaux, Emile Closset, Gustave Coune, M. Creplet, Ernest D'Hoop, Vital Françoise, E. Gevaert, G. Gillon, Robert Goldschmidt, Saturnin Hanappe, Albert Jaspar, Edouard Lacomblé, Paul Nemery, Emile Piérard, F. Saurat, Fernand Vande Wiel and Emile Vytborck. The total attendance was thus 47 representatives, including 23 from countries outside of Belgium. The honorary secretary of the commission, Col. R. E. Crompton, C.B., and the general secretary, Mr. C. Le Maistre, were also in attendance. The president of the commission, Prof. Elihu Thomson, was unable to leave the United States to attend the reunion, but forwarded a message of encouragement and goodwill.

The program issued by the Belgian committee comprised three days of business sessions (Aug. 8 to 10), and three days of visits to plants, factories and places of electrotechnical interest (Aug. 11 to 13).

The general secretary, Mr. Le Maistre, issued in advance of the reunion a program of the business to come before the meeting. It comprised three general topics, namely, (1) nomenclature, (2) symbols, (3) rating of machinery.

The opening meeting was called to order on the morning of Aug. 8. Prof. Eric Gerard was unanimously elected chairman of the sessions. Professor Gerard read an address of welcome. Col. Crompton, the honorary secretary, read a brief report outlining the history and progress of the commission, showing that 16 countries were now officially taking part in the work.

The first subject under discussion was that of nomenclature. It was shown that lists of electrotechnical definitions in alphabetical order had been completed by the British committee from A to E, and by the French committee from A to G. These two lists were in process of being mutually adjusted into conformity. The Italian committee had also made progress.

Dr. Budde offered the opinion that the lists of terms and definitions under preparation by the above mentioned committees were too lengthy and time-consuming. He submitted a list of 80 German terms, with their corresponding terms in English and French. All of these terms related to dynamo-electric machinery. He proposed that this list of equivalent terms should be made the basis of further and more accelerated progress in nomenclature, leaving the work already undertaken by the other committees to be completed at leisure. Dr. Budde's proposal was discussed at length by Messrs. Boucherot, Hammond, Duddell, Siemens, Semenza, Brunswick, and others. It was then deferred for reconsideration at the next session.

The next subject considered was that of symbols for use in electrical engineering, a suggested list of which had been previously prepared and submitted by the United States committee. The French committee proposed a series of regulations of principles, for provisional adoption, on the types and styles of letters which should be used in electrotechnical formulas. This proposal was also deferred to the next session for further consideration, and the meeting then adjourned.

At the second meeting, on the morning of Aug. 9, the subject of nomenclature was again considered. After a long discussion, participated in by representatives of a number of countries, it was unanimously voted as the sense of the meeting that Dr. Budde's list of equivalent terms should be adopted as the basis of further work in definitions by the various national committees; but that the French committee, with the aid of the Belgian committee, should prepare a separate systematic and logically connected system of definitions for subsequent consideration; also that a subcommittee of three from the British, French and German committees should meet between March 1 and Sept. 1, 1911, to collate the various nationally prepared lists for report to the next meeting of the commission.

The attention of the commission was drawn to the fact that next year (1911) joint expositions are scheduled to be held at Turin and at Rome. Preliminary proposals had been made to hold an electrical congress at Turin in connection with the exposition. It was suggested that if it were possible to hold the meeting of the commission at Turin this would probably be of great service to all concerned.

Dr. Budde, on behalf of the German committee, expressed his belief that although his committee would, of course, prefer to have the commission meet next year in Berlin, yet, in view of the undesirability of attempting to convoke the commission in one city and an electrical congress of very largely the same membership in another city, during the same season, he felt sure that it would be better to choose Turin as the place of meeting in case an electrical congress was to be held there. It was then voted to leave the decision as to the place of meeting next year to the Italian committee in conference with the German committee.

The question of symbols was next discussed at considerable length by a number of delegates. It appeared as though the matter was likely to be returned back to committee, until a solution presented itself and it was unanimously voted to adopt as the sense of the meeting five of the French committee's recommendations, and also the list of nine symbols proposed by the American committee, with certain slight amendments, and with the single exception of the symbol for permeability, owing to some question as to the use of Greek letters.

The question of rotation of vectors was next considered. It was reported by the American delegates that at the last convention of the American Institute of Electrical Engineers (at Jefferson, N. H., in June-July, 1910) a resolution had been carried to submit the question to the commission for an international decision as to which direction of vector rotation should be adopted in electrotechnical literature. It was recommended that the matter should be taken up for consideration, and that the various national committees should be invited to submit arguments on either side of this question for circulation by the central office, with a view to a decision being reached at the next meeting of the commission. The meeting then adjourned.

The third and last day's session was devoted almost entirely to the discussion of the United States committee's proposal on the subject of rating of machinery. The matter was debated at considerable length by Messrs. Crompton, Budde, Boucherot, Hammond, Kennelly, Scott, Semenza, Hanssens, Siemens, de Bast, Brunswick, Hanappe, Duddell, Julius and Larsen. A unanimous resolution was finally arrived as to the effect that in the case of direct-current machines the output of generators should be defined as their electrical power available at terminals,

and the output of motors as the available mechanical power at their shafts. In both cases the power should be expressed in international watts. This resolution definitely deals with Clause A of the United States committee's proposal. It was decided not to take up Clause B at the present time.

At the suggestion of Dr. Kennelly a resolution was unanimously reached, on a motion by Signor Semenza, that if names should be needed in the future for other electromagnetic units the name of Kelvin should be given first consideration.

After unanimous votes of thanks to Chairman Gerard, Honorary Secretary Col. Crompton and General Secretary Le Maistre the session adjourned.

Following is the list of symbols and synopsis of their rules recommended to the several national committees for international adoption:

Electromotive force	E, e
Electric quantity	Q, q
Inductance	$\mathcal{L}$
Magnetic force	$\mathcal{H}$
Magnetic flux-density	$\mathcal{B}$
Length	L, l
Mass	M, m
Time	T, t

Small letters are to be reserved for instantaneous values of electrical quantities varying with time, and capitals used for effective or constant electrical quantities.

Capital letters with subscript m to be reserved for maximum cyclic values of periodic electrical quantities, capital script letters for magnetic quantities, and with the subscript m for the maximum cyclic values of periodically varying magnetic quantities.

Eastern Tennessee Hydroelectric Plant.

Work will soon be commenced on the dam and hydroelectric power station of the Eastern Tennessee Power Company, on the Ocoee River, at Parksville, Polk County, Tenn., about 12 miles from Cleveland, Tenn.

The dam will be of cyclopean concrete and about 780 ft. long on the crest. Four hundred and thirty lineal feet of this dam will be of the overflow type and 350 lineal ft. will be of the non-overflow type. The overflow portion, which will be about 110 ft. high above mean water stage, will be of the usual ogee section. The non-overflow portion of the dam will be about 13 ft. higher than the overflow section and will be of a special section to accommodate penstock intakes at the top and penstocks passing from the intakes to the turbine below.

The power house will be located on the down-stream side of the non-overflow portion of the dam and will be an integral part of the same. The substructure will be of massive concrete and will consist mainly of piers and arches below the dam. The turbines will be located at the elevation of the main floor and will discharge into the tailrace under the arches. The superstructure will consist of brick or stone walls with enclosed steel columns. These columns will support the superstructure floors, crane runway and steel-roof trusses. The superstructure floors will be reinforced concrete slabs supported on steel girders and floor beams. The roof slabs will be reinforced concrete supported on steel purlins and will be provided with suitable roof covering.

The power equipment will consist of four main units of normal rated capacity of 3000 kw each, one 200-kw exciter unit, the necessary step-up transformers and switching equipment for the control of this apparatus. Each main unit will consist of one tandem horizontal turbine in enclosed case direct-connected to a three-phase, 60-cycle, water-wheel type alternating-current generator. Each generator will have mounted on its shaft an exciter having a capacity sufficient for its excitation.

The miscellaneous equipment will consist of an electrically driven traveling crane; a transformer truck; necessary gates and gate hoists; water, oil and air circulating systems; miscellaneous piping; pumping apparatus, lighting system and all other apparatus which is essential for the complete equipment of a first-class station.

A tailrace will be excavated for some distance down-stream from the power house and will, if found necessary, be separated from the main river channel by timber crib or concrete wall. The shore of the river adjacent to the power house will, if necessary, be protected by means of a riprap. A permanent gravel or macadam road will be constructed from the present highway to the power-house entrance. Along the Ocoee River and its tributaries public roads will be relocated at various places where their present grade is below the maximum flow line of the reservoir. New bridges, culverts, etc., will be built where necessary, due to these changes.

The estimated cost of the work is approximately $2,000,000. The contract for the complete engineering and construction of the plant has been awarded to J. G. White & Company.

Widespread Combination of Public-Utility Properties in Minnesota and Adjoining States.

An important combination of public-utility companies in the states of Minnesota, North Dakota and Wisconsin, but centering at present more particularly in the southern part of Minnesota, has been made by the recently organized Northern States Power Company. This company is a holding company owning the controlling interests in the stock of the Consumers' Power Company and the Apple River Power Company. The Consumers' Power Company controls the plants in Minnesota and North Dakota and the Apple River Power Company the two water-power developments in Wisconsin, near Stillwater, Minn., which comprise all the present properties in Wisconsin controlled by the Northern States Power Company. H. M. Byllesby & Company, of Chicago, are promoters, engineers and operators for the Northern States Power Company.

In St. Paul, Minn., the largest city in the territory involved, the combination has acquired the Northern Heating & Electric Company, which is a comparatively new central-station company doing an electric-service and district-heating business. The general manager of this company since Jan. 1, 1910, has been Mr. H. C. Eddy, who has made a conspicuous success in directing its affairs. The Washington County Light & Power Company, of Stillwater and White Bear, Minn., has been acquired by the Consumers' Company. In Stillwater it has supplied gas and electric service, and in White Bear it has been a straight electric utility. At Hudson, Minn., near Stillwater, a gas company has been acquired. Stillwater and White Bear are not far from the two water-power developments on the Wisconsin side of the St. Croix River, and belonging to the Apple River Power Company. They are supplied with electricity from these hydroelectric plants.

South of St. Paul, at Cannon Falls, on the Cannon River, near Northfield, Minn., there are two water-power developments now under construction. There is a head of 55 ft. in the river at this point and about 2000 hp will be developed. At Northfield, the Northfield Light, Heat & Power Company, an electric company, has been acquired for the system, while the local Cannon Falls Electric Service Company is also a part of the system. There is a transmission line from this point to Faribault, where the Faribault Gas & Electric Company is the local property belonging to the system. From Faribault west to Mankato, a distance of about 45 miles, it is proposed to build an additional transmission line. At Mankato, the Mankato Gas & Electric Company has been acquired, and 8 miles south of this city a water-power development with a 60-ft. head is being built on the Blue Earth River. About 2000 hp will be available from this hydroelectric station. A feature of the Ambursen dam which will be built here will be that the county bridge over the river at this point will form a part of the crest of the dam.

In the northwestern part of Minnesota and in two adjacent cities in North Dakota, just west of the Red River of the North, which forms the boundary between the two states, is another group of properties belonging to the Consumers' Power Company, and in turn controlled by the Northern States Power

Company. At Grand Forks, N. D., the Grand Forks Gas & Electric Company has been acquired. This company supplies the gas, electric service and district heating. Across the river is East Grand Forks, Minn., and here there is a gas and electric property which is included in the system. About 45 miles east of these cities is Red Lake Falls, Minn., where the Red Lake Falls Electric Company has been acquired. Near by is a water-power development on the Red Lake River, and it is proposed to connect Red Lake Falls and Grand Forks by a transmission line. Ninety miles south of Grand Forks is Fargo, N. D., and here the Union Light, Heat & Power Company has been acquired. This company supplies gas, electric and heating service. Across the river a gas plant has been acquired in Moorhead, Minn.

All the companies and properties mentioned will be operated as one concern. There is a rapid extension of the business of supplying gas, electricity and heating in the territory named. The gas business is pushed in the direction of using it as fuel, particularly for domestic purposes. The companies controlled by the Northern States Power Company have made a feature of giving away gas stoves to consumers if the latter will agree to burn a certain amount of gas. In this way about 3000 gas stoves have been placed throughout the system in one month.

Chicago Consolidated Traction Company Rehabilitation.

There now appears to be a good prospect of the merger of the Chicago Consolidated Traction Company with the Chicago Railways Company and the rehabilitation of the street-railway surface lines of the former in the outlying portions of the North Side and West Side of Chicago. Negotiations looking toward this end have been protracted, owing to difficulty in arriving at a settlement with the owners of the underlying bonds of the Consolidated properties. On Aug. 15, however, the reorganization committee of the bondholders accepted the final valuation of the tangible property of the Consolidated Company (including legal expenses, brokerage, etc.) made by Messrs. Bion J. Arnold and George Weston, engineers acting on behalf of the city of Chicago, which was an active party to the negotiations, as the franchises of the Consolidated lines have in many cases expired or have nearly expired. This valuation was $3,957,454, and it believed that the sum inserted in the rehabilitation ordinance, which will be presented soon at a meeting of the City Council, will be a round $4,000,000. If the ordinance is adopted, it is said that 29 miles of the tracks of the Chicago Consolidated Traction Company will be rehabilitated before next spring, and that 215 of the large pay-as-you-enter cars will be added to the equipment. As far as local conditions permit, the rehabilitation ordinance will follow the same lines as those adopted in the case of the Chicago City Railway Company, the Chicago Railways Company and the outlying companies on the South Side.

By the terms of the agreement, the Chicago Railways Company will acquire the plant of the Consolidated Company, free from liens or incumbrances of any sort, placing the physical properties on its books at the valuation of $4,000,000 mentioned. This company is to agree to commence rehabilitation immediately upon the passage of the ordinance, and to finish the work within 18 months. In the detailed statement of the valuation, the principal item is for track, which is valued at $1,121,216. The value of the electric power distribution is placed at $695,416; power plant, $410,463; rolling stock, $195,119; while the items of real estate, buildings, tools, supplies and furniture, paving, brokerage, construction profit, legal expenses, etc., make up the remainder.

The Chicago Railways Company is in the hands of receivers owing to the entanglements growing out of its relations with the Chicago Consolidated Traction Company, but it is believed that in case the present agreement is carried into effect, the receivers will be dismissed. However, the receivers of the company are given the right to take over the Consolidated properties in case they are not dismissed before the date of the passage and acceptance of the ordinance. One provision of the agreement is that in case the present arrangement fails to be accomplished, owing to some unexpected legal difficulty, the Chicago Railways Company shall extend its lines over the streets now occupied by the Consolidated Company as fast as existing franchises expire. This provision was inserted to protect the city in case the plan for reorganization should prove unsuccessful.

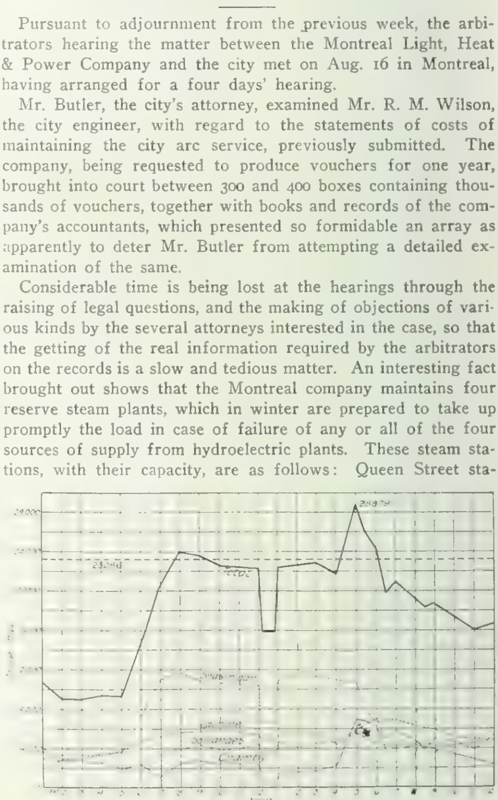
Since the above was written a new complication has arisen in a suit begun by three holders of Consolidated Traction general mortgage bonds against the Chicago Railways Company. The plaintiffs seek to recover the value of $125,000 worth of bonds, with two years' interest, making $139,000. Counsel for the receivers of the two companies and for the city seem to agree, however, in the belief that the new suit will not be a dangerous menace to the rehabilitation plans.

Montreal Lighting Controversy.

Pursuant to adjournment from the previous week, the arbitrators hearing the matter between the Montreal Light, Heat & Power Company and the city met on Aug. 16 in Montreal, having arranged for a four days' hearing.

Mr. Butler, the city's attorney, examined Mr. R. M. Wilson, the city engineer, with regard to the statements of costs of maintaining the city arc service, previously submitted. The company, being requested to produce vouchers for one year, brought into court between 300 and 400 boxes containing thousands of vouchers, together with books and records of the company's accountants, which presented so formidable an array as apparently to deter Mr. Butler from attempting a detailed examination of the same.

Considerable time is being lost at the hearings through the raising of legal questions, and the making of objections of various kinds by the several attorneys interested in the case, so that the getting of the real information required by the arbitrators on the records is a slow and tedious matter. An interesting fact brought out shows that the Montreal company maintains four reserve steam plants, which in winter are prepared to take up promptly the load in case of failure of any or all of the four sources of supply from hydroelectric plants. These steam stations, with their capacity, are as follows: Queen Street station, 3300 kw; East End station, 1020 kw; Chenneville Street station, 900 kw; Cote St. Paul station, 450 kw; total, 5670 kw. Testimony was given as to the flexibility of the company's system in permitting it to transfer its load, and particularly the city arc lighting, from one source of power to another, thus ensuring uninterrupted service. It developed that in addition to 1666 alternating-current, 6.6-amp enclosed lamps supplied the city of Montreal, 196 additional lamps of the same character are furnished adjacent municipalities, together with 250 9.6-amp direct-current open arc lamps. Mr. Wilson testified that his lamp trimmers recarbon 502 enclosed-arc lamps per day. Before the expiration of the last contract with the city, which ran for five years beginning Jan. 1, 1904, but a comparatively


Daily Load Curve.

small amount of the company's income was derived from city lighting; for example, the figure for the fiscal year ending April 30, 1907, showed only $98,272 out of a total revenue of $2,037,873—that is about 4.8 per cent; and for the year ending in 1908 the arc income was $101,895 out of $2,251,186, or 4.5 per cent.

The defendant's attorney called for records and curves showing the maximum demand for power on all the stations combined for various years. One of these exhibits is reproduced herewith. The loads supplied by the various water-power plants are shown separately, and also summarized. The peak load reached the maximum of 28,879 kw on Dec. 1. The averages of the maximum loads throughout the year are indicated by the light line at 23,286 kw. The testimony indicated that the curve given was typical of the daily load. The relatively small peak and the large and uniform day load are obtained by the sale of limited power to large customers, such as mills, which close down early in the afternoon before the lighting peak comes on, thus giving an unusually high load factor, seldom below 65 per cent and frequently reaching from 80 per cent to 85 per cent.

Legal Regulation of the Consulting Engineer.

By Sydney W. Ashe.

England boasts of her code of law procedure. Still attention is called by Mr. W. Valentine Ball*, in a recently issued volume, to the fact that she possesses no laws regulating the ways of the consulting engineer. This fact is all the more interesting because practically the same conditions exist in this country. "Whatever the code of professional ethics may prescribe," he says, "the statute book lays down no rules to guide engineers or their clients. Touting and advertising offend against no act of Parliament; and it is in this respect that, for good or ill, there is a great difference between the brotherhood of engineers and other learned professions. The General Medical Council, for example, exercises certain disciplinary powers over registered medical practitioners. If a doctor is guilty of infamous conduct in a professional respect he may be deprived of the right to practise. It has been held, moreover, that the powers of this council are not limited to matters which would be dealt with in the law courts. Thus a doctor who advertises can be struck off the register.

"Again, the State exercises control over those who practise dentistry. A man who improperly assumes the title of dentist may be struck off the register, while it has lately been decided that anyone who adopts a title which is calculated to lead the public to believe that he is qualified as a dentist in the popular sense may be prosecuted and fined. In the profession of the law the Incorporated Law Society can deal with solicitors, while the benchers of the Inns of Court have power to supervise the action of every member of the bar. But the engineering profession has no domestic body to control and prescribe rules of conduct for its members."

The means which have been applied in this country to solve this problem have been to attempt to regulate who should use the title consulting engineer and then to rely upon the professional standing of the individual to protect his clients. The public at large is very quick to condemn engineers who make mistakes either directly or indirectly. A doctor may improperly prescribe, the patient die and no one be a whit the wiser; but the financial interests in this country are so alert to the competency of engineers that should improper advice be given the engineer would quickly lose his standing. Some years ago the American Institute of Electrical Engineers as a result of the presidential address of Dr. S. S. Wheeler formulated a code of ethics in which the use of the title of consulting engineer was regulated, but for some unexplained reason this was never brought before the membership for final adoption or rejection. The English Institution of Civil Engineers has gone a step further, its committee in 1902 having recommended the following rules of professional etiquette for its members:

"1. No consulting engineer should solicit employment as consulting engineer verbally, by letter, by agent paid by commission or otherwise, or by any other means.

"2. No consulting engineer should answer advertisements for consulting engineers.

"3. No consulting engineer should advertise for employment.

"4. No consulting engineer should pay by commission or otherwise any one who introduces clients.

"5. No consulting engineer should receive trade or other discount, or surreptitious commissions or allowances in connection with any works which he superintends.

"6. A consulting engineer who is also directly or indirectly interested in any contracting or manufacturing business should inform his client in writing what his connection is with such contractor."

The general idea in the whole scheme of engineering ethics seems to be that only those who have had a wide variety of experience, theoretical and practical, extending over a number of years are entitled to call themselves consulting engineers. It appears unnecessary to have rules or laws regulating the professional behavior of such men, as their professional standing, as previously mentioned, should be a sufficient regulator. The ordinary physician, although of long standing, is likely to meet competition from the newly graduated M.D., and it is, therefore, wise to have rules regulating the behavior of the recent graduate; but the consulting engineer has nothing to fear in the way of competition from the newly graduated electrical engineer, and if means are taken to regulate when the latter can assume the title of consulting electrical engineer this would appear to be the only regulation necessary. While it is true that this would impose a heavy burden upon the young, ambitious, capable engineer whose career lies before him, still it would strengthen the engineering profession to instill in its members some of the code of honor that exists in France.

*The Law Affecting Engineers. (Mr. B[illegible] tor to these columns.) W. Valentine B[illegible] [illegible] Archibald Constable & Company.

Associations of Consulting Engineers.

Germany has had an Association of Electrical Consulting Engineers since 1902, the name of the body being the Verein Beratender Ingenieure für Elektrotechnik, with headquarters at Berlin. The requirements for membership are very strict, including scientific education, extensive practical experience and absolute commercial independence. The president of the society is Dr. E. Mullendorff.

As recently noted in these columns, an Association of Consulting Engineers has been formed in England, and will be finally organized after the summer vacations. The honorary secretary is Mr. Alfred H. Dykes.

One of the principal objects of the British association is to assure that municipal and other public works shall be supervised by duly qualified consulting engineers. In order that this may be done, it is necessary to know who is a qualified consulting engineer, and it is hoped that the register of the association will give this information.

The association will not be antagonistic to the principle of specialization, as the intention is to include in the association all branches of the profession—civil, mechanical, electrical, gas, and possibly others. It is not suggested that every member should possess a knowledge of all branches, or even more than one. Every member will be as free to specialize as he is now. All that is proposed is that every member shall be a properly trained and qualified engineer, and that he shall be acting solely in a professional capacity—that is, as a consulting engineer.

It is not intended to encroach in any way on the authority of the councils of the leading institutions which deal with the different branches of engineering. In fact, it is hoped that these councils will support the association as acting in the interests of those of their members who are consultants. Although the existing institutions are thoroughly representative of the profession of engineering as a whole, their province has been to deal with the science and problems of engineering which are of equal interest to all engineers. The association does not propose to deal with these matters at all, but only with the

professional status and conduct of those engineers who have adopted consulting work as their profession, and who represent a comparatively small percentage of the engineering body as a whole.

The by-laws governing professional conduct issued by the Institution of Civil Engineers, and now adopted also by the Institution of Electrical Engineers require that the members of these institutions when acting in a "professional capacity"—that is, as consulting engineers—shall conform to certain rules. The above institutions can make no distinction between their members, and are therefore not able to say to which of their members the rules are applicable. As the rules stand, a member can act in one capacity one day and in another the next. The organizers of the new association believe there is, or should be, as clear a distinction between the work of a consulting engineer and that of other members of the engineering profession as there is between the work of a barrister and that of a solicitor in the legal profession, and the association has been formed to clearly define this distinction.

The register of the association will, it is hoped, form a complete list of the qualified consulting engineers to whom the professional conduct rules above referred to will be applicable at all times, and which register will be open to inspection by the authorities responsible for spending public money, as well as to anyone else requiring the advice of a consulting engineer. The rules of the association, which are now under consideration, and will be submitted to a general meeting in the autumn, will be based on the professional conduct rules of the Institutions of Civil and of Electrical Engineers, to which it is intended to add other rules applicable to consulting engineers only.

At present membership is confined to those who are corporate members of the Institution of Civil Engineers and also of the institution representing the particular branch of the profession in which they practice. The Institution of Civil Engineers has taken the lead in establishing examinations for admission, and has in many other ways taken great pains to improve the status of the engineering profession. The association is not prepared at the present time to accept the responsibility of considering the qualifications of engineers other than those mentioned above, but it will no doubt be able to do so in the future should it receive the support it desires from all members of the profession. A provisional list of members is now being drawn up which will be revised after the constitution and rules of the association have been settled.

Indiana Electric Light Association Convention.

The second annual meeting of the Indiana Electric Light Association was held at the Denison Hotel, Indianapolis, Aug. 17 and 18, 1910. The attendance was large, the registration reaching 102.

In calling the meeting to order President C. C. Perry, of Indianapolis, announced the appointment of Mr. J. V. Zartman, of Indianapolis, as secretary following the death of the former secretary, Mr. Fred M. Leslie, of Muncie. Secretary Zartman reported the financial condition of the association to be good, and announced a total active membership of 99—a gain of 27 during the year.

In his annual address President Perry referred to the good work of the secretary already in bringing about the growth shown the past year, and remarked the constant and energetic work required on the part of the officials to impress upon the companies of the state the importance, benefit and desirability of membership in an organization which is of mutual aid to all. He said he regretted the indifference and the willingness of some electrical men to allow the more progressive companies to carry their burden while they derive the benefits without being members. He also observed that the Indiana Association is now—and can be made even more so—one of the most helpful and efficient organizations in the development of the electric service business in the country. President Perry spoke of the progress that has been made along a great many lines and of the better understanding existing regarding the wants of the people. He called attention to the general and varied use of electric devices outside of the motor-service and lighting fields that have made it possible for central-station plants to get better load-factors. The sale of these devices at practically cost to the consumer by the station companies, he said, has been criticised and opposed by the supply men, and he remarked that this matter was one for the convention to discuss and justify. Mr. Perry also questioned the advisability of lending the association's aid and influence toward the formulation and enactment of a public-utility commission which will doubtless come before the next Indiana Legislature.

Mr. Charles A. Bookwalter, former Mayor of Indianapolis, and now associated with the Merchants' Heat & Light Company, of that city, also addressed the convention on the subject of the impending public utility law, which, he insisted, may be confidently expected during the next Legislature. Mr. Bookwalter said he did not believe such a commission would hurt the electric-light business, but would be rather a benefit to both the companies and the consumers. He thought it would discourage the duplication of plants in territory not sufficient to support them. He said he did not look upon the possibility of a utilities commission as a serious matter, providing the appointing power selected men who are competent and fair to look after the matters under their jurisdiction. "The Indiana Railroad Commission has made good, and no one wants it abolished," said he. Mr. Bookwalter deplored the fad of American municipalities to grant short-time franchises, or miscellaneous franchises to promoters. This is not fair to investment of capital in public service plants, and would be remedied under a commission. Nor can there be objection, he thought, to a commission control to prevent abuses that are inimical to the people.

The discussion of a public utilities commission and its probable affect in Indiana was ably continued in a paper by Mr. T. C. McReynolds, general manager of the Kokomo, Marion & Western Traction Company. The centralization of the supervision of public utility properties, said Mr. McReynolds, is in line with modern economical thought, and in theory is right. A commission composed of intelligent men, who are constantly in touch with utility properties, is much more able to judge as to the equitable relation which should exist between such utility properties and the public than would be local councils or boards of public works.

The question of granting the proper franchises and establishing equitable rates for the service rendered cannot be handled with that degree of skill and intelligence by local authorities as through the medium of a commission, whose members are trained by daily experience for such purposes, and who are free from all environments of local politics and prejudices.

The commission, he declared, would not only act as a medium through which adjustments would be made between the public and utility properties, but would aid materially along educational lines to all concerned, and especially the small utility companies. Many small electric-light companies are operating in Indiana on a losing basis, rendering poor service, and have practically no hope or encouragement held out for bettering their condition. In such instances, if the same practice was invoked as in other states, the commission when called upon would make an investigation of local conditions and ascertain the trouble. If improvements were necessary, these would be ordered, and rates would be adjusted so as to enable such companies to procure the necessary capital to make improvements and earn a reasonable profit upon their investment. The cloak of protection of the state would be thrown around such a company—eliminating the fear of competition by some rival promoter, placing what was once a losing investment on a profitable and permanent basis, furnishing sufficient and good service, and winning the confidence and respect of the whole community.

Mr. McReynolds said he thought there could be no legitimate objection to the enactment of a conservative law which has for its purpose better regulation in connection with issuing stocks and bonds. He is not, he said, in favor of any legislation that would have a tendency to frighten away capital, or serve as a menace to capital already invested, or would prevent or curb the reaping of reasonable rewards from such investments, but

he would approve of the enactment of such legislation as will prevent the organization of corporations and the issuing of stock and securities without regard to the intrinsic value represented, and the sale of such securities to people who have not the opportunity or inclination to make such investigations as would reveal the true condition of their value.

Mr. E. M. Poor, of Sullivan, said he thought the association should go on record as favoring a public utilities commission. He cited instances of illegitimate competition which would be prohibited by such a commission.

Mr. F. A. Bryan, of the Indiana & Michigan Electric Company, of South Bend, said the subject appealed to him as being the most important of the convention. He urged the necessity of the association's taking steps toward securing the services of good legal talent in formulating the kind of law that would prove satisfactory. He said such laws tried out in certain other states are bringing about good results.

During the discussion several raised the question of the cause of the failure of the passage of the bill two years ago. It was thought by some that the apparent willingness of the public-service corporations to the enactment of such a law occasioned the local press and a few legislators to oppose its passage, suspicion being created by the activity of the public-service corporations in favor of the bill.

The afternoon session was opened by the reading of a paper on the "Commercial Value of Low-Head Water-Power," by Mr. F. A. Bryan, general manager of the Indiana & Michigan Electric Company, South Bend. Mr. Bryan presented a practical account of the limitations of water-power development, and exhibited a number of tables showing under what conditions a steam plant or a hydroelectric plant might be expected to be most profitable. An abstract of this paper will be given in a later issue. The discussion of Mr. Bryan's paper was led by Prof. C. F. Harding, of Purdue University, who cited some interesting cases within his own experience.

The next paper was read by Professor Harding, head of the electrical engineering department of Purdue, on "The Relation of Purdue University to the Electric Public-Service Companies of Indiana." The speaker urged co-operation between practical operators and the instructional corps, enlisting the aid of each to complete the effectiveness of the work of the other in training students. He suggested that greater use be made of the facilities for carrying out tests which the university is able to present to electric companies of the state, with its splendid instrument and laboratory equipment. While the employment of students on such tests is necessarily secondary to regular instruction, it is nevertheless encouraged. Besides researches and examinations in both practical electricity and pure science, the university renders valuable service in answering technical queries and in serving as a clearing house for practical information.

Professor Harding's paper was well received. President Perry remarked, "The talented men of Purdue have always shown a commendable and generous spirit in rendering valuable assistance to electric associations of the state. The students turned out by Purdue are all right. Those we have employed have made good," said he.

The concluding paper for the day was presented by the engineering department of the National Electric Lamp Association on "The Cost of Light." This discussion was a study of the various cost factors entering into the charge for electric service from the central station. It recognized a demand charge, a customer charge and an output charge, the second being based on the first with a proper reference to the diversity factor of the service, and the last named, or output charge, being figured on the energy actually delivered rather than that generated, and so not including the losses. Reference was also made to the use of current-limiting devices for small flat-rate customers. Tendency to waste energy by long-hour burning could be prevented by having customers purchase their own renewals and impressing them with an understanding of how extravagant burning will shorten the periods of renewal.

Mr. A. C. Blum, of Evansville, and Mr. Perry, of Indianapolis, discussed the paper briefly. Mr. Perry said that the questions brought out should not be dealt with on any other than a scientific basis. The fixed charges and the rate to consumers are important factors, and while the purpose of a plant is to serve the people, in order to do this it is absolutely necessary to get a revenue.

The morning session of the second day's convention opened with a discussion of the relation of central stations to supply houses, relating especially to some aspects of the sale of electrical apparatus to customers by central stations at practically cost, or at figures below those possible for the supply houses to meet.

Mr. C. A. Howe, of Chicago, representing the supply men, said that the supply men deplored the lack of co-operation between station men and the dealers. He said that the practice of electric companies in selling devices at cost, while unfair to the regular dealers, was not even appreciated by the consumers, who are not disposed to credit the company with disposing of anything without a good price. For this reason a fair margin might as well be secured, he thought, by selling at not less than the list price. He deemed the matter important and hoped a better and more equitable understanding might be brought about.

Mr. G. M. Sanborn, of Indianapolis, who is president of the National Electrical Contractors' Association, remarked that having been a contractor for years, it was difficult to get used to the competition of the central-station companies. "If present practices are kept up supply houses, in some places at least, will be put out of business and central-station men must prepare to control the business in its entirety." He admitted that new business must be developed by introducing appliances, but thought it far better to do so by co-operating with the contractors, who, he said, are the electric company's best solicitors. The best way to solve the question, he concluded, is to get together, the central-station men taking the initiative and affording the strength of their capital.

The subject was further discussed by Messrs. McReynolds, Perry, J. W. Robb, of Clinton; T. C. Pullen, of Evansville; T. F. English, of Muncie, C. B. Hart, of Fort Wayne; George Loring, of Indianapolis, and others, each giving his experience in handling lamps and devices. The central-station men seemed to make a pretty strong case of being compelled to handle these sales in order to do the soliciting and demonstrating and otherwise to bring the use of the electric devices to the attention of the people, testifying in some cases that contractors are too slow and indifferent to push the development of new business. Mr. McReynolds made the point that he believed established commercial appliances should be left for the dealer to handle, while new devices needing popular introduction are best disposed of through the central-station office, even if at cost price. One manager present said he was now forced, against his will, to do all the wiring in his city, because the combination plumber-electricians, who are the only contractors, proved so incompetent and irresponsible. These men would give no assurance of good installation, held up jobs indefinitely, and in the end the central station had to make good these mistakes. Most of the speakers agreed that the sale of lamps must be handled by the station to secure a good grade and satisfactory service. Mr. Loring pointed out that where contractors and supply men fail the local central station must be all things. However, he believed that dealers prefer to handle a better grade of lamp than they are now able to dispose of, being prevented from receiving a fair price in competition with the low renewal rates of electric companies. The new tungsten lamps have been taken over by central stations in an effort to control the wattage of these lamps on their lines, for it should be remembered that for each dollar of first cost of an energy-consuming device the central station derives returns of $2 or $3 a year.

Following this discussion an interesting talk was given on "New Developments in Heating Devices," by Mr. W. F. Hadaway, of the Westinghouse Electric & Manufacturing Company. Mr. Hadaway discussed the general principles of heating apparatus construction, and described the new "stove-lid" enclosed

unit which marks the most recent advance in an art more than 20 years old—for a full set of electric cooking appliances was exhibited at the World's Fair in Chicago in 1893. Improvements since then have been chiefly in the resistors employed, the various nickel alloys now used being capable of high temperatures and rapid changes. The so-called stove-lid unit is built up of a pair of iron plates pressed together on the resistor and welded along their periphery by an oxy-acetylene torch. Electric cooking apparatus suffers the serious competition of gas and coal, for while electric stoves can be worked to a heat conversion density of 12 watts to 15 watts per square inch, fuel stoves can be similarly worked to a density equivalent to 35 watts to 40 watts per square inch. Proper heat insulation is also demanded, to conserve the heat produced in electric apparatus.

The morning session was concluded by the reading of a paper by Mr. E. Darrow, general superintendent of the Merchants' Heat & Light Company, Indianapolis, in which various kinds of ornamental street lighting were compared, their advantages discussed, and differences in cost shown. Mr. Darrow's company inaugurated the extensive system of ornamental tungsten street lighting in Indianapolis and in preparing this installation had occasion to make a careful study of available systems of illumination, which are outlined in his paper. An abstract of his conclusions will be presented in these columns.

The afternoon session was opened by the reading of a paper relating to municipal ownership in Indiana entitled "Further Education in Central-Station Work," by Mr. R. A. MacGregor, of the Connersville Light, Heat & Power Company. The author advocated employing the same methods which have been so successful in educating the public along the uses of electric devices, to instruct citizens of some of the fallacies in municipal-ownership arguments which may be advanced by over-zealous promoters. Mr. MacGregor drew a dismal picture of a municipal-ownership town.

A paper on the subject of feeder-line regulators was read by Mr. F. W. Shackelford, of the General Electric Company. Induction and switch-type apparatus was described, and some typical recording-instrument charts shown, illustrating the straightening effect of regulators on the voltage curve. Mr. Shackelford also discussed the disadvantages and losses resulting from abnormal and subnormal voltages at distribution points, and demonstrated the close regulation of regulating apparatus when compensated for line drop at a distant point.

Mr. J. K. McDonough presented a paper on methods of introducing current-consuming devices, which had been prepared by Mr. H. J. Mauger, of the General Electric Company. The methods outlined were: Personal solicitation; showroom display; public demonstration; private demonstration; display advertising, and solicitation by letter. After discussing the best applications of these methods, the paper continued with suggestions for keeping apparatus once sold in commission. Many central stations are adopting a policy of perpetual care of appliances purchased through them, realizing that an electric flatiron laid away on a shelf for some trifling defect means a serious loss of revenue. Indeed, the central-station profit begins only after the apparatus has been placed in the consumer's service.

Resolutions on the death of the late secretary, Mr. F. M. Leslie, were adopted and ordered spread on the minutes.

Officers were elected and committees appointed for the ensuing year as follows: President, Mr. F. A. Bryan, South Bend; vice-president, Mr. S. B. Harting, Elwood; secretary and treasurer, Mr. J. V. Zartman, Indianapolis. Executive committee: Mr. R. A. MacGregor, Connersville, chairman; Messrs. E. Darrow, Indianapolis; J. P. Ohmer, Elkhart, and T. F. Grover, Terre Haute. Advisory committee: Mr. C. C. Perry, Indianapolis, chairman; Messrs. T. C. McReynolds, Kokomo, and J. W. Robb, Clinton. Finance committee: Messrs. C. A. Elliott, Muncie; J. A. Moncrieff, Bloomington; Felix Cadou, Vincennes; C. M. Poor, Sullivan, and T. A. Wynne, Indianapolis. The place of holding the next meeting was left to the executive committee.

Kansas Electrical Convention.

The 1910 annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association will be held at Kansas City, Kan., Tuesday and Wednesday, Sept. 27 and 28. Following the address by the president, Mr. M. T. Flynn, of Kansas City, the following papers will be read:

Boiler-Water Troubles, by Mr. C. C. Young, Lawrence, Kan. —*Electric Vehicles from a Central-Station Standpoint,* by Prof. B. F. Eyer, Manhattan, Kan.—*The Other Fellow,* by Mr. L. O. Ripley, Wichita, Kan.—*Prevention of Accidents,* by Mr. Geo. E. Haylor, Joplin, Mo.—*Co-operation Between Manufacturer and Central Station,* by Mr. Harry G. Glass, Pittsburgh, Pa.—*Financing a Plant in a Small Town,* by Mr. H. A. Walker, McPherson, Kan.—*Rates for Water Works Companies,* by Mr. J. H. Rathert, Junction City, Kan.—*Troubles of a Water Commissioner,* by Mr. Jno. G. Pease, Junction City, Kan.—*Review of Work of Wisconsin Utility Commission,* by Prof. Geo. C. Shaad, Lawrence, Kan.—*Electrical Standardizing Laboratory of Kansas University.*

After reading and discussion of these papers there will be a "Question Box." Mr. James D. Nicholson, of Newton, Kan., is secretary of the Kansas association.

Convention of the Michigan Electric Association.

The seventh annual convention of the Michigan Electric Association was held at the Harrington Hotel, Port Huron, Mich., Aug. 16, 17 and 18. Over 100 were in attendance, about half the number being central-station men and half salesmen. The first session was held on the evening of Aug. 16, Mr. A. C. Marshall, of Port Huron, president of the association, presiding. He assured the visitors, "You'll like Port Huron," this slogan being placed at both ends of the Black River bridge on Military Street, Port Huron's principal thoroughfare, so that all incomers may surely read. Mayor John Bell, of Port Huron, said a few words of welcome, after which the president introduced Mr. J. C. Sloan, manager of the Port Huron Gas Company, who also welcomed the convention.

Mr. Sloan made a few appropriately facetious remarks about the presence of a gas man in an electric light convention. He thought that in the minds of some his presence there could best be desired by the quotation from scripture, "And the devil came also." However, gas and electric men are all public servants together and in this capacity he spoke to them. He said that we must realize our responsibility as public servants. If managers of public utilities apply the golden rule and horse sense it will help them to fulfill properly their obligations. It is sometimes necessary to exercise firmness, but always kindness. He spoke against the policy that some companies have pursued of giving various appliances away to consumers. Such policy makes the public think that the profits of the business are high when a company can afford to do this. He asked how many companies there represented were charging enough for a depreciation account. Dividends which are shown by the books, but not earned, will cause trouble when readjustments are made. He also remarked that a manager who can make a manufacturing enterprises earn 25 per cent dividends is considered a hero, while public service officers who would make their companies earn 10 per cent dividends would be considered as thieves.

President Marshall then delivered his address, in which he called attention to the fact that from 80 to 85 per cent of the plants represented in the association are in towns of from 5000 to 10,000 population. Officers of the association should remember this in arranging its programs. There had been, he said, no radical changes in the electric lighting business in the past year. He called attention to the increased importance of the series-tungsten lamp for street lighting. It is destined to replace arc lamps in many cases. He opposed the system established by the association in past years of giving each president

two terms. He knew that many ex-presidents felt as he did about the matter, that it was better to pass the work and the honor of this office around more rapidly among the men of the State. However, there is naturally considerable delicacy about opposing the two-term idea because of the possibility that it would be taken as a personal matter. President Marshall, in the position of a president who has served one term, felt free to express his convictions this year as he would not two years hence. The time of association meetings was formerly October. In recent years this has been changed to August. However, since Michigan is quite a summer resort State some managers cannot get away in August. Further consideration should be given to the time of meeting. He suggested the adoption of an official badge or emblem which could be used on Association printed matter and letterheads, thereby following the example of other similar associations. The Association's finances are in much better shape than formerly.

He suggested that the Association could do something of real benefit to many of its small members by purchasing some of the more expensive instruments for commercial testing which small members would like to use but cannot afford to purchase; such instruments, for example, are curve-drawing wattmeters, carbon-dioxide flue-gas recorders, etc.

On motion of Mr. R. W. Hemphill, of Ann Arbor, it was voted to have the secretary appoint a committee of three to consider the president's address. The president called attention to the St. Clair tunnel generating plant of the Grand Trunk Railroad in Port Huron as a very fine piece of engineering which members should visit. The session then adjourned.

On Wednesday morning at the opening of the session Secretary A. B. Biggs, of the Detroit Edison Company, read a letter of regret from Mr. E. F. Phillips, of Detroit, past-president and active worker in the Association. Mr. Phillips was confined to his bed and unable to attend. It was voted to instruct the secretary to wire the Association's regrets and a hope for the speedy recovery of Mr. Phillips.

"The Boiler Room and Its Contents" was the subject of a paper by Mr. H. F. Rosenkrans, of Durand, which was followed with a written discussion of the same subject by Mr. H. A. Chase, of Hart. These called attention to sources of waste in boiler-room practice. The subject was discussed by President Marshall, of Port Huron; Messrs. A. N. Richardson, of Ann Arbor; J. R. Cravath, of Chicago; John A. Cavanaugh, of Benton Harbor; R. W. Hemphill, of Ann Arbor, and F. B. Spencer, of Cheboygan.

"Accounting for Central Stations in Small Towns" was the subject of a paper by Mr. F. B. Spencer, of Cheboygan, which was discussed by Messrs. Thomas Hinks, of Mt. Clemens; John A. Cavanaugh, of Benton Harbor, and others. It was voted that the president appoint a committee of three on accounting to report at next convention.

A paper on "The Real Cost of Street Lighting," by Mr. F. R. Mistersky, superintendent of the Detroit Municipal Lighting Plant, was read in the absence of the author by the secretary, as it was announced that Mr. Mistersky was ill. This was discussed by Messrs. Cavanaugh, Cravath, A. D. Furlong, of Pontiac, and others.

A paper giving some experiences in the baking of enamel by electricity was presented by Mr. John A. Cavanaugh, of Benton Harbor. This paper described some large enameling ovens evolved by a large manufacturing concern in Benton Harbor for baking enamel on steel office cabinets. These ovens are proving more economical than steam-heated ovens. After this Mr. Cavanaugh was asked a number of questions about these ovens and his experience with other household baking appliances.

On Thursday morning, at the third and last session, the executive committee announced the following nominating committee: Messrs. F. B. Spencer, of Cheboygan; A. N. Richardson, of Ann Arbor, and Howard Pett, of Big Rapids. The president announced the appointment of a committee on accounting consisting of Messrs. F. B. Spencer, of Cheboygan; Thomas Hinks, of Mt. Clemens, and H. A. Wing, of Adrian.

"Flat Rates for Residence Lighting" was the subject of a paper by Mr. R. S. Stewart, of Detroit, in which he related some successful experiences in small towns with flat rates. The presentation of this paper developed a discussion in which there were decided differences of opinion and which was participated in by Messrs. A. T. Holbrook, of the Excess Indicator Company; F. L. Prindle, of Gladwin; W. H. Friederich, of Coldwater; A. E. Williams, of the National Electric Lamp Association; Stewart, Cavanaugh and others.

A paper on "The Cost of High-Efficiency Lighting," by engineers of the National Electric Lamp Association in conjunction with Mr. George Westover, of Cadillac, was read by Mr. A. E. Williams, of Cleveland. This paper was immediately followed by a paper on "Maintenance of Meters in Small Towns," by Mr. A. N. Richardson, of Ann Arbor. Following the presentation of these papers there was more discussion on the question of meters versus flat rates.

"Tungsten Lamps in Mt. Clemens" was the title of a paper by Mr. Thomas Hinks, of that city. This paper was discussed by Messrs. A. C. Marshall and R. S. Stewart.

OFFICERS ELECTED.

The nominating committee made its report, which resulted in the election of the following officers: President, Mr. John A. Cavanaugh, of the Benton Harbor-St. Joe Railway & Light Company; vice-president, Mr. F. B. Drees, of the Michigan Power Company, Lansing; secretary and treasurer, Mr. Herbert Silvester, of the Detroit Edison Company; executive committee, Messrs. O. L. Wood, of Ionia; James De Young, of Holland, and H. A. Fee, of Adrian.

Mr. Cavanaugh made a suggestion for the holding of the next convention by chartering a boat for a two-day or three-day cruise on the Great Lakes. This plan would be pleasant in hot weather and do away with the distractions of the larger cities.

The treasurer presented a report showing receipts for the year amounting to $1,115.85; expenses, $797.86. Figuring all assets and liabilities of the immediate future the association's finances have about come out even, exclusive of the deficit of two years ago.

The association went into executive session and listened to a talk by Mr. J. V. Oxtoby, attorney for the Detroit Edison Company and other similar interests, on the present aspect of the legal affairs in the State. He outlined the laws affecting electric light and power companies recently passed, one requiring the filing of franchises, frontage consents, etc., with the Railroad Commission, whenever extensions are made, and another requiring approval of the commission for all stock and bond issues. He told some of the things which had and had not been done under these laws. The convention then adjourned.

Abstracts of most of the papers and discussions not found in this issue will be found in later issues.

ENTERTAINMENT FEATURES.

Wednesday afternoon was given over to a boat ride down the St. Clair River. At the Diamond Crystal Salt Works at St. Clair the boat landed to allow the party to visit these large salt works and see the methods of manufacturing, packing and shipment. After this the boat went on down the river and brought the party back as far as Stag Island, where dinner was served at the hotel. From Stag Island the boat went up the river and out into Lake Huron, returning to Port Huron about 10:30 p. m. This method of spending the afternoon and evening was very agreeable in view of the unusually hot, close weather.

On Wednesday morning at 8:30 a trip was made to the plant which supplies energy to the single-phase electric locomotives operating through the Grand Trunk Railway tunnel under the St. Clair River from Port Huron to Sarnia. This plant is a very interesting piece of engineering, which has been fully described in the technical press. The chief feature of interest is the heavy overload which is imposed upon the plant while trains are pulled up the grade in the tunnel, and the very light load on the plant at other times. This condition necessitates automatic control of draft and stokers which speed up as soon as the steam pressure drops slightly with the coming on of the load. After visiting the plant the party made a trip through the tunnel

and back on one of the double-unit electric locomotives, which are equipped with single-phase motors. Mr. W. D. Hall, electrical engineer of the Grand Trunk Railway, piloted the party and explained the features of interest.

On Thursday afternoon the Detroit Edison baseball nine played the Port Huron Independents in a good game which resulted in a score of 4 to 0 for the Detroit Edison team. For the ladies an automobile trip was given on Wednesday morning taking in the Lake Huron beaches, with luncheon at the Windermere Hotel on Lake Huron. On Thursday morning they went on a trip through the Port Huron tunnel, returning by way of the ferry.

THE NEW PRESIDENT.

Mr. John A. Cavanaugh, the president-elect, is superintendent of the lighting department of the Benton Harbor-St. Joe Railway & Light Company. He is 49 years old, was born in Ohio and raised in Michigan. He received a common-school education and started his working career in the boiler and engine room of a woodworking establishment. He then entered the employ of a fruit-packing concern of which he was later made manager. In 1886 he went to the Valparaiso (Ind.) Water Company as engineer, where he remained 10 years. In 1896 he became engineer of the electric light plant in the same town, remaining a short time and then going to Three Oaks, Mich., as manager of the electric lighting company. In 1900 he rebuilt the water-works plant at Fremont, Ohio. From 1901 to 1905 he was superintendent of public works at Niles, Mich, and from 1905 to 1906 held a similar position at Coldwater, Mich. In 1906 he took his present position at St. Joseph and Benton Harbor, immediately following the purchase of the property by its present owners. He has charge of the lighting department of this company and all overhead work and the electric generating and distributing apparatus for both railway and lighting. The gross earnings of the lighting department have been more than doubled since he took charge in 1906.

Massachusetts Commission News.

The Massachusetts Railroad Commission has issued a finding, in the petition of the Boston & Eastern Electric Railroad Company for a certificate of exigency, to the effect that until the Legislature of 1911 makes known its opinions with regard to many important proposed metropolitan improvements further consideration of the petition should be suspended. The majority of the board, represented by Commissioners Bishop and White, state that the question of steam railroad electrification at Boston, and that of a north and south tunnel between the two steam railroad terminal stations, should be considered by the next Legislature before action is taken by the commission upon the Boston & Eastern petition. Another important question is the proposed acquisition of control of suburban railway systems by the Boston Elevated Railway Company, for the purpose of establishing a uniform transportation service in Eastern Massachusetts, and of instituting many operating economies through centralized administration. The Boston & Eastern project has been before the board for about three years, and the Legislature of 1910 passed a law granting it the right to build a tunnel under Boston Harbor and a subway entrance into the city, although the act disclaimed any adjudication of the exigency of the road. The proceedings before the commission have included the most thorough engineering studies that have been brought before that tribunal since it began to deal with electric railway matters. Probably upward of $125,000 has been expended in the preparation and conduct of the company's case to date. The proposed road has been combated by every existing transportation company in the territory. Chairman Walter Perley Hall, of the commission, files a minority report with the majority finding, in which he says: "I regret my inability to agree with the conclusions set forth by my colleagues in the foregoing memorandum. I am of the opinion that the passage of the Acts of 1910, Chapter 630, authorizing the Boston & Eastern Electric Railroad Company to construct a tunnel and terminal in the city of Boston, taken in connection with the whole subject of metropolitan improvements and the action of the General Court of the same year relating thereto, creates a situation that will be in no wise be prejudiced by an adjudication at the present time of the petition of the Boston & Eastern Electric Railroad Company for a certificate of exigency, so-called."

The present finding of the board throws the whole question upon the Legislature of 1911, and the fight will undoubtedly be resumed immediately after the General Court convenes. There have as yet been no hearings held by the several commissions upon the resolves of the last Legislature requiring investigations and report upon a number of important transportation matters at Boston, before the end of January, 1911. The action of the majority of the commission in the Boston & Eastern case opens the question of the influence of steam railroad electrification and other improvements upon the future of high-speed electric interurban railroads to be built under the acts of 1906. There is every evidence that strong pressure will be brought to bear upon the next Legislature to secure the passage of an act requiring the railroads at Boston to electrify within a specified time, regardless of contentions as to the cost of such work. The railroads argue that if the building of new lines like that of the Boston & Eastern is permitted, the electrification of suburban service will be long postponed. Chief Engineer J. H. Bickford, of the Boston & Eastern, announces the purpose of the company to continue its efforts to secure authority to build.

New York Commission News.

The Public Service Commission, of the First District, has received a letter from L. S. Miller, president of the New York, Westchester & Boston Railway Company, suggesting quite a number of changes in the plans of that road. These changes include a more direct route to Clason's Point and to the locality around Throgg's Neck. Mr. Miller also advocates a joint Interborough and Westchester terminal at 180th Street, with a spur to the West Farms elevated station of the subway three blocks distant. The new terminal is to be used by the Westchester road and by the Interborough in common. He also asks that the new company be permitted to use some of the six tracks of the New York, New Haven & Hartford Railroad between Willis Avenue and 174th Street to avoid the necessity of building. As the Westchester line belongs to the railroad company, it was generally understood, at the time permission was given for it to change its route parallel to the railroad, that this request would be made subsequently. He suggests that if the Broadway-Lexington route is finally built, that some sort of an arrangement may be made with it whereby express and local trains can be run from the center of the city over the Westchester road.

Chairman Wilcox, of the commission, has announced that the forms of contract for the proposed tri-borough subway are entirely completed and now only await the approval of the corporation counsel. As soon as this is received, he says, the advertisements for bids will be made.

Maryland Commission News.

Mr. Albert C. Ritchie, assistant counsel of the Maryland Public Service Commission, has informed the United Railways & Electric Company, of Baltimore, that members of the public press are not among those to whom free passes may be issued, and that such passes may be issued to public officials only when they are performing public duties and their transportation would be an expense properly chargeable to the United States, state or municipal government. Policemen and firemen are also excepted when they are in uniform, as they are then presumed to be engaged in the public service, and, therefore, entitled to free transportation. Attorney-General Straus, the drafter of the Maryland Public Service law, has taken exception to this ruling, declaring that the purpose of the law as drawn up by him and his construction of it is to allow no public official under any condition to hold a pass. According to Mr. Ritchie free street car transportation for public officials,

whether city or state, is permissible when the officials are engaged on public business of such a character that they could properly charge the city or state with transportation expenses. The opinion which Mr. Ritchie gave was the result of a request to the Public Service Commission from the United Railways & Electric Company for an interpretation of the section of the Public Service Commission bill which treated of railway passes. Following receipt of the opinion, the company sent out a letter to those who have been enjoying free transportation, stating that since the issuance and use of complimentaries is in conflict with the Public Service Commission law such passes should not be accepted for transportation and coupons of such books should not be tendered to conductors after Aug. 20.

The matter of proposed new rates for telephones in Baltimore will be taken up by the Public Service Commission this week. A reduction of the existing rates has been filed by the Chesapeake & Ohio Telephone Company in pamphlet form with the commission, and a date will be set for a public hearing at which the commission will investigate complaints of users of telephones and take up other matters relating to rates. According to the pamphlet the general reduction is about 15 per cent under those now prevailing on one-party lines for unlimited service. It descends from this until a point is reached where there is no reduction for limited service and party lines. The existing charge for limited service and party lines is not more than $24 per year in the residential section and there are no unlimited telephones in the business section. The average lowering of the cost will be about 10 per cent with the new reduction, but it is understood that this will not apply to those using a restricted call.

Canadian Hydroelectric Commission News.

According to a report from Berlin the manufacturers of that city are getting tired of waiting for the hydroelectric power from Niagara Falls. The transmission line has been constructed to Berlin on Aug. 17, but owing to a missing link between Guelph and the Falls a stretch of 15 miles, not having yet been constructed, power is not expected to be delivered to Berlin until Sept. 1.

The commission, through Hon. Adam Beck, chairman, is advertising for tenders for the construction of a transformer station to be built at Port Credit for the purpose of serving the district between that town and Toronto, as well as supplying, through a branch line, Brampton, Milton, Georgetown and Mimico.

The Town Council of Ingersoll, at a special meeting on Aug. 16, adopted the report of the electric light and power committee recommending the acceptance of the tender of the Canadian General Electric Company for transformers for the step-down station, costing $4,600; switchboard, $3,500, and other equipment to a total of $10,780.27, and the Mayor was authorized to notify the company through the town's engineers, Messrs. Ross and Holgate, of Montreal. The report also recommended the construction of a substation, and that plans and specifications be prepared.

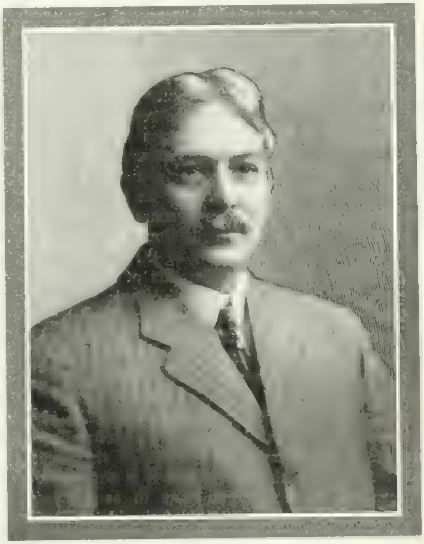
AMERICAN ELECTRICAL ENGINEERS—XI.

John L. Harper.

Mr. John Lyell Harper was born in Harpersfield, Delaware County, New York, Sept. 21, 1873. The pioneer settlers of that section, from whom he is descended, received the township of Harpersfield from the English Government early in the eighteenth century. His early education was obtained at Stamford Seminary, Delaware County, from which institution he was graduated in 1893; receiving a State scholarship to Cornell University, he matriculated there the same year and was graduated in 1897 with the degree of M.E. Mr. Harper then went to Seattle, Wash., where he entered the employ of the Oregon Improvement Company as draftsman. Realizing the prospective development in the electrical field, he obtained employment with the Union Electric Company, of Seattle, working as an electrician in its shops until 1898, when he went to Minneapolis, Minn., to accept a position with the Twin City Rapid Transit Company. This company operates the traction lines of Minneapolis and St. Paul, the power supply being obtained principally from a hydroelectric plant at St. Anthony's Falls.

The traction company had about 20 miles of 12,000-volt, three-phase cable in service, and Mr. Harper made an extended study of the electrolytic effects of the ground returns of the trolley systems upon the water and gas pipes, as well as upon the lead sheaths of the underground transmission systems. He made plans for remodeling practically all of the switchboards of the main hydroelectric station and the five substations operated by the company. Later, he was made operator of the main plant, which position gave him opportunity to study methods of handling frazil and cake ice in the Mississippi River, and also their effect on the operation of a hydraulic plant.

In 1889 he was employed by Messrs. Floy & Carpenter, consulting engineers, to represent them as inspecting engineer during the construction of a hydroelectric plant and transmission system then being built for the St. Croix Power Company at Apple River, Wis. In 1900 he was given full charge of the construction work, upon the completion of which he became superintendent of the power plant and its transmission systems,



Mr. John L. Harper.

which position he held until 1901. Energy from this plant was transmitted at 25,000 volts a distance of 30 miles to St. Paul, Minn.; three miles of the transmission circuit is within the city limits of St. Paul in the form of underground three-phase cables, and furnished the first example of underground transmission on a large scale at such a high voltage.

In 1902 Mr. Harper became assistant engineer of the Niagara Falls Hydraulic Power & Manufacturing Company, of Niagara Falls, N. Y., and the following year was made chief engineer of the same company, which position he still holds with its successor, the Hydraulic Power Company, of Niagara Falls, together with that of chief engineer of the Cliff Electrical Distributing Company of the same city. The Hydraulic Power Company owns the surface canal power development on the New York State side at Niagara, the plant being one of the earliest and most notable hydroelectric systems of the world, while the Cliff Electrical Distributing Company was recently organized and has taken over the extensive electrical generating and distributing system in Niagara Falls and vicinity.

In 1902, when Mr. Harper became connected with the Niagara Falls Hydraulic Power & Manufacturing Company, the devel-

opment was about 20,000 hp, while to-day this development is 125,000 hp. During these eight years of remarkable activity and growth on the part of the company, Mr. Harper has had full engineering charge of all the hydraulic, mechanical and electrical work. Station No. 3 of this system represents the latest ideas in this field. It is planned to contain 13 10,000-hp turbines when completed, its present capacity being 90,000 hp. It is without doubt one of the most efficient hydroelectric developments in existence, an actual hydraulic efficiency of 90 per cent being obtained between head water and tail water. The rotating parts of the horizontal type generators in this station weigh 50 tons, and for the proposed speed of 300 r.p.m. it was found that no bearings had thus far been built adapted to this weight and speed. As a consequence, Mr. Harper made an extended original research and investigation to determine the proper elements of design. The electrical generating and distributing systems now installed are models in simplicity, flexibility and ease of operation.

While in Minneapolis and Apple River Mr. Harper had exceptional opportunities to study the formation of ice, its handling, as well as its effect on hydraulic operation, which knowledge proved valuable at Niagara. Lake Erie discharges vast fields of ice into the Niagara River, and these when transported by the currents to the Falls are a menace to the generating plants there, to overcome which requires much engineering skill. Under Mr. Harper's direction diverting works have been constructed in the intake from the river and at the power plants, with the result that the Hydraulic Power Company operates continuously during the winter season despite the extremely adverse ice conditions above referred to.

Since Mr. Harper has been in Niagara Falls the far-reaching and all-important question of the preservation of the scenic beauty of Niagara has come strongly into public notice, and he has represented his company in an engineering capacity before Congressional committees in connection with this movement. Through him the Hydraulic Power Company has taken a leading part in the improvement of the Niagara gorge view, and Mr. Harper has had the direction of the expenditure of large sums of money to accomplish scenic results. Among other details in this connection, he designed and built a rough rubble facing wall over 200 ft. high, 14 ft. thick and 500 ft. long, which completely conceals the power development structures of his company and returns the face of the cliff to its original appearance.

In addition to his larger engineering work, Mr. Harper has given attention to the development of the electric furnace, and has invented a type especially adapted to the needs of the ceramic industry. With this furnace it is possible to fire the finest porcelain insulators and china in as many hours as formerly days, and with a control of the higher temperatures heretofore impossible.

As an indication of the breadth of activity of Mr. Harper, it may be mentioned that he is engineer of the Niagara Falls Grade Crossings Commission, which has important work on hand; a member of the Niagara Falls Industrial Commission; president of the Young Men's Christian Association of Niagara Falls, and in addition acts as consulting engineer to a number of corporations and municipalities. He is a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Society of Civil Engineers, American Electrochemical Society, American Ceramic Society, American Society for the Advancement of Science, National Geographic Society and American Civic Alliance.

CURRENT NEWS AND NOTES.

Gasoline-Electric Truck Performance.—On the Indianapolis motor speedway, Aug. 16, a 5-ton gasoline-electric commercial truck attained a speed of 26 miles an hour carrying 9000 lb. of gravel in sacks. The day before a similar truck, acting as a tractor for six wagons, moved a total load of 50 tons. These trucks have a gasoline engine direct-connected to an electric generator from which energy is distributed to motors at the axle of each of the four wheels. The trucks were built by the Universal Motor Company, of Indianapolis.

Meter Tests.—The New York City Public Service Commission reports that of 30 electric meters tested on complaint in July one ran fast, two were slow and 28 were within the legal limit of accuracy.

Valuation of Telephone Plants.—The Department of Public Utilities of the city of Seattle has employed Mr. Frank B. Hall, of Wheeling, W. Va., and Mr. C. H. Judson to make a valuation of the two telephone plants in that city—the Pacific Telephone & Telegraph Company and the Independent Telephone Company—and to report if the companies are at present charging fair and equitable rates. The result of the investigation will be brought before the Washington Railroad Commission on Sept. 26, at which time the report of the commission's engineer on the Independent Telephone Company will be presented.

The Modern Way of Ridding a Dog of Fleas.—Dog fanciers realize the difficulty of separating the animals from the fleas which often inhabit them. Few of the older methods are entirely satisfactory, but a Chicago electrical man is authority for the statement that the use of the vacuum cleaner is most efficacious. This man has a pet dog which is troubled with fleas, and at intervals he has considered it his duty to endeavor to relieve Ponto of the parasites by the time-honored water method, partly immersing the animal in water drawn in the bath tub and laboriously pursuing the elusive insects to a watery death. But one day he had a brilliant idea and he tried the effect of the vacuum cleaner, using a small nozzle and carefully going over the dog's skin and hair. Ponto did not like the operation very well, but he has been free from fleas ever since. The vacuum removed not only the full-grown insects, but their eggs as well, and the experiment has been a complete success apparently.

International Telegraphic Contest.—The Italian Minister of Posts and Telegraphs has arranged for an international telegraphic tournament to be held next year at the Turin international industrial exposition. Those desiring to enter the contest should apply not later than June 11, 1911, to the secretary-general, Minister of Posts and Telegraphs, Rome. There will be three contests, namely, with Morse key and sounder or recorder; with the Hughes apparatus and with the Bandot quadruplex apparatus. The time for the Morse trial is 20 minutes and an hour for the Hughes and Bandot trials. Individual prizes will consist of gold and silver medals and objects of art. A champion prize cup will be competed for by those who have won a prize in each of the three contests, and a cup will be awarded to the country which carries off the most prizes. A pamphlet giving full details of the contest can be obtained upon application to the above-mentioned address.

Colorado Electric Club.—At the electrical lunch on Aug. 18 of the Colorado Electric Club, at which 120 were present, ex-Governor Thomas, of Colorado, was the speaker. He made a very convincing plea for the proper restitution by the state to the holders of former state warrants, which constitute the so-called "repudiated debt of Colorado." He related that the credit and integrity of the commonwealth were those of the individual citizen, stating that a reflection against the good faith of the commonwealth could not fail to be injurious to each stockholder citizen. One hundred and twenty converts will be active supporters of a coming constitutional amendment of the state authorizing bonds for the payments of state warrants. This matter has been a very sore one for years among many Eastern investors of these warrants, and has aided in depreciating the credit of Colorado. A reversal of this condition is hoped for as a result of the fall election.

Electrical Business of St. Louis.—The Merchants' Exchange of St. Louis estimates that St. Louis does a business of $12,000,000 a year in electrical goods. This includes apparatus manufactured in St. Louis and electrical machinery and supplies made elsewhere and distributed from St. Louis. In addition the value of cars made in St. Louis for electric railways is placed at $3,500,000 a year.

Wireless for Airship.—An airship on which Walter Wellman promises to cross the Atlantic is being fitted with a Marconi wireless equipment. Mr. J. R. Irwin, the wireless operator of the S.S. *St. Louis,* has been assigned to the dirigible station. The latest announcement of Wellman is that he will start on the transatlantic trip in September.

Municipal Plant Proposed for San Bernardino.—The San Bernardino (Cal.) City Council has declared in favor of a municipal lighting plant, and the Mayor has appointed a committee of the Councilmen to start proceedings. This action was taken as the result of a resolution adopted by the Merchants' Protective Association, which declared for a lighting system owned and operated by the city.

Outing of St. Louis N. E. L. A. Branch.—On Wednesday evening, July 27, the St. Louis Section of the National Electric Light Association, which is composed of employees of the Union Electric Light & Power Company, making, with their friends, a party of about 600 in all, enjoyed a moonlight Mississippi River trip on the steamer *Alton,* which had been chartered for the occasion. There was dancing on board, and refreshments were served. Those who enjoyed the occasion are anticipating with pleasure the date of the next outing.

Right-of-Way for Pole Lines at Rear End of City Lots.—The Realty Board and representatives of the electric service and telephone companies of Los Angeles are endeavoring to extend the plan of reserving a 4-ft. right-of-way in the rear of lots in new tracts for poles to be used by all the electrical corporations, thus removing them from the streets. A form of easement will be prepared which, if approved, will be inserted in all new deeds of lots. Owners and agents of real-estate subdivisions where lots have been sold with this provision in the deed report that the plan has proved advantageous, as prospective home-builders are anxious to locate on streets free from poles. Of course, in cities having alleys between streets this provision would hardly be necessary.

Joseph Henry as a Diner-Out.—An interesting anecdote of Joseph Henry is contained in a recent article by Mr. Jasper Alban Conant, the painter, who gives in the *Metropolitan Magazine* reminiscences of a visit to Washington in 1861 and 1862. Mr. Conant says: "I met Prof. Joseph Henry, of the Smithsonian Institution, who arranged with me to restore and varnish some of the pictures in the government collection. Henry, besides having done more for the development of electricity in America than any man since Franklin, had even a European reputation in other branches of science. Yet he was a keen disappointment to Bates [attorney-general in Lincoln's cabinet], I remember; for the first night the brilliant physicist was invited to dine, the only person he talked to was a ranchman just back from Texas whom he plied with questions about swamp-hogs and some ancient mounds."

The "Trouble Man" in St. Louis.—An interesting feature of central-station work in large cities is supplied by the alert resourcefulness of the "trouble department," which is open for business 24 hours a day, with no holidays and no vacations. In St. Louis, for instance, the Union Electric Light & Power Company has an "ambulance corps" of 23 men, with three automobiles and one wagon. These men are on duty to answer all reports of trouble, scattered throughout the city wherever wires run to carry electricity. As soon as a troubleman has finished a job of repair work, he telephones headquarters and gets his next order. Every fire alarm is sounded in the Union Electric headquarters and to the scene of every fire is sent at least one member of the "trouble platoon." Every half hour the trouble man must telephone to headquarters and report where he is and what he is doing.

Electric-Steam Heat for Pennsylvania Tunnel Trains.—For use during cold weather, when the trains of the Pennsylvania Railroad entering the New York station through the electrified tunnel zone are disconnected from their steam locomotives and taken across the Jersey meadows and through the tunnels by electric locomotives, steam generated in electric boilers will be used to maintain the temperature in the cars and to keep the train connections from freezing. These boilers will utilize the 600-volt direct current from the third rail, and will have a capacity for generating 1000 lb. of steam at 80 lb. per square inch pressure, each hour. Their output will be connected into the regular train steam line, and will be of service principally in protecting the cars against the windswept run across the Hackensack meadows after the electric locomotives are hitched on at the Harrison terminal. The tunnels themselves will, of course, remain at practically a mean winter temperature throughout the cold weather.

Electric Energy Distribution in Northern Italy.—Work is progressing rapidly on the 9000-hp station at Ponte della Serra in the Province of Belluno, under the direction of three electrical companies, one of which is the Edison (Italian company), the central office of which is located in Milan. The Milani hydroelectrical plant, near the city of Verona, producing 10,000 hp, was put in service in November. The electrical equipment was supplied by the Westinghouse Company of Havre. Electric car lines are springing up in all parts of this district, enormously stimulated by the cheap electric energy. The State frequently subsidizes these companies, as in the case of the line from Belluno to Pieve di Cadore, which will receive $115 per kilometer (0.62 of a mile). Railroad activities are also progressing. The line from Bologna to Verona is nearing completion, much to the regret of the citizens of Padua and Vicenza, for these cities will be cut off from the international line to and from Milan and Bologna, and incidentally Venice will lose many visitors who have been accustomed to stop off at Padua and pay a little visit to Venice before proceeding north or south. A new road from Belluno will penetrate the Dolomites at Lavaredo, and be extended to Toblach, in Austria-Hungary, thus opening up another means of communication with central Europe.

Purdue Electric Special for Central Stations.—Taking a hint from the agricultural department of Purdue University, which each year runs a "corn special" train through the farming region of Indiana, having cars equipped as auditoriums and exhibit rooms where lecturers demonstrate improved methods of planting and farm culture, Prof. C. F. Harding, head of the school of electrical engineering, has suggested to Indiana central-station men that Purdue's electric test car might be equipped as an exhibit-on-wheels of industrial and household electrical appliances and operated over the electric interurban lines of the state for the instruction of users of electrical energy. At the meeting of the Indiana Electric Light Association at Indianapolis, Aug. 17, Professor Harding explained that the car might be fitted with machinery for making both alternating and direct current of commercial voltages available for the operation of small-motor applications and various lighting loads. Thus equipped, the car could make stops at points wherever possible electric-light users could be found, and with lecturers aboard to explain the use and operation of the apparatus, the test car would be of much educational value among the non-electrical people of the state, besides its present service as the subject of electric traction tests which the engineering school is making.

Pacific Coast Electrical Exhibition.—Arrangements are now nearing completion for the Pacific Coast Electrical Exhibition to be held in San Francisco from Sept. 17 to 24. About 75 exhibitors have already engaged booths for the occasion.

Convention of Alabama Association.—The third annual convention of the Alabama Light and Traction Association will be held at Anniston, Ala., Nov. 21, 22 and 23, 1910. Mr. George S. Emery, 11 North Royal Street, Mobile, Ala., is secretary of the association.

Extension of Metropolitan "L" in Chicago.—The Metropolitan West Side Elevated Railway Company, of Chicago, will extend the Douglas Park division of the road from South Forty-eighth Avenue to Lombard Avenue. The new line must be in operation before Aug. 1, 1912, and there will be stations at South Central Avenue, Austin Avenue and Lombard Avenue.

Chicago Meeting of American Electrochemical Society.—Arrangements have been made to hold the general meeting of the American Chemical Society in Chicago on Oct. 13, 14 and 15 at the Hotel La Salle and the University of Chicago. The sessions of the first two days will be held at the hotel and of the last day at the university. A number of papers will be read, and there will be excursions to points of technical interest as well as purely social entertainments. Mr. A. B. Marvin, 950 Commercial National Bank Building, Chicago, is the secretary of the local section.

Electric-Light Plants in Indiana.—From a survey of the electric light plants in Indiana, recently made by Mr. J. V. Zartman, secretary of the Indiana Electric Light Association, who wrote to the treasurers of the various counties of the state, 240 central stations are now in operation. Of this number 175 plants are owned and operated by private companies, the remaining 65 stations being municipal plants. About one-half of the electric light companies in the state are represented in the Indiana association.

New Hampshire State Prison Discards Candles for Electricity.—The warden of the New Hampshire State Prison on Aug. 17 banished the flickering and smoking candles heretofore used in that institution and in their stead 4-cp tungsten lamps illuminate the 186 cells. The lighting hour has also been extended from 8 p. m. to 8:30 p. m. The energy for the installation is supplied from the mains of the Concord Electric Company and the cost is not more than that previously paid out for candles.

Aurora-De Kalb Electric Railway.—Aurora and De Kalb Ill., are now connected by an interurban electric railway. These cities are about 30 miles apart, and a service of one car every hour and a half is maintained. Aurora, which is 40 miles west of Chicago, has become an electric railway center, with lines radiating to Chicago, Elgin, Joliet, Yorkville and De Kalb. These lines carry not only passengers, but a large variety of farm products, including milk.

Gas Testing in Chicago.—A gas-testing station in charge of the Department of Electricity has been in service for some time in the City Hall of Chicago. Preparations are now under way for the establishment of three outside gas-testing stations to be placed on the North Side, West Side and South Side. These stations will be located at 3547 Janssen Avenue, 1841 West Twelfth Street and 5441 South Halsted Street. Working from these centers samples of illuminating and fuel gas will be taken by employees of the department at different places and brought to the nearest station for examination. The test consists of chemical analyses of the gas, photometric tests and tests to determine the pressure of the gas. As far as possible, the tests will be conducted at the stations. The work at the gas-testing stations is quite distinct from the municipal testing of gas meters, and relates entirely to the testing of the quality and pressure of the gas itself.

Prevention of Electrical Accidents to Persons.—The Department of Electricity of the city of Chicago, in charge of Mr. William Carroll, city electrician, is collecting information relating to accidents to persons from electrical causes, with a view of ultimately preparing a set of rules designed to prevent personal injuries from electrical installations. This work, which has been under way for some time, is in direct charge of Mr. Victor H. Tousley, chief electrical inspector. When a human being is killed or injured by means of electricity, the accident is referred to an electrical engineer, who makes a study of the conditions which caused it, and all the attending circumstances. A record is kept of the data thus secured in the case of electrical accidents to persons, and from this material it is hoped in time that some code of rules may be devised. It is reported that the United States government is also working along the same lines, although in this case seeking to prepare a code of rules to prevent dangers both from fire and from accidents to persons.

Low Water Causes Smoking Chimney.—An electric light company in a Western city was recently summoned into court on the charge of violating the anti-smoke ordinance by permitting dense smoke to escape from the chimney of its power station. The manager pleaded in extenuation that the low water in the river running through the city was the cause of the occurrence. The judge was surprised at this novel excuse, and for a moment appeared to deliberate whether the defendant should not be fined for contempt of court. The electrical man hastened to explain, however, that the water in the river was at such an unprecedented low stage that when a water-power company a few miles up the stream manipulated its head-gates to divert the water to its own use the effect was noticeable at the witness' steam-power plant. This diversion bared the electric light company's intake for condensing water, so that it suddenly became necessary to run the plant non-condensing. This, in turn, involved the "firing" of cold boilers, and it was this operation that produced the dense volume of smoke. The judge listened to this explanation attentively and after a brief deliberation imposed only the minimum fine.

Fireman Gets Shock When Hose Stream Is Shut Off.—During a fire on the elevated structure of the Metropolitan West Side Railroad, Chicago, Aug. 13, one fireman armed with a hose-stream, supplied by a steamer, did very effective work in playing water on the seat of the fire, which was near the third-rail. From time to time the water struck the charged rail, and though he was at first apprehensive, the fireman felt nothing, and finally took courage to turn the stream of water directly on the 600-volt third-rail, where it would do the most good in drowning out the burning platform. After the blaze was entirely out, the order was given to shut off the water pressure, and just as the stream from the nozzle fell short of the rail, the man holding it received a severe shock which made him sway perceptibly and almost fall from the structure. At the time he was standing on the water-soaked wooden planking of the structure, over which there must have been considerable leakage from the damaged insulators supporting the third-rail. While he kept the nozzle directed on the rail doubtless the small current which flowed over the moving stream and through the hose to the ground on the water mains kept the nozzle at a potential so near to that of the charged platform that he felt nothing. But when the connection through the nozzle stream was interrupted, the man received the full effect of the difference in potential between the charged planking where he was standing and the ground provided by the water in the hose line. The fallacy about the danger of turning a stream of water on a trolley wire has been exploded for some years, or ever since some one had the courage to try the experiment and discover what really happened. It is more surprising, however, to the lay mind, at least, when a man gets hurt by withdrawing from danger.

THE ARIZONA POWER COMPANY.—II.

Description of the Generating Station, Electrical Operation, Transmission Line and Substations.

BY R. S. MASSON.

IN the issue of Aug. 18 the history of the hydroelectric development of the Arizona Power Company, of Prescott, Ariz., was given, and all the works, including concrete flumes, pipe lines, syphons, tunnels, etc., incident to bringing the water from Fossil Creek to the site of the generating station on Verde River, described. The present article is devoted to the generating station, substations and transmission system and includes an account of the very simple switching arrangements and the method of operating the system.

POWER HOUSE.

The power house, located on the Verde River, is constructed of rubble concrete. The building is 30 ft. wide, 72 ft. long and 16 ft. high to the crane runway. The transformer house adjoins it and is 16 ft. wide and 60 ft. long.

The entire electrical equipment was supplied by the General Electric Company. Each of the three 1800-kw generating units is complete in itself with transformers, measuring instruments, overhanging waterwheel mounted on one end of the two-bearing generator shaft, and an exciter overhanging on the opposite end of the generator shaft.

There are no switches in the generator leads; each generator connects directly to its own bank of transformers. No attempt is made to run these machines through any bus system or other parallel connections, excepting to connect the high-tension side of the transformers of each unit to either or both of the transmission lines. The entire arrangement of the station is exactly as though three stations, each with one generating unit, were located at points along the transmission line. This plan is adopted on account of the wonderful success which has always accompanied a single-unit generating station, and, of course, the objection to the single-unit stations is removed by having the other two units close at hand. There is, however, a small

Fig. 2—Power House and Penstock Line

set of switches and buses which can take energy from any [illegible] and [illegible] and these switches are used to hold the generators in synchronism temporarily when starting up, until the main line switches are closed. This avoids the strains incurred in closing high-tension switches with machines slightly out of step, causing surges. There are no exciter buses or switches of any kind in the exciter or field circuits, making the operation as simple as direct-current opera-

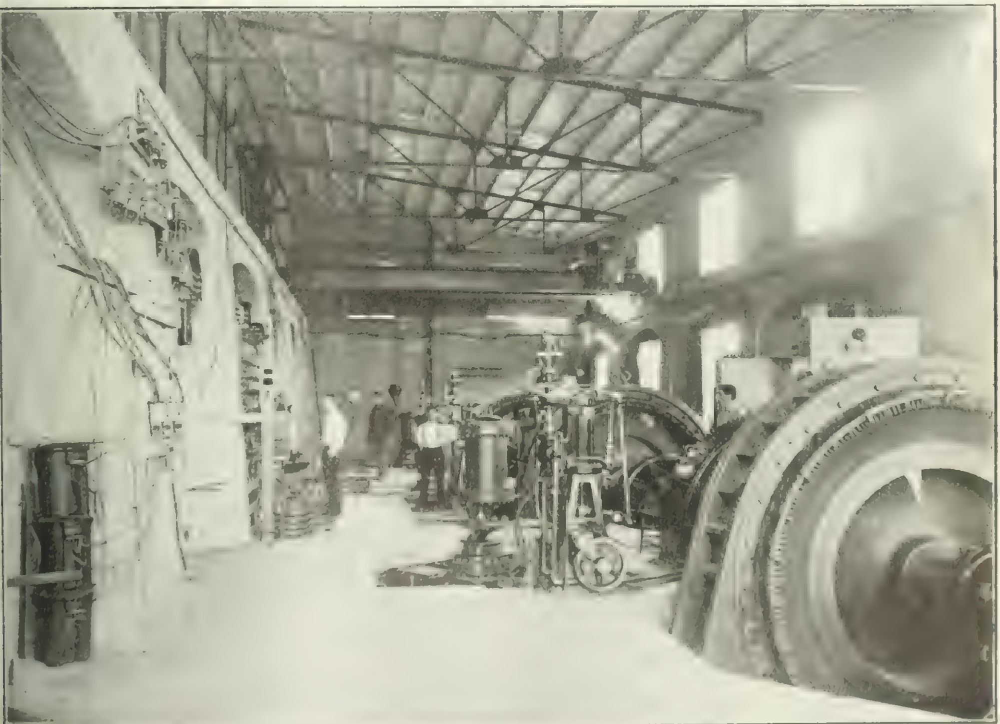


Fig. 1—Interior of Generating Station of Arizona Power Company.

tion. A special Tirrill regulator with three sets of contacts was provided to operate these exciters whenever they are working on the same transmission system; the pilot pressure is taken from the small station bus.

Fig. 3—Map of Transmission System of Arizona Power Co.

Each bank of transformers is provided with two 45,000-volt Kelman switches on the high-tension side, one connecting to the north line and one to the south line. Each switch is located in a separate room and each bank of transformers is located in a separate room. The transformer and switchrooms are separated from each other and from the generating room by high concrete fire walls, but the roof over these concrete rooms is made of wood and covered with rubberoid roofing. This plan of construction is based on the assumption that if either transformer oil or switch oil has once been raised to a temperature sufficient to ignite it, it is absolutely impossible to extinguish the fire unless air can be excluded or a sufficient amount of water or other cooling medium be placed thereon to lower its temperature. No attempt was made to introduce an air-tight system on account of the extraordinary expense of wall bushings and other devices incident thereto.

A hydraulic giant, similar to those so familiar in Western hydraulic mining enterprises, is located on the hill above the power house on the side toward which the transformer and switch houses open. When a fire begins in a power house, there are always one or more operators who would be particularly pleased to have an opportunity and a just cause for leaving the scene of activity and those men voluntarily and quickly man the hydraulic giant and turn a stream taken directly from the main pressure pipe on to the roof of the burning switch or transformer room. Drainage is so arranged that this water will not affect the balance of the rooms and in this way a fire which might otherwise be serious is promptly handled and usually without any very bad results, and possibly without shutting down, though this is not likely.

WATER WHEELS.

Each generator is equipped with a 3000-hp waterwheel of the impulse type, made by the Abner Doble Company, of San Francisco. A specially interesting feature of this equipment is the regulation of the speed by needle nozzle throttling of the stream, which is satisfactorily done in spite of the long pipe and high head, by using the Doble needle nozzle form of automatic by-pass relief valves. The by-pass is a needle nozzle similar to the one used on the main wheel and about half the size. Its needle is attached to the governor through the dash-pot and in such a manner as to produce an inverse motion, opening when the main nozzle closes. The dash-pot is similar to the regular arc-lamp dash-pot, allowing easy motion when the governor attempts to close the relief nozzle and acting very slowly when the governor attempts to open the relief nozzle. The needle of the relief valve is forced toward the closed position by the action of the water and some heavy springs, and it is pulled open by the dash-pot. Two dash-pot needle regulating adjusting valves, one located near the center and the other at the end of the stroke, allow the operator to regulate the speed of closing in two sections. Thus he may allow the relief valve to close quickly during the first half of the stroke and then slowly close the balance of the way.

By adjusting these by-pass nozzles to a proper time period the tendency of the governor to fluctuate with the period of pressure fluctuations in the pipe is easily interrupted. The amount of water thus discharged through the by-pass needle is a very minute fraction of the total amount of water used as this opening of the by-pass can be so arranged that it will only occur for considerable movements in the main needle, and need not occur at all on small changes of load, and the water economy is, therefore, not seriously lowered by this device. The usual Lombard oil-filled governors, with a motor-driven pump and an entire equipment of tanks, etc, for each unit, operate these needle valves.

SYSTEM OF ELECTRICAL OPERATION.

Many years ago the writer was particularly disturbed upon entering a substation of a very large Pacific Coast transmission company by the following notice: "If the power goes off, open all switches and telephone to the chief operator, Mr. ——— at ——— for orders." Thereupon the writer devised the plan used here and which is now in use on all Huntington systems in southern California, which includes more than 12 power houses and 30 substations in one operating combination, all electrically connected.

This plan again reverts to the wonderful success which accompanied not only single generating stations, but single transmission lines. One of these plants with a single generator and

Fig. 4—Lightning Arrester Houses in Base of Transmission Towers.

a transmission line, 30 miles in length, with a 15,000-volt transmission, during the years 1897 to 1899, operated for 33 months without an unforseen interruption to the service and the electricity was off the line only four times during that period. The writer's plan, therefore, of operating a transmission system as though there were two separate and distinct transmis-

sion lines doing separate and distinct work, grew from this idea. A further consideration which led to this plan was the fact that of all the troubles experienced in the transmission of energy up to that time, 85 per cent of the interruptions which had occurred were due to troubles in switches themselves and not less than two-thirds of these interruptions were due to the accidental or unintended opening of automatic switches and circuit-breakers, due to error and not to any short-circuit or heavy current.

Fig. 5—Transmission Line Below River.

After connecting up several power houses and substations without automatic switches of any kind anywhere on the system (all apparatus, of course, being alternating) the rule posted in the substation differed materially from that quoted above, and was as follows: "Run each of your banks of transformers on one line only, dividing between two lines as near as possible. If the power goes off on one line throw on the other. *Quick!* Take power from either line as you see fit."

The result is simple; the operator at the power house notes a short-circuited line. His line ammeters indicate that one or the other of the lines is short-circuited. (Only one generating plant in the entire system is allowed to connect the two lines together; all other plants, whether generating stations or substations, operate with each bank of transformers on one line only. The master plant, therefore, controls the situation. All of the generators in that plant are operating on both lines, each generator through its own transformer.) If trouble occurs on one line, the operator opens the transformer switches, disconnecting all of his generating units from the said short-circuited line. This relieves the load on the generators considerably, probably about half (never all), but immediately the various substation operators, acting without telephone orders, throw in their loads on this generating system and if there are other generating stations, the operator immediately synchronizes the generators which were on the dead line, and throws them onto the live line and thus all substation loads and generators come back at approximately the same time.

Fig. 6—Walker Substation on Prescott Line

In many instances on the Huntington system the entire outfit was transferred from divided lines to one line of the system within two minutes. Substations usually made their change inside half a minute, and frequently in 10 seconds or less. Thus induction motors are usually supplied with energy before they loose a perceptible amount of their speed. In cases of very long lines, where it is inconvenient to proportion the load evenly between the two lines for maximum economy, a single automatic switch is connected directly between the two lines at some remote point, and as this switch can be adjusted for a maximum current amounting to the difference between loads it opens immediately upon the occurrence of a short-circuit on either line, leaving the system separated as above.

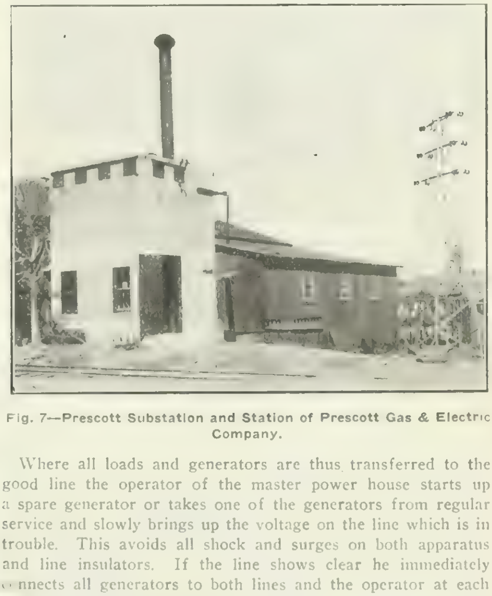


Fig. 7—Prescott Substation and Station of Prescott Gas & Electric Company.

Where all loads and generators are thus transferred to the good line the operator of the master power house starts up a spare generator or takes one of the generators from regular service and slowly brings up the voltage on the line which is in trouble. This avoids all shock and surges on both apparatus and line insulators. If the line shows clear he immediately connects all generators to both lines and the operator at each substation seeing the pilot lamps bright on both lines returns to the original arrangement. After this is all over and the load is again adjusted between the two lines as before, telephoning begins for social purposes as usual, but it is in no wise connected with the operation of the plant except making reports or to arrange with line men for repairs, etc.

TRANSMISSION LINE.

Two tower bases are enclosed for lightning arrester houses and in them the General Electric electrolytic lightning arresters are located, the horn-gaps being located outside on the usual racks.

The transmission line is composed of steel towers, 45 ft. high with three wires in a vertical plane, on each side of the towers and a steel messenger wire for lightning protection running over the peak. The line wires are 5 ft. apart vertically and 10 ft. horizontally; the messenger wire being located over the center and 5 ft. above the upper line wires.

Double [illegible] are used. Thirty [illegible] the line is composed of No. 1 B. & S.

seven-strand wire. The two branches 16 and 24 miles respectively from the junction are composed of No. 4 B. & S. three-strand wire running to Prescott and Jerome. Towers were supplied by the United States Wind Engine & Pump

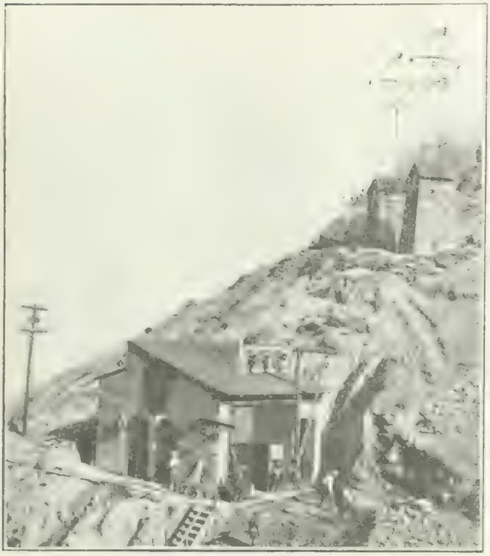


Fig. 8—Jerome Substation and Lightning Arrester House

Company, Batavia, Ill., and are of the usual rectangular rod and [illegible] type. The wire hardware between [illegible] and copper is composed of a pair of [illegible] clamped together with two bolts similar to the old bolted [illegible] which is [illegible] connected by a link. This clip prevents the slipping of the wire and at the same time is flexible and allows for a change in the position of the insulator without in any way kinking the wire.

SUBSTATIONS.

Fig. 6 shows a typical substation constructed at Walker, Ariz. These substations have separate switchrooms on the upper floors and transformer rooms below. Each bank of transformers has a high-tension switch connecting to each line. By killing one of the transmission lines from the adjacent substation or the power house, these rooms are rendered entirely safe by opening disconnecting switches underneath the ceiling of the ground floor. The map given in Fig. 3 shows the location of the various substations. For purposes of distribution the line voltage is reduced to 11,000 volts in the substations and delivered to customers at 440 volts, 60 cycles, three-phase.

It is worthy of note that in the entire course of construction there was not a single accident involving serious injury or loss of life. This is remarkable in view of the very large amounts of powder used in blasting. Every pound of material used in the construction was hauled by teams a distance of from 2 to 50 miles; the total amount being 50,000,000 lb.

SERVICE RENDERED.

Two thousand horse-power is now being supplied to the United Verde Copper Company at Jerome, 600 hp of which is transformed into direct current by a General Electric 500-kw rotary converter. Several mines are being supplied with energy and the entire load of the Prescott Electric Company is being carried by the plant. Extensions of distribution lines are being made in many directions from the regular substations located on the transmission lines. The energy is carried at 10,000 volts on three-wire lines erected on wooden poles; this form of construction being adopted in order to faciliate easy moving in the event of changes in the mining location. Steel structures are only used where permanent consumers are located.

The financial interests of the Arizona Power Company have been in the hands of William P. Bonbright & Company, New York. The system was designed and constructed and is now operated by the Electric Operating Construction Company, New York, Messrs. Viele, Blackwell & Buck acting as consulting engineers for the enterprise.

Fig. 9—United Verde Copper Company's Smelter, and Jerome Substation at Right.

A MICHIGAN HYDROELECTRIC DEVELOPMENT.

Water Power Plant of Unusual Design for Sturgis, Mich.

Several novel features have been incorporated in the design of the hydroelectric plant on which the city of Sturgis, Mich., has started construction, to utilize a 25-ft. fall in the St. Joe River, near Centerville. The site of the new station is 20 miles distant from the municipality of Sturgis, which will construct and operate it, transmitting energy for sale to its own citizens

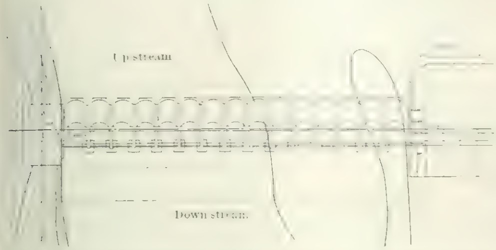


Fig. 1—Plan of Spillway and Generating Station on St. Joe River.

and disposing of the remainder of the output among the neighboring towns. The constitution of the State of Michigan accords municipalities the right to issue bonds for the development of water-powers, to condemn lands needed for such developments, and to sell the surplus energy so produced wherever a profitable market can be found for it.

The new Sturgis plant will develop 1100 kw from a 22-ft. to 25-ft. fall in the St. Joe River at a point where its flowage varies from extreme floods of 4000 cu. ft. per second down to a minimum of 300 cu. ft. per second. The power house, a concrete structure, 33 ft. x 50 ft., containing two 550-kw vertical-shaft units, will be located at the north shore end of a 300-ft. concrete-arch dam spillway construction of unique design, extended by 1200 ft. of embankment across the flats bordering the river-bed.

The design of the 300-ft. spillway section of the dam is quite unusual, being made up of 15 40-deg. inclined reinforced-concrete arches supported between concrete abutments 20 ft. apart. These arch slabs, presenting their convex surfaces to the upper pond, will make clear spans of 18 ft. each, and are 25 ft. in oblique length. They will be mounted on foundation rings, which add 3 ft. to their effective 17 ft. vertical height, and will be capped by a 2.5-ft. crest slab, which extends the length of the spillway. Viewed in right section, the arch slabs will be 12 in. thick, reinforced by transverse and longitudinal ½-in. round rods, inserted at 18-in. centers, 2 in. within the inner and outer faces. The arches will have a rise of 2 ft. 9 in. The abutments will be of triangular form, with a 45-deg. downstream slope. They are 24 in. thick, 17 ft. 6 in. above the foundations, and have an extreme base of 47 ft. The crest slab, 2 ft. 6 in. thick, is reinforced by ½-in. rods, spaced at 6-in. distances on its under side. At 12-ft. intervals along the crest slab 12-ft. lengths of 80-lb. tee-rail are inserted to serve as standards for the flashboards used to raise the effective height of the dam.

The power house itself will be a concrete building, 50 ft. x 35 ft. The duplicate generating units comprise 844-hp Allis-Chalmers water turbines, driving 550-kw, 2300-volt, 60-cycle, three-phase alternators, mounted on the same vertical shaft. The entire weight of the rotating element is to be carried on a single bearing at the floor level. Another point of novelty is in the so-called "scroll" design of the turbine chambers. By means of this construction the water entering at any of the intake wickets of the turbine is brought in from a tangential movement sweeping around the pit, so that all of the inlet parts receive their water at the same angle, regardless of their position with respect to the gates. The two 550-kw generators are equipped with Allis-Chalmers oil governors. The 40-kw exciter, which is driven by a separate water-wheel, is arranged for hand regulation only. Each unit will be equipped with a separate oil pump and tank, belt-driven from the main shaft. The switchboard will be housed in a compartment just behind the wheel pits, from which it will be divided by bulkheads rising above normal water level. The transformer room is the compartment directly below, and will house two groups of three 200-kw transformers, raising the generated potential of 2300 volts to 23,000 volts for transmission to the city of Sturgis, 20 miles distant, and to other points. Electrolytic lightning arresters will be installed at the generating plant and substations.


Fig. 2—Plan of Sturgis Station, Showing "Scroll" Wheel Pits.

Besides Sturgis, the towns of Centerville, Meaden and probably other neighboring villages will purchase electrical energy generated at the new station.

Mr. M. E. Aulsbrook is president of the Sturgis town board, which has charge of the undertaking, and Mr. Christian Wilhelm is Mayor of Sturgis. The construction work will be done by the Olson Construction Company. Prof. Gardner S. Williams has acted as consulting engineer and designed the new

development, the total appropriation for which amounts to $175,000. Of this amount, about $40,000 has been expended on real estate. The new station is expected to be in operation by Jan. 15, 1911.

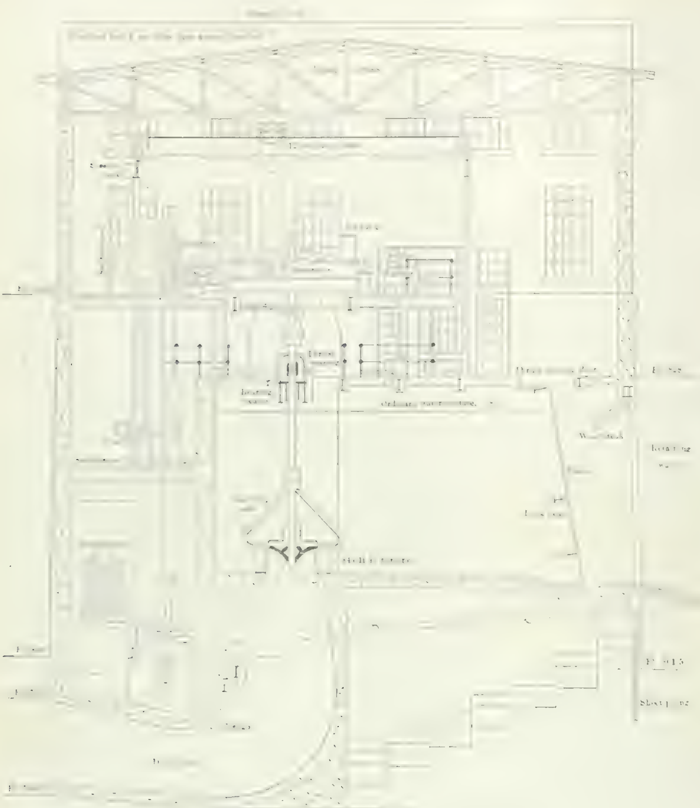


Fig. 3—Elevation of Sturgis Hydroelectric Station.

HYDROELECTRIC DEVELOPMENT OF THE UNITED MISSOURI RIVER POWER COMPANY.

The dam and hydroelectric plant now under construction on the Missouri River by the Capital City Improvement Company will form part of the system of the United Missouri River Power Company. This company has already two plants on the Missouri River; one at Hauserlake of 25,000-hp capacity, and one at Canyon Ferry of 12,000-hp capacity. These powers are developed by means of dams which produce lakes of large area and thus provide storage reservoirs of great value in equalizing the flow of the river. The total available water storage in the three lakes, without appreciably affecting the heads of the plants, will be not less than 150,000 acre-feet, or an amount sufficient to double the flow of the river during the low-water season.

The present plants are used exclusively for the generation of electrical energy for transmission purposes, and the new plant of the Capital City Improvement Company will be used for the same purpose and will be connected to the general system. The electricity is transmitted as three-phase alternating current, at 70,000 volts, to the cities of Helena, Butte and Anaconda and to numerous towns and mining camps in the same territory. The Canyon Ferry plant went into service in 1898, and the Hauserlake plant in 1907. The dam at the latter plant was destroyed some time ago, but the installation will be in operation again about Oct. 1, 1910.

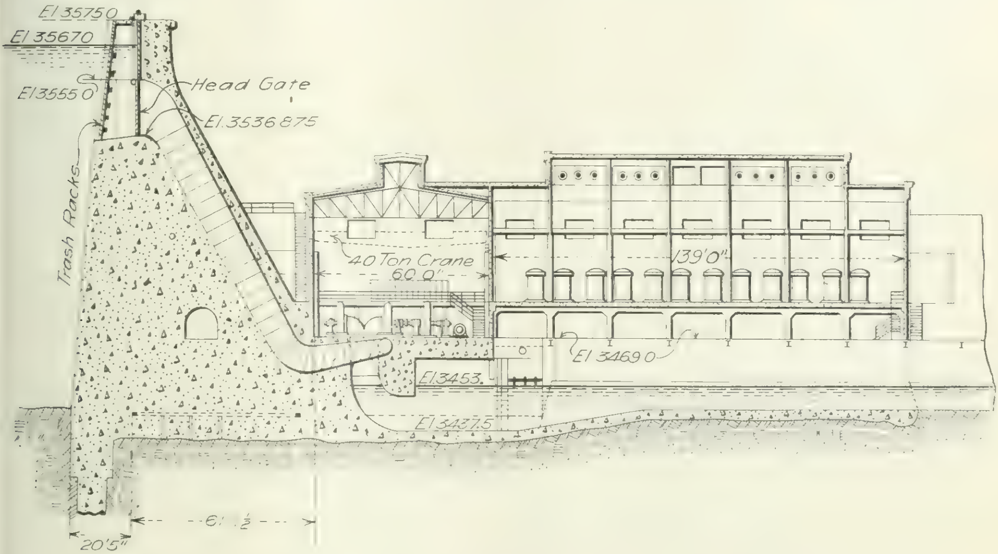
The development now building by the Capital City Improvement Company (a subsidiary corporation of the United Missouri River Power Company) is variously known as Plant No. 3, Wolf Creek Plant, Holter Plant and the Capital City Plant. It is located about 30 miles north of Helena, Mont. The Missouri River at this point passes through a short and narrow canyon with good rock on both sides and at an average depth of not exceeding 10 ft. below low water level. On the right bank the natural rock slopes upwards at an angle of about 20 deg. from the horizontal. On the left bank the rock rises at first quite precipitously, then forms a bench or shelf, and again rises with about the same slope as on the right bank. The width of the main channel, which embraces all that section of the dam where the foundations extend below the present water level, is about 700 ft., but the total length of the dam at the highest elevation is nearly 1400 ft.

The bedrock at the site of the dam is of cretaceous formation, including shales and sandstones with a little limestone and quartzite. The shale is principally red, but there is also some green as well as mottled. This is a massive and practically impervious rock, reasonably hard, and in every way affording a safe foundation for the dam. It is permanent in its nature and not subject to deterioration by solution or otherwise when below the water level. The sandstone is of grayish color, very fine and even grain, and of massive structure. In certain parts it is slaty in appearance and grades off insensibly into the shale; it is perhaps the best rock for foundation purposes. There is also one narrow band of bituminous shale, carrying narrow seams of coal. This rock is reasonably hard and also affords good foundation material for a dam.

The power plant is on the left or west bank of the river. The main generating station is placed parallel with the line of the crest, while the transformer station is at right angles to this line. The dam, power house and hydraulic works will be of concrete masonry, with imbedded rock in the more massive sections. The concrete will be made from river gravel, which is of excellent quality and does not require the addition of either sand or broken stone. The gravel is found in ample quantity in the river bottom near the site. The amount of cement in the concrete will vary in different parts of the work; the surfaces and thin sections having the richest mixtures. The dam will average 130 ft. in height from the foundations to the top of the bulkhead section, and in working condition will sustain an average head of 114 ft. The general features are clearly shown in the engraving.

In addition to the dam section proper, there has been provided on the down-stream side, a submerged apron of concrete 70 ft. in width and of an average thickness of 5 ft. This apron will be built directly on bedrock and will be strengthened by anchor bolting and reinforcing, and will be provided with a suitable

drainage system. The main dam section will be provided with an inspection tunnel and a complete drainage system, as indicated on the plans. There will be about 300,000 yd. of masonry in the entire structure and about 1500 tons of steel. The crest of the dam will be provided with a bridge and flashboard system, designed on lines of standard practice of this company. This arrangement permits of raising the level of the lake to a maximum elevation at the beginning of low-water periods, and also permits the lowering of the lake level during flood conditions to such a point as to provide ample discharge over the crest, and sufficient fall in the canyon between the dams to prevent interference with the plant higher up the river. This flashboard system has been in use in the Canyon Ferry dam for about 12 years, and its efficiency has been thoroughly proven. The arrangement consists essentially of a permanent bridge supported by concrete bents encasing heavy steel reinforcement,



Sectional Elevation of Dam and Generating Station of the Wolf Creek Station.

and of a system of steel stanchions supported by the bridge at their upper end and from the dam at the lower end; these stanchions in turn supporting the flashboards, which are removable planks manipulated either from the bridge or from a floating barge. The flashboards are customarily removed gradually, but provision is made so that in case of necessity the stanchions can be automatically tripped, thus instantly releasing the flashboards and discharging the water for the full height over the crest.

The hydraulic works in connection with the generating plant are designed as part of the main dam structure. There will be seven main hydraulic units and three exciter units; each main unit has its own penstock, which will be imbedded in concrete masonry and provided with a suitable opening at the upper end, this opening being controlled by a massive steel gate provided with Stoney rollers, and operated by means of an electrically driven head-gate machine. Each penstock entrance will be an independent section formed in the concrete and so designed that it can be closed off with a floating gate or with stop logs for the purpose of inspection or repairs of the racks, head gates, guides, etc. The designs provide for the water entering through the trash racks and gates at very low velocity and gradually and uniformly accelerating in the penstock until it reaches the scroll case of the waterwheels, at which point it is moving at the proper velocity for producing the most efficient results.

The waterwheels are under construction by the S. Morgan Smith Company, of York, Pa. Each unit is composed of two runners mounted on a single shaft, each wheel being provided with its individual scroll case and both discharging into a common draft chest placed between the wheels. The governors are of a vertical type and the largest size manufactured by the Lombard Governor Company. They will control the gates through a system of steel links and walking beams. The waterwheel gates will be of forged steel with connections all in one piece. The waterwheel runners will be of government bronze and the main shafts of nickel steel. Each waterwheel unit will develop 8800 hp under full gate opening, and will be direct-connected with a 5000-kw, three-phase, alternating-current generator. The generators will produce current at 6600 volts, which in turn will be transformed to 70,000 volts for transmission purposes. In addition to the main generating units, there will be three exciter units and one auxiliary unit; these machines will be driven by spiral case waterwheels direct-connected with suitable direct-current electrical generators.

The high-tension transformers and apparatus will be located within the fireproof transformer room. All cables will be carried in tunnels and ducts, expressly designed to prevent trouble from short-circuit or from fire. The low-tension switches and busbars will be encased in concrete compartments and will be placed in rooms apart from the high-tension apparatus. All of the electrical equipment is being manufactured by the Westinghouse Electric & Manufacturing Company.

The electrical energy generated at the Wolf Creek station will be combined with that from the Hauserlake and Canyon Ferry stations and will be transmitted over the present lines and system of the United Missouri River Power Company and over additional lines into every city, town and mining camp within many miles of Helena. The lines for the most part are on private right of way and in duplicate. At Butte there is an auxiliary steam station of 6000 hp rating.

The entire development has been planned and the designs prepared by the engineers of the United Missouri River Power Company; Mr. M. H. Gerry, Jr., chief engineer; and Messrs. A. C. Pratt, W. L. Miller, H. Hoyem, Jacob Anthonisen and A. W. Verharen, assistant engineers. The officers of the company are: Mr. S. T. Hauser, president; Mr. B. Y. Frost, vice-president; Mr. W. B. Gower, secretary-treasurer, and Mr. M. H. Gerry, Jr., general manager. The principal office of the company is at Helena, Mont.

CONSTANTS OF CABLES.

The Resistance, Inductance and Capacity of Eccentric Cylinders.

BY MAYO DYER HERSEY

THE usual formulas for the capacity of a cable with eccentric core, and for the other constants of a circuit made up of two circular cylindrical surfaces with parallel but eccentric axes, are too complicated for rapid handling. It is the object of this note to deduce simpler expressions.

If R denote the insulation resistance between the two surfaces, C their electrostatic capacity, and L the self-inductance of the circuit for a high-frequency current, then it can be proved that the three constants are connected by the following general relations, where l is the axial length and ρ, μ, κ denote, respectively, the specific resistance, permeability and dielectric constant:

$$L = \frac{4\pi\mu l^2}{\rho} R \qquad (1)$$

$$C = \frac{\kappa\rho}{4\pi}\frac{1}{R} \qquad (2)$$

$$L = \mu\kappa l^2 \frac{1}{C} \qquad (3)$$

Bearing in mind equations (1) and (2), it will be sufficient mathematically to discuss R alone even when interested physically in L or C; also it may be assumed that $\rho = \mu = \kappa = l = 1$.

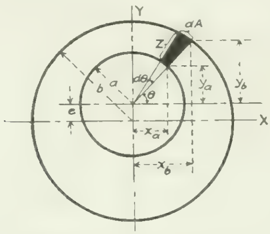


Fig 1—Eccentric Cylinders.

Now if the inner and outer radii are respectively a and b and the surfaces are concentric, the resistance in c.g.s. units will be

$$R_0 = \frac{1}{2\pi} \cdot \log_\varepsilon \frac{b}{a}. \qquad (4)$$

but if there is an eccentricity or displacement of axes e, then the exact formula reduced to its simplest form becomes

$$R = \frac{1}{2\pi}\log_\varepsilon\left(\beta + \sqrt{\beta^2 - 1}\right)$$

where $$\beta = \frac{a^2 + b^2 - e^2}{2ab} \qquad (5)$$

In place of this Russell has proposed the approximate expression*

$$R' = \frac{1}{2\pi}\log_\varepsilon\left(\frac{b}{a} - \frac{b}{a}\frac{e^2}{b^2 - a^2}\right) \qquad (6)$$

Finally, the new formula to be presented is the following,

$$R'' = R_0\sqrt{1 - x^2} \qquad (7)$$

where x stands for the ratio of eccentricity to difference in radii; and if the ratio of eccentric to concentric resistance be denoted by y, so that

$$x = \frac{e}{b - a} \text{ and } y = \frac{R''}{R_0},$$

the relations sought for reduce to the beautifully simple case of the equation to a circle,

$$x^2 + y^2 = 1 \qquad (8)$$

Evidently equation (7) is the more useful in analytical and (8) in graphical work, while the new formula is in either case so much more attractive than (5) or (6) as to call for some explanation of its derivation and accuracy.

As an approximation the stream-lines may be assumed to be straight and normal to the inner cylinder. Adding in parallel the elementary resistances of which (Z, dA), in Fig. 1, is typical, the total resistance per unit length is

$$R = \frac{1}{\sum \frac{1}{dR}}, \text{ where } dR = \frac{Z}{dA};$$

or, by introducing the assumption

$$dA = \tfrac{1}{2}(a + b) \cdot d\theta,$$

which is satisfactory when b/a is not too great, an approximate value becomes

$$R''' = \frac{1}{a + b}\frac{1}{\int_{-\frac{\pi}{2}}^{+\frac{\pi}{2}}\frac{d\theta}{Z}} = \frac{1}{(a + b)I} \qquad (9)$$

To evaluate I, Z may be expressed in terms of θ by means of the geometrical relations

$$Z + a = \frac{y_a}{\sin\theta}$$

and

$$Z + a = \sqrt{x_b^2 + y_b^2} \text{ or } \sqrt{b^2 - (y_b - e)^2 + y_b^2},$$

from which the elimination of y_b yields the equation

$$Z = \sin\theta\left[\sqrt{e^2 + (b^2 - e^2)\csc^2\theta} - e\right] - a \qquad (10)$$

Therefore, neglecting e^2, the integral takes the form

$$I = \int_{-\frac{\pi}{2}}^{+\frac{\pi}{2}}\frac{d\theta}{\sin\theta\,(b\csc\theta - e) - a} \qquad (11)$$

which may be rewritten thus

$$I = \frac{1}{e}\int_{-\frac{\pi}{2}}^{+\frac{\pi}{2}}\frac{d\theta}{\left(\frac{b - a}{e}\right) - \sin\theta} \qquad (12)$$

(12) gives upon integration

$$I = \frac{\pi}{\sqrt{(b - a)^2 - e^2}} \qquad (13)$$

When $e = 0$,

$$I_0 = \frac{\pi}{b - a} \qquad (14)$$

Now substituting from (13) into (9),

$$R''' = \frac{\sqrt{(b - a)^2 - e^2}}{\pi(a + b)} \qquad (15)$$

and by substituting from (14) into (9)

$$R_0''' = \frac{1}{\pi}\frac{b - a}{b + a} \qquad (16)$$

While both (15) and (16) are simple and useful expressions, a closer degree of approximation is got by dividing the two and writing

$$\frac{R''}{R_0}\left(= \frac{R'''}{R_0'''}\right) = \sqrt{1 - \left(\frac{e}{b - a}\right)^2} \qquad (17)$$

which is identical with equations (7) and (8) above.

To sum up for the general case the following formulas may be written:

$$R'' = R_0\sqrt{1 - x^2} \text{ where } R_0 = \frac{\rho}{2\pi l}\log_\varepsilon\frac{b}{a} \qquad (18)$$

$$L'' = L_0\sqrt{1 - x^2} \text{ where } L_0 = 2\mu l\log_\varepsilon\frac{b}{a} \qquad (19)$$

* [illegible] formula on p. 104 of Vol. I of "The Theory of [illegible]" by Alexander Russell.

$$C' = \frac{C_0}{\sqrt{1 - x^2}} \quad \text{where } C_0 = \frac{\text{[illegible]}}{2 \log_e \frac{b}{a}} \qquad (20)$$

The usefulness of the formulas in practical work is shown by Fig. 2, a graphical scheme for the calculation of the resistance corresponding to any value of b/a and of x.

Suppose, for example, in two eccentric cylinders the outer radius is 2 in. and the inner radius ¾ in., and eccentricity ¾ in.; then $b/a = 2.67$, $x = 0.6$ and the dotted lines show the course followed by the eye in reading off directly the approximate result $R'' = 0.125$ c.g.s. units when ρ and l are unity. The logarithmic curve DE serves to locate the auxiliary line AB for any value of b/a, and after this only AB and the circular quadrant AC are necessary in solving for any value of x. As an example of the inverse problem, given $a = 1$ in., $b = 3$ in., how great may the eccentricity be without diminishing the resistance by more than 10 per cent of itself? The law of the circle shows at a glance that when $y = 0.9$, $x = 0.43$, consequently $e = 0.86$ in. Capacity and inductance can be just as easily calculated.

Now the accuracy of the several formulas will be examined, denoting by R_0 the concentric resistance (4), and by R, R' and R'' the eccentric resistance according to the exact formula (5), Russell's approximation (6), and the new formula (7), respectively. Let Δ denote the fractional change in resistance due to the displacement e, while Δ' and Δ'' stand for the errors

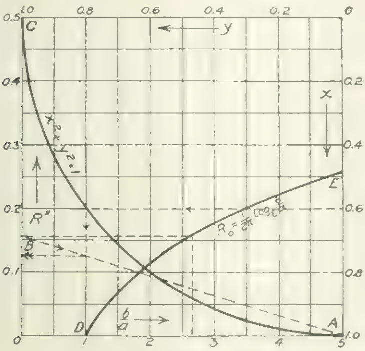


Fig. 2—Calculating Chart.

in R' and R'', respectively. Also let Δ_0 denote the ratio of error of computation to the change due to eccentricity, this relative error being sometimes a more significant criterion than the absolute magnitude. That is,

$$\Delta = \frac{R_0 - R}{R_0}, \quad \Delta' = \frac{R' - R}{R}, \quad \Delta'' = \frac{R'' - R}{R},$$

$$\Delta_0' = \frac{\Delta'}{\Delta}, \text{ and } \Delta_0'' = \frac{\Delta''}{\Delta}.$$

The full curves in Fig. 3 show how the errors Δ' and Δ'' increase with x for several values of b/a, while the dotted curves show the variations of Δ_0' and Δ_0'' for the typical case $b/a = 2$.

The curves in Fig. 4 show how the errors Δ' and Δ'' increase with b/a for several values of x. The shaded area represents a region which can never be crossed by curves of error; the line $x = 1.0$ is the curve of maximum error. There is no corresponding region with Russell's formula. The following facts in favor of the new formula are apparent:

(1) When the outer radius does not exceed three times the inner, the errors of both formulas are negligible for eccentricities less than half the difference in radii.

(2) When x exceeds one-half, the error Δ' rapidly approaches ∞, while Δ'' remains finite and small, even for the maximum eccentricity.

(3) While Δ_0' also approaches ∞, the relative error Δ_0'' diminishes with increasing eccentricity.

(4) As the thickness of insulation decreases, i.e., as b/a approaches unity, Δ' increases, but Δ'' decreases.

(5) Δ' is always + and Δ'' always —; that is, the new formula always yields a result on the safe side, the apparent resistance being slightly less than the true resistance and the apparent capacity greater than the true capacity.

Thus the new formula is to be preferred to Russell's approximation on grounds of accuracy, except in the single case when a large value of b/a combines with a small value of x.

To conclude, there has been developed a system of formulas

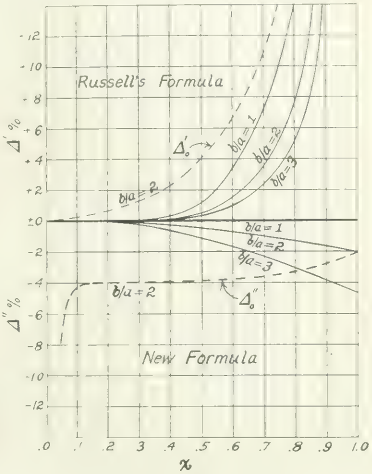


Fig. 3—Correction Factors.

for the constants of eccentric cylinders which can be expressed in three different ways, of which the first is illustrated by equation (8), the second by (15) and (16), and the third by (18), (19) and (20). While the second group is the simplest for

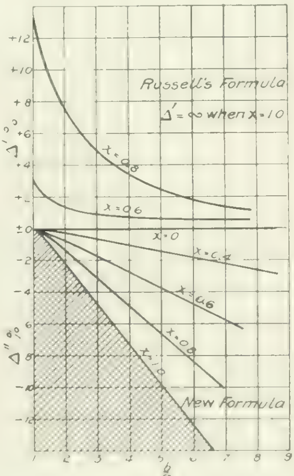


Fig. 4—Correction Factors.

slide-rule work, the first and third are the most generally useful, possessing the following advantages:

(1) Analytical simplicity.

(2) Adaptability for graphical solution.

(3) Explicit relation between eccentric and concentric values.

(4) Accuracy.

In arriving at these results, advantage was taken of whatever relations existed between R, L and C and the ap-

proximations were introduced into the premises as being preferable to remodeling the conclusions. The deduction of approximate formulas in many other cases might be facilitated by a wider application of these two principles.

ESTIMATED COST OF CONDUIT CONSTRUCTION AT SALEM, MASS.

The Salem Electric Lighting Company of Massachusetts is about to undertake the installation of 30,050 ft. of underground conduit including 90 line manholes, 14 transformer manholes and 500 underground connections to buildings, poles, and lamps. The total cost of this work is estimated at $228,097, and the estimate for the company was prepared by Mr. D. A. Harrington, Boston. The company filed the estimate of cost with the Massachusetts Gas and Electric Light Commission at a recent hearing. In the following table is given a transcript of the estimate arranged in accordance with the number of ducts in the conduit and including the manholes required in the lengths of conduit specified. In general the work is to be done in the more populous section of the city. Only such items are transcribed as are of general interest, and the cost of cables, underground connections, service connections, transformers, special distributing poles and lamp posts are not included in the table, which covers simply the estimated cost of typical conduit sections of specified lengths laid in the streets, backfilled and ready for drawing in the mains.

In explaining the figures to the commission, Mr. Harrington stated that each street had been examined and its local conditions noted. It was estimated that the cost of the 30-duct conduit would be 15 or 16 cents per duct foot for each of the 30 ducts for 500 ft., and that the manholes would cost about $250 apiece. Excavation, backfilling and repaving would cost from $1 to $1.50 per cu. yd. The cost depends greatly upon the local conditions. A 12-duct conduit will vary from 20 to 30 cents per foot in different streets, according to the pavement, piping present, tree conditions, etc. Mr. Harrington said that with 4-duct conduit it would be necessary to add perhaps 15 cents per foot on account of different kinds of pavement, whereas the difference in 30-duct conduit would amount to perhaps not over 2 cents per duct foot. The minimum distance from the top of the conduit to the grade of the street is from 18 in. to 30 in. The 18-in. minimum provides for a street with a concrete base under the paving or a concrete track foundation set in the midst of block pavement. The cost of a first-class service pipe laid in a concrete envelope would be about 60 cents per running foot, the street being block-paved.

DETAILED ESTIMATE OF COST OF CONDUIT CONSTRUCTION, SALEM, MASS.

Number of Ducts	Length of Conduit in Feet	Manhole Details in Given Length of Conduit	Estimated Cost, Dollars
4	450	1—4'x5'x5'	800
4	1500	2—4'x5'x5'	2560
4	850	2—4'x5'x5'	1490
4	500	1—4'x5'x5'	880
4	600	2—4'x5'x5'	1090
4	200	2—4'x5'x5'	480
6	800	4—5'x6'x7'	2040
6	900	3—5'x6'x7'	2130
6	1200	3—5'x6'x7'	2730
6	350	1—5'x6'x7' 1—5'x8'x8'	980
6	300	1—5'x6'x7'	710
6	500	2—5'x6'x7'	1220
6	400	....	800
6	2000	4—5'x6'x7'	4440
6	700	1—5'x6'x7'	1510
6	700	2—5'x6'x7'	1620
6	800	3—5'x6'x7'	1930
6	500	1—5'x6'x7'	1110
6	450	1—5'x6'x7'	1010
6	400	1—5'x6'x7'	910
6	1200	4—5'x6'x7'	2840
6	700	2—5'x6'x7'	1620
8	600	2—5'x8'x8'	1660
8	500	2—5'x8'x8'	1440
8	650	2—5'x8'x8'	1770
8	900	2—5'x8'x8'	2490
10	250	1—7'x7'x8'	760
12	500	2—5'x8'x8'	1540
12	850	3—5'x8'x8'	2550
14	300	1—6'x8'x8' 1—4'x4'x4'	1090
14	350	1—5'x8'x8'	1150
16	500	1—7'x7'x7' 1—6'x8'x8'	1950
22	800	3—6'x8'x8'	3340
22	400	1—8'x8'x8'	1625
[illegible]	500	3—8'x8'x8'	2925

The estimate provides for 500 underground connections to buildings, poles and lamps at a cost of $25,000, and the system is planned to reach every building along the line so that future customers can be reached without laying other underground conduit. Transformers are to be located in manholes instead of on poles as heretofore. The building connections will in the main be made from submanholes.

Central Station

Management, Policies and Commercial Methods

PASADENA MUNICIPAL LIGHTING SITUATION.

Mr. William A. Brackenridge, vice-president and manager of the Southern California Edison Company, has made a public statement in which he says that if the truth were known the municipal electric-lighting plant in Pasadena, Cal., is not a paying institution. Mr. Brackenridge says that the recent offer made by his company to light the streets of Pasadena was made in good faith, and should receive the consideration of the voters. This was the second proposal of the company, and it is complained that it was received with scant courtesy. Mr. Brackenridge adds that some time ago, at the request of the Mayor of Pasadena, his company submitted a proposal to buy out the municipal plant and relieve the city of an investment of about $250,000, which is said to be about $75,000 more than the property actually is worth at present. "The Mayor," continues Mr. Brackenridge, "was quite insistent upon the whole [illegible] paid, and the point was finally conceded to the Mayor upon his assurance that this would bring about a final and complete settlement of the electric-lighting question in Pasadena. As a part of our proposal, we offered to make an agreement with the city as to rates to be charged for electric service, and the rate schedules incorporated in our proposal were made with the knowledge and approval of the Mayor." Mayor Earley, of Pasadena, makes general denial of these charges.

CHEAP ENERGY AT JANESVILLE.

The Janesville Electric Company, of Janesville, Wis., recently inserted a half-page advertisement in one of the Janesville daily papers inviting manufacturers to come to Janesville where, among many other advantages enumerated, is low cost of electric energy. The advertisement shows that the company supplies energy to over 75 per cent of the Janesville manufacturers using electric service, while 17 per cent use steam, 6 per cent combined steam and electricity, and 2 per cent use steam and water-power. A list is then given of 68 Janesville manufacturers using central-station service in this town of 14,000 population.

The Janesville Electric Company, which is under the management of Mr. P. H. Korst, generates a considerable portion of its output with water-power.

HOT-WEATHER ELECTRIC-SERVICE ADVERTISING AT ST. LOUIS.

The Union Electric Light & Power Company, of St. Louis, has been conducting an effective advertising campaign of hot-weather electrical appliances in the English and German daily newspapers of that city. Electric fans for the office and home have been the subject of some well-arranged display "ads," illustrated by line sketches of comfortable offices and kitchens suggestively made so by the fans, on each of which is marked the low cost of operation an hour. Pictures also show how the home laundry is made comfortable by electric washing machines, mangles and flatirons. The Union Company also attaches to some of its outgoing mail a little red sticker combining a diagram of a baseball diamond with a picture of an electric fan, and bearing the appropriate legend: "Fan Time; Put It Home." Other advertisements of the company in the daily papers have illustrated and described large business and manufacturing buildings in St. Louis, where central-station service is used.

AN OIL SINK FOR OIL CANS.

A casual visitor to the sub-basement engine-room of one of the newest office buildings in Chicago will notice against one of the supporting columns near the center of the room what appears to be an ordinary wash-basin or sink, in which the oil-can equipment is kept on a wire basket. The gooseneck over the sink, however, is not connected to the water mains, but leads from the gravity oiling system and can be used to fill the oil cans directly, like drawing water from a faucet. The drain from the sink leads to the oil pump, so that any leakage or oil spilled in filling the cans is caught and returned to the overhead tank. This oil sink thus saves considerable oil otherwise wasted, and keeps the engine-room spotless. The sink is installed in a position where it is convenient to the various machines, and all cans not in use are kept in place on the wire basket where chance drops are drained back into the tank and saved.

THE READING OF METERS BY CUSTOMERS.

A plan which is in force in many central-station organizations is that of leaving a postal card at consumers' premises where the meter reader finds no one at home. This postal card is addressed to the company and has upon it a statement to the effect that the meter reader found no one at home when he called to read the meter and if the consumer will mark the positions of the pointers on the meter dial on the dials printed on the card, his bill will be made out to him as usual. Mr. Frank McMaster, manager of the Beatrice Electric Company, Beatrice, Neb., who tried this plan, stated on the card that this would enable the customer to get the regular discount for prompt payment. He found that this plan is liked by the customers because it tends to convince them that there is no mystery about the reading of meters and that the company certainly must have confidence in its meters if it allows its consumers to read them.

CENTRAL-STATION STORAGE-BATTERY ENGINEER

The Toronto Electric Light Company, Ltd., has appointed from the sales department a storage-battery engineer, who will devote his entire time to exploiting the use of the electric automobile for business and pleasure purposes in Toronto and suburbs. Within the last few months two American concerns have opened garages in Toronto and with the assistance of the local electric-light company a number of sales have been closed. The General Vehicle Company's representative reports selling the O'Keefe Brewery Company two five-ton electric trucks, and states that he has a number of prospective customers who will undoubtedly order trucks in a short time.

The Toronto Electric Light Company offers the services of its expert to all present and prospective owners of electric carriages or business wagons. A rate of 5 cents per kw-hour has been made for current for charging purposes, with lower rates for different classes of business, depending on the amount of current used monthly.

The salesmen at the regular morning meetings have heard addresses on the different makes of batteries from representatives visiting the city and have become familiar with the operation of electric vehicles. The company, to show its progressiveness, has ordered two 500-lb. wagons of different manufactures, and is looking for a great deal of commercial and pleasure electric vehicle charging business.

ELECTRIC STEAM BOILER AND WATER HEATERS AT ESTES PARK, COL.

Beginning June 20, with the second season of the notable "all-electric" hotel of Mr. F. O. Stanley at Estes Park, Col., electricity has been used exclusively for generating the steam used in the laundry, and for supplying the hot water required about the guest-rooms and buildings. As has been already noted in these columns, this hotel derives its electrical energy from a 180-ft. waterfall about four miles distant down the canyon. This water-power site has been developed by the construction of a 200-kw hydroelectric plant which transmits single-phase, 60-cycle energy at 6600 volts to the hotel buildings and the nearby village of 200 persons. Estes Park is 22 miles from the nearest railroad, and is reached only by automobile trucks over a precipitous road. All supplies have to be freighted in this manner, and coal at the park costs $12 a ton. The water-power development and the hotels—a second "manor house" for winter use is now under construction—are properties of Mr. Stanley, an Eastern automobile manufacturer, who is the "discoverer" of Estes Park and has a cottage nearby.

The 85-kw boiler which supplies steam at 60 lb. pressure for the washing machines and mangles in the hotel laundry is capable of evaporating 250 gal. of water an hour. For controlling the heat the electrical equipment of this boiler is divided into four sections, each controlled under separate switches. When starting up with cold water in the boiler, the entire complement of heating units is turned on, and brings the contents up to steam at 60-lb. pressure per square inch in about 40 minutes. After the initial heating only one-half of the electrical heating equipment is required to maintain this pressure under normal operation of the laundry. The boiler is constructed after the fashion of a "porcupine" boiler in which short radial tubes are inserted into the cylindrical shell. Over all the electric boiler measures about 6 ft. in height and 3 ft. in diameter. Inserted in its cylindrical surface are 85 dead-ended tubes, each about 1¼ in. in diameter and 5 in. in length, and containing a 1-kw, 110-volt heating unit. The tubes are arranged in rows, having their outer open ends between the pairs of busbars which encircle the boiler cylinder. The jumpers from the busbars to the binding posts of the heating elements are formed of special zinc link-fuses. As the entire boiler, busbars and all, is enclosed in an outer jacket, ordinary lead fuses would not have been practicable in the high temperature under the jacket. The construction employed affords each heating unit the maximum surface contact with the boiler contents, and provides separate fusing for each heating element. This electric steam boiler was constructed especially for the Estes Park Hotel by the General Electric Company, and is doubtless the largest similar apparatus ever built.

Besides the steam boiler in the laundry, there are four heaters in use for supplying hot water to the hotel buildings and the laundry. A 600-gal. tank in the main summer-hotel basement provides hot water for the guests' baths, lavatories, etc., and

has also pipe connections to small hot-water radiators in the private bathrooms, intended for emergency use on chilly mornings during the hotel season. Another heating tank, of 200 gal. capacity, is in use in the kitchen, furnishing all hot water for washing and cleaning purposes. A 200-gal. tank in the laundry supplies all the needs of that place, in conjunction with the steam boiler, besides furnishing hot water for the employees' quarters, which are above. In the new "manor house" now under construction, which is smaller than the main summer building, and will remain open throughout the year, a 400-gal. heater tank will be installed for furnishing the hot water for baths and lavatories. Each of the four electric heating tanks above mentioned is equipped with 20 kw in heating units. The tanks themselves are 8-in. pipes, in which the small dead-ended tubes containing the heating elements are ranged in two parallel rows throughout the length of the pipe. Three busbars run the length of the two rows of tubes, one row of which being connected between each pair of bars. In this way three heats are obtainable by interchanging connections, throwing in the two rows in series, one row at a time, or both rows in multiple across 110 volts.

Mr. Stanley, who has taken a lively interest in the use of electrical devices in his hotel, is very much pleased with electric water heating on a large scale after two months' trial. He says: "The steam boiler and hot-water heaters are an entire success, and the problem of hot-water supply has been completely solved. Twenty kilowatts for the 600-gal. tank has proved ample. The laundry is delightfully cool, and the temperature at the outside of the jacket of the steam boiler does not rise above blood heat, in spite of carrying 60 lb. pressure inside."

Electric heat is now under consideration for the manor house, which will be open during the coming winter.

ORGANIZATION OF MUNICIPAL DEPARTMENT OF ELECTRICITY IN CHICAGO.

The accompanying chart, showing the actual organization of the Department of Electricity of the city of Chicago, will be inspected with considerable interest. The work is classified as follows: (1) Electric street-lighting service; (2) fire-alarm, police and other municipal telephone and telegraph systems; (3) electrical construction, maintenance and renewals; (4) bureau of electrical inspection; (5) gas and gasoline lamp and meter service; (6) examiner of moving-picture operators; (7) office clerical force, and (8) the personal stenographer of the head of the department. All these bureaus and individuals report to the city electrician.

The gas and gasoline lamp and meter service has to do principally with street lighting by gas lamps, although provision is also made for testing gas meters of individual consumers, where an official complaint is lodged with the department. The examination of moving-picture operators is a comparatively late addition to the department, and is no doubt assigned to the Department of Electricity owing to the conspicuous and almost indispensable use made of electric lighting in the particular form required by the moving-picture theaters. The greatest number of classified positions is in the bureau of electrical construction, maintenance and renewals, while the electric street-lighting service and the bureau of electrical inspection are both important sub-departments. The duties of the former will be greatly extended, no doubt, when the contemplated addition of 10,000 street arc lamps, supplied by the Sanitary District, is in operation.

The chart given herewith was made by the Civil Service Commission of Chicago (of which Mr. Elton Lower is president) in co-operation with the Municipal Efficiency Commission. Similar charts are made for all the other departments of the city government, and they show the organization, with the lines of authority, the working forces and salaries or wage scale. Acting with the Efficiency Commission, the civil service administration is putting into effect an efficiency plan—that is, a system for maintaining the efficiency of employees, in addition to filling the municipal positions on merit by competitive examinations. In general, the efficiency plan may be described as an effort to adapt to municipal service the conditions of efficiency and cost-figuring in operation in many large business corporations. It has for its object the organization of an administrative and expert staff, charged with the duty of ascertaining what results each group, bureau and department of the municipal service is obtaining from men and money allotted to it. The plan also contemplates determining and recording the success or failure of individual appointees in performing their duties, either personally or in handling subordinates. Before adopting it, it became necessary to make a thorough classi-

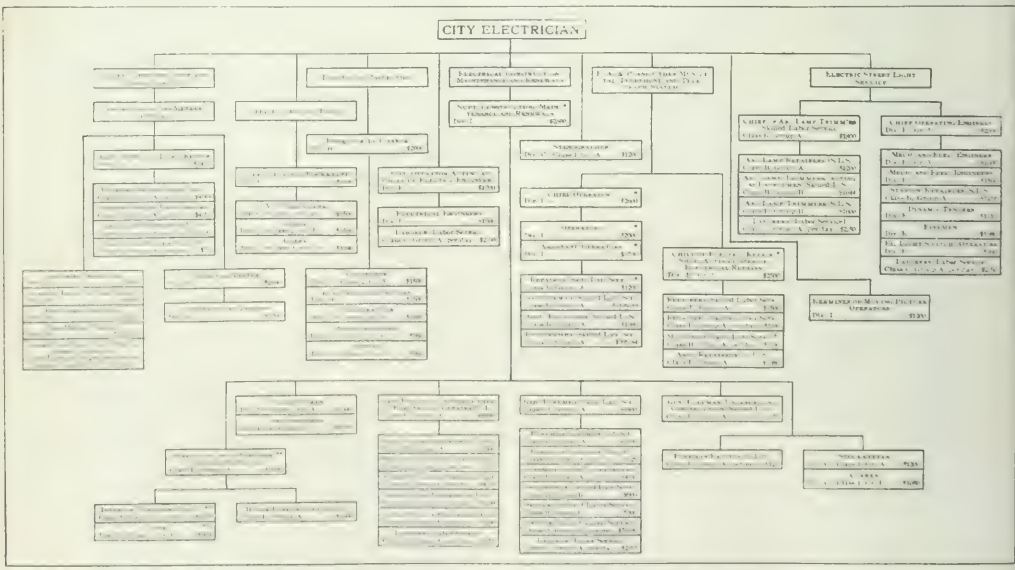


Chart Showing Organization of Department of Electricity, Chicago.

fication and study of the duties of the entire municipal service, including approximately 15,000 employees. The chart made of the Department of Electricity in carrying out this classification is the one presented herewith.

Wiring and Illumination

LOW-VOLTAGE TUNGSTEN LIGHTING IN THEATER

In the new Crystal Theater in Milwaukee, a handsome little vaudeville playhouse seating about 1000 persons, the auditorium is lighted throughout by low-voltage tungsten lamps, with the exception of a few indirect-lighting units in the center of the house. The interior is lighted by about 1800 20-cp, 27-volt, tungsten lamps of the new wire-joint type, energized from nine 220-to-27-volt auto-transformers. In addition to these lamps, which are principally decorative in arrangement, there are eight indirect-lighting units each containing four 100-watt, 110-volt, tungsten lamps. All of the stage lighting is done by carbon lamps, as it was feared that the dimming equipment required for the low-voltage tungsten lamps would complicate operation and require special apparatus. Outside of the theater is a large sign containing 1000 4-cp, 5-watt, 10-volt tungsten lamps connected in multiple-series, without the use of transformers. The lighting of the Modjeska Theater in Milwaukee, where only moving pictures are shown, has recently been converted from 110-volt carbon to 27-volt tungsten, with a large consequent saving in the energy required. These theaters are two of a chain of six owned by the Sachs Company, in all of which low-voltage tungsten lighting will be installed.

ILLUMINATION OF THE TACOMA STADIUM.

A practical illustration of the use of flaming-arc lamps for illuminating large areas is found in the Stadium, at Tacoma, Wash., which is said to be the largest in the world. It covers an area of five acres.

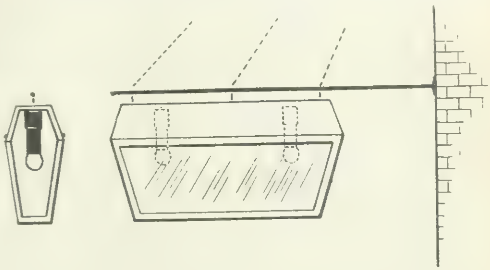
Illumination of Tacoma Stadium.

For illuminating this area use is made of five rows of flaming-arc lamps parallel to the bay end of the stadium. On the outer row there are six lamps; on the next, four; the third, six; the fourth, four; and the fifth, three, making a total of 23 immediately over the arena. At either end of the abutment and above each of the 28 gates leading to the seat tiers is a 3000-cp lamp, the rating of lamps directly above the field being 3500 cp. The lamps around the stadium are not shaded, but shading reflectors are used on those directly above the field. The arrangement is such that a spectator may sit anywhere in the stadium without receiving rays in his eyes directly from any lamp. Excellent diffusion of illumination is obtained, and the effect produced by the soft, mellow light is quite pleasing. The illumination density is such that a cavalryman can pick up objects from the ground as readily at night as in the daytime.

The lamps are of the Grant type, each consuming about 550 watts. They were furnished by Parrott & Company, San Francisco, Cal.

ILLUMINATED SIGN USING FLAMING-ARC LAMPS.

The accompanying sketch shows an arrangement of a flaming-arc illuminated sign, suggested by Mr. C. M. Axford, Chicago, in which a pair of lamps are used to illuminate the letters, and



Sign Illuminated with Flaming Arc Lamps.

at the same time to light the sidewalk and store front where the sign is installed. The proposed construction is made clear by the sketch. The two flaming-arc lamps are connected in series across 110 volts, and together consume about 1 kw. The signs should be black letters on a frosted background, or vice versa, and the sign surfaces should be inclined about 10 deg. to the vertical so as to be most effectively read along the street. Above the sign spaces are hinged doors, through which access can be had to the lamps for renewals. These doors should be

provided with gutters discharging at the curb line. The street end of the box should be closed, or may be used for a small sign, while the end toward the building should be left open and preferably cut away as shown, to allow light from the lamps to reach the windows and store front. For this purpose, the sign, which should be about 10 ft. in length, extending to the curb, should be mounted at least 4 ft. away from the building line, being suspended from a chain and bracket or other construction. Opal globes on the flaming-arc lamps will tend to improve diffusion of the light within the sign, and minimize "spotting" of the letters. The use of an illuminated sign of this kind is suggested in positions where it has been the custom to hang a pair of naked flaming-arc lamps in front of a store, depending on them to light the front and windows and the owner's sign. Under such conditions the extreme intensity of the lamps defeats the latter purpose, causing passers-by rather to instinctively shield their eyes from the glare. The sign proposed would, on the other hand, show the proprietor's legend to advantage along the entire street, besides lighting his sidewalk and windows, all at minimum electrical expenditure.

STORAGE-BATTERY EXIT LAMPS FOR THEATERS.

Mr. Samuel Lederer, manager of the Olympic Theater in Chicago, has been in Berlin inspecting systems of theater-exit lighting by electric lamps energized from storage batteries, an arrangement which eliminates all danger of interruption of outside supply sources, and marks an improvement over the gas flames that have been used in Chicago houses since the Iroquois fire. It is proposed to install a local storage battery of several cells to furnish energy for each exit lamp, making the equipment at each exit complete in itself. As a further precaution against outage, due to broken filaments, each exit sign will be provided with two lamps, the second of which is automatically switched on if the first lamp goes out from any cause. By connecting all the exit-lamp circuits in series by a tie-wire, the batteries can be charged from the regular source of energy during normal operation, while any interruption to the supply leaves each lamp fed by its individual battery. The use of gas for exit signs has been open to the objections of freezing during winter, blowing out when exit doors are opened, and the danger of having matches, gas and open flames about a theater building. The Chicago ordinance permits either gas or electrically lighted exit signs, but at present the majority of the larger theaters have gas installations on account of what is believed to be their greater reliability against possible interruption.

NEW TELEPHONE PATENTS.

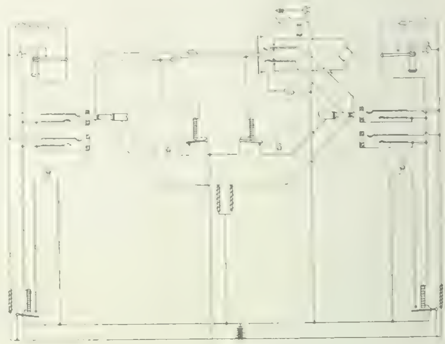
NEW TRANSMITTERS.

A departure in transmitters is described in patents granted to Mr. C. L. Chisholm, of New Brunswick, Canada. In this transmitter the diaphragm is reduced in size until its diameter is substantially that of the usual microphonic button. It is stated that the fundamental period of vibration of such a diaphragm is far higher than the highest tones of the voice and therefore no damping is required. The peripheral seat for the diaphragm should be as small as possible and there should be no initial strains. Thus the seat is reduced to a sixty-fourth of an inch and the diaphragm soldered or cemented in. The back of the microphone button is an auxiliary diaphragm carrying the back electrode at its middle. The electrode is rigidly mounted, but the button casing is free to move within the limits of flexure of the rear diaphragm.

EXCHANGE SYSTEMS.

A very inexpensive exchange system has been devised and patented by Mr. E. C. Rodman, of West Point, Ia. The cord pairs normally have no connection to the common battery and a cheap form of signal is used. An ordinary drop serves as a line signal, being released when the circuit is closed at its corresponding station. In answering the operator cuts off the drop through jack contacts. When a connection is completed, one pole of the battery is connected to one side of each of the two lines, and thence back through the instruments and jacks to the top side of the cord circuit. The other pole of the battery is connected through the jacks to the second strand of the cord circuit. A single magnetic signal is connected between the two-cord strands and this serves as an isolating retardation coil. This signal is displayed as long as either party holds the receiver off the switch hook.

The illustration shows a diagram of the system of common-battery working patented by Mr. C. L. Goodrun, of Atlantic City. It will be seen that when a plug is in the jack of a line the line relay becomes shunted out by the battery feed retarda-



Goodrum Common-Battery System.

tion coil of the cord circuit. At the same time the supervisory lamp finds a path back to battery, its circuit turning back through the strapped contacts in the jack and thence through the dip cord strand and the cord retardation coil.

An automatic exchange system is the subject of a patent granted to Mr. A. E. Stevens, of Fall River, Mass. This is designed especially for use in small centers of population where there are, in addition to the usual exchange lines, multi-party, rural or farmer lines. The apparatus and manipulations are of the types general for automatic systems, but the system is especially arranged so that the stations of a line may intercommunicate without involving the switching apparatus, yet while in use are barred to an incoming call from the exchange. Again, they can at will call through the exchange. The system also provides for either common or local-battery talking sets.

PARTY LINE DEVICES.

A rather complete lockout party line system has been invented and patented by Mr. H. J. Roberts, who has assigned his patent to the Homer Roberts Telephone Company. One side of the party line is continuous from end to end. The other is in sections from station to station. At each station the incoming section is connected through the bell to the continuous side of the line. Thus, if a signal be sent out from central it will ring the first station bell. To skip the first station it is necessary to build the line to the second station. This is done by sending out an impulse of current, which cuts out the first station and connects on the line section extending to the second section.

For an incoming call, a signal is set over the continuous side of the line. The operator upon responding pulls a key which sends out in rapid succession a considerable number of impulses and thus she rapidly builds up the broken side of the line to the calling station at which the apparatus is so set as to stop the effect of further impulses of that polarity. Arrangement is also made for clearing out the circuit after a connection and for supervision. It is also possible for a locked out station to set the line so that his calling signal will come in as soon as the line is free. Mr. W. E. Zabst, of Portage, Wis., has also patented a party line apparatus. This includes a bar for

obstructing the motion of the bell clapper and a mechanism for elevating the bar.

Normally the bell comes to rest in such a position as to engage a barb upon the bar and prevent its elevation normally. Upon the arrival of properly poled impulses of current, the bell rod is thrown clear of the barb and at the same time the bar is elevated one step. Each bar has a notch which comes opposite to the bell and thus releases it at the elevation corresponding to its station. After conversation all bars are advanced to their uppermost positions when they fall back to zero.

The patent issued to Mr. L. W. Carroll, of Anamosa, Ia., relates to a harmonic system of signaling. Vibrating reeds, linked to transmitters, send out currents of predetermined frequencies, and the various stations have tuned receiving devices to correspond. These vibrate before resonators and give the audible signal.

The plan of signaling selectively, proposed by Mr. O. T. Lademan, of Milwaukee, requires a double-wound differential relay at each station. The windings of the relay are included in the respective sides of the line so that their action in retarding talking currents is confined to the ohmic resistance. To signal, current is sent out on both sides of the line in parallel and thence to ground through a connection made between coils at the line extremity.

The invention of Mr. A. H. Dyson, of Chicago, relates to a recording system for party-lines operated in connection with an automatic system. For certain classes of calls it is necessary to know not only the line number, but the station number originating the call. In the automatic system contemplated one side of the line is used in sending stepping impulses, while the other side serves to effect the shift from one digit mechanism to the next. Mr. Dyson codifies the shifting impulses so that not only is the required shift made, but also his register is affected to set a type wheel and print the station number. Thus, one impulse on the shift line may be station one, two station two, etc. The Kellogg Switchboard & Supply Company has obtained this patent by assignment.

IMPROVEMENTS IN MANUAL SWITCHBOARDS.

A circuit system for a manual common-battery switchboard forms the subject of a patent issued to Mr. S. B. Fowler, of Lafayette, Ind. In this system a special combined line and cut-off relay is used. The line coil is double wound and serves as a battery feed retardation coil. Two armatures are arranged before it. One of these is a long armature pivoted at its middle, and its other end is exposed to action of the cut-off relay winding. When a call arrives both armatures respond to the line winding. The long one lights the line lamp and the short one removes a short-circuit from the cut-off relay winding. When the operator inserts a plug the cut-off winding restores the long armature to normal through its counter pull. There is no effect upon the short armature and the supervisory relay lamp in the cord strand circuit does not glow as the cut-off relay is of too high resistance. If, however, the line relay be de-energized, permitting the short armature to fall and restore the shunt upon the cut-off relay, the cord lamp will glow.

Mr. A. D. T. Libby, of Elyria, Ohio, has arranged a cord circuit with a three-strand cord and two-part plug. Two-cord strands connect to the plug shank. One of these carries talking currents exclusively and the other carries only battery currents for signal operation. This patent has been assigned to the Dean Electric Company.

LETTERS TO THE EDITOR.

Transmission Line Calculations.

To the Editor of Electrical World:

SIR:—I have read with much interest the article by Mr. J. F. H. Douglas in your issue, April 28, 1910, page 1066, on the application of certain [illegible] and practical method for the calculation of alternating-current transmission lines. I beg, however, to be allowed to point out that a similar employment of series, together with numerous practical applications under a form somewhat different, but in essence identical, by M. C. Le Roy and the writer, appeared in *La Lumière Electrique* in the issues of 1909 numbered 38, 39, 43, 44 and 52. Referring notably to the formulas on page 360, it will be seen that the only difference is that Mr. Douglas represents the vectors by letters accompanied with a dot underneath, while we indicated the vectors by a horizontal line above, with an indication alongside of the angle of rotation of the vector. Our notation appears to be the clearer and more apt to obviate error. The method of Mr. Douglas is the more rapid, but it does not show the convergence and the degree of approximation so well as the geometrical method we employed. We believe that a comparison of the two articles will show that priority for the method should be assigned to M. Le Roy and the writer.

Paris, France. ANDRE BLONDEL.

[The belated appearance of Prof. Blondel's letter, which is dated June 6, is due to the communication not having been properly delivered upon its receipt in New York.—ED.]

Protection of Iron by Galvanizing.

To the Editor of Electrical World:

SIR:—During the demolition of the Gillinder Building, at the northwest corner of Wall and Nassau streets, New York, I have had opportunity to observe the condition of the electrical installation installed 12 years ago. One or two features of its condition at the time of demolition deserve notice.

The conduit used was "lined" standard-weight iron pipe, enameled on the outside. Wherever this conduit had come in contact with cinder concrete fill it showed considerable flake rusting and pitting, although the corrosion had not advanced sufficiently to injure the pipe seriously. The enameling or outside treatment had entirely disappeared. Had the conduit been made of thin wall pipe the corrosion might have been considered a serious matter.

Wherever the conduit was encased in cement or built into chases the enameling had almost entirely gone, but the rusting was merely a surface skin and could be almost wiped off with a piece of cloth, thus showing that it was not progressive. In general, all threads well leaded in couplings were clean and bright. In many cases the lining of the conduit had flaked off, cracked, or had coagulated into the form of irregularly-shaped beads adhering to the wire and to the inside of the pipe. This condition existed generally wherever the conduit was laid near steam pipes, even at some distance from them, and wherever the conduit was exposed to heated air.

The rubber-covered conductors showed a remarkable state of preservation, due largely to the fact that the insulating compound contained the proper amount of fine para gum (30 per cent), and was protected with fine quality braids well impregnated. The compound as it exists to-day exhibits the physical characteristics of a new high-grade code insulation containing, say, from 15 per cent to 20 per cent of inferior rubber. There was no sign of cracking, hardening or disintegration, even where the conduits had been exposed to a moderate heat and where the conduit lining was in bad shape.

This is particularly interesting since in samples of rubber-covered code wire, taken by the writer from another building of about the same age and now under reconstruction, the insulating compound was largely disintegrated. This wire had been pulled in circular loom, but was installed in a perfectly dry frame construction.

The lesson I draw from a study of the Gillinder Building installation has to do with the conduit and its rust protection. Comparisons may be drawn in this same building with the rust protection of pipes used for other purposes, and it may as well be stated at once that the only pipe in contact with cinder fill that had not rusted was the hot-dip galvanized plumbers' pipe. All black-iron pipe not in chases had badly disintegrated.

The writer has observed much rusting of conduit and outlet boxes even where not in contact with cinders, due largely to the

high speed and often slovenly methods of modern building construction. He has particularly in mind one installation where the building was wet even after the white-coat plaster had been placed on the lower floors; concrete and mortar mixing was in progress on the upper floors, thereby causing a constant seepage of water from the top to the bottom of the building. In this installation electro-galvanized conduit and boxes were used, while all floor boxes were hot-dip galvanized. The electro-galvanized conduit and boxes exposed to the acid-charged water were badly rusted before the work was half completed. The hot-dipped material showed no signs of corrosion except in one or two cases of defective galvanizing.

This hot-dipped material seemed to be protected by a coating of insoluble zinc oxide that had formed over the zinc. Recent tests lead to the belief that no conduit now on the market, enamel or otherwise, as it is usually installed, is free from this defect of corrosion.

The writer hopes that this matter will receive discussion, for most of the conduit manufacturers have recently installed expensive electro-galvanizing or sherardizing plants, which would prove a loss should it be finally shown that the old-fashioned marine hot-dip process or some other process where thorough amalgamation of the two metals occur is the best.

New York. BASSETT JONES, JR.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Testing of Transformer Regulation.—C. V. DRYSDALE.—Where transformers are run in parallel it is important that all of the transformers should have similar regulation curves. For inductive loads the curves are not similar, unless the ratio and phase displacement are the same for each transformer at the same fraction of full load. The usual short-circuit test is not very suitable for obtaining these data, as the instruments are generally working at the bottom of their range, and a small error in the indications makes a large error in the final result. The author, therefore, proposes a method in which the voltage of the transformer under test is compared with that of a second transformer of approximately the same ratio on open circuit. For the measurement of the difference of the voltages, use is made of a wattmeter in which the moving coil is connected to the constant voltage of the auxiliary transformer, while the main coils, in series with a non-inductive resistance, are used as a low-resistance voltmeter. In order to measure the reactance or phase displacement with greater accuracy, a condenser can be inserted in the shunt circuit. The connections for the test are shown in Fig. 1, in which the transformer under

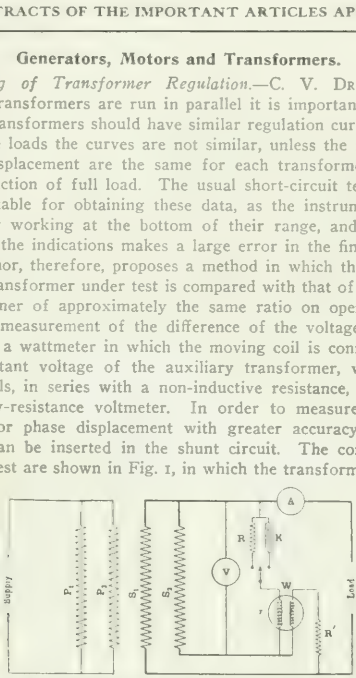
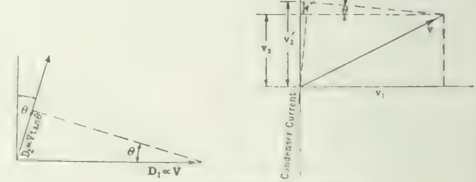


Fig. 1—Diagram of Connections for Test.

test P_1S_1 is shown connected to the supply mains and to a load exactly as in service, and in parallel with an auxiliary transformer P_2S_2 of approximately the same ratio. If the secondary circuits of the transformers S_1 and S_2 are connected as shown, the potential difference between the two lower conductors will be the vector difference between the voltage of the auxiliary and test transformer. The main coil of the wattmeter W is connected between these two lower leads with a non-inductive resistance R' in series with it, while the moving coil circuit is connected to the secondary of the auxiliary transformer, the voltage of which is conveniently kept constant by maintaining the supply voltage constant. The non-inductive resistance R in the wattmeter shunt circuit is, however, connected to a change-over switch which puts either this resistance in series with the moving coil or replaces it by a condenser K. If a little care is taken in arranging the circuits beforehand the measurements can be made quite simple. The best way, as a rule, is first to select a suitable condenser for the moving coil circuit of, say, 1 mfd or 0.5 mfd capacity. The capacity reactance of this condenser is then $10^6/K\omega$, where K is the capacity in microfarads and $\omega = 2\pi f$. In a certain test a 0.5-mfd condenser was used with a frequency of 50 cycles, for which $\omega = 314.2$. Hence the capacity reactance $= 6360$ ohms. The resistance of the moving coil of the wattmeter was 620 ohms, so that the impedance of the circuit with the condenser in series was $\sqrt{6360^2 + 620^2} = 6390$ ohms, or practically the same as the capacity reactance. If the moving coil resistance ($= 620$ ohms) be subtracted from the above, there remain 5770 ohms, and if the non-inductive resistance R is adjusted to this value, the current in the shunt circuit will be of the same amount whether the resistance or condenser is in circuit. If use is now made of a small transformer which has a known ratio of, say, 10-to-1, and it is connected to the secondary of the auxiliary transformer, then if the potential difference of the auxiliary transformer is 100, that of the secondary of the small transformer is 10 volts and in time-phase with it. The main coils of the wattmeter, in series with its non-inductive resistance, may now be applied to the terminals of the small transformer, and the resistance may be adjusted until a convenient reading is obtained. In the experiment a torsional wattmeter with 500 divisions on the torsion head was employed, and the resistance in series with the main coils was adjusted until with 100 volts on the shunt, and consequently 10 volts on the secondary of the small transformer, there was obtained a deflection of 500 divisions, or of 50 divisions per volt. At the same time, the shunt circuit was changed over to the condenser, and a reading of 62.5 divisions was obtained. Had the change over to the condenser changed the wattmeter current into exact time-quadrature there should have been no deflection in the second case; the fraction $\frac{62.5}{500} = 0.125$ is the tangent of the angle by which the shunt current departs from time-quadrature, or tan θ in Fig. 2, where D_1 and D_2 are the two deflections of the wattmeter with the resistance and condenser respectively in the shunt circuit. This tan θ should



Figs 2 and 3—Vector Diagrams.

have been equal to the resistance of the moving coil divided by the capacity reactance $= \frac{620}{6360} = 0.0975$ if the condenser had no absorption, the difference $0.125 - 0.0975 = 0.0275$ being approximately the power-factor of the condenser. When

these preliminary calculations have been made and the voltage and frequency are kept approximately constant, the wattmeter becomes a direct-reading voltmeter, which, when the resistance R is in the shunt circuit, reads the component v_1 of any voltage v in time-phase with the "exciting voltage" on the shunt (in this case the voltage of the auxiliary transformer), while with the condenser in circuit it reads the component v_2 in time-phase with the condenser current. As will be seen at once from Fig. 3, however, the time-quadrature component $v_2 = v'_2 - v_1 \tan \Theta$ approximately, and, since $\tan \Theta$ is known, the two components are at once given. Details of a test made by means of this method are given.—Lond. *Electrician*, July 29.

Tests of Induction Motors.—G. H. FLETCHER.—A description of a modification of the Hopkinson test for induction motors. A test of two induction motors of large size is described. They are coupled rigidly together, one above the other, both rotors being joined by a sleeve coupling, the top machine being run as a motor and the bottom as a generator. Both stator windings are connected in parallel, and, of course, have the same direction of rotation. When the two are up to speed the rotor of the motor is short-circuited, while that of the generator is connected to the slip-rings of a rotary converter (*RC* in Fig. 4). The rotary must be supplied with energy from a low-voltage circuit—50 volts or less—a motor-generator set being used for this purpose. If, when both motors are running at full speed, current be switched on to the direct-current side of the rotary

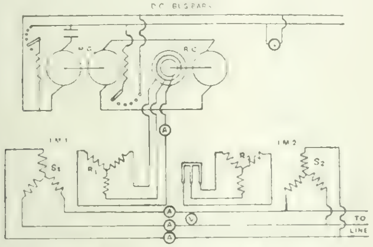


Fig. 4—Testing Induction Motors.

converter (the field of which is unexcited) the rotor R_1 will then become excited with a direct current, and an e.m.f. will be generated in stator S_1 which will be of the same frequency as that of the supply. If, now, the excitation of the rotor R_1 be increased, the e.m.f. of stator S_1 will tend to become higher than that of S_2 and accordingly a circulating current will be produced between the two machines. This will, of course, have the effect of loading up the motor, and consequently the speed will drop somewhat below the synchronous value owing to the slip. The current generated in the stator S_1 would, therefore, be of less frequency than that of the supply, and the two machines would fall out of step. If, however, the field of the rotary converter be excited, the machine will commence to revolve, and the direct-current excitation of the rotor R will be changed into an alternating current of low frequency which will have a value corresponding to that of the motor slip. No very fine adjustment of the field is necessary to obtain the right speed for the rotary, as the e.m.f. generated in the rotor of that induction machine which is run as a generator will fall into step with that of the rotary, and the two will run synchronously. One can easily find the value of field current which will give the steadiest running. The load is regulated by increasing or diminishing the voltage impressed on the commutator of the rotary; an increase in the volts will increase the stator volts generated, and, consequently, the circulating current. At the same time, it will cause the speed of the rotary to increase slightly, and will thus make up for the increased slip. The resistances of stator and rotor having been determined, and a light load reading (core loss and friction) on one machine having been obtained, the efficiency is equal to:

$$\frac{(W_1 + W_2) - (W_l + 3\,[C_s^2 R_s + C_r^2 R_r])}{W_1 + W_2} \text{ where}$$

W_1 and W_2 = wattmeter readings on underload.

W_l = light-load reading.

C_s and C_r = stator and rotor currents.

R_s and R_r = stator and rotor resistances.

Another method of determining the efficiency is as follows: Connect wattmeters in the motor and also in the generator circuits of the set. The three phases should be equally balanced, and in this case one wattmeter in each case will suffice. If there were no input from the rotary the efficiency would simply be W_o/W_1 where W_o is watts output and W_1 is watts input. However, there is also W_3 input from the rotary, where $W_3 = \eta E_r C_r$ (E_r and C_r being the direct-current voltage and current to the rotary); η is the efficiency of the machine, which, being a test machine, has been experimentally determined. The combined efficiency of the motors is now $W_o \div (W_1 + W_3)$. The power-factor and the percentage slip may also be easily determined.—Lond. *Elec. Rev.*, Aug. 5.

Compensation and Commutation.—A note on a recent British patent (15,319, 1909; July 21, 1900) of R. Pohl and the Phœnix Dynamo Manufacturing Company. In direct-current turbogenerators and alternating-current commutator machines, where the commutation conditions are difficult, the usual compensating winding is placed in the face of the main poles, but this is designed to compensate the armature reaction under the poles only. A further compensating winding is provided in the spaces between the poles, and this is designed to produce the flux for commutation also. The compensating winding is arranged close to the armature and an unwound commutating pole is fixed outside of the winding, or the winding may be in the face of the commutating pole. In order to vary the commutating field without altering the degree of compensation, reluctance is introduced into the magnetic circuit of the commutating poles in the form of a variable air-gap, or the poles themselves are moved transversely across the armature.—Lond. *Elec. Eng'ing*, July 28.

Three-Phase Commutator Motors.—F. EICHBERG.—A paper read before the Berlin Electrical Society in which the author gives, with the aid of diagrams, a simple theory of the construction and mode of operation of polyphase commutator motors. He then discusses the method of regulation, conditions of commutation and compensation. He finally gives the results of tests which show that these motors possess, within wide limits, the properties of direct-current shunt motors with field regulation.—*Elek. Zeit.*, July 28 and Aug. 4.

Leakage Reactance.—J. REZELMAN.—The conclusion of his mathematical paper on the analysis of leakage reactance. The author continues his investigations into the leakage of the windings of alternating-current machines. The expressions for the various permeance are considerably simplified and made much more general. The leakages of many machines have been carefully analyzed and the results are given. Bar windings are also dealt with.—Lond. *Electrician*, July 29.

Faults in Armatures.—W. H. F. MURDOCH.—It frequently occurs that owing to defective insulation there may be faults between the armature windings and core, or between commutator segments and shaft. The consequences of such faults are briefly discussed. Faults close together are preferable to diametrally opposite faults, and the current flowing depends on the e.m.fs. and resistances, and whether there is an odd or even number of faults.—Lond. *Elec. Rev.*, July 29.

Parallel Running.—W. WOLF.—A translation in abstract, with illustrations, of his recent German article on modern arrangements employed in Continental Europe for the synchronizing and parallel running of electrical machines.—Lond. *Electrician*, July 29.

Lamps and Lighting.

Fragility of Metallic-Filament Lamps.—A note on the deteriorating effect of vibrations on metallic-filament lamps. Attempts have been made to overcome this drawback by a spring suspension of the filament, but have not met with the anticipated measure of success. Under certain conditions the springs, which are an essential part of the appliance, are prone to vibrate

in unison with some other vibration, and thereby accentuate the trouble they were designed to overcome. The transmission of outside vibrations to the filament is prevented to a large extent, if not altogether, by a Continental method of manufacture. The foot of the lamp carries a rod arranged axially, which is surrounded concentrically by a cylindrical part, which forms the filament-holding device. The connection between the latter and the center rod is formed by springs so arranged that all vibration along the rod is taken up before the filament supports are reached. In one form the elastic connection is by means of carefully tensioned hair-springs, while in the most improved form the filament support is held concentrically with the center rod by means of one spring and is slung on two other springs arranged as part of the leading-in wires, which successfully prevent any vibration of the lamp being transmitted to the filament.—Lond. *Elec. Rev.*, Aug. 5.

Flame-Arc Lamp.—An illustrated description of a new direct-current flame-arc lamp of English make. The electrodes are inclined, but the regulation of the arc is effected entirely from the top of the lamp, the electrodes sliding axially in guides. Fig. 5 shows the arrangement of the controlling gear. It consists simply of a differential shunt and series solenoid, actuating a clutch, through the agency of a lever, against the tension of an adjustable spring. The clutch is of a very peculiar design, having three working parts enclosed in a box; one part is connected to the lever by a link, and presses a T-shaped piece against the chain, while the third part acts in the opposite sense, releasing the clutch when its toe comes in contact with the top-plate of the lamp. The flat chain is also of novel construction, presenting a perfectly smooth surface to the clutch and to the opposing wall of the box. As shown, one end of the chain is attached to a bar from which the electrodes are suspended by rollers, while the other end is attached to a balance-weight enclosed in a tube. On closing the circuit the electrodes are retracted, striking the arc to practically its normal length, after which they are gradually lowered until the toe of the clutch meets the plate; subsequently the arc is controlled by the clutch, which feeds the chain by almost imperceptible movements.—Lond. *Elec. Rev.*, July 29.

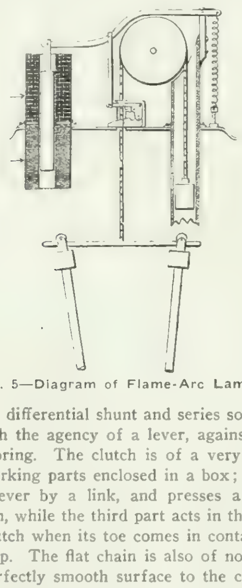


Fig. 5—Diagram of Flame-Arc Lamp.

Mercury Arc.—C. T. Knipp.—An account of an experimental investigation in which the author determined the temperature-gradients from electrode to electrode under various conditions of pressure, current, and form of tube of a mercury-vapor lamp. The average temperature of the mercury arc in a vertical tube was investigated from electrode to electrode by means of a movable thermo-junction introduced through a barometric leg of the lamp for pressures up to 3 mm mercury at a constant current of 3 amp. The temperature increased very rapidly with the pressure. The temperature-gradient along a diameter 27 mm from the anode showed a fall in temperature of 20 per cent of the whole at a distance of 12 mm from the axis in a tube 34 mm in diameter.—*Phys. Rev.*, August.

Filter for Heat Rays.—R. A. Houstoun and J. Logie.—In photometric experiments it is sometimes necessary to separate the light rays from the heat rays. This is generally done by means of glass vessels filled with water or with an alum solution. But in both cases considerable quantities of dark heat rays are permitted to pass, and, contrary to general opinion, alum solutions do not absorb the heat rays better than does water. Russler recommends solutions of ferro ammonium sulphate in water and the present authors employ such a solution containing 12.56 grams per liter. This solution is much superior to water.—*Phys. Zeit.*, Aug. 1.

Generation, Transmission and Distribution.

Electric Equipment of Steel Works.—An illustrated description of the use of electric motors in the works of the Barrow Hematite Steel Company at Barrow-in-Furness. The various shops, the machinery in the iron works and in the rolling mill, the blast-furnace hoists, pumping and other plant are electrically driven, and in all some 120 motors are installed, aggregating about 2500 hp. Energy is generated by three large gas-engine sets operated with blast-furnace gas, and is distributed at 220 volts direct current on the two-wire system by means of bare overhead cables.—Lond. *Elec. Eng'ing*, July 28.

Condensers.—M. Leblanc.—The conclusion of his illustrated article on his condenser, with special reference to the construction and arrangement of the rotary pumps.—*La Lumière Elec.*, July 23.

Traction.

Prussian-Hessian State Railways.—K. Wiesinger.—An article on the development of electric operation on the Prussian-Hessian State Railways which are to be operated by 15-cycle, single-phase current. The trolley e.m.f. is 10,000 volts, and the transmission e.m.f. 50,000 volts. For the trial roads, two different kinds of locomotives will be used, serving for high-speed passenger service and freight service respectively. The author gives some constructive details of the locomotives according to proposals made by Wittfeld. They contain large driving wheels near the center of the locomotive and small trucks or running axles with a moderate axle pressure at the ends. The motors are placed at a comparatively high level. The reduction of the axle pressure from 16 to 14 tons is considered a great advantage of electric traction, which, in connection with the quiet running of the electric locomotive, will reduce considerably the cost of maintenance of the roadbed.—*Elek. Zeit.*, Aug. 4.

Surface-Contact System.—Some notes on the troubles experienced at Torquay with the Dolter surface-contact system, due to a large number of defective studs and an alleged excessive cost of maintenance. It is claimed that the number of stud failures has been unduly increased by the fact that so many have been allowed to remain in a defective condition. On the other hand the working cost is thought not to be higher than in other hilly towns where the trolley system is used. Figures are given showing that at Bradford, Halifax and Huddersfield, all working on the trolley system, the energy per car-mile is 1.88, 1.97 and 2.25 kw-hours respectively; the revenue per car-mile is 20.66, 22.16 and 19.46 cents respectively; and the costs per car-mile are 14.44, 21.0 and 18 cents respectively. These figures are then compared with those of Wolverhampton, Lincoln and Torquay, all surface-contact systems, and, of course, running a less number of car-miles per year. In these cases the kw-hours per car-mile are 1.56, 1.11 and 2.24 respectively, while the revenue per car-mile is 20.94, 18.40 and 20.1 cents. The cost per car-mile in the case of Wolverhampton is 13.2 cents and in the case of Torquay 20 cents, while the figures for Lincoln are not given. At Torquay the management and general expenses are high. The cost of repairs and maintenance is not considered excessive, but the cost of energy is high. The high energy consumption is due chiefly to the hilly nature of the town. The price charged to the company for electrical energy is 3.14 cents per kw-hour.—Lond. *Elec. Eng'ing*, July 28.

Trackless Trolley Systems.—An account of the report of the committee sent by a British central station to Continental Europe to investigate the different trackless trolley systems in

practical use. The conclusion is that the railless trolley systems as used in Vienna and in Italy are such that either system could be adapted to English conditions and prove of great value to tramway authorities and to the public in providing a means of transit to districts where the heavy capital cost would prohibit the construction of an ordinary tramway.—Lond. *Electrician*, July 29.

Liverpool.—An abstract of last year's financial account of the Liverpool tramway system. While the number of passengers and total receipts have decreased by 0.3 per cent against 1909, the net profit has increased due to economies in the management. The total expenses, including capital charges per car-mile for 1909, were 20.30 cents and the total revenue 23.78 cents.—Lond. *Electrician*, July 29.

Installations, Systems and Appliances.

Central-Station Statistics for Germany.—G. Dettmar.—The author first gives some statistical data supplementary to last year's statistics of the central stations of Germany and then sums up the situation as existing on April 1, 1910. The total number of central stations on that date is estimated as 2358, supplying electrical energy to 6470 cities and towns. The total rating is 1,373,000 kw. With respect to the kind of prime movers employed, it is stated that 767 stations employ steam, 214 water, 350 internal-combustion engines, while 51 are transformer or converter substations. Both water and steam are used in 390 stations, while the nature of the prime movers is not known for the balance of the stations. Fifty-two stations employ single-phase current, 241 three-phase currents, 1736 direct current, while the balance employ either a mixed system or did not give any information on this subject.—*Elek. Zeit.*, Aug. 4.

Statistics of Austrian Electricity Stations.—On July 1, 1910, there were 675 central stations in Austria (against 571 last year), supplying energy to 1500 towns. There were 241 municipal stations and 434 were owned by corporations or private parties. The data relate to 19 stations which supply, besides energy for lamps and stationary motors, also energy for traction, but all pure traction stations are excluded. The number of stations transmitting energy over an extended district is 139, that of high-tension plants is 225. The total rating of all works is 318,614 kw, against 285,353 kw last year; the greatest increase was in the three-phase stations, the smallest in the direct-current stations with storage batteries. There are 238 direct-current stations with storage batteries (57,342 kw), 165 direct-current stations without storage batteries (8689 kw), 15 single-phase stations and 5 two-phase stations (total rating, 41,525 kw), 192 three-phase stations (94,156 kw), 37 combined three-phase and direct-current stations (116,902 kw). For the balance of the stations the system was not reported. Of the stations, 145 have a rating up to 25 kw, 105 stations to 50 kw, 129 to 100 kw, 114 to 250 kw, 58 to 500 kw, 48 to 1000 kw, 23 to 2000 kw, 18 to 5000 kw and 10 have a rating above 5000 kw. Of the stations 127 are operated by steam, 308 by water, 87 by steam and water, 52 by internal combustion motors, 15 by steam and internal combustion motors, 42 by water and internal combustion motors, and 11 by water, steam and internal-combustion engines. The total rating of all the prime movers is 475,954 hp, against 410,459 hp last year. Overhead wires are used in 326 stations, cables in 17 and both overhead wires and cables in 186. As to the methods of charging for energy the following figures are given:

Tariff System	[illegible]	[illegible]
[illegible]	136	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	107
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

As to the age of the different stations there were four in existence at the end of 1888. The number of new stations erected reached a maximum in 1905, when 62 stations were opened, while the numbers of stations opened in 1909 and 1910 were 36 and 33 respectively.—*Elek. und Masch.* (Vienna), July 31.

Electricity in Agricultural Districts.—H. Wallem.—The conclusion of his paper read before the German Association of Electrical Engineers on the use of electric energy on farms. In the present installment the author discusses the chief conditions to be fulfilled in order to make an electric distribution system in agricultural districts profitable. By means of equations and curves he discusses the relation between capital invested, cost of operation, selling price of electric energy, and the number of kw-hours which must be sold per year to make the system profitable. In discussing how the energy required for agricultural purposes may best be generated, he points out that it is used chiefly during the day and at hours while the load on central stations in cities is low. For this reason he thinks that central stations in cities surrounded by agricultural districts would do well to consider the supply of energy to farmers, or to a substation for farmers. This energy could be supplied cheaply, since the demand of the farmers would not increase the maximum demand of the station, but would tend to equalize the load. The author finally estimates the possibilities of electric energy distribution over the agricultural districts in Germany for the next 25 years and thinks that there is a promising field here for electrical developments.—*Elek. Zeit.*, July 28.—A long discussion on the subject of transmission and distribution systems for agricultural districts following the above and several other papers presented at the recent meeting of the German Association of Electrical Engineers was opened by the Secretary of Commerce, Von Podbielsky, and participated in by various speakers. The report of the meeting is given in full in *Elek. Zeit.*, July 28, page 765, and Aug. 4, page 791.

Wires, Wiring and Conduits.

Fuses.—R. Edler and R. Schuster.—An account of experiments with fuses of silver wire, copper wire and lead wire in porcelain tubes. The length of the fuse wire depends only on the voltage, while the diameter depends on the current. As to the relation between the diameter d of the fuse wire and the maximum current i_m which it can carry continually without melting, the equation $i_m = cd^x$ holds good. If i_m is given in amperes and d in millimeters the values of the constants c and x are as follows: Silver, $c = 44.5$, $x = 1.558$; copper, $c = 62.5$, $x = 1.48$; lead, $c = 6.5$, $x = 1.575$. With respect to the relation between this maximum current i_m and the normal current i of operation reference is made to the regulations of the Vienna Electrical Society, according to which a fuse for a normal current of i amperes must be able to carry continually 33 per cent overload, but must melt certainly within two minutes if the current becomes twice the normal. As first approximation one may therefore select the dimensions of the fuse wire so that the normal current i is 75 per cent of the maximum current i_m. The relation between i and d is then of the same form as above, the values of x remain the same, but the values of c are three-fourths those given above. The authors then discuss on the basis of experiments the following two problems. First, after what time does a fuse melt with double the normal current $2i$ as defined above? and secondly, what is the temperature of the fuse wire at the normal current i? The results are given in form of tables and diagrams. In the second part of the paper is given the theory of the problem which is shown to agree with the experiments.—*Elek. und Masch.* (Vienna), July 24 and 31.

Earthed Concentric Cables in Collieries.—W. B. Shaw.—For direct-current colliery work the author favors a system in which the outside earthed metallic layer or armoring is used as one of the current-carrying conductors, the cable being made as a single-core armored cable. A substantial earth connection should be made to the negative busbar on the main switchboard, and taken to two independent grounds. In the discussion which

followed, some speakers thought the concentric system to be a thing of the past, owing to difficulties in its installation.—Lond. *Elec. Eng'ing,* Aug. 4.

Electrophysics and Magnetism.

Photo-Electricity.—O. Stuhlmann.—An account of experiments in which the author established a difference in the photoelectric effect caused by incident and emergent light. The author's experiments show that when beams of ultraviolet light of equal intensity are compared, the ionization they produce is greater on the emergent than on the incident side of a thin platinum film. For a film so thin that the absorption of the light in it is negligible, the ratio of the ionization on the emergent to that on the incident side is as 1.17 is to unity. There is thus an increase of 17 per cent in favor of the emergent side of the film. An effect of this kind would obviously be expected on any corpuscular theory of light. It can also be explained on an undulatory theory by a process of the nature of light-pressure, which tends to push the electrons forward in the direction in which the light is propagated. In its ordinary electromagnetic form, however, the undulatory theory does not appear to give rise to effects large enough to explain the phenomena observed. The difficulty appears to be similar to that which arises when the ordinary theory attempts to explain why the ultraviolet light is capable of causing the expulsion of the electrons, with their observed properties, under any circumstances.—*Phil. Mag.,* August.

Constant Current from Constant Potential.—J. Bethenod.—An article on an arrangement suitable for obtaining constant current from constant-voltage supply, and the reverse. When upon a circuit containing a condenser and a transformer there is impressed a constant voltage and the primary self-induction and the capacity fulfill the condition of resonance, a constant current is obtained in the secondary. A special case of this is the method of Boucherot in which the transformer is replaced by a simple inductance coil. The method is generalized by the author for a number of transformers connected in cascade.—*La Lumière Elec.,* July 30.

Demagnetizing Factors.—C. L. B. Shuddemagen.—A brief paper giving tables of demagnetizing factors for iron rods.—*Phys. Rev.,* August.

Absorption Lines.—P. Zeeman and B. Winawar.—A second paper on the magnetic splitting of absorption lines and its connection with the spectrum of sun spots.—*Phys. Zeit.,* Aug. 1.

Electrochemistry and Batteries.

Ozone.—D. H. Kabakjian.—An account of an experimental investigation of the formation of ozone by the silent electric discharge. In all cases studied by the author the quantity of ozone produced in a given ozonizer was found to be, over quite a large range, almost directly proportional to the current, after a full steady discharge is established and practically independent of the voltage. The phenomenon cannot be explained by the increased ozone density or by the deozonizing effect of the current, as these were varied in many different ways and yet the above relation seems to hold good in general. A given current passing through a given volume of air does not produce the same amount of ozone in different ozonizers. Other things remaining the same the yield in grams per coulomb increases with decrease of capacity. The output of the ozonizers, such as described in this paper, in grams per kw-hour, was found to increase with increase in capacity.—*Phys. Rev.,* August.

Units, Measurements and Instruments.

Thermo-Elements.—W. P. White.—An account of an investigation of the thermo-element as a precision thermometer. The e.m.f. of a thermo-element, whether homogeneous or not, can be expressed as equal to $\int H dT$ (H thermo-electric power, T temperature). It follows that the effect of each portion of a thermo-element is proportional to the magnitude of the temperature gradient in which it lies; hence the vital parts of a thermo-element are the parts along which the temperature varies; they mainly determine the calibration and the constancy; with them alone need the maker or user of the thermo-element be much concerned. In changing them (as by varying the depth of immersion in a furnace) the thermo-element itself is changed, if not homogeneous, while alterations in regions of uniform temperature distribution, as at the junction, have little effect on the temperature measurement. Commercial constantan wire good enough to make thermo-elements accurate to about 0.05 per cent is easily obtained and causes but little trouble in the selection, but cannot be relied upon without any test for possible non-homogeneity. A compensated thermo-element of higher accuracy, reading consistently to 0.0001 deg. for use at ordinary and low temperatures, can be made in a day or two. Improvement in the accessory apparatus has shown that their constancy is about 10 times that shown three years ago. The accuracy of 0.0001 deg. reached by the thermo-element can also be attained in its auxiliary apparatus (potentiometer, etc.). The resulting accuracy, both absolute and relative, and the sensitiveness are quite comparable with those of the best resistance thermometers yet used. For the measurement of single temperatures, the resistance thermometer is often more convenient. On account principally of the comprehensiveness of the potentiometer and its indifference to external contact resistances the thermo-element is usually preferable where several different measurements are to be made at one time. The thermo-element is also usually superior for differential measurements, and its advantages in this respect can be made available for calorimetric work by the substitution of a suitable comparison body for the usual ice bath. A very convenient wire-tester, a simple bath for testing and comparing thermo-elements, and a convenient form of tabulation for calibration, are also described.—*Phys. Rev.,* August.

Calibration of Thermo-Elements.—W. P. White, H. C. Dickinson and E. F. Mueller.—A pair of copper-constantan thermo-elements for use in calorimetric work was calibrated by comparison with resistance thermometers to an accuracy of 0.004 deg. It seems probable that the accuracy of the calibration could be considerably exceeded. A cubic equation probably represents the relation between temperature and electromotive force in the interval 0 deg. to 100 deg.; with an accuracy of 0.005 deg. or better. New thermo-elements may be very conveniently calibrated by direct differential comparison with those whose calibration is already known.—*Phys. Rev.,* August.

Instrument Transformers.—K. Edgcumbe.—The author discusses the errors which can be introduced by instrument transformers and which are due to an error in the ratio of transformation or to a time-phase displacement between the primary and secondary currents or pressures. He shows, however, that, given satisfactory design and rational precautions as regards range and secondary load, the errors introduced by the use of series and shunt transformers with measuring instruments are so small as to be negligible in practice.—Lond. *Elec. Rev.,* July 29.

Telegraphy, Telephony and Signals.

Telephone Exchange.—Janzen.—A continuation of his long illustrated description of the new long-distance telephone exchange in Hamburg, Germany. In the present installment he gives details of the switchboard construction.—*Elek. Zeit.,* July 28.

Wireless Telegraphy.—P. Brenot.—An illustrated review of the present situation of wireless telegraphy and telephony.—*La Lumière Elec.,* Aug. 6.—An article by Henry gives brief sketches of the methods used in wireless telegraphy and telephony due to Fessenden, Balsillie, Collins, Jeance and Colin, von Lepel, and the Telefunken Company.—*L'Industrie Elec.,* July 25.

Miscellaneous.

Tests of Feed Water.—W. P. Digby.—The author first describes a form of conductivity tube which he has devised for use, not only in the physical laboratory, but in every-day engineering work. It furnishes information as to whether condensers are leaking, the amount of the leakage, the amount of priming arising in boilers, and the control of oil-eliminating and water-softening plants. Details of tests carried out at various power stations are given.—Lond. *Electrician,* July 29.

BOOK REVIEWS

MAKERS OF ELECTRICITY. By Brother Potamian, F.Sc., D.Sc., and James J. Walsh, M.D., Ph.D., LL.D. New York: Fordham University Press. 494 pages, illus. Price, $2.

This handsome book contains biographical notices, and résumés and appreciations of the [illegible] of the great pioneers and masters of electrical science, namely: Peregrinus, Norman, Gilbert, Franklin, Galvani, Volta, Coulomb, Oersted, Ohm, Faraday, Maxwell and Kelvin. Of the joint authors, Brother Potamian needs no introduction to electrical readers, and Dr. Walsh is doubtless known to many in this circle through his writings on the historical side of science. One of the objects of the work is to bring out that there is no incompatibility between religious belief and profound knowledge of science; and in the preface it is noted that all of the great men whose lives and work are sketched were "firm believers in the existence of Providence, of a Creator, of man's responsibility for his acts to that Creator, and of a hereafter of reward and punishment where the sanction of responsibility shall be fulfilled." This object, however, is not made obtrusive, the references to the religious belief of the several subjects differing little from what would be considered appropriate in an account of their lives emanating from a strictly secular source.

The book is, however, more than a record of the work of the men who are the titular subjects of the various sections. The chapters covering the period down to Volta give a connected history of the evolution of electrical science from the earliest days to that date, and in the following sections the work of the men who are the subjects of chapters is related with that of predecessors and of contemporaries. A goodly part of the contribution of Brother Potamian (which covers the period to Galvani and includes also the chapters on Oersted and Kelvin) originally appeared in these columns, but this matter is here related with the work of other men and placed in proper perspective with the general plan of the book, which is that of a biographical history of electricity. Of particular interest and of much value for reference are the results of his researches in the early history of magnetism, given in the chapters on Peregrinus, Gilbert and Norman, and on the discovery and first experiments with the lightning rod, given in the chapter on "Franklin and Some of His Contemporaries." Other notable features are his accounts of investigations that barely missed anticipating the discoveries of Galvani, Volta and Oersted, and the several notices of early forms of electrical telegraphs.

Among the omissions we note that in the chapter on Volta reference is not made to the curious form of electrostatic telegraph he suggested in 1777; and in the chapter on Faraday there is no mention of the experiment of Colladon of Geneva in 1825, which only missed the discovery of electromagnetic induction on account of the employment of a galvanometer which could not respond to instantaneous currents. In reference to the electrical telegraph, the two most important steps in its invention are passed over—those made by Schilling and Henry. The principles of the modern telegraph are almost entirely contained in the Henry bell telegraph of 1830 and the Schilling needle telegraph of 1832. While Morse will always occupy a high place in the history of the telegraph, he, like Fulton, was rather the promoter to a commercial stage of the ideas of others than a creative factor in his field in other than an industrial or commercial sense. While considerable space is given to the Ronalds telegraph of 1816, no mention is made of its Sommering prototype of 1809. We note that the portrait of Ampere is a reproduction of the counterfeit presentment occasionally seen in print, which bears no resemblance to the homely but strong face of the great savant.

Aside from the intrinsic interest of its matter the book is delightful to read owing to the graceful literary style common to both authors. One not having the slightest acquaintance with electrical science will find the book of absorbing interest as treating in a human way and with literary art the life-work of some of the greatest men of modern times; and, moreover, in the course of his reading he will incidentally obtain a sound knowledge of the main principles upon which almost all present-day electrical development is based. It is a shining example of how science can be popularized without the slightest twisting of facts or distortion of perspective. Electrical readers will find the book also a scholarly treatise on the evolution of electrical science, and in reading a most refreshing change from the "engineering English" of the typical technical writer.

THE CORROSION AND PRESERVATION OF IRON AND STEEL. By Allerton S. Cushman and Henry A. Gardner. New York: McGraw-Hill Book Company. 373 pages, 68 ills. Price, $4.

Corrosion of metals is beginning to attract attention in a measure more in proportion to its importance than formerly. Steel now enters into all classes of construction, and upon the permanence of structural material depends the safety of thousands of lives and the saving of millions of dollars. The subject of corrosion is so important that everyone owning, designing or building metallic structures should be fully informed on the subject and understand as thoroughly as may be possible just how much can be done to prevent destruction of property by corrosion. Much experimental work has been done and many papers have been written, but the book of Cushman and Gardner appears to be the first to gather and digest the present knowledge on the subject of corrosion of iron and steel and the properties and virtues of protective coatings. The first part of the book is given over to theoretical discussion of corrosion, and after presenting the various theories, the authors declare themselves in favor of the electrolytic theory and proceed with the subject on that basis. The iron and steel manufacturers' side of the subject is treated by pointing out the effects of chemical composition, heat treatment and mechanical working on the inhibition and stimulation of corrosion, thus indicating the proper methods of manufacture to secure a non-corrosive metal. The consumers are more concerned with the latter half of the book, which tells of methods of protecting from corrosion the metals now on the market. This part of the book is undoubtedly the most valuable and at the same time of interest to the most people. That part of the book which takes up the protection of metallic surfaces by the use of coatings and special treatments is given up largely to the study of paints, and this branch constitutes in itself a most valuable contribution to the literature of paint manufacture, testing and the properties of pigments and paint vehicles.

At the end of the volume is given a bibliography compiled from lists of the Carnegie Library of Pittsburgh and various other sources. This list is brought right up to date, with remarks accompanying each reference.

ILLUMINATION AND PHOTOMETRY. By William Elgin Wickenden. New York: McGraw-Hill Book Company. 203 pages, 116 ills. Price, $2.

The subject of illumination, or illuminating engineering, as some prefer to call it, is coming rapidly into prominence and a number of colleges now offer courses in the subject. The lack of a suitable text-book has hampered the study of illumination and made it necessary for each teacher practically to write a book of his own.

Professor Wickenden has collected and presented in a clear and interesting manner such information as should form the basis of an illuminating engineer's education. The subject is introduced by a discussion of radiation and light, followed by photometers and methods of measuring light. The latter half of the book is given up to a description of the various illuminants, including gas and electric lamps, with rules and directions for their use in illumination. At the end of the book various tables useful in the calculation and design of illumination are given.

The calculation of illumination involves no new principles, but when a subject is lifted out of the realm of physics into that of practice, it must necessarily undergo a great change in

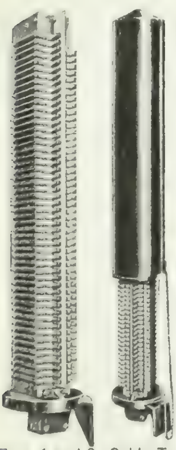
many details. All terms of negligible magnitude are ignored and approximate methods are introduced which enable the engineer to get quickly results which are sufficiently accurate for practical work. Development in this direction is very active just at present and, therefore, this book can scarcely be expected to include what appear now to be the most practical methods of calculating illumination. The calculations are here based on the point-by-point and flux-of-light methods, and attention is called to the effect of reflection, and the effect explained with the aid of a series of infinite reflections, a method which is common and which is also responsible for the tendency to neglect reflection in calculations. The absorption-of-light method now becoming recognized offers an extremely simple means of including reflection, which, contrary to common belief, plays an extremely important part in illumination. The absorption-of-light method enables the designer to ascertain in a few minutes the amount of power and light flux required to give a certain illumination in a given space without regard to location of the lamps. When the lamps are located the efficiency of the location can be checked by comparison of the total flux of the lamps with that obtained by the absorption method. Attention is called to this method with the hope that it may be included in the future editions of this most excellent book. It is the best text-book that has come to our attention and should have little difficulty in holding its place by suitable revision for many years to come.

New Apparatus and Appliances

PROTECTED CABLE TERMINAL.

A new cable terminal recently placed on the market by the Western Electric Company is designed to replace the compact, hooded, but unprotected type, and the cumbersome wooden-box protected terminal, although combining all of the advantageous features of those two older types. The terminal is a compact, weatherproof device which affords protection to the central office equipment against lightning discharges and accidental contact with electric light wires. The "No. 18" protected cable terminal, which is illustrated in Figs. 1 and 2, consists essentially of a rectangular oiled and shellaced wooden box into which the cable is led. Two sides of this box serve as mountings for the fuse clips and as fanning strips for the bridle wires. The third side of the box acts as a support for cut-outs.

During manufacture the interior of the box is filled with waterproof pot-head compound, which fills the space between the fanned-out wires and seals the end of the cable against moisture. The box is mounted on a cast-iron base, or bracket, in the center of which is fitted a wooden bushing for clamping the cable in place and relieving the wires of all strain. The cable chamber, binding posts and connections are protected against weather by a heavy reinforced, galvanized sheet-iron hood which may be lifted to any height necessary to examine the fuses, etc. The hood is held at the desired height by a spring latch mounted on top of the fanning strips. However, should the hood be removed completely it will be prevented from falling to the ground by a non-corrosive sash-chain which attaches it to the bracket. The protective devices supplied consist of fuses and open-space, carbon-block cut-outs, two of each wired into each pair of wires; the cut-outs are arranged to be connected between the fuses and the cable. The Western Electric Company manufactures this type of protected terminal for use with No. 22 gage wire, paper insulated, lead-covered cable in sizes of from 10 to 60 pairs of wires.



Figs. 1 and 2—Cable Terminal without and with Cover.

Ordinarily the terminal is supplied with a 6-ft. cable stub which is spliced to a cable of sufficient length to make the connection desired. However, where possible the terminal should be ordered with a cable of the required length, thereby eliminating one splice.

BATTERY CHARGING RHEOSTAT.

The rheostat shown in the accompanying illustrations is based on the "compressible resistor" method of regulating current for starting and controlling electrically operated machines, which consists in causing the current to flow through a column of disks loosely piled one upon the other within an insulated metal tube. These disks are constantly in more or less intimate contact, and the resistance of the loosely piled column may be decreased at will by compressing the disks, thus perfecting the contacts and increasing the conductivity of the column.

This principle has recently been applied to the regulation of current for charging storage batteries, for which service it possesses a number of advantages. The rheostat shown, known as the Allen-Bradley charging rheostat, and made by the American Electric Fuse Company, Muskegon, Mich., consists of one, two or four resistor tubes with suitable compressing mechanism and an operating hand wheel. There are thus no segments or contact plates, no sections of coils or cast grids with their accompanying heavy copper leads, no step-by-step variation and no interruption of the circuit during charging. The resistance units are well ventilated and the tubes are provided with radiating fins to facilitate the dissipation of heat. Due to its simple construction, the rheostat can be installed in very much less space than is required by apparatus which secures resistance through banks of coils or grids.

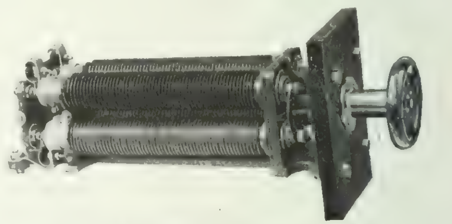


Fig. 1—Four-Unit Rheostat.

The compressible resistor varies the resistance by infinitesimal gradations, thus insuring a delicacy of control and close regulation which enables the desired charging rate to be maintained to a fraction of an ampere throughout the entire charging period. Moreover, the principle of regulation of current through imperfect electrical contact enables the rheostat to cover a very wide range. A single rheostat can be used in charging any number of cells from 6 to 48 and at almost any desired rate, the maximum rate rising with number of resistors employed.

Freedom of this type from arcing or burning is apparent, as there are no contact plates or segments and no wide differences in potential due to step-by-step variations, hence no opportunity is offered at any point for arcing or burning. The makers state

that the resistance disks are subjected during the manufacturing process to a temperature of 7000 deg. Fahr. and also undergo severe tests for mechanical strength; the resistance will therefore withstand extraordinary heat and abnormal mechanical strains and for all practical purposes is indestructible. The

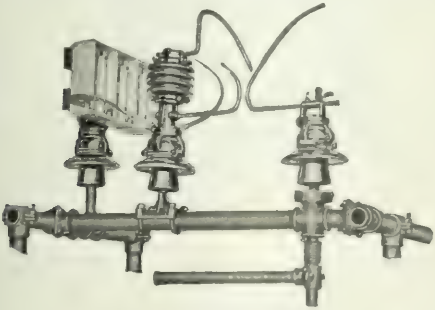
Fig. 2—Details of Resistor Switch.

charging rheostats are especially adapted for large installations and for use where the work to be performed is subject to constant and wide fluctuation, such as train lighting, laboratory and electric-vehicle service. In this latter service their wide range of operation gives them a special advantage. They are, however, also adapted for charging storage batteries for any service whatever and of any size.

ALUMINUM-CELL LIGHTNING ARRESTERS FOR UNDERGROUND CABLES.

One of the most serious problems with which operators of underground cable systems have to contend is the protection of the cables against internal surges and against lightning in cases where the underground circuits are connected to overhead lines. During the past two years the aluminum-cell arrester has been given a very wide application in the protection of cable and mixed overhead and cable circuits, in fact, it is said to have practically superseded all other forms and with its recent improvements is still better adapted for this class of service.

One characteristic of the aluminum-cell arrester which has an important bearing on this application is the daily charging of the cells—a process which consists simply of subjecting the stacks



Horn-Gap Charging Resistor.

of aluminum cones to the line voltage and short-circuiting the series horn-gaps for a brief period. This charging process, as well as normal discharges resulting from high-voltage disturbances, is accompanied by a slight arcing at the horn-gaps. On cable systems where the electrostatic capacity is large compared with the inductance of the circuit, it is advisable to take every possible precaution to limit the charging current to a minimum value.

In the General Electric aluminum-cell arrester this result is accomplished by means of a special horn-gap used in connection with a charging resistor. The resistance limits the charging current and even if the cells are in poor condition smooths out the wave-shape of the current and damps out any tendencies to oscillate. At the same time it does not prevent the cells from taking their full charge. These auxiliaries are so arranged as to give selective paths to the cells; one is through a horn-gap without resistance, which is the same as in the arresters for overhead circuits, and the other through a resistor and a horn-gap, the setting of which is slightly less than that of the gap without resistance. With this arrangement the daily charging current and the average surge discharge take the path through the resistor. The resistance of the resistor is adjusted so that it will modify the nature of the charging arcs until there is no liability of resonance occurring. It also makes the charging more uniform and reliable.

Heavy discharges which will be impeded somewhat by the resistor will be shunted through the principal horn-gap and have a free path without resistance. The arc from this discharge, rising on the horns, will be intercepted by the horn blade, which is connected to the resistor, and hence the current is limited at the end of the discharge and as the arc breaks. Thus surging which would be produced by the breaking of a large current arc in air is entirely eliminated by having the arc and current suppressed. Thus the safety horn-gap with the charging resistor combines a number of valuable features in safety of operation without in any way decreasing the efficacy of the arrester as a protector of cable systems.

MOTOR-DRIVEN ERASER.

It is a fact well known to draftsmen that mistakes in inking tracings are not infrequent and that changes in design are frequently necessary so that alterations must be made in the tracings. With a light, fast motion the ink may be removed without injury to the tracing cloth; but there are very few draftsmen who have the patience to do the work without putting too much pressure on the rubber, and thereby producing a scar on the cloth.

A rapidly revolving circular eraser, electrically driven through a flexible shaft by a small motor, places at the disposal of every drafting room a perfectly satisfactory means of removing ink from tracings. The motor-driven eraser shown herewith is equipped with a 0.05-hp motor, running at 1700 r.p.m.,

Motor-Driven Eraser.

and taking energy from any convenient lighting socket. The circular eraser is securely fastened in place by a wing to allow for renewals. A cleaning rubber is arranged to touch the rotating circular eraser very gently and remove the ink which would otherwise collect; adjustment is made by the movement of a sleeve on the handle of the erasing head. The flexible shaft is about 3 ft. long, and permits a large tracing to be covered, because the shaft can be bent in a curve of short radius.

A single erasing outfit is sufficient for any ordinary drafting room, as it is customary to locate the eraser permanently on one table and bring all the work there. This equipment is manufactured by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

THE "ROTARY CLUB" MOVEMENT.

The formation of the National Association of Rotary Clubs of America at a convention of representatives of 17 Rotary clubs, held in Chicago, on Aug. 15-17, directs attention to the growth and extent of the Rotary Club movement. It is not strange that the first convention of the National association was held in Chicago, for the parent Rotary Club was formed in that city six years ago by Mr. Paul P. Harris, a Chicago lawyer. Inasmuch as a cardinal principle of the Rotary Club is that members shall help one another in business, and as a number of electrical men are members, some account of the movement may be of interest to our readers.

The distinctive principle of the Rotary Club idea is reciprocity in business among members. The Rotary Club says frankly to its members: "Cultivate your fellow-members and use them to get business from; they in turn will do the same by you." Not only are members expected to buy goods from one another, but they direct their friends and customers to fellow-members of the club. A member is not obliged to favor his fellow-members in this manner, but he is expected to do so whenever possible in pursuance of fair and reasonable business methods. To carry out this plan, the membership of each club is limited to one representative of each line of business, and he must be either a proprietor, partner or corporate officer in a legitimate business or professional undertaking. Clergymen, physicians and lawyers are members. Members are elected only by unanimous vote, and all applications for membership are scrutinized carefully, the idea being that once a member, the other members may have no hesitation in recommending the applicant as to character and responsibility.

Rotary clubs are now established in about 20 cities of the United States, and it is said that the total membership is about 3000. This means that practically 3000 different business houses are represented, and it is asserted that the amount of capital represented is about $300,000,000. Thus the organization is already a powerful one, and it is said to be growing steadily, as all its members are loud in its praise, being benefited automatically by membership in it. It may be mentioned also that considerable attention is paid to social relations among members, thereby promoting good-fellowship.

The National Association of Rotary Clubs has a membership composed of clubs and not of individuals. The initiatory fee is $50 for each club, and the dues are $1 a year for each member of the club. In the case of the Chicago club, with its 350 members, this will amount to $350 a year. As set forth in the constitution adopted at the recent Chicago convention, the National Association has five objects: (1) To extend and develop "Rotary" principles; (2) to unify the work and principles of affiliating clubs; (3) to arouse and encourage civic pride and loyalty; (4) to promote progress and honorable business methods; (5) to advance the business interests of the individual members of the affiliated Rotary clubs.

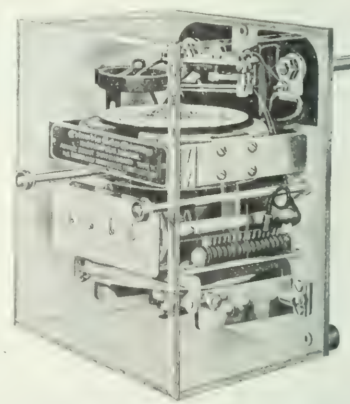
The officers of the National Association are: President, Mr. Paul P. Harris, Chicago; first vice-president, Mr. R. R. Denny, Seattle; second vice-president, Mr. Bradford A. Bullock, New York; treasurer, Mr. Elmer A. Rich, Chicago; sergeant-at-arms, Mr. Werner Hencke, St. Louis. There is also a board of nine directors, and this body will appoint a secretary and select the next place of meeting, for which Portland, Ore.; Kansas City and St. Louis are applicants.

Rotary clubs are in existence in Boston, Brooklyn, Chicago, Cincinnati, Detroit, Indianapolis, Kansas City, Lincoln (Neb.), Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Oakland (Cal.), Portland (Ore.), St. Louis, St. Paul, San Francisco, Seattle and Tacoma.

The president of the Chicago club is Mr. A. M. Ramsay, contract agent of the Chicago Telephone Company, and among others Chicago electrical men who are members are: Messrs. Charles E. Browne, American Electrical Supply Company; I. B. Eberhardt, George P. Benton Company; Carl J. Metzger, Woods Electric Vehicle Company; Henry Newgard, Henry Newgard Company; G. M. Proudfoot, Chicago Engineering & Inspection Company; G. A. Roth, Roth Brothers Company, and Thomas H. Sidley, Robinson-Sidley Company. Mr. Bion J. Arnold is an honorary member. Electrical men in St. Louis who are members of the Rotary Club in that city are: Fred B. Adam, Frank Adam Electric Company; Charles W. Brainerd, Franklin Electric Manufacturing Company; Fred E. Briner, C. J. & F. E. Briner; Edwin F. Carter, Bell Telephone Company; John A. Laird, consulting engineer; W. N. Matthews and Claude N. Matthews, W. N. Matthews & Brother; T. O. Moloney, Moloney Electric Company, and Charles Scudder, Jr., Wesco Supply Company.

DIRECT-CURRENT WATT-HOUR METERS FOR SWITCHBOARD.

In perfecting, after several years of experimentation, the astatic, shunted-motor type of direct-current watt-hour meter shown herewith, the Columbia Meter Company, of Indianapolis, Ind., strove for at least three qualities: accuracy, sensitiveness on light loads and adaptability of design for switchboard work. Many meters in counteracting the effects of stray fields have two armatures on the same revolving element, or two ammeters wound as one. The armature of the Columbia meter, by which the effects of induction and stray fields are nullified, consists of six small coils placed parallel and equidistantly around the shaft, with a separate magnetic core for each coil, each core extending radially outward from both ends of the coil with the ends of the cores divided into a plurality of paths. A six-part silver commutator is used in connection with these coils and the armature being somewhat heavier than that of house-type meters revolves on diamond jewels. Shunts may be used in



Switchboard Type Watt-Hour Meter.

connection with the meter instead of passing all the current through the series coils, doing away with expensive and cumbersome connections of heavy terminals direct to the meter. All of the company's astatic meters are of 10-amp capacity and are connected to shunts of suitable size, which may be placed behind the switchboards or in any other convenient place and connected in series with the main lines. The shunts have a drop of about 100 millivolts and are well ventilated. When it is desired to check the meter, it is disconnected from the shunt and tested as an ordinary 10-amp meter. The company manufactures another meter which differs only from the one shown in that it has a round glass case.

Industrial and Commercial News

THE WEEK IN TRADE.

THE condition of trade during the past week shows considerable improvement over previous reports. This is especially noticeable among the wholesalers and jobbers, who declare that fall orders are now coming in in better quantities than at any time during the season. The most marked improvement is in the West, where general rains have improved the crop condition, and where house trade has expanded as the result of the arrival of country buyers. Southern trade has been slower to expand. There is still a disposition to go slowly in that section, pending a clearer view of the cotton crop, which has, however, also been benefited by prevailing weather conditions. In the large Eastern centers the buyers are numerous, and trade is expanding, but the same conservatism that has been noted on many occasions is still to be observed. The best reports of buying come from Chicago, St. Louis and Kansas City. Reports from the leading industries are not much changed. Iron and steel are quiet, and the demand for finished products shows no disposition to increase. Building operations continue to be active in many centers, and lumber and hardware are in better demand in the West and South. Foreign trade reports are still unsatisfactory. Imports for July exceeded exports, and for the seven months the excess of exports over imports was only $1,666,346, as compared with more than $66,000,000 a year ago. The exports of farm products are at low ebb, but this loss is made up in some degree by the increased exports of manufacturing products. The general better condition in the securities market has encouraged all lines of trade. It is believed that many large operations are simply waiting a favorable market upon which to float securities in order to begin making extensive improvements and additions. At the present moment there are no labor troubles which threaten to interfere with business. Collections continue to be only fair, but it is believed that after the crop is harvested and moved to market there will be no difficulty in this direction. Business failures for the week ended Aug. 18 as reported by *Bradstreet's* were 222 against 231 the previous week, 183 in like week of 1909, 236 in 1908, 153 in 1907 and 155 in 1906.

THE COPPER MARKET.

HIGH prices demanded by producers for electrolytic copper last week resulted in an extremely dull market. The selling companies have practically checked the demand of consumers both in this country and abroad. The melting of copper by consumers is close to what it was during the two preceding months, but new business is not coming in very rapidly, and extensions of electrical industries in the West are not particularly active. The dullness of demand, however, has had no effect upon the quotations at which producers are offering metal. The better report made for July by the Copper Producers' Association has done much to strengthen the market and encourage those who have for a long time been carrying large quantities of metal. It is generally believed that the curtailment of production which it is now admitted is fairly well started will eventually result in bringing the production of copper down to a basis but little in excess of the consumption. In the meantime it must be remembered that very large stocks are being carried both in this country and Europe by producers, speculators and consumers. In the monthly copper circular issued by the National Conduit & Cable Company, it is stated that there have been larger sales of copper and firmer conditions lately both in the local and foreign markets, partly as the result of the necessity of filling a moderate amount of new requirements, and partly from the impression produced by the talk of restricting production. "Continued over-production has kept the consuming trade," says the circular, "in a state of uncertainty for a long time. Manufacturers have been unable to state to what levels prices were liable to decline in consequence of the piling up of an enormous surplus in this country and at foreign points." Imports of copper continue to be fairly heavy, and exports are about at the rate of the two preceding summer months. For the present month up to and including Aug. 22 exports have been 20,027 tons. The daily call on the metal exchange Aug. 22 quoted standard copper as per accompanying table.

	Bid.	Asked.	Settling price.
Spot	[illegible]	[illegible]	.....
August	[illegible]	[illegible]	[illegible]
September	12.20	12.40	12.30
October	12.20	12.40	12.30
November	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]

The London market Aug. 22 was as follows:

	Noon.	Close.
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
London, best selected	[illegible]	[illegible]

INDUSTRIAL AND COMMERCIAL NOTES.

Electrification on the Lackawanna.—A conference was held at Scranton last week upon the subject of electrifying what is known as the "pusher service" on the Delaware & Lackawanna Railroad. The conference was held in the office of T. S. Lloyd, the superintendent of motive power, and there were in attendance, besides Mr. Lloyd, S. S. Riegel, chief engineer, together with representatives of the Erie railroad, American Locomotive Company and the General Electric Company. Considering the heavy grades which the road has to contend with in that section, and at some points on the Buffalo division, the officials of the company have asked Mr. Lloyd to ascertain whether the electrifying of the road would mean a saving in operating expenses. The Erie representative was present to show how much that road had saved by the use of electric power under similar circumstances. While no result of the conference was given out, it is understood in Scranton that the directors will be informed that it would be cheaper to make a limited use of electricity. It is also said unofficially that within a year the Lackawanna from Scranton to Clark's Summit west, and from Scranton to Lehigh east, will be electrified. This will take in two of the most hilly sections of the road.

Otis Elevator Company.—It is given out by officials of the company that the business of the Otis Elevator Company for the first six months of the current year is the largest in its history. Gross sales during that period were at a rate which would mean a business for the year of approximately $16,000,000. A feature of the business of the past six months which has given the officials of the company especial satisfaction has been the increase in the actual number of elevators sold. While the percentage in the total of the gross sales over 1909 has been large, it has not been nearly so great as the percentage of increase in the number of elevators ordered. The business has been a multiplicity of small orders. In order to take care of this increased business the company has been obliged to spend about $500,000 on its property this year. The company has about $7,000,000 working capital and its plant and real estate have recently been appraised at $14,000,000.

Maryland Telephone Company.—It is reported that the Chesapeake & Potomac Telephone Company will shortly discontinue operating the Maryland Telephone Company as a separate institution with distinct exchanges and service. Preparatory to carrying out this plan it is stated that the company will on Jan. 1 next retire the outstanding Maryland Telephone Company first mortgage 5 per cent bonds, of which the original issue was $1,000,000. It is said that the Bell interests, which control both companies, have been quietly buying up the bonds for some time, which would account for the recent strong demand for them.

Gas-Electric Cars in Texas.—The Gulf, Colorado & Santa Fe Railroad Company has ordered a number of gas-electric cars, to be operated after Sept. 1, on its Houston and Galveston line in competition with interurban service of the Galveston, Houston & Henderson Railway.

Crocker-Wheeler Sales.—The Crocker-Wheeler Company, Ampere, N. J., has recently sold the following apparatus: Two 600-kw direct-current turbo-type generators for connection to DeLaval turbines to the Iroquois Iron Company, of Chicago; one 400-kw direct-current turbo-type generator for the United States Finishing Company, of Connecticut; one 500-kw synchronous motor-generator set to the Tennessee Coal, Iron & Railroad Company, of Ensley, Ala.; a 200-kw direct-current generator with 200-amp balancer for the Mercantile Library Building, Cincinnati, Ohio; two 125-kw direct-current generators for the Kilburn Mills, New Bedford, Mass.; two 120-kva belted alternators to the Waterous Engine Company, Canada; a 250-kw engine-type direct-current generator for the Gleason Works, Rochester, N. Y.; one 300-kva engine-type alternator with exciter for the Great Lakes Engineering Works, Ashtabula Harbor, Ohio; one 350-kw generator for the Thomas G. Plant Company, of Boston, Mass.; one 750-kw direct-current generator for the Superior Steel Company, Pittsburgh, Pa.; two 150-kw direct-current generators for Ohio Fuel & Supply Company; 3460 hp in direct-current rolling-mill motors for the American Sheet & Tin Plate Company, of Indiana; one 200-kva engine-type alternating-current generator for Crown Mills, of New York; 235 hp in direct-current motors for crane service in the Central Furnace Plant of the American Steel & Wire Company, of Ohio; one 500-kva engine-type alternating-current generator for the Lynn Building Trust, of Lynn, Mass.; one 375-hp motor to drive an Ingersoll air compressor in the works of the Bethlehem Steel Company, and three 250-kw generators with two 350-amp balancers for the Utah Hotel, Salt Lake City, Utah.

Eastern Tennessee Power Company.—Messrs. J. G. White & Company, of New York, have been awarded the contract for the complete engineering and construction of a hydroelectric station for the Eastern Tennessee Power Company. The dam and station will be erected on the Ocoee River at Parksville, 12 miles from Cleveland, Tenn. The dam will be of cyclopean concrete 780 ft. long on the crest, 450 ft. being provided for overflow and 350 ft. non-overflow. The overflow portion will be 110 ft. high above mean water and will be equipped with flashboards and the necessary sluices. The non-overflow portion of the dam will be about 13 ft. higher than the overflow portion and will accommodate the penstock intakes at the top and penstocks passing from the intakes to the turbines below. The generating station will be located on the down-stream side of the dam and will be an integral part of the non-overflow portion of that structure. The substructure will be of concrete with a steel and masonry superstructure. The equipment will consist of four main units having a normal rating of 3000 kw each; one 200-kw exciter unit, step-up transformers and switching apparatus. Each main unit will comprise one tandem horizontal turbine in enclosed case directly connected to a three-phase, 60-cycle generator. Each generator will have an exciter mounted on its shaft. A tail-race will be excavated for some distance down stream and will, if necessary, be separated from the main river channel by a timber crib or by a concrete wall. The shore of the river adjacent to the power house will, if necessary, be protected by rip-rap. The estimated cost of the entire development is placed at approximately $2,000,000.

Probable Turbine Order.—An English electrical contemporary comments as follows on an item which recently appeared in these columns: The *Electrical World* states that Mr. C. M. Shaw, city electrical engineer of Worcester, is to pay a visit to the United States in August and September, and asks manufacturers to send him particulars of "up-to-date turbine plants and umbrella-type alternators," for a head of 10-13 ft. and of 150-600 hp, as well as of the latest domestic electrical appliances (not for lighting). The probability that Mr. Shaw will place a large order with our American competitors should prove a valuable stimulus to their jaded energies, and afford them an opportunity of renewing that invasion which for some reason or other seems to have lain in abeyance for the last decade. It is time for England to wake up!

Citizens' Light, Heat & Power Company.—General Manager P. R. Whiting of the Citizens' Light, Heat & Power Company, Montgomery, Ala., in a circular letter regarding the status of ownership suit, says that the company has been advised by its attorneys that the only effect of the temporary injunction granted by Judge Jones is to maintain the existing status relating to the possession of the stock of the Citizens' company, and to keep the matter in court pending a final hearing and decision after submission of the facts. The decision rendered is only based on demurrers filed to the bills and does not go into the merits of the controversy or indicate in any way what the final decision of the court will be. On the belief that the ownership of the property will eventually be found to belong to R. Tillis, chief owner of the Montgomery Traction Company, a contract, it is announced, has been given to Messrs. J. G. White & Company, of New York, for extensions and improvements costing in the neighborhood of $500,000. These improvements include two large steam turbines with a combined output of 8000 hp, several boilers, switching apparatus and other devices required in connection with the operation of the plant. This equipment when installed will give the company a capacity of 100,000 hp.

Crude Rubber Prices.—There have been wide fluctuations in the market prices for crude rubber during the past few weeks and the result has been that most of the manufacturers of rubber goods and of insulated wire have refrained from buying. It is believed by the users of rubber that the present fluctuations are due to manipulation and do not have any connection with supply and demand. One manufacturer says tha the market is apathetic and that buyers do not care to take advantage of declines and certainly will not buy upon advances Ever since crude rubber sold at $3 a pound for Para the manufacturers have been loth to purchase. When the price decline to $1.75 on Aug. 9, which is the low point for the year, the manufacturers were still unwilling to take hold. Quotation Aug. 22 were $2.12@2.17 a pound. During the past week the fluctuations have been so wide that the market is more or les demoralized. While the manufacturers are not complainin of hard times, they do not deny that sales by the larger rubbe companies have fallen off during the past month. This is i spite of the fact that the automobile dealers declare that thi will be the record year in the automobile industry.

Automatic Telephone in Chicago.—It is given out tha on Oct. 1 the Automatic Telephone Company, a subsidiary o the Chicago Subway Company, will open its service to th public, with considerably more than the 20,000 subscribers required by the ordinance. It is anticipated that before April the company will have 30,000 subscribers. Of the $3,500,00 receiver's certificates of the Chicago Subway Company las spring, all but $500,000, which has been held in reserve, ha been spent upon the construction of the telephone systen Nothing is being done at the present time toward the reorganization of the Illinois Tunnel Company or the Subway company. All plans looking to this have been held up pendin the completion of the telephone system, when it is believed th combined properties will show earnings sufficient to at least pa operating expenses.

New Automobile Industry for Canada.—The Unite Motors, Ltd., with a capital of $200,000, has decided to locat at Welland, Ontario, giving employment to 100 hands. Th buildings will be fireproof, and will be erected at the junctio of the Michigan Central and Grand Trunk railways, wit switches to the T., H. & B., affording ample shipping facilitie It is proposed to build 300 motor cars for next season. Th provisional directors are: Frederick Sager, of Detroit; Willi L. Adams, Niagara Falls, N. Y.; E. A. English, Toronto; L. C Raymond and B. J. McCormick, of Welland, Ont.

Mexican Order for Westinghouse Company.—The Westinghouse Electric & Manufacturing Company has recently received an order from La Blanca & Anexas Mining Compan for 40 type MS motors, to be used in the company's mill a Pachuca, Mex. The motors ordered range in size from 5 h on the pulp thickeners to 75 hp on the tube mills. The orde also includes seven 250 kva O. I. S. C. transformers and on 12-panel switchboard.

Automobile Driving Lamps.—C. A. Vandervell & Company, Warper Way, Acton Vale, London, England, ask us t say that a type of double-ended holders for automobile lamp recently described in these pages as something new has bee made by them for some years under British patents. Protection under U. S. patents was not, however, applied for.

The Electrose Manufacturing Company, Brooklyn, i making considerable extensions to its plant. With its preser equipment it has been found necessary to work overtime, bu with the facilities now being added orders can be handled wit greater promptness.

McCall Ferry-Baltimore Transmission Line.—The Penn-ylvania Water & Power Company announces that it has se-ured all of the rights of way for the pole line which is to ring electrical energy from McCall Ferry to Baltimore. The ay for the entire distance is 100 ft. wide and the length of e pole line is 45 miles. Workmen are now engaged in placing e towers which will support the wires along the route from e plant to Baltimore, and it is thought that the line will be ady for distribution in Baltimore and vicinity about Nov. 1. ne of the first installations will be for the supplying of light d power for the Consolidated Cotton Duck Company in oodberry and Mount Vernon.

Bids for Naval Academy Power Plant.—Bids will be re-ived until Oct. 1 for a complete equipment for the new ower plant of the United States Naval Academy, An-apolis, Md. The work includes the transfer of a portion of e equipment from the old power house, furnishing new uipment, lighting the power house, new switchboard and nnections to outside service. Plans and specifications may obtained from the superintendent of the Naval Academy pon deposit of $10 for their return.

Financial.

The Week in Wall Street.

SENTIMENT in Wall Street during the past week was the most optimistic that has been observed in the financial district for many months. There was a general happy cpression on the faces of traders and even commission houses gin to feel that they may again earn money. Stocks for the ost part showed considerable advance, and in some cases the ains were very pronounced. The advances from the low points

NEW YORK.

	Aug. 15.	Aug. 22.	Shares sold.		Aug. 15.	Aug. 22.	Shares sold.
. Ch.	9¼	[illegible]	500	Int.-Met., pfd	37⅛	48	[illegible]
l. Ch., pfd.	35	33	400	Mackay C[illegible]..	[illegible]	[illegible]	700
al. Cop...	[illegible]	64⅞	90,225	Mackay C.,pf.	72¾	73¾*	300
n. D. T...	20½*	20½*	——	Man. Elev...	128	[illegible]	100
.. I[illegible]......	37½	34½	2,410	Met. St. Ry..	15*	[illegible]	——
n.Loco.,pfd.	104	103½*	100	N.Y.&N.J.Tel.	139¼*	[illegible]	——
. Tel. & C.	71	71½*	——	Steel com...	[illegible]	[illegible]	[illegible]
. T & T..	[illegible]	134½	6,525	Steel, pfd....	116	[illegible]	[illegible]
R. T.....	76½	75½	22,680	W. U. T.....	[illegible]	[illegible]	[illegible]
n Elec....	143	144	800	West'h., com	[illegible]	[illegible]	4,200
Met.	17	17¾	23,500	West'h., pfd.	[illegible]	110*	-

PHILADELPHIA.

	Aug. 15.	Aug. 22.		Aug. 15.	Aug. 22.
. Rys............	41	44	Phila. Elec..........	[illegible]	[illegible]
c. Co. of A.....	[illegible]	113⅜*	Phila. R. T..........	[illegible]	[illegible]
ec. St. B'ty.......	49	[illegible]	Phila. Trac..........	[illegible]	[illegible]
S. B'ty, pfd.....	[illegible]	30*	Union Trac..........	[illegible]	[illegible]

CHICAGO.

	Aug. 15.	Aug. 22.		Aug. 15.	Aug. 22
. City Ry.......	180*	180*	Chi. Tel. Co........	[illegible]	117*
i. Rs., Ser. 1.....	70	70	Met. El. Co........	——	[illegible]
i. Rs., Ser. 2.....	16½	16⅛	Met. El., pfd.......	——	[illegible]
n. Edison	[illegible]	[illegible]	Nat'l Carbon.......	——	[illegible]
. Subways......	6	[illegible]	Nat'l Car., pfd.....	117	117*

BOSTON.

	Aug. 15.	Aug. 22.		Aug. 15.	Aug. 22.
. T. & T........	133¾	134¾	Mex. Tel..........	[illegible]	[illegible]
m. Tel..........	——	142½*	Mex. Tel., pfd.	[illegible]	[illegible]
son E., Ill	257	258½	N. E. Tel..........	130	130
Elec..........	144	144	W. T. & T..........	[illegible]	15*
ass. E. Ry.......	16¼	17¼	W. T. & T., pfd....	84	85*
E. Ry., pfd..	81½	82¾*			

*Last price quoted.
Shares sold for week Aug. 15 to Aug. 20.

the early summer are sufficient to make glad all those who d the courage to buy in the days of depression. Although e movement in price was somewhat irregular, and the close the week was not at the highest point, this fact did not offer y element of discouragement. Conflicting factions were ruggling throughout the entire period, and every considerable lvance was followed by profit taking, which brought about a action. There was considerable evidence during the week at some master hand or some clique of important interests ere engaged in manipulation. At times there would suddenly pear large buying orders for half a dozen issues, and pools rang up in many of the cheap industrials, and were able to cure advances on several points. Rumor in Wall Street tributed the most important of these manipulative movements a group of large bankers. It was said that this group was pecially interested with Lehigh Valley, Missouri Pacific and hesapeake & Ohio. There was also considerable activity in ock Island and in Denver & Rio Grande, common. The ability of New York State to sell 4 per cent canal bonds at 101¾ indicates that the investment situation is not as bad as had been believed. Many of the more conservative houses in the Street are earnestly advising their customers to purchase good bonds at the present levels. The money market continues to be extremely easy, and the bank statement shows large quantities of cash available for borrowers. While the price of sterling exchange does not at the moment warrant gold imports, this fact does not interfere with the easy condition of the money market. Quotations Aug. 22 were: Call, 1¼@1½ per cent; 90 days, 3½@3¾ per cent. The quotations in the table are those of the close of Aug. 22.

Financial Notes.

Hudson River Power Reorganization.—In a circular letter to bondholders, Mr. James R. Hooper, chairman of the protective committee of bondholders of the Hudson River Electric Power Company and its seven affiliated companies, states that of the total Hudson River issues, amounting to $11,009,000, the company has added to its various depositaries $7,702,000. Of the three principal issues there are $2,819,000 of Hudson River Electric Company; $3,352,000 of the Hudson River Electric Power Company, and $1,069,000 of the Hudson River Water Power Company. The first draft of the plan for reorganization has been submitted to the Public Service Commission of the Second District, because it is necessary for the company to obtain the approval of the commission to any proposed plan before its issuance to depositing bondholders. Messrs. Stone & Webster, Boston, have been working for the past two months preparing an inventory and appraisement of the company's holdings. The company's attorneys are making up their records of foreclosure proceedings of the 11 major and a large number of minor mortgages, having compiled thus far six large volumes.

Chester County Electric Company to be Sold at Auction.—The Chester County Electric Company, of Avondale, Pa., having failed to pay the Central Trust & Savings Company of Philadelphia $204,606, as required under a decree handed down by Chancellor Curtis, all the property of the company will be sold at public auction on Sept. 1. The trust company is the trustee of $190,000 of first mortgage bonds of the electric company and the Chester County Electric Company defaulted in the payment of the interest on these bonds; the interest amounts to nearly $15,000. The sale will be held at 11 a. m. Sept. 1 at the County Court House in Wilmington, Del., and will be conducted by Mr. William M. Hope, of Dover, receiver for the company. The company operates three plants and supplies electrical energy to the towns of Kennett Square, Avondale, West Grove, Toughkenamon, Chatham, Kemblesville, New London, Strickerville and Landenburg, Pa., besides Little Baltimore and Hockessin, Del.

Consolidation in New Mexico.—A telegram has been received from George W. York, Roswell, N. M., announcing the consolidation of the Roswell Gas Company and the Roswell Electric Light Company, the combination to be known as the Roswell Gas & Electric Company. The president of the new company will be L. K. McGaffey, of Roswell; secretary and treasurer, George W. York, Cleveland, Ohio, and general manager, D. W. Low. The consolidation was effected by Otis & Hough, of Cleveland, who are also interested in the Michigan Power Company, Lansing, and the Alliance (Ohio) Gas & Power Company. W. D. Sweet will be retained as local manager of the company.

Consolidation in Upper Ohio Valley.—It is said that a holding company has recently been formed under the laws of Pennsylvania, with a capital of $1,500,000, to take possession of the lighting and power franchises of the upper Ohio and Beaver Valleys. The principal properties to be taken over will be the Steubenville-East Liverpool Railway & Light Company and the East Liverpool Traction & Light Company. Of both of these companies Van Horn Ely is president, and it is announced that he will be the president and general manager of the new holding company. No announcement has yet been made of the properties that will be included in the deal.

Springfield (Ill.) & Jacksonville Electric Railway.—H. H. Randolph & Company, of Chicago, are offering $800,000 6 per cent bonds of the Springfield & Jacksonville Electric Railway Company at 97½. These bonds will provide for the entire construction cost of the line between the two terminals, a distance of 34 miles. Work has already begun.

Chicago Consolidated Traction.—The merger ordinance for the franchise for the consolidation of the Chicago Railways Company and the Chicago Consolidation Traction Company has been introduced in the Chicago City Council and it is said is favorably considered by the transportation committee of that body. It is believed that the franchise will be passed next week and that the rehabilitation of the Consolidated Traction property will be commenced at once. Most of the material is at hand or available and it is said that work will be begun the instant the franchise ordinance is signed. President Roach, of the Railways company, says track laying will be rushed, possibly at the rate of two and a half miles a week. Between 3000 and 5000 men will be employed and probably $2,500,000 will be expended before winter. Under its 154 franchises the Consolidated company has 185 miles of track. Of this 128 miles is in the city of Chicago and about 60 miles of this track will be entirely rebuilt. It is intended also to install 250 large cars this fall.

Bullock Public Service Company.—A consolidation of the managements of a number of small central stations companies in Eastern Nebraska and Western Iowa has been brought about by Mr. E. A. Bullock, of Norfolk, Neb., who for a number of years past has been president of the Norfolk Electric Light & Power Company, and is an ex president of the Nebraska Electrical Association. He has organized the Bullock Public Service Company with offices at 515 Brandeis Theater Building, Omaha, Neb. The companies controlled are the Norfolk (Neb.) Electric Light & Power Company, Blair (Neb.) Electric Light & Power Company, Beatrice (Neb.) Electric Company and Missouri Valley (Ia.) Electric Light Company. A recent item in our construction news stating that the York, Neb., plant had been purchased by this company, was an error.

Commonwealth Edison Company.—The gross earnings of the Commonwealth Edison Company of Chicago for the first ten months of the current fiscal year are running 20 per cent ahead of last year. Estimated gross for the year ending Sept. 30 is over $12,000,000, as compared with actual gross of $10,630,446 last year. The increase of net is less than that of gross on account of the increased cost of fuel and labor. The subsidiary companies are expected to show proportionate increases. The North Shore Edison Company has done more business for the first ten months of this year than for all of last year. It is understood that 80 per cent of the $5,000,000 of Chicago Edison bonds were exchanged for Commonwealth Edison Company bonds before the right to exchange expired on Aug. 15.

Canadian Light & Power Company.—The annual meeting of the Canadian Light & Power Company was held at Montreal on Aug. 12. The particulars of the physical development were given and the shareholders expressed general satisfaction with the present condition of the company. Construction work is well advanced and well within the estimates of the company's engineers. It is expected that power will be turned on about Jan. 1 next. The old board of directors was re elected as follows: F. Howard Wilson, president; E. A. Robert, vice-president; George G. Foster, K. C.; N. Curry, J. M. Wilson, William C. Finley, J. W. McConnell, R. N. Smyth and F. J. Shaw. The capital of the company is $6,000,000, with a bond issue of $4,000,000.

Sale of Phonograph Company.—The property and all franchises and rights of the Edison Bell Consolidated Phonograph Company of London will be sold at auction in New York, Sept. 1, to satisfy a judgment and foreclosure obtained by the Guaranty Trust Company. The action was brought to satisfy a lien against the company of $443,606, with 6 per cent interest from June 27, 1910. Included in the sale is the right, title a interest of the Edison United Phonograph Company in German company in Cologne and to the proceeds of the sale phonographs stored in New York; also 2,500 shares of capital stock of the Edison United Phonograph Company the par value of $250,000, and 45,000 shares of the Internatio Graphophone Company of the par value of $4,500,500.

East St. Louis (Ill.) Light & Power Merger.—This co pany was incorporated under the laws of the State of Illi with $1,000,000 of authorized capital stock in $100 shares, which the East St. Louis & Suburban Company owns the ent outstanding amount of $733,500. The company will control East St. Louis Light & Power Company, organized in 1900 a possessing a 99-year franchise; the Citizens Electric Light Power Company, and the Southwestern Light & Power Co pany. The officers are as follows: President, Mr. L. Haynes; secretary and treasurer, Mr. G. L. Estabrook. bonds have been authorized yet. The company purchases electricity from the East St. Louis & Suburban Railway Co pany.

California Utility Merger.—The Long Beach (Cal.) Co solidated Gas Company has been incorporated under the la of California with an authorized capital stock of $1,500,000 carry out a plan for merging on the basis of 37 per cent and per cent respectively the properties of the Inner Harbor Company and the Southern California Edison Company in city of Long Beach. The new company proposes to is $1,000,000 in bonds.

Forty second Street Railway Sale.—The United Sta Circuit Court has signed an order postponing the sale and fo closure proceedings of the Forty-second Street, Manhattanv & St. Nicholas Avenue Railway Company from Sept. 1 u Oct. 18. This foreclosure sale is on a judgment upon mortgage held by the Union Trust Company to secure a sum $1,600,000 in bonds.

Ontario Power Company.—The general balance sheet the Ontario Power Company, of Niagara Falls, including Ontario Transmission Company, as of July 31, 1910, sh total assets of $19,053,086. The new conduit which was ope July 25, it is said, will more than double the power alre developed by the company.

DIVIDENDS.

American Railways Company, quarterly 1½ per cent, p able Sept. 1.

Brockton & Plymouth Street Railway Company, preferr semi-annual, $3 per share, payable Sept. 15.

Brooklyn Rapid Transit Company, quarterly, 1¼ per ce payable Oct. 1.

Brooklyn Union Gas Company, quarterly, 1½ per cent, p able Oct. 1.

Elmira Water, Light & Railway Company, preferred, se annual, 2½ per cent, payable Sept. 1.

Federal Mining & Smelting Company, preferred, quarte 1¾ per cent, payable Sept. 15.

Gas & Electric Securities Company, preferred, ini monthly, 7/12 per cent.

Manufactured Rubber Company, preferred, quarterly, p able Sept. 1.

New York & Queens Electric Light & Power Company, p ferred, quarterly, 1¼ per cent, payable Sept. 1.

Susquehanna Railway, Light & Power Company, preferr semi annual, 2½ per cent, payable Sept. 1.

Underground Electric Railways Company, Ltd., London, per cent on income bonds.

REPORTS OF EARNINGS

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surp
[illegible] Light & Traction Company	$[illegible],723	$[illegible],660	$[illegible]	......	.
[illegible]	234,[illegible]	9,4[illegible]3	[illegible]	...	..
[illegible]					
[illegible] Rapid Transit Company	[illegible]	11,[illegible],092	9,[illegible]	7,108,360	2,611
[illegible]	10,[illegible]04,462	11,391,[illegible]	[illegible]	[illegible]	1,936
[illegible]					
[illegible] Power Company	308,847	21[illegible]	183,[illegible]	69,[illegible]	114
[illegible]	[illegible]73	1[illegible]	1[illegible]	[illegible],883	115
[illegible]					
[illegible] & Light Company	144,547	84,131	[illegible],414	37,708	22
July, 1910	140,886	85,574	55,339	37,220	18.
[illegible]					
[illegible] Power Company	57,[illegible]	11,638	4[illegible]	17,[illegible]	4
[illegible]	47,144	9,[illegible]	37,618	26,091	11.
[illegible]					
[illegible] Electric Railway Company	57,202	28,393	28,809	......	...
[illegible]	54,403	23,439	21,0[illegible]4	......	....

General News

Construction News.

ANNISTON, ALA.—The entire system [illegible] Company in this city is being overhauled. [illegible] are to be [tak]en down and over 8000 ft. of new cables installed.

MONTGOMERY, ALA.—The Citizens' Light, Heat & Power Company, [Mo]ntgomery, Ala., which has recently closed a $500,000 contract for the [en]gineering and construction work required for additional facilities, is also [pla]nning an extension of its transmission lines which will represent an [ex]penditure of between $100,000 and $200,000.

TUSCUMBIA, ALA.—A movement has been started by local citi[zen]s for the construction of an electric light plant in Tuscumbia. A [su]bscription of $25,000 is now being taken for this purpose. The Shef[fie]ld Company, of Sheffield, Ala., furnishes electrical service in this [pla]ce.

PHOENIX, ARIZ.—Sealed proposals will be received by Charles W. [Go]odman, superintendent Indian school, Phoenix, Ariz., for furnishing [an]d delivering at the school 1150 electric lamps, cord, wire, taps, etc., [du]ring the fiscal year ending June 30, 1911.

PHOENIX, ARIZ.—The stockholders of the Salt River Valley Water [Us]ers' Association have declared in favor of a land tax of $900,000, the [pro]ceeds to be used for the construction of three power plants and canal [ex]tensions, plans for which are being prepared by Louis C. Hill, en[gin]eer of the United States Reclamation Service. The association pro[po]ses power plants on sites already selected for them on the Salt River, [bel]ow the Roosevelt dam, where it is estimated that 18,000 hp can be [de]veloped. Other sites are available which will increase the total de[vel]opment to 25,000 hp.

HAMBURG, ARK.—Bids will be received by the Board of Improve[me]nt, District No. 2, of Hamburg, Ark., until Aug. 31 for furnishing [ma]terials, machinery and construction on electric light plant and water[wo]rks system for the city of Hamburg, in accordance with plans and [spe]cifications which are on file at the office of the Board and at the [offi]ce of Willis E. Ayres, engineer, 370 Randolph Building, Memphis, [Te]nn. W. L. Blanks is chairman of board.

ALLEGHENY, CAL.—It is expected that the substation of the Middle [Yu]ba Hydro-Electric Company now under construction in the Buckeye [Dig]gins, near Smith's Flats, will be ready to supply electricity through[ou]t Allegheny by Sept. 15. The company is reconstructing the road [on] the Lafayette ridge between the Croesus mill and the Plumbago [mi]ne in order to facilitate the transportation of material for the new [pla]nt in American Hill, which it is estimated will take two years to com[ple]te. In the meantime the company will secure power from the Pike [Cit]y plant.

LONG BEACH, CAL.—Plans have been prepared by H. W. Dennis, [chi]ef engineer of the Southern California Edison Company, for a por[tio]n of the work in connection with the erection of the steam gener[ati]ng station at Long Beach. The cost of the work is estimated at [$1]25,000 and will include the foundations for the buildings and ma[chi]nery, salt water intake and adjacent retaining wall, intake conduit, [dis]charge conduit and protecting structure. One portion of the build[in]g will be 82 x 221 ft. and the other 145 x 72 ft. The conduit will [be] 900 ft. long, 6½ x 6 ft., built of concrete. The concrete retaining [wa]ll will be 218 ft. long with a 10-ft. base, 10 ft. high and 14 in. thick.

LOS ANGELES, CAL.—Bids will be received by the Board of Super[vis]ors until Aug. 29 for furnishing necessary equipment and electricity [for] lighting certain streets in Sheridan lighting district, and the Man[hat]tan Beach lighting district. C. G. Keyes is county clerk.

NEEDLES, CAL.—The Board of County Supervisors has granted [th]e petition of the citizens of Needles for an election to be held in [Se]ptember to vote on the question of establishing a lighting district in [th]is city. The supervisors have also granted similar petitions presented [by] the citizens of Highland and Rialto.

PASADENA, CAL.—The City Council is contemplating extending the [m]unicipal electric light system to parts of the city not having electrical [se]rvice. The city clerk has been authorized by the lighting committee [to] call for bids for an auxiliary boiler for the municipal electric light [pl]ant. C. W. Koiner is general manager of the plant.

POMONA, CAL.—J. M. Paige, superintendent of parks, has been in[illegible] installing a lighting system in Ganesha Park.

SACRAMENTO, CAL.—The South Sacramento Power Company, re[ce]ntly incorporated, proposes to furnish electricity for lighting and for [op]erating pumping plants and industrial plants in all the territory of [Sa]cramento County, south of Oak Park and Sacramento City down to [Co]urtland. The company will purchase energy from the Great Western [Pow]er Company. Work has already [illegible] [distr]ibuting system. H. W. Conger, Fred Ferheart, Robert Lewis, F. L. [H]olland, A. L. Darrow, J. Govan, George J. Bryte, E. A. Nicholas, E. L. [S]outhworth and Joseph Shaw are interested in the company.

SAN DIEGO, CAL.—At an election held Aug. 10 the proposition to issue $1,250,000 in bonds for establishing municipal gas and electric plants was defeated by a large majority.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has commenced work on the construction of a large gas plant in San Diego. The company is also contemplating the installation of a new electric generator, turbine type, with high power engines and new boiler in its electric power plant.

SAN FRANCISCO, CAL.—Preparations are being made by the Great Western Power Company to install an additional 10,000-hp unit in its plant. The company is said to have placed contracts for the entire output of its plant and is obliged to increase the equipment of power stations to meet the demands for service. Up to the present time, it is said, the company has placed contracts for nearly 50,000 hp.

RIDGEWAY, COL.—The electric light franchise recently granted to A. V. Walther by the Town of Ridgeway has been extended and taken over by a new company.

WILMINGTON, DEL.—The Chester County Electric Company, having failed to pay to the Central Trust & Saving Company, of Philadelphia, Pa., $204,606 in a specified time, as required under a decree handed down by Chancellor Curtis, all the property of the company will be sold at a public sale on Sept. 1. The company owns and operates plants in Delaware and in Chester County, Pennsylvania.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Aug. 29 for equipping with electrical apparatus, switchboards, wiring, piping and carpenter work on the physics laboratory of the Business High School, located on Rhode Island Avenue, between Eighth and Ninth Streets, Northwest, Washington, D. C. Form of proposal, specifications and other information may be obtained upon application to the property clerk, District of Columbia, Room 320, District Building, Washington, D. C. John A. Johnston, E. M. Markham, acting commissioners.

ST. AUGUSTINE, FLA.—Extensive improvements are contemplated by the St. Johns Light & Power Company to its electric light, power and street railway systems, which will include the installation of additional machinery at the power plant, installing an electric motor at the drawbridge and rebuilding its tracks with heavier rails.

ATLANTA, GA.—The finance and electric light committees of the Council have voted to recommend to the Council the acceptance of the plan for a "Great White Way," on Mitchell Street from the terminal station to Whitehall Street, on Whitehall from Mitchell Street to the viaduct and on Peachtree Street from the Viaduct to Ellis Street, submitted by George A. Miller representing the Flour City Ornamental Iron Works, of Minneapolis, Minn. The plan calls for the erection of 125 Corinthian standards, 70 feet apart along the entire route, each standard carrying five lamps. The cost of maintaining the system is estimated at $45 per year for each standard, the lamps burning from dusk to midnight. Property owners along the route have agreed to pay for the cost of the installation providing the city would maintain them. It is expected that the Council will adopt the recommendation and work will commence on the installation of the system at once.

BERRYTON, GA.—Arrangements are being made by the owners of the Berryton Mills to remodel the buildings of the former Racoon Mills and install 5000 spindles and knitting machinery. The company proposes to construct a dam to develop water power. A generator will be installed to supply electricity for lamps. For further information address John M. Berry, of Rome, Ga., president.

MONTICELLO, GA.—The Jasper Cotton Mills, recently organized, is making preparations for the construction of a mill with a capacity of 10,000 spindles, equipped for electric motor drive. It is understood that the committee is ready to place contracts for machinery. The company is capitalized at $20,000. For further information address L. O. Benton.

CAPRON, ILL.—Investigations are being made in Capron by Edward J. Dunn, superintendent of the Harvard Light & Power Company, of Harvard, Ill., with a view of extending its transmission lines to this village. The Village Board is considering the installation of street lamps. It is understood that if sufficient patronage is guaranteed the company will extend its system from Chemung to Capron within the next two months.

CHICAGO, ILL.—It is reported that a final agreement has been reached between representatives of the city and the Sanitary District for the lighting of the streets by the district, the transfer to the latter of all municipal street lighting equipment and the addition of 10,000 street lamps in the next three years.

ROCK ISLAND, ILL.—It is reported that work has commenced on the construction of the new power plant of the People's Power Company. The equipment of the station will include a steam turbo-generator set with a rating of 900 kw and four water tube boilers, rated at 600 hp each.

GREENFIELD, IND.—[illegible] will be received by the Common Coun-

cil of Greenfield, Ind., until Sept. 6 for one 150 to 175-hp engine and one 150-kw generator, specification for which can be secured on application. Ora Myers is Mayor.

MUNCIE, IND.—Preparations are being made by the Muncie Electric Light Company, which recently purchased the electric light and power plant at Dunkirk and Hartford City, to extend its service to Redkey.

DES MOINES, IA.—Bids are being received by the Coliseum Company for the installation of an electric light plant in the Coliseum. The plant will supply electricity for lighting the building and for a large electric sign to be erected on the Locust Street side of the convention hall.

ELDORA, IA.—Application has been made to the Council by E. H. Lundy for a franchise to install an electric light plant in Eldora. If granted a franchise Mr. Lundy agrees to erect a concrete dam, at a cost of $10,000, and install a new power plant.

ELDORA, IA.—A syndicate has been formed by local business men for the purpose of erecting a large hydroelectric power plant on the Iowa River, near Eldora. It is proposed to build a large concrete dam on the site of the old mill, near here. The new power house will be equipped with a steam auxiliary plant. Application will soon be made for a franchise in Eldora.

WEBSTER CITY, IA.—The Webster City Electric Light & Water Works, R. J. Mullins, superintendent, writes that it is at present installing 40 five-lamp electroliers in the business portion of the city.

BURLINGAME, KAN.—The city is remodeling the municipal electric plant. When completed a day service will be established and electricity furnished to the mines. Prof. B. F. Eyer, of the State Agriculture College, is consulting engineer.

NATIONAL MILITARY HOME, KAN.—Sealed proposals will be received at the office of the treasurer of the western branch, National Home Disabled Volunteer Soldiers, National Military Home, Kan., unt l Sept. 3 for furnishing and installing an electric elevator at the quartermaster's storehouse. Plans and specifications can be seen at the office of the quartermaster; specifications with blank proposals and other information can be secured upon application to W. W. Martin, treasurer.

OAKLEY, KAN.—Plans and specifications have been prepared by Burns & McDonnell, of Kansas City, Mo., consulting engineers, for water-works system and electric light plant in Oakley, to cost about $40,000. Bids will be received for construction of the plants as soon as the plans have been approved by the State Board of Health.

VIDALIA, LA.—Plans are being considered by the Town of Vidalia for improvements and extensions to its water-works system, including the installation of deep well pumps, etc. H. E. Burnham is manager.

ATHENS, MAINE.—It is reported that preliminary steps are being taken by the citizens of Athens and Skowhegan for organizing a company to construct a railway between these places. An appropriation of $15,000 has been voted in Athens. A committee composed of J. E. Chapman, F. B. Rollins, C. R. Oliver and others has been appointed to promote the project.

DEXTER, MAINE.—Work has commenced on the erection of the transmission line of the Central Maine Power Company, of Waterville, from Pittsfield to Dexter. It is expected to have the line completed by Sept. 15. When the new service is installed the company will establish a 24-hour service and supply electricity for manufacturing plants and other industries.

ANNAPOLIS, MD.—Bids will be received at the Navy Department, Washington, D. C., until Oct. 1 for completing power plant at the United States Naval Academy, Annapolis, Md. Plans and specifications can be obtained on application to the superintendent of the Naval Academy, Annapolis, Md. A deposit of $10 will be required to insure return of plans. Beekman Winthrop is acting secretary.

BALTIMORE, MD.—The Susquehanna Transmission Company of Maryland, which is constructing a pole transmission line through Baltimore and Harford counties, has applied to the County Commissioners for permission to cross certain county roads in Eleventh and Fourteenth districts. The company is a subsidiary of the Pennsylvania Water & Power Company, of McCall Ferry, Pa., and proposes to erect a pole transmission line from McCall Ferry, Pa., to Baltimore, Md.

FREDERICK, MD.—Preparations are being made by the Washington, Frederick & Gettysburg Railway Company for the extension of its railway from Thurmont to Emmittsburg and Gettysburg in the near future. The road from Frederick to Thurmont, now operated by steam, is being equipped for electrical operation.

BOSTON, MASS.—Orders have been placed by the Edison Electric Illuminating Company of Boston for a 15,000-kw turbo-alternator, to be placed in the L Street generating station at South Boston.

GLOUCESTER, MASS.—The Gloucester Electric Company is contemplating placing its wires in underground conduits on Main, Vincent and Duncan Streets and has petitioned the Council for permission to do the work. It will take several years to complete the work.

GREENFIELD, MASS.—It is stated that there is no foundation for the reports that are current to the effect that the Greenfield Electric Light & Power Company has been absorbed by he Connecticut River Power Company. Joseph W. Stevens, president of the company, and also president of the First National Bank, is quoted as saying that the local plant is not for sale.

LENOX, MASS.—The Rogers Electric Company has secured the con tract for installing electric lamps in and about the grounds and drive way at the Highland House for W. B. O. Field. The company will als wire the gate house for electric light service. About 100,000 ft. o cable will be used in connection with the work.

NEW BEDFORD, MASS.—The State Board of Gas and Electric Ligh Commissioners has approved the application of the New Bedford Gas & Edison Light Company for an increase in capital stock to the amount o $215,000, the proceeds to be used for additions to plant and to take u floating indebtedness.

OXFORD, MASS.—Several of the mills in Oxford are reported to b contemplating installing electric motors as auxiliary power. The Edwi Bartlett Company, of North Oxford, has recently installed a 75-hp moto in the upper mill to be used during low water periods. Electricity will b supplied by the Webster & Southbridge Gas and Electric Company.

WESTFIELD, MASS.—Plans are being considered for extensions an improvements to the municipal electric and gas plants, bids for whic will soon be asked. The cost of the work is estimated at $15,000 an will include the erection of a new building and the installation of ne machinery. Improvements will be made to the gas plant, which will i crease the output from 125,000 cu. ft. per day to 225,000 cu. ft.

MUSKEGON, MICH.—It is reported that the City Council will n give the bids of the Muskegon Traction & Lighting Company and th Grand Rapids-Muskegon Power Company further consideration. Bot companies have asked for an extension of time in which to make thei bids for furnishing service to the city. It is said that the Council considering the installation of a municipal electric light plant.

ALEXANDRIA, MINN.—The City Council is considering the que tion of installing an additional generating unit in the municipal electr light plant, at a cost of about $4,000.

AURORA, MINN.—The Village Council is reported to have decided install three blocks of ornamental standard lamps.

BRAINERD, MINN.—M. D. Stoner is reported to be considering th construction of a power plant 10 miles southeast of Brainerd, at a cost about $300,000.

GAYLORD, MINN.—The Village Council is contemplating increasi the output of the municipal electric light plant next spring. It is propose to install a 25-hp engine direct connected to a 15-kw, 220-volt generator. J. Hecht is superintendent.

NASHWAUK, MINN.—Preparations are being made by the village Nashwauk for the installation of an ornamental electric illuminating sy tem on Central Avenue for three blocks. Orders for poles and materi have been placed with the St. Paul Electric Company, of St. Paul, Min Each standard will carry three lamps. George A. Lindsay, superintende of the water and light department, will have charge of the work.

PINE RIVER, MINN.—It is reported that Charles E. Webber an Harry H. Hill will construct a dam and an electric light plant in Pi River, at a cost of about $6,000. C. E. Wood, of Minneapolis, Minn., w have charge of the work.

ST. PAUL, MINN.—It is reported that the controlling interest in t Northern Heating & Electric Company, of St. Paul, has been acquired H. M. Byllesby & Company, of Chicago. The new owners expect to ma many improvements and extensions in the system, and it is probable th connections will be established between the local plant and the wate power rights at Cannon Falls and Mankato.

SANDSTONE, MINN.—The Sandstone Telephone Company has bee incorporated under the name of the Eastern Minnesota Telepho Company, and proposes to extend its telephone lines to Superior a Duluth.

CLEVELAND, MISS.—The local electric light and ice plant has bee purchased by Nott & Ward, of Cleveland, and the Southern Coal Co pany, of Memphis, Tenn., both creditors of the company.

OSYKA, MISS.—It was voted by the citizens of this city on Aug. 16 issue $20,000 of bonds, the proceeds of which are to be used for wate works and an electric light plant. It is stated that plans have bee completed and contracts will be awarded as soon as the bonds ha been disposed of.

OMAHA, NEB.—It is expected that bids will soon be called by th County Commissioners for electrical work on the new court house. Tw electric elevators will probably be installed. The cost of the wor exclusive of the elevators, is estimated at $20,000.

VERDI, NEV.—It is reported that preparations are being made by th Truckee River General Electric Company for the construction of a larg dam in the Truckee River, near Verdi, which will back up the water mo than 2500 ft. above the dam and form a large lake, feed a canal mo than 40 ft. wide, which will carry the entire flow of the river and emp into the stream again just below Verdi, where a large power plant will erected.

PATERSON, N. J.—Contracts have been awarded for the installati of a light and power plant in the General Hospital. T. M. Thorpe, Paterson, N. J., has secured the contract for the electric plant, f $5,690; Leslie Elliott & Company for two boilers, at $3,300.

BAYPORT, N. Y.—The South Shore Traction Company has purchase a site for its proposed power plant on Oakwood Avenue, Bayport.

BROOKLYN, N. Y.—Sealed proposals will be received at the office the Supervising Architect, Treasury Department, Washington, D. C., un

Sept. 7 for furnishing and installing lighting fixtures in the post office building at Brooklyn, N. Y., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

FULTON, N. Y.—The Oswego River Power Transmission Company, represented by Eugene M. White, bid $2,000 for a franchise for the distribution of electricity through the streets of Fulton. The Common Council has adopted a resolution authorizing the Mayor to award the franchise to the successful bidder.

GOUVERNEUR, N. Y.—The Bell Telephone Company in this city is planning to overhaul its plant, and it is expected that much new equipment will be installed.

LANCASTER, N. Y.—The citizens of Cheektowaga are considering the question of installing electric lamps on Broadway through the town from the city line to the Village of Depew. A. A. Durringer, a member of the Town Board, is interested in the project.

CHARLOTTE, N. C.—A contract has been closed between the Globe Electric Company, of Charlotte, N. C., and John E. Schott, representative of the John W. Fries Company, of New York, N. Y., for equipping the company's humidifying systems for electrical operation. The Globe Electric Company has also secured contracts to equip the plant of the Peck Manufacturing Company, of Warrenton, for electric motor drive and the Clyde Cotton Mills, of Newton, to be operated by electricity.

NASHVILLE, N. C.—It is reported that the Parker & Whitaker Lumber Company is contemplating the installation of a generating unit in its saw-mill to supply electricity in connection with its plant and for lighting purposes.

NEWBERN, N. C.—Extensive improvements are contemplated by the Home Telephone & Telegraph Company to its system, including the installation of a new switchboard and copper toll service, the reconstruction of cable system, laying 5000 ft. of new cable and construction of direct lines to Goldsboro and Weldon, N. C.

SALISBURY, N. C.—The Hambly Manufacturing Company of Salisbury, N. C., has made arrangements with the Southern Power Company for electricity for operating its plant and for equipping its factory for electrical operation.

BOWMAN, N. D.—The installation of an electric light plant in Bowman is under consideration. C. M. Cleveland, of Wausau, Wis., is reported to be interested in the project and will apply for a franchise.

SCRANTON, N. D.—It is reported that Messrs. Wall, Hawkes and Gardner, of Glendive, Mont., are interested in a project to establish an electric light, power and heating plant in Scranton.

STROUD, N. D.—Preparations are being made by the Dakota Western Telephone Company for the erection of a two wire-circuit to Alexander, a distance of 37 miles.

ANTWERP, OHIO.—Extensive improvements and additions have been made to the local electric light plant owned by A. A. Pointer, including the installation of one 150-hp high pressure boiler, one 156-hp Erie City, four-valve engine, one 150-kw, one 70-kw, 2300-volt, 60-cycle generators, one double-panel switchboard complete, and one 25-lamp General Electric magnetite arc lamp outfit.

EAST LIVERPOOL, OHIO.—The East Liverpool Traction & Light Company has purchased a building at Yellow Creek, which will be remodeled and equipped as a power station.

MIDDLETOWN, OHIO.—The Construction Department of the Safety Insulated Wire & Cable Company, 114 Liberty Street, New York, N. Y., has been awarded a contract by the Middletown Gas & Electric Light Company for laying underground electrical conduits and installing cables in Middletown. The work will represent an expenditure of approximately $2,000, and it is expected that part of the system will be in operation by Sept. 1.

NEWARK, OHIO.—The Newark Telephone Company has been granted a 21-year franchise to install an automatic telephone system in Newark, Ohio.

SANDUSKY, OHIO.—Bids will be received by John Bing, director of public works, until Aug. 29 for lighting the streets, public parks and highways for a term of 10 years.

YOUNGSTOWN, O.—Bids will be received by the Clerk of the Board of Education until Sept. 19 for installing electric wiring in the South High School. W. N. Ashbaugh is the director of schools.

BARTLESVILLE, OKLA.—Preparations are being made by the Bartlesville Interurban Railway Company to supply electricity for commercial and domestic purposes. Orders have been placed by the company for equipment, for its plant, including a boiler, wires, poles, etc. [illegible] Atkin, formerly superintendent of the electric plant at Atchison, Kan., will assume management of the local plant. J. J. Curl, of Bartlesville, is president and general manager of the company.

COQUILLE, ORE.—The electric plant of the Coquille River Electric Company is reported to have been [illegible] recently. The plant furnished electrical service in Coquille and Myrtle Point.

REDMOND, ORE.—The Odin Falls Power Company, which recently applied to the City Council for a franchise to supply electricity and [illegible] in Redmond, proposes to erect a power plant at Odin Falls and transmit electricity and pipe the water to this town.

REDMOND, ORE.—Application has been made to the City Council by the Crook County Water, Light & Power Company for a franchise to install a water-works system and an electric light and power plant. The company is developing a water power project at Cline Falls, 4 miles from Redmond.

SALEM, ORE.—The Capitol Heating & Lighting Company is reported to have been granted a permit to construct and operate a heating and lighting plant in Salem.

PANAMA.—Sealed bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Sept. 16 for furnishing and erecting machinery to operate the Stoney Gate valves for controlling the main culverts and machinery to operate the cylindrical culverts of the upper lock at Gatun and the Pedro Miguel Lock. Blanks and general information relating to this circular (No. 596) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 55 National Realty Building, New Orleans, La.; and 1086 North Point Street, San Francisco, Cal.; also from the U. S. Engineer offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburgh, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala.; and Galveston, Tex.; Commercial Club, Kansas City, Mo.; Chamber of Commerce, Quincy, Ill.; and Chamber of Commerce and Board of Trade, Tacoma, Wash. Captain F. C. Boggs is general purchasing officer.

CHAMBERSBURG, PA.—The construction of an electric railway from Chambersburg to Mercersburg, with a branch from St. Thomas to Edenville, is under consideration.

HOLLIDAYSBURG, PA.—Plans are being considered by the United Telephone Company for the installation of a new system in Hollidaysburg in the near future. The present system will be replaced with the common battery system.

McCALL FERRY, PA.—The machinery of the power plant of the Pennsylvania Water & Power Company at McCall Ferry has been put in operation to be tested. The plant will not be ready for operation for several months. When completed the plant will have an output of more than 100,000 hp.

McKEESPORT, PA.—Preparations are being made by the Pittsburg, McKeesport & Westmoreland Railway Company for the construction of a power house, 40 ft. x 40 ft., to be erected on a site adjoining its car house in Westmoreland County. The company now purchases electricity for operating its system from the West Penn Railways Company.

NEW BRIGHTON, PA.—Van Horne Ely, former president of the traction and lighting interests between East Liverpool and Steubenville, Ohio, has completed the construction of an electric and power system in the upper Ohio Valley, extending from Steubenville, Ohio, to Sewickley, Pa. A holding company is to be formed capitalized at $1,500,000. The lighting plants in this part of the Ohio Valley will remain in control of the Ohio Valley Scenic Railway Company, while those between Midland and Freedom, Pa., will be under the direction of the Beaver Valley Light & Power Company. Those further up the river will be held by the holding company, but will have one head. The main plant will be located at Ambridge, Pa., and substations in all other Ohio Valley towns. The main office is at New Brighton, Pa. Mr. Ely will be president and general manager of the company.

NORTH WALES, PA.—Preliminary surveys are being made for the proposed electric railway to connect the Philadelphia division of the Lehigh Valley Transit Company at this place with the Philadelphia & Western Railway Company at Villanova. E. B. Smith & Company, of Philadelphia, Pa., are reported to be interested in the project.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has made arrangements with the Delaware County Electric Company and the Beacon Light Company, of Chester, subsidiary corporations of the Philadelphia Electric Company, to supply electricity for operating its railways in Delaware County.

PROVIDENCE, R. I.—F. E. Chester & Company are moving their manufacturing plant from Dudley Street to the factory recently purchased in Bellefonte and the output of the plant will be greatly increased. The new plant will be equipped for electric motor drive. Electricity for operating the plant will be supplied by the Narragansett Electric Lighting Company.

HIGHMORE, S. D.—The installation of an electric light plant in Highmore is reported to be under consideration.

PARKESVILLE, TENN.—J. G. White & Company, of New York, N. Y., have secured the contract for the complete engineering work and construction of a hydroelectric power plant for the Eastern Tennessee Power Company. The dam and power station will be located on the Oconee River, at Parkesville. The cost of the proposed plant is estimated at $2,000,000.

BRADY, TEX.—J. N. Paxton, of Abilene, Tex., is reported to have purchased the property of the Brady Telephone Company from George W. Vierling, for $30,000. The new owner, it is understood, will extend and enlarge the system.

FLATONIA, TEX.—A franchise has been granted to the owners of the proposed electric light plant and water-works system for a term of 50 years. The city has entered into a contract with the company for street lighting and also for furnishing electricity to light the court house.

LAREDO, TEX.—It is reported that preliminary steps have been taken toward the [illegible] plant on the Rio

Grande River, about 33 miles above Laredo, by a syndicate, of which H. A. Stucky is the head. The proposed plant will be located in a coal field embracing 45,000 acres, owned by Mr. Stucky and associates. Coal screenings will be used for fuel for the plant. The company will transmit electricity to Laredo, Carrizo Springs, Cotuila and to several towns and cities in Mexico.

FAIRMONT, VA.—Owing to the increased demand for electrical service the Fairmont & Clarksburg Traction Company is reported to be planning an addition to the Jayenne power plant. The equipment, it is said, will include two 1000-kw generators.

NORFOLK, VA.—The Southern Bell Telephone & Telegraph Company, Atlanta, Ga., is to install a $70,000 switchboard in the new exchange which it expects to build at Norfolk.

ANACORTES, WASH.—The Anacortes Water & Electric Company is installing a 400-kw Curtis steam turbo-generator set, with new switchboard and other apparatus. The company is planning to establish a 24-hour service and will supply electricity for manufacturing plants and other industries. The cost of the improvements is estimated at $16,000.

ELLENSBURG, WASH.—Extensive improvements are being made to the municipal electric light plant, including the installation of a 100-hp, Morgan-Smith water wheel and a 550-kw, 6600-volt, three-phase, 60-cycle generator. Contract has also been placed for a 300-hp water tube boiler, to be used as an auxiliary. E. L. Butler is superintendent.

SEATTLE, WASH.—The Board of Public Works has authorized the purchase of the street lighting system in Ballard from the Seattle Electric Company, at $5,629. The company held a contract for lighting the streets in Ballard before the consolidation, which was kept in force because the city, it was claimed, was unable to supply the service.

SPOKANE, WASH.—It is reported that J. J. Hill is interested in a project to construct an electric railway from a point near Spokane to Priest Lake.

STEVENSON, WASH.—It is reported that arrangements are being made by the Skamania Light & Power Company to extend its transmission lines to Carson immediately.

TOPPENISH, WASH.—Arrangements are being made by the Yakima Valley Telephone Company for the installation of a complete new telephone system in Toppenish.

WHEELING, W. VA.—Sealed proposals will be received until Sept. 27 at the U. S. Engineer office, Wheeling, W. Va., for construction of fire-proof power house and chimney and installing two 115-hp boilers, two steam-driven air compressors, receivers, piping, etc., at dam No. 26, Ohio River. Bids will be considered on the entire plant, or for house and chimney and for different lots of machinery, etc. For further information address Captain F. W. Alstaetter.

SHEBOYGAN, WIS.—Preparations are being made by the Citizens Telephone Company for improvements to its system, which will involve an expenditure of from $8,000 to $10,000. A mile of cable will be erected between Sheboygan and Sheboygan Falls to provide for the increasing business in the rural districts.

SUN PRAIRIE, WIS.—At an election held recently bonds were voted to purchase the local electric light plant.

TOMAHAWK, WIS.—A new dam is being erected across the Wisconsin River, near Tomahawk, by the Bradley interests. The proposed plant will develop about 2000 hp.

EVANSTON, WYO.—Application has been filed with the State engineer by C. H. Solier, of Evanston, Wyo., appropriating 50 cu. ft. of water in the east fork of the Bear River in Summit County. The application states that it is proposed to develop from 300 to 600 hp at first, which will be increased later to 2000 hp. The plant will supply electricity in Evanston and other points in this locality.

FORT SASKATCHEWAN, ALTA., CAN.—Bids will be received until Sept. 1 by John Haddin, of Wetaskiwin, Alta., chief engineer for the John Galt Engineering Company, of Toronto, Ont., for water-power development in connection with the electric plant at Fort Saskatchewan.

STETTLER, ALTA., CAN.—Advices have been received from David Mitchell, city secretary-treasurer, that the proposed electric light plant recently reported will not be constructed this year.

ST. BONIFACE, MAN., CAN.—Bids will be received until Sept. 14 at the office of the Commissioners of the Transcontinental Railway at Ottawa (P. E. Ryan, secretary) for the wiring system required in connection with the locomotive shops of the National Transcontinental Railway east of Winnipeg. Bids will also be received at the same time and place for wiring ducts required in connection with the Transcontinental Railway shops east of Winnipeg. Address S. R. Poulin, district engineer, St. Boniface, Man.

BERLIN, ONT., CAN.—Contracts have been awarded by the People's Railway Company as follows: To F. W. Maxwell, Port Hope, Ont., for the construction of the 3-mile section of its proposed railway between Berlin and Bloomingdale on the main line to Guelph; to D. B. Campbell, of Latchford, Ont., for construction of road from Berlin to New Hamburg, a distance of about 14 miles. The Acme Construction Company is now grading between Bloomingdale and Guelph. Thomas Robbins, of Galt, has the contract for all the concrete work along the railway. Work will soon commence on the survey of the railway north from Guelph to Elora, Fergus and Arthur; also to complete the survey from Guelph to Hespeler and Puslinch Lake. When completed the company will have a direct route from the south partly over the Galt, Hespeler & Preston Railway to Guelph.

PORT CREDIT, ONT., CAN.—Sealed tenders will be received at the office of the Hydro-Electric Power Commission, Continental Life Building, Toronto, Ont., Can., until Aug. 29 for the construction of a transformer station building, near Port Credit, plans and specifications for which can be obtained at the above office. Hon. Adam Beck is chairman of the Commission.

TORONTO, ONT.—The contract for the construction of the new substation at the corner of Edwin and Ruskin Avenues has been awarded to Masonry, Teagle & Son, for $26,905.

TORONTO, ONT., CAN.—The Toronto Electric Company has set up a claim that the company under the terms of the agreement of 1889 is entitled to carry on business in any part of the city and contends that it is not limited as to area and has a right to operate in the territory annexed to the city since the agreement was made. The company now asks that the Board of Control remove the prohibition placed on its rights. If the board refuses to grant its request it is said that the company would test the claim in the courts.

New Industrial Companies.

THE AMERICAN AUTOMATIC BOILER FEEDER COMPANY, of Waterville, Maine, has been organized with a capital stock of $100,000 to manufacture and sell automatic boiler feeders, engines and other machinery, etc. G. W. Boynton is president and M. S. Goodrich, treasurer and clerk, both of Waterville, Maine.

THE AMERICAN ELECTRIC & MANUFACTURING COMPANY, of Hallowell, Maine, has been chartered with a capital stock of $50,000 for the purpose of doing a general manufacturing business, etc. The officers are: G. W. Boynton, of Waterville, Maine, president, and C. H. O'Brien, of Hallowell, Maine, treasurer.

THE AMERICAN HEAR-PHONE COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $10,000. The incorporators are: H. C. Shinnick, A. E. Coy and H. Schmidt, of Chicago, Ill.

THE AMERICAN ROTARY ENGINE MACHINE COMPANY, of Hartford, Conn., has been incorporated to take over all American patent rights of the Von Pittler system of rotary engines. A. K. Baylor, of New York, N. Y., is president and treasurer; E. M. Sawtelle, of Englewood, N. J., vice-president, and W. Baylor, of New York, N. Y., secretary. The executive offices of the company are at 103 Park Avenue, New York, N. Y.

THE COLLINS GEAR & MOTOR COMPANY has filed articles of incorporation with the Secretary of State at Dover, Del. The company is capitalized at $250,000 and the incorporators are: F. R. Hansell, of Philadelphia, Pa.; E. T. Vennel and G. H. B. Martin, of Camden, N. J.

THE ELECTRO-CHEMICAL RUBBER & MANUFACTURING COMPANY, of Jersey City, N. J., has been chartered with a capital stock of $200,000 for the purpose of manufacturing electric motors, dynamos, electrical machinery, etc. The incorporators are: L. Daft, of Rutherford, N. J.; A. H. Martin, of Short Hills, N. J.; C. E. Haydock and W. M. Clark, of New York, N. Y.

THE EUREKA SMOKE CONSUMER COMPANY, of Rochester, N. Y., has been chartered with a capital stock of $50,000 to manufacture and sell smoke consumers, etc. The incorporators are: John R. Armstrong, Frederick Fish and George Simmons, all of Rochester, N. Y.

THE INDEPENDENT ELECTRICAL SUPPLY COMPANY, of Boston, Mass., has been chartered with a capital stock of $3,500 and the following directors: L. Marcus, president; Max J. Charm, 145 Portland Street, Boston, Mass., treasurer, and S. J. Lipsitz.

THE JOACHUM ELECTRIC COMPANY, of New Orleans, La., has been incorporated with a capital stock of $3,000 by J. A. Douglas, Jr., R. A. Borey and Leon C. Muller. The company proposes to deal in electrical supplies.

THE JOHNSON WIRELESS HOLDING & MANUFACTURING COMPANY, of St. Louis, Mo., has filed articles of incorporation with a capital stock of $100,000, for the purpose of manufacturing and dealing in devices for wireless telephones. The company expects to establish a large laboratory in San Antonio, Tex., for the manufacture of telephones and equipment of a number of wireless stations in that city. The incorporators are: Charles P. Johnson, trustee, Charles P. Johnson, Ralph Jones, Alexander Young, Max F. Ruler and Ralph O. Johnson. Headquarters of the company will be located in St. Louis, Mo.

THE KERMONT INCANDESCENT LAMP COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $100,000 and the incorporators are: F. M. Shive, S. E. Roberson and H. W. Davis, of Wilmington, Del.

THE MODEL GENERATOR COMPANY, of Louisville, Ky., has filed articles of incorporation with a capital stock of $7,500. The incorporators are: H. C. Offutt, C. R. Offutt and Oscar Scott.

THE NORTHWESTERN ELECTRIC EQUIPMENT COMPANY, of Jersey City, N. J., has been incorporated by H. H. Flagg, A. B. Trigg and J. R. Turner, of Jersey City, N. J. The company is capitalized at [illegible] and proposes to manufacture and deal in electrical apparatus.

New Incorporations.

BAKER, MINN.—Articles of incorporation have been filed for the Baker & Downer Telephone Company with a capital stock of $1,000 by D. O. Lamb, of Downer, Minn.; G. P. Schneck and W. Cook, of Baker.

SUMMIT, MISS.—The Summit-McComb Motor Line Company has been incorporated with a capital stock of $40,000 to construct an electric railway to connect Summit, McComb and Godbold Mineral Springs, 6 miles in length. The officers are: T. Blackmore, president and treasurer; Dr. V. Simmons, vice-president, and Clem V. Ratcliff, secretary and general manager.

FORBES, MO.—The Business Men's Telephone Company has been incorporated with a capital stock of $3,000 by Elmer Siper, H. E. Milne, G. T. Metcalf and others.

McCONNELLSVILLE, OHIO.—A charter has been granted to the Citizens' Telephone Company of McConnellsville with a capital stock of $20,000. The incorporators are: F. J. Bailey, James Donahue, A. J. Davis and M. D. Davis.

ANTLERS, OKLA.—The Antlers Light & Power Company has been incorporated with a capital stock of $10,000 by J. Easten, Clark Wasson, I. Silverman, Wotten Sliverton and C. Dudley, all of Antlers.

MARSHFIELD, ORE.—The Coos Bay Traction Company has filed articles of incorporation with a capital stock of $1,000,000 for the purpose of building electrical railways from Coos Bay to connect with the transcontinental systems. The incorporators are George M. Perine, George F. Averill, W. B. Campbell and A. T. Harding. The company will also generate and distribute electricity in the towns and villages along the route of its railway lines.

AMITY, PA.—The Amity Farmers' Telephone Company has been chartered for the purpose of building a telephone line from Amity to Dunn's Station, with connecting branch lines. The company is capitalized at $5,000. H. W. Horn, of Amity, Pa., is one of the incorporators.

MILWAUKEE, WIS.—The Badger Railway & Light Company of Milwaukee has been organized to construct an interurban railway from Whitewater to Lake Geneva. The company is capitalized at $10,000 and the incorporators are: H. B. Kamschultze, Gustav Pickhart, Charles Zingsheim, Victor Lachmund and Charles H. Franz, Jr.

Personal.

MR. W. K. BOONE has been appointed general manager of the Jalapa Railroad & Power Company, Jalapa, Mexico.

MR. FRANK NOWLETT, of Fort Wayne, Ind., has been appointed superintendent of the Bath (N. Y.) Electric Light & Gas Company.

MR. L. S. KEDNEY has been appointed superintendent of the electrical department of the Jalapa (Mexico) Railroad & Power Company.

PROF. SYDNEY W. ASHE has been retained by the Harrison Branch of the General Electric Company to expand its educational work in salesmanship and illuminating engineering.

MR. LUDWIG KEMPER has sold out his interest in the Fuel Engineering Company in Chicago and is again acting as general manager for the Albert Lea (Minn.) Light & Power Company.

MR. J. W. THOMAS, formerly of the engineering staff of Westinghouse, Church, Kerr & Company, has been appointed mechanical engineer of the New England Engineering Company, formerly of New Haven and now at 50 Church Street, New York.

MR. L. R. PARKER, formerly with the Westinghouse Electric & Manufacturing Company, has been appointed electrical engineer on the staff of the New England Engineering Company, 50 Church Street, New York.

MESSRS. TRIBUS AND MASSA, consulting engineers, New York City, have been retained to take charge of the completion of the sewer system and sewage disposal works of Monticello, N. Y. This work a short time ago was commenced by Mr. George N. Bell, of Kingston, recently deceased.

MR. F. W. L. PEEBLES has been appointed professor of electrical engineering at Marquette University, Milwaukee, Wis., where he will take over much of the work formerly performed by Dean J. D. Davis. Professor Peebles is a graduate of St. Louis University and for five years had charge of the X-ray laboratory of the Missouri-Pacific Hospital system and as early as [illegible]

MR. H. A. STRAUSS, vice-president and chief engineer of the Falkenau Electrical Construction Company, Chicago, Ill., has been appointed consulting engineer of the Alton, Jacksonville & Peoria Railway Company, and will undertake the design of the extension of this system to Jerseyville, Ill., involving about twenty miles of roadbed, track, and overhead construction, together with power house.

MR. HORATIO A. [illegible], [illegible] of Chicago, is in Los Angeles in connection with the appraisement of some electric properties in that region. Owing to many developments of water power in that particular region, some of these properties spread over a territory extending from the Kern River power house, about 120 miles north of Los Angeles, to Redlands, about 70 miles east of the same city, and to [illegible]

MR. ARTHUR WILLIAMS, of the New York Edison Company, returned to New York on Aug. 16 after a 10 weeks' sojourn in Europe. While abroad Mr. Williams devoted most of his time to the study of sociological conditions, attending many conventions devoted to considerations of such topics. Incidentally he was able to compare commercial methods in European electric lighting industries to those of the United States and was not a little elated over the superiority of American business-getting methods.

MR. C. G. KILBOURNE has been made assistant in the office of the chief electrical engineer of the New York Edison Company, Mr. Philip Torchio. Graduating from Columbia University, N. Y., in the course of electrical engineering in 1906, Mr. Kilbourne in December of the same year secured a position in the company's laboratory, having charge of the experimental and research work, and testing of the substation electrical equipment. He resigned on July 1 this year as assistant to the chief of the laboratory to accept the present well-earned promotion.

DR. W. H. TOLMAN, director of the American Museum of Safety and chairman of the American Executive Committee of the International Committee on Social Insurance, has been appointed by the State Department a delegate on the part of the United States to the International Congress on Workmen's Insurance to be held at The Hague, Sept. 6 to 9. Among the questions to be discussed are the extension of social insurance to include others than workmen, that is, small tradespeople, shop keepers and farmers; provisions for widows and orphans by means of insurance and insurance against unemployment.

MR. L. D. GIBBS, secretary-treasurer of the New England Section of the National Electric Light Association, is exceptionally qualified for the work of that position by former experience in secretarial and newspaper work. Mr. Gibbs was born in St. Johns, Mich., and after graduation from the high school, taught himself shorthand, clerked in numerous stores and spent the greater part of a year driving a delivery wagon in Denver and "rustling" in the mining camps of Clear Creek County before he settled down again in his home town to run a newspaper, *The St. John News*. After a couple of years he decided he should get a college education, and upon graduation became a reporter on the *Springfield Republican*, of Springfield, Mass. Later, he spent three years in Washington doing secretarial and committee clerkship work in the House of Representatives, but devoted the most of his time to newspaper work, representing during the first year, the *Springfield Republican* and the last year was assistant Washington correspondent for the *Boston Transcript*. During the presidential campaign in 1904 he had charge of the suburban newspaper publicity work in the Literary Bureau of the Republican headquarters. Four years ago he accepted the opportunity that was opened for "a man with some newspaper experience" to join the staff of solicitors in the Edison Electric Illuminating Company, of Boston. On July 1 last, upon the retirement of Mr. Converse D. Marsh as advertising expert for the Boston Company, he was made superintendent of advertising. Mr. Gibbs was secretary of the New England Section of the Illuminating Engineering Society from January, 1909, to February, 1910.

MR. L. D. GIBBS.

Obituary.

ALBERT SPIES.—We regret to announce the death of Mr. Albert Spies, who died of pneumonia, Aug. 16, at his home in Jersey City. Mr. Spies was born in New York City, July 20, 1862, and was graduated from Stevens' Institute of Technology with the degree of M.E., in 1881. For two years after graduation, he was an associate editor of *The Iron Age*, and later became editor of *Mechanics*. After engaging in engineering practice for some years, he became, in 1893, the editor of *Cassier's Magazine*, which position he retained until after the death in 1906 of the [illegible] *Electrical Record*, and at the time of his death was editor and proprietor of *Foundry News*, the publication of which began only a few months ago. Mr. Spies was a member of the American Institute of Mining Engineers, member of the Society of Mechanical Engineers, associate member of the Institute of Electrical Engineers, and member of the Engineers' Club, of New York. He is survived by a widow and one son.

MR. THEODORE P. BAILEY, Assistant Manager of the General Electric Company, Philadelphia District, died at his home in Mount Airy, Philadelphia, after an operation for appendicitis, and was buried on Tuesday morning, Aug. 23. Mr. Bailey was born in Covington, Ky., Aug. 17, [illegible], and after [illegible] Ill., engaged in newspaper work at that place. Taking up the study of stenography, he became a court reporter at Morris, Ill., in 1879, which work he later continued at Joliet, Ill., at the same time pursuing the study of law. In 1881 Mr. Bailey was admitted to the bar and shortly afterward removed to Chicago, where he became associated with [illegible] the

original promotors of the Vandepole Electric Company, in which Mr. Bailey became interested, and thereafter turned his attention to electrical matters. In 1885 he was made western representative of the Thomson-Houston Company, and after its merger with the General Electric Company, he continued in charge of the street railway business in the Chicago district, later becoming assistant manager of that office. In 1905 he resigned to enter the railway contracting business, as vice president and general manager of the L. E. Myers Company, Chicago, with which he remained until 1907. After about a year in charge of the Auto Department of the St. Louis Car Company, Mr. Bailey, in the fall of 1908, returned to the General Electric Company as assistant manager of the Philadelphia district. For many years Mr. Bailey was one of the most widely known men in the street railway circles of the west, and was among the first to project electric light systems in that section, having been interested in establishing the first installations in such cities as Des Moines, Omaha, St. Louis, Kansas City, Minneapolis and St. Paul. He is survived by a widow and one child.

Trade Publications.

COUPLINGS.—The General Electric Company has issued Bulletin No. 4750, describing shaft couplings adapted for coupling electrical apparatus together, or to other machinery. The types described are the leather-link flexible coupling, laced-belt coupling, rubber buffer coupling and flange coupling.

SWITCHES.—Dr. Paul Meyer, N 39 Lynarstr. 5-6, Berlin, Germany, has issued, as sheets to the 1910 catalog, illustrated price-lists of 550-volt, manually-operated switches and automatic circuit-breakers for direct and alternating current, arranged for electro-motive forces not exceeding 550 volts.

AUTOMATIC TELEPHONES.—The automatic telephone system designated by the title "Autophone" is briefly described in a folder of S. H. Couch, 156 Purchase Street, Boston. The folder contains an outline of the advantages and disadvantages of this system in comparison with the manual switchboard system.

COAL-HANDLING MACHINE.—A 400-page publication dealing with coal-handling and ash-handling apparatus has been issued by the Link-Belt Company, Philadelphia, Pa., as its catalog No. 90. This book is well illustrated throughout, views being given not only of the constructive details, but of completed equipments.

BALL BEARINGS.—The Hess-Bright Manufacturing Company, Philadelphia, Pa., is distributing for insertion in its loose-leaf catalog sheets 52 and 53, containing much valuable data relating to ball bearings for heavy service. A thrust bearing intended particularly for service of marine nature is illustrated and described in sheet 53.

TELEPHONE SWITCHBOARDS.—Many of the details embodied in the construction of central battery non-multiple switchboards with lamp signals are shown in bulletin No. 1004 of the Western Electric Company. The switchboards described in this bulletin are intended for exchanges where the ultimate number of subscribers' lines will not exceed 500.

DIRECT CURRENT SWITCHBOARDS.—Switchboards designed for direct current service at electromotive forces of from 125 to 250 volts are briefly described and illustrated in bulletin No. 33 of the F. Bissell Company, 226 Huron Street, Toledo, Ohio. In this bulletin are listed also the numerous elements used in the construction of the switchboards.

SWITCHES.—The Agutter & Griswold Company, 411 Occidental Avenue, Seattle, Wash., is distributing its general catalog, devoted to knife switches, fuses, panel boards and switchboard instruments. The catalog is a well-executed publication of 126 pages. It contains outline illustrations, brief descriptions and list prices of the various types of devices described.

DIRECT-CURRENT MOTORS.—Bulletin No 193 of Roth Brothers & Company, Adams and Loomis Streets, Chicago, is devoted to direct-current motors ranging in rating from 4 hp to 30 hp. Bulletin No. 199 of the same company deals with motors designed particularly for use with band saws, for cutting either wood or metal. These motors are arranged for complete enclosure.

DIRECT-CURRENT INSTRUMENTS.—The General Electric Company has issued Bulletin No. 4760, illustrating and describing a line of direct-current instruments. The illustrations comprise external and internal views of the instruments, showing the details of construction, together with dimension diagrams of the instruments and the shunts; the scales used for different ratings are also shown.

FLOOR OUTLETS.—Bulletin "B" of the Steel City Electric Company, 1207 Washington Avenue, Pittsburg, Pa., gives detailed information concerning floor outlets and the auxiliary apparatus used therewith. The outlets described are of the self-adjusting type, being so designed as to present a smooth surface for the floor, quite independent of the position of the main body of the outlet box.

ELECTRIC SIGNS.—Electric signs of the sparkle type are described and illustrated in bulletin No. 60 of Betts & Betts, Heidelberg Electric Tower, 42d Street and 7th Avenue, New York. The electric sparkle sign is offered as a substitute for the ordinary electric letter [illegible] the desired effect at night at a much lower [illegible] appearance in the day time.

[illegible]—James G. [illegible], Philadelphia, has issued a [illegible]

tachometer bulletin (No. 716), relating to Frahm vibration tachometers and Ja-Ga-Ba hand tachometers. The former type is built on the resonance plan and is especially suited for high-speed turbines and generators. Ja-Ga-Ba tachometers are made on the centrifugal principle, and combine compactness with convenience in use and accuracy in results.

PRINTING PRESS MOTOR DRIVES.—Bulletin No. 505-G of the Garwood Electric Company, Garwood, N. J., contains a good description of the methods which may be employed for driving printing presses by means of electric motors. Much of the information given in this bulletin is of an engineering nature, and the bulletin should prove of service to those interested in the application of electricity to print-shop machinery.

THE ELECTRIC LIGHTING OF AUTOMOBILES.—The Engineering Department of the National Electric Lamp Association, Cleveland, Ohio, has issued bulletin No. 12, dealing with the use of electric lamps for automobiles. The bulletin does not partake of a trade nature, but contains much technical information, concerning the operating characteristics of incandescent electric lamps, especially those of the miniature type.

POWER STATION ERECTION.—Much interesting information relating to the architectural features of modern power stations is given in a neatly executed bulletin sheet by the Stone & Webster Engineering Corporation, Boston, Mass. Outlined descriptions are given of the Lincoln Power Station, the Harvard Power Station, and the Charlestown Power Station, which have recently been erected in the Boston neighborhood.

ILLUMINATION.—The Nernst Lamp Company, Pittsburg, Pa., has published as example No. 1 of modern merchandising establishments a description of the installation of Marshall Fields Company, Chicago. The lighting equipment used in each department is described in detail. The average consumption throughout the different floors varies from 0.8 watt to 2.3 watts per square foot, and the mean illumination varies from 2.0 to 6.8 foot-candles.

REFRIGERATION.—The Triumph Ice Machine Company, Cincinnati, Ohio, has issued bulletin 508 giving a detailed description of machines for manufacturing ice. Particular attention is directed to the advantageous features of ice making as a profitable day load for central stations. Bulletin 501 of the same company is a 35-page publication, giving numerous details relating to the constructive features of compressors for use in connection with the manufacture of ice.

SERIES INCANDESCENT SYSTEMS.—Bulletin No. 4718 of the General Electric Company deals with the apparatus required for a complete series incandescent lighting system. The illustrations include Mazda tungsten lamps for street lighting with various forms of reflectors and suspension insulators, street system brackets, constant-current transformers, panel boards, socket cut-outs and ornamental poles, as well as complete dimension and connection diagrams and illumination curves.

WIRING DATA.—The Pettingell-Andrews Company, Boston, is distributing booklets containing much valuable data relating to wires and installation of electrical circuits. In addition to the various gages, tables are given of conductivities of various metals and alloys, the conduits for different sizes of wires, specifications for standard wiring symbols, metric equivalents, wiring formulas for both direct current, alternating current circuits and instructions for the care and installation of motors and generators.

LUMINOUS ARC RECTIFIER SYSTEMS.—In its Bulletin No. 4752 the General Electric Company gives much information concerning rectifier sets, luminous arc lamps and the auxiliary apparatus for complete series luminous arc rectifier systems. The bulletin is fully illustrated and shows views of the exterior and the mechanism of the luminous arc lamp, as well as the series vertical electrode flame arc lamp for operation in series with luminous arc lamps. Luminometer chart, illumination curves and wiring diagrams are also shown.

BUILDING CONSTRUCTION.—The Stone & Webster Engineering Corporation, Boston, Mass., is distributing mailing cards showing by means of photographs the rapidity with which the company was able to construct the White Building in Seattle. It is claimed that this building was ready for tenants within 10 months after construction was begun. On a separate mailing card is shown a view of the Georgetown power station of the Seattle Electric Company, which contains a 16,000-hp equipment installed by the Stone & Webster Engineering Corporation.

ICE-MAKING MACHINERY.—In its catalog "A" The Vilter Manufacturing Company, Milwaukee, Wis., discusses at considerable length the equipment required in the manufacture of ice, and arrangements which may be employed for installing this machinery most conveniently. The publication contains numerous sectional drawings of existing installations, and should prove of considerable value to central stations. This company has issued a 63-page booklet containing a partial list of the users of ice-making and refrigerating machinery which it has manufactured.

INTENSIFIED ARC LAMPS.—The General Electric Company has issued publication No. 4742, devoted to general illumination by its intensified arc lamp. The publication contains a description and illustrations in considerable detail of a lamp designed for general illuminating purposes, which is simple mechanically, and reliable in operation. The principal characteristics of the lamp, however, are its high efficiency and the color-value of its light. The publication contains a color chart showing the illuminating values of various forms of lighting as compared with daylight. [illegible] compares the incandescent, Welsbach, Nernst and the [illegible] daylight.

BUSINESS NOTES.

MR. A. F. NORCROSS has succeeded Mr. Hubert S. Collins as general manager of the Engineering Supervision Company, 45 West Thirty-fourth Street, N. Y. City.

THE WHEELER CONDENSER & ENGINEERING COMPANY, Carteret, N. J., has acquired the patterns and drawings of the "Conover" condenser and will hereafter manufacture that apparatus.

THE NEW ENGLAND ENGINEERING COMPANY has removed its engineering offices from New Haven, Conn., to 50 Church Street, New York. The staff has been increased by the addition of Mr. J. W. Thomas, mechanical engineer, formerly of Westinghouse, Church, Kerr & Company, and Mr. L. R. Parker, electrical engineer, formerly of the Westinghouse Electric & Manufacturing Company.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 16, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

967,151. INDICATOR FOR ARC LAMPS; J. H. Allen, Chicago, Ill. App. filed Jan. 23, 1908. An indicator for arc lamps consisting of a trigger tripped by the carbon to get a signal when the carbons require trimming.

967,159. METHOD OF REDUCING ORES; F. M. Becket, Niagara Falls, N. Y. App. filed March 24, 1908. Passes an electric current by means of a metallic electrode into a molten bath containing a metal and a reducing agent and cools the electrode to protect it from the bath and reduction products.

967,160. MACHINE FOR BLACKLEADING MOLDS FOR ELECTROTYPING; G. H. Benedict, Chicago, Ill. App. filed Jan. 7, 1910. A reciprocating frame with a rotatable plate which carries a matrix and is partially rotated at each reciprocation of the frame so as to discharge a fluid upon the matrix at an angle thereto.

967,171. LOW-SPEED CIRCUIT CONTROLLER; F. B. Corey, Schenectady, N. Y. App. filed May 20, 1909. For controlling the circuits of lock magnets for levers controlling railway switches and signals including a worm and worm wheel driving mechanism.

967,186. CONTROL SYSTEM FOR ELECTROMAGNETS; J. H. Hall, Cleveland, Ohio. App. filed May 13, 1910. For lifting magnets for moving billets in which a master switch is used in connection with a magnet having an energizing winding, the connections causing currents to flow successively through the winding so as to demagnetize it with means for limiting the value of the demagnetizing current.

967,192. RELAY FOR BLOCK SIGNAL SYSTEMS; L. A. Hawkins, Schenectady, N. Y. App. filed March 4, 1908. A movable contact member having operative operations on both sides of its off position with means for engaging the member to hold it in off position and a locking member controlled by the current and the relay for locking the contact member in the off position.

967,190. SWITCH FOR ELECTRIC TOOLS; L. A. Hauck, Cincinnati, Ohio. App. filed Jan. 27, 1909. For portable electric tools comprising terminals and the movable contact for breaking the circuit between them with a thumbpiece for operating it.

967,200. ELECTROLYTE AND METHOD OF ELECTRO-DEPOSITING ZINC; E. F. Kern, Knoxville, Tenn. App. filed Sept. 1, 1909. For electrolyte consists of a salt of zinc, a salt of aluminum, an organic substance and a salt of ammonium.

967,204. MAGNETO TELEPHONE; O. M. Leich, Genoa, Ill. App. filed June 19, 1908. A wall telephone with cabinet and door in which the ringer is mounted near the top and below the induction coil, below which is the transmitter, below which a large space is left for the condenser. The back of the cabinet need not carry conductors.

967,210. ELECTRIC MOTOR CONTROL; L. V. Lewis, Wilkinsburg, Pa. App. filed April 9, 1910. A transformer connected with the field and armature with means for controlling the direction of current through the transformer so as to control the direction of rotation of the motor.

967,217. TRANSMITTER; H. S. Mattison, La Crosse, Wis. App. filed March 22, 1909. A circular diaphragm with an annular groove and a gasket in the groove and between the diaphragm and case and a spring pressing the diaphragm toward the case.

967,222. RELAY; D. J. McCarthy, Wilkinsburg, Pa. App. filed March 5, 1910. For automatic signaling systems employing alternating current in tract currents, including a vane assuming three positions under the influence of two magnetic fields.

967,233. ELECTRIC INCANDESCENT LAMP AND CONNECTIONS THEREFOR; W. J. Phelps, Decd., Detroit, Mich. App. filed July 15, 1907. Lamps with connections and controlling switches for dimming by means of a resistance coil contained in the flexible cord leading to the lamp.

967,237. ELECTRIC HOIST; A. Rausch, Berlin, Germany. App. filed March 2, 1910. Electrically operated hoist driven by an alternating motor with a controller having a braking position so as to cause the motor to act as a braking generator driven by the load with means for stopping the hoisting movement.

967,240. COIL SUPPORTING STRUCTURE FOR DYNAMO-ELECTRIC MACHINES; J. T. Roberts, Wilkinsburg, Pa. App. filed Nov. 6, 1908. For supporting high-speed armature coils by means of an inner ring and an outer ring with annular baffle plates secured to the brackets to form an air chamber through which air is driven by a fan carried by field magnets.

967,254. TURBO-GENERATOR CONSTRUCTION; C. H. Smoot. App. filed Jan. 2, 1906. A cylindrical core with lengthwise slots each carrying an insulated conductor and end discs for interconnecting them.

967,276. MICROTELEPHONE; J. [illegible], [illegible], Wis. App. filed March 22, 1909. Includes a handle with a receiver and a transmitter, [illegible] bers to hold them together, the receiver and transmitter being attached to one half.

967,280. MAGNETIC BLOW-OUT; H. E. White, Schenectady, N. Y. App. filed Feb. 4, 1910. [illegible] is placed in series with the arc to produce a field to blow the arc.

967,281. MAGNETIC BLOW-OUT; H. E. White, Schenectady, N. Y. App. filed Feb. 4, 1910. The field produced by the current confines the arc near the center of the contact, the contacts being shaped to cause the current to have a movement transverse to the arc chute.

967,295. BRAKING ALTERNATING-CURRENT MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed June 4, 1906. Connects the armature to the source and impresses on the field of the motor a voltage displaced 90 deg. from the voltage of the source, and controls the phase of the voltage to vary the braking effect..

967,296. ELECTRIC BRAKING; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Feb. 19, 1908. Operates a portion of the motors as separately excited generators driven by the load, and operates other motors in the same way, but excited by currents generated in the first-named motors.

967,323. CLUTCH ARRANGEMENT FOR ARC LAMPS; T. L. Carbone, Berlin, Germany. App. filed March 5, 1907. Includes a pair of plates loosely pivoted to a vertically oscillating rod, one end having holes for the carbon and acting as a clutch.

967,325. WIND-WHEEL ELECTRIC GENERATOR; A. Carlson, Klamath Falls, Ore. App. filed Aug. 9, 1909. A driving shaft drives a countershaft by means of a worm gear, the latter carrying an armature disc.

967,361. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, Eng. App. filed Jan. 29, 1909. Single-phase induction motor with an induced winding closed on itself independently of a commutator with a neutralizing winding on the inducing member connected with the commuted winding so that the current passing through one will bear a constant ratio to the current passing through the other.

967,362. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, Eng. App. filed May 8, 1909. The stator has a main inducing winding and the rotor a commuted winding, and a second winding is closed on itself with a magnetic shunt forming a pathway for magnetism to link with the commuted winding without linking with the second winding, and means for directing the flow of current in the commuted winding along two axes.

967,363. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, Eng. App. filed July 9, 1909. A squirrel-cage winding and a commuted winding on the induced member, both windings being on the periphery of the motor with short-circuited brushes on the commuted winding in the axis of the inducing winding and connected in series with the inducting winding along another axis.

967,386. SYSTEM OF CONTROL FOR ALTERNATING DIRECT-CURRENT MOTORS; R. P. Jackson, Wilkinsburg, Pa. App. filed Dec. 18, 1905. For railway systems including a source of alternating currents, direct currents, translating devices operated by either current, switches for the circuit connections controlled by magnets and energized in a predetermined order when operated by alternating current and in another order when operated by direct current.

967,387. SYSTEM OF CONTROL FOR ALTERNATING DIRECT CURRENT MOTORS; R. P. Jackson, Wilkinsburg, Pa. App. filed Dec. 18, 1905. See 967,386. A non-inductive resistance between a controlling magnet winding for the circuit switch and a transformer whose primary is in series with the resistance, and the secondary supplies current to the other controlling magnets of the circuit switch.

967,388. ELECTRICAL CUT-OUT DEVICE; R. P. Jackson, Wilkinsburg, Pa. App. filed March 3, 1906. Fuse holding terminals, a fuse mounted therein and a casing open at the bottom whose sides support the terminals.

967,389. ALTERNATING DIRECT-CURRENT SYSTEM OF CONTROL; R. P. Jackson, Wilkinsburg, Pa. App. filed Dec. 18, 1905. For railway systems in which alternating motors may also be operated by direct current. See 967,386.

967,398. MECHANICAL CONTROLLER FOR ELECTRIC CURRENTS; D. L. Lindquist and D. Larson, Yonkers, N. Y. App. filed Oct. 30, 1907. Motor controlling apparatus for hand-rope control of alternating-current elevators, including a reversing switch operated by a rotary cam with one or more accelerating switches.

967,404. OUTLET BOX; N. Marshall, Newton, Mass. App. filed Oct. 31, 1908. For interior conduits, the box having two walls at right angles with an aperture through one wall and a union and screw-threaded connector held from turning by engagement with the other wall.

967,409. TELEPHONE SIGNAL ATTACHMENT; W. F. Mikolasek, Scotland, S. D. App. filed March 9, 1909. Party line telephone selective system with a switch for consecutively closing the talking circuit and the call circuit and opening the latter with the opening of the ringing circuit and the closing of the receiver circuit.

967,469. X-RAY APPARATUS; H. F. Waite, New York, N. Y. App. filed July 5, 1906. An X-ray tube housing is mounted on horizontal pivots in slides and is counterbalanced by weight connected to the slides.

967,471. BRUSH HOLDER; [illegible], Milwaukee, Wis. App. filed Oct. 6, 1909. Includes a clamp having two parts engaging a stud secured diagonally with a pivoted arm secured to one part and [illegible]

967,475. TELEPHONE SYSTEM; C. W. Winston, Chicago, Ill. App. [illegible] a pair of telephone lines, a cord circuit with calling and answering signals and four relays, one in each end of each talking strand with switches under the operator's control for two of the relays which actuate the supervisory signals and [illegible] control for the other two relays for effacing the signals.

967,4[illegible]. TELEPHONE SYSTEM; C. W. Winston, Chicago, Ill. App. filed Nov. [illegible], 1907. Central battery system with an impedance coil in a bridge of the talking strands of the cord circuit and a second relay with its coil normally in series with one of the talking strands with a shunt depriving the second relay of actuating current and completing a non-inductive path for voice currents.

967,508. ELECTRIC LIGHT BUTTON; J. Fortas and J. R. Jackson, Memphis, Tenn. App. filed Dec. 3, 1909. A turned button, having a chamber with a clasp therein having flat jaws and the tongue extending out from one end of the chamber.

967,527. BRUSH HOLDER; E. R. Knight, Norwood, Ohio. App. filed Feb. 4, 1905. A slotted guideway of sheet metal, with carbon engaging the slotted face of the guideway carrying a shoe with wings parallel to the face of the carbon and engaging the guideway.

967,574. APPARATUS FOR AGING LIQUORS; J. Seitz, Chicago, Ill. App. filed July 13, 1908. Electrolyzes the liquid by an electrode carried by a bung which carries a non-conducting tube in which the wire electrodes are mounted.

967,575. LIQUOR AGING AND PROCESSING APPARATUS; J. Seitz, Chicago, Ill. App. filed Feb. 3, 1909. Electrolyzes liquids by means of a threaded plug with an insulating sleeve and a conducting point projecting from the sleeve, the apparatus entering a barrel containing the liquid.

967,578. ART OF ELECTRIC WELDING AND REPAIRING; H. L. J. Siemund, New York, N. Y. App. filed June 3, 1909. A clamp for electric arc welding having a magnetizing coil and holding a piece of the welding metal.

967,579. METHOD OF ELECTRIC WELDING AND REPAIRING; H. L. J. Siemund, New York, N. Y. App. filed Jan. 19, 1910. Establishes an arc between the metallic object and the end of a rod of the repairing metal used, the heat of the arc beginning the fusion.

967,590. MANUFACTURE OF STEEL; W. R. Walker, New York, N. Y. App. filed April 21, 1906. Treats molten iron in a Bessemer converter, then pours the metal through basic slag for removing phosphorus, and then treats the metal in an electric furnace.

967,597. DIFFERENTIAL GALVANOMETER; J. L. Zander, Newark, N. J. App. filed March 16, 1910. A pair of horseshoe magnets with a wire would coil about the pole of each magnet and movable relatively thereto, the poles tapering.

967,631. ELECTRIC TERMINAL; E. Gerhardt, Jr., Mauer, near Vienna, Austria-Hungary. App. filed Oct. 15, 1908. A body of insulation receiving a conductor with an integral projection extending beyond the opening and engaging the insulating support and holding the terminal in the support.

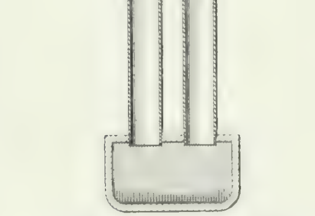
967,632. COMBINED JUNCTION BOX AND CUT-OUT AND SWITCH SUPPORT; W. J. Gibbons, Philadelphia, Pa. App. filed June 2, 1909. The parts are supported with a single base.

967,633. CIRCUIT MAINTENANCE SYSTEM; A. Goldstein, New York, N. Y. App. filed Jan. 22, 1906. For establishing the circuit around a brake by means of magnets and circuit breakers in the ground connection of each armature of each magnet, which ground is removed when another ground is established.

967,649. MEANS FOR VISIBLY INDICATING FAULTY INSULATORS; C. Linke, Strassburg, Germany. App. filed June 30, 1909. Hollow rings of celluloid which is inflammable pass around the insulator below the wire and are dissipated by the arc on short circuiting.

967,658. FIRE ALARM; F. E. Oviedo, Mexico, Mex. App. filed July 2, 1909. A weight suspended by cords held by fusible material which falls so as to close an electric circuit and give the signal.

967,681. ELECTRICAL TRAIN SYSTEM; J. R. Sloan, Altoona, Pa. App. filed Nov. 16, 1906. For train lighting systems, for wiring the several cars, including a flexible conductor carrying contacts and carried by separate cars, the contacts pressing against each other with



967,159.—Method of Reducing Ores.

spring pressure tending to separate the terminals and means for automatically releading the retaining mechanism for the contacts.

967,684. ARC LAMP; C. H. Sprague, Newton, Mass. App. filed July 16, 1908. For regulating the feed of the electrodes by means of a flexible strip of fusible material with two downwardly extended rods having grooves to contain these strips, the latter being guided at a point near the arc with means for supporting one of the electrodes by [illegible]

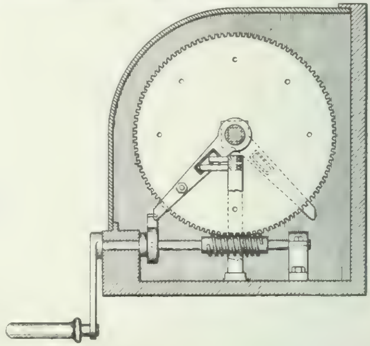
967,692. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed Jan. 22, 1907. Lockout system with a plurality of substations on the line each with two normally open branches in the bridge of the limbs of the line with a transmitter, relay, manual switch and winding [illegible] receiver, another winding of the induction coil and a contact for the relay in a local circuit at each substation.

967,719. TELEPHONE NOISE EXCLUDER AND CURRENT SAVING DEVICE; W. E. Burt, Uba, Wis. App. filed May 11, 1910. An attachment for holding the receiver hook at a point where the battery circuit is broken and the talking current completed by means of a gravity-returned retaining hook engaging the receiver hook.

967,738. ELECTRIC ARC LAMP; T. J. Digby, London, Eng. App. filed Sept. 8, 1908. For stage lighting in which the light is regulated by shutters with a V-shaped notch in each, which overlap so as to vary the size of the opening.

967,747. TRANSMITTER MOUTHPIECE; O. F. Falk, Belleville, N. J. App. filed July 13, 1909. A cone-shaped shield is inserted in the mouthpiece of the transmitter with its point toward the mouth and leaving a channel between the rim of the cone and the mouthpiece.

967,748. TELEPHONE DICTATING MACHINE OR APPARATUS; O. F. Falk, Belleville, N. J. App. filed July 13, 1909. For dictating from a central manager's desk selectively to any one of a corps of



967,171.—Low-Speed Circuit Controller.

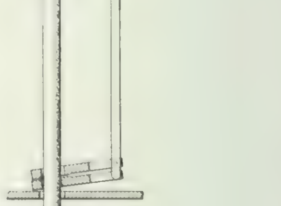
stenographers, the manager's instrument including a box with an inside frame supporting keys and signals with a swinging frame carrying the transmitter and receiver.

967,753. SWITCH FOR ELECTRIC LIGHT SOCKETS; C. D. Gervin, New York, N. Y. App. filed Oct. 22, 1909. A pull-cord switch in which the switch arm is mounted on a shaft having an angular portion with a pawl in engagement with the sides of the angles.

967,762. PROCESS OF FORMING GLUE FROM LEATHER; H. G. Halloran, Brighton, Mass. App. filed Dec. 27, 1909. Treats the leather with a salt solution by electrolysis, then washes, etc.

967,773. PRIVATE BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM; N. H. Holland, Chicago, Ill. App. filed Nov. 23, 1907. For answering a call over a trunk line at any one of several stations without causing a disconnect signal at central while using the telephone for communicating with a local station.

967,782. MOTOR CONTROLLING APPARATUS; S. H. Keeper, Plain-



967,323.—Clutch Arrangement for Arc Lamps.

field, N. J. App. filed April 14, 1910. For controlling reversing motors by means of a magnetic switch actuated by a pilot switch which controls the solenoids of the magnetic reversing switch.

967,847. REGULATOR; L. R. Smith, Chardon, Ohio. App. filed April 6, 1909. For automatically regulating the flow of liquid from a vessel, after the liquid has reached a given temperature by means of an electric controller which moves a valve which controls the outlet, the controller being operated through a thermal circuit closer.

967,862. CONDUIT ROD OR COUPLING THEREFOR; E. L. Upson and F. J. Dole, New York, N. Y. App. filed Sept. 11, 1908. For carrying wires through conduits, each rod having at both its ends a coupling socket, each socket symmetrical and carrying locking means and a single wheel on each socket, thus providing a pair of wheels at [illegible] sockets.

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SOME ASPECTS OF THE CENTRAL-STATION SITUATION.

It is now somewhere more than three years since the tungsten lamp began to come into general use in Europe, and but little more than two years since it became a definite central-station factor in this country. At first viewed askance by electric lighting men as a possible menace to the industry, the new lamp has been found by the more enterprising class of central-station men to be a powerful means for placing the electric-lighting business on a firm basis through relieving it of the competition from gas lighting, which danger in recent years had been on the increase, and also in finally offering a solution to the residence lighting problem. It must be confessed, however, that with the exception of a relatively small number of central stations which have attacked vigorously and intelligently the problem of the introduction of the tungsten, the early period of transition from the carbon to the metallic filament is yet in course. This, we believe, is in part due to the survival of the past Fabian policy of central-station men—to their Micawber attitude toward new situations—rather than to actual conditions. The men holding back are of the class who occasionally at electric light meetings enter feeble protests against the low meter rates of rational charging systems, or against low motor or cooking rates, on the ground that they can see no money in electrical supply at a rate less than 15 or 20 cents per kw-hour. Happily, the awakening of central stations to commercial methods during the past four or five years has resulted in depleting this class considerably; and the competition to which they are increasingly subject from among technical graduates who are taken on by central stations for an apprenticeship training in commercial methods will further clear the field of laggards. Like any important advance in any department of life the change of conditions in the electric lighting field, due to the coming of the tungsten lamp, requires a corresponding change in central-station methods, and also of central-station personnel where this cannot be adapted to the new order of things. Where this principle has been recognized, the introduction of the tungsten lamp has proceeded smoothly, if we allow that the difficulties overcome were such as must naturally be expected in a radical departure from the old, and, therefore, to be considered merely as incidents of an inevitable transformation rather than feats calling for extraordinary capacity.

It is in the extension of residence lighting that the tungsten lamp has opened up the greatest possibilities. How great is this field becomes evident from the fact that only about 10 per cent of the houses within central-station territory are now lighted by electricity. As specific examples may be cited the case of one city in which 12,000 houses wired for the electric light are not connected with the central-station service; and of another where, though having a greater proportionate residence load than any other city of its class in the country, there are 60,000 houses into which the electric light has not yet gained admittance. In short, the great problem now before the central [illegible]

profitable to the station and satisfactory to the consumer. While no general solution has been offered to this problem and none applicable equally to all communities appears to be possible, yet there is no doubt that intelligent and well-directed effort will go far toward removing the reproach offered to the central-station industry by the poor showing of residence lighting; and what can be accomplished by such effort is exemplified by the results now being achieved in Hartford, an account of which in detail appears elsewhere; in Detroit, where electric light is supplied to one-third of the residences; in Denver, and in a number of smaller cities, particularly in the Central West and on the Slope. It may here be pointed out that where success has been met it cannot be ascribed to a close following of the principles which were formerly considered a necessary basis for service charges, but rather to a close study of an actual existing situation to be met, and the adaptation to it of every means available, even though apparently heterodox according to views established in the carbon-filament period. In other words, the methods have been those of the opportunist and not of the accomplished maker of "rational rates." In time, without doubt, certain principles will be segregated from such fortuitous systems upon which a service-charging system of general application may be based, and errors will be recognized and weeded out; but instead of waiting for that happy period, the wise central-station man will attack the residence lighting problem with every means he can devise or borrow. It will be better to fail with three plans and succeed with a fourth than to try none at all. It should be added that we do not mean to deprecate the thorough investigation of rate-making principles or the formulation of elaborate rate systems. Such work will not only be useful to those who are striving to meet an emergency with little regard to the permanency of the means to be employed, but will also be a framework when the time is ripe for a definite system or systems.

A disturbing factor which has recently entered into the incandescent lighting situation is the small candle-power tungsten lamp, now being introduced. This journal has consistently maintained that the 16-cp unit is too small for general purposes to-day, and it welcomed the metallic-filament lamp as a means of raising the candle-power of the incandescent unit to a value approaching that of its then vigorous competitor, the Welsbach mantle. This opinion is well defined in an editorial printed in these columns four years ago, from which we quote as follows: "In the days of our great-grandfathers the pair of candles on the mantle-piece, or the single one on the table, gave a quantity of artificial illumination which for ages had been considered entirely satisfactory. Then came the plain kerosene burner, which reduced the units to one, to be displaced later by the single argand burner. Next the advent of gas, with its accompaniment of several outlets to a room, still further lifted the gloom, and the electric light ushered in the present era of brightness. In this genesis of artificial illumination two points stand clearly out: First, that none of the illuminants was displaced by the later-comer because of any pressing human necessity for a higher illumination; a fraction of a ft.-candle is sufficient for reading newspaper print, and the light of a candle will guide one's footsteps. And second, each new artificial source was more expensive in service than its predecessor. The fact is, the only criterion for quantity of illumination is daylight. One may to-day fix according to the best existing practice the illumination in ft.-candles for various purposes, but in time the data will pass out of date, perhaps becoming almost as obsolete as similar candle-light data would be to-day. The margin for increase in illumination will exist until that of bright daylight is reached, and yearly this margin will be encroached upon. The example set by public lighting—the lighting of main streets, of windows, stores, hotels, etc.—is a powerful stimulus to the inherent desire for artificial illumination everywhere which approaches daylight. The advance in the brilliancy in this class of lighting has grown enormously in the past few years, but its effect with respect to house lighting has been minimized by the universality of the 16-cp lamp unit. The introduction of the metallic-filament lamp, which will probably occur within the next twelvemonth, will provide an ideal opportunity to raise the candle-power. For, aside from the considerations above presented, there will be a powerful commercial one. With a consumption of one-third of that of the carbon filament, the tungsten lamp will bring with it a crisis for the central station. The means to meet this crisis seems to be clearly indicated: The craving for brighter illumination is far from being satisfied, the present electrical incandescent lamp unit is too small, and the new lamp, when placed on the market, should be of a candle-power not less than 25—perhaps as high as 40."

Looking back at the present date, we find that the higher candle-power tungsten lamps first introduced not only were of inestimable service to central stations in protecting their interests, but were also appreciated by consumers, who gladly accepted the condition of "More light for the same money." Should there now be a return to the low candle-power unit which was in line of promotion to the obsolete, it will be distinctly unfortunate to the central station, no real boon will be conferred on the consumer, and the Welsbach mantle with its superior candle-power will be given a respite. We would not advocate that the consumer shall be denied any choice in the selection of a lamp; but we believe that every effort should be exerted toward inducing him to use "More light for the same money," and the 40-cp and 60-cp units are the rational means to this end. In Germany the lesson has been learned from earlier experience with 16-cp and 20-cp tungsten units, which wherever possible are by concerted effort now being relegated to the rear in favor of 32-cp and 50-cp units.

TUNGSTEN LAMPS FOR INDIRECT ILLUMINATION.

In an article abstracted in the Digest in this issue Dr. M. Monash reports the results of tests showing that when used for indirect illumination tungsten lamps are more efficient than arc lamps equipped with pure carbon electrodes. It is evident, therefore, that a tungsten-lamp installation would prove much more economical than an arc-lamp installation for indirect lighting. The author gives no data relating to the comparative efficiencies of the indirect and the direct methods of illumination, but one can readily determine the effect of substituting the one method for the other. The portion of the light flux reaching the ceiling directly from the lamp is subjected to the single absorption at the ceiling surface, while the flux that strikes the reflector before reaching the ceiling is subjected to the additional absorption at the reflectors. Therefore, it appears that, when all other conditions are the same, the system in which the greater portion of the light from the lamps passes

directly to the ceiling would possess the higher efficiency. Moreover, of two systems having equal initial efficiencies, the one depending least upon the light redirected by a reflector should possess the higher efficiency under service conditions, by reason of the smaller amount of light absorbed by the layer of dust which inevitably collects upon the reflector. In regard solely to the formation of a layer of dust, it might seem that a tungsten-lamp installation is somewhat preferable to an arc-lamp equipment, but one should not overlook the fact that the arc-lamp equipment requires attention at very frequent intervals, and hence the reflector is much more likely to be kept in a polished condition than that of a tungsten-lamp installation which suffers from the dust that is allowed to collect at a rate so slow that it escapes attention. One of the greatest drawbacks to a tungsten-lamp equipment for indirect lighting is the deterioration of the reflector surface. An installation of tungsten lamps for this purpose can be considered successful only when provision is made for frequent removal of the collected dust. The best arrangement would be one in which the dust is removed automatically, or the removal of the dust is rendered practically compulsory at stated intervals.

HOTEL LIGHTING.

While it is perhaps difficult to say that general practice in one class of lighting is any worse than in any other, traveling men and especially those who visit the smaller towns are very much of the conviction that for inadequate and inefficient lighting the average hotel bedroom stands near the head of the list. While some of the more modern hotels in the larger cities represent the best in illuminating practice, the majority of the country hotels undoubtedly represent the worst. In the first place, the average hotel guest is notably careless and wasteful as to turning off lamps when not needed. To counteract this some niggardly hotel keepers have reduced the candle-power of the lamps in each room to a point where adequate illumination is impossible however the light may be utilized. To counteract this some traveling men carry 50-cp lamps in their grips, while many others more charitably content themselves with an extension cord fitted with an attachment plug and a lamp socket. In the small hotels a single lamp on a drop cord in the middle of the room, hung at about the level of the guest's eyes, is the regular practice, while in a slightly larger class of hotel a two-lamp or three-lamp ornate chandelier, controlled by switch and equipped with some fancy shade, is the rule. Usually no provision is made for the lighting of mirrors. For the cheapest class of work where drop cords are now used a lamp on a ceiling socket with a good reflector controlled by a pendant switch or chain-pull socket would work great improvement when the substitution of tungsten for carbon lamps is made. In cases where chandeliers are used a single large tungsten lamp in a proper ceiling fixture is a good substitute for the chandelier. The lighting of mirrors can be accomplished at a reasonable expense by mounting small lamps directly on each side of the dresser mirror and plugging these to some wall outlet, if there is such an outlet. If the room is sufficiently light as to color of ceilings and walls, plenty of indirect light will almost do away with any necessity for special mirror lighting, although if side outlets are available, the mirror lamps are always convenient and desirable. While awaiting the happy day when public hosts shall finally recognize the art of illumination, we would advise everyone who travels often or even occasionally to carry in his grip a cord extension for hotel and steamer use.

THE PURPOSE OF STREET LIGHTING.

In all the current discussion of ways and means for street lighting there is a tendency to ignore the questions that underlie the necessity for lighting the streets at all. People talk glibly enough about average ft.-candles and methods of measuring the illumination, but do they really at bottom know the purposes for which the illumination is furnished at all, much less their relation to its amount? Historically, the story is a comparatively simple one. The streets of a medieval city were crooked and narrow thoroughfares for the most part, undrained and ill-paved, beset by buildings irregularly placed and separated by frequent dark alleys. They were haunted after nightfall in the most populous districts by lawless prowlers of every sort, from mere vagabond cut-purses to drunken roisterers with swords ready for blood-letting upon the smallest excuse. The nightwatchman with his lantern and halberd was marked from afar by the one class and held in contempt by the other. Foot passengers and carriages blundered about as the prey of both. The earliest public lighting was definitely in defence of public order and safety, and its purpose was to disclose the dangers of the way, and check the crimes that are bred by darkness. The earliest lighting by lantern was altogether ineffectual from our modern standpoint, but contemporary evidence shows that it did tend to prevent accident and disorder. It is a common saying to-day that an arc light is as good as a policeman, and the same principle held 250 years ago.

Fundamentally, then, street lighting was and is a police measure so far as populous districts are concerned. It is good policy to use light in certain localities with a lavishness that the appearance of things by daylight would scarcely suggest. It is the density of the nocturnal population that counts, not the diurnal condition. In some districts there is dense traffic until an hour or two after darkness has fallen, and then the streets are deserted. Here the situation is clearly different, and the lighting needed is chiefly to facilitate getting about, and need not be kept to its full intensity all through the night. This is a fact very commonly recognized in foreign cities, where the lighting in certain districts is often reduced by midnight, or even earlier. Still another situation must be met in streets where the density of population is small, but the use by night is disproportionately large by reason of general employment as a thoroughfare. Here the way must be well marked out, especially in these days of motor cars, but the police value of the illumination is merely incidental. Again, there are certain streets in which the shop lighting is so considerable as to far outshine ordinary public lighting, and where, consequently, the brilliant total illumination of the early evening is automatically reduced in the later hours.

Now, all these facts show clearly one general principle—that the public lighting required is essentially non-uniform. Any attempt to light a large city on the basis of a fixed sum, or a fixed number of lights per mile of street, necessarily leads to failure, unless the sum or number is fixed to meet the maximum requirement, which means abnormally high cost. We are, in theory at least, a democratic people, and are very prone to assert principles of equality quite against our saner judgment.

[illegible] indignant at being a denizen of a street only moderately lighted, and raising a protest to the city fathers, one should really consider that moderation a tribute to the quiet and orderliness of his neighborhood. The chief of police is a better judge of the real needs of a city in the way of illumination than is any other single official. When his requirements are met it is time enough to consider the rest of the situation. These things point to the distribution of illumination on very various scales and perhaps by different methods. It is clearly almost useless to economize by lighting in spots with long intervals of darkness between, which has been a favorite American practice. An arc lamp every 500 ft. is not street lighting, but a practical joke at the expense of the public treasury. The same amount of money put into smaller units brings better returns provided only a moderate amount of light is needed. In other cases such a change would still leave the street very badly lighted for the conditions of its use, and the only thing to do is to mass lighting units of the largest size until there is light enough and to spare. The practical problem of street lighting is to suit the illumination to the needs of the case without reference to the traditions of the art. It cannot be solved with due regard to economy by the use of any single type of lamp, and it cannot be solved at all unless one turns a deaf ear to protestations of equal rights in the lighting fund.

BASEBALL BY ELECTRIC LIGHT.

Numerous attempts have been made at various times to play baseball by electric light, but the results have left considerable to be desired both from the spectator's and the player's standpoint. Last Saturday night, at Chicago, at the new American League Baseball Park, a semi-professional game was played under the most elaborately and carefully planned arrangement of electric light yet put in operation on a baseball field. The details of the apparatus used are described elsewhere in this issue. The general scheme was to use huge flaming-arc projector lamps with impregnated carbons 30 mm (1¼ in.) in diameter, taking about 100 amp each and so placed high up on each side of the diamond as not to interfere with sight of the ball by the players. Some parts of the field were screened from the rays of certain lamps of which the glare would otherwise have prevented the players from following balls. These high lamps were supplemented with ground lamps for lighting along the surface, these being also screened. While there is still room for improvement, the results were certainly remarkably good. The game was so free from errors as to settle once for all any question as to players seeing the ball, whether high in the air or near the ground. The spectators also could always see the ball. With all the lamps going the volume of light was more than sufficient. The most serious problem, of course, in this work is the location and screening of the lights so that the players and spectators can follow the ball with the eye. The moment a ball gets within a few degrees of a bright light, the glare of the lamp hides it by the effect of the light on the eye. Mr. Cahill, in his skillful arrangement on the Chicago field, following up his previous experiments along the same line, has succeeded remarkably well in avoiding this glare trouble, which has been the bugbear of baseball field lighting. In a recent paper before the Franklin Institute Mr. A. J. Sweet gave the results of experiments which seemed to prove that until an object approaches within 25 deg. of a light (measured from a cone of which the eye is the center) the presence of such light in the range of vision does not reduce ability to see the object. The results last week on the Chicago field seem to confirm these findings, and to show that numerous powerful lamps around a field will not interfere with vision if they are properly placed. It is not to be inferred from this, however, that with such powerful lamps vision anywhere in the field is as comfortable for the players or spectators as in daylight. There is required a certain effort to concentrate the attention on the ball in spite of the presence of the lights.

THE LIGHTING OF SMALL RESIDENCES.

The tungsten lamp, together with our present knowledge of the utilization of light to best advantage, suggests several changes from the layout of five years ago for wiring small houses. The same remark applies also to larger residences, but we shall here confine consideration more particularly to the smaller houses which some central-station companies are at present making extra efforts to secure as consumers. A number of central stations have recently made special arrangements with local contractors, or have organized their own wiring departments, to carry out the wiring of these small houses at a very low cost per outlet. This is a movement commendable in itself and has been well carried out on modern lines by many companies; but the equipment which is being provided in some of these cases indicates a lamentable lack of knowledge of modern illuminating methods on the part of those who are responsible, being of the kind that is already antiquated. In a house which is to be wired and equipped complete for $15 or less for four ceiling outlets, or a proportionate sum for larger houses, there is no place for fixtures. In such a house, where the expense must be cut down to the last cent, the money which would be spent in fixtures might better be put to some other purpose. This statement does not, of course, apply to the use of proper fixtures in a more expensive class of houses. For example, take the case of a living-room or dining-room in a small cottage. Some of the special wiring offers we have seen made by central-station companies have included two-light or three-light fixtures in both dining-rooms and living-rooms. In some cases these are a cheap old-fashioned kind of fixture, which has been out of date for a number of years and gives poor results from an illuminating standpoint on account of the fact that the lamps are hung low and placed at an angle. In such cases it would be much better to place a single neat, substantial brass ceiling socket at the center of the ceiling, equipping the lamp with a proper reflector, and devoting the money on a wall-switch outlet which would otherwise be spent on a fixture. One 40-watt or 60-watt tungsten lamp at the center of the ceiling, with a good glass reflector giving an extensive type of distribution, will give as much light as is required in the ordinary small cottage living-room or dining-room; and the use of a fixture having two sockets and two lamps to be renewed is simply a needless expense. But it may be said that it is not necessary to have as large a lamp as a 40-watt or 60-watt tungsten for such a room, and that a lamp of 20 watts to 25 watts with proper reflector would be sufficient for ordinary reading purposes. The answer to this is that if the customer must practise such rigid economy as to get along with a 20-watt tungsten lamp with the light concentrated under the lamp for reading purposes, he would fittingly come in a class which should use a

lamp and reflector hung low on a drop cord, and could hardly afford a fixture. In the cheaper class of houses, the fixtures which are likely to be installed for the low figures named in these special offers are certainly not a credit to the manufacturer, the central-station company or the art of electric lighting in general; and the small amount they cost might better be expended on other conveniences, efficient reflectors, wall switches and the like. When we get into a more expensive class of houses, where fixtures are desirable, the types with short stems, which hold the lamps near the ceiling for direct lighting, are now very largely preferred by those who are looking for illuminating effect as well as for neatness in appearance. For indirect and semi-indirect lighting the fixture is still necessary, although drop cords can be employed and have been used in such cases to some extent.

It is hard to realize, after all that has been said and published regarding correct illumination in the past few years, that central-station companies will allow antiquated equipment to be put in under their supervision. It is the old difficulty of failure to have plans passed upon by those qualified in this branch of work. There are electrical contractors and central-station men who claim that in their respective communities they cannot sell anything but the old-fashioned, flimsy chandelier with sockets at an angle. The fact of the matter is, the public buys whatever the dealers keep in stock and recommend to customers as the best and latest thing; and if customers cling to the old styles, it is because the dealers or the central-station companies have not been up to date themselves. There is also another aspect to the situation. A consumer with low chandeliers in his living-rooms may, by using small lamps, get his bills down to a point where there is no profit in serving him except with a large minimum bill; and in the latter event there is no object in the consumer having his rooms partially lighted when they might as well be adequately and fully lighted for the same money.

BUILDING UP THE CENTRAL-STATION LOAD.

How long will it be, we wonder, before central stations in general will make a determined effort to bring electric cooking and heating into real popularity? A few have tried it already and generally with very satisfactory results for all concerned, but on the whole the business is relatively small. The chief difficulty, of course, is the making of a suitable rate for meeting the peculiar exigencies of the case. On the face of things a heating and cooking load is undesirable on account of the relatively large demand and modest total consumption. But the unconsidered advantages in the case are the time of the demand, and the effect of the diversity factor. The general experience of those companies making a drive for such business is that the load thus acquired is very largely off the peak, so that the effect of the relatively large demand may be almost ignored. Take, for example, the case of the minor household appliances like flatirons, coffee urns, vacuum cleaners and so forth. These are almost universally used during daylight hours when the lighting is not on in any amount, and the lines and stations are lightly loaded. They do not even materially affect the house wiring or the house transformer capacity, since in nearly every instance the current required is less than that allowable for the smallest wire permitted by the Underwriters' rules, and the appliances are not in use when the transformer is carrying any lighting.

In the more important but less common case of electric kitchens and luminous or other radiators, the conditions are also favorable. Cooking proceeds actively only at times when the lighting load is small or on the wane. Two meals of the three are prepared at times of almost no lighting, and the evening one comes on after the cessation of the day's activities has lessened the load in shops and offices. Its general effect would be to produce a somewhat more gradual tapering off of the evening peak than is ordinarily found, which from the operating standpoint is certainly no disadvantage. There is, too, a considerable variation likely in the time of using ranges and radiators, the effect of which is still further to spread out the load and lessen the aggregate effect of the individual demands. Load of this kind is therefore rather desirable than otherwise, and if it can be secured in any considerable amount, is a very considerable addition to the income derived from the plant. It is only by the acquisition of diverse loads, in fact, that the load factor of a system can be worked upward. If the lighting load is the chief point of increase, the inevitable result is to raise the peak and load still more heavily the distribution system, increasing the difficulties of regulation and the general operating charges.

Heating and cooking load and the like is therefore good for the same reason that small motor load is good. The chief difficulty in getting the former is that by common consent motor load is taken on at rates relatively much lower than any other. It is tacitly recognized that motor rates must be low in order to get the business. The ostensible reason frequently given is that motor load requires less exact regulation than lighting, but as a matter of fact since most motors are actually on the lighting distribution system and are in use during part of the peak, they embarrass regulation instead of lessening the necessity for it. Of course, the real fact is that to get business one must quote a figure that is attractive to the customer; and since special rates are generally looked upon with disfavor, the same result must be reached by a rate system of a slightly more general character. The existence of a motor schedule is a tacit recognition of the need for a classified service not unlike that widely used in the earlier days of central-station work. It is, in fact, the beginning of such a classification. Now whether heating and cooling should be reached from the lighting rates or from motor rates, or should be classified separately, is a difficult question to decide. Those stations which have acquired a large load of minor household and manufacturing appliances have perhaps most commonly done it by means of a lighting schedule, so that a moderately liberal customer could get the benefit of a liberal secondary rate. Whether the same plan would work well as a stimulant for the larger cooking and heating business remains to be seen. It is, in fact, not a matter of large consequence how the business is secured, but it is important that it should be secured. In any city the prosperity of the central station depends upon securing a large load. The price obtainable is commonly predetermined by competition or by municipal enactments, and is constantly tending downward. Consequently, the vital question of finance is the possible load that can be secured in the given community. The lighting load is generally even now shamefully less than it should be from the failure to grasp the residential business that is the gas company's best asset. On the heating and cooking there has yet been made scarcely a beginning, hence this homily on the subject.

Convention of Edison Illuminating Companies.

The twenty-sixth annual meeting of the Association of Edison Illuminating Companies will be held Sept. 6, 7 and 8 at the Hotel Frontenac, Thousand Islands, N. Y. The following papers will be read: *A Reasonable Profit—Its Collection and Distribution,* by Mr. James V. Oxtoby; *Display Street Lighting in Toledo, Ohio,* by Mr. W. E. Richards; *Experience with Lamp Renewals,* by Mr. Louis A. Ferguson; *The Illumination of Streets,* by Mr. P. S. Millar; *Workmen's Compensation,* by Mr. Arthur Williams; *Recent Employers' Liability Legislation as Affecting Central Stations,* by Messrs. E. M. Atkin and H. M. Edwards; *The Heating Problem in Its Relation to Central Station Service,* by Mr. R. P. Bolton; *The 1910 Edison Storage Battery,* by Mr. Walter E. Holland; *Canvassing by Telephone,* by Mr. T. I. Jones; *The Supply of Breakdown Service for Isolated Plants,* by Mr. M. F. McAlpin; *Purchase Inspection of Central Station Apparatus,* by Mr. F. M. Farmer; *An Analysis of Diversity Factors,* by Mr. H. B. Gear; *Ideas, Suggestions and Methods of the Commercial Department,* by Mr. J. D. Israel; *The Electric Vehicle as a Promoter of Central Station Business,* by Mr. P. D. Wagoner; *Measuring Demand,* by Mr. R. S. Hale; *The Promise of Electrified Agriculture,* by Mr. E. D. Edwards, and *Characteristics and Operation of Relays for Tripping Oil Circuit Breakers,* by Mr. A. S. Loizeaux.

Committee reports as follows have been prepared for presentation at the meeting by the respective chairmen: *Incandescent Lamps,* by Mr. J. W. Lieb, Jr.; *Meters,* by Mr. Joseph W. Cowles; *National Code,* by Mr. William C. L. Eglin; *Storage Batteries,* by Mr. S. C. Harris; *Steam Turbines,* by Mr. Alex. Dow; *Electric Heating and Kindred Uses,* by Mr. John F. Gilchrist; *High Potential Disturbances,* by Mr. Philip Torchio, and *Electric Vehicles,* by Mr. James T. Hutchings.

There will be two business sessions daily, and a number of forms of entertainment have been provided to furnish relaxation between meetings. Mr. Thomas E. Murray, of the New York Edison Company, is the president of the association.

Convention of the Colorado Electric Light, Power and Railway Association.

The eighth annual convention of the Colorado Electric Light, Power and Railroad Association will be held at Glenwood Springs, Col., Sept. 21-23. The meetings will be held in Hotel Colorado. In addition to the papers listed below, committee reports on "Grounded Secondaries," "Insurance" and "Meters" will be presented. The subjects covered by papers are as follows: *Storage Batteries in Street Railway and Central Station Work, Attitude Which Central Stations Should Maintain Toward Their Customers, Mazda Series Street Lighting, High- and Low-Tension Pole Lines, High- and Low-Pressure Turbines, The Place of Rotary Condensers and Induction Generators in Transmission Systems.* Mr. W. T. Wallace, of the Colorado Light & Power Company of Canon City, is president of the association, and Mr. F. D. Morris, of the Colorado Springs Light, Heat & Power Company, is the acting secretary-treasurer.

Pacific Coast Electrical Exposition.

The Pacific Coast Electrical Exposition, which was planned to be held in San Francisco on Aug. 20 to 27, has been postponed to Sept. 17 to 24, the cause of the postponement being delay in completion of the new Coliseum. This building will now be completed by Sept. 1, and active preparations are being made for what will be the largest exhibition of the kind ever held on the Pacific Coast. The building has a floor area of [illegible] sq. ft., all of which will be taken up by the exhibits. The list of exhibitors, which numbers over 80, includes all the leading electrical firms in San Francisco and vicinity. Prominent among its exhibits will be those of the city of San Francisco and the Universities of California and Santa Clara. It is expected that the illumination of the building will be specially attractive, as it will be furnished by 500-watt tungsten lamps. The active management of the exposition is in the hands of Mr. D. M. Moses, general manager, 34 Ellis Street, San Francisco. The other officials who are directing the enterprise are as follows: Executive committee: Messrs. W. W. Briggs, chairman; John R. Cole, vice-chairman; Arthur H. Elliott, secretary-treasurer; J. A. Vandegrift and W. L. Goodwin. Mr. W. W. Hanscom is consulting electrical engineer and director of exhibits.

Successful Playing of Baseball at Night.

The powerful electric lighting equipment of the new American League Baseball Park in Chicago, described in some detail elsewhere in this issue, was put to its first real test in playing baseball at night on Aug. 27. Lacrosse and association football had been played successfully on the two nights preceding, but the crucial test did not come until a game of baseball was played by the light of the 20 search-lanterns placed about the park. The baseball game was between two semi-professional nines, the Logan Square and Rogers Park teams, and was witnessed by a large number of spectators. The game was played without any difficulty and proved to be a fast, snappy contest. Nine full innings were played, and the game was over in 1 hour and 10 minutes. The score was 3 to 0 in favor of the Logan Squares, and in every feature—pitching, batting, base-running, throwing to bases, fielding, and the catching of "fly" balls—the game was carried out without a hitch. Some annoyance was caused by lamps going out at intervals, but there were always enough burning so that the playing was never interrupted. The outages were due largely to the blowing of fuses, and this, on the three-wire system, affected more than one lamp. Some of the 20 operators of the hand-fed lamps were inexperienced also, but on the whole the experiment may be pronounced a complete success, only minor improvements being needed to insure smooth and uninterrupted working. The volume of light from the projectors was ample, possibly more than enough; the principal difficulty seems to be to adjust the screens in front of the lamps so as to prevent the light from dazzling the eyes of players without causing shadows. Improvement in this respect will come as the result of practical experience in manipulation. A number of electrical men were present, and they united in extending their congratulations to Mr. George F. Cahill, who designed the lighting equipment.

Agreement Between the City of Chicago and the Sanitary District to Extend the Street-Lighting System.

An elaborate contract between the City of Chicago and the Sanitary District of Chicago was submitted to the City Council of that city on Aug. 22, and will probably be passed and approved by the mayor. The city is desirous of extending its electric street-lighting system, which is now inadequate, and has entered into an arrangement with the Sanitary District, which generates electrical energy at a hydroelectric plant on the Chicago Drainage Canal, by which the district will take over the existing municipal stations and substations and supply electricity to them, at the same time nearly doubling the number of lamps in use. The Sanitary District is to undertake the financing of the proposition, and the city is to pay for the electricity used, also a fixed sum per lamp for substation operating expenses; further, the city agrees to repay the district for permanent improvements in seven annual payments. The agreement is considered an advantageous one for the city, but it also gives the Sanitary District the use of the city's pole lines and conduits, and affords the district a steady market for a large block of electrical energy during long hours of consumption. Inasmuch as the contract is a unique one in many respects, being between two municipal bodies and providing a rather novel and interesting arrangement, the following details may be of general interest.

The city of Chicago is the owner of 13 electrical stations and substations. The possession of these stations and their

contents, as well as all transmission lines, conduits and electrical equipment connected with them on the primary or incoming side, is yielded to the Sanitary District during the life of the contract. Any desirable changes in cables, wires, connections or equipment may be made by the district, if the city electrician and electrical engineer of the district agree that it is a desirable improvement. The district may use space in the city's conduits, and on transmission lines and pole lines, not required for municipal purposes, for its own requirements. Another provision is that the district may use the city electrical equipment during those hours of the day when it is not required for municipal purposes, and also during the hours of street lighting if a dangerous overload is not developed by doing so. The city is given the privilege of using unoccupied space in the district's conduits and on the district's poles and towers in the same way as the district is allowed to use unoccupied space in similar equipment owned by the city.

During the term of the contract the district agrees to accept the substations, transformers and transmission lines of the city and to manage and operate them. The city on its part agrees to manage and operate all distributing circuits, for which the district has supplied the electrical energy. The distribution is taken to include cables, wires, poles, arc lamps, etc. "Transmission lines" are defined as lines used between the terminal station of the Sanitary District and the point or points where the distribution lines center. "Distribution lines" are used between the ends of transmission lines and the street-lighting lamps operated, and include the lamps.

The district agrees to furnish and install all conduits, wires, cables, poles, lamp-posts, lamps and other electrical equipment necessary to change the present direct-current arc lamps into such improved modern equipment as may be agreed upon by the city electrician and the electrical engineer of the district, so as to constitute a new operative electric system of 10,000 complete 450-watt arc lamps, in addition to the lamps already in service. It is provided that a different type of lamp may be used if the total consumption of electrical energy is not increased.

The existing 12,200 street arc lamps of the city are to form a part of the system to be supplied with electricity by the district through stations and substations turned over by the city to the district. The 10,000 new lamps to be installed shall be located by the city electrician at the rate of 500 a month, beginning not later than six months after the date of the ratification of the contract. When 3000 lamp locations are thus decided upon, the list of locations and the plans shall be turned over to the electrical engineer of the district, and he and the city electrician shall determine upon the location of the new substations. Plans for these substations and transmission lines shall be prepared by the district, while plans of the new distribution lines shall be prepared by the city electrician. Each of these officers shall submit his plans of this description to the other for approval.

It is provided that about 50 lamps shall be on each circuit, and from 30 to 60 circuits shall be supplied from one substation. At least three additional substations will be built by the Sanitary District. The entire additional system of 10,000 lamps is to be installed in three years from the date of approval of the location of all additional substations. Not less than 3000 lamps shall be installed in each of the three years mentioned.

The Sanitary District agrees to furnish all electrical energy required for the city lighting system for seven years after service is first begun. This demand for electricity is for arc lamps now installed, as well as the new ones to be placed, up to the number of 10,000. The district agrees to use all reasonable diligence to provide regular and uninterrupted service, but it does not guarantee to do so. The city also agrees to take from the district any additional electrical energy it may require for public buildings, pumping stations, bridges, etc., at a price to be agreed upon hereafter. The district promises to furnish electricity for existing street lamps immediately after it has taken over the city's electrical equipment, so that there will be no interruption to service.

All contracts awarded by the district in pursuance of this agreement are to be approved by the city electrician. The city agrees to pay the district monthly for electrical energy consumed under the contract at the rate of $15 per hp per year. The supply is to be metered at the primary side of substations. In addition, the city agrees to pay $1 a year, for substation operating expenses, for each 450-watt arc lamp, or its equivalent, supplied with electricity.

Means for the testing of meters are provided. The amount of electricity furnished shall be determined by taking the highest peak of five minutes' duration, shown on the load curve plotted from the sums of approximately simultaneous readings taken graphically at all of the substations in use at the time of such readings in any night's operation during the billing period.

Electrical energy is to be furnished by the district for an average period of 11 hours each day, ranging from 8½ hours in May, June and July to 14 hours in November and December.

The city agrees to repay the district for the money expended for building substations and in rearranging, repairing, furnishing and installing the cables, wires, conduits, poles, towers, lamp-posts, arc lamps, etc., which may be installed for the existing or extended street-lighting system. This repayment is to be in equal annual installments, with interest, ending in 1918. The district will undoubtedly raise the considerable amount of capital needed to finance this extensive undertaking by a bond issue, which the city cannot do because it is too near the limit of its bonded indebtedness imposed by law. It is probable that the management of the city street lighting will be made an entirely distinct department of the business of the Sanitary District, so that the bookkeeping and accounts of the general business and the Chicago street lighting department of the district may be kept separately.

The total number of arc lamps to be used for street lighting under this arrangement will be 22,200, and when the plan is in complete operation Chicago should be one of the best lighted cities in the country.

Montreal Lighting Controversy.

The fourth consecutive week of hearings in the $250,000 case of the Montreal Light, Heat & Power Company against the city began on Aug. 24. The sessions lasted only two days and then adjourned until Sept. 13, in order to permit the plaintiff to prepare and file a mass of information regarding station records, detail expenditures, and even names of employees called for by the attorneys of the city. The arbitrators also desired an extended recess, as Professor Herdt's duties in connection with the Winnipeg electrical development require his presence in the West early in September, while Mr. Block has the Toronto electrical exhibition on his hands this week, and Chairman Dion's attention is required in Ottawa where the city authorities are contemplating an extensive removal of poles and wires and the substitution of underground conduit distribution.

At the hearings the cross-examination of Mr. R. M. Wilson was continued, and his testimony has now made a record of nearly 15,000 words. A large number of additional station load curves, similar to the one published in these columns last week, were presented, and also maximum load readings at each distributing station for every day in the year 1908, together with a statement of number and capacity (manufacturers' rating) of all transformers and switches in city stations. Data were also placed on file giving the hours of operation of each engine and boiler in the reserve steam plants during the year 1908, and also itemized statements of expenditures, accompanied with vouchers.

Mr. Wilson has testified that the average of the maximum loads, at a given moment on all city distributing stations' busbars, was 18,808 kw for 1908 and 20,421 kw for 1909, thus making the arc load of 1000 kw 5.3 per cent of the total average maximum load during 1908, and 4.9 per cent during 1909.

Records introduced show that the company actually paid out to employees on account of accident and insurance in connection with the city arc lighting practically 3 per cent of the

gross income therefrom. As noted in another column, the city of Montreal has just issued specifications calling for new bids for city lighting to be begun Nov. 1 next, the bids to be submitted before the arbitrators reconvene. Thus an interesting side light as to city lighting in Montreal may be expected before the present hearings are further advanced.

Results of Electrical Operation at Holyoke, Mass.

The Electrical Department of the city of Holyoke has made its annual return to the Massachusetts Gas & Electric Light Commission for the year ending June 30, 1910. The total number of customers supplied with electricity is 1892. The cost of the electric plant is given as $865,598, the four largest items being: Steam plant, $259,980; electric plant, $223,501; real estate, $159,301, and lines, $97,680. The total income from the sale of electricity was $221,745, including street lighting. Electric power sales amounted to $92,702, and the power output sold was 5,518,645 kw-hours. The average return for electric power was 1.68 cents per kw-hour. The total sales of the city were about 7,933,000 kw-hours, and the total income per kw-hour averaged about 2.8 cents. The plant delivered 8,957,120 kw-hours at the switchboard during the year, at a cost of $95,386 at the station, or 1.06 cents per kw-hour, exclusive of any fixed charges. The income from commercial lighting was about $90,400. The total assets on June 30 last as shown by the books were $1,486,035. The boiler plant included 3400 hp in steam generating equipment, and there are now in service three Curtis turbines of 5329 hp total rating. There are four waterwheels in the plant rated at 280 hp each and operating under a head of 20 ft. The electric generators include two General Electric 2300-volt, three-phase, 350-kw alternators driven directly from the jack shaft run by the waterwheels, and three alternators driven by the turbines, the capacity of these machines being 2500 kw, 1000 kw and 500 kw.

Motor Trucks for Railroad Station Service.

Mr. T. V. Buckwalter delivered a paper before the convention of the Society of Automobile Engineers at Detroit, on July 29, devoted to the application of motor trucks to railroad station service. The possible applications of motor trucks for this service were classified as follows:

First, trucks utilized to replace box cars in the transfer of freight between different stations in the same city; second, trucks to replace horse-drawn vehicles in the transportation of both passengers and merchandise on the public highways; third, trucks to replace manual labor in the handling of baggage and mail in large stations, machinery and supplies in railroad shops, and in the transfer of freight in large freight and transfer stations.

The transfer of freight between two stations, when accomplished with motor trucks instead of box cars, results in quicker service, more available platform area, more useful track space and more box cars available for freight transportation.

Regarding the second use of trucks, the author points out that experiments of the Pennsylvania Railroad with taxicabs have demonstrated the success of the passenger service and that whatever troubles have been encountered were due to faulty design. Gasolene motors were recommended for this class of service. For freight haulage and delivery the advantage of motors over horses depends largely upon the character of the work. If the bulk of the time is spent loading and unloading, little if anything will be gained by substituting motors for horses.

The third class of service, where motor trucks are used to reduce manual labor, forms the main portion of the paper. He describes a series of tests carried on by the Pennsylvania Railroad with trucks used for handling baggage in the Jersey City Terminal.

As a result of these experiments new trucks were designed with the following requirements in mind:

(1) Arrangement of controlling apparatus to be operated with equal facility from either end, avoiding the necessity of turning on narrow platforms and runways; (2) Provision for driver to ride for the purpose of running at a higher speed; as a means of conserving his energy for transfer of baggage at his destination, and to give him more positive control of the truck; (3) Operation of brake with least effort and in a manner most natural to inexperienced men; (4) Reverse motion in natural manner; (5) Ease of steering, resulting in more positive control; (6) Flexible frame, on 4-point support to provide greatest stability, with each wheel carrying its quota of load; (7) Increase of tread so that wheels are just within protection of side sills and reduction of hub projection to rim of wheels, to reduce possibility of collision with railroad equipment, columns and other trucks; (8) Flexible suspension of batteries; (9) Direct operation of controller; (10) No projection of controlling apparatus beyond end sills of truck when not in use.

Based on these requirements new trucks were designed and these were described by Mr. Buckwalter in great detail and illustrations were shown of two different types of chassis.

Excellent Showing of Electric Commercial Vehicles.

On Aug. 12 69 motor trucks of all sizes, powers and types participated in the *North American's* motor commercial vehicle run from Philadelphia to Atlantic City, via Camden, and return. Nine of the vehicles were electrics, which, although competing out of their class, and taken from active service and without special preparation, made records of moment. The distance between Camden, N. J., and Atlantic City is 60 miles, and the return run was made on Aug. 13.

According to the rules governing the contest, each truck was weighed-in, both empty and full, and in order to facilitate matters three weighing-in stations were established. The schedules of speeds established were as follows: Class "A," 1½ tons and less, 12 miles per hour; class, "B," 3001 lb. to 5999 lb., 10 miles per hour; class "C," 3 tons and over, eight miles per hour. In reckoning the results a penalty of one point was imposed for every half minute a car departed from the schedule, and the awards were based on the ability of cars to make time schedule and for smallest outlay for electricity. The actual load carried by the vehicle over and above its own weight formed the basis of computations. The energy consumed was charged for at a rate of 4 cents per kw-hour. The results were as follows:

PERFORMANCE OF ELECTRIC COMMERCIAL VEHICLES.

Maker	Weight empty, lbs.	Load carried, lbs.	Penalties	Kw-hours used	Cost per ton-mile
	CLASS A.				
Commercial truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Commercial truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Commercial truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
General vehicle	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	CLASS B.				
General vehicle	[illegible]	[illegible]		[illegible]	[illegible]
Commercial truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Commercial truck	[illegible]	[illegible]	[illegible]	[illegible]	
	CLASS C.				
*Commercial truck	10,250	7000	0	83.190	0.00792
General vehicle	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* Winner. † Meter defective.

The nine vehicles came within 100 per cent of each other on cost per ton-mile, while those of a single manufacturer came within 43 per cent on cost per ton-mile. The gasoline vehicles showed a difference of 867 per cent. Gasoline vehicles of the same manufacture showed a difference of 143 per cent. The lowest cost per ton-mile for the gasoline vehicles was $0.00705 and the highest $0.06814. Every electric vehicle finished the run and 11 per cent of the gasoline vehicles, seven trucks, failed to finish.

American Society of Engineer Draftsmen.

On June 18 the first steps were taken toward the formation of a permanent organization to be known as The American Society of Engineer Draftsmen, the scope of which is to embrace every branch of the engineering profession, including electrical, mechanical, civil, architectural, marine, sanitary, auto-

mobile and aeronautic. The first regular meeting of the society was held on July 7, at which the following officers were chosen: President, Mr. E. Farrington Chandler, of E. W. Bliss & Co., Brooklyn; vice-president, Mr. William B. Harsel; secretary-treasurer, Mr. Henry L. Sloan. Headquarters have been opened at 116 Nassau Street, New York, and the work of extending the organization is being actively pushed.

The constitution and by-laws of the society are similar to those governing other engineering societies, and it is proposed to have regular monthly meetings at which papers will be read, and technical topics discussed. The principal objects of the society are the advancement of engineering knowledge and practice, and the maintenance of a high professional standing among its members. An engineering library will be established, and also an employment bureau for the benefit of the members. It is the aim of the society to maintain a high standard among members in order to secure recognition and cooperation from all concerns employing draftsmen. There are three classes of members, as follows: Honorary members, who may be elected from leaders among the engineering profession; active members, who shall be competent as designers, and in the preparation of drawings for actual construction; junior members, who shall be competent as tracers, or in any other subordinate position in the drafting room; this latter grade is intended to be preliminary to final qualification for active membership.

Computation of Annual Franchise Tax in New York on Electrical Companies.

An important decision has recently been made by the New York Court of Appeals, construing the New York statute, placing an annual tax upon the gross earnings of lighting, power and other companies. The statute is section 186 of the Tax Law and imposes an annual tax of five-tenths of one percentum upon the "gross earnings from all sources within this State" of "every corporation, joint stock company or association formed for supplying water or gas, or for electric or steam heating, lighting or power purposes." The statute defines the term "gross earnings" to mean "all receipts from the employment of capital without any deduction." This was added as an amendment to the statute in 1907. The question presented to the court was whether the State was entitled to include in the "gross earnings" amounts which represented the "cost of raw materials converted into gas and electric current." It was argued by the Westchester Lighting Company that, in spite of the amendment, the statute still limited receipts for the purposes of taxation to such as resulted from the "employment of capital," as contradistinguished from receipts representing the replacement of capital. It was held, adversely to the contention made in behalf of the company, that it was not entitled, under the statute as it now reads, to deduct from the gross earnings the amount thereof which had been expended during the year for raw material to be converted into gas and electric current.

Referring to this argument it was said: "The argument has its force unquestionably. The bituminous, or coking, coal, which is placed in retorts for the production of coal gas, or the anthracite coal, or coke, through which, when in an incandescent state, steam is passed for the production of water gas, or the coal which, used as fuel, is converted into power and produces electricity, all, indeed, represent investments, or the employment of capital and the return of the cost in the price of the product is a return of capital. But the argument does not suffice to meet the objection that the Legislature meant to enlarge the scope of the franchise tax by including all moneys that were received as products of all uses of corporate capital 'without deduction.' Doubtless the legislative intent is inartistically expressed; but, if that intent can be spelled out from the words of the statute, effect must be given to it. . . . In this amendment it can not be denied that the Legislature has chosen to give a definition to the term 'gross earnings,' which makes it include all receipts, and caps its mandate in that respect, by adding the words 'without any deduction.' When the statute provides for taxing 'gross earnings from all sources,' and adds that that means 'all receipts from the employment of capital without deduction,' however the language offends against the normal concept, we must regard the law as classifying with earnings, for the purposes of the tax, all receipts from the use of capital. That is what the Legislature has done. Its enactment measures the tax for the privilege of exercising the corporate franchises by a percentage upon all receipts of the company, which the use of its capital originated."

The same question came up before the adoption of the amendment of 1907 in the case of People ex. rel. Brooklyn Union Gas Company vs. Morgan, 114 N. Y. App. Div. 266, where it was held that, for the purpose of estimating the gross earnings of the company, it was entitled to deduct the sum of $947,546.28, representing the amount spent during the year for raw material. The following is quoted from the opinion: "The Comptroller has fixed the tax, not on the 'gross earnings,' as required by the statute, but on its gross receipts. Capital of a corporation, which must first be invested, before it begins to earn anything, cannot be said to be a part of the earnings of such corporation merely because it is turned into cash and thus in one sense becomes a receipt of the corporation. Earnings do not include capital, but are the productions or outgrowth of capital. In some cases like the one now under consideration the capital must be supplemented by labor and such other expenditures as may be incidental to the development of the manufactured product from the raw material. Such incidental expenditures are doubtless part of the 'gross earnings.' If the coal in question had been used under the boilers for developing heat, such coal, like labor, would be merely an incidental expenditure in the process of converting the capital from one form into another, and should probably be included as part of the 'gross earnings' of the company. But the evidence is that the coal in question was not used in generating heat, but was of a different kind and was converted into gas. In fixing the 'gross earnings' of the relator there should, therefore, have been deducted from the gross receipts the cost of the raw material, which amounted to the said sum of $947,546.28."

The effect of this decision is overcome by the amendment of 1907, and under the statute as it now stands companies of the character referred to in the statute must include amounts expended for raw material in figuring the amount of their "gross earnings" for the purpose of computing the amount of the annual franchise tax. People ex rel. Westchester Lighting Company, New York Court of Appeals, 92 N. E. Rep. 230.

Roosevelt on Conservation.

Ex-President Roosevelt in a speech in the Auditorium at Denver, Col., on Aug. 29, gave his views on the conservation question to the immense throng which crowded the structure. These opinions, coming as they do from so noted a person and the oracle of the conservation school, are bound to exert some influence on the Government's policy toward the issue. Speaking of the control of natural monopolies in the interests of the people, Mr. Roosevelt said:

"Conservation does not mean non-use or non-development. It does not mean the tying up of the national resources of the States. It means the utilization of those resources under such regulation and control as will prevent waste, extravagance, and monopoly, but at the same time not merely permit, but encourage, such use and development as will serve the interest of the people generally. . . . The conservation question has three sides. In the first place, the needless waste of the natural resources must be stopped. . . . The Nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased and not impaired in value, and behaves badly if it leaves the land poorer to those who come after us.

"In the second place, the natural resources must be developed promptly, completely, and in orderly fashion. It is not conservation to leave the natural resources undeveloped. Development is an indispensable part of the conservation plan. The

forests, the mines, the water powers, and the land itself must all be put to use. Those who assert that conservation proposes to tie them up, depriving this generation of their benefits in order to hand them on untouched to the next, miss the whole point of the conservation idea. Conservation does not mean depriving the men of to-day of their natural rights in the natural resources of the land. All it means is that we of this generation shall so use our rights as not to deprive those who come after us of their natural rights in their turn.

"In the third place, so far as possible these resources must be kept for the whole people and not handled over for exploitation to single individuals. We do not intend to discourage individual enterprise by unwisely diminishing the reward for that enterprise. On the contrary, we believe that the men of exceptional abilities should have exceptional rewards up to a point where the reward becomes disproportionate to the service, up to the point where the abilities are used to the detriment of the people as a whole. We are for the liberty of the individual up to, and not beyond, the point where it becomes inconsistent with the welfare of the community. Thus our consistent aim is to favor the actual settler—the man who takes as much of the public domain as he himself can cultivate, and there makes a permanent home for his children who come after him; but we are against the man, no matter what his ability, who tries to monopolize large masses of public land."

On the control of water powers the ex-President said:

"The enormous importance of water-power sites to the future industrial development of this country has only been realized within a very few years. Unfortunately, the realization has come too late as regards many of the power sites, but many yet remain with which our lands are free to deal. We should make it our duty to see that hereafter the power sites are kept under the control of the general government, for the use of the people as a whole. The fee should remain with the people as a whole, while the use is leased on terms which shall secure an ample reward to the lessees, which shall encourage the development and use of the water power, but which shall not create a permanent monopoly or permit the development to be anti-social, to be in any respect hostile to the public good. The Nation alone has the power to do this effectively, and it is for this reason that you will find these corporations which wish to gain improper advantage and to be freed from efficient control on the part of the public, doing all that they can to secure the substitution of State for National action."

Rejuvenated Sons of Jove.

Announcement is made that the eighth annual meeting of the Order of Rejuvenated Sons of Jove will be held in Birmingham, Ala., on Oct. 13, 14 and 15, 1910. This announcement will be of interest and will be readily understood by many readers of these pages, but there may be others, perhaps, who will think it rather strange that the doings of what is apparently a secret society, with an unusual and perplexing name, should be of general interest to electrical men and worthy of attention in the columns of an electrical journal. For the benefit of this latter class some account of the origin, organization and aims of the Sons of Jove may be of interest.

The organization is composed of persons engaged in electrical pursuits or allied industries, and its principle purpose is frankly commercial—to harmonize and fraternize the different elements in the electrical business, to eliminate petty jealousies and distrust, unfair competition and questionable methods, and to increase the market by effective co-operation. Allied with this is an element of mystery and of fun-making, with social relaxation, but the main significant purpose is co-operation, living up to the motto of the order, which is: "All together all the time for everything electrical."

In the days of Greek and Roman mythology the legend ran that the god Jupiter, or Jove, reigned over all things, with his [illegible] on Mount Olympus. He was represented as majestic in appearance, and when seated on the throne had a scepter in one hand and thunderbolts in the other. Jupiter, then, according to the ancestral line traced by the Sons of Jove, was the earliest controller and dispenser of the thunderbolts of electricity. "Glorious he sat," according to the conception of one of their writers, "upon his high throne on Mount Olympus, with Juno by his side; with forked lightning grasped in his right hand, typical and prophetic of the day which was to come, and which has come, when mortal man should in fact control the 'fiery fluid' and make it subservient to the uses of mankind."

With this grand figure in view, it is not strange that when the idea was conceived of forming a co-operative and social organization of electrical men Jupiter, the ancient deity of mythology, should have been selected as the traditional titular protector of the phenomena of electricity. It is declared that the Sons of Jove are the disciples of electricity of the present day and of the future. Therefore, the society was called the Order of Rejuvenated Sons of Jove, and with this mythological explanation the name is understandable.

The similitude to the court on old Mount Olympus is carried out in many ways. The affairs of the order are directed by a Jovian Congress of nine members, each of whom bears the name of a god or hero of mythology. The supreme head is the reigning Jupiter, and the other officers are known as Neptune, Pluto, Vulcan, Mercury, Hercules, Mars, Apollo and Avrenim. These are all familiar names, except the last, and that is simply the result of a little masculine stratagem to disguise the name Minerva by spelling it backward. Mercury performs the duties of secretary for the order. There is a secret ritual, but there is no concealment made in relation to the aims and purposes of the order, and it is a cardinal principle of Jovianism to exhibit a broad spirit in co-operating and working with all other electrical organizations.

The members of the Jovian Congress are elected at the annual meeting. Their tenure of office is limited to one year, and no Jovian may be re-elected to fill an office once held, except in the case of Mercury, the secretary. Executive officers, known as Jovian Statesmen, to the number of 100, may be appointed by Jupiter, subject to the approval of the Jovian Congress, to preside over territorial districts within the continent of North America and also dependencies of the United States. Jovian Statesmen serve for one year, unless removed for cause, and they may be reappointed. There are now 70 Jovian Statesmen, including 13 statesmen-at-large, for United States, one at Montreal, Canada, two at Toronto, Canada, and one in Mexico. The others are scattered through the various States of the Union.

There is but one regular meeting, which is held annually, and it is fixed to include Jupiter's Day, which falls on October 15. The annual meeting is always held in the city which is the place of residence of the reigning Jupiter. Meetings for rejuvenations (initiations) may be held at such times and places as may be desired, authority being granted, and such meetings are generally held at electrical conventions, electrical shows or other occasions where there is a general gathering of electrical men. In the past some of these initiations have been rather boisterous, but recently they have been conducted in a more dignified manner. An assistant to Jupiter is appointed and he is the business manager of the order, giving his whole time to the work, with an office in Chicago.

The members of the Jovian Congress now in office are: Jupiter, Oscar C. Turner, Birmingham, Ala.; Neptune, John F. Dostal, Denver, Col.; Pluto, Frank M. Bernardin, Kansas City, Mo.; Vulcan, James A. Campbell, Detroit, Mich.; Mercury, R. M. Van Vleet, Chicago, Ill.; Hercules, W. W. Lovell, Toronto, Ont.; Mars, Harry V. Carter, San Francisco, Cal.; Apollo, James A. Vaughan, Philadelphia, Pa.; Avrenim, Thomas A. Burke, Atlanta, Ga. Edward D. Strickland, 1157 Monadnock Building, Chicago, Ill., is the assistant to Jupiter.

The statesmen-at-large for the United States are as follows: Messrs. Julien Binford, Jr., Richmond, Va.; Victor L. Crawford, St. Louis, Mo.; Charles M. Crofoot, Cincinnati, Ohio; Ernest H. Haughton, Chicago, Ill.; Chauncey L. Hight, Boston, Mass.;

Philip H. Hover, New York City; Ja[illegible] B. Olson, New York City; Albert N. Palmer, Pawtucket, R. I.; Thomas C. Ringgold, Schenectady, N. Y.; F. V. L. Smith, Atlanta, Ga.; Edward D. Strickland, Chicago, Ill.; James R. Strong, New York City; Frederic P. Vose, Chicago, Ill.

The Order of Rejuvenated Sons of Jove was first established at Austin, Tex., on May 5, 1899, as a means of entertainment for the representatives of electrical manufacturers and dealers present at conventions while duly accredited delegates were in executive session. The charter membership numbered 44, and the first Jupiter was Mr. C. W. Hobson, of Dallas, Tex. It may be noted here that the succeeding Jupiters or presidents have been Messrs. H. F. MacGregor, of Houston, Tex.; S. A. Hobson, of St. Louis; C. A. Newning, of Houston; H. B. Kirkland, of Pittsburg; W. E. Robertson, of Philadelphia, and J. Robert Crouse, of Cleveland. The present incumbent is Mr. Turner, as has been mentioned.

At first the order grew rather slowly. During the first six years and a half the membership increased to 241. During that time the ritual was developed and the essential characteristics of the order were formulated and established. Over 3000 members have been added since Jan. 1, 1906, making a total membership of nearly 3500, well distributed throughout the United States and Canada. Membership in the order is limited to 10,000 white male persons over the age of 21, who are engaged in any of the branches of the science, art or business of electricity, or in any business allied so closely with electrical development that it may be considered practically a part of it. The initiation fee is $10 and the dues are $2 a year. The year is reckoned from October 15. No other taxes or assessments are allowed under the constitution. There are no insurance features. The order has no permanent headquarters (except the office of the assistant to Jupiter) or any clubhouse. A number of Jovian lunch clubs have been established in various cities, however, and in several cases these have broadened out and developed into general electric clubs of wide usefulness. Each Jovian is given a number and is also entitled to wear the small but readily recognized badge of the order.

In the original planning of the Sons of Jove it was provided that there should be five degrees, but the degree work has not yet been taken up, and one Jovian stands on exactly the same footing in this respect as every other member of the order. The members of the Jovian Congress are elected by a majority vote at the annual meeting, a roll call by states being provided. The voting at the annual meeting is by states, according to the constitution. The members present cast the votes of the entire membership of the states in which they reside. In case more than one member is present from one state the total vote of that state should be equally divided among the members present from that state.

The order has great possibilities in fostering an interest on the part of the public in the use of electrical appliances, creating a greater market for the benefit of all. It is expected that the annual meeting in October will be well attended. It is remarked that the order was founded in the South, but no annual meeting has been held there for the last four years. The convention will be held during the cotton-picking season, and in addition to the business sessions there will be various entertainments and side excursions to Chattanooga, Lookout Mountain, the National Cemetery and other points. It is also pointed out that the Appalachian Exposition at Knoxville is held from Sept. 12 to Oct. 12 and that the Alabama State Fair at Birmingham will be held during the week of the convention.

New York Commission News.

The appointment of Mr. W. C. [illegible] chief of the Division of Statistics and Accounts [illegible] by the Public Service Commission for the Second District to succeed Mr. William J. Meyers, who has assumed an important post with the Interstate Commerce Commission at Washington. Mr. Wishart is a former resident of Brooklyn, and for the past two years has been an examiner in the Division of Statistics and Accounts of the Interstate Commerce Commission. During the years 1901 and 1902 he was assistant secretary of the Corporation Commission of North Carolina, which has jurisdiction over all transportation agencies in that commonwealth. Prior to that time he acted as an accountant for the Terminal Railways in Brooklyn, and was also associated with the DuPont Powder Company in a similar capacity. He will assume his duties on Sept. 1.

Canadian Hydroelectric Commission News.

According to reports in Western Ontario, it is expected that the hydroelectric energy will be supplied from Niagara Falls to Berlin, Ontario, about Sept. 2, and then the transmission line will be completed to London. It is expected that energy will be delivered in London in October.

It is now stated that the London Electric Company is willing to sell out to the London city corporation at a lower figure than that first named some months ago when negotiations were opened between the company and the corporation. Some representations have been made that the company should be allowed to sell to the city without a vote of the people, the water commissioners to take over the plant for the city. Such a scheme, however, is not likely to be considered by the commissioners.

There are rumors that the Cataract Power Company of Hamilton will extend its transmission line to London to aid the local electric company, but nothing definite is known. It is thought the Cataract Company is awaiting developments at London before going on with the railway and power line extension from Brantwood to Windsor. The London Street Railway Company has been offered Niagara energy by the commission on a basis which it is expected will remove the railway company's objection against the peak load method of charge. The new offer proposes that there shall be an average struck for each month, the company to pay upon the average consumption. If the peak load on 29 days of the month is 800 horse-power, and on the 30th day is 1200 horse-power, the whole consumption will be aggregated, divided by the number of days, and the company will pay upon the average, the price being at the rate of $31 per horse-power per annum. General Manager C. B. King, of the street railway, stated that the company had received no definite offer other than the form of contract first submitted. It is expected, however, that the commission will have the offer put in formal shape and submitted to the company at once.

By a vote of 324 to 61, the ratepayers of Tilsonburg, Ontario, on Aug. 22, endorsed the by-law providing for the raising of $25,000 to install the necessary equipment for distributing hydroelectric energy in the municipality. The overwhelming majority in favor of the by-law was somewhat of a surprise to the citizens, as for some weeks a strong campaign has been waged against the scheme. Hon. Adam Beck, chairman of the commission, addressed the citizens on Aug. 19 in favor of the Hydroelectric by-law.

Mr. W. K. McNaught, M. P., member of the Hydroelectric Commission, in a recent address pointed out impressively the present and future importance of Ontario's supply of "white coal." Against Ontario's lack of coal and dependence on a foreign country is counted a multitude of large and small water powers aggregating 7,231,787 horse-power, of which the Niagara district has 2,000,000 hp, central Ontario 2,201,187 hp and northern Ontario 2,030,600 hp. The cash value of this energy, estimated on the basis of $3 per ton for coal, would be $180,000,000. The magnitude of this is appreciated by a comparison with the total crop output of Ontario, which for 1908 was $164,077,282. An estimate of the saving that may be effected by hydroelectric development as distinguished from the aggregate value of the development is based on a difference of $20 per annum per horse-power between the cost of coal and the cost of water power. This estimate gives $60,000,000 as the possible aggregate saving per annum.

As to present development, Hon. Clifford Sifton, chairman of the National Conservation Commission, estimates the aggre-

gate at 514,890 hp for the Dominion and 331,157 hp for Ontario, which saves the province from importing, according to Hon. Mr. Sifton's coal equivalent, 7,285,000 tons of coal. Mr. McNaught's estimate is lower than Hon. Mr. Sifton's. He places the total at 232,000 hp, which is quite sufficient to impress the present as well as the future importance of this source of wealth.

Maryland Commission News.

The Chesapeake & Potomac Telephone Company has submitted to the Maryland Public Utilities Commission a new schedule of rates affecting principally business service. The most notable change is that the unlimited service for business houses is entirely abolished and all business house service is placed on a measured rate service basis. In the measured-service schedule for business houses the reductions in the various grades amount to as much as $30. Their rate for 600 messages or less is reduced from $48 annually to $42; 1000 messages, from $66 to $60; 2100 messages, from $105 to $99; 3000 messages, from $132 to $126; 4200 messages, from $168 to $150; 5400 messages, from $204 to $174.

Another plan proposed by the company provides for a measured service rate, but without refunds for calls not used, which are permitted under the schedule given above. This plan provides a flat rate for the number of messages contracted for and this rate must be paid whether the calls are used or not. For private branch exchanges on a 3000-message basis, with two trunk lines and two stations, there is a reduction of $6 from the regular rate and with a service of 8400 calls there is a reduction of $90 made. The two-part line at $2.50 a month for business houses with limited telephone needs is continued, the rate covering 30 messages a month.

For residences the present rate of $48 a year for unlimited service is not changed. The residence party-line rate of $36 a year for 600 calls or less is abolished. A party-line rate of $24 a year for 30 calls or less a month is established and is a reduction of $6 a year from the present rate for this service. A subscriber for this rate is entitled to 30 calls a month and is charged 5 cents for each additional call.

The commission has announced that no hearing would be held on the proposed decrease suggested by the Chesapeake & Potomac Company until Oct. 24. Pending this hearing the commission will not permit the suggested rates to go into effect, although the date for the new schedule is Sept. 1. Delay in the hearing was desired by the commission in order that it could prepare itself by making a thorough study of the telephone business. Neither Vice-President Bethel, of Philadelphia, who filed the proposed schedule of rates for the company, nor Mr. Bernard Carter, the legal representative of the Chesapeake & Potomac, are in Baltimore, and it is regarded as necessary to await their return before any definite steps are taken.

Much opposition to the new rates has been manifested and the commission is kept busy with the complaints that are coming in. The chief point of objection seems to be the elimination of the unlimited service business telephone. Secretary Louis M. Duval says that the commission has received a number of letters protesting against the commission accepting the new schedule of rates if unlimited service is to be abolished. The fact that protests have already been made against the elimination of that class of phone had led to the belief that a concerted protest will be made at the hearing on Oct. 24, and that steps will be taken by the present holders of contracts to have the unlimited service retained. A large number of the complaints pointed out the fact that the limited phone service afforded the subscriber no opportunity to keep account of the number of calls used. It was therefore suggested to the commission that the new rates should not be allowed to go into effect until the company could provide an automatic arrangement that would register the number of calls used.

The commission having learned that there are "dead" wires on numerous streets in the city, the Maryland Telephone Company, to which the wires belong, has been ordered to remove them by Aug. 30. The investigation was the result of an accident which occurred last week when several persons were severely shocked. Mr. C. E. Bryan, vice-president of the Maryland Telephone Company, notified the commission that the work of removing all of the company's overhead "dead" wires had been begun some time ago and the work would be finished by the time specified by the commission.

New Jersey Commission.

The New Jersey Board of Public Utility Commissioners has requested all gas, electric light, water, sewer, telephone and telegraph corporations, associations and joint stock companies, operating within the State of New Jersey for public use, to furnish information to the board as follows:

1. A complete schedule of all rates charged for service of any kind within the State.

2. A list of all persons or corporations receiving service at other than the published schedule rates.

3. The rate charged in each instance for such service and the rate which would ordinarily apply.

4. Whether rates, other than published schedule rates, are based on contracts terminable at the will of the public utility.

On Sept. 15 a meeting will be held to which every central-station company in the State has been asked to send a representative to confer informally with Mr. Philander Betts, electrical engineer of the commission.

Massachusetts Commission News.

The Massachusetts Highway Commission has issued a report on the telephone charges of the New England Telephone & Telegraph Company in the Boston & Suburban District, which in general accords with the exhaustive report upon this subject submitted to the board a few months ago by the engineering firm of D. C. & W. B. Jackson, Boston and Chicago. The investigation has covered a period of nearly four years, and the effect of the studies made is to order sweeping reductions in the prices of telephone service in a territory having over 120,000 subscribers. The zone system is to be adopted, and unlimited rates are to be abolished except in the zones. By this means certain large users of telephone service who secured their facilities at a price per call less than the wages of the operators serving them will be required to pay more nearly the proper revenue. The principal changes from the recommendations of the Jackson report are:

1. The existing private branch exchange rates and the single-party measured service rate, both sets covering the whole Boston and suburban area, are retained.

2. The 5-cent toll rates to and from the metropolitan center are extended to cover an area with a radius of eight miles from the center of Boston instead of one with a radius of 7.5 miles.

3. The 5-cent eight-mile radius is also applied to inter-zone calls from any exchanges within the whole district.

4. The present local toll rate of 10 cents between adjoining exchanges on opposite sides of the suburban boundary is reduced to 5 cents for all distances not exceeding five miles.

5. Four-party coin-box guarantees are to be made up from the yearly receipts, and all toll calls within the district are to be counted as a part of the guarantee.

6. The yearly guarantee on one and two-party measured service is to include all calls within the 5-cent toll radius of eight miles.

The commission expects that the net revenue of the company in the Boston district will fall off by about $400,000 at the outset, but that in a short time the increased business will be sufficient to meet the situation. In 1909 the net revenue of the company increased by $600,000 under the existing rates. About 10,000 new wire lines will be installed for the conversion of existing four-party unlimited suburban residence service into two-party lines.

The Boston & Eastern Electric Railroad Company has petitioned the Massachusetts Railroad Commission to reopen hearings upon its request for a certificate of public convenience and

necessity. About a week ago the commission issued a majority report recommending that nothing be done in regard to this project until the Legislature of 1911 had expressed its views upon the Boston transportation problem. As a result of this report the commission has been subjected to a storm of criticism, particularly on the part of the North Shore public, since the board declared three years ago that public convenience and necessity require additional facilities in the territory. The commission has decided to give a hearing to counsel on Aug. 31, to enable them to show cause for the immediate adjudication of the case. The pressure being brought upon the board to secure an immediate decision in this case exceeds in intensity anything which has come to it in recent years.

AMERICAN ELECTRICAL ENGINEERS.

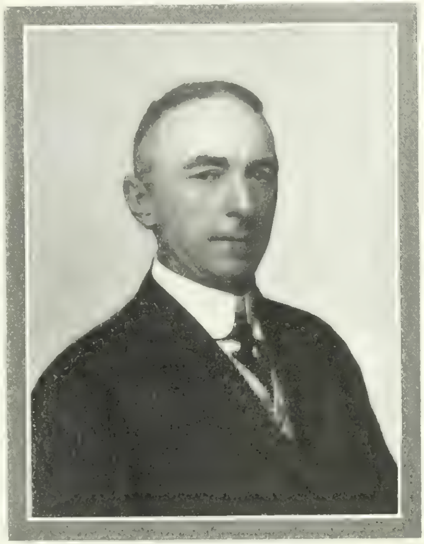
R. E. Richardson.

Robert Eaton Richardson was born in Pittsburgh, Pa., July 29, 1861, moving to Concord, Mass., in 1866, where he received his early education in the public schools. When 14 years old he went back to Pittsburgh, and at the age of 17 he entered the Massachusetts Institute of Technology, taking the course in mechanical engineering, from which he was graduated in 1885. Summer vacations during that period were spent in manufacturing works learning shop practice. After graduation Mr. Richardson taught mathematics in Morgan Park Military Academy, near Chicago, where he also established and conducted a manual training department. In 1886 he entered the employ of the Western Electric Company of Chicago, where he successively passed through the various departments of arc lamp testing and repair, cable room, laboratory, armature winding, machinery testing and operation, and telephone switchboard work. After this experience he was given charge of the operation of a small public lighting plant on Monroe Street, in Chicago, and next detailed as lamp trimmer and night troubleman in Chicago. Shortly after he was sent out by the Western Electric Company to install central stations in various parts of the country, including Toledo, Memphis, Buffalo and Milwaukee, and to operate them until turned over to the purchasers. Later he tested out the first large underground telephone cable system in New York City, which was connected with the first large multiple and trunk switchboard of the Bell company.

In 1890 Mr. Richardson established an engineering business with Mr. R. H. Pierce and Mr. E. M. Izard, formerly of Leonard & Izard, western representatives of the original Edison Company. The firm did a general engineering and construction business, and was the pioneer in interior-conduit construction in the Chicago and St. Louis districts; the *Globe-Democrat* Building and the Mercantile Building, of St. Louis, for which the firm were electrical engineers, were the first two large buildings in the West to be equipped throughout with interior conduit. In 1892 Mr. Richardson joined Mr. Pierce (who had been appointed Chief Engineer of the Chicago World's Fair) as assistant, and in his charge were placed the installation of the underground system and the laying out and lighting of the grounds. Just before the close of the fair he entered the employ of the Ansonia Electric Company as assistant general manager, in order to obtain a more thorough knowledge of the commercial side of the electrical industry. In the latter part of 1893, with Mr. Pierce, he established the firm of Pierce-Richardson, consulting engineers; Mr. S. G. Neiler afterward became a member of the organization when the firm took the present name of Pierce, Richardson & Neiler.

Mr. Richardson's special line of work with the firm of Pierce, Richardson & Neiler was what might be called commercial engineering, investigating and reporting on electrical and mechanical properties, and laying out plans for their operation. During the latter part of 1899 he was retained to report on various electric light and power companies in Kansas City, Mo., and Kansas City, Kan. Following his report, which was favorable, several of the various properties were purchased, and the services of Mr. Richardson were secured to form an organization for their joint operation. Since June, 1900, he has [illegible] as general manager [illegible] supplying electric light and power for Kansas City, Mo., Kansas City, Kan., Argentine, Armourdale and Rosedale; and the combined properties have now grown into one of the large light and power organizations of the country. In 1906 he installed a large central heating system, supplying the business portion of Kansas City, Mo., which he has also operated as general manager since its completion. In the ten years in which he has had charge of the above-mentioned properties, the connected load has increased from 17,000 16-cp lamps and 700 hp of motors to approximately 500,000 16-cp lamps and 90,000 hp of motors. Mr. Richardson resigned his position as general manager of the above companies in July, 1910, to give entire attention to personal business matters.

Mr. Richardson has always taken much interest in public matters. He has been a director of Convention Hall, of Kansas City, for six years and president for the past two years, and is one of the eighteen members of the Priests of Pallas, an organization which conducts a gala week for Kansas City every fall. He is a member of the board of directors of the Kansas City Club, a director of the Employers' League, a member of the Arts and Crafts Society, a charter member of the Aero Club, an alumnus of the M. I. T. Technological Society, a member of the Kansas City Commercial Club and of a number of purely social clubs and fraternal orders. Mr. Richardson has been a member of the American Institute of Electrical Engineers since 1894, is a member of the National Electric Light Association, and the National District Heating Association.



Mr. R. E. Richardson.

CURRENT NEWS AND NOTES.

Telephone Census Report.—The United States Census report on the telephone industry will be ready for distribution in about a month.

Electricity in Mines.—At the thirteenth annual American Mining Congress, to be held at Los Angeles, Cal., Sept. 26 to Oct. 1, two reports will be submitted on the application of electricity to mining. Mr. Samuel A. Taylor, of Pittsburgh, will, as chairman, submit the report of a committee on standardization of electrical equipment in coal mines, and Gen. Irving Hale, of Denver, Col., will submit the report of a committee on standardization of electrical equipment in metal mines, of which committee he is chairman.

Central Station Census Report.—The report of the United States Census Office on central stations will in a few days be delivered by the printer and distributed shortly after.

Montefiore Engineers in Spain.—The members living in Spain of the Association of Engineers graduated from the Montefiore Institute of Liege, Belgium, have formed a branch in Madrid, called the Delegacion Espanola A. I. M.

Robert Davidson Memorial.—A movement has been started having for its object a memorial to Robert Davidson, of Aberdeen, Scotland, who in 1839 exhibited over a large part of Great Britain a model electric railway, the motor car being run at a speed of five or six miles per hour by means of electricity. Thomas Davenport, of Brandon, Vt., in 1835 exhibited a similar model electric railway in Boston.

Illinois State Electrical Association Convention.—The place of meeting of the Illinois State Electrical Association convention for 1910 has not been definitely decided by the executive committee. It is learned on good authority, however, that the sentiment is so much in favor of Rock Island that there is little doubt that the executive committee will select that city as a meeting place. The time of the convention will probably be in October.

Western Association of Electrical Inspectors.—The sixth annual meeting of the Western Association of Electrical Inspectors will be held at the Hotel Rome, Omaha, Neb., on Oct. 11, 12 and 13. Mr. Fred G. Dustin is president of this association, and the secretary is Mr. William S. Boyd, 125 Monroe Street, Chicago. A large portion of the time of the convention will be taken up by the presentation and discussion of reports from 14 standing committees.

Electrification of Hudson Bay Railway.—Advices from Norway House state the arrival there of Mr. William Ogilvie, of the Interior Department, after a trip of a month along the Saskatchewan River from Prince Albert to Lake Winnipeg. It is understood that his special mission is to report on the feasibility of electrifying the proposed Hudson Bay Railroad with water power from the falls and rapids along the river. Mr. Ogilvie says that the information on hand is yet incomplete and not sufficient to warrant the Dominion government in coming to a decision, but he thought the matter would be discussed at the next session of Parliament.

Edison Kinetophone.—An exhibition was given to invited spectators at the Edison laboratories in West Orange, N. J., last week of the Edison kinetophone, a combination of the effects of the phonograph and kinetoscope, to which problem Mr. Edison has given attention for some years. A moving picture man appeared on the screen, who after announcing the subject of the demonstration performed a number of experiments. A plate was thrown on the floor and the sound when it was dashed into fragments coincided with the impact. Other experiments were with a rebounding ball and an automobile horn, which latter sounded when the demonstrator squeezed the actuating bulb.

Assessment of Chicago Public-Service Companies.—Both the Commonwealth Edison Company and the Chicago Telephone Company, of Chicago, will be required to pay personal property taxes on valuations which have been considerably increased this year by the Board of Review. The personal property tax valuation of the Commonwealth Edison Company has been fixed at $23,940,000 for 1910, whereas the corresponding figure for 1909 was $21,975,000. In the case of the telephone company the corresponding figures were $13,713,676 and $12,507,695. The personalty assessment of the People's Gas Light & Coke Company, on the other hand, shows a slight decrease, the figure for this year being $15,620,508, and for last [illegible]

Civil Service Examination for Army Electrical Assistant.—The U. S. Civil Service Commission will hold an examination on Oct. 5 to fill a vacancy in the position of electrical assistant in the Signal Service at New York City, at $1,500 per annum. Copy of circular 591, giving details as to qualifications, may be obtained from the U. S. Civil Service Commission, Washington.

Cyanamide Fertilizer.—The current issue of the *Bulletin* of the American Chamber of Commerce in Paris contains an article by the indefatigable consul-general, Frank H. Mason, on the production of cyanamide, the new fertilizer produced by the fixation of atmospheric nitrogen. The material is manufactured by combining nitrogen gas with calcium carbide at 1000 deg. C., and has a content of 15 to 20 per cent of nitrogen. The production in France for the present year is estimated at about 10,000 tons and for Germany about 8000. The largest plants, however, are in Norway. The price in Paris of 15 per cent cyanamide is about $36 per ton, which is considered less than the price of Chili saltpeter having the same content of nitrogen, while the 60 per cent of lime contained in the former gives it an increased agricultural value. The paper states that nitrogen at a pressure of 300 lb. per square inch is sold in Paris at prices ranging from 1 to 1½ cents per cubic foot.

Ground Wires to Telephone Lightning Arresters.—A recent Arkansas decision holds that it is negligence for a telephone company to fail to have its lightning arresters equipped with ground wires. The plaintiff was using his telephone in the ordinary manner when lightning entered the instrument and gave him injuries for which he was awarded a verdict of $5,900. According to the expert the wires, on entering the building, should immediately be connected to a protective device which would protect the phone from lightning and also from abnormal currents and against what are called "sneak" currents. These protective devices should be installed right at the point, or as close as possible to the point where the wires enter the building where the phone is to be installed. It was further stated that a protective device or lightning arrester, in the absence of a ground wire from the telephone, would be almost no protection against lightning; that the object of the ground wire is to convey the lightning from the lightning arrester to the ground; that the ground wire should be placed either on the outside or inside of the room, but generally it is placed on the outside. The evidence showed that there was no ground wire attached to the lightning arrester on the phone in question. The verdict of the jury was affirmed.

Railway Electrical Engineers' Convention.—Preparations are under way in Chicago for the forthcoming annual convention of the Association of Railway Electrical Engineers, to be held at the Hotel La Salle on Sept. 27-30. A carefully arranged program will be presented, and it is believed that there will be a large attendance of steam-railroad men interested in electrical applications. A feature of the convention will be a large display of exhibits, and the roof garden or nineteenth floor of the hotel has been engaged for the exclusive use of the convention. The meetings will be held here, and the remaining space will be used for exhibits. A committee of the Railway Electric Supply Manufacturers' Association, an allied organization, is in charge of the local arrangements for the convention. Mr. George H. Porter, of the Western Electric Company, is chairman of this committee, and the other members have been assigned duties as follows: Exhibits, Mr. W. E. Ballentine, Willard Storage Battery Company; entertainment, Mr. W. H. Glatt, New York Leather Belting Company; finance, Mr. A. C. Moore, Safety Car Heating & Lighting Company; auditing, Mr. J. M. Lorenz, Central Electric Company; publicity, Mr. Edward Wray, *Railway Electrical Engineer;* membership, Mr. J. M. Schilling, Westinghouse Electric & Manufacturing Company.

A MODERN COMBINATION UTILITY PLANT.

An Electric-Generating, Steam-Heating, Refrigerating and Cold-Storage Plant at Detroit.

A GREAT district steam-heating station, an extensive refrigerating, ice-making, brine-circulating and cold-storage plant, and an electric generating station of respectable proportions are all combined and contained in the massive and handsome public-service block of the associated Murphy utility companies, at the corner of Wayne and Congress Streets, Detroit. With the business of central-station district heating, which is the primary purpose of the plant, grown to its present extent, the by-product operations of refrigeration and generating electricity have in themselves become considerable undertakings, although their output is, with exceptions, wholesaled, and the details of distribution left to other hands.

The electrical customers of the Murphy plant are downtown factories and office buildings, while a large amount of energy is wholesaled to the Detroit Edison Company. The latter system is tied to that of the Murphy company for mutual reliability and aid, by both 4600-volt primary and 250-volt network cables. The rates charged by each for electrical energy are practically the same.

The Murphy electric generating station has the distinction of containing the only two turbine-driven homopolar or acyclic direct-current generators in commercial lighting service. These machines are of the vertical shaft type and as operated develop 500 kw each at 250 volts.

CENTRAL POWER STATION.

The Murphy group of public-service companies is the outgrowth of a small steam-heating plant erected seven years ago to serve the Penobscot Building, a 14-story office structure owned by the Murphy Estate. In building this plant, the plan was to have the heating apparatus entirely independent of the building. The original plant contained four 300-hp Babcock & Wilcox boilers, serving four Westinghouse standard engines connected to 225-kw, 250-volt General Electric direct-current generators. The exhaust-heating business grew rapidly, finally necessitating the building of the present plant.

The new central station, at the corner of Wayne and Congress Streets, is a 10-story brick and steel structure, occupying a plot 156 ft. x 129 ft. The exterior, of red brick trimmed with stone and terra cotta, presents a really handsome architectural effect. After dark the building is more than ever a landmark among the city's structures. Twenty-five flaming-arc lamps, hung on bracket-arms extending 10 ft. over the walls on all sides, mark the roof level, 124 ft. above the street. Four of these flaming arcs are installed at the corners of the brick stack enclosure. These roof lamps are operated under conditions of unusual efficiency, five being connected in series across the 250-volt circuit.

On the ground floor are the boiler-room, turbine-generator room, shipping entry, and auxiliary departments. Over the turbine-room, on the fourth-floor level, is the refrigerating plant. The remainder of this floor, and practically all of the floors above, are given over to cold-storage purposes, with the exception of a small space on each used for offices. The entire cold-storage section of the building is enclosed in a thermal insulation of cork between walls of brick and tile, and has a cubical contents of over 1,000,000 cu. ft. In this part are stored produce, eggs, meats and other foodstuffs, while an entire floor, especially fitted up, is given over to the safe keeping of valuable rugs, furs, clothing, etc., for protection against insects, theft or

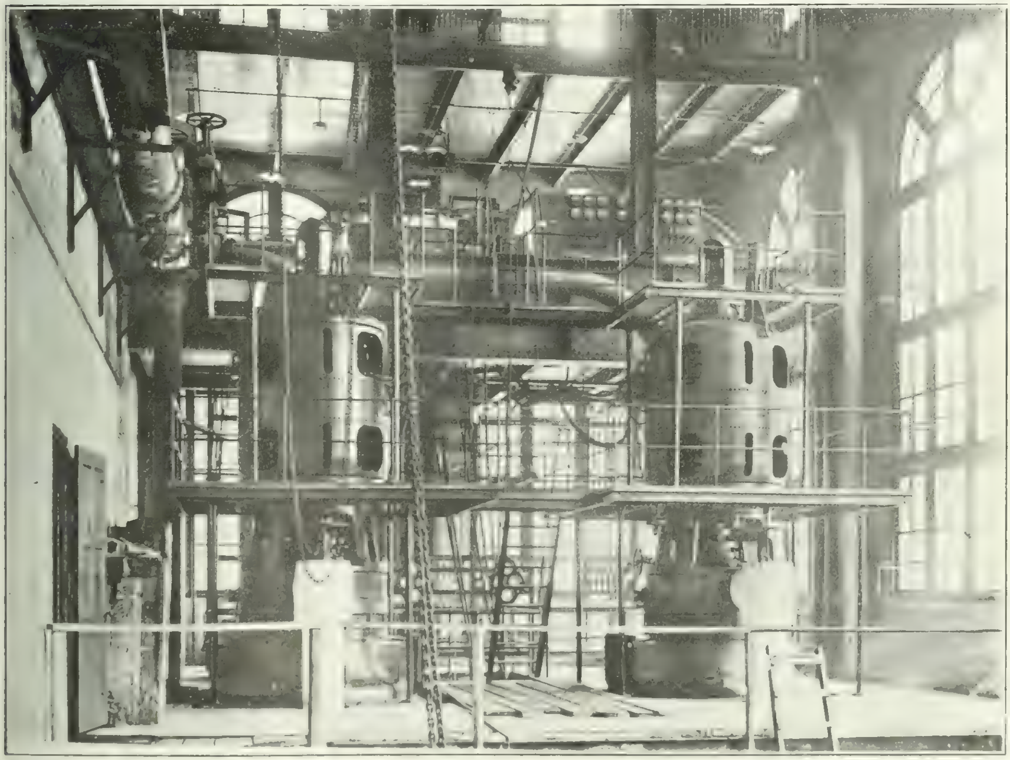


Fig. 1—View of Turbine Room, Showing Two 500-kw Acyclic Turbo-Generators.

fire. All floors are reached by one passenger and three freight electric elevators.

The boiler-room, on the ground level, contains 12 400-hp Wickes vertical boilers, fed by Murphy automatic stokers from steel-and-concrete coal bunkers overhead, which have a storage capacity of 2500 tons. Coal is hauled by wagon from the railroad yards, a mile distant, and at the plant is delivered to a Peck link-belt conveyor, driven by a 7½-hp motor, which raises it to the fifth-floor level at the top of the bunkers, where it is fed by gravity to the stokers. In the bins, this coal costs the plant about $2.70 a ton. Forty thousand tons a year are burned under the boilers. The same conveyor is arranged for removing the ashes from the sub-pits, dumping them into a chute, whence they are hauled away by wagons. The 12 furnaces are connected by transverse flues to the 245-ft. stack rising through the building. This stack is lined with firebrick to the top, and has a clear inner diameter of 13 ft. The water for boilers, and for the condensers, which are used about four months in the year, is obtained from the Detroit River, four squares southeast of the plant.

The intake tunnel, 15 ft. below the engine-room level, is of elliptical section, 4 ft. x 3 ft., and just above is paralleled by a 24-in. sewer for the discharge water. The river water, the overflow from Lakes Superior, Michigan and Huron, is treated with soda ash before being used in the boilers. Several 300-ft. wells were first used for condensing purposes, but the water delivered proved to be so highly impregnated with sulphur compounds that the piping was rapidly destroyed and the copper about the plant corroded. Careful and complete analyses of the water entering the boilers, as well as of the coal, ashes, flue gases leaving the stack, etc., are made at frequent intervals.

For the electrical generating equipment, it was originally planned to install all direct-current, turbine-driven generators of the homopolar or acyclic type. Following this intention, two

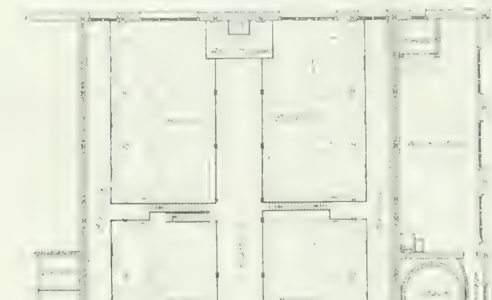


Fig. 2—Floor Plan of Generating Station.

500-kw General Electric 12-ring homopolar generators, producing 50 volts per ring, at a speed of 2000 r.p.m., and connected for 250-volt operation, were contracted for. These machines are mounted with vertical shafts, supported on oil step-bearings of the standard type, and are driven by 500-kw Curtis steam turbines, operating at a steam pressure of 175 lb. In connection with these machines, and the two additional 2000-kw acyclic generators first planned, it was proposed to install a storage battery for emergency and stand-by service.

Just about this juncture, however, the original scheme was modified in favor of installing the rest of the generating equipment of the alternating-current type, of a voltage and frequency the same as that of the Detroit Edison Company's great generating stations; extending a 4600-volt cable tie-line

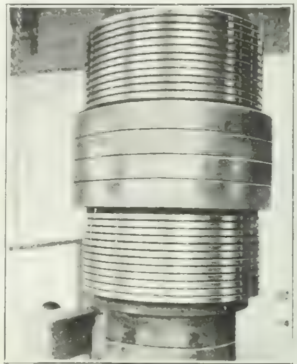


Fig. 3—Armature of 300-kw Turbine Driven Acyclic Generator.

from the Murphy generator bus to the lines of the Edison company at one of its substations; and installing motor-generator sets to convert the alternating-current into direct-current for use in parallel with that produced by the acyclic machines. This arrangement avoided the necessity for a storage battery,

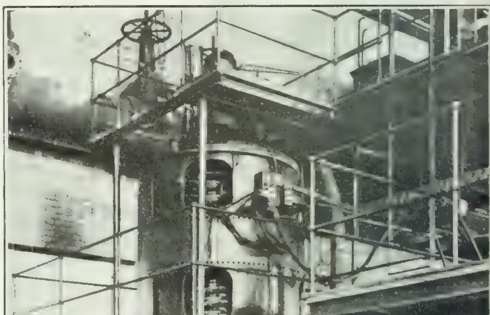


Fig. 4—500-kw Acyclic Turbo-Generator.

giving each system the benefit of the other's assistance in case of trouble.

Accordingly, the rest of the generating equipment installed consisted of two 1500-kw, 4600-volt, 60-cycle General Electric alternators, mounted on vertical shafts and driven by Curtis steam turbines, operating at 900 r.p.m. These turbines are rated at 2250 kw when exhausting into a vacuum of 28 in., but

during the steam-heating season they are operated at a back-pressure of about 2½ lb., developing about 1650 kw. During four of the summer months the turbines are served by Schutte & Koerting eductor-type condensers, creating a vacuum of about 26 in. Condenser water is delivered at 10-lb. pressure by two 100-hp Kerr turbine-driven centrifugal pumps. For converting the output of the alternators into direct-current at 250 volts, two 1000-kw General Electric motor-generator sets

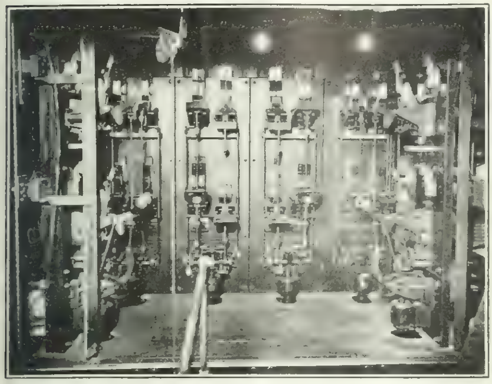


Fig. 5—Direct Current Transfer Switches and Acyclic Generator Circuit Breakers.

are installed, comprising 4600-volt synchronous motors driving inter-pole generators at 514 r.p.m.

ACYCLIC GENERATORS.

As before noted, the two 500-kw acyclic generators in the Murphy plant are the only machines of this type in use for commercial lighting work, and their interesting characteristics deserve some mention. As is well known, the acyclic or homo-

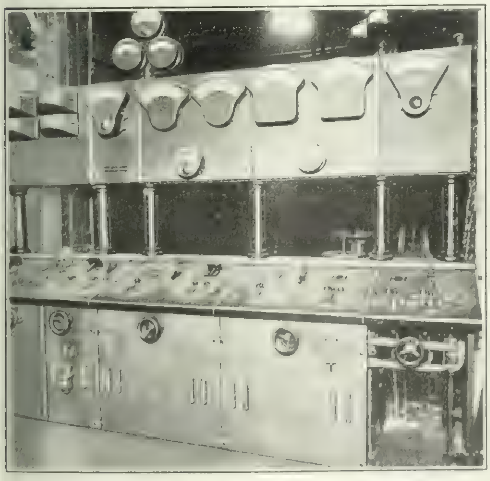


Fig. 6—Control Board for High-Tension Switches.

polar direct-current generator is an amplification of the Faraday disc principle, employing active conductors of but one turn, and effective pole-pieces of but one polarity, completing the magnetic circuit along the armature of the machine itself. Thus the voltage developed in each conductor is relatively low, and must be added to by passing the current out to brushes bearing on slip-rings and returning it again through the armature in order to get the incremental boosting effect of successive lengths of active conductor. The acyclic generator avoids the use of a commutator, since the current produced is essentially direct, as the conductors always traverse a field of the same polarity. There must be, however, a multiplicity of slip-rings and brushes, to pass the current through the successive conductors always in the same direction. It is obvious that the acyclic machine is inherently best fitted for high-speed operation by a steam turbine, avoiding, as it does, commutation, but other considerations have held back the development of this interesting class of direct-current generator.

The acyclic generators in the Murphy plant are of the 12-ring type, developing 50 volts per ring. They are therefore capable of supplying 600-volt direct current, but are now connected with two groups of conductors in parallel, for 300-volt (actually 250-volt) operation. The ease with which fractional voltage steps are secured by simple changes of connections, and the fact that several different voltages can be obtained simultaneously from one machine, are marked advantages of the acyclic type over other direct-current generators. For example, in driving the 250-125-volt three-wire system of the Murphy distribution, a tap is taken off the middle ring, between the outer voltage mains. A 75-kw Western Electric balancer-set is used for preserving the current equilibrium of the system when the acyclic machines are not in operation.

Each collector ring of the acyclic generator is fitted with a "dead" graphite lubricating brush and two current-carrying metal brushes, each composed of a hundred or so alternate leaves of phosphor bronze and nickel steel. The rings themselves are of nickel steel. In the operation of the machines a marked electrolytic action is noted in the wearing of the brushes and rings, the positive rings being cut away much more rapidly than the negative ones. In the same way, the negative brushes have to be renewed oftener, the old ones being transferred to the positive holders where the destructive pace is less rapid.

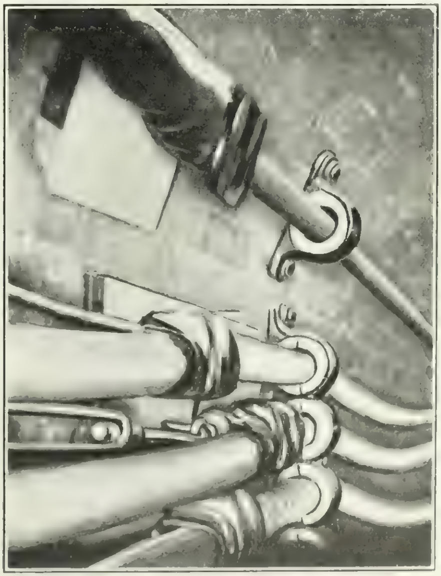


Fig. 7—Cables in Tunnel.

To secure even wearing of the rings, the polarity of the machine is reversed every year or two.

The armatures of these machines are 11 ft. in circumference and weigh 13,000 lb. Revolving at 2000 r.p.m., they attain a pheripheral speed of nearly four miles per minute, developing enormous centrifugal stresses. When the machines were first installed, three years ago, this action was responsible for destroying the mica insulation of the conductors in some instances, creating several short-circuits and burnouts. This trouble has

been effectively remedied by substituting molded mica insulation where the conductors pierce rings of other polarity. Generally, bush trouble has been one of the limiting factors in homopolar operation, but the Murphy machines have given little annoyance in this regard. The oil step-bearings used to carry the 6½-ton armatures of these generators, are identical in size with those used for turbine-alternator field structures of the same output, but of only approximately half the rotating weight, and this fact has caused some little trouble in operating these generators. The Murphy 500-kw acyclic machines show an efficiency of 90-91 per cent.

AUXILIARIES, SWITCHBOARD, ETC.

Auxiliary to the Westinghouse 250-volt motor, 125-volt generator excitation set, is a 250-volt, 1280-amp-hour storage battery, installed on the seventh floor. This battery is arranged to be charged at 250 volts, and to be cut in half and paralleled for discharge for field excitation at 125 volts. By means of a switch of special design, working with the low-voltage-release exciter circuit-breaker, the battery is automatically connected to the excitation circuit, if the latter's pressure drops below 100 volts. This connection occurs an instant before the exciter is disconnected, and is automatically made, even if the battery happens to be on charge, in which case a tap is made across half the cells without disturbing the 250-volt charge. One side of the three-wire 250-125-volt system is also available for excitation.

The operation of both direct-current and high-tension alternating-current switches is performed by remote control from an overhead switchboard gallery at the west end of the turbine room. The high-tension switching mechanism is mounted on a similar gallery at the east end of the room, reached only by climbing a stair from the operating floor. By a construction detail of the control bench-board it is impossible to close the oil-switch of an alternator until the synchroscope plug is in; this plug in turn cannot be inserted until the field switch has been closed. The 4600-volt tie-line from the Murphy plant to the Edison company's Station A has a carrying capacity for the output of one of the 1500-kw alternators, but is used only in case of an emergency, the regular supply of energy to the Edison system being carried out on the 250-volt direct-current side. The high and low 250-volt outer buses and the grounded neutral bus of the Edison system are brought to the Murphy switchboard. The transfer switches controlling the connection

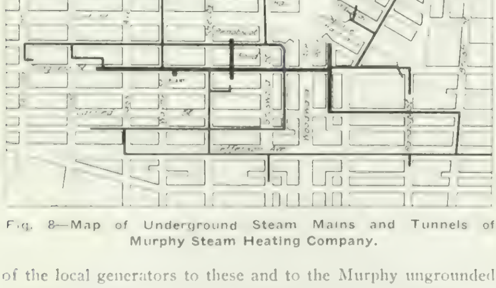


Fig. 8—Map of Underground Steam Mains and Tunnels of Murphy Steam Heating Company.

of the local generators to these and to the Murphy ungrounded three-wire system, are motor-operated and are arranged with interlocks, so that the two three-wire systems cannot be interconnected by any carelessness in manipulation.

ELECTRICAL OUTPUT AND SALE.

The average monthly generation of the Murphy plant is from 200,000 to 300,000 kw-hours. The maximum load on the plant reaches 2500 kw. The rates for the sale of electricity are as follows: General lighting, non-contract—14 cents per kw-hour, up to 60 hours' use of connected load. Additional energy, 4 cents per kw-hour. General lighting, annual contract—14 cents per kw-hour for first 30 hours' use of maximum; 4 cents per kw-hour for next 120 hours' use per month, and 2 cents per kw-hour for further use. Customer guarantees 30 hours' use. Rates for motor circuits, non-contract—4 cents per kw-hour.

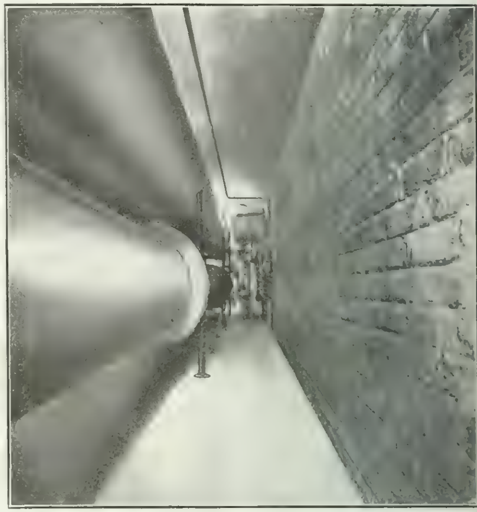


Fig. 9—Interior of Tunnel.

Ten per cent discount is allowed for payment within 10 days.

All of the electrical customers are within two squares of the central station. They receive energy through 1,500,000-circ. mil cables, carried in a 5 x 6-ft. tunnel under Congress Street, along with the pipes conveying the other products of the station. The weatherproof cables used in this tunnel have been given a ⅛-in. coating of niagarite, and are carried along on iron cable racks, the cables themselves resting on folded sheets of mica inserted between the iron and the coating. This construction, though a departure, was found to be economical and effective.

DISTRICT HEATING SYSTEM.

The 5 x 6-ft. tunnel under Congress Street is 1800 ft. in length, extending in both directions from the plant, as the sketch of the territory served (Fig. 8) shows. Besides the electric cables, it contains a 30-in. low-pressure pipe carrying steam for heating, at 2 lb. per sq. in.; an 8-in. high-pressure main, carrying steam for cooking, at 80 lb. per sq. in.; a 2-in. vacuum return pipe, and the 4-in. brine circulating pipes for refrigeration.

The steam heating equipment employs the Paul vacuum system, and serves 320 customers, having 400,000 sq. ft. of radiation, in the business territory between the City Hall and the Detroit River, as shown by the map. The underground plant comprises over 20,000 ft. of steam mains and services, ranging from 30 to 6 in. in diameter. In Detroit, steam is required for heating about eight months in the year, although the Murphy company holds its service in readiness 365 days. During the heating season, all of the exhaust from the plant steam-consuming apparatus is utilized, but when the temperature nears the freezing point, live steam must be introduced from the boilers to aid the supply. In fact, during the winter time, more than one-half live steam is required to keep pace with the heating demand, at the present load requirements of steam for the turbines and auxiliaries.

The low-pressure steam distribution mains, wrapped in asbestos paper, are enclosed in wooden log casings, which are in turn covered with tar paper and asphaltum. At 50 ft. intervals, variator joints are inserted to take up expansion due to temperature changes. Traps are also arranged to discharge what con-

densation occurs in the pipe, together with that drained back from the customers' lines, so that not a drop of water can enter the latter installation except in the form of steam.

On the customer's premises at the end of his heating system, the condensation is collected and measured in a tilting meter, which trips the register each time one of its pans is filled and emptied. The condensation is discharged into the sewer. These meters are read regularly once a month, and any showing a

Fig. 10—Ice Factory of Murphy Cold Storage Co.

tendency to give trouble are examined at short intervals. Two men are employed for reading and inspecting meters. The Murphy company sells its steam at the following rates per 1000 lb.: First 25,000 lb. per month, 58 cents; next 75,000, 55 cents; excess above 100,000 lb., 53 cents. Discount, 5 per cent for payment within 10 days of billing. The distributing investment in the underground piping plant is $325,000. Up to July 1 the company charged a straight rate of 49 cents per 1000 lb., regardless of amount consumed. From this business the annual revenue was $100,000, which is at the rate of 26 cents per year for each square foot of radiator surface. The company encountered no difficulty in explaining to customers the reasonableness of its increase in rates, and lost no consumers as a result of the change. The customers of the heating system range from the largest office building in the city, down to small merchandizing establishments whose monthly bill amounts to only a few dollars.

As before noted, high-pressure steam, at 80 lb. per sq. ft. is supplied to the kitchens of several hotels and restaurants on the lines of the low-pressure service. Since with most of the devices used for cooking with steam it is impossible to recover the condensation, and as a steam-flow meter is impracticable for the consumer's purpose, a flat rate, special for each case, is resorted to in charging for high-pressure steam. This service, from the plant's standpoint, is not satisfactory, and would probably be discontinued except for the necessity of supplying kitchens of buildings which use low-pressure steam heat with some means of cooking.

REFRIGERATING PLANT.

The refrigerating machinery is installed directly over the turbine room, its floor level with the fourth story and its condenser coils at the [illegible] story. [illegible] absorption system, using hydrate of ammonia, and the three units installed have a capacity of 300 tons refrigeration daily. Provision has been made for the fourth set of generator and condensing coils, which will be added later. The absorption system of refrigeration differs from the more common compression system in substituting a [illegible] heated generator or "boiler" for the compressor pump, employing a temperature rise instead of increased pressure for delivering the ammonia gas to the condenser. At the Detroit plant, the exhaust steam from the auxiliary pumps is passed through the coils of the generator, giving up the latent heat to the "boiling" of the ammonia. The circulating water used to cool the condensers is raised from the river intake by two 125-hp motor-driven centrifugal pumps capable of producing a 300-ft. head. This water is well warmed in its passage through the condenser coils, and is returned to a Cochran heater for boiler-feed use. The condensation from the generator coils is also recovered for this purpose.

The calcium chloride brine is chilled to a temperature of 2 deg. below zero, or lower, and is used for a variety of refrigerating purposes, both within and outside of the building. The floors on which butter and meats are stored are cooled directly by brine coils to a temperature approximating zero throughout the year. Those on which produce, apples, eggs, etc., are kept are maintained just below freezing by brine coils on the ceiling. About 100,000 ft. of pipe is used for the brine cooling coils within the cold-storage plant. The sixth floor, which has been especially fitted up for the storage of fine furs, coats, rugs, tapestries and hangings, which it is desired to protect against insects, fire and theft, is now cooled by an "open spray" system, in which all the air drawn into the compartment by the motor-driven blowers is passed through a spray of the chilled calcium chloride brine, reducing its temperature to 20 deg. This air is kept in circulation in the storage rooms, being forced into the compartment at one side of the house and drawn out at the other. The arrangements for storing all kinds of valuable goods or material are of the finest, and every precaution is taken against injury of any kind. At times, goods of an aggregate value of $1,000,000 are stored in this department. The storage charge includes insurance. Thus, on a suit of clothes, stored for $3 for the season, insurance up to $30 is granted the owner. This storage department contains 60,000 cu. ft. of space, but is already overtaxed and will shortly be given double its present space.

PLATE ICE FACTORY.

The ice factory is a separate large three-story concrete-and-steel building on Congress Street, 800 ft. from the main power house. The tunnel before referred to connects both buildings and conveys the brine refrigerating pipes for the freezing of the "plate" ice made at this plant.

Water from the city mains is used for the ice, being first filtered through sand and then ozonized to remove germ life.

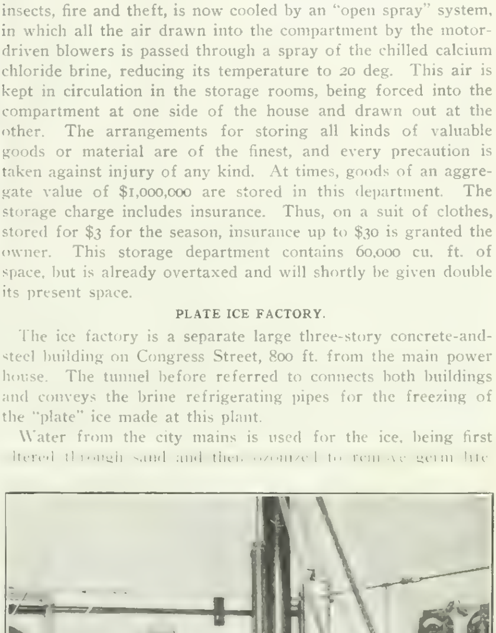


Fig. 11—Ozonizing and Water Purifying Apparatus in Ice Factory.

The ozonizing plant, shown in Fig. 11, comprises a [illegible] motor-generator set, producing alternating current, which is stepped up through a transformer to 14,000 volts. This potential is used to create a silent brush discharge between concentric metal cylinders, ozonizing air drawn through the annular spaces. This air must be previously dried by traversing cooling coils in a brine-chilled refrigerator. The motor-generator set also supplies energy to operate the compressor pump used to

force the ozonized air into the bottom of a tall standpipe, in which it bubbles upward, sterilizing the water. As the pump handles ozonized air which is extremely destructive to organic matter, graphite and "aquadag" have been resorted to as lubricants for the cylinder. Ordinary water contains hundreds and thousands of germs per cu. cm, it is said, while that leaving this purifying system has its germ life reduced to less than ten per cu. cm. which is just about one-tenth of the minimum specified by the German standard of purity. After pre-cooling to nearly the freezing temperature the sterilized water is led to the ice tanks. Three kw-hours per day supplies energy for sterilizing 50 tons of water or ice.

At this plant the ice is frozen in huge plates, 16 x 12 ft. and 11 in. thick, which are afterward cut into cakes of the customary size. The tanks are 17 ft. long and 13 ft. deep and 3 ft. wide, and behind their steel-plate sides are lined with refrigerating brine pipes. When the brine is turned on, freezing starts from each side of the tank, so that two cakes are produced simultaneously, growing towards each other from opposite sides. When these have reached a thickness of 11 or 12 in., after freezing for six days or a week, which is about the natural period, hot brine is turned through the coils for 6 or 7 hours, loosening the plates of ice from the sides of the tank. Two 4-hp slow speed motors driving centrifugal pumps are used for handling the brine circulation in the ice factory, one being employed for the chilled and the other for the hot liquid. During the freezing process the water is continually aerated from a 7½-hp motor-driven air compressor outfit. The plates of ice are frozen with eyerods in place throughout their width. These grappling rods are engaged by the crane hooks for lifting the plates out of the tanks and carrying them by aid of the motor-driven crane to the tilting table, which lowers them to a horizontal position for cutting. The tilting table is counterweighted and is driven by a 2½-hp motor equipped with a magnetic brake for easing down the table at the end of its travel, in order not to crack the plate. The plates of ice are beautifully clear and transparent. Each weighs about five tons and is cut into 54 blocks. Hand saws were formerly employed, but a motor-driven 22-in. circular saw, mounted on rollers, has been devised locally and now saves much time. The 1½-hp motor is constantly kept at a freezing temperature and carries its 300 per cent overload with ease. After being sawn, the cakes are lowered by pneumatic drops to the runways below, leading to the shipping and ice-storage departments. There is storage capacity in the ice factory building for keeping 5000 tons of ice. The ice factory is rated to produce 100 tons of ice per day. The freezing tanks are in two rows, 120 ft. long,

Fig. 12—Cake of Plate Ice.

each containing six compartments for freezing 12 cakes each.

Refrigeration by the circulation of brine is supplied to the cold boxes of a number of hotels and restaurants in the downtown section bordering the tunnel. The brine pipes traversing this tunnel are lagged with felt soaked in crude parafine. So effective is the insulation that although the temperature in the tunnel is normally 120 deg. Fahr. from the steam pipes the brine circulation undergoes a rise of only about two degrees during its passage. The wide variety of cooling services which this brine circulating system is called upon to perform makes it impossible to fix a standard rate, but the charge varies from 12 cents to 50 cents per year per cu. ft. of contents of the box

Fig. 13—Produce Store Room.

cooled, depending on the use of the box. During the summer time about 70 tons of equivalent refrigeration is thus delivered to the "iceless" cold boxes of customers.

The extensive physical equipment of the Murphy Heating Company, the Murphy Cold Storage Company and the Murphy Power Company, which is one of the finest of its kind in the country, involves an investment of $2,800,000, all of which is represented by stock, no bonds having been issued. Mr. W. H.

Fig. 14—Butter Room, Murphy Cold Storage Warehouse.

Murphy is president, Mr. C. Murphy is secretary and treasurer and Mr. J. F. Lewis is manager of all the companies. Mr. George D. Higgins is superintendent of the heating and power companies. During the design and construction of the plant Mr. W. T. White has served as electrical and mechanical engineer.

GAS AND OIL-BURNING ELECTRIC POWER STATION.

The Modern Equipment of the Light and Traction Company, of Fort Smith, Ark.

THREE years ago, following the advent of natural gas into Fort Smith, Ark., the Fort Smith Light & Traction Company began the use of this fuel instead of coal for its steam-driven generating station. Auxiliary provision has since also been made for burning oil in case of low pressure or accident to the gas supply lines. Natural gas, however, has proved itself thoroughly dependable as a working fuel, and the oil supply is called on only in times of heavy commercial gas consumption, when the operation of the plant burners seems likely to affect the distribution pressure. The cost of operation with gas at 8 cents per 1000 cu. ft. has been found just about to equal that with coal as formerly purchased at $1.20 to $1.45 per ton. With the use of gas, however, there have resulted important savings in the cost of labor and of handling coal and ashes; even if no mention be made of the obvious advantages of the simple, and to a large extent, automatic, manipulation of the fuel supply, and the total avoidance of dust, dirt and smoke.

GENERATING EQUIPMENT.

The generating station of the Fort Smith company, where electrical energy is produced for the local lighting and street railway service, is situated on the east bank of the Arkansas River, in the northeast section of the city. The varying flow of the stream, which, with its shifting channels and sandy shallows, is nearly a mile wide at this point, would make any intake works both difficult to construct and useless most of the time, while the large amount of matter carried in suspension by the river renders this water generally unfit for plant use. The generating station is accordingly entirely independent of the river water, running non-[illegible] and [illegible] its boiler supply from the city pumping plant.

The principal building of the generating plant is a brick structure, 115 ft. x 115 ft., the main engine room containing the following engine-driven equipment:

One 2250-hp Hamilton-Corliss cross-compound engine, direct-connected to drive a 1615-kw, 2300-volt, two-phase, 60-cycle General Electric alternator, at 90 r.p.m. One 1200-hp simple Allis-Chalmers engine, direct-connected, to drive an 800 kw, 550-volt, direct-current Allis-Chalmers generator at 100 r.p.m. One 800-hp tandem-compound Fulton engine, direct-connected to drive a 500-kw, 2300-volt, two-phase, 60-cycle General Electric alternator, at 120 r.p.m. One 500-hp tandem-compound Fulton engine, direct-connected to drive a 300-kw, 550-volt direct-current General Electric generator at 125 r.p.m. One 350-hp simple Russell engine, direct-connected to drive a 2300-volt, two-phase, 60-cycle Westinghouse alternator, at 144 r.p.m.

In adjacent buildings is the following auxiliary generating equipment which will be supplanted when the present main engine room is completed:

One 400-hp, 100 r.p.m. Allis compound engine, belt-connected to drive a 300-kw Fort Wayne 550-volt, direct-current railway generator at 825 r.p.m. Two 225-hp Southwork engines, 200 r.p.m., direct-connected to Westinghouse 550-volt direct-current generators.

The exciting equipment consists of the following motor-generator apparatus:

One 90-hp, General Electric, 2300-volt, alternating-current motor driving a 60-kw, General Electric, 150-volt, direct-current generator at 900 r.p.m. One 45-hp, General Electric, 550-volt, direct-current motor driving a 30-kw, General Electric, 150-volt generator at 1150 r.p.m. One 35-hp, General Electric, 300-volt, alternating-current motor driving a 22-kw, General Electric, 150-volt, direct-current generator at 900 r.p.m. One 15-hp, General Electric, 550-volt, direct-current motor driving a 12-kw, Westinghouse, 150-volt generator at 100 r.p.m.

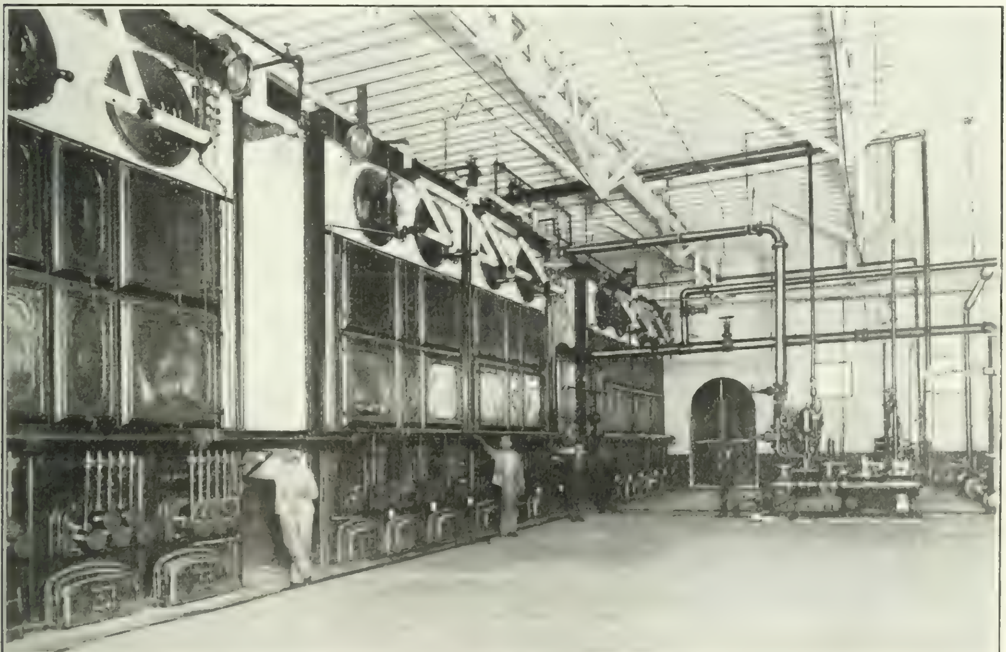


Fig. 1—Boiler Room, Showing Gas and Oil-Burning Equipment.

The principal switchboard control of the station is centered in an overhead gallery along the south side of the main generator room. Here are located the various generator bus and

feeder panels and instruments. Beneath the gallery are the constant-current transformers for the street arc lighting, the step-up transformers for the 6600-volt, 6-mile transmission to the Van Buren substation, the station-lighting transformers, three of the exciter sets, and the field rheostats.

The steam-generating equipment comprises five 500-hp Ault & Taylor double-deck water-tube boilers, each containing 152 4-in. tubes and 70 sq. ft. of effective grate area. These are served by five stacks, each 160 ft. high and 60 in. in diameter.

GAS AND OIL BURNING APPLIANCES

The furnaces are equipped for both gas and oil burning, being arranged for conversion to the latter fuel on a few minutes' notice in case of accident or interruption to the gas supply.

Each furnace has 15 burners, five in each of its three fire doors. These burners are of the Kirkwood type, and each is supplied through a 2-in. pipe out of an 8-in. header. The gas is fed to the burners at a pressure of from 8 oz. to 15 oz., and is mixed with air while passing through the whirling chamber of the burner, which is equipped with an adjustable trapdoor for fixing the proper mixture. The gas then burns with a clear blue Bunsen flame, being adjusted by means of the trapdoor until all yellow color is removed. Inside the furnace, the direct blast of the flame is broken by a wall of brick checker work, which deflects the highly heated gases against the boiler tubes. Each burner consumes about 25 cu. ft. of gas per second, when operated at full load. The boiler heat is in general roughly regulated by increasing or reducing the number of burners in operation, rather than by throttling the individual jets, each of which burns at nearly full blast when operated. The gas supply to the burners is to a large extent, however, regulated automatically to correspond with the load on the station, by means of a diaphragm-operated valve controlled by the steam pressure in the header leading from the boilers. When properly set, by adding weights to a lever arm, this regulating valve controls the gas supply to follow the load closely.

Natural gas burned in this plant is received from the fields about five miles distant, and is brought to the power station at 80 lb. presssure per sq. in. Just outside the plant it is re-

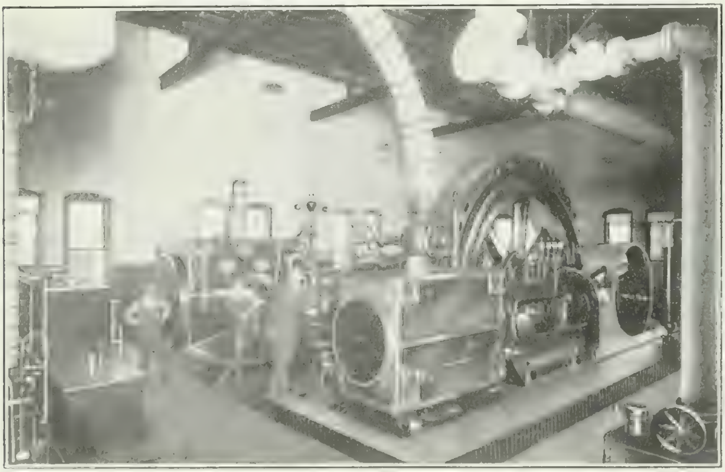


Fig. 2—Cross Compound Engine Driving Alternator.

duced to 15 lb. pressure, and then in the pipe line in the boiler room traverses a second reducing valve, which lowers it to a a pressure of from 15 oz. to 8 oz. per sq. in. Before entering the 8-in. header to the burners, the gas also passes through a Westinghouse proportional gas meter and the gas-steam regulator [illegible] referred to.

The oil-burner nozzles, one to each fire door (three to each boiler) are installed in place directly below the gas burners

with all connections complete, ready to be pressed into service in a few minutes' time. Oil is used as fuel only when the gas supply is interrupted or the pressure falls to such a point that it is feared the station demand will affect the domestic and commercial supply, as the Fort Smith Company does a combination business, distributing natural gas locally. At times, however, oil firing has been used nine or ten hours a day for a week at a time.

The oil is burned with the admixture of live steam from the

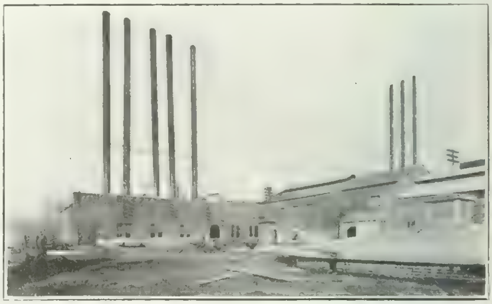


Fig. 3—Plant of Fort Smith Light and Traction Company. Oil Storage Tank in Foreground.

boilers, reduced by diaphragm valves to 60 lb. per sq. in., the oil being supplied at 35 lb. pressure. The Tate & Jones oil burner used consists of a mixing chamber which the fuel enters through an atomizing needle valve, and a flattened nozzle from which the flame emerges in a strong fishtail jet. The flame is broken up and directed against the boiler proper by a wall of brick checkerwork set up about 5 ft. from the nozzles at the front of the fire-box. When set for full load, each burner consumes 35 gal. of oil per hour, or about 100 gal. per boiler. A recent 10-hour test of four boilers with an average output of 330-hp each, showed a consumption of 98.3 gal. of oil per boiler.

The crude oil used for fuel at Ft. Smith costs $1.75 per barrel. It is shipped from the Oklahoma fields in railroad tank cars from which it is pumped through flexible connections to the reservoir on the plant property. The generating station occupies the site of the former artificial gas plant, and the subpit of one of the holders is now utilized for oil storage. This pit is 37 ft. in diameter and 16 ft. deep. It is covered by a conical roof with a center 18-ft. ventilating tower 24 in. in diameter, and has 12 screened windows in the circular wall above ground, providing ventilation for carrying away the gases which are given off by the oil. For keeping the oil from becoming cold and viscous in winter, when it would be difficult to handle by the pumps, the tank is provided with a heating coil of pipes supplied with steam from the exhaust auxiliary apparatus.

PROVISION AGAINST FIRE.

As a lesson of the disastrous fire which occurred in this pit six months ago, elaborate precautions have been taken against accidental ignition of the oil, as well as every means for extinguishing a possible fire. The immediate cause of the former

fire is obscure; a short-circuit on the street railway system occurred the same moment that the fire broke out, and it is presumed that some difference of potential engendered between pipes near the surface of the oil was responsible for igniting the vapors. The principal damage was caused by the ignorance of the local fire department, which attempted to extinguish the fire by deluging the tank with water. This, of course, had only the effect of floating the burning oil up out of the pit, and so spreading the fire among adjacent buildings.

The present tank is provided with 6-in. drains at both top and bottom of the oil contents, discharging into the river, so that the tank can be quickly emptied in case of fire. An oil fire is best attacked by excluding all air from the flames by covering the surface with a mantle of steam vapor. For this purpose, the tank is provided with 26 2-in. steam nozzles fed from a 4-in. line in which 200 lb. steam pressure is available. When turned on, these nozzles form a heavy blanket of vapor over the pit, which would quickly suffocate any fire. The ventilating windows of the pit are carefully screened, so that no lighted matches or burning particles can be thrown into the tank.

OIL PUMPS AND BOILER ROOM ECONOMY.

Fifty feet from this outside tank are the Snow duplex pumps for delivering oil to the boiler room. These pumps are mounted 4 ft. above the oil level so that all drainage returns to the tank. The 235-ft. line of 4-in. pipe from the pump to the boiler-room is provided with a relief valve set to open at 45 lb. in case of stoppage of the line beyond. The overflow from this valve returns to the outside tank. Within the boiler-room is a receiver having a capacity of about one barrel. This serves to equalize the output of the pumps, and is the only quantity of oil, in addition to that in the pipes themselves, which is present in the boiler-room, at any time. From the receiver, after passing a meter for recording consumption, the oil is taken directly to the burners.

The boiler room of the Fort Smith station is as clean as the switchboard gallery or any other part of the plant. The room is painted white throughout, and is spotless. This high order of maintenance is made possible, of course, by the cleanly burning characteristics of the fuel employed. The new fuel has also been the agent of cutting the labor force by 70 per cent. With the present equipment, if coal were used, ten men would be required on the day and night shifts. Now, one man for each of the 12-hour shifts handles the fire-room easily. Thus eight stokers at 17 cents an hour have been eliminated, the former head firemen being retained at about the same wage as before.

STATION OUTPUT.

The total output per month of the plant is 550,400 kw-hours, of which approximately 200,000 kw-hours is in alternating current. The lines of the company reach 2300 customers, 2000 of whom are in Fort Smith. The service rendered in the city is 110-200-volt, 60-cycle, two-phase and single-phase alternating current for power and lighting, and 550-volt direct-current for downtown motors, elevators, etc. The peak load of the alternating-current demand reaches 1250 kw; of the direct-current power service, 190 kw; and of the railway system, 840 kw. On May 1 there were 42,000 incandescent lamps (16-cp equivalent) connected to the company's lines, [illegible] tungstens. Garrison Avenue [illegible] most brightly illuminated streets in the Southwest, with its large number of electric signs. About 7000 sign lamps are installed. The company also furnishes the city street lighting—[illegible] 6-amp. series enclosed carbon arc lamps. The total connected lighting load is about 3000 kw. The total in motors is [illegible] kw, one-third [illegible] direct-current motors. About 600 fan motors of all kinds, and about 300 electric irons are in use. The company also has an [illegible] investment of 275 transformers, totaling 1650 kw; 130 miles of line for commercial lighting [illegible] miles for city lighting and an extensive system of lighting and trolley feeders.

Van Buren, seven miles north of Fort Smith, receives its supply of electricity over a 6600-volt transmission line which includes a 2200-ft. span of No. 6 special river-crossing wires carried on 105-ft. towers, crossing the Arkansas River. There are about 300 electricity customers in Van Buren. The transmission line has been designed for 13,200 volts, double its present pressure, and the transformer capacity at each end totals 200 kw.

GAS-ENGINE COMPETITION.

The Fort Smith company has had to meet the situation of having cheap natural gas for power and lighting customers accompany its own plant saving with the advent of the new fuel. In this respect, however, it is fortunate in having to meet only its own competition. Gas for domestic purposes is furnished at 25 cents pere 1000 ft., and for manufacturing use at from 8 cents to 12½ cents. The rates for electrical energy for lighting vary from 15 cents for the first 10 kw-hours, down to 5 cents for all over 500 kw-hours per month. The power rate is 5 cents per kw-hour for the first 400-kw hours, sliding to an average of 2 cents for all above 20,000 kw-hours. A monthly charge of $1.00, designated, in accordance with the State laws which prohibit "minimums," as a "readiness-to-serve" charge, is made for each installation. As the result of the low cost of gas, there are a number of gas-engine installations, of various ratings from 5 hp to 60 hp, in Fort Smith. Above 50 hp capacity, the gas engine is pretty firmly entrenched, as its service is then satisfactory and uniform, and is stated to produce energy at a cost of from 3 cents to 4 cents per hp-hour. However, where new installations are to be made, especially in the smaller sizes,

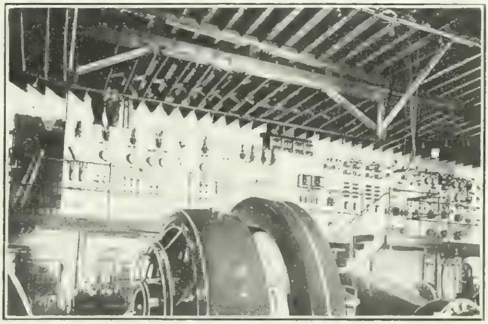


Fig. 4—Switchboard Gallery.

the high first cost of the gas engine is a factor in favor of the use of the electric motor. If the investment cost and the item of labor be properly figured into the expense of gas engine operation, the superior economy of the electric motor can also be proved in addition to its simplicity, flexibility, dependability and freedom from breakdown. As a result, the motor is steadily replacing gas-engine installations, and by adding new loads, is rapidly raising the proportion of electric drive in Fort Smith.

PERSONNEL.

The Fort Smith Light & Traction Company, besides furnishing electricity for lighting and power and distributing gas chiefly for cooking, operates the local up-to-date street railway system, which includes modern car shops and barns and one of the handsomest electric pleasure parks in this country. For its railway ballasting and building operations, the company owns and works a stone quarry. In all it employs about 350 men in its electric lighting, gas and railway departments. The company is controlled by H. M. Byllesby & Company, Chicago. Its officers are: President, Mr. A. S. Huey; vice-president, Mr. H. M. Byllesby; secretary, Mr. James Brizzolara; and treasurer and general manager, Mr. J. Walter Gillette. Mr. B. A. Hoag is superintendent of the railway department; Mr. J. A. Brake is superintendent of the gas department; Mr. L. R. Robertson, chief engineer; Mr. A. Patterson, superintendent of the electrical department and Mr. Geo. Chynoweth is master mechanic.

ELECTRICALLY OPERATED EQUIPMENT IN A HOTEL LAUNDRY.

One of the model hotel laundries of the country is that installed in the new Blackstone, Chicago, in which a number of the machines are heated by electricity, and all are driven by electric motors. The laundry is located on the top floor of the 20-story structure, under the roof, where an abundance of fresh air is secured, and all heat and vapors may be dispersed without permeating the lower stories of the hotel. The arrangement of the various machines in the laundry-room has been worked out with the idea of routing the work through in the most direct manner, without the necessity of doubling back any pieces. As the accompanying plan shows, the pieces to be washed traverse in order the washing tubs, centrifugal extractors, and the various ironing machines.

The washing and ironing machinery installed in the Blackstone Hotel laundry is capable of handling 30,000 pieces a day, including 20,000 flat-work pieces, tablecloths, sheets, etc. Provision is made for doing guests' work in addition to the hotel laundry work.

The washing machinery comprises three 36-in. x 62-in. brass-cylinder, galvanized-iron shell washers, driven by a 7½-hp motor, and two 32-in. x 30-in. and one 36-in. x 48-in. washers driven by a 5-hp motor. Each of these groups is belt-driven from a countershaft running the length of the group. In a row in the center of the washing room are four 28-in. centrifugal extractors, each individually driven by a 3-hp motor. These extractors employ large perforated metal baskets arranged to be whirled at a speed of nearly 1500 r.p.m., thus engendering sufficient centrifugal force to throw and press the moisture out of the wet clothes contained in the basket. By means of the centrifugal extractor, about 75 per cent of the water present can be removed, leaving the remaining 25 per cent to be dried out in the process of ironing. Each centrifugal extractor in the Blackstone laundry is equipped with a safety cover, which when opened trips the motor switch. By this arrangement, the operator cannot put her hands into the extractor without stopping the machine.

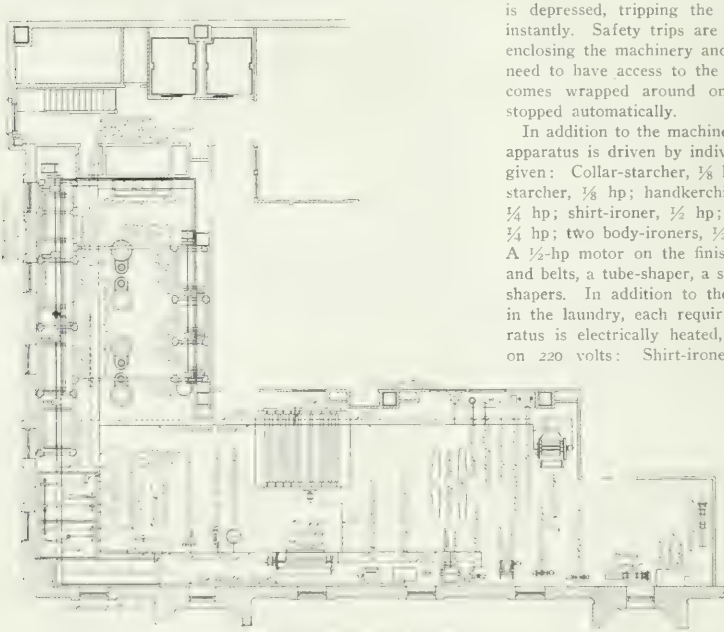


Fig. 1—Floor Plan of Laundry.

From the extractors the flat pieces are next brought to the large steam-heated ironer, or mangle, which was designed for ironing 20,000 pieces in a 10-hour day. This machine has a steam-heated roll, 120 in. long and 48 in. in diameter, and is driven by a 2¼-hp motor. For the safety of the operator, a trip plate is provided the length of the roll, so that should she carelessly allow her fingers to get too near the rolls, the plate is depressed, tripping the switch and stopping the machine instantly. Safety trips are also provided on the wire screens enclosing the machinery and rolls, so that should the operator need to have access to the rolls, in case a piece of work becomes wrapped around one of them, the machine is first stopped automatically.

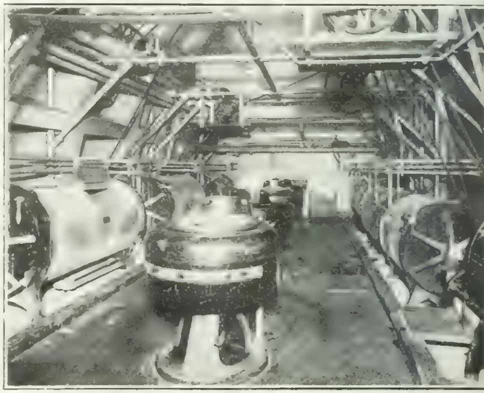


Fig. 2—Interior of Laundry Room.

In addition to the machinery before mentioned, the following apparatus is driven by individual electric motors of the rating given: Collar-starcher, ⅛ hp; shirt-starcher, ⅛ hp; négligée-starcher, ⅛ hp; handkerchief-ironer, ½ hp; collar-dampener, ¼ hp; shirt-ironer, ½ hp; band-ironer, ⅛ hp; sleeve-ironer, ¼ hp; two body-ironers, ½ hp; collar- and cuff-ironer, 1 hp. A ½-hp motor on the finishing table drives, through a shaft and belts, a tube-shaper, a smoothing-machine and three collar-shapers. In addition to the eight 5.5-lb. electric irons in use in the laundry, each requiring 600 watts, the following apparatus is electrically heated, taking the current demand given on 220 volts: Shirt-ironer, 13 amp; band-ironer, 3 amp; sleeve-ironer, 7 amp; two body-ironers, each 16 amp; two collar ironers, each 3 amp.

From the last ironing operations, the finished work is taken to dumb-waiters connecting with the service pantries on the various floors, from which it can be distributed to the linen closets.

The Blackstone Hotel laundry is, for its size, one of the most complete laundries installed, the large use of electricity for both heating and individual drive ranking it among the most modern installations in this country. Both the electrical energy and the steam used in this laundry are derived from the hotel power plant, in the basement, 24 stories below the laundry floor. This isolated-plant equipment comprises four 250-hp boilers supplying steam for two 200-kw and one 300-kw engine-driven direct-current generator sets, which furnish electricity for lighting and other uses in the hotel. The laundry machinery was supplied by the Troy Laundry Machinery Company, of Chicago.

DEFECTS IN THE VOLTMETER METHOD OF THE MEASUREMENT OF INSULATION RESISTANCE.

By Arthur J. R[illegible]

For practical, every-day measurement of insulation resistance it is probable that no instrument is so widely in use as the voltmeter. The range of high-resistance measurement possible by using it is greater than for any simple apparatus. The same instrument can be used for a number of other purposes, while the voltage used with it for testing is commonly the same as that regularly in use on the line. The very fact of its common use makes it important that every user of the method should understand its limitations and defects. It is the purpose of this article to point out some of them.

It may be wise at the beginning to outline briefly the voltmeter method in its simplest form. Suppose, in Fig. 1, that X is a device the resistance of which is to be measured. A voltmeter is connected as shown. Terminal a is connected to b and then to c, a reading of the instrument being made at each connection. Suppose when at b the reading is 100 volts and when at c the reading is 20 volts; then if the resistance of the instrument is 10,000 ohms the resistance of X may be computed from $X = \frac{D-d}{d} R$, where R = voltmeter resistance; D = reading with a on b; d = reading with a on c. In this case

$$X = \frac{100-20}{20} \; 10{,}000 = 40{,}000 \text{ ohms.}$$

Importance of High Sensibility.

In measuring insulation resistance that voltmeter is most valuable which will give a readable deflection with the highest resistance in series. Thus, a reading of 1 volt is considered as the lowest one may care to use, the highest resistance the voltmeter above (instrument A) can measure is

$$X = \frac{100-1}{1} \; 10{,}000 = 990{,}000 \text{ ohms.}$$

If, however, another instrument is available (instrument B) which has twice the resistance, and which in a certain test shows the same reading when connected as above, one is measuring with it twice as high a resistance for 1 volt deflection.

$$X = \frac{100-1}{1} \; 20{,}000 = 1{,}980{,}000 \text{ ohms.}$$

If both these instruments have 100-volt scales, A has a resistance of 100 ohms per volt and B 200 ohms per volt. Hence

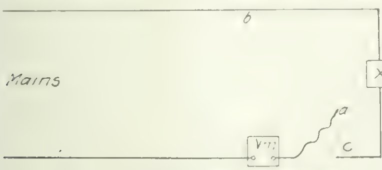


Fig. 1—Voltmeter Test of Insulation.

the advantage of B is due to its higher "sensibility" as thus expressed. A certain current through it gives twice the deflection it would in instrument A. It is possible to purchase voltmeters the "sensibility" of which is as high as 1600 ohms per volt, but they are bulky, expensive and so essentially delicate as to be undesirable for most purposes. Instruments A and B above represent first-class voltmeters of the D'Arsonval type and conclusions regarding "sensibility" drawn from them are representative of good practice. It is seen, then, that one can hardly expect to measure resistance higher than a megohm or two, and even then it will be done with poor accuracy.

It will be well to bear in mind through the remainder of this article that an instrument with a "sensibility" of 100 ohms per volt is assumed.

Limit of Range and Accuracy.

The examples already given indicate about the upper limit of resistance measurement for voltmeters of the kinds in most general use. It must not be inferred from what has been said about "sensibility" that high resistance in an instrument is in itself desirable. Suppose, for example, instrument A is a double-scale instrument (100 volts and 200 volts) and the readings are repeated with 990,000 ohms in series, using the 200-volt posts. A 20,000-ohm instrument is now in use, but the scale readings would come out 100 and 2* as before, no gain in accuracy or range being obtained; while if the voltage is increased to 200, using the 200-volt scale, the only advantage is that the accuracy is slightly improved, the deflection with resistance in series being 4 volts instead of 2 volts.

In any instrument, the accuracy of the measurement depends on the accuracy of reading and the point along the scale at which the reading is taken. It is claimed that a skilled laboratorian can read an instrument with accuracy to one-tenth of the smallest scale division. It is certain that for the majority of persons used to instruments reading to one-fifth of the smallest division is the best they can do. At this accuracy of scale reading and with 1 volt deflection on a voltmeter (A), used as above, the resistance is known within 23 per cent for the addition of a whole 1,000,000 ohms will drop the voltmeter reading by only ½ volt. If the same resistance is under measurement, instrument B will give twice the accuracy of A. Higher on the scale the accuracy is, of course, much greater, but under the best of conditions, and with the best of instruments, readings only show roughly approximate results.

Troublesome Points.

There are many troublesome points connected with use of a voltmeter for insulation resistance testing which may be noted in passing before taking up the most serious troubles and defects of all.

Most people find it confusing to read volts on a voltmeter when measuring ohms, because the reading of volts is really no indication of the amount of resistance, unless one knows his instrument and has a constant testing voltage; a difference of 1 volt represents wonderfully different change of resistance at different parts of the scale; it is necessary to hunt up instrument resistance in order to get a numerical result and to remember a formula into the bargain.

One way to overcome this algebraic trouble is to make a table of resistance values for every division deflection of the voltmeter and refer to it when making tests. This, however, will only hold good for a single applied e.m.f., and at small voltmeter readings the steps of resistance in the table will be very large.

Another vexatious thing is that the method is worthless for

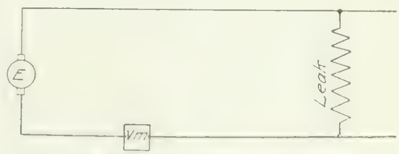


Fig. 2—Leak Between Conductors.

alternating-current circuits, particularly because of the low resistance inherent in all alternating-current voltmeters, their low sensibility and the bad scales they have near the zero point. Then, too, the very high insulation resistance values encountered in high voltage alternating-current apparatus and lines put the measurements far beyond their reach.

Testing Insulation Between the Sides of a Circuit.

Such a measurement would be made by connecting the voltmeter as in Fig. 2 for a reading (d), the voltage of the source $E(D)$ having previously been observed. The calculation is then made as shown in the first example of this article. But it happens that it is most rare to have a single leak on one branch of a circuit, and that leaks are commonly by way of an earth connection. We have then in practical work a condition of affairs shown by Fig. 3, in which only two branches are taken

*[illegible] when the [illegible]

for the sake of simplicity, the parts of the resistance on each side of earth connection being as marked. Let it be assumed that from one earth connection to the other the resistance is zero. Fig. 4 shows the circuit simplified, with values for all the resistances set down so a numerical result can be calculated. If conditions were as shown in Fig. 2, the voltmeter would

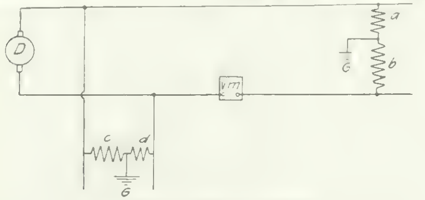


Fig. 3—Leaks to Ground.

read 20 volts and the insulation resistance would figure out to 40,000 ohms. But as in Fig. 3 the voltmeter reads 13 volts and, using the formula, the resistance appears to be 66,900 ohms. Here is an error of nearly 70 per cent. Now while it is true that the magnitude of the various resistances and the location of the earth connection are all important factors in determining what the result of a measurement will be, such conditions as those indicated in the problem here given are as likely to be encountered as any others. Practical circuits with *many* branches are liable to introduce unknown and unknowable difficulties and thus yield results from measurements which cannot be interpreted. Even if all the other branches are cut loose in order to make a measurement, the dynamo or other source of e.m.f. is not perfectly insulated and may itself introduce a cause for similar false readings. It must be clear, then, that the measurement of insulation resistance from one side to the other of a commercial circuit by a voltmeter inserted for the purpose is unreliable, since it is uncertain just what is really shown by the voltmeter deflection. The only method for obtaining true results is by the use of a separate source of e.m.f. This method is considered later.

Testing Insulation to Ground.

The defects in the voltmeter method of measuring insulation resistance are worst of all when making the very common test of insulation to ground. In Fig. 5 are shown the connections which are made to measure the resistance to ground of the negative side of a circuit. If things were only as simple as this in practice, the measurement would be easy and results reliable. But there is certain to be on one branch or another a leak on the positive side. Fig. 6 will show what is meant. Now, with conditions as shown in Fig 5, the voltmeter (10,000-ohm instrument) would read 20 volts and the resistance figure out 40,000 ohms. But with leaks as in Fig. 6 the 10,000-ohm fault to ground on the positive side of the circuit, even though in

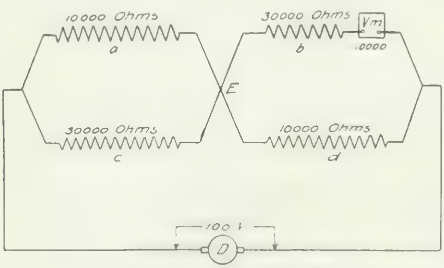


Fig. 4—Equivalent Circuits.

an entirely different branch, is in parallel with the voltmeter. The combined resistance of leaks and instrument is, therefore, 45,000 ohms and the voltmeter will read 11.1 volts, seeming to indicate an insulation resistance on the negative side of the circuit of a little more than 80,000 ohms, while the real resistance is 40,000.

Hence, it must be obvious that it is impossible to measure the insulation to ground of any apparatus or line unless every other connected apparatus, line and generating source is perfectly insulated. The only possible chance to use the voltmeter method is to isolate the branch on which the test is to be made from the remainder of the system, use a separate insulated source of e.m.f. and a formula which properly allows for the

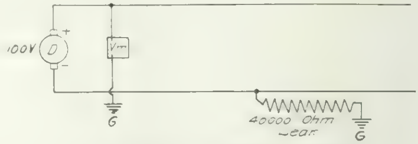


Fig. 5—Leak to Ground On One Side.

fact that neither side of the system is perfectly insulated. Space does not permit the development of such a formula here.

The Separate Source of E.M.F.

For a separate source of e.m.f. to be really useful it must be perfectly insulated, and the e.m.f. must be steady. A generator may be used for this particular work; but testing is absolutely limited to lines which start from the place where the generator is, and the apparatus which can be brought to its location. A storage battery might be used, but in addition to the limitations of a generator as a source, it is difficult to keep the battery insulated and it is sure to vary in e.m.f. from time to time. A primary battery may serve and it can be insulated, but small dry cells must be employed for convenience and portability. After some period of use they are apt to polarize. Thus a set of silver-chloride cells in possession of the writer after being in use for some time when connected to a voltmeter having a

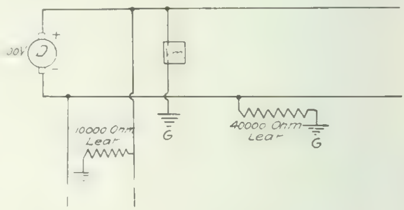


Fig. 6—Leaks to Ground On Both Sides.

"sensibility" of 100 ohms per volt dropped 8 per cent in e.m.f. within five seconds, while others quite new would rise 2 per cent within a minute. This sort of thing renders it necessary to make repeated readings in order to secure any real determination of the resistance; a change in the applied e.m.f. has a proportionate effect on the result calculated, and to assume an e.m.f. which does not exist at the time of a reading on account of polarization introduces an error for which no allowance can be made.

On the whole, then, the measuring of insulation resistance by a voltmeter should be done only by one who thoroughly understands the defects and limitations and applies the instrument intelligently.

WAYSIDE STREET LIGHTING FOR LATE HOME-COMERS.

In the Saxon village of Joketa, in Germany, the regular municipal street lighting is extinguished at 11 p. m., when it is assumed that everybody ought to be in bed. Since this practice has been established, however, some of the gayer spirits of the town have registered serious objections to coming home in the dark, and in order to meet their demands for all-night street lighting the central-station authorities are reported to have attached slot-machine switches to the electric-lamp poles. A 10-pfennig piece will secure enough illumination to light one's way home unless the distance is a long one, when two coins may be necessary. Apartment houses on the Continent are usually equipped with push-button stair lamps, which remain lighted long enough for the latecomer to reach his own floor after the regular house lamps have been extinguished

COMMERCIAL CENTRAL-STATION PRACTICE AT HARTFORD—METHODS OF THE MOST PROGRESSIVE OF AMERICAN CENTRAL STATIONS.

AMONG the successful central-station organizations serving American cities of moderate size, the Hartford Electric Light Company, of Hartford, Conn., has for many years maintained a high reputation for progressive development along both technical and commercial lines. The management of the company has always been keenly alive to the influence of a centralized generating and distributing organization upon the industrial prosperity of its territory when energy is offered at reasonable rates and under terms which permit the public to take advantage of the most advanced developments in the art. As a pioneer in the application of commercial policies the company has often been obliged to face the charge of heterodoxy in matters of central-station service. Thus, it is fast breaking away from the use of meters in connection with residential lighting; it has taken up the question of low rates for long-hour service in full confidence that by such means the isolated plant will pass from the urban field which the company supplies; and it has carried on a large amount of original experimentation with electric heating and cooking apparatus in the firm belief that even the difficult problem of heating can be solved by electricity and before long electric cooking be brought within the means of persons of even moderate circumstances. A growing bank account testifies to the wisdom of the Hartford company's commercial policies, and, in its opinion, offsets all the criticism that has been directed against it on account of its so-called "radical tendencies." Under the presidency of Mr. Austin C. Dunham, seconded by the work of Mr. R. W. Rollins, general manager, the company is steadily acquiring intimate relations with every user of electricity for lamps and motors in the communities served. Through the electrically operated fireless cooker the company hopes to popularize electric cooking.

The commercial work of the company has been described at some length in various issues of this journal during the past two years. In view of the continuous progress of the company toward a broader popularization of electricity it has been considered worth while to print in this issue a résumé of the company's commercial practice with particular reference to the problem of residence lighting and domestic cooking.

LOW-VOLTAGE TUNGSTEN LAMPS.

On the introduction of the tungsten lamp, it appeared at first the goal of incandescent electric illumination. It was an efficient lamp for the central station to operate and for the customer to burn. As pointed out, however, by Mr. Frederic W. Prince, of the Hartford company, in a paper before the first semi-annual convention of the New England Section of the National Electric Light Association in the fall of 1909, the Hartford company early realized that from the standpoint of commercial utility the tungsten lamp was not wholly pleasing. The reduction in wattage and questions of supply, renewal and metering were of serious import. The company turned to the low-voltage tungsten lamp as the solution of the problem of residence lighting, on the ground that this lamp has a slow, gradual increase in candle-power, does not blacken as much as the carbon lamp, and by a slight sacrifice in efficiency can be made to last almost 2000 hours, thus overcoming the principal faults of carbon lamps. It was felt advantageous that the low-voltage tungsten lamp can be made in sizes as low as [illegible] cp or 12 cp without sacrifice in efficiency, whereas one of the chief troubles of the metallized-filament lamp was the inability of the manufacturers [illegible] lamp, principally in demand in house lighting. Ordinary handling with practically no breaking was another feature which appealed to the management of the company. The low-voltage lamp was also less costly than the high-voltage unit.

The Hartford company first adapted the low-voltage system to its existing circuits by the use of a so-called "economy coil" with 112-volt primaries and four 28-volt secondaries. Extra taps were brought out on the primary side to admit of exact voltage adjustment on the regular transformer secondary leads of the system. The first difficulty was found in large houses, owing to the drop in the long distribution circuits at 30 volts. Under the low-voltage system a lamp of the same candle-power as the old carbon lamp took 50 per cent more current at one-quarter the voltage, so that the drop in potential per candle-power installed was about six times as great as that formerly obtained. This could be in part overcome by using the primary taps above mentioned, but when the coil was installed in a residence it rendered useless all the heating appliances, fans, sewing-machine and other small motors, and the circuits controlling this apparatus had to be rewired so as to remain on 112 volts, which proved to be expensive and inconvenient. These problems were partially solved by adopting a 60-volt lamp in place of a 30-volt unit. The company ascertained that most of the commercial, cooking and heating apparatus can be made for 60-volt service with satisfactory results. The 60-volt lamp has a negligible breakage, the same efficiency as the higher-voltage lamps, and has the standard 16-cp bulb. In the installation of a large number of economy coils of the original pattern with only a two-wire 112-volt primary difficulty was experienced in maintaining a balance on transformers and the three-wire street system. This difficulty was surmounted by the use of an economy coil with a three-wire, 120-240-volt primary, and a three-wire, 60-120-volt secondary, so that the house voltage is now reduced suitably for the lamps.

FLAT RATE LIGHTING FOR RESIDENCES.

For this residential business a flat rate was made at the outset, the original proposition being a charge of 10 cents per lamp per month for service supplied to 10-cp low-voltage lamps; 15 cents per lamp per month for 20-cp low-voltage tungstens, and 25 cents per lamp per month for 30-cp low-voltage lamps. Before the advent of the low-voltage lamp the company was offering its customers a flat rate of 35 cents per month per lamp on installations of five high-voltage 25-watt tungstens, but this system did not have an opportunity to gain much headway before the low-voltage lamp entered the field. The original rates have been maintained in connection with the low-voltage system, and the number of low-voltage lamps installed has been more than doubled in the past 12 months, there being at present about 27,500 lamps in residence service. When the low-voltage lamp was offered to the public in Hartford, the company already had 120,000 incandescent lamps in residential service on meters, and a thorough investigation showed that each lamp brought the company on the average a net income of $1.10 per year. This revenue gave the basis of handling the low-voltage tungsten lamps. The first installation of lamps is furnished the customer at 20 cents each for all sizes. Renewals, of all sizes, are charged at 10 cents each. The installation of the economy coil and wiring is done free. The customer has the choice of a meter service in case he wishes the latter. A meter rental of 50 cents per month, minimum, is charged, but this sum is taken out when the bill reaches a minimum of 80 cents per month. The contract flat rate on an installation of 10 low-voltage lamps per month is $1 net.

Soon after the advent of the high-voltage tungsten and its introduction in residences on a flat-rate basis trouble appeared from customers purchasing 40-watt lamps and screwing them in the places of the 25-watt lamps without the knowledge of the company. This fact necessitated the adoption and use of a current-limiting controller or excess indicator, and in the low-voltage installations this equipment is included in addition to the economy coil. This apparatus causes the lights to flicker if more than a certain number of lamps are turned on at once. In the first issue of February, 1910, a résumé was printed of the experience of several companies in the East with the excess indicator, including Hartford. The Hartford company has found a convenient and cheap combination in the form of a three-wire, maximum-demand controller and three-wire economy coil. In connection with the first 12,000 low-voltage lamps installed on a flat-rate basis, the company found that the aver-

age number of lamps installed per economy coil was 24, and the average monthly revenue per economy coil was $2.29. The loss of power in the coil was found to be not over 11 watts, and the company has found it possible to cut down meter expenditure to minimum, for both maintenance and initial purchases. The present meter expense is merely nominal, whereas formerly the expense for new meters exceeded $2,000 per month.

The company carried on an active campaign in connection with the introduction of the low-voltage lamp for the purpose of securing the business of houses using gas, but without electric wiring. A contract price was made of $35 for wiring, and for this sum the customer's home is provided with six outlets. For these outlets are furnished one three-lamp fixture, two two-lamp fixtures, and one single-lamp fixture, one bracket and one drop cord, or a total of 10 sockets or lamps. This proposition still holds, and there are not over 5 per cent of the new houses built in Hartford at the present time which are not wired during construction, while many old houses which for years have depended upon gas are changing over to electricity.

If the customer demands a meter, carbon-filament lamps are used. For an initial cost of $35, therefore, many a family in moderate circumstances can enjoy the benefits of electricity, the running charge being simply $1 per month. Ten 10-cp lamps may be burned day and night if desired, at this rate. In case 10 lamps are insufficient, extra outlets are installed with the original contract equipment at a price of $3.50 each, with extra fixtures at cost. Most of the contracts run in excess of the 10-lamp proposition. The policy is to install the higher candle-power lamps for reading and the lower ones in the out-of-the-way sockets. The maintenance of the economy coil and flat-rate controller is practically nil. About three times as many flat-rate consumers are received as meter customers. For all lamps above the 12-cp size the company charges 12 cents per month per lamp for energy. The only cause for dissatisfaction through the action of the indicator is when a customer tries to use a larger connected load than his contract permits.

Before Mr. Dunham took hold of the residence lighting business in Hartford competing interests were handling the work at a loss. The company has found by check meters that residential lighting can be operated on the flat-rate basis above given and net the company from 6 cents to 15 cents per kw-hour. Therefore, on the average, the results are good. The low-voltage lamps are specially adapted to the small consumer, for hall lighting, etc. Customers do not burn their lamps 24 hours per day, although they tend to use energy for long periods under the flat rate.

About a year and a half ago, before the low-voltage flat-rate tungsten lamp service was inaugurated, the company placed in effect a method of charging for light instead of for kw-hours. The plan was to graduate the meter scale to read in cp-hours instead of kw-hours. The details of this scheme were described in these columns at the time. It had the advantage of enabling the company to make use of the improvements in lamp efficiency without a serious reduction in revenue, and brought to the customer a bill for a service which was much more intelligible to him than a bill for kw-hours. The greater simplicity of the low-voltage, flat-rate plan, however, soon led the company to adopt the latter in connection with its residential lighting service.

ELECTRIC HEATING.

For a number of years past President Dunham has been greatly interested in electric heating and cooking, as many engineers who have enjoyed the hospitality of his home can testify. About two years ago he developed an electric range which has been used in more than 50 Hartford households with success. It is equipped with three 500-watt, General Electric cartridge heater units disposed in two stoves, and four units of the same size placed at the bottom of an oven. A feature is an aluminum reflector in the oven, which enables the cooking to be done more evenly, and which also saves energy. The company manufactured the range and sold it for $40, connected and ready for service, with a broiler, cooker and roaster. Cooking rates were put on the basis of 4 cents per kw-hour by meter, or on the basis of $1 per person per month, with half price for children under six. Elaborate tests of the cost of cooking meals for different numbers of people were made by the company, and these showed that the cost varied from about 1.5 to 4 cents per person, depending upon the variety and character of the menu. Other heater developments made under Mr. Dunham's personal supervision included an electric radiator for special service in heating rooms that are difficult to heat by steam or hot air, and a tank heater for kitchen service. These heaters are still under development, largely with respect to the improvement of mechanical details.

ELECTRIC FIRELESS COOKER.

The principal investigation in the heating line which the company now has in hand is in connection with a fireless cooker. This apparatus is still in the laboratory stage, but tests made upon several elementary units which have been made show that attractive results are in prospect when this type of equipment can be placed on central-station service. Mr. Dunham is devoting special attention to securing the proper materials for the fireless cooker, the question of insulation being most important when combined with accessibility of the interior. Experiments have already shown that a pot of Boston baked beans can be cooked in the best possible manner by this means, and that only 35 watts continuous input are required to do this, maintaining a temperature of 250 deg. Fahr. Stews and cereals also can be cooked in the best way by this method. The tests show that a baking temperature of 350 deg. Fahr. can be maintained by 100 watts input into the heating elements, and a loaf of bread has been baked in an hour on the 100-watt size of cooker. The introduction of this device will permit an even, slow cooking, which makes cheaper cuts of meats more palatable and nearly equal in taste to the highest-priced cuts. The juices are retained in using this apparatus, and the low quantity of energy required adapts it to any outlet. To the central station it will furnish a desirable load for 20 hours per day in many cases. The cooker will probably be developed with different sized resistance units, adapting it to varied requirements. It is probable that in the average household the fireless cooker can be counted upon to produce a load of from 1500 to 2000 watt-hours per day, and the price for energy will probably be less than the cost of cooking in a stove by coal.

STREET LIGHTING.

Hartford is one of the best lighted cities in New England. There are at present in service on the streets about 580 magnetite arc lamps of the 4-amp size, and 1600 series-tungsten lamps of 125 watts rating. The magnetite lamps are installed in opalescent globes, and the tungstens are of the clear-bulb type.

The city is illuminated on a five-year contract, which expires in 1914. Each magnetite lamp is required to consume at least 300 watts at the arc. The city pays the company $64 per year for each arc lamp supplied from the underground circuits and $60 for each arc lamp fed from the overhead system, on an all-night and every-night schedule. The tungsten lamps supplied from underground circuits are charged at the rate of $25 per year each, while those receiving energy from the overhead lines are paid for at the $17 rate. Lamps in parks are supplied at the same rates as those on the streets, the schedule being approximately 4000 hours per year. On Bushwell and State Parks the company has placed 60 125-watt tungsten lamps singly in opalescent globes 9 ft. 8 in. above the ground.

The street lighting contract, executed under the advice of Dr. Louis Bell, of Boston, consulting engineer to the municipality, provides that all lamps may be operated at the option of the company in either series or multiple circuits, subject to the ordinary requirements of good practice as regards steady and safe operation. An interesting point is the retention by the city of 10 electrodes serving as standards by which the quality of all electrodes offered for service is tested. The company is required to supply electrodes in lots of not less than 5000, and

to test the light-giving power of each lot. The contract originally provided that the maximum diameter of the mineralized electrode should not exceed ½ in., but in January, 1910, a supplementary agreement was made allowing the use of 9/16-in. mineralized electrodes, as a life of 175 hours could not be obtained with the ½-in. electrode. All globes are cleaned by the company at least every 100 hours of burning. Any lamp falling below the rated mean by 20 per cent is regarded as out for the week in which the deficiency is noted. No arc lamp is required to be over 1000 ft. from an existing circuit of capacity sufficient to run it.

EXHIBITIONS.

The Hartford company has long been a believer in the value of a well-appointed exhibition room in the business center of the city, and has for some time maintained quarters of this sort on Main Street. The commercial work in connection with lighting bills is handled here, and all the latest apparatus is shown, as far as space permits. In an old church building long since abandoned to the needs of commerce, the company has at times fitted up an electrical apartment having all the latest modern conveniences from the electric range to the front door bell. Indirect lighting has been shown here, with ornamental shades for table service, and last June a demonstration was held in the form of an electrical show, which was open from 9 a. m. to 9 p. m. A large number of electric signs were shown and many were sold from the exhibit. Chafing-dish demonstrators were also on hand, and upward of 2000 persons frequently visited the show in a day. At its Pearl Street offices the company has recently fitted up two rooms for the display of different schemes of electric interior lighting. There are shown different types of fixtures, shades and lamps. Wired up are the lamps which are sold to residence customers on the $35 wiring basis outlined above in connection with the flat-rate, low-voltage service. If a customer desires to see what the illumination will be under a six-outlet contract, it can be shown him by the turn of a switch. There are also comparative exhibits of a 10-cp, 110-volt carbon lamp; a 10-cp, 60-volt tungsten lamp; a 20-cp, 60-volt tungsten and a 16-cp carbon, all with bare bulbs against a pure white wall and 18 in. apart on a horizontal axis.

The company's income from residence lighting now amounts to over $128,000 per annum. At present the average installation per economy coil is about 19 lamps. The company is getting a life of about 1500 hours minimum from the 10-cp, low-voltage lamps. It has watched the regulation of its feeder circuits very carefully since the tungsten lamp came into vogue, and will shortly place in service at prominent industrial plants which it supplies with energy two rotary condensers of 200 kw each, which will still further improve the regulation and raise the power factor. The tendency will be further to increase the lamp life. Nine electric vehicles are owned by the company and constantly used in its service.

STREET-LIGHTING PRACTICE IN MASSACHUSETTS

Massachusetts central stations, in common with companies elsewhere, are large users of the series tungsten lamp of general street-lighting service. The operating economy and excellent life of these lamps have now become so well established that new contracts for incandescent street illumination are practically standardized upon the tungsten filament as a basis. It is estimated that at the present time there are not far from 20,000 tungsten lamps of various sizes in service on the streets of municipalities lighted by private companies, and probably at least 5000 such lamps in use in communities receiving energy from publicly owned plants. For the year ending June 30, 1908, the income of all the private companies in Massachusetts for the sale of energy for arc lighting on streets was $1,479,422, while for the [illegible], the income from this source was about $29,000 less, or $1,450,637. The income from incandescent street lighting, on the other hand, was $188,582 in 1908 and [illegible] a gain of about $33,500. In general, the substitution of tungsten street lamps has been effected without reductions in rates, the plan being to give the municipality more and better lighting for the same expenditure of money than was possible with the carbon-filament lamp. The above figures are indicative of the waning ability of the arc lamp as an illuminating standard outside localities where intense local lighting is required, although it is probable that the substitution of tungsten lamps for arc lamps and the installation of new lamps of the incandescent type are not exactly proportional to the figures given. The street-lighting income in each year was practically 19 per cent of the total revenue.

In the following paragraphs are given various details of the street-lighting service in a number of the larger municipalities in Massachusetts served by private plants, the figures in the main covering the fiscal year ending June 30, 1909.

ATTLEBORO.

Attleboro had a population of about 12,702 persons, according to the census of 1905. The streets were equipped at the end of the year ending June 30, 1909, with 331 incandescents of 40 cp each and 105 alternating-current arc lamps of 1200 nominal cp. All series lamps were supplied with 6.6 amp through tub transformers, and the price paid by the town was $18 per lamp per year for incandescents and $72.50 for arc lamps on an average burning of 6.4 hours per night and 28.7 nights per month, the yearly total being about 2200 hours.

The company's income from street lighting was $13,937, the arc-light service paying $7,867 and the incandescent the balance. The income per capita for street lighting was $1.10. The company's total income from the sale of electric energy was $85,527, so that the street-lighting income represented 16.2 per cent of the whole. The company delivered at its switchboard 186,076 kw-hours for street-lighting service, and received a revenue of 7.5 cents per kw-hour therefor. The total sales of the company for the year were 1,760,842 kw-hours. A special feature of the lighting in the town is the use of 16-cp incandescent lamps under the arches of the steam-railroad lines passing through the municipality. These are lighted all night and every night, and are supplied at a cost of $20 per lamp per year. They furnish a desirable long-hour load. The price of street arc lighting for public service in Attleboro was reduced on Jan. 1, 1909, from $75 to $72.50 per lamp per year.

BOSTON.

Nothing spectacular has occurred in the Boston street-lighting situation during the past year. In the *Electrical World* of May 6, 1909, an account was given of the investigation of street lighting by the city authorities and the awarding of a five-year contract to the Edison Electric Illuminating Company of Boston in the face of sharp competition by the local gas company. About 3500 lamps were involved in the situation. The standard arc lamp for Boston street-lighting service was made the magnetite of 6.6-amp rating, and for the service of these lamps all night and every night the city pays $103.54 per lamp per year, provided the wattage is between 475 and 550 per lamp.

The rates for energy are arranged on the basis of a fixed charge of $42 per lamp per year and a running charge of 1.75 cents per lamp-hour. The average rate per kw-hour at these lamps is 5.4 cents, based on 3828 hours of burning per year. The total contract amounts to about $350,000 per year, but by the substitution of magnetite lamps the city saves at least $30,000 annually, besides getting a much superior illumination of its thoroughfares and a larger volume of light. About 3200 magnetite lamps have been installed in Boston proper, and the company is extending the installation of these lamps into parts of its suburban territory in order to demonstrate what can be done with this type of equipment. A typical line of these lamps is to extend from the heart of Boston westward through the Allston, Brighton and Newton districts to West Newton. Another installation will follow Commonwealth Avenue to Weston Bridge, the lamps being 40 ft. apart and 27 ft. above the street. The installations follow the main electric railway lines and are certain to awaken an interest on the part of the public of Boston and vicinity in high-class highway illumination.

In Boston proper there are about 1000 tungsten lamps in

street service, the 40-cp size being standard. In the West Roxbury, Dorchester and Brighton districts naphtha lamps were displaced by tungsten lamps at a saving to the city of about $10 per lamp per year. In the business districts gas-mantle lamps have been displaced by tungsten lamps in a number of instances with a saving of $1.50 per lamp per year. Superintendent of Streets Rourke has just written a letter to Mayor Fitzgerald recommending that the electric lighting zone be extended and that many gas lamps be discarded. The letter states that automatic gas lighting is at present in a state of evolution, and has not as yet reached a state of perfection which would warrant its recommendation to the city of Boston for an installation of 12,000 lamps. Superintendent Rourke recommends the immediate replacement of 1500 underground service gas lamps in the business center by tungsten lamps, which, he points out, would save the city $4,300 per year.

A departure from ordinary practice has recently been made by the company in connection with the lighting of the Charles River Basin. The illumination of the West Boston Bridge, Harvard Bridge, the Basin Promenade and Back Street is performed by tungsten lamps run in multiple-series circuits, the sizes of the lamps varying from 60 cp to 100 cp. According to the conditions, 9 lamps, 18 lamps or 19 lamps are run in series across the company's underground Edison service, which operates at 110 volts and 220 volts, direct current. Series tungsten lamps are used, and the height of the lamp above the Promenade is about 11 ft. Multiple tungsten lamps could not be used on the two bridges on account of the vibration from electric cars and other heavy vehicles, and high-tension series circuits could not safely be used on account of the installation of all lamps on iron posts. A clear outer globe is provided for each lamp to protect it from breakage and the weather conditions. The company is also lighting Back Street, a narrow thoroughfare running through the Back Bay at the rear of the Beacon Street residential estates. This street has been improved in connection with the work of the Charles River Basin Commission, and was formerly lighted by a feeble gas-lamp equipment. The present installation on Back Street consists of 60-cp Mazda lamps arranged in multiple-series circuits and carried on brackets supported on ornamental iron posts. From a dingy, poorly lighted street the thoroughfare has been transformed to a well-illuminated roadway bordering on the latest addition to the Boston water-park system.

The Boston Edison Company has paid special attention to the suburban street-lighting problem within the past few years, and it is safe to say that from the standpoint of the municipalities and the company alike, the situation is as satisfactory as in any other locality in the country. By encouraging the use of long-term contracts the company gives the cities and towns served the benefits of a reduction in rates based upon the contract life, and it secures freedom from political agitation.

Electricity for street lighting use is sold to municipalities in accordance with the following table of rates:

Description of Lamp	Fixed Costs per Lamp-year in Dollars	Running Costs per Lamp-hour in Cents
[illegible]	10.80	[illegible]
[illegible]	12.00	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
500-watt direct-current magnetite arc lamp...	[illegible]	1.75
[illegible]	[illegible]	3.20

A rate of 1 cent per hour per incandescent lamp and 5 cents per hour per arc lamp is allowed for all outages in any month. When agreements are made for periods longer than one year, a discount of 1 per cent a year is allowed for each year up to 10.

At present the company has two 20-year contracts in force, one being in the town of Arlington and the other in the town of Needham. When a 10-year contract is signed, the municipality secures the benefit of having its equipment placed in the most modern form, including such changes in the shades and lamp-mounting as conduce to the most advanced illumination. A feature of much of the company's suburban street lighting is the substitution of 40-cp tungsten lamps for former installations of 25-cp carbon lamps, so that the municipality not only obtains a larger volume of light for the former expenditure, but also enjoys the benefits of a higher maintenance of lamp rating as the life of the lamp goes on. The city of Somerville, for example, saves about $20,000 per year on its old contract, with 40-cp tungsten lamps in the new agreement; in Newton about 1500 lamps have been changed from 25-cp to the 40-cp tungsten type, while a large number of 425-watt arc lamps of the enclosed type are being replaced by 6.6-amp, 500-watt magnetite lamps with a nominal increase in total cost to the city. The city of Waltham obtains all-night and every-night service with 40-cp tungsten lamps for the same contract price that obtained with 25-cp carbon lamps operating formerly until 1 a. m. The town of Milton had 25-cp lamps in its old service, used until 12:30 a. m. on a moonlight schedule. These have been changed on a new Edison contract to 60-cp tungsten lamps and all-night and every-night service is obtained at not far from the old cost to the town.

The street-lighting income of the Boston Edison Company in 1909 was $503,861, or 12.2 per cent of its total revenue from the sale of electric energy. The company serves a territory of about 500 sq. miles, and the lighting of streets in its district embraces many different sizes and types of lamps. The per capita street-lighting revenue of the company was about $0.715 for the year, and the average income per kw-hour from this source was 4.5 cents. Of the 65,343,358 kw-hours sold by the company 11,218,347 were delivered at the switchboard for street-illuminating service. The towns of Canton, Hopkinton, Medway, Millis, Norfolk, Sharon, Winchester and Woburn are lighted by the company at the regular rate on a 10-year contract basis. Five-year contracts at the regular rates are in force in Boston, Ashland, Holliston, Milton and Stoneham.

BROCKTON.

This community is served by the Edison Electric Illuminating Company, of Brockton, the tributary population being 59,385. The city of Brockton is lighted by 288 enclosed-arc lamps of the 6.6-amp size, at a price of $87 per lamp-year, on all-night and every-night burning. In 1909 these lamps averaged 10.8 hours' burning per night. There are also 768 tungsten street lamps of 5.5-amp rating, for which the city pays $17 per year on a moonlight schedule. Last year the average burning per night was 5.2 hours. The company's street-lighting income was $27,373, or $0.46 per capita, and for this service 834,353 kw-hours were delivered at the switchboard, at an average price of 3.27 cents. The company's total income from the sale of energy was $243,115, of which street lighting represented 11.2 per cent.

CAMBRIDGE.

A population of about 97,434 is served by the Cambridge Electric Light Company. The street lighting of the territory is handled by 500 40-cp lamps at a price of $25 per year per lamp, and 648 so-called 1200-cp arc lamps, for which the city pays $90 per year each. The schedule is an all-night and every-night service for all street lamps. The company's street-lighting income for the year 1909 was $67,280, of which $56,131 was derived from arc service and the balance from incandescent lamps. The street-lighting expenditure of the community per capita was $0.69, and for this purpose the company sold 1,498,065 kw-hours, at an average price of 4.5 cents per kw-hour. The street-lighting revenue was about 22 per cent of the total. The total energy sales for the year were 5,706,241 kw-hours.

FALL RIVER.

The Fall River Electric Light Company serves a population of [illegible], and the streets were equipped on June 30, 1909, with 823 4-amp magnetite arc lamps supplied with direct current through mercury-arc rectifiers. The city pays the company 25 cents per lamp per night for these lamps, an all-night service being maintained every night in the year. The revenue of the company for this service amounted to $74,677 in 1909, or $0.705 per capita, and the energy sales for street lighting were

1,173,458 kw-hours at an average cost to the city of 6.35 cents per kw-hour. The total sales of the company were 3,194,652 kw-hours, and the total income was $229,143, so that the street lighting represented 37 per cent of the energy sold and 32.5 per cent of the income. The latest report of the company filed with the state (1909) gives no incandescent street lighting in the city up to June 30, 1909.

FITCHBURG.

On June 30, 1909, the Fitchburg Gas & Electric Light Company had 164 40-cp incandescents and 326 arc lamps on its street circuits, the price of the former being $20 and of the latter $95 per lamp-year. All-night service was furnished, and the income from incandescent street lighting in 1909 was $2,668 and from arc lighting $30,998, making a total income of $33,666, which, with a population of 33,021 on the basis of the 1905 census, gave a per capita expenditure of $1.02. The city purchased 701,400 kw-hours at an average cost of 4.8 cents each for this service. About 25 per cent of the company's revenue came from street lighting. The total energy sales for the year were approximately 3,300,000 kw-hours.

HAVERHILL.

The Haverhill Electric Company, which serves a territory of about 37,830 inhabitants, lights the streets with 203 titanium arc lamps of 2.5-amp rating, on an all-night schedule at a price of $100 per lamp per year. The company also furnishes six 25-cp carbon incandescent lamps for street service at a price of $26 per lamp-year. In 1909 the street-lighting income of the company was $20,402, and the output was 148,140 kw-hours, or about 7300 kw-hours per lamp. These cost the city 13.8 cents per kw-hour, but the charge per capita was only $0.54. There are as yet no street tungsten lamps in use in Haverhill. The company's total income from sales of electricity was $155,149 in 1909, and the total energy sales were 2,867,710 kw-hours. The street-lighting income represented about 13 per cent of the whole.

LAWRENCE.

The Lawrence Gas Company supplies street illumination in Andover, Lawrence, Methuen and North Andover; its tributary population is estimated at 89,972 persons. Arc lamps furnish the bulk of street illumination in this territory, although in Methuen there are about 250 incandescent lamps of the 40-watt size. The total income of the company from street lighting was $64,997 in 1909, or $0.72 per capita, and this service required the delivery at the busbar of 1,145,849 kw-hours, the average return per kw-hour to the company being 5.65 cents. All-night service is given in Lawrence and the streets are lighted until midnight in the other towns. The total electric service income of the company in 1909 was $225,539, and the total output sold was 3,354,849 kw-hours. The price for arc lighting in Lawrence for street service varied from $80 to $90, according to the size of the lamp.

LOWELL.

The tributary population of the Lowell Electric Light Corporation is 110,786, and the company lights the city of Lowell by 561 7.5-amp alternating-current enclosed-arc lamps on an all-night basis at a price of $100 per lamp per year. There are also in service in the city 531 tungsten street incandescent lamps of the series type, 60-cp size, for which the city pays $23.50 per lamp-year. These operate on an all-night schedule. In the outlying districts there are now in service about 376 series-incandescent lamps of from 25-cp to 40-cp rating, the majority being of the larger size. The prices of these lamps vary from $18 to $24 per year. In the fiscal year 1909 the company's total street-lighting income was $71,636, or $0.65 per capita. Arc lighting furnished $54,820 and incandescent service the balance. The street-lighting income was 20.5 per cent of the whole. The company's street-lighting output was 1,205,755 kw-hours, and the average return per kw-hour in this service was 5.95 cents.

LYNN

The Lynn Gas & Electric Company serves a territory having a population of 89,358 persons, and in the city of Lynn it supplies energy to 340 arc lamps of so-called 2000 cp at a price of $94.90 per lamp-year. There are also 1,340 incandescent lamps of 40 cp in street service; this company was one of the first to adopt tungsten lamps for the lighting of the less prominent thoroughfares. The latter lamps operate on a moonlight schedule at a price of $15.50 per lamp-year. The company uses no carbon lamps in its street system. The arc lamps in Lynn operated 11 hours per night in 1909, and the incandescent lamps 8.6 hours. In the adjoining towns of Nahant, Saugus and Swampscott there are about 256 tungsten lamps in street service, the size being 40 watts each. The rates for these lamps vary from $16 to $18 per year. There are also about 208 arc lamps in these towns, of so-called 1200 cp each, and the prices vary from $67 to $73.50 per year. The total street-lighting revenue of the company in 1909 was $73,811, or $0.825 per capita. The company's total income was $367,408. For the street-lighting service the company delivered 1,300,800 kw-hours at an average return of 5.7 cents each.

MALDEN.

The cities of Malden, Everett, Melrose and the town of Medford are served by the Malden Electric Company, and their combined population is 101,129. The territory is largely suburban and within an area of about 5 miles from Boston. On June 30, 1910, the street lighting of Malden was supplied by 123 arc and 1167 incandescent lamps at a revenue of $2,824 per month. The prices of additional arc lamps are $100 per lamp-year and of incandescent lamps $18.75 per lamp-year. The arc lamps are of 2000 rated cp, and are run nightly from dusk to daylight. The incandescent lamps are of the 40-cp tungsten type, 1145 being operated every dark hour from dusk to daylight, and the remaining 22 on the arc circuit every night and all night without extra charge.

In Medford 168 arc lamps of 2000 rated cp are operated every dark hour of every night from dusk to daylight, and during the months of June to September, inclusive, they are run every night and all night. There are 585 incandescent tungsten lamps of 40 cp run every dark hour from dusk to 2 a. m., and a few lamps of 16 cp run all night. The price for each arc lamp per year on the basis of a 10-year contract is $76.63 and for each incandescent lamp on the same basis $14.22.

Melrose is lighted by 62 arc lamps of 2000 rated cp run every dark hour from dusk to daylight. The price per lamp per year is $88. There are 642 40-cp tungsten lamps operated every dark hour from dusk to 12:30 a. m. The price of the latter is $15 each per year.

Everett is provided with 140 lamps of 2000 rated cp operated every dark hour from dusk to daylight. The price per arc per year is $88. There are 646 tungsten lamps of 40 cp operated until 12:30 a. m. The price is $15 per year for the Everett incandescent lamps.

The Malden company's street-lighting revenue was $89,994 in 1909, and the per capita expenditure of the territory, $0.89. The total output for street lighting was 1,187,180 kw-hours, and the average return 7.6 cents. In Malden and Everett the company recently changed the lighting from the 25-cp carbon standard to the 40-watt tungsten service without extra charge.

MARLBORO.

A population of 18,857 is served by the Marlboro Electric Company, the street lighting being entirely by tungsten lamps in the city of Marlboro and the towns of Berlin, Cordaville, Fayville, Northboro and Southboro. The company reported 637 tungsten lamps of 40 cp in its territory, with the addition of 270 lamps of 60 cp to the installation in the city of Marlboro. The rates on these lamps varied from $15.75 to $18 per year. The total street-lighting revenue of the company in 1909 was $14,572, or $0.77 per capita, and the company's output for this service was 186,834 kw-hours. All of the arc lamps formerly in Marlboro were discontinued in 1909 and replaced by tungsten lamps. The average revenue per kw-hour from street lighting was 7.8 cents, and the company's total income for 1909 was $70,554.

NEW BEDFORD.

The New Bedford Gas & Electric Company supplies street lighting in the municipalities of New Bedford and Fairhaven, the tributary population being 79,777. The greater part of

the lighting is performed by arc lamps of 1200 rated cp at a price of $97.56 per lamp-year, the burning being on an all-night basis. There were 268 arc lamps in the service in 1909 and about 142 incandescent lamps, mostly of 16 cp. The bulk of the incandescent service was in Fairhaven, the principal price being 6.5 cents per lamp per night, on a moonlight schedule. The company's street-lighting income in 1909 was $27,330, or $0.34 per capita, and the output for this service was 482,584 kw-hours at an average price of 5.65 cents.

QUINCY.

The Quincy Electric Light & Power Company earned $23,621 in the fiscal year 1909 from street lighting, the service being rendered to a population of 28,076 persons. There were 756 32-cp incandescent lamps at a price of $16.50 per lamp-year, and the greater portion of the remaining service was handled by 169 arc lamps of 6.6-amp rating, the price for the latter being $70 per year. A 1 a. m. schedule was performed. The per capita income from street lighting was $0.84, and the output for this service 300,051 kw-hours, for which the company received an average return of 7.9 cents each.

REVERE.

The Suburban Gas & Electric Company serves the towns of Revere and Winthrop, both being Boston suburbs. In each town all the new lighting is performed by tungsten lamps. There are 254 incandescent lamps of 40 cp in Revere and 242 in Winthrop. Revere has 141 arc lamps of 2000 rated cp and Winthrop 82. A price of $88 per arc lamp per year is made on a moonlight schedule, while the average price per incandescent is about $19 per year. In general, five 40-cp tungsten lamps replace one arc lamp with satisfaction to the community. The tributary population is 19,693, and the street-lighting revenue per capita in 1909 was $1.40. The company had a street-lighting output of 489,260 kw-hours, at an average rate of 5.6 cents per kw-hour, so that, although the per capita rate was relatively high on account of the volume of lighting and small population of the wide area served, the rate for electrical energy compared favorably with that in other municipalities.

SALEM.

The population served by the Salem Electric Lighting Company is 37,627 persons, and the street-lighting income for 1909 was $43,602, or $1.16 per capita. The output for this service was 714,680 kw-hours, and the average revenue per kw-hour was 6.1 cents. There were 503 incandescent lamps of from 30 cp to 50 cp, and 320 arc lamps of 6.6-amp rating. The prices per lamp were, respectively, $22 per year for the smaller incandescent lamps and $36 per year for the larger ones. Arc service was charged for at the rate of $95 per year. All the service was on the all-night basis.

SPRINGFIELD

The United Electric Light Company supplied street lighting in Agawam, Ludlow, Springfield and West Springfield, there being on June 30, 1909, in service a total of 1115 arc lamps of the 1200 rated cp size and about 428 incandescent lamps of 60 cp and 40 cp. In Springfield there are now in service 175 75-watt tungsten lamps operating on 5-amp series direct-current arc circuits, for which the company receives $15 per year for 4000 hours' service. The company reports that it is getting excellent life from some of these lamps, which have operated for over 3000 hours. The population served is about 86,486. The street-lighting income for the fiscal year 1910 was $92,670, or $1.07 per capita, and the output for this purpose was 1,996,800 kw-hours. The revenue averaged 4.65 cents per kw-hour.

WORCESTER.

Worcester, like Fall River, is lighted almost entirely by magnetite arc lamps of the 4-amp size. These are supplied with direct current by mercury-arc rectifiers and the city pays the company 25 cents per lamp per night. There were 852 of these lamps in service on June 30, 1909, and the company's street-lighting income for that year was $80,633, giving a per capita street-lighting revenue of $0.615 on a population of 131,549 persons. The output for street lighting was 1,301,100 kw-hours, and the income per street-lighting kw-hour 6.2 cents.

In the accompanying table is given a summary of the street-lighting earnings, outputs and revenue of the companies above reviewed:

SUMMARY OF ENERGY SALES, 1909, STREET LIGHTING.

Company	Population Tributary (1905)	Street Lighting Income	Street Lighting Income per Capita	Kw-hours Street Lighting	Street Lighting Income per Kw hour Cents
Attleboro	12,702	$13,937	$1.10	186,076	7.5
Boston (Edison)	703,597	503,861	0.715	11,218,247	4.5
Brockton	59,385	27,[illegible]	0.46	834,353	3.27
Cambridge	97,434	67,280	0.69	1,498,065	4.5
Fall River	105,762	74,677	0.705	1,173,458	6.35
Fitchburg	33,021	33,666	1.02	701,400	4.8
Haverhill	37,830	20,402	0.54	148,140	13.8
Lawrence	89,972	64,997	0.72	1,145,849	5.65
Lowell	110,786	71,630	0.65	1,208,755	5.95
Lynn	89,358	73,811	0.825	1,300,800	5.7
Malden	101,129	89,994	0.89	1,187,180	7.6
Marlboro	18,857	14,572	0.77	186,834	7.8
New Bedford	79,777	27,330	0.34	482,584	5.65
Quincy	28,076	23,621	0.84	300,051	7.9
Revere	19,693	27,492	1.40	489,260	5.6
Salem	37,627	43,602	1.16	714,680	6.1
Springfield*	86,486	92,670	1.07	1,996,800	4.65
Worcester	131,549	80,633	0.615	1,301,100	6.2

*Year ending June 30, 1910.

TUNGSTEN LAMPS IN MT. CLEMENS, MICH.

Mr. Thomas Hinks, of Mt. Clemens, Mich., gave his experience in the introduction of tungsten lamps at Mt. Clemens before the Michigan Electric Association convention at Port Huron, Aug. 18, 1910. His company formerly operated a flat-rate, series, direct-current, arc circuit for commercial lighting. This system was a source of numerous complaints, because it was not operated 24 hours a day, and the opinions of various customers differed so much as to the times that light was necessary.

In December, 1908, after notifying the customers by letter, the company discontinued its series arc system, and replaced the arcs with two-lamp and three-lamp fixtures, equipped with 100-watt tungstens and reflectors. The company installed a three-lamp fixture with 100-watt tungsten lamps and shades complete for $10, and to satisfy the customers allowed them $5 on each $10 fixture installed, because the customer paid $10 to have the flat-rate arcs installed. This plan was agreeable to all concerned. At present 90 per cent of the business houses in Mt. Clemens are lighted by the electric light company, and there are not over 16 per cent of this number that have not at least one tungsten lamp installed.

It took about one year to displace about 50 gas arcs and 10 gasoline lamps. While some of the previous flat-rate customers paid less than formerly, after a change to the tungstens on a meter basis, others increased their consumption, but were satisfied because they had more light and better distribution, and could have it whenever wanted. A number of 500-watt multiple arcs were remodeled for tungsten lamps. The lower portion of the lamp and carbon holder was removed and three ordinary sockets substituted, with three 60-watt tungsten lamps. Fourteen of these so-called "tungsten arcs" have been installed for lighting outside stores and entrances to amusement places. The average life of tungsten lamps installed in Mt. Clemens is about 950 hours. One lamp in the City Hall clock tower has burned 2150 hours, and three more in different places 1800 hours each. While at first there were complaints from early burnouts, during the last 12 months the complaints have been few.

In discussion of the paper, Mr. A. C. Marshall, of Port Huron, said that his company had between 300 and 400 multiple alternating-current arc lamps in service three years ago, and none of them is in service now as the result of the introduction of tungsten lamps. Many of the former arc consumers reduced their consumption. However, there was an increase in other business, and, on the whole, his company is pleased with the tungsten lamp.

THE TUNGSTEN LAMP and the CENTRAL STATION

Opinions from Central Stations on the Tungsten Lamp Situation.

TWO years ago this journal made a canvass of a selected list of central stations in order to record their experience in meeting the tungsten-lamp situation, which at that time appeared to present problems of the greatest import to the electric lighting industry. The replies, which were printed in the issue of Sept. 5, 1908, indicated that while the radical nature of the situation presented by the advent of a lamp, which, on the basis of equal light would reduce meter bills by two-thirds, was clearly recognized, yet that the more enterprising element of the central-station industry had immediately responded to the emergency, and optimism was the prevailing note of the opinions offered as to the ultimate effect of the new lamp on central-station income. The results of a similar canvas recently made are given below, from which it will be seen that the optimism of two years ago was fully justified in the case of those stations which attacked the problem intelligently and energetically. In fact, among such stations there would no longer be a tungsten-lamp situation were it not for a recent complication arising from the appearance on the market of low candle-power lamps. The opinions of central-station men on this subject are, at the present time, of the highest interest. As supplementary to this section, attention is particularly directed to the article elsewhere on the Hartford, Conn., central-station business methods, which includes an account in detail of the means there used in the introduction of the tungsten lamp, and the manner in which it enabled residence lighting to be greatly extended. Several additional articles bearing more or less directly on the subject of this section will also be found on other pages.

PORTLAND, OREGON.

We have kept no statistics to show the exact effect of tungsten lamps on our lighting business, but are confident that the effect has been decidedly a beneficial one, as we have been enabled to secure many customers who were formerly customers of the gas company, and whom we had previously been unable to close contracts with for electric service. It is largely because of the fact that we were so confident that the effect of the lamps would be beneficial that we have not thought it necessary to keep any statistics of the results produced by the introduction of the lamp.

We deem it very advisable to push the use of the 40-watt lamp to prevent the use of smaller lamps as much as possible. It stands to reason that customers once induced to use the 40-watt lamps will not be satisfied with the amount of illumination obtained from the smaller lamps.—*W. M. Hamilton, illuminating engineer, Portland Railway, Light & Power Company.*

WINDSOR LOCKS, CONN.

There was no question that the tungsten lamp would be demanded by the public and would come into general use. In cases where central stations have been reluctant in putting out tungsten lamps, contractors have sold them, particularly in 25-watt size, which has been not only detrimental to central-station revenue, but also a handicap to the general introduction of the lamp, as the 25-watt lamp was short-lived. For the past year and a half we have been pushing tungsten lamps and trying to educate the public up to the use of them. We have given public lectures, demonstrating the increased illumination obtainable by the use of tungsten lamps with Holophane shades. We ran a house-wiring campaign in which we furnished 10 40 small-bulb tungsten lamps. Practically all business places in our territory are using tungsten lamps with satisfaction.

We have sold tungsten lamps at 5 cents less than the regular list price, with the exception of the 25-watt lamp, which we sold at the same price as the 40-watt lamp in order to encourage the latter in preference to the 25-watt lamp. Eighty per cent of our lamp sales during the past year were tungsten lamps. Of this 80 per cent, 17 per cent were 25-watt lamps, 23 per cent 60-watt lamps, and 60 per cent were 40-watt lamps. The tungsten lamp has been a means of entirely removing complaints of poor service in cases where there was trouble with old lamps. Where tungsten lamps are used, the only complaint seems to be the fragility of the lamp itself. Some people would rather put up with the yellow light of the carbon lamp and pay for the increased energy consumed rather than stand the high lamp renewal charges. Owing to the introduction of the tungsten lamp our revenue has not increased in proportion to the number of consumers added, but we have added considerable business by the use of the tungsten lamp that could not have been obtained otherwise.

For regular lighting, as in dining-rooms, libraries and kitchens, the 40-watt unit is as small as should be used. For closets, cellars or where lamps are only turned on occasionally, we recommend carbon lamps of smaller candle-power, as tungsten lamps would probably be broken before the saving of energy would equal the difference in the cost of the lamp. During the past 18 months we have changed all our arc lamps and carbon street-series lamps to tungsten series lamps, and the results have been very satisfactory. By this change we have been able to reduce the size of our current regulator from 17½ kw to 8 kw, and from 31 kw to 17½ kw, in each case supplying an increased number of lamps on the circuit. We are experiencing exceedingly long life in these street lamps, and will later on have some definite information on this point, as we are just beginning to keep a history card of each lamp on the circuit.—*Walter P. Schwabe, general manager, Northern Connecticut Light & Power Company.*

EAU CLAIRE, WIS.

The introduction of the tungsten lamp on our circuit has been successful in two ways. We are giving practically all of our customers more light, and very few, if any, customers are using less current than they did before the introduction of the lamp. We have, furthermore, succeeded in securing a great many customers whom we could not get with the older form of lamps.

I would prefer to see a 60-watt, small-bulb tungsten lamp at least no larger than the old 32-cp lamp. I find that most of our customers desire more light rather than small bills. We do not encourage the 25-watt tungsten lamp, but carry it in stock for such people as may demand it. We lead them toward the 40-watt size by keeping the difference in the cost of the two lamps only 5 cents.

We are still having some trouble with tungstens blackening and do not have entirely satisfactory results from tungstens burned in horizontal position. We hope the manufacturers will improve the filament material, as this will be a great advantage to the lamp.—*A. E. Peirce, assistant manager, Chippewa Valley Railway, Light & Power Company.*

DENVER, COL.

Our experience in the introduction of tungsten lamps on revenue has been an increase rather than a decrease. This is accounted for through our sign and illuminating departments conferring in nearly every instance with our consumers and recommending the installation of high candle-power lamps; otherwise the consumer would be apt to arrange his installation according to past standards that would give him the same light at about one-third the cost. We, of course, recommend precisely the reverse, namely, about the same kilowatt consumption giving the consumer about three times the light. The result has been that we have greatly increased the standard of illumination, which, in turn, has led at least to a continuance of the same revenue, while in many cases we note an increased revenue due to a scientific arrangement of lights and the consequent increased standard of illumination.

During the past two years nearly all of our many window-lighting contracts have been changed from carbon-filament to tungsten lamps, which in turn led in many cases to tungsten lamps being installed for interior lighting. We have installed

for exterior and interior lighting many 250-watt tungstens. In our windows we use mostly 100-watt tungstens. We prefer to encourage the use of 40-watt or even 60-watt lamps as opposed to the use of low candle-power lamps.

We sell 25-watt, 40-watt, 60-watt, 100-watt and 250-watt lamps. Our average candle-power on tungsten lamps sold is 107 on a flat rate and 65 on a meter rate, which proves the advisability of the central station controlling the lamp situation, for I am told that in towns where the dealers handle the lamps the average candle-power lamp sold is much less than the above mentioned.—*Clare N. Stannard, secretary and commercial manager, Denver Gas & Electric Company.*

DUBUQUE, IOWA.

The experience of the Union Electric Company following the introduction of the tungsten type of lamp has been along lines which have proved entirely satisfactory to the company. We have no respect for the "bogey-man" theory that the introduction of this lamp would result in the curtailment of the central-station income. There is undoubtedly a marked economy from the viewpoint of the consumer through the use of this lamp, and this condition in itself is of inestimable value to the company in that it is directly responsible for the securing of many additional consumers, and at the same time induces all consumers to use the service much more freely than under the conditions obtaining with the units of less efficiency. Without condemning the low-wattage units we will say that our experience has been more satisfactory with those of 60-watt, 100-watt and 150-watt rating. It appears to us that the larger the wattage capacity of the lamp, the more opportunity is afforded the manufacturers to strengthen the filament, thereby conducing to a longer life. To summarize, the tungsten lamp has done much to strengthen central-station companies with their customers and has been directly responsible for the large increase in connected load as reported by many of the central stations.—*L. D. Mathes, general manager, Union Electric Light Company.*

BENTON HARBOR, MICH.

Starting with one of the first orders placed in the state of Michigan for a standard package of tungsten lamps (100 watts) we have steadily pushed the use of these lamps and to-day are carrying in stock upward of 30 standard packages of lamps varying in size from a 20-watt to a 500-watt. We have been able to show during this time an increase of practically 100 per cent per annum in lighting receipts.

In lighting we recommend the use of various sizes of lamps, endeavoring in every way to reduce the cost of lighting to the customer. In 1907 we had a few of the stores using electric light for general illumination, nearly all of them, of course, burning a small amount of light for basement and show-window lighting, but the most were gas consumers, so far as general illumination went. Now we have a few using gas for general illumination, but most of them are using electric light throughout their stores. The customers increase in numbers, of course, but there has been a very great increase in the amount of light used by each individual, thus bringing the income up to where it would have been at that time had they used the ordinary carbon or Gem lamps.

In the residence district the usual complaint from the customer was that they could not read or do sewing or fancy work by electric light, the illumination not being sufficient for that purpose. With the introduction of the tungsten lamp we are enabled to give them the class of illumination they want at a price they can afford to pay, with the result that where we had one or two customers in a neighborhood, we now have four to six or eight customers.

Our position at the commencement of what might be called the tungsten lamp era was that the people were willing to pay a certain amount for lighting and were bound to get the greatest possible amount of light for their money; and, after three years' experience we are more than ever convinced that this is the correct view.

We have taken on a number of customers with a positive guarantee to reduce the cost of their lighting over gas. This we have been enabled in every case to do, showing a saving of from 25 per cent to 35 per cent. It has been our experience that they invariably add to their lighting system sufficient lights to bring their monthly bills back to about where they were before the change.

Our light rates are based on the hours used rather than the kw-hours used. This has been a great help to us, for we believe that a man using five lights on an average of four hours per day is a much better customer than the one using 20 lights one hour per day. Our rates are arranged on this basis and give the man using the five lights exactly the same rate for the first hour used per kw-hour as the man using 20 lamps gets.

To offset the first high cost of the tungsten lamps we introduce what we call a maintenance rate, furnishing the lamps and maintaining them for 2 cents per kw-hour consumed. This has proved very satisfactory to us and to the customer. We find that after the first installation the customer comes around with the proposition that if we will allow him the amount he has paid for maintenance he will pay for his lamps and maintain them himself. This, of course, we are more than willing to do, so that our maintenance customers gradually become owners of their lamps. We have yet to have our first tungsten-lamp customer go back to any other form of illuminant.—*John A. Cavanaugh, superintendent electric light department, Benton Harbor-St. Joe Railway & Light Company*

COLORADO SPRINGS.

The tungsten-lamp situation to date is one that has been of vital interest to every central-station manager, and further rapid exploitation on the part of the lamp manufacturers, particularly as to the introduction of 15-watt and 25-watt lamps in large quantities is, or will in my judgment, become a menace to the lighting industry.

Many companies, including our own, cannot adopt a fixed charge plus a kw-hour rate as a substitute for a straight rate for the reason that present franchises or contracts provide that no rate shall be made in excess of a fixed amount per kw-hour. A differential or a two-rate method, therefore, could not be applied with the expectation that the income would be increased from the short-hour or residential class of business, unless the first rate or the fixed-charge rate be placed at an amount higher than prescribed by the contract or franchises now effective.

As a consequence, assuming that a higher rate could not be made effective, the introduction of large quantities of 15-watt or 25-watt tungsten lamps in residential territory would produce only one result, i.e., to reduce the earnings per consumer. The lamp manufacturer says that the consumer would use more units of light. It has not been the experience in the past that residential consumers would order new fixtures and rewire their houses so that the company could receive as much earnings in the future from the use of more units when the *increased* candle-power per unit on the old basis of outlets would give a greater candle-power per room than enjoyed on the old basis. The manufacturer's argument might apply to large residences, but the majority of residential business includes houses where the outlets per room are few in number.

The earnings per consumer have not decreased for the reason that to keep up the average of such earnings central-station companies have waged vigorous campaigns for the sale of flat-irons, toasters and other auxiliary appliances. In other words, up to the present time the intensive methods used in increasing the sales and the use of energy have only increased to a very small extent, if at all, in many instances, the earnings per consumer, but have simply overcome the deficiency caused by the influx of tungsten lamps. Let us, therefore, do everything possible to discourage the use of the tungsten lamp lower in candle-power than the 40-watt type, excepting, of course, in the commercial districts where each installation stands on its own basis, and where it is possible to increase the number of units of light to make up the deficiency caused by the increased efficiency per unit, or at least ask the manufacturers so to limit the output that the supply will fall below the demand for a period of the next five years.

The manufacturers seem to overlook the fact that expenses

of central-station companies, due to increased cost of labor and material, are increasing from year to year, while, on the other hand, rates for electric service are decreasing, due to federal, state and municipal regulation, and that business is not increasing in the proper proportion to overcome the increased efficiency in illumination and decrease in rates.

Companies like our own that are not on a free-renewal basis, and which do not find it necessary to go on such a basis to increase their business, find that the present higher cost of tungsten over carbon-filament lamps helps to hold down the tungsten situation; but in the event of large increases of demand for tungsten lamps, with a corresponding decrease in price, the low-price, low-wattage tungsten lamp will materially affect our earnings.—*George B. Tripp, general manager, Colorado Springs Light, Heat & Power Company.*

WATERLOO, IOWA.

The last year has seen very remarkable developments in the introduction of the tungsten lamp, more particularly in the tungstolier equipment. The more popular size seems to be the 60-watt lamp, although many of the 100-watt size are put out. We are still selling a large number of carbon-filament lamps, but a considerable falling off on this type is noticeable. We have done very little active work in pushing the tungsten lamp, but have felt that it would procure a more certain foothold by letting it take its course. We encourage the use of the 40-watt lamp for regular lighting and do not handle the 25-watt size at all, leaving that for the supply houses. The reduction in prices of all sizes of tungsten lamps has helped a good deal in its general use. There is general feeling on all sides that we have not yet seen the fullest development of electric lamp and many are letting this influence them to some extent in their purchase of lighting equipment. Our lighting income has increased upward of 22 per cent during the past year, which is quite contrary to our expectations, and still our gas lighting has not fallen off proportionately.—*Austin Burt, General Superintendent, Citizens' Gas & Electric Company.*

SAULT STE. MARIE, MICH.

Since I gave a statement to the *Electrical World* of our early beginning in the installation of the tungsten lamps in 1908, there has been a period of constant progression. We have carried forward the plan then adopted of practically controlling the tungsten lamp situation, and pushing the introduction of the lamp as rapidly as possible by giving the consumer all the illumination possible with the same, or nearly the same, consumption of energy. This plan has resulted in nearly all our business places being lighted by tungsten lamps. The losses in the consumption of energy in some places has been more than made up by the accession of places which had been using gas.

The plan adopted of introducing the lamps in clusters of four proved so satisfactory that when the lamp manufacturers declined to continue making the 30-volt lamp for series use, with which we started the tungsten campaign, we had no trouble in changing to the 120-volt lamp for use in the same fixtures, and so well established had this manner of installation become, and so satisfactory has it proven, that practically all the new installations have been along the same lines. The 60-watt lamp has been used almost exclusively, although a small number of the smaller, as well as the larger, sizes have been called for.

We supplied the lamp in the first instance at about the ordinary retail price, and the renewals at a lower price, that would give the customers about the same average benefit that had accrued from the free renewal of the carbon lamp for the watt-hours used. The general result has been the displacement of a large proportion of gas lighting and the transformation of every dissatisfied customer into a satisfied one, kickers being transformed into boomers for our service.

We have not pushed the use of the tungsten lamps in our residence districts for the reason that we could see no way of increasing the use of light in anywhere near the proportion that the kw-hours would be decreased; and under the conditions existing here any very radical reduction in the watt-hour output would put that part of our system on the losing side of the ledger. Neither have we discouraged their use. The lamps are for sale and many buy them, but without being pushed the use does not appear very marked. While we are constantly putting on new customers our residence gross does not increase. By following this plan the change in energy consumption comes so gradually as not to disturb the relative condition between the gross and net revenues.—*William Chandler, vice-president and general manager, Edison Sault Electric Company.*

KOKOMO, INDIANA.

The amount of increase of yearly business has been much greater since the appearance of the tungsten lamp than ever before. The decrease of energy used by customers has been very small on account of the change to tungsten installations. The great demand seems to be for greater light rather than for smaller bills. Saloons were voted out of business in this county last year, and we supposed that there would be considerable decrease in business of this kind on that account, but, on the other hand, by the use of tungsten lamps, the business seemed to increase, as a number of saloons had gas and gasoline plants of their own, and other businesses going into the same locations made an opportunity for our solicitors to demonstrate and install permanent tungsten installations, resulting in an increase instead of decrease of business. This we do not believe could have been done nearly so satisfactorily with previous methods of lighting.

We thoroughly believe that the 40-watt tungsten lamps should be pushed for residence lighting, as when the people try this lamp they almost invariably use it in their residences in preference to smaller lamps, when it is explained to them that by the use of the 40-watt lamp two-thirds of the energy is saved compared with a 60-watt carbon lamp.—*Phil. H. Palmer, assistant general manager, Kokomo, Marion & Western Traction Company.*

WALLA WALLA, WASH.

It has been my experience that the use of the tungsten lamp has made it possible for the central station to increase its lighting. As is well known, when this lamp was first put on the market many central-station operators felt that it was going to cut down their receipts per consumer. I did not feel so, as it has always been my experience that if you can show a consumer a device that is cheaper in operating than the one he has been used to using, he will install it, but in nine cases out of ten he will use it much more when he knows it to be a cheaper operating device, so that in the long run his consumption will be as large as it was previously.

The actual figures in the case bear out my opinion on the subject. Taking seven different cities, located in as many different states, I find that the average receipts per consumer in 1907 were $60.15 and in 1907 the tungsten lamp was hardly known. In 1908 average receipts per consumer in these same cities were $60.40, showing that although the tungsten lamps had made some inroad in the receipts, nevertheless there had been a small gain, while in 1909 these same cities had an average receipt per consumer of $67.06.

When tungstens are first installed the consumer's bills may for a while fall off, but he soon becomes aware of the fact that it is not costing him as much to use this lamp as it did the old carbon lamp, and he at once begins to be more liberal in their use. Personally, I believe in allowing the consumer to use as small a tungsten lamp as he desires, and do not try to force a 40-watt or larger upon him; if it is to his advantage to use a 25-watt lamp I believe in telling him so. In this way I have found it possible to install our service in the premises of the laborer, who cannot afford large bills, and I have not found that it in any way cut down our receipts from large consumers. It is my belief that wherever you can do so it is an advantage to furnish the consumer with the most economical installation possible, and by so doing you are able to cut out all classes of other lighting.

To sum up the situation, my advice, backed by the experience of the last two years, is to install the lamps using the smallest amount of electricity necessary to furnish the service that the consumer needs, and I feel sure that the result will

be an increased revenue for the company.—*H. B. Foshay manager, Pacific Power & Light Company.*

IOWA CITY, IOWA.

The advantage of the introduction of the tungsten lamp by central stations can be stated in a few words.

It is a business-getter in competition with *all* other forms of illumination. While it may temporarily reduce the income from lighting, it will soon regain this loss and extend the electric light to fields which, under previous conditions, it would have been impossible to secure on a paying basis.

This is our experience, and it is no different from the average central station. I believe the time is not far distant when the low-voltage candle-power tungsten lamps will be used in the smaller homes where strict economy is now necessary.—*George S. Carson, president and manager, Iowa City Gas & Electric Company.*

ST. LOUIS.

The Union Electric Light & Power Company, of St. Louis, finds that the demand for the tungsten lamp is increasing steadily and rapidly. The effect of the lamp has been both to increase illumination and to reduce the consumption of energy. This is very noticeable in the case of a number of large installations.

The demand for 25-watt, 40-watt and 60-watt lamps is about the same, and there is a smaller demand for other sizes. Inasmuch as there are many places where low-cp lamps will suffice it is deemed advisable that the central stations be prepared to furnish such lamps. There has always been a demand for 8-cp carbon lamps and the St. Louis central-station men see no reason why an 8-cp or 10-cp tungsten should not be used if it can be made to stand up in ordinary service.

There are many places where lamps are used for decoration as well as light, and where a small lamp will give a better effect than a large one. In addition, there are many places where but a small amount of light is used, and if the customer wishes the tungsten lamp for such places it should be available.

The Welsbach lamp, for a short time, caused a reduction in the revenue of the gas companies, but in the long run it increased the use of light and the consumption of gas. Similarly, it is believed in St. Louis that there is no doubt that in the long run the tungsten lamp will increase the sale of electricity and the income therefrom.

MASON CITY, IOWA.

Our company has found the use of the tungsten lamp of very great assistance in securing new business, especially among the commercial houses in this city. Unlike the majority of other stations, however, this company has confined the use of tungsten lamps to the 60-watt and 100-watt sizes exclusively. The 60-watt lamps are now very generally used in the residential district, whereas the 100-watt size is the more popular in the commercial territory.

We have quite a number of large installations, chief among which is one in a large dry-goods store in this city, consisting of 25 five-lamp fixtures, each fixture using five 100-watt tungstens. Fully 60 per cent of the merchants are now using tungsten lamps, some using them in clusters, others in fixtures, and still others as individual drop lamps. We have also tried to introduce the larger units and have some 150-watt and 250-watt lamps in use, but these are not very popular, the majority of the installations consisting of four-lamp and five-lamp clusters.

We do not carry any of the smaller sizes nor have we found a popular demand for them, the majority of people being satisfied with an increased light at the same energy consumption rather than the same light at a lesser energy consumption.

Of course, we also control the gas company and consequently do not have the gas competition that some other companies have to contend with. We have, however, induced all of the merchants in this city to use either gas or electric lamps for illuminating their stores, and I believe this is the only city of its size that can boast of the fact that there is not a single gasoline lighting plant in use by any of its merchants and that fully 90 per cent of all the lighting is done by electricity.—*A. W. Zahm, general manager, People's Gas & Electric Company.*

BROOKLYN.

Since the tungsten lamp was first brought out, the Brooklyn Edison Company has been a consistent advocate of its use. In order to offset the reduction in kilowatt-hour consumption which it was felt the introduction of the higher efficiency unit would produce among its existing customers, the Brooklyn company organized a separate company known as the Tungsten Lamp Specialty Company to obtain new installations.

During the past year the business or kilowatt-hour sales among existing customers has been on the increase—which would seem to favor the theory advanced when the tungsten lamp was first brought out that while at first it would cause a reduction in the kilowatt-hours sold, ultimately the lost business would all be regained and a higher standard of lighting established.

Aside from the result on the company's existing customers, the Tungsten Specialty Company before mentioned, devoting itself exclusively to stores unwired, has in its two years of existence closed contracts with over 2000 installations, and at the present time is closing contracts at the rate of 15 to 20 per week. This new work has chiefly been among stores wherein the customer has been permitted to pay for his wiring and fixture equipment in six monthly installments. The result of the tungsten specialty work has been to induce the wiring contractors to take up the same work with very gratifying returns.

The type of tungsten lamp which has been pushed most energetically in Brooklyn has been the 100-watt unit with proper reflector. As a means of increasing the standard illumination among the company's customers the company has suggested where 16-cp carbon units are to be replaced the use of a 40-watt tungsten lamp, and has backed this recommendation by making the price of the 40-watt lamp to its customers the same as the 25-watt lamp. The schedule of prices follows:

LAMP		PRICE	
Candle Power	Watts	To Free Renewal Customers	To Non-Free Renewal Customers
20	25	$.40	$.50
32	40	.40	.50
48	60	.50	.70
80	100	.60	.95
120	150	.80	1.35
200	250	1.00	1.95
32	Meridian 40	.70	.85
48	Meridian 60	.75	1.00

No additional charge made for frosted bowl lamps

The tungsten sign lamp has not been received with much favor in Brooklyn, principally because of the low voltage of the lamp, and, secondly, because many merchants believe—and this is an important factor—that the tungsten sign lamp is a cold and cheerless proposition and does not give the inviting warm glow of the small candle-power carbon lamp.

In street lighting, the tungsten lamp has opened up a productive field of revenue to the central-station companies. These lamps are a great improvement over the old Welsbach gas lamps and are being used throughout the Brooklyn suburban and park sections.

The life of the lamp when properly handled has been very satisfactory—an average of 800 hours being a conservative figure. The higher candle-power units seem to show the greater life.—*T. I. Jones, general sales agent, Edison Electric Illuminating Company.*

NEW YORK.

In New York City fully a million of tungsten lamps have been introduced. The result has been an enormous increase in candle-power and material improvement in the character of light. In the belief that the public would be served by this policy, the New York Edison Company has endeavored in every practicable manner to facilitate the use of tungsten and, where more desirable, tantalum lamps, however much might be the reduction in the consumers' use of electricity.

I feel decidedly that in other than very special circumstances the use of lamps of medium size should be encouraged, say, from 40 to 60 watts for ordinary illumination, and of the larger sizes for commercial service. Only under exceptional circumstances is one able to secure enough light when artificial illumination becomes necessary. In this I have in mind the light required for ordinary purposes, such as moving about, writing and reading, and that larger use which in business should be called advertising and in the home makes an attraction and charm of surroundings that can be obtained in no other way.

Light "sufficiency" will not be secured until we approach, usually with properly shaded effects, a sun-lighted day in summer. This probably measures illuminating limits, unless we want to improve upon nature itself. Small units, giving only as much light as from the lamps formerly available, will not bring this desirable end. I feel, therefore, that efforts should be made to enhance the standards of illumination in volume and quality, rather than through the use of the smaller units to continue simply the illuminating standards found within the means of the usual consumer under the economies obtainable in the old types of incandescent lamps.—*Arthur Williams, general inspector, New York Edison Company.*

LAWRENCE, MASS.

Mr. C. J. R. Humphreys, vice-president of the Lawrence Gas Company, states that in a general way the effect of the tungsten lamp appears to have been advantageous in its relation to income. The company charges from 70 cents for the 40-watt lamp to $1.10 for the 100-watt lamp, with a 10 per cent discount for cash payment. There are 1061 tungsten lamps in the city street-lighting service, and fairly good life is now being obtained. The regular lighting rate is 15 cents per kw-hour, less 10 per cent for cash. There are no flat rates.

POUGHKEEPSIE, N. Y.

The tendency of all lighting for many years has been toward increased brilliancy and increased use, particularly among "business" consumers. Before the introduction of tungsten lamps all the available types of lamps required so much capacity, as well as energy, that both the central stations and their consumers were handicapped in their efforts toward improved light. That this problem has been solved by the tungsten lamp, and the slogan, "More light for the same money" has met the demands of the consumers and helped to maintain the income of the company.

At first we were somewhat fearful that the substitution of tungsten lamps at one-third of the energy consumption per candle-power would produce a considerable loss of income, and there is no doubt that this would have been the case had we attempted to combat the introduction of the tungsten lamp or waited for lamp manufacturers to bring them to our consumers. After careful consideration we decided on a policy of aggressive advocacy of the tungsten lamp, particularly to our "business" consumers, showing them how they might save a little money and still add to the brilliancy of their lighting, and to make their stores and windows more attractive. As a result the small loss in income that came from the saving to individual consumers was more than made up by increased business in the territory at large, some of which was made possible by the advantages of the tungsten lamp.

The tungsten lamp has also helped us materially in solving our rate question. For several years we have been studying the question of electric rates with a view to developing a system which would automatically preserve a proper balance between a consumer's demand and his hours of use. This we have finally put into concrete form, and all of our customers have now been changed over to the new rate. This change of rate under many of the old installations would have raised the average bills of such consumers, but a rearrangement of their installations on a tungsten basis has prevented such increase, gave them better light, preserved the company's income, and made them satisfied instead of dissatisfied consumers.

As a result of our company's policy relative to tungsten lamps we have raised the standard of lighting in Poughkeepsie so that its main business streets will bear favorable comparison with any other city of its size; we have not only prevented a reduction in lighting income, but produced an increase; we have reduced the station generating capacity required for our lighting consumers, which we have in the meantime sold to long-hour power consumers for additional income; and we have been enabled to change our old form of electric rates to a new and equitable schedule without raising the average bills of any of our consumers who have been willing to change their installations to tungsten lamps in accordance with our recommendations.

The new developments in the manufacture of tungsten lamps whereby metallic filament can be drawn for direct use in the lamps, thereby increasing their life to a par with the old carbon filament, gives the final touch necessary to make the tungsten the commercial success it is certain to be for all concerned. *A. S. Ives, assistant general manager, Poughkeepsie Light, Heat & Power Company.*

DETROIT.

As shown by this year's census, Detroit is rapidly approaching the 500,000 mark in population, and is one of the large cities of the country. It is correspondingly alert in electrical matters, and it is interesting to note that the sales manager of the Edison Illuminating Company is a woman. Miss Sarah M. Sheridan, who fills this position admirably, has this to say of the tungsten-lamp situation:

"We have for the last two years recommended the use of tungsten lighting in commercial installations. The first six months we found that there was a decided tendency on the part of our customers to reduce the wattage of an installation in order to reduce bills, but since then we find a strong reaction in favor of a higher standard of illumination, and in very few instances do we find a cut in revenue from customers who have always been electric-light users; in the great majority of cases the consumption has increased. We also find that we have been able to displace gas with tungsten lamps in small stores where heretofore electricity was considered too high in price. We find the 60-watt and 100-watt tungsten lamp the most satisfactory for commercial lighting, and these sizes are quite generally used in Detroit."

BOSTON.

Since the advent of the tungsten lamp about 210,000 have been installed upon the system of the Edison Illuminating Company. Customers entitled to free renewals of carbon incandescent lamps can now obtain tungsten lamps at the following prices: 25 watts, $0.45; 40 watts, $0.45; 60 watts, $0.55; 100 watts, $0.65; 150 watts, $0.90, and 250 watts, $1.15. In common with many other companies, the Boston Edison organization offers the 40-watt lamp to its customers at the same price that it charges for the 25-watt lamp, for the double purpose of encouraging a liberal illumination and maintaining a good lighting revenue. There is little evidence that the tungsten lamp has injured the company's revenue. As in many other cases there is no question that many new customers have been secured by virtue of the increased efficiency of the tungsten filament. In the latest residential lighting the 25-watt size is coming into wide use, but in commercial installations the 60-watt and 100-watt sizes are thoroughly standardized. Tungsten lamps given out at the above prices remain the property of the company.

LEWISTON AND AUBURN, MAINE.

The tungsten lamp has enabled the central-station service to be successfully extended in Lewiston and Auburn, Maine, and in combination with a lighting rate of 8 cents per kw-hour has pushed gas lighting close to the wall. The Lewiston & Auburn Electric Company produces its entire supply of electricity from hydroelectric plants located on the Androscoggin River, and does not own a single steam prime mover. This fact enables the rate to be considerably lower than in cities where electricity must be produced from coal. The price of gas in Lewiston is $1.30 net per 1000 cu. ft. The company renews tungsten lamps at practically cost to its customers. The policy is to encourage chiefly the 40-watt size for residential lighting. The company installs residence wiring at approximately cost

to the customer. The company points out that wiring the house for electric light is not the formidable undertaking which many people suppose, and that it is not necessary to tear the house to pieces in order to install electric service, or to ruin decorations, break up plaster and rip out partitions. The company points out that the work can be done with less trouble and dirt than when the parlor carpet is sent to the cleaners. In a special wiring advertisement the company shows that the wireman of to-day works quietly and cleanly; that he removes a board or two from the floors of a few closets and makes a hole less than 3 in. in diameter in the plaster where the fixtures are to be hung. By the use of special tools and modern methods he easily fishes the wires between joists and stanchions. As much as possible of the work is done in the electrical contractor's shop. This advertisement is placed on a postal card of large size and is sent to prospective customers.

REVERE, MASS.

The Suburban Gas & Electric Company, of Revere, Mass., reports that in addition to successful street lighting by tungsten lamps in place of arcs it is introducing them into general commercial service in large numbers. The initial installation and selling price on renewals are the same. For the 25-watt and 40-watt sizes the company charges $0.60 each; for the 60-watt size, $0.80, and for the 100-watt tungsten lamp, $1. The company has as yet no flat rates for residence lighting. It considers the 40-watt tungsten lamp the most desirable size for general service. A rate of 8⅓ cents per lamp per month is made for 4-cp tungsten lamps in window-lighting service. These burn from dusk until 10 p. m., except on Saturdays, when they burn until midnight. A time switch is used in these installations.

PORTLAND, MAINE.

In common with several other central-station organizations in northern New England, the Portland Electric Company has recently moved into new offices, which reflect the point of view of salesmanship that considers electrical supply a standard business in the community. The Portland company now has about 6000 customers, and its lighting rates to all new customers are 9 cents per kw-hour net, with a minimum of $12 per year in residence service. Summer residences are charged 15 cents per kw-hour and $1.50 per month minimum. The company renews carbon lamps of 8-cp size and over free, and allows 15 cents for any size of burned-out tantalum lamps. The prices for tungsten lamps vary from 70 cents for 25-watt lamps to $2.50 for the 250-watt size. The company renews tantalum lamps at the following prices: 25 watts, 40 cents; 40 watts, 50 cents; 50 watts, 75 cents. Reflectors are sold at from 60 cents to $1. Frosted lamps are 5 cents extra, and turn-down lamps are sold at from 45 cents to $1. The total lighting connected load of the company is about 127,000 16-cp equivalents.

LOWELL, MASS.

The Lowell Electric Light Corporation has found that the tungsten lamp has aided it materially in securing business that could not have been obtained with carbon incandescent lamps. A net rate of 10.8 cents per kw-hour is made for residence lighting, and the regular commercial lighting rate is 13 cents gross for the first 50 kw-hours per month, all in excess being billed at 6 cents gross. A minimum of 25 kw-hours at 13 cents gross is charged. The company has a window-lighting proposition which covers the hours from sunset to midnight, the price being on the flat-rate basis of $1.50 per 100-watt tungsten lamp per month, net. The lamps are controlled by automatic time switches. About 450 100-watt lamps have been installed in this service in the past two years. The company also rents tungsten lamps, with shades and holders, at the rate of 18 cents net per lamp per month. This plan appeals highly to small merchants who might otherwise find the initial investment burdensome. The company cleans the fixtures regularly. The same rate is made for sign lighting as for window illumination. A life of from 1200 hours to 1400 hours is being regularly obtained on street tungstens. The company builds a box sign of galvanized iron for service in situations where only a few letters are required, and sells the sign to customers at a nominal price. Thus a sign marked "Lunch" may sell for $14, the price covering the sign ready for service, installed on the customer's premises. The company does not favor the use of 20-cp tungsten lamps, but does everything in its power to encourage the use of the larger sizes by selling the 25-watt lamp at 70 cents and the 40-watt size at 50 cents each. The price of the 100-watt lamp is 90 cents, and of the 250-watt lamp, $1.80.

BRUNSWICK, MAINE.

Tungsten lamps are used extensively in drug stores, small restaurants, fruit stands, etc., and their effect is to raise the business tone of the entire community in comparison with former nights when the stores and streets were but dimly lighted. Outline lighting of an amusement house in the center of this town has been effected by incandescent lamps with a resulting improvement of the illumination of a considerable section of the main business street.

BROCKTON, MASS.

The residential and commercial lighting rates of the Edison Electric Illuminating Company are fixed at 16⅔ cents per kw-hour for one hour's burning per day, energy in excess being sold at the 10-cent rate. Where four hours' burning per night is guaranteed the company makes a monthly rate depending on each installation in connection with window and sign lighting. The company encourages the use of 40-cp lamps in residential work, rather than the smaller size. About 5000 tungsten lamps are now in service on the system. The renewals and installation prices vary from 50 cents in the 25-watt and 40-watt sizes to $2.25 for the 250-watt lamps. Much new business has been secured by the tungsten lamp.

BEVERLY, MASS.

At Beverly, Mass., the local central-station organization serves a residential territory of wide area, many of the customers being the occupants of summer residences in the North Shore district of Boston society fame. The commercial and residential lighting rates are 12 cents per kw-hour. This company does not supply its customers with either carbon or tungsten lamps, but leaves its patrons to buy lamps when and where they prefer. In this way it escapes all the troubles incidental to renewals and responsibility for lamp life. Superintendent A. Macauley states that the 40-watt and 60-watt sizes are preferred. There is no sign lighting in the territory, and as yet the tungsten lamp has not entered the street-lighting field to any extent. The company has the distinction, however, of lighting the summer residence of President Taft, at Beverly Cove, and also the executive offices.

LYNN, MASS.

The regular lighting rates of the Lynn Gas & Electric Company vary from 12 cents to 8 cents per kw-hour, according to consumption. A customer must use 72 kw-hours in one month in order to get a 10-cent rate, and 228 kw-hours to obtain the 8-cent rate. There are many 25-watt tungsten lamps in commercial service in this city. The company's policy is to encourage the use of gas for cooking and heating, and electricity for lighting and power service. There are no flat rates for window and sign lighting. The company does not feel that its lighting revenue has been injured by the advent of the tungsten lamp.

SALEM, MASS.

The Salem Electric Lighting Company feels that its lighting income has not been particularly lessened by the advent of the tungsten lamp. The commercial and residential lighting rate is 13 cents net per kw-hour, except in the case of lighting by Nernst and arc lamps, when a deduction of 33⅓ per cent is made from the 15-cent gross rate for prompt payment. The tungsten lamp is solving the problem of displacing gas arcs in Salem. The company recommends the 60-watt and 100-watt sizes for mercantile service and the 40-watt size for house work. Its experience with the 25-watt lamp has not inclined it to push it, although the time is approaching when this smaller size may be extensively used in residential lighting. The first installation as well as renewals of carbon incandescents are free, and tungsten lamps are sold at prices varying from 60 cents for the 25-watt and 40-watt units to $2.25 for the 250-

watt lamp. Arc and Nernst lamps have been installed free and maintained by the company. The same plan of window and sign lighting used in Malden, Haverhill, Fitchburg and other of the Tenney companies is employed successfully in Salem.

SPRINGFIELD, MASS.

The United Electric Light Company has commercial lighting rates running from 15 cents to 4 cents per kw-hour, depending upon the demand of the installation and the monthly consumption. House-lighting rates are from 15 cents to 8 cents, the first being the primary charge and the second a consumption charge. The former is based upon the demand of the installation. The company has been successful in displacing gas arcs with the 250-watt tungsten lamp, or clusters containing four 100-watt lamps. The latter is generally preferred. A charge of 75 cents each is made for all sizes of tungsten lamps when installed and renewed. The company has no flat-rate propositions for window and sign lighting. So far as it can determine the income has not been greatly affected by the tungsten lamp, as customers tend to use more light with the tungsten service.

MANCHESTER, N. H.

Vice-President and General Manager J. Brodie Smith, of the Manchester Traction, Light & Power Company, states that the tungsten lamp has produced no serious reduction in revenue in his territory. While the lamp was pushed from the beginning, and a slight reduction was noticed at first in the income, it was soon overbalanced by the greatly increased use of electric lighting. The company sells tungsten lamps at a small percentage above cost, sufficient to cover the expense of breakage. The life of tungsten lamps appears to be very satisfactory. For street lighting the company has in service 215 7.5-amp, 60-cp series tungstens, with a large Edison screw base, from which it receives from the city $32 per lamp-year. A life of considerably over 1000 hours is anticipated from the company's investigations and experiments. The schedule is "all night and every night." The company does not encourage the use of the smallest size of tungsten lamps for residence lighting. Its customers are usually satisfied to use more light at about the old bill than to save money and use less light. There are a few gas arcs in the territory, and there are no flat-rate customers. The lighting rates begin at 12 cents per kw-hour, with a 5 per cent discount for prompt payment in the case of the so-called "open-order" rates. On a yearly basis, the company makes a primary rate of 12 cents, and a secondary rate of 6 cents. To obtain the secondary rate the use of energy must exceed the equivalent of 50 hours' use of the lighting demand. A 5 per cent discount also applies for prompt monthly payment on the yearly lighting contract. In both the open-order and yearly rates a minimum charge of $1 per month is made for single-phase current and $2 per month for three-phase current.

NEW BEDFORD, MASS.

The New Bedford Gas & Edison Light Company has found no noticeable reduction in its revenue from tungsten lighting. The lamps are sold at cost, and installed by the purchaser. The price of a 16-cp lamp is allowed for a burned-out lamp. Some dissatisfaction is expressed in connection with the life of the tungsten lamp as regards breakage. The company has no flat rates, and recommends sizes depending entirely upon local requirements.

FITCHBURG, MASS.

The prices of the Fitchburg Gas & Electric Light Company for tungsten lighting are its regular lighting rates, which have recently been reduced for residence customers, so that all using less than 100 kw-hours per month get a rate of 12 cents net in place of 14.4 cents net, which formerly obtained. The general effect of the tungsten lamp has been to increase revenue to a considerable degree. In some instances bills have been cut down, but, on the other hand, the tungsten lamp has served to increase, or give a means of increasing effectively, the use of electricity. There are now 245 6.6-amp street tungstens in service. The flat-rate sign and window lighting is progressing most satisfactorily. There are about 75 customers on this class of long-hour service, totaling 25 kw connected load. The prices are as given under Malden. The company maintains an impartial attitude regarding the different sizes of tungsten lamps, but endeavors to show the customer the benefits of using the larger sizes. The same prices are charged for the 25-watt and 40-watt sizes. In the case of a typical shoe-store window illumination taken on a flat-rate basis the cost of the service to the merchant is $62.40 per year, including renewals and the switching service incident to the proposition. In the case of a typical haberdashery, the yearly cost is $78. The first installation is lighted by eight 40-watt tungstens at each window, and the second by 10 40-watt lamps. The company also uses tungsten lamps in its office illumination.

HAVERHILL, MASS.

The Haverhill Electric Company finds that the tungsten lamp has not materially affected its lighting revenue, although the company has replaced many arc lamps with tungstens for mercantile lighting. The additional business has more than made up for any loss. The lighting rates vary from 15 cents to 12 cents per kw-hour, depending upon the consumption. A minimum charge of $1 per month is made. The rates are formed on a sliding scale, which is equitable to all consumers, provides a uniform discount, and offers a reasonable service. A special arc-lamp rate is made on a sliding scale of from 7.2 cents to 2 cents per arc-lamp hour, with a minimum charge of $1.50 per lamp-month. The company advocates the 40-watt lamp for house lighting and the 60-watt and 100-watt lamps for commercial service. It has been successful in replacing a number of gas arcs with tungstens. The initial and renewal prices of tungsten lamps vary from 50 cents for 25-watt, 80 cents for 40-watt, to $1 for the 100-watt lamp. There are no incandescent street lamps, all this service being by titanium arcs. There are 71 customers and 1146 lamps on the flat-rate sign and window-lighting plan mentioned under Malden, page 503.

BANGOR, MAINE.

The Bangor Railway & Electric Company makes an effort to encourage the use of the larger sizes of tungsten lamps instead of the smaller ones. A large number of the 40-cp lamps are in residential service. The company has been exceedingly successful in displacing inverted gas arcs. In furnishing tungsten lamps the company allows 15 cents per lamp for any size of carbon incandescent. It furnishes gem lamps free. The commercial lighting rates are from 16 cents to 6 cents per kw-hour, the first being the primary rate applied to 1.5 kw-hours per 16-cp lamp per month, and the second taking the rest of the business. The company does no house wiring, but furnishes carbon lamps free for initial installations as well as renewals. A feature of the company's introduction of tungsten lamps is the maintenance of a well-equipped display-room at the rear of the street-railway waiting-room in the business center of Bangor. An elaborate lighting exhibit is maintained here of different types of lighting, including comparisons of tungsten and carbon lamps, ceiling and wall lighting.

CHICAGO.

After an experience of two years and over with the tungsten lamp, the verdict of the men in charge of the departments of the Commonwealth Edison Company of Chicago which have been directly affected by the new iluminating agent is entirely favorable. The conclusion is that the use of the economical tungsten lamp has enabled the company to obtain a large amount of business that in all probability it would not have secured if the new lamp were not at its disposal. The officers of the company, indeed, never experienced any trepidation as to the effect of the advent of the tungsten lamp on the income account of the company. They are believers in a widespread use of cheap electricity, and the tungsten lamp, making electric lighting more economical and popular, fits in well with their progressive ideas.

In a few cases, no doubt, the monthly bills of the company for electricity supplied for lighting have been reduced by the use of tungsten lamps, but this reduction in income has been offset many times by the securing of new business which the tungsten lamp has rendered possible. This is notably the case

in relation to the use of tungsten clusters, employed mainly for store lighting. Four-lamp clusters, the lamps being usually of the 60-watt size, are supplied by the company at a fixed monthly rental charge, varying with the number of hours' use per day, to which is added the cost of the electricity used at the regular Wright demand rates of the company's schedule. These clusters have proven very popular, and on July 26 last 14,673 of them had been contracted for. Probably half of these have replaced gas-lighted installations in stores and represent business which the company could probably have secured in no other way than by presenting the tungsten lamp with its economy in consumption of electrical energy. The revenue to the company from these tungsten clusters is probably about $600,000 a year, so that it can be seen that the new lamp has been turned to profitable account by the Commonwealth Edison Company.

The tungsten clusters are used extensively by merchants in lighting their places of business. The 60-watt lamp is more popular and in greater demand for this purpose than the 40-watt lamp. The clusters are largely used by small storekeepers, and perhaps the average number of clusters to each customer is two, the maximum number to an installation running up to about 50. The 250-watt tungsten lamp is now being introduced for store lighting, but its field seems to be principally in the larger stores which have been using gas for illumination. For small stores and shops the unit is too large, but in large establishments the 250-watt lamp enables the lighting arrangements to assume a more impressive appearance, with handsomer fixtures than are usually adopted in the case of the four-lamp clusters equipped with lamps each of which consumes 60 watts.

Two-year contracts are made with customers who install the tungsten clusters. The following table shows the monthly

MONTHLY RENTAL CHARGES FOR FOUR-LAMP (60-WATT) TUNGSTEN CLUSTERS IN CHICAGO.

240-WATT, 4-LIGHT TUNGSTEN CLUSTER							Cost of Electricity for 200 c.p. [illegible] 3.1-Watt [illegible] Filament Lamps	
Hours Use per Day	Kw-hour Consumption for 2 Years	Kw-hour Consumption for 1 Month	W. D. Rate Less ½ c [illegible] 12 c Base	Monthly Rental Charge	Monthly Bill for Energy at W. D. Rate 12 c Less ½ c	Net Monthly Bill Rental and Energy 12 c Base	Kw-hours per Month	Net Monthly Bill 12 c Base
1	175.2	7.3	11.5	$1.00	$0.80	$1.80	18.6	$2.23
2	350.4	14.6	8.76	1.00	1.21	2.21	37.2	3.35
3	525.6	21.9	7.85	1.00	1.61	2.61	55.8	4.46
4	700.8	29.2	[illegible]	1.10	2.00	3.10	74.4	5.58
5	826.0	36.5	7.12	1.20	2.41	3.61	93.0	6.69
6	1051.2	43.8	6.92	1.30	2.81	4.11	111.6	7.81
7	1226.4	51.1	6.79	1.40	3.22	4.62	130.2	8.93
8	1401.6	58.4	6.69	1.50	3.62	5.12	148.8	10.04
9	1576.8	65.7	6.60	1.60	4.01	5.61	167.4	11.16
10	1752.0	73.0	6.55	1.70	4.42	6.12	186.0	12.27
11	1927.2	80.3	6.50	1.80	4.82	6.62	204.6	13.39
12	2102.4	87.6	6.46	1.90	5.22	7.12	223.2	14.51
13	2277.6	[illegible]	6.42	2.00	5.63	7.63	241.8	15.62
14	2452.8	102.2	6.39	2.10	6.02	8.12	260.4	16.74
15	2628.0	109.5	6.36	2.20	6.42	8.62	279.0	17.85
16	2803.2	116.8	6.34	2.30	6.83	9.13	297.6	18.97
17	2978.4	124.1	6.32	2.40	7.22	9.62	316.2	20.09
18	3153.6	131.4	6.30	2.50	7.63	10.13	334.8	21.20
19	3328.8	138.7	6.28	2.60	8.03	10.63	353.4	22.32
20	3504.0	146.0	6.27	2.70	8.43	11.13	372.0	23.43
21	3679.2	153.3	6.26	2.80	8.84	11.64	390.6	24.55
22	3854.4	160.6	6.25	2.90	9.24	12.14	409.2	25.67
23	4029.6	167.9	6.24	3.00	[illegible]	12.64	427.8	26.78
24	4204.8	[illegible]	6.23	3.10	10.04	13.14	[illegible]	27.89

rental charges for four-lamp clusters, using 60-watt tungsten lamps:

The first column refers to the number of hours in which the cluster is in use during the day, ranging from 1 to 24. The second column shows the total kw-hour consumption for the contract period of two years, and the third the kw-hour consumption for one month, for any number of hours' use per day. The fourth column gives the regular Wright demand rate of the company, less ½ cent per kw-hour, which is the deduction made when the company does not furnish free lamp renewals. Inasmuch as the lamp renewal cost is included in a separate monthly rental charge this ½ cent is deducted from the kw-hour charge.

The fixed monthly rental charge is shown in the fifth column. This charge includes furnishing and maintaining the fixture and lamp renewals. The next column gives the monthly bill for electricity at the Wright demand rate, while the seventh column shows the net monthly bill, including the monthly rental charge and the bill for electricity consumed. For comparison, the last two columns show the corresponding monthly kw-hour consumption and net monthly bill for the use of 3.1-watt carbon-filament lamps, giving about the same amount of light. Comparing the seventh and ninth columns of the table it will be seen that the consumer effects a marked economy in every case by the use of tungsten lamps. On an average the customer's electric light bill for this class of illumination will be about half with tungsten lamps what it would be if he used ordinary carbon lamps.

In general, the efforts of the company have been directed to encouraging the use of more light as the result of the opportunity afforded by the tungsten lamp. For instance, the employment of 40-watt lamps is favored rather than 25-watt lamps. Usually it is found that customers fall in with this idea, for, as has been stated, the 60-watt lamps are much more popular for store lighting and the lighting of large interior spaces of considerable size than the 40-watt lamps. The company advertises freely the superior economy of tungsten lamps, and in the case of residence lighting exchanges carbon lamps cheerfully for tungstens.

The tungsten lamps are not supplied free, as is the case with the carbon lamps, but are sold to customers, an allowance being made for the cost of the carbon lamp that would otherwise be supplied free. For instance, if the price of the tungsten lamp is 50 cents, the company supplies it to its customer at 40 cents, the difference of 10 cents being taken to represent the cost of the carbon lamp which would be given free. This 10 cents is not the equivalent of the full cost of the 16-cp carbon lamp, the company reserving a margin to protect itself in the matter of breakage and variation in the life of the newer type of lamps.

In relation to the low candle-power tungsten lamps which have lately been placed on the market, the company has not had a very wide experience with them as yet, and has so far not encouraged their use.

PROVIDENCE, R. I.

For the Narragansett Electric Lighting Company Mr. E. R. Davenport, sales manager, states that the lighting income has been very greatly increased by the use of tungsten lamps. The regular retail lighting rates are the same for both commercial and residential illumination. The company has been particularly successful in replacing gas arcs by tungstens of the higher candle-powers. Local conditions largely determine the

PRICES CHARGED FOR LAMPS.

110-VOLT LAMP		250-VOLT LAMP	
Watts	Price	Watts	Price
32	$1.00	90	$1.40
45	[illegible]	110	1.60
70	1.25	180	2.50

size of lamps recommended, but, in general, the company prefers to advocate the 40-watt size for residential lighting instead of the smaller lamp. The gross lighting rate is 12 cents

per kw-hour, subject to discounts of from 5 per cent to 33⅓ per cent, depending upon the consumption. The 5 per cent discount applies to a bill of from $25 to $50 per month, and the largest discount to a bill of $200 or over. Tungsten lamps are sold at the prices shown in the above table with 10 per cent discounts from them when standard packages are bought: The same price is charged for renewal as in the first installation. The company has no flat-rate propositions of any kind.

MALDEN, MASS.

The regular residence lighting rate in the territory of the Malden Electric Company is 12 cents net per kw-hour. Commercial rates drop to a minimum of 10 cents secondary rate. Sign lighting by 4-cp low-voltage tungsten lamps is sold at the rate of 8⅓ cents per lamp per month, with burning until 10 p. m. every week night, except Saturday, when service runs to midnight. On Sunday no sign lighting is run on the flat-rate basis. The lights are cut off by patrolmen or time switches. A flat rate is made for window lighting on the basis of the following table:

Candle-power	[illegible]
20	$0 50
[illegible]2	0 65
[illegible]	0.95
[illegible]	1.50
200	3.65

This service includes free renewals of all lamps that are burned out or blackened so as materially to lower the candle-power. Time switches are sold to the customer at cost or rented at a price of $1.25 per month each. The customer pays for the wiring. Free renewals are given of tungsten sign lamps that become dim. A 10-volt service is used in the latter work. For general interior lighting the company pushes the sale of the 40-watt lamp in preference to the lamps of the lower sizes.

ROCKFORD, ILL.

Among cities of about 40,000 population few have more progressive central-station companies than the Rockford (Ill.) Electric Company. Mr. F. H. Golding, manager of the Rockford Electric Company, says:

"We have about 3500 tungsten lamps in service in Rockford, and, so far from reducing income, I am satisfied that they have been of material aid to us in securing business that might otherwise be difficult. For commercial use we believe that the 60-watt and 100-watt tungstens are the most serviceable, as the cost of renewals per kw-hour consumed is materially lower than on the smaller sizes, while the general illuminating results are more satisfactory. We find that the 40-watt lamp is small enough for practically all of our consumers, and we have very little demand for the 25-watt sizes or lower."

THE CENTRAL WEST.

An inquiry directed to a northern Indiana company brought the following response, which is the result of more than a local experience.

"From a survey of the electrical situation throughout the territory east of the Rocky Mountains, among the properties with which we are familiar, we are inclined to believe that much of the impetus given the business during the last two years may be directly traceable to this type of lighting. While the tungsten lamp has been a business-getter it has in some instances reduced the income, due to the failure of the central station to control the local tungsten-lamp sales, resulting in reduced bills and the same relative candle-power rather than the same size of bills and greatly augmented candle-power, the latter being a very excellent method of increasing energy sales in adjacent commercial installations.

"With the inauguration of a plan of maintenance of tungsten lamps, we have a very easy means of superseding 'gas arc' units, as by putting out the lamp at cost, or thereabouts, the fear of excessive cost is overcome, while at the same time the actual renewal expense is determined. The life of the units seems longer than during last year, due no doubt to greater care in manufacture and also in increased experience of electrical people in handling the individual lamp, the exercise of ordinary care, as with the carbon lamp, being of no avail in preventing broken filaments due to shock.

"We should prefer to see more durability of the 25-watt and 40-watt sizes rather than lower or intermediate units, unless, of course, lower consumption than 1¼ watts per candle may be obtained in practice, for in the usual residential or store work 20 cp is as small a unit as can be of service. For window outlining and sign work the regular 4-cp size answers all purposes. Why, therefore, be under the additional burden of carrying a multitude of sizes to suit the whim of a customer? As a general proposition, we think we are justified in requiring much greater durability for lamps of the smaller sizes on account of the more general adaptability of these sizes and consequent greater ratio of demands as compared with the 100-watt to 250-watt sizes; until the manufacturer can insure us of a greater life, a small-size lamp is a detriment rather than a help to the business."

EXPERIENCE OF A LARGE ORGANIZATION.

Mr. A. S. Huey, vice-president in charge of operated properties for H. M. Byllesby & Company, Chicago, expresses the sentiment of that large organization as strongly in favor of the tungsten lamp. Electric-service properties are operated by Byllesby & Company in 42 municipalities in the Central, Southern and Western States. Mr. Huey is decidedly of the opinion that the tungsten lamp has been a great benefit to the industry. He says that central-station companies should above all things serve their communities and their customers faithfully, giving them the advantages of improvements in the art, and the tungsten lamp has been a conspicuous instance of the manner in which the companies may seize upon this advancement for the benefit of their public. The aim should be to produce electricity as cheaply as possible, and to sell it in large quantities at a small margin over the cost of manufacture. The service must be popularized to the last degree, and the policy of the companies with which Mr. Huey is connected is in favor of the introduction and extensive use, not only of the tungsten lamp, but of any other article or device that will enable the consumer to get his service at a rate less than he is now paying.

The public should be educated to use more light. This has been done in a degree in the large cities, as any one can attest who can look back 20 or 30 years and contrast the appearance of these cities after nightfall with their present comparative brilliancy. But in the smaller cities and towns, both indoors and out, there is still, as a general rule, dimness after dark instead of plenty of light. The cry should be: "More light!" This represents a characteristic of advancing civilization. In a large way the central-station manager should identify himself with this progress, and in doing so the tungsten lamp will be found an effective ally.

The Byllesby companies are not frightened by the existence or prospect of tungsten lamps of low candle-power. They take the position that whatever benefits the consumer will in the long run benefit them. If for some certain purposes the customer wants tungsten lamps of low candle-power, he should have them. In the increasing use of electricity for all purposes, and in the constant betterment of relations between sellers and buyers of electricity, the situation is one that will take care of itself, if the management of the company on the whole is judicious, progressive and enterprising. The manager of the central-station property should identify himself with the needs and advancement of his own community; doing this is more important than worrying about the introduction of low candle-power lamps. If correct and broad lines of policy are laid down and adhered to, the use of the tungsten lamp in small sizes will undoubtedly be found to be a benefit, although some station managers may now consider it a blessing in disguise.

DEVELOPMENT AND APPLICATION OF THE TUNGSTEN LAMP FOR SIGN LIGHTING IN MINNEAPOLIS, MINN.

By Robert W. Clark

THE marvelous development in the use of electrical advertising during recent years has been such as not only to call forth frequent and favorable comment on the part of the public, but from the press as well. This class of publicity through merit and attractiveness has won a permanent place among those forms of advertising that are considered by recognized authorities to be the best for appealing to the public.

The extent of the development of this class of business in any city seems to be taken as a barometer of the aggressiveness of the local central-station management, and much effective work has been done along this line with the result that the business streets and building exteriors of many cities are not only beautifully but often gorgeously illuminated by both private and public electric displays.

Structural, artistic and economical reasons have been, to a considerable extent, responsible for the use generally of the smaller units for this work—that is, the 4-cp and 2-cp carbon-filament lamps. For a long time the writer has felt that their low efficiency as compared with the larger incandescent units in use for other illuminating requirements was somewhat of a handicap to the growth of sign and decorative lighting business.

With the introduction of the tungsten lamp, in sizes adapted for ordinary illuminating requirements, came an aggravation of the situation, as this type of lamp had a specific consumption of 1¼ watts as against approximately 5 watts and 7 watts per candle-power for the 4-cp and 2-cp carbon-filament lamps, the then only suitable small candle-power units available for sign and display purposes. It seemed evident that this great difference in specific consumption would before long give rise to an impression that electrical advertising was rather costly.

Fig. 1—Building Front Lighted with Series-Multiple Lamps.

Fortunately the broad-minded policy of the management of the Minneapolis General Electric Company in encouraging effort on the part of its commercial department in eliminating as much as possible wasteful use of energy by the consumer resulted, about 2½ years ago, in that department devising ways of securing the advantages of tungsten lamps for sign and decorative lighting.

At the outset it was obvious that the filament of a 4-cp, 110-volt tungsten lamp would be so small and so fragile as to make the lamp useless for sign lighting. Attention was directed toward securing a lower voltage lamp with a shorter and sturdier filament and devising a system whereby it could be operated satisfactorily on the usual standard circuits. This led to experimental work with the series-multiple method of connection, now in quite general use for this work. Mr. Gus Frech, proprietor of "Old Vienna," a local café, was interested in the matter and installed on the front of his place of business the tungsten sign and display lighting shown in night view, Fig. 1. This display contains 154 12-volt, 5-watt tungsten sign lamps. By referring to the wiring diagram shown in Fig. 2 it will be seen that 11 groups (each consisting of 14 lamps in multiple) are connected in series across the 110-volt, direct-current mains.

Negotiations were opened up with Mr. Frech early in May,

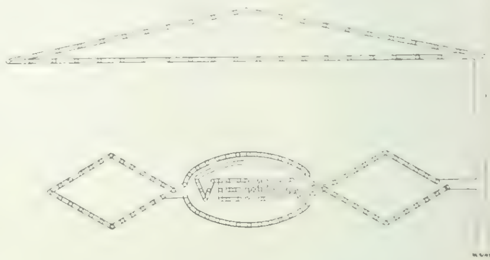


Fig. 2—Wiring of Building Front Shown in Fig. 1.

1908, and by the end of the month he placed his order with a local electric sign firm for the complete installation exclusive of lamps at a contract price of $177, ordering also the initial installation of lamps at a then cost of $92.40. A special order was placed with an Eastern lamp factory for 200 lamps, which were found to fall short in stability and uniformity of what was necessary to give satisfactory service. The lamp company then made up a second batch, which, although representing an improvement over the first, still lacked electrical and mechanical perfection.

Neither the lamp company nor the lighting company was willing that the project should be a failure, and a third set of lamps was made up and forwarded. This third shipment of lamps was installed Feb. 2, 1909, and the complete display has been

Fig. 3 — Corner Sign Fitted with Tungsten Lamps.

burning an average of a little over five hours per night regularly, over 2500 hours, with only one lamp going out at the end of about 2300 hours' burning. Upon replacement it was impossible to distinguish when the sign was in operation the exact location of the new lamp, which indicated that the other lamps had lost little of their brilliancy on account of their long use.

In the event of a lamp burning out in one of the multiple

groups under the above conditions the rise in voltage on the remaining lamps in the group is not over 10 per cent, and since the initial voltage across each group is only about 10 volts, while the lamps are rated at 12 volts, the burning out simultaneously of two lamps in the same group would not strain the remaining lamps in that group, because even under these conditions they would then be subjected to only about their normal voltage.

Fig. 4—Day View of Vertical Sign.

With the 5-watt tungsten sign lamp now available in standard form, it is possible to get more electric display lighting, for due to a saving of 75 per cent in energy consumption over the 4-cp carbon lamp, the annual operating charge is only about 75 cents per lamp, or fully 25 per cent less per year than the first cost of a most ordinary one-dollar-a-socket electric sign.

In Minneapolis it has been found that those installing electric signs invest anywhere from 25 to 100 per cent more in original cost, due no doubt to the much lower operating cost when using tungsten lamps. The number of users of electric signs is also increasing at an extraordinary rate, while the average revenue per sign, considering all types, is considerably more.

Fig. 5—Large Sign Fitted with Low-Voltage Tungsten Lamps.

These points are quite forcibly brought out in the case of the "Old Vienna" installation. Prior to a consideration of the tungsten display shown in Fig. 1, the proprietor's idea of electric advertising was a transparency involving a first-cost limit of about $50, with an operating cost of not over $40 a year. The energy charge for the tungsten display as finally installed is $9.24 a month, or $110.88 a year, or over two and one-half times the amount of his original appropriation for energy.

For sign lighting in Minneapolis the rate is 6 cents net per lamp per month for the 5-watt tungsten on a flat-rate schedule, the lamp burning slightly over five hours a night. This rate is exactly one-fourth of the 4-cp carbon sign lamp rate, which is 24 cents net per lamp a month on the same burning schedule. The rate on the tungsten sign lamp, however, does not include first installation or renewal of lamps. These are purchased by the consumer, but placed in the sockets by the company's sign-lamp inspectors, who keep very close check on the outages. The company planned to give this method of sign lighting a thorough trial before recommending it generally, and did not attempt to push it until the "Old Vienna" display had been in service for nearly seven months and the lamps had given a full 1000 hours' life without the loss of a lamp.

Fig. 6—Combination Tungsten and Carbon Lamp Installation.

That it has been successful and productive of considerable good business is best indicated by the additional photographs shown of a few signs recently installed in Minneapolis embodying the use of 5-watt tungsten sign lamps. The large vertical corner sign shown in Fig. 3 is readable effectively four ways. It contains 352 5-watt lamps, is of metal construction throughout and cost nearly $500, installed and connected, exclusive of lamps. The monthly energy charge is $21.12 net, or $253.44 a year. This display is considered very good advertising by the users.

Fig. 7—Roof Signs in Minneapolis.

The vertical sign shown in Fig. 4 contains 264 5-watt lamps. It is of metal construction throughout, cost in place connected without lamps about $450 and the monthly cost for electricity

on flat rate is $15.84, or $190.08 a year. This is a clean-cut display with a long effective range both ways, day and night.

Fig. 5 shows a sign consisting of large 6-ft. letters attached to a well-designed angle-iron framework across the face of the building at the second story. The letters flash on one at a time, then all off and all on. The bottle lights up gradually in the flashing process, as it contains the lamps necessary to equalize the number of lamps in each letter for proper series-multiple connection.

The letters in the sign have double rows of sockets, the display containing a total of 429 5-watt lamps. The cost of this

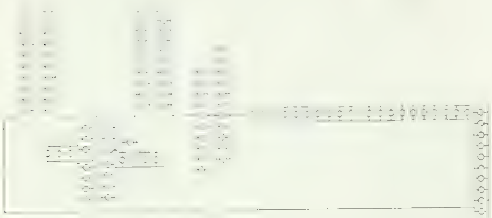


Fig 8—Low-Voltage Lamps on Direct-Current Outline Circuit.

installation was in the neighborhood of $400, installed and connected without lamps. The flat rate for flashing signs being but 4½ cents per month per lamp, the energy cost of this display is but $19.31 per month net or $231.72 per annum. It is difficult to pass anywhere in the vicinity of this sign without having the attention attracted.

The display shown in Fig. 6 is interesting and attractive, being a combination tungsten and carbon lamp installation. The carbon lamps are used for lighting the kicking ballet girl figure, which is very effective. The letters contain 231 5-watt tungsten lamps. The bands of the cornice contain the same number of lamps as do also the letters of the vertical sign. Each of these groups contains 11 multiple groups of 21 lamps in series across 110-volt mains. This display is unusually effective, as the building can be viewed from a long range down one of the main thoroughfares.

Fig. 7 shows two signs, one lighted, mounted on a massive iron framework above a 1,000,000-bushel wheat elevator in the heart of the great Minneapolis flour milling district overlooking St. Anthony Falls, and is a very striking example of the value placed on electrical advertising by national advertisers. From the railroad tracks to the top of the signs is 260 ft. The signs, being about 50 ft. square with letters 8 ft. high, are visible up and down the Mississippi River a long distance, as well as from depots and principal steam and electric trains entering and leaving the city. The two signs contain over 1300 5-watt tungsten lamps placed in a single row in each letter in the center of a wide groove. The letters are strong and clear at night, the photographs shown being taken from the ground nearly a half mile distant. The signs cost complete about $3,500, over half of which was expended for the structural supports.

Since the general introduction of the tungsten sign lamp in Minneapolis scores of additional signs have been installed containing lamps ranging in numbers from 110 up, embodying many striking features.

The use of small transformers on signs fed with alternating current is becoming quite general; but as many are under the impression that the series-multiple system is rather complicated and not flexible in its application Fig. 8 has been drawn to illustrate the miscellaneous manner in which the wiring can be done. The diagram shows 11 lamp groups of 10 each connected in series, and is nothing more than straight multiple wiring with alternate sides of the line left open between the multiple groups. The number of 5-watt lamps in the multiple groups can be as high as 24. As the National Electrical Code permits the use of 1320 watts on a circuit for outside lighting, these may be grouped within small dimensions, or spread over considerable area, requiring but two wires. The rule promulgated by the Underwriters' National Electric Association, however, only permits 66 sockets or receptacles to be connected to a single circuit.

The low cost of service of tungsten sign lamps should result in a majority of the going business concerns becoming generous users of electrical advertising.

National advertisers should certainly employ it as the main or basic feature of advertising campaigns, and the tungsten sign lamp puts the electric light company in a strong position to talk efficiency of expenditures in this direction. Outline lighting should also receive considerable impetus, as the series-multiple system of wiring for this purpose is most simple and should be less costly than multiple wiring, the former method permitting of the spreading of a single circuit well over the front of most buildings. For this class of display the 12-volt, 10-watt tungsten lamp seems best adapted, unless the building exterior in question is of very light finish. One circuit will accommodate 66 lamps and in outline wiring the sockets and receptacles must be of the keyless porcelain type, and the wires must be soldered to the lugs of the sockets or receptacles as the case may be.

DISCUSSION ON FLAT RATES AND TUNGSTEN LAMPS AT MICHIGAN CONVENTION.

The subject of flat rates in connection with tungsten lamps was up for a lively discussion at the Michigan Electrical Association convention, at Port Huron, on Aug. 18. The discussion was started by a paper by Mr. R. S. Stewart, consulting engineer of Detroit, on "Flat Rates for Residence Lighting," telling of some of his experiences in a town of 2500 population. By way of introduction he showed how flat rates were first used in the early days of electric lighting for business houses where the hours of service were long, and it was considered equitable to charge consumers a fixed monthly sum, proportional to the number of lamps installed. When the attempt was made to apply this plan to residence business, however, it was found that charging according to the number of lamps connected prevented companies from obtaining a large amount of business. As soon as reliable meters were obtainable at a reasonable price, all of the larger companies and many of those in smaller towns discontinued their service on flat rates and charged for electric lighting on the basis of the amount of electricity used. In the course of a few years' experience it was demonstrated that such a system of charging was as inequitable as the old flat-rate system, for the man who used his equipment many hours per year paid much more than his share for such service, and the man who used his equipment for only a few hours per year was an unprofitable customer under any rate.

The present rational systems of charging for electric consumption are combinations of the old flat-rate system and a meter rate based on the electric consumption as measured by meters. Mr. Stewart said it is doubtful whether the meter system is the proper method for small companies. In a small town under the fixed cost should be included interest and depreciation of the plant and also all salaries and wages. This leaves practically nothing but the fuel bill for running cost. Even the fuel bill is hardly a fixed cost, for a certain amount of fuel is required to run the plant. Among the smaller towns there are very many where it is necessary to employ only one man to look after the lighting business of the locality, regardless of the number of consumers. Meter rates will drive away a certain amount of business.

Many persons who would be customers if their bills be limited to 50 cents or $1 per month prefer to use oil lamps or gas rather than pay high rates for electric lighting. Since from 50 cents to $1 per month is required to pay for interest, depreciation and maintenance of a meter, and the cost of read-

ing it, it is readily seen that small customers are not profitable to a company which charges for service by meter. Such small services on a flat-rate system bring in a profit proportional to the amount of service. In the smaller places the number of lamps installed does not exceed much the maximum number connected, therefore, it is feasible to charge a customer on the basis of the number of lamps installed, or to put in a current-limiting device. The customer should pay for this device. With a system of flat-rate charges, together with an optional meter rate, it is possible to obtain 75 per cent or more of the total business and residence lighting of a small town.

The author took for example a town of 2500 people with a maximum load of 100 kw and an investment of $25,000. Gross income was estimated at $600 a month. Of this $200 a month will cover charges for fuel, oil and other running charges, and $400 the fixed charges. The number of customers was assumed at 250 and the number of hours' use per month of the maximum load 100. The ratio of energy paid for to energy generated was assumed at 66 per cent. The diversity-factor compensates for the lost energy, so that the demand charges are estimated on the basis of the station meter readings. The total kw-hours per month will be 10,000, and the fixed cost $4 per kilowatt per month. The running cost will be 2 cents per kw-hour measured at the station. If a customer makes a contract for two 16-cp lamps, or 100 watts, the cost per month, as before estimated, would be for 50 hours' use, fixed charges 40 cents, running charges 10 cents, total cost 50 cents. However, if he uses the lamps continuously, five hours per night, or 150 hours per month, the total cost would be 40 cents for fixed charges, 30 cents for running charges, or a total of 70 cents. Therefore, a flat-rate charge of 40 cents per 16-cp lamp per month for store lighting will be profitable. The charge for residences of 25 cents per lamp per month is not profitable, but pays all expenses.

If a customer is paying on a meter basis at 15 cents per kw-hour for the first 50 hours' use per month and 5 cents per kw-hour for all in excess of 50 hours, his total bill will be 75 cents for the first 50 hours and 25 cents for each subsequent 50 hours of the use of 100 watts. In addition to this charge the customer should pay at least 25 cents for the extra investment which the central station must make in a meter. This brings the total charge for two lamps for 50 hours to $1 per month, and for 150 hours to $1.50 per month. If it is admitted that a meter costs the company 50 cents a month, then 50 hours' use of 100 watts on meter service will cost the company $1 and 150 hours' service will cost the company $1.20. The meter rates that have been assumed, therefore, show no profit for the small 50-hour customer, and only 30 cents profit for the small 150-hour customer. The tendency of every meter customer to turn off all unnecessary light tends to make his lighting unprofitable.

Records of the past year of a company operating on flat rates show an average use of the paid-for connected load of 125 hours per month, as measured by the station meters. If this is the record of flat-rate lighting, metered lighting will show a smaller use per month and will, therefore, not be profitable.

One of the main arguments in favor of flat rates is that the average customer prefers to pay a fixed monthly bill rather than to pay a variable bill depending on the reading of some meter concerning which he knows nothing. Experience has demonstrated that flat rates with all-night service are profitable in a small town, if the only carbon lamps sold by the company are graphitized lamps. These lamps should be operated at their lowest voltage, so as to give approximately 16 cp. They should be sold at cost, so as to prevent competition from others who are selling ordinary carbon lamps. For residence customers who desire to have a larger number of lamps connected, but wish to use only a few at any one time, demand limiting devices should be used.

In a small town the flat-rate system of charging with tungsten lamps is more satisfactory than any other. The customer who buys his tungsten lamps and pays the high price does not wish to buy new lamps [illegible] carefully turn off all lamps which he is not using. This condition will reduce the number of hours' use of the load paid for. It is satisfactory to adjust the rates for tungsten lighting so that the price of one new tungsten lamp per year is included in the flat rate. For each tungsten lamp contracted for on the flat rate, a card may be given which will entitle the consumer at any time within a year to one new tungsten lamp, provided the old lamp is returned.

Even though the charge per candle-power is less for tungsten lighting than for lighting from carbon lamps, the former bills will not be reduced. Most people will prefer to increase their lighting and keep their bills the same. From an experience of over a year it has been found that the revenues have been increased considerably, the maximum peak load has been decreased, and the total consumption of energy by the central station has been decreased. Complaints from poor lighting have been eliminated to a large extent, because of the smaller voltage drop in the line and because of the more constant light given from tungsten lamps when the voltage is variable. Practically every store in town uses electric lighting, and there are only two examples of gasoline lighting. Natural gas is available for lighting with incandescent mantles, but it is used rarely because of the trouble and expense connected with new mantles and chimneys. Lighting from oil lamps is more expensive than electric lighting with tungsten lamps on a flat rate, the two systems being compared on the basis of equal illumination.

The proper charge for flat-rate tungsten lighting depends on local circumstances, but a rate of 1.25 cents per month per watt less 10 per cent for cash should be sufficient to cover all costs and pay for the renewal for one lamp per year for each lamp installed. The cost of 100 watts per month would then be fixed cost 40 cents, running cost 20 cents, new lamps 10 cents, or a total of 70 cents per month for 100 hours' service. For 150 hours per month the cost would be 80 cents. At a flat rate of 1.25 cents per watt per month, less 10 per cent for cash, the revenue from 100 watts would be $1.12. There would, therefore, be a profit on all tungsten lamps used less than 150 hours a month, and this number of hours is much in excess of the average number of hours of the peak load.

The main principle which should always be kept in mind in making any change in existing rates in a small town is to obtain more revenue from the present customers by giving the customers more light or better service. It may seem to some, who have not studied the question fairly, unjust to charge more per watt for tungsten lighting than for lighting from carbon lamps, but it must be remembered that the fixed cost per kilowatt depends on the existing load, and if the load is decreased by the use of tungsten lamps the fixed cost per kilowatt is increased. As the fixed cost is two-thirds of the total cost, the charges should be based on fixed, rather than on running cost. After sufficient additional business has been obtained by tungsten lighting, it is proper to reduce rates to encourage still further addition, but this reduction should not be made until it is proved that the revenue will be increased thereby.

In the discussion of the above paper, Mr. A. T. Holbrook, of the Excess Indicator Company, said that whether a central station adopted the controlled flat-rate method of charging or not would depend on whether it wanted small residence business at a profit, and whether the manager was willing to cast aside preconceived ideas and prejudices. He suggested that the rate for flate-rate residence lighting contracts with tungsten lamps with the use of some current-limiting device should be 1 cent per watt contracted for per month or more. He advocated the use of this system for new business which could not be secured at a profit in any other way, but not for existing metered customers or for all classes of new business. Many unconnected residence consumers would be glad to get service were it not for the fear that the bills would be too big. It must be borne in mind that the controlled flat rate with limited maximum demand is different from the old-fashioned flat rate with no restriction save the honesty of the consumer. The flat-rate controlled system will give greater

gross income per kilowatt of maximum demand than any other system.

Analyzing the cost of serving a residence consumer having a connected load of 200 watts, he figured that with a consumer charge of $3 per year, an output charge of $1.71, and a demand charge of $6 per year, the total cost would be $10.71 for this consumer. As such a consumer at a 1-cent-per-watt-per-month rate would pay $24 per year. The service would show a net profit of $13.29 over the foregoing estimate of cost to operate. He quoted the last National Electric Light Association paper on "Residence Lighting," by Mr. H. J. Gille, of Minneapolis, in which $80 per kw per year is given as a fair average gross income figure. He asked members to compare this with $120 per kw of connected load obtainable with the proposed controlled flat-rate system.

Mr. Holbrook outlined the results obtained in practice with this system in several cities. At Sheboygan, Wis., since July 9, 1910, 51 contracts have been secured on the limited flat-rate basis. Most of these are stores and saloons which had hitherto used gas. The total revenue per year from these consumers will be $3,175. At Superior, Wis., since July 16, 1910, 43 residence consumers formerly using gas have been secured on this basis, with an annual gross income to the company of $815. Similar figures have been obtained at Marinette, Mich., and Wausau, Wis.

At Hartford, Conn., flat-rate consumers on this kind of contract averaged $2.30 per month. By installing 100 check meters to record the watt-hours taken by various flat-rate consumers, it was determined that the rate obtained varied from 6 to 14 cents per kw-hour.

Mr. Stewart, in answer to a question regarding results in the town in which he was interested, said that there are 80 stores in the town and 78 of these are on the company's books. Of these, only 4 or 5 use meters. The rest are charged flat rates.

Mr. E. L. Prindle, of Gladwin, spoke very positively against the use of flat rates without a current-limiting device.

Mr. W. H. Friedrich, of Coldwater, opposed flat rates on account of the uncertainty as to the number of hours' use per day the consumer will make of his equipment. Flat rates are also a source of complaint because one consumer objects to paying the same rate as his neighbor who is less economical with the electricity.

Mr. A. E. Williams, of the National Electric Lamp Association, told of an experience which he had at one time while soliciting business for a central station company in a factory district where there were many workmen's cottages. In soliciting such possible consumers, the first question usually asked was, "How much per month will this service cost?" If he had been able to answer definitely just what it would cost he was sure he could have secured many consumers who would not otherwise take the service. The workman likes to figure just how much he must lay aside to meet his lighting bill each month, and is wary of the uncertain cost of metered service.

Mr. Stewart pointed out that his paper did not advocate the use of flat rates to the exclusion of meter rates. He advocated both systems.

Mr. Holbrook read a part of a letter from a Colorado central station, which formerly used a flat rate of 50 cents per lamp per month. On Jan. 1, 1910, it changed to a meter basis, installing 375 meters. The rates are from 14 cents to 18 cents per kw-hour, yet this manager said that he would gladly go back to a rate of 50 cents per lamp per month if he could do so. The change to meters has decreased his revenue.

A paper on the cost of high-efficiency lighting, written by members of the engineering department of the National Electric Lamp Association, in conjunction with Mr. Geo. D. Westover, was read by Mr. A. E. Williams, of the National Electric Lamp Association. A statement by Mr. Alex. Dow, of Detroit, was quoted to the effect that central stations must not rest serenely in the belief that there is not to be a flood of tungsten lamps, as there will be a deluge of them. The paper then went on to say that companies which have not revised their rates [illegible] In making up the new rate it must be formulated on a more business-like basis than formerly. He then stated that any rate must be made up of three factors: a customer charge, to cover the cost of bookkeeping, meter maintenance, meter reading and collecting bill; a demand charge to cover the interest and depreciation on equipment, and other fixed charges dependent on the demand, and an output charge based on the cost of generating kw-hours, which is variable according to the number of kw-hours produced. Among the plans of arriving at the fixed charge, he mentioned especially the plan of basing this on the area of rooms to be lighted.

He referred to the Canadian Electrical Association paper of Mr. S. B. Hood, read last July, in which was given an analysis showing that a rate based on area is almost equivalent to an average rate per room in the majority of cases. By this plan in residences the main floor rooms are estimated a certain amount and the occupied rooms on the second floor at one-half this amount per room. This plan of fixing the estimated maximum demand does not discourage the use of cooking and other devices, because they are not counted as influencing the maximum demand. By using a certain charge per room, instead of per square foot, very little error is introduced.

The paper urged the importance of securing as many consumers as possible per 1000 ft. of service mains—that is, of keeping the density of service high in order to keep the cost of service down. In serving small consumers the demand and customer cost are the large items. The kw-hour costs are very small, because of the small number of kw-hours used. The paper favored the use of some current-limiting device, and a flat rate for small residence customers of this class. To overcome the objection, urged against this system, that it does not allow the flat-rate consumer on such a contract to illuminate the whole house, it was suggested that the Hartford plan of allowing the current-controller to be out of service for one night during each month should be followed.

In conclusion, the author said that the exact method of making a rate is not so important as a recognition in the rate of the existence of three elements which go to make the total cost of service; these three elements must be properly reckoned with in whatever system of charging is adopted.

President Marshall, of Port Huron, laid special emphasis on the closing paragraph of his paper to the effect that all should recognize that principles rather than exact methods are the important things in making up a system of rates. The trouble with the kw-hour as a unit, upon which to sell electric service, he said, is that it does not correspond to the unit of cost. The cost is made up of the different elements recounted in the paper.

One member asked Mr. Stewart what provision would be made in the flat-rate system for the use of electric flatirons. Mr. Stewart replied that this could best be taken care of by a meter rate if the plant was large enough to give day service, so that flatirons could be used. The objection was raised that a certain number of small consumers, if on the meter system, will pay only from 50 to 75 cents per month, whereas on the flat rate they must pay more and the bills will be too high for them. In answer to this objection Mr. Stewart said that if a consumer can pay only 75 cents per month, the company does not want him to use a meter. It cannot afford to maintain service for him. He said that representatives of the Boston Edison Company testified at hearings on that subject that the cost per meter is $1 per month.

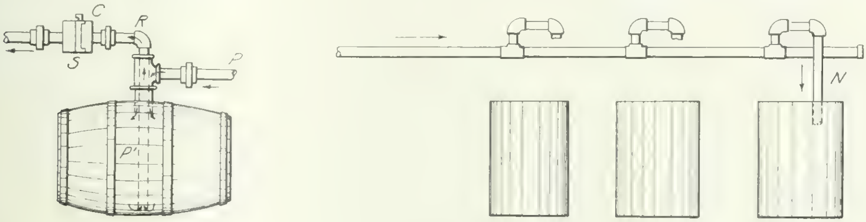
Mr. W. H. Friedrich said that the use of heating devices, electric irons and vacuum cleaners is barred by the flat-rate system.

Mr. John Cavanaugh, of Benton Harbor, said that unless the charge on the flat-rate system is based on 24 hours per day use of energy, the company cannot afford to go to flat rates. Electric irons will be most used where the income of the family is so small that the housewife does her own washing and ironing. The electric light company could better get a revenue from ironing than the gas company. It is not correct to assume that the small users do not need electric irons.

LETTERS ON PRACTICAL SUBJECTS

MOVING OIL BY AIR PRESSURE.

A very simple method of moving oil or other liquid from barrels is illustrated in Fig. 1. Formerly the barrel of machine or cylinder oil was rolled up to its tank and then by means of a long pump the barrel was emptied of its contents; the pumping being done by hand. This method of handling the oil was slow and laborious, as it took about thirty minutes to pump out a barrel, and since we use six barrels of oil per month it was decided to utilize the air pressure from an air compressor to move the oil instead of doing so by hand, as above mentioned. Fig. 2 shows the oil storage tanks, a connection being taken for each tank from the main discharge pipe, as indicated. Referring to Fig. 1, the sketch shows the pipe and its connections. The air enters the tee through the pipe *P*, and surrounds the outside surface of the pipe P_1. Thence it passed into the barrel through the space between the outer nipple and inner pipe, as shown by the curved arrows. In making the connections to a barrel, a carpenter's bit of the right size will be necessary for boring the hole to receive the outer nipple. The inner pipe extends through the tee and connects with the nipple and elbow outside the tee, as shown at *R*. The length of the inner pipe allows about a ½-in. clearance between its end and the surface of the barrel, when it is screwed in position ready for operation.



Figs. 1 and 2—Air Pipe Connections to Oil Barrel and Tanks.

A carpenter's expansion bit will be found the handiest tool to use in boring the hole to receive the outer nipple, because the bit can be shifted so as to bore the hole a trifle small; then when the pipe tap is used to thread out the hole, the nipple can generally be screwed into this threaded hole sufficiently tight to prevent leakage. The size of the piping used in constructing such an "oil lifter," as it is called, depends in a great measure on the quantity of oil to be moved and the air pressure available. At the plant with which the writer is connected the outer nipple is 2 in. and the inner pipe is 1¼ in. in size. The inside of the outer nipple is reamed out so as to offer the least resistance to the entering air.

At first, when we began to use the oil lifter we encountered a few obstacles never expected. First of all, the air pressure was too great and this caused the heads of the barrels to bulge and leak. This difficulty was greatest whenever the pipe carrying the oil to tanks became clogged with any foreign matter such as chips of wood or pieces of old bungs left in the barrel. In either case the heads would bulge and leak, although the air pressure was reduced to 10 lb. per sq. in. and this difficulty had to be gotten over before the oil lifter could be considered a success. The way in which the oil pipe was kept free from such stoppages is shown at *S*, Fig. 1. A strainer was inserted in the oil line, as shown and it removed all difficulties. From inspection it will be seen how the strainer is made and connected in the oil discharge line. After a barrel has been emptied the cap, *C*, is removed, and any chips or dirt within the screening chamber dislodged. The removal of such matter insures a free passage of the oil through the screen and out to the storage tanks.

Referring to the illustration shown in Fig. 2, it will be noticed that over each tank is fixed a connection to receive the nipple *N*, as shown. Each elbow is plugged and when oil is to be discharged into any particular tank the plug in the elbow over that particular tank is removed and the nipple, *N*, inserted in its place. The plug taken from the elbow is screwed in place of the nipple and in this way the nipple and plugs are interchanged. After the nipple is screwed in position and plug is fastened into the elbow the air pressure is gradually turned on. It is good policy to do this, because a sudden turning on of the pressure might bulge the heads. After the oil has all been run out of the barrel the air pressure is shut off and the barrel removed. The oil lifter is then ready for insertion in another barrel. Ground unions are used on the air line, oil line and strainer which enable quick connections and easy removal of the oil lifter from the air and oil lines. The device will pay for itself in a short while, and it is worth making and connecting up wherever air pressure is obtainable. It is clean and forms a very easy way of moving liquids from barrel to any desired point of storage.

Philadelphia, Pa. KINGSLEY WILLIAMS.

LAYOUT OF A MODERN SUBSTATION

The last few years have seen such a change in the equipment of substations that the following article may be of advantage to those interested in this branch of electric transmission. To begin with, the building itself should be of such a size as to permit of a reasonable increase of capacity. That is, it should have some spare space so that if it be desired, one or more additional machines may be installed, together with the necessary switchboard apparatus, etc. It should if possible be a brick structure, having cement or tiled floors, and be well ventilated. Next, it should be a two-story building with a basement.

In the basement are the oil switches. These are either motor, or solenoid-operated, controlled from the switchboard. An air duct with inner and outer doors, forming a vestibule so as to permit one to enter without shutting off the blowers, is run directly under the space where the transformers will be on the first floor. The blowers and motors are placed right outside of the duct, the air being carried into the duct through an opening level with the floor. A good place for the series transformers is inside of the air duct.

On the main floor are placed the rotaries, motor-generators, boosters, balancers, transformers and the switchboards. The rotaries and motor-generators should be placed in a row when possible, although in some cases, in order to economize in floor space, this is not done. The machines are either three-phase or six-phase. A great many of the rotary converters are six-phase, the primary of the transformer being wound "delta" and each phase of the secondary brought out separately. In the floor under each machine should be a hole cut through to the basement, slightly smaller than the size of the inside diameter of the base of the machine. The cables are then brought straight down to the centre of the basement and

thence to the switchboard and transformers. This gives one easy access to them in case of trouble. The transformers should be placed in a row over the air duct. Some use three single-phase transformers for each rotary, while others use a single three-phase unit. Personally, the writer prefers the latter. However, this is a matter open to debate, as each has its advantages as well as disadvantages. The same rule applies to boosters and balancer sets, as to rotaries, in regard to location. As there are usually only one or two in a station, it is however comparatively easy to find a place for them where they will be out of the way.

Sometimes the switchboard is on a gallery extending along one side of the station, midway between the first and second floors. More often, though, it is on the main floor. It should be at one side of the room, far enough from the wall to give one plenty of room to work behind it—say 4 ft. The board itself is made up of panels of marble—gray or black—and the arrangement of the switchboard is of vital importance. In case of trouble the operator must know where, or at least what part of the board, each switch is. Hence it should be divided into three sections, possibly more; but three is a good standard. First, and to the left as you face the board, are the control switches for the oil switches. This is known as the high-tension board. Each control switch has red and green pilot lamps, which show at a glance whether the switch is open or closed. They are also provided with little flags worked mechanically, so that in case the lamp should burn out one would still know whether the switch were open or closed. At the top of the board are the pilot lamps for the three-phase bus, and at the bottom, under the corresponding control switches, are the relays for tripping the oil switches. Next in order come the machine panels. On each of these are the positive and negative machine switches, circuit-breaker, ammeter, receptacle for voltmeter plug, field rheostat control switches, and induction regulator or dial switch control, depending upon which is used, induction regulators, or dial switches on the transformers. The latest stations carry four buses. This necessitates the use of a switch which will enable one to connect the machines to either one of the four buses. The cable is led to the movable part of the switch, which consists of two double-throw blades electrically connected to one another, but independently operated. From each bus leads are taken, terminating in clips on the board in such a position as to allow the left-hand blade to be thrown up onto No. 1 bus, and down onto No. 3. In like manner the right-hand switch can be thrown onto either No. 2 or No. 4 bus. There is one of these switches for the positive and one for the negative side. The best circuit-breaker is one that has both an overload and speed-limit release coil. Some eliminate the overload release and depend on the relay on the high-tension side of the line; but it is safer to have it. The field rheostat may be placed on top of the board, but it is much better to have it in the basement directly under the board. Now comes the "feeder" section. This consists merely of a positive and negative switch for each feeder (of the same type as those described for the machines), and two ammeters for each feeder, one in the positive and one in the negative side of the line. If there is a storage battery in the station the panel for it should be between the machine and feeder panels. On it are the main switches (like those on the machines), two duplex ammeters to show whether the battery is charging or discharging, and the end-cell control switches with their pilot lamps. A combination desk and pressure-cabinet is more convenient than to have the pressure box on the board, as it enables the operator to take readings, and enter them in the log without leaving the desk.

The second floor is devoted to the battery and end-cell switches with their motors. The writer has purposely neglected to describe or mention any synchronizing apparatus, for while some still install that method of starting, it will only be a matter of time before all rotaries are started from the alternating-current side as an induction motor, taps being taken from the transformer for starting. This lessens the chance for "knocking" other machines off the line, causing interruption to service.

Brooklyn, N. Y. W. R. Sherwood.

ENGINE ERECTING EXACTITUDE.

During the installation of a cross-compound condensing engine in a central station considerable trouble was experienced by the engineers in charge of erection by seeming discrepancies in the leveling of the engine. No matter how carefully the work of leveling seemed to have been done, when some new part was assembled, trouble would be found in some portion of the machine which was not exactly in its position.

The work was not done with a transit as it should have been done; but the engineers relied upon an ordinary level, bridging the parts to be leveled by means of a straightedge. Unless the utmost care is taken to secure accuracy, there will be trouble from such leveling. The writer does not wish to be understood that accurate leveling cannot be performed by means of the common level and straightedge, for the work can be done that way, and done accurately, too; the writer has had to perform his share of it, but much care and several precautions are necessary in order to secure good work in leveling with such tools.

To begin with, the straightedge must be carefully made from well-dried lumber and it must have good care and careful usage from the minute it is finished until the work of setting the engine has been completed. Any careless handling of the straightedge will cause errors to creep into the leveling which all the care possible with the level and straightedge afterward cannot make good. The ordinary level, as used by the carpenter, is of little value for engine work. An all-metal level should be used, by all means, thereby eliminating one great source of error, that of distortion of the wooden portion of the level by moisture and temperature changes. Cast iron makes by far the better level frame. While cast iron may be easily broken, it will stay in place better than most other metals, and will resist any strain without distortion until it breaks. Therefore, the mechanic with a good cast-iron level may be fairly certain that the instrument is all right as long as it is not broken. A strain sufficiently severe to injure a cast-iron level will break it.

Having procured a good and accurate level frame, the mechanic must see to it that the vial is accurate enough for the purpose. An ordinary vial as supplied with common levels is not generally accurate enough. The vial must be ground on the inside, perfectly straight, or as straight as the duty demands. Level vials are tested in a sort of trough which can be inclined from the horizontal by means of a micrometer screw. The trough is either 10 in. or 1 ft. in length and the screw is so proportional that the movement of the bubble in the vial, when in the trough, represents the elevation of the level vial at a stated distance per mile. Thus, it is possible to grind vials so accurately that the variation of the bubble 1/8 in. in the length of the vial means the elevation of the line of sight 1 in. in a mile.

A vial of this accuracy will cost several dollars. Set in a well-proportioned and well-finished iron frame the level for engine work will cost at retail about $5, and a level costing less than that amount may well be looked at askance by the engineer who desires a good and accurate instrument. The engine in question had been erected by a level with an unground vial. Upon testing out the level it was found that an appreciable elevation of one end of the tool could be made with hardly a noticeable change in the position of the bubble. When a vial is so made that the vial is smaller in the middle than at either end, or when there is a slight low place in the portion where the bubble moves, then, if the low place be near the middle of the vial, it will be almost impossible to adjust the level so that the bubble may come to rest in the middle of the vial. This defect is frequently found in levels in which the vials were inserted and set by the owner thereof.

Cases noted above happen usually because, in unground vials, the man who inserts them is not aware that the vials have been

selected, or straightened on one side only, and that side is usually marked with a short file-mark at or near one end of the vial. In setting, the file-mark should be placed uppermost in order that the bubble may traverse at all times the straight side of the vial. Failure thus to set the vial results in the "good" and the "cranky" level, both forms of which should be rejected by the engineer the instant he realizes the condition of the instrument. Such a tool caused the trouble noted in the instance described, and it was only straightened out by a tedious and careful going over the entire work with a good level, and the wedging up of some portions of the engine and the lowering of some of the other portions.

South Bend, Ind. James F. Hobart.

ELECTRICAL CIRCUIT DESIGNING.

In the designing of electrical circuits engineers, wire chiefs and amateurs seldom avail themselves of a very simple and practical scheme. Primary cells, secondary cells, generators and transformers are connected in parallel and give satisfaction. The loss of current through difference in e.m.f. is little, and the only precautions taken are to connect apparatus of equal e.m.fs. The scheme referred to is to divide the source of e.m.f. into two equal parts, place the parts at the ends of the transmission line, connected in parallel through the line. Any form of electrical apparatus can be placed in series with the line at either or both ends of the line. The two sources of e.m.f. are both practically on open-circuit. When current is wanted, by reversing the connections of the source at one end both courses are placed on closed-circuit in series through the line and apparatus. Closed-circuit batteries may thus be eliminated, using dry cells, etc., on closed-circuit lines without deterioration except during actual service. The value of this system is very apparent on a two-party telegraph or telephone line. If such a line is long, many cells are needed, and under existing conditions, a battery is required at each end, capable of operating the line, unless magnetos are used for signaling. But under the new plan the zincs at both ends are connected to one line, and the carbons to the other line or to the ground. When either party wishes to call the other he reverses the connections of his group of cells, and both groups furnish energy. He reverses the connections again when through with the line. The same number of the same kind of cells must be used at each end. A telegraph line of this kind, using wet batteries, was in successful operation for some time. The cells at each end may be grouped series, parallel, or both, but the e.m.fs. must be equal on open circuit. Storage cells or generators may be used equally well. Transformers or alternators would have to be thrown 180 deg. out of phase from synchronism. For private telephone or telegraph work, telephone testing, bell circuits, police and fire alarms, cable testing, and the subsidiary wiring (circuit-breaker alarms, motor-operated valves, etc.) that central-station and isolated-plant operators have to do, this system will be desirable, particularly when control of the apparatus on a line from both ends is a factor.

Madison, Ind. E. E. George.

AN ELECTRICAL DISPLAY KINK.

During the recent gathering of Knight Templars at Chicago the writer noticed among other and more elaborate displays a simple electrical search-lamp which was doing yeoman's duty continuously, flashing up and down the street, upward and downward, and all without any attendant whatever. The lamp, evidently of self-feeding construction, was mounted in a window which commanded almost 180 deg. and the light played continuously in every imaginable direction. After skirmishing for a position from which the method of operation for the search-lamp could be determined, it was finally observed that the lamp was mounted upon one of the oscillating desk fans which distribute their blast in many directions. The manner in which the vertical oscillations were caused could not be determined from the point of observation, but it may readily be seen that a simple lever connection with another oscillating fan would give the pencil of light as many compound curves of projection as could be evolved from the use of a full-fledged geometric lathe for the purpose. The use of a device similar to the geometric lathe would permit the path of the pencil of light to be predetermined as desired, but the fan connection will not do this without the use of further mechanism to render the fans synchronous in their action. For the purpose, the fan arrangement was sufficient and the search-lamp certainly made itself felt at unexpected times and places during the very short time the writer was able to spend in observing its action.

Chicago, Ill. John Stanton.

VENTILATING A HOT ENGINE-ROOM.

The engine-room where the writer is employed is somewhat similar to the majority of engine-rooms situated in New York City. It is located about thirty feet below the level of the street, and is very unhealthy, having a continuously overheated atmosphere for the engineers and engine-room employees to work in. Not a single ray of sunshine ever enters the engine-room and no person working in the plant can tell what kind of weather exists outside, unless by inquiring from some person who may happen to call. After a considerable number of attempts the chief engineer succeeded in having a system of ventilation installed and placed in operation and the manner in which the system was put in working order is of interest because of its importance in maintaining the engine-room in a comfortable condition. Fig. 1 is a plan view of the engine-room and the motors and fans are located in the windows, as shown at *FF*, etc. The windows were put in for the purpose of lighting and ventilating the engine-room, but owing to their location and depth below the street leved they were of absolutely no benefit, as regards to light, and of very little benefit

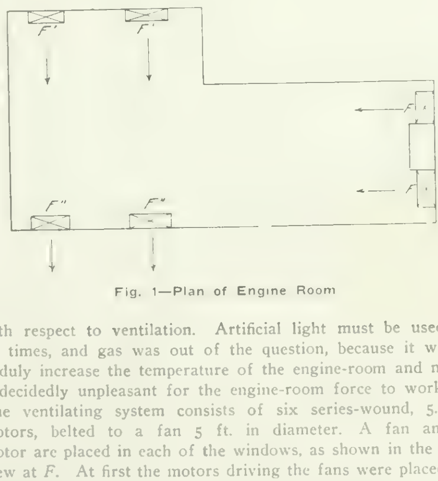
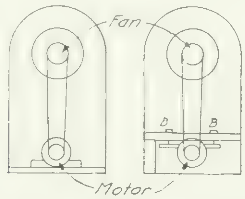


Fig. 1—Plan of Engine Room

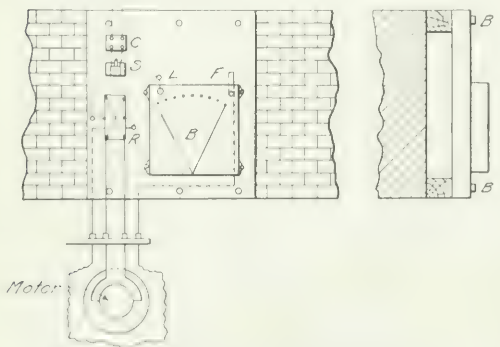
with respect to ventilation. Artificial light must be used at all times, and gas was out of the question, because it would unduly increase the temperature of the engine-room and make it decidedly unpleasant for the engine-room force to work in. The ventilating system consists of six series-wound, 5.5-hp motors, belted to a fan 5 ft. in diameter. A fan and a motor are placed in each of the windows, as shown in the plan view at *F*. At first the motors driving the fans were placed on the window sills, as shown in Fig. 2, but since there was very little space to allow for moving the motors, the belts soon became useless as driving mediums, and some other plan had to be adopted in order to obtain the necessary tension for driving the fans. This was not an easy problem. Various ideas were put forth and finally one was adopted, as shown in Fig. 3. The fan was placed on a platform sufficiently high to allow a distance of 6 ft. between the centers of the fan and motor shafting, as shown by the double-headed dart. The motor is suspended from a framework by means of four long threaded bolts; each bolt sustaining an equal load caused by the weight of the motor. The motor is held suspended by means of the nuts and washers, as shown at *B*. Whenever more tension is required on the belt, the motor is lowered a sufficient distance by unscrewing the nuts at *BB*, which increases the distance between the shaft centers. After the fans and motors were fixed in position all unnecessary openings were closed with

galvanized sheet metal, leaving only a hole or opening equal to the fan diameter. Before this was done it was found the fans when in operation simply churned over and over again the same air, which, of course, did not materially lessen the temperature of the engine-room. The plan first adopted was



Figs. 2 and 3—Motor-Driven Fans.

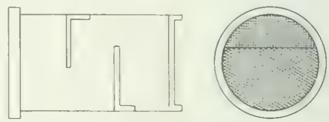
to have any gang of fans draw in the cool air and another gang would then discharge it. Now if the fans at F were discharging cool air into the engine-room then the gang of fans at either F'' or F' would discharge the warm air outdoors, hence the motors had to be connected up in a manner to allow for reversal of rotation at any desired moment, as it was thought this would be necessary whenever the wind changed its direction. How the motors were wired to suit such conditions will be immediately explained. Fig. 4 shows a slate slab bolted to the wall in a convenient situation so as to cause the least effort for the person starting the fans for either direction of rotation. Fig. 5 is a side view of the mounting, and shows how the slate slab is bolted to the wall. Six slabs were sawed out of a large piece of slate and on one piece were placed the necessary switches, etc., to enable operation of the motors. Referring to Fig. 4, the cut-out is shown at C; main switch at S; reverse switch at R, and starting box at B. After these were placed in position, the holes were scribed and center-punched, the slab put under a drill press and the holes drilled with a twist drill. Twenty-five holes had to be drilled in each slab, six of which are shown. After one slab was drilled it was used as a templet and enabled rapid drilling of the remaining slabs. The mains are run to the cutout at C, and thence to the switch S. Here the mains divide, one lead running to the reversing switch R, while the other connects the starting box. All of the wiring possible was concealed behind the slabs; the necessary connections being made through



Figs. 4 and 5—Front and Side Elevation of Slate Slab.

holes as before mentioned. This method of wiring gave the job a neat appearance and it also protected the wiring from injury to a considerable extent.

After the fans were in operation it was found that the machinery would quickly become covered with a film of dust, on account of the air being drawn from the street level. In order to avoid any further deposition of dust on the engines, [illegible] lowing manner: A galvanized sheet-iron pipe was extended from the framework outside the box in which the fans are located and in this was placed a series of canvas screens, through which the air must pass before it enters the engine-room. Fig. 6 is a longitudinal section of the pipe extension and Fig. 7 is a cross-section of the same pipe showing how the screens are fixed and held in position. The wooden framework to which the screens are fixed is held in place by means of three bolts, thus admitting of repairs, renewal or cleaning. Whenever the canvas surfaces become covered with dust they are removed and the dust is swept off and the screens again put back in place. Since the introduction of the screens the dust has been almost entirely eliminated. Of course, a more refined method of screening and washing could be adopted, but owing to conditions it is almost impossible to install a modern method of air filtration. The temperature of the engine-room has fallen from 115 deg. Fahr. to 86 deg. Fahr., which speaks for itself. From the above it will be evident that the engine-room was sorely in need of some sort of ventilating system, and the one just described was thought the quickest and handiest to install. We soon learned a great deal about how to adapt the system to realize the best results. When the fans were first started one set of fans forced in cool air while another set forced out the hot air. The result of this plan was to raise the temperature, especially in that region of the engine-room where the hot air was forced outdoors, and to decrease the temperature in that part of the engine-room, when the cool air was forced inwards. From this we soon



Figs. 6 and 7—Details of Air Screen.

learned that at least two sets of fans must force cool air into the engine-room, while the other set, or one most remote from the point of operation, must discharge the warm air outdoors. Hence the fans shown at $F''F''$ in the plan view are used exclusively for discharging the warm air outdoors, while the fans at F and F' supply the necessary cool air. The system is a complete success, and in hot weather the temperature of the engine-room is lower than that outdoors.

New York. WILLIAM KAVANAGH.

THE EFFECT OF LOAD FACTOR ON STEAM BOILERS

It is well known that stations having the largest outputs and the highest load factors show the best coal results. The coal bill of a station in its early stages, before its output has reached a reasonable figure, is apt to be abnormal, since it is necessary to have the apparatus ready to supply energy before there is much demand. Conditions such as these are not favorable to economical running, as the fuel required for banking and keeping up steam is out of proportion to the output. The effect of a bad load factor, however, is more pronounced in the boiler-room than in the dynamo room. With a reasonable choice in the size of units, it is possible to operate a generating plant in a fairly economical manner. A standing engine does not waste coal, and it has been said that under ordinary working conditions, the radiation from a boiler amounts to from 5 to 10 per cent. Now, if the boiler is worked at only about half of its power, the amount of radiation will still be the same, since the steam temperature is not altered, but the ratio of loss by radiation to heat put into the boiler is doubled. On the other hand, if a boiler is overloaded greatly, the result, of course, is inefficiency of the heating service, but the relative loss by radiations is very much reduced. From the foregoing it would appear that the number of boilers under steam should be kept at the minimum possible, and some method of forcing the draft employed to quicken the generation of steam when necessary.

[illegible] [illegible]

QUESTIONS AND ANSWERS

What are the usual voltages of electr[illegible] cities, and is direct current or alternating current mostly employed? C. J. H. S. Co.

In Germany the favorite e.m.f. for direct-current two-wire systems is between 220 volts and 260 volts, 534 stations using this e.m.f.; 228 stations use an e.m.f. between 105 volts and 125 volts; 489 stations use the three-wire, direct-current system with 220 volts between the outer wires; 427 stations use the three-wire, direct-current system with 440 volts between the outers; 26 stations use an e.m.f. of between 110 volts and 120 volts single phase; of the stations employing polyphase systems 191 use an e.m.f. between 210 volts and 225 volts and 192 between 110 volts and 127 volts. From the above it will be seen that 220 volts would be suitable in most all cases. In France there are more direct-current stations than alternating, and the voltage of the distribution network is almost everywhere between 110 volts and 120 volts. The number of 220-volt lines is small. Among the Austrian electricity supply stations the favorite e.m.f. of distribution seems to be 220 volts, while a small number use 110 volts, and a still smaller number use 150 volts. In Switzerland the e.m.f. of lighting circuits is stated to be from 100 volts to 120 volts in 52 per cent of the stations, 150 volts in 17 per cent and from 200 volts to 240 volts in 31 per cent. Among the British stations the e.m.f. in London stations is around 220 volts; Westminster stations use an e.m.f. of 210 volts to 230 volts; in Glasgow an e.m.f. of 220 volts to 250 volts is used, and in Dundee use is made of the three-wire system with 400 volts between the outers. The majority of stations in England generate direct current and statistics relating to these stations can be obtained from issues of the London *Electrician* published on Jan. 20, 1909, and Jan. 28, 1910.

It is desired to rewind a small alternating-current, commutator-type motor. The machine has a two-pole field frame 2 in. thick and 6 in. in diameter; its armature core is 2 in. in diameter and has 30 slots. There are 160 turns of No. 20 wire on each field, and the armature has 10 turns of No. [illegible]7 wire. What size of wire [illegible] would be necessary to wind this motor for 133 cycles and 25 cycles, the machine being a [illegible]-cycle motor? The voltage in both cases should be about 110. C. D. L.

The information given is not sufficient to justify a definite conclusion. We assume that the machine is a series motor. It may safely be stated that if, as now constructed, it operates satisfactorily at 60 cycles, the same machine without any change whatsoever will operate and give even better results at 25 cycles. In fact, in order to obtain equal results in the two cases it will be necessary to insert some impedance in series with the motor when it is used at 25 cycles. It is very greatly to be doubted whether the machine can be rewound in any way so that it will give even approximately satisfactory results at 133 cycles. The greatest difficulty in the operation of commutator motors is encountered on account of the sparking. If the sparking could be neglected, one could very readily determine the changes to be made when rewinding a 60-cycle motor for either 133 cycles or 25 cycles. In regard to 133 cycles, it can be stated at once that the rewound machine would not operate with the same output, or give equally as good satisfaction, as when running at 60 cycles. The 60-cycle machine can very well be considered as merely an extremely well-designed 25-cycle machine, so that if the machine is to be operated at 25 cycles it will be unnecessary to rewind it. If it is desired to experiment at 133 cycles, attention might be called to the fact that fewer turns should be used on the machine, especially in the field coils. When used at 25 cycles a larger number of turns could be employed, but it is doubtful whether any advantage would be obtained from any changes introduced in the machine.

From time to time [illegible] that the power factor of an [illegible] accurately defined, owing mainly [illegible] is. It would seem that the time [illegible] be a puzzling question [illegible] accordance with well-known relations. Let the real power in phase 1 be $E_1I_1 \cos\theta_1$, and in phase 2, $E_2I_2 \cos\theta_2$. The total apparent power then is $E_1I_1 + E_2I_2$, and since the power-factor equals real power ÷ apparent power, we have actual power-factor in two-phase circuit $= \frac{E_1I_1 \cos\theta_1 + E_2I_2 \cos\theta_2}{E_1I_1 + E_2I_2}$. Similarly, consider each branch of a three phase circuit (either delta or star connection) by itself: The real power generated or consumed in any branch will always be $E_nI_n \cos\theta_n$, and the corresponding apparent power, E_nI_n. The total real or apparent power will always be the sum of the corresponding values for each of the three phases. Hence, the expression for the power-factor of a three phase circuit is,

$$\frac{E_1I_1 \cos\theta_1 + E_2I_2 \cos\theta_2 + E_3I_3 \cos\theta_3}{E_1I_1 + E_2I_2 + E_3I_3}.$$

Is there any flaw in this reasoning? A. F. P.

It is evident that the facts brought out in your query relating to the power-factor of unbalanced polyphase systems are of considerable general interest, because they come to our attention at very frequent intervals. The difficulty in defining the power-factor of a polyphase system operating at unbalanced loads resides in the lack of ability to determine the exact value of the apparent power. You have given a method which might perhaps be considered as defining accurately the apparent power under commercial conditions. However, it neglects entirely the fact that the ordinary method of obtaining e.m.fs. and currents in three-phase systems would not give the values stated by you. That is to say, in a delta-connected system one can determine at once the e.m.fs., but difficulty would be encountered in assigning the proper values to the currents. In a star-connected system the currents are easily determined, but the e.m.fs. are not as easily ascertained. Even in cases where knowledge is had of the exact values of the current, the formulas given by you could not be considered to be generally applicable, on account of the fact that in most all three-phase systems a certain amount of triple harmonic currents exists and your formulas ignore the presence of these currents.

I have a shunt-wound motor which will not run properly. When first connected the speed was 3000 r.p.m., instead of 1300 r.p.m., and the only way in which the latter speed could be obtained was by connecting the field coils directly across the mains and inserting a water rheostat in series with the armature circuit. The motor is rated at 1 hp, 500 volts, 1.84 amp, 1300 r.p.m. The voltage of the circuit is 650. What changes are necessary? I. B.

It may be stated that a motor properly designed for running on 500-volt circuits and giving, under normal conditions, a speed of 1300 r.p.m. should when operated at 650 volts revolve at a speed slightly less than 1690 r.p.m. Just why the motor described by you should run at 3000 r.p.m. we are unable to understand. It is possible to operate a 500-volt motor across a 650-volt circuit, assuming that the motor has been properly designed for 500 volts by connecting the field coils directly across the 650-volt mains, and keeping the field current at all times at as high a value as is possible without seriously overheating the coils. Across the 650-volt circuit there should be joined a resistance so arranged that the armature may be connected in parallel with a portion of this resistance and in series with another portion, the arrangement being such that the whole resistance receives the total 650 volts, while the armature receives the proper e.m.f. for its operation. A resistance circuit of this nature can be formed of incandescent lamps. The portion of the resistance which is to be joined in parallel with the armature could be made up of, say, five 16-cp, 110-volt carbon-filament incandescent lamps, while the remaining resistance, which is joined in series with both the armature and the above-mentioned resistance, could be made up of the required number of 32-cp, 110-volt carbon-filament incandescent lamps. The number of lamps in each of these circuits should be adjusted until the desired running conditions are obtained; that is to say, all of the lamps in the resistance joined in parallel with the armature should be connected in series, while the other lamps should be arranged so as to carry the sum of the armature current and the current taken by the resistance in parallel with the armature. Whether or not your motor will operate properly when thus connected cannot be stated immediately, because there is no apparent reason why the machine should run at 3000 r.p.m. rather than 1690 when operated as stated.

Central Station

Management, Policies and Commercial Methods

RAPID DEVELOPMENT IN OKLAHOMA CITY.

Oklahoma City is growing in population rapidly, but central-station development is increasing at an even greater rate. For instance, in 1904 the rating of the electric generating station was 700 kw, whereas in 1910 it is 5500 kw. During the same period of six years the electric distribution system has increased from 20 miles to 121 miles, and the number of electrical customers from 1400 to 6301. In the year 1909 alone the number of electrical customers increased 50 per cent. The gas business of the company also shows a remarkable increase.

INSUFFICIENCY OF WATERPROOF INSULATION.

A lineman was killed in Louisiana as a result of coming in contact with a wire, carrying energy at 2300 volts, covered with an insulation consisting of cotton tape impregnated with asphaltum. On the trial of the action in the Supreme Court, brought by the lineman's representative against the electric company which owned the wire, the company's engineer, with reference to this method of insulation, said: "Its value as an insulator is almost nothing, and it is simply used to prevent actual contact between the wires, in case they blow together or, accidentally, touch. When this insulation is perfectly new it has some value as an insulator, but it is rapidly washed out, and in the course of a few months it is useless as an insulator." An ordinance of the city provides that "electric light and power conductors shall be secured by insulating fastenings, covered with an insulation which is waterproof and is not easily abraded, and that whenever the insulation becomes impaired, it shall be renewed immediately. In addition, the insulation to be used must be approved by the city electrician." It was apparent from the engineer's testimony that the defendant company did not live up to the obligation of the ordinance, and the company was held liable for $10,000 damages.

COURTESY IN ELECTRIC LIGHT EMPLOYEES.

Large public service corporations having a great number of employees who come in contact with the public are placed at more or less disadvantage as compared with smaller companies, where a single individual represents the company in all its dealings with the public. For the purpose of impressing on the minds of its employees the necessity of being courteous to customers the New York Edison Company has recently distributed to its agents, inspectors and other representatives the following essay on courtesy:

It is sometimes amazing to those who have cultivated the faculty how many of life's rough edges are softened by the exercise of courtesy.

Courtesy is but another name for politeness, originating in practical kindliness as a habit. It is a gift common to all and yet, unfortunately, exercised by a comparative few. These latter have found in it a great source of satisfaction, and of profit.

This company deems it not amiss to draw the attention of its agents, inspectors and other representatives to the advantages of courtesy in dealing with the public.

It should not be assumed that the company considers its representatives lacking in courtesy. On the contrary, it knows them to be, as a whole, an uncommonly courteous body of men.

The question of light and power service is of an intricate nature, which the public, through whom this company exists and you are paid, finds it difficult to understand—a fact that you, in your perfect familiarity with the subject, may forget.

Therefore, the public asks questions, has a perfect right to ask them, and will doubtless ask them as long as electric light and power are used.

A short inadequate answer cultivates wrath—and simply leads to the asking of more questions. Your time and temper, the questioner's time, temper and good will and the company's best interests are best served by a complete answer.

Completeness of reply, however, is but half of courtesy. The manner of replying is the other half.

Therein lies the sign of a self-respecting man. To aim to be uniformly well mannered toward all, young and old, rich and poor, men and women—this is the quality which strikes a responsive chord in every human being and leads to respect for and kindliness toward you and the company in whose service you are.

From all points, it pays to be courteous—for your own good, for the public's good, for the company's good, and for the standing it gives you in the company's estimation.

The Golden Rule is man's best law. What is courtesy but an effort "to do as you would be done by"?

TRANSMISSION SYSTEM AT SULLIVAN, IND.

The new 450-kw central station of the Sullivan County Electric Company, at Sullivan, Ind., which will be completed by Oct. 1, will also transmit 11,000-volt, three-phase, 60-cycle energy to Shelburn, 6 miles distant, and to Farmersburg, 12 miles further. At the present time the company's station at Farmersburg transmits to Shelburn, and Sullivan is supplied with electricity from the station now being rebuilt and enlarged. Sullivan is a little city of 5000, and has 431 electrical customers. Shelburn and Farmersburg are towns of half this size, and have about 200 customers apiece. The Sullivan County Electric Company, which will operate the plant and transmission lines, was formed last June. Its officers are: Mr. H. C. Dies, president; Mr. C. M. Poor, vice-president and general manager, and Mr. J. W. Robb, secretary-treasurer. The main office of the company is at Clinton, Ind., its officers being also identified with the Clinton Electric Light & Power Company there. The Clinton plant generates about 30,000 kw-hours per month, of which more than half is consumed during daylight hours by the 150-hp total in motors locally installed. Clinton is a city of 6500, and the lines of the electric company reach 450 consumers. The ultimate rating of the new Sullivan central station will be 600 kw, of which one 300-kw and one 150-kw unit will be completed at once. The equipment comprises Fitchburg engines driving Westinghouse generators.

USE OF WATER RHEOSTAT NOT NEGLIGENT.

The Appellate Division of the New York Supreme Court has held a power company liable for the death of an employee under circumstances which would indicate that the employee was at least partially to blame for the accident. A new generator was being installed in a new section of the power house, then about completed. For the purpose of testing the generator wires were temporarily run from the generator out through the side of the building, over a raceway and a 60-ft. space to the ridge board of the carpenter house, so called, and thence 40 ft. further to a rheostat in the river. The wires were under a tension of 12,000 volts, the circuit being turned on and off as occasion required in testing. The workman who was killed had been instructed to clear out the raceway. His working place was almost immediately under the charged wires. The wires sagged at this point so that they were but 8 ft. from the ground. He was engaged in assisting to dislodge a rock lying

at or near the edge of the race, using an iron bar for that purpose. He stepped back or away from where he had been thus engaged, with the bar uplifted in his hands. It came in contact with or so near a cable heavily charged with electricity that a short-circuit was formed, causing his death instantly. One of the grounds upon which the plaintiff sought to predicate negligence was the use of a water rheostat—that is, instead of grounding the rheostat, place it in the water, as was done in this case—but the trial judge eliminated that as a ground of negligence in his charge, stating that, as the evidence finally stood, it was proper to conduct the wires to the rheostat and have them end in the water. The only serious question presented was whether or not the employee had assumed the risk of being injured or killed. The jury held that, under the circumstances, he had not. The company was therefore held liable.

ELECTRICITY IN HOSPITAL AT MADISON, IND.

Many interesting electrical features have been introduced in a model hospital for the insane recently built by the State of Indiana, near Madison.

Electrically operated machines are used in the laundry, the bakery and the kitchen. Among the special devices in the kitchen are potato-peelers and dough-kneaders. Electric cranes are employed for conveying meats from the wagons through the weighing-room and into the refrigerator. Although much of the cooking is done by means of steam, use is made of many electrical utensils for cooking purposes. All of the laundry equipment is run by electricity. The washing machines, ironers, mangles and even the drying machines are thus operated. In the drying process, the wet clothes are hung on little hooks attached to an endless chain which moves through a large box containing heated air. When the clothes complete the circuit they are thoroughly dry, and are ready for the ironers within a few minutes after leaving the washing machines.

For the purpose of conveying the electrical energy from three generators in a private station to the various buildings for motors and lamps use is made of wires placed in tunnels which interconnect all of the buildings. The tunnels, which are 8.5 ft. high and 5 ft. wide, contain also the various water and steam pipes used around the institution. The total length of the tunnels is about 1 mile.

EDUCATING THE PUBLIC ON ELECTRIC-PLANT OPERATION

Mr. R. A. MacGregor, of the Connersville (Ind.) Light, Heat & Power Company, in a paper before the Indiana Electric Light Association convention at Indianapolis, Aug. 18, presented a graphic description of the differences in degree of enterprise which may result from the public or private ownership of electric-light plants. After describing the causes which in the past and at present can be held accountable for the desire for municipally owned plant Mr. MacGregor suggested a course of instruction for the public similar to that it has been given on the uses of electricity, educating the thinking populace on the various costs which enter into central-station operation and bringing it to a realization of the real facts as the best corrective of public-ownership sophistries.

"Of two towns nearly the same in size, one's public-service companies are owned by private capital; the other's electric plant is owned and operated by the municipality. One need go no further than the station platform to see the difference. The first city is hustling, endeavoring to build itself up, looking for new industry, banding itself together to help one another, and wearing a general air of health and prosperity. And, it might be added, that the public-service companies are not left out in the cold, but are included in everything for the good of the town. The second town is right where it was 10 years ago, everyone attending to his own business and satisfied with the result. There is no electric company wishing to see the city grow and expand so that its business can increase. Indeed, a full description of this town is given when it is said that it is 'dead.' Cities usually grow outside their boundaries on one or more sides, but why should municipal plants care to serve non-taxpayers? The plants are built to supply the townspeople for less money than a grabbing corporation would, and if they are self-supporting that is sufficient. Once in a while a superintendent imbued with the idea that he will make some money does run out of the city limits, but on his next deficiency is usually so reminded of it that he doesn't do it again.

"If municipal plants could give the incentive for personal ambition that a privately owned plant can things might be different, but as long as they are everybody's business we have the result of that old adage: 'What is everybody's business is nobody's business.'

"We have educated the people in our own cities to use electricity for lighting, ironing, cooking and washing, and factory owners to use it for power purposes. Does it seem impossible then for an electric-light association as a whole to educate the state to the fact that it is not coal, water and labor which make up the cost of producing electricity? Show them your depreciation; show them your losses; show them your investment. Lay out a system of accounting so that direct statements are secured which will show to the people that we are earning only a fair interest on our investment? Can we not make this to apply to municipal plants so that the actual results may be known to the public?"

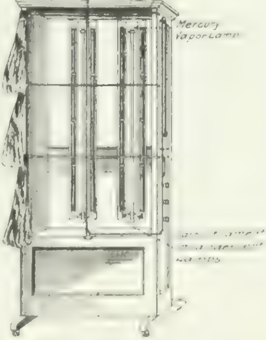
Wiring and Illumination

BIG ELECTRIC SIGN IN LOUISVILLE.

A large tungsten-lamp spectacular sign, 110 ft. long x 60 ft. high, has been erected in Louisville, Ky. The sign is divided into six panels, 22 ft. x 34 ft., each of which is leased to a separate advertiser. The display comprises, it is said, 18,000 4-cp, 10-volt tungsten lamps. Among the spectacular displays will be a full-size representation of an interurban car, with wheels turning and sparks flying from the trolley; a girl skipping a rope; and a woman playing a piano. In point of size and number of lamps, this sign is said to be the largest permanent display ever erected.

MERCURY-VAPOR-INCANDESCENT LAMP CABINET FOR PHOTOGRAPHIC WORK.

After combating the prejudices which subjects display against having their portraits taken under the greenish glare of the



Photographer Light Cabinet.

mercury-vapor lamp, Mr. M. J. Steffens, a Chicago photographer whose work is confined to portraiture of the best class, has constructed a lamp cabinet for use in his studio, in which the

red rays from carbon-filament "linolite" lamps are combined with the mercury-vapor light. As a result of this combination, the illumination afforded is nearly natural in color, and effects are said to be obtained on the photographic plate that have been impossible with other qualities of either artificial or natural light. The "snappiness" of outline of the mercury lamp is retained, while the red rays render the representation of lips and skin tones more nearly correct. Of course, the electrical efficiency of the illumination is reduced from the high figure attained by the mercury-vapor tubes alone, as the consumption of the complementary carbon lamps exceeds that of the tubes themselves.

As the cabinet has been constructed for use in Mr. Steffens' studio, it consists of an oak frame, 4 ft. wide and 7 ft. high, in which are mounted two Cooper Hewitt self-starting mercury-vapor lamps, with tubes vertical. On the white-enamel reflectors of these lamps, and paralleling the tubes on each side, are mounted polished reflecting troughs, each containing four 16-cp carbon-filament "linolite" lamps. Experiments have been made with clear-globe and red-dipped lamps, and a combination of the two is at present used in the Steffens' studio. Each one of the Cooper Hewitt lamps consumes 385 watts at 110 volts, while the eight 16-cp carbon lamps required to correct its color characteristic take 440 watts. This obviously reduces the high electrical efficiency of the mercury-vapor installation, but it works important results in the satisfaction of patrons unaccustomed to the mercury-vapor light, and who object to its use. The cabinet containing the lamps is equipped with a tracing cloth shade for securing diffused illumination, and is also fitted with three sets of sliding curtains, so that the light cast on the subject can be controlled perfectly in amount or direction. The lamps are energized through a flexible cable, with a plug connection, so that the cabinet can be rolled to any part of the studio.

At a national convention of photographers in Milwaukee several weeks ago, Mr. Steffens was awarded first prize for having produced the "most useful and valuable" portrait device during the year.

SPECIAL STREET LIGHTING BY CHICAGO MERCHANTS.

As must prevail in any city when its corporate area extends over 180 square miles of territory, with an extreme reach of 26 miles from north to south limits, much of the retail business of Chicago is conducted through local trade centers scattered at more or less regular intervals throughout the city and each serving its own little neighboring community. Among the merchants of these outlying business streets, there are almost 150 local improvement associations whose purpose it is to stimulate trade and to attract to the community center purchases which in many cases would be made "downtown" in the big stores of the "loop" district.

Tungsten Lighting, Blue Island Avenue, Chicago.

One of the most effective ways of "booming" the local streets has been the installation of some kind of special lighting, chiefly tungsten lamps on pillars, illuminating sidewalks and windows to a cheerful brilliancy that invites people to stroll abroad at night, examine the goods of the neighborhood merchants, and make selections that become purchases next day. In this way, too, as a result of the presentation of useful articles at attractive prices, new wants are discovered and purchases made, the need for which might never have occurred to the household purchasing agent downtown on bargain day with her shopping list.

There are now 14 of these outlying business centers equipped with some kind of special ornamental street lighting. Installations of this kind have been erected in the following communities: South Chicago, Thirty-first Street; Roseland, Milwaukee Avenue (three separate installations); West Chicago, Armitage Avenue, Ogden Avenue and Thirtieth Street, Blue Island Avenue, Ogden Avenue and Kedzie, West Van Buren Street, West Madison Street, North Clark Street and South Halsted Street.

Of the above installations, the last to be completed are those on Ogden Avenue, between Kedzie Avenue and Fortieth Street, and on Chicago Avenue near Thirty-first Street. The Ogden Avenue installation, which is the second to be created on this long diagonal avenue, comprises 65 posts, each carrying four 60-watt tungsten lamps. These lamps are operated 37 hours a week, and cost the Ogden Avenue Business Men's Association, which carried out the illumination, $1.50 per post per week. This cost is divided up among the merchants, each paying an amount proportional to the direct benefit he receives. In general, two merchants share the cost of a post. The Chicago Avenue installation comprises 50 posts of the same type and arrangement as the Ogden Avenue lighting. This special ornamental street lighting is furnished by the Commonwealth Edison Company at a weekly rate of $1.50 per post. This charge is based on a two-year contract, the company furnishing and erecting the fixtures, which remain its property.

While the majority of the ornamental street-lighting installations in Chicago have been of 110-volt multiple tungsten lamps on pillars, several streets have been equipped with arc lamps, and at least one installation of Nernst lamps is under way. The special-lighting service of the Commonwealth Edison Company, which is in charge of Mr. Oliver R. Hogue of the contract department, has recently been experimenting with some new 11-ft. fixtures surmounted by a single 18-in. Alba globe containing a cluster of tungsten lamps aggregating 250 watts or more. It is likely that an equipment of this new type of fixture will be installed, in the case of a special street illumination now under consideration by an association of Milwaukee Avenue business men.

RUNNING BOARDS FOR A TUNGSTEN LIGHTING INSTALLATION.

By Chas. H. Wales.

A tungsten lamp installation was laid out for a building, shown in the sketch Fig. 1. With the best arrangement of lighting units it was found that one row lay directly under a

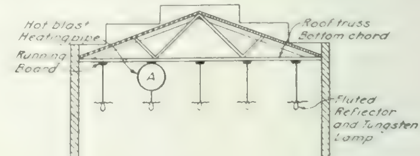


Fig. 1—Section Through Building.

large galvanized-sheet-iron, hot-blast, heating duct. At first this was considered a serious obstacle and a rearrangement of the units was considered, but the scheme indicated in Fig. 1 and detailed in Figs. 2 and 3 was finally adopted and has given entire satisfaction.

All of the conductors were supported on porcelain cleats, which were attached to running boards similar to that shown

in Fig. 4. A running board was clamped to the bottom of the heating duct with a wrought-iron strap. The middle of each strap (see Fig. 3) was flattened for a distance equal to the width of a running board and drilled and countersunk for 1½-in. flat head stone bolts. One of these straps, which had previously been bent to a circular form, the circle having an internal diameter the same as that of the outside of the heating pipe, was bolted to a running board every 10 ft. Ears, as shown in Fig. 2, were formed at the ends of the straps, and

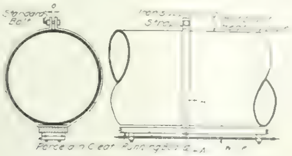


Fig. 2—Method of Securing Running Board to Pipe.

holes drilled therein through which the clamping bolts were inserted. The porcelain cleats were fastened, but not set up tightly to the boards before they were raised to position. The straps were so designed that the distance *O*, Fig. 2, was about 1 in. after the bolts had been set up snugly.

Boards and straps were raised to position and clamped to the pipe, the wires run and the rosettes put on. The length of drop cord, from rosettes on the running board on the pipe, was made as short as possible, as it was desirable to have the lamps hang high. Drop cords from the other running boards, attached directly to the roof-truss chords, were made of such a length that the lamps which they carried were the same dis-

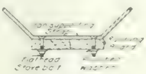


Fig. 3—Section "AA" of Fig. 2.

tance from the floor as those supported by the running board on the heating pipe. This was done to insure an appearance of uniformity and to prevent objectionable shadows being cast by the hot-blast pipe.

In Fig. 4 are shown details of the running boards which were attached directly to the roof trusses and of the fittings used in making the attachment. The distance between centers of roof trusses was so great that a single plank was not sufficiently stiff to carry the wires and fixtures without excessive deflection. Accordingly each board was reinforced with another plank, which was clamped to the first with carriage bolts. The second was arranged vertically as indicated in Fig. 4. The built-up combination was of ample strength. Each vertical

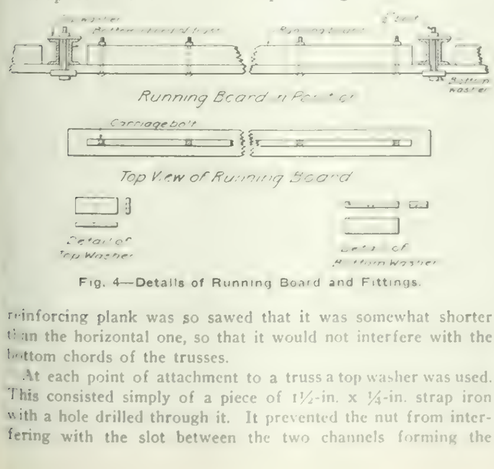


Fig. 4—Details of Running Board and Fittings.

reinforcing plank was so sawed that it was somewhat shorter than the horizontal one, so that it would not interfere with the bottom chords of the trusses.

At each point of attachment to a truss a top washer was used. This consisted simply of a piece of 1½-in. x ¼-in. strap iron with a hole drilled through it. It prevented the nut from interfering with the slot between the two channels forming the chord. The bottom washer was, as detailed in Fig. 4, a piece of strap iron with its ends bent up. Each bottom washer formed a rest for the ends of two adjacent running boards. With the boards and supporting arrangement in position the bolts were set up tightly clamping the combination firmly in position.

LIGHTING BASEBALL PARK FOR OUTDOOR GAMES AT NIGHT.

Night baseball has been attempted in various cities in the United States, and not always with conspicuous success. The whole game of baseball centers around the ball itself, and as this is not large, and is often batted high in the air, it is a difficult undertaking to provide light enough outdoors at night over the area of the large playing field and high in the air so that the players and spectators may follow the course of the ball at all times easily and accurately. The sources of light must be powerful, and yet they must be screened so that they will not blind the eyes of performers or spectators. The task is thus no easy one, but improvement is steadily being made, and those who have studied the subject predict that no baseball park in any of the larger cities of the country will be considered complete in years to come without electric-lighting equipments.

At least three baseball parks in the large cities are provided with electric-lighting facilities. These are at Philadelphia, Pittsburgh and Cincinnati. All belong to National League clubs. The Philadelphia park has 6 search-lanterns, Pittsburgh 7 and Cincinnati 14. The last-named city is the only one where the playing of baseball at night has been attempted. In the others outdoor entertainments requiring a smaller amount of light, such as football, athletic events, lacrosse, "Wild West" shows—in short, the class of performances generally grouped under the title "hippodrome" work—are given at night. The light for these spectacles is supplied by search-lanterns mounted in elevated positions and throwing their light down on the playing field. In the case of night baseball, it is also required that there should be lamps on the ground with beams directed upward so that the atmosphere may be lighted to enable the course of the small ball to be followed in the air.

The fourth large baseball park to be equipped for outdoor games at night is the one just put into service by Mr. Charles A. Comiskey for the American League Baseball Club of Chicago, commonly known as the "White Sox." This park is located at Thirty-fifth Street and Shields Avenue, on the South Side. It is 600 ft. square, thus containing about 8 acres of ground. Seating capacity is afforded by a very large and well-designed double-deck grandstand, built of reinforced concrete and brick, with flanking pavilions at each end for 50-cent seats and large "bleachers" for 25-cent seats in right and left field. The general arrangement is shown diagrammatically in Fig. 1. Seats are provided for about 32,000 spectators, making this possibly the largest ball park in the country. The whole plant was designed by Mr. Z. T. Davis, of Chicago, architect for Mr. Comiskey. A fair idea of the size of the principal structure may be gained from the fact that the outside wall of the grandstand and pavilions is nearly one-fourth of a mile long. Elaborate arrangements for the drainage of surface water have been made by the configuration of the diamond, and also by a liberal supply of drainage tile laid underneath the surface. In every respect the park is modern and thoroughly well equipped.

A large amount of capital, possibly half a million dollars, is represented by this baseball park and its equipment. Obviously it would be good business policy to utilize this expensive plant in the evenings for entertainments as well as in the daytime. Mr. Comiskey therefore entered into contract with Mr. George F. Cahill, of Holyoke, Mass., to illuminate the park so that it could be used at night. For years Mr. Cahill's hobby has been the playing of baseball at night, and to this end he has developed a remarkably powerful arc lamp, constructed as a search-lantern, together with a system for arranging the lamps to accomplish the purpose desired. A very interesting and un-

usual installation has been made, which will be put to a practical test about the time this issue of the *Electrical World* goes to press.

The total installation includes 20 powerful flaming-arc lamps, and may be divided into two parts—10 lamps elevated to a height of about 80 ft. above the ground on the roof of the grandstand and on towers, and 10 other lamps placed around the park about 7 ft. above the ground and used only when baseball is played. All of the lamps are grouped in pairs.

Of the 10 lamps placed in an elevated position, two are installed on a 30-ft. tower over the right-field pavilion, and two are similarly mounted over the left-field pavilion. Two others are mounted upon the roof of the grandstand on the third-base side, about opposite the center point of the line between third base and the home plate. Four additional lamps are placed in a corresponding position on the roof of the grandstand on the first-base side. The preponderance of light is thus on the first-base side, where most of the plays are made. These 10 lamps are arranged to throw light down onto the ground, and they produce a remarkable illumination.

Fig. 2 is a daylight picture showing the two lamps on the tower above the right-field pavilion and the four lamps on the

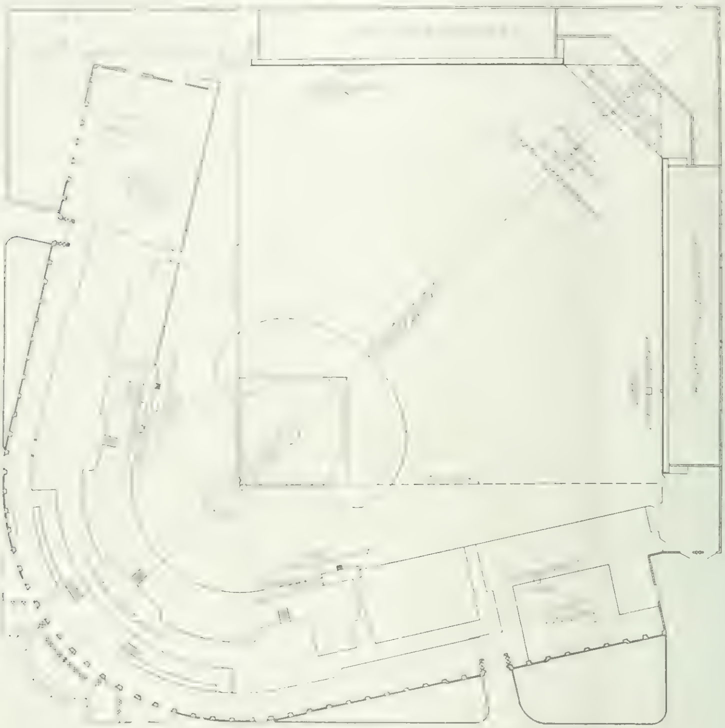


Fig. 1—Plan of Baseball Park, Showing Location of Lamps.

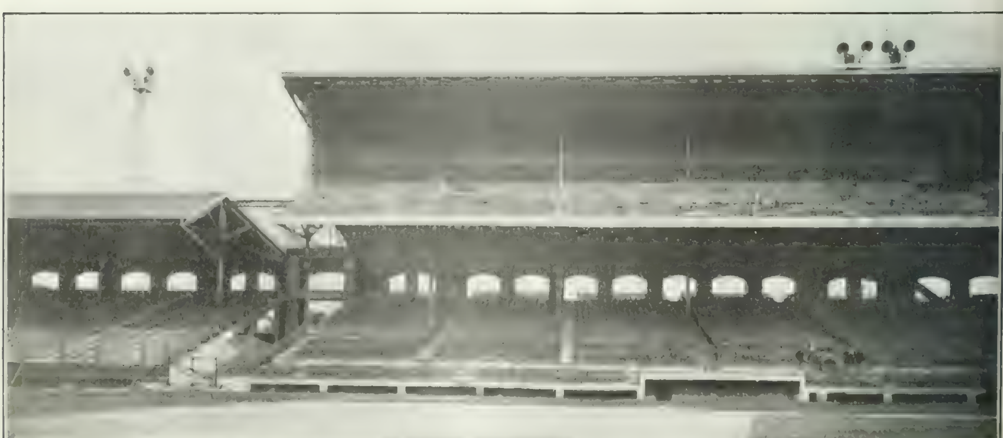


Fig. 2—Daylight View, Showing Six of the Twenty Flaming Arc Lamps.

roof of the first-base side of the grandstand. Figs. 3 and 4 are nearer views of the tower and lamps on the roof of the right-field pavilion. Fig. 5 is a particularly interesting picture. It was taken at 9:10 p. m. on Aug. 19 by the light of four of the


Figs. 3 and 4—Night and Day Views of Tower Lamps.

10 overhead lamps, none of the ground lamps being in service. Thus only 20 per cent of the total amount of light provided for night baseball was available when the photograph was made. Nevertheless, the illumination was strong, and in the original nearly all of the lettering on the combined scoreboard and signboard can be read. An 80-ft. tower is shown back of this scoreboard, which may be used for future lighting if required. The distance of this signboard from the camera was over 500 ft. The time of exposure in taking the photograph was five minutes. The lines of light shown in the upper left-hand corner of this photograph are due to some freak of the camera which is not understood.

The 10 lamps designed to be placed on the ground for use in playing baseball at night are portable, so that they can be removed during the daytime. Two of these lamps will be placed in deep center field, two in front of the right-field bleachers, two in front of the left-field bleachers, two near the grandstand back of the first-base line, and two near the grandstand back of the third-base line. These positions are indicated in Fig. 1.

Different numbers of lamps will be used as needed for different events. Thus, from four to six elevated lamps are intended to be used for hippodromes, basket-ball or any other game, athletic meet or display not extending more than 200 ft. or 250 ft. from the apex of the grandstand. Further, two of the four lamps on the roof of the first-base side of the grandstand may be placed on the roof of the apex of the grandstand when desired, and two of the ground lamps may be elevated to the top of the tower in deep center field back of the scoreboard, shown in Fig. 5. All lamps are to be provided with screens of sheet metal, placed about 15 ft. in front of the lamps, to prevent the eyes of the players and spectators from being dazzled from looking into the powerful arc.

For night baseball all 20 lamps are to be used, the elevated ones throwing their light down onto the ground and the ground lamps sending light across the field and hundreds of feet upward into the air. When all 20 lamps are in operation the consumption of power will be about 240 kw. The lamps are adjusted by hand, a trained operator being required for each pair of lamps. The electrodes, which are impregnated and imported, are each 1 5/32 in. in diameter.

The light produced by the lamp is remarkable for its power and diffusion. Measurements recently made in Philadelphia are said to have shown 137,600 cp (apparent) for a single lamp

Fig. 5—Night View of Playing Field, with 20 Per Cent of the Lamps in Use

The e.m.f. at the arc is from 60 volts to 80 volts. The initial current required to start the lamp is 125 amp, and the normal operating current is 90 amp. The lamps are supplied with direct current from 110-220-volt circuits. When they are running at full efficiency they draw an arc 6 in. long. The arc is struck in the rear of a conical galvanized-iron reflector, whitewashed on the inside. This reflector is about 32 in. in diameter and 38 in. deep. With only one of the lamps in use a person is able to read fine newspaper print at a distance of about 400 ft. from the lamp. The heat of the lamp is great and, as shown in Fig. 4, each lamp is provided with a chimney. Metallic resistors are also provided to reduce the voltage of the 110-volt circuit to that required at the arc. The towers supporting the lamps are built of galvanized iron and are four-sided with a platform at the top about 4 ft. square.

Besides the general illumination of the playing field, which has just been described, there is provided a separate system of exit lighting. Every runway, exit and passageway is lighted by 100-watt tungsten lamps, and 150 of these lamps are needed. The unusual electric wiring work required for both the general arc-lamp illumination and the incandescent lighting in the grandstand was laid out by Mr. L. M. Gordon and installed by the George E. Black Company. Electricity is supplied by the Commonwealth Edison Company, and the energy is brought into the premises underground from Thirty-fifth Street, the cables entering a steel cabinet provided with the necessary switches, watt-hour meters and maximum-demand meters.

From the service cabinet the conductors are taken to a point about midway of the corridor in front of the offices at the center of the grandstand and over the main entrance gate. Here they enter another steel cabinet with a distributing switchboard and circuit panels. In this distributing cabinet all switches are mounted on Italian marble. The cabinet itself is lined with Italian marble, except the back, which has two iron doors, giving access to the busbars and heavy fuses on the back of the board. The front of the cabinet is paneled in wood, with a lining of No. 16 iron. Five doors are provided to give access to the distributing switches and the circuit switches. Each of these doors has a beveled plate-glass panel, while the exterior woodwork of the whole cabinet is finished to match the woodwork of the offices.

Between the service cabinet and the distributing cabinet there are six 750,000-circ. mil cables for furnishing electrical energy for the arc-lighting system alone. In addition, there are three No. 0 cables to furnish electricity for the exit lighting system. This system is rather interesting, because an excellent degree of illumination is attained by a comparatively small number of the 100-watt tungsten lamps. The total load for the whole establishment is about 250 kw, including that for the illumination of the playing field and that for the exit lighting.

Letters to the Editor.

Bends vs. Expansion Joints.

To the Editor of Electrical World:

Sir:—In your issue of July 7 Mr. Kingsley Williams, in an article entitled "Bends vs. Expansion Joints," advocates the use of fittings arranged so that expansion will be cared for by the twisting of the pipe within the thread of the fitting. I should like to call your attention to an article on "Expansion of Pipes" by the writer which appears in the February, 1910, number of the *Proceedings* of the American Society of Civil Engineers, and will be found also in Vol. LXX, 1910, of the *Transactions* of the American Society of Civil Engineers.

In speaking of this method of allowing for expansion of pipes, namely, by the twisting of the pipe within the thread of the fitting, I quote as follows:

"Some authorities have suggested the use of fittings arranged so that the expansion will be cared for by the twisting of the pipe within the thread of the fitting. This has been done in some cases in low-pressure work, but a little thought or [illegible] will [illegible] that it is not a method to be relied on, for as soon as the slightest actual twist occurs within the fitting, the pipe becomes loose and the joint formed by any white lead or varnish is broken. This destroys the effect of white lead or varnish, and the difficulty of making an ordinary pipe joint tight without some such cement is well known. In many cases, where it is thought that the expansion is cared for by a twisting in a fitting, a careful examination will show that it is really cared for entirely by the spring of the pipe and it may be set down as a safe rule that, if there is actually a twist in the pipe thread, due to expansion, there will almost surely be a leak, even where the pressures are low."

Expansion should certainly be allowed for, but it should not be allowed for by the twisting of a pipe within the thread of its fitting. Such methods of allowing for expansion are universally condemned by steamfitters of experience, and it seems to me a serious mistake to advocate such methods in an engineering publication.

New York. Ralph C. Taggart.

Compounding of Alternators.

To the Editor of Electrical World:

Sir:—The article on "Compounding of Alternators" in your issue of Aug. 4 is interesting, but the scheme proposed by Professor Blondel was worked out 15 years ago by Mr. E. W. Rice, Jr., of the General Electric Company, and is covered by one of his numerous letters patent, taken out in about 1897.

Mr. Rice did not employ a separate winding on the armature of the exciter as does Professor Blondel, but passed into the armature a portion of the main alternating current, regulating the e.m.f. and power-factor by its effect upon the magnetomotive force of the armature in substantially the way proposed by Professor Blondel. Such machines have been built and operated, as described in full in bulletins of the General Electric Company. I believe it was not found necessary by Mr. Rice to employ separate excitation for the exciter field, but an ordinary shunt winding was used. I am quite certain that a separate excitation was tested out, however. The claims in Mr. Rice's patent are very broad and would, I think, until its expiration, prohibit the use in this country of Professor Blondel's arrangement without a license. The separate winding described may have some advantages, though I should think it would make the machines complicated and costly, perhaps to such an extent as to make it not worth while to employ the construction.

New York. T. J. Johnston.

Peculiar Underwriters' Ruling.

To the Editor of Electrical World:

Sir:—Referring to the article headed "A Peculiar Underwriters' Ruling," in the first issue of July, criticism is made of the specifications for *National Electrical Code* standard enclosed fuses as contained in the 1909 edition of the *Code*, chiefly for the reason that, according to Mr. Kemery's understanding, the Edison plug casings are not permitted for use with the 31-60-amp, 250-volt. cartridge-type fuses, and also that these casings with 0.30-amp, 250-volt cartridge fuses are not allowed for use on circuits over 125 volts.

Mr. Kemery's understanding, however, is not correct, and, therefore, certain of his conclusions are in error. Undoubtedly some of the readers of the *Electrical World* have obtained from this article a wrong impression of the Underwriters' requirements, and may also have been led to think that experience has shown that the dimensions and style of certain of the approved fuses were ill-advised and that the use of these particular fuses had, therefore, best be avoided if possible. It seems desirable, therefore, that a correct statement of the facts in the case should be made, and as chairman of the Switch and Cut-out Committee I would respectfully request that this letter be printed in an early issue of your paper.

Rule 52-o governs the styles of the terminals of the enclosed fuse cut-outs and limits them to Edison plug, spring clip, or

knife blade. Rule 53-f governs the styles of the terminals of the enclosed fuses, namely, ferrule contact cartridge fuse 0-60 amp, 0-600 volts, and knife-blade contact cartridge fuses 61-600 amp, 0-250 volts and 61-400 amp, 251-600 volts. In addition to the above two styles of cartridge fuses, Edison plugs of 0-30 amp capacity are permitted for use on circuits not exceeding 125 volts and on the three-wire circuits with grounded neutral where the voltage between the outside wires does not exceed 250.

Nowhere in the *Code* is reference made to casings or other devices of such design that by their use fuses of one type can be fitted to cut-outs of another type. However, the *List of Electrical Fittings* approved by the Underwriters includes 250-volt cut-outs of the Edison plug type of 31-60 amp capacity "designed for porcelain casings containing removable standard cartridge enclosed fuses." The above fact would seem to be sufficient evidence that the Edison cut-out casing-fuse combination so strongly advocated by Mr. Kemery is recognized and approved by the Underwriters for the 31-60-amp, 250-volt capacities, as well as for the 0-30-amp, 125-volt, which Mr. Kemery already admits is permitted by the *Code*.

Possibly the present wording of Rule 53-f of the *Code* could be changed to advantage in order to recognize definitely these Edison plug casings, and it may be found advisable to do this later when the *Code* is again revised, although the Laboratories have found no difficulty whatever in interpreting this section to apply strictly to the fuses themselves.

Mr. Kemery calls attention to certain characteristics of the smaller sizes of cartridge ferrule contact fuses which he evidently considers to be quite objectionable. We are of the opinion, however, that the disadvantages mentioned have been largely overestimated and in general practice are not being found to be important factors—referring, of course, to those makes of cut-outs and fuses mentioned in the approved list. Several instances of poor contact between the fuses and cut-out terminals have from time to time been reported to this office, and we have invariably requested that the cut-outs in question be sent us for examination, provided, however, they were of an approved make. In no case have we received the samples, and we are led to infer that the troubles were due to faults of manufacture rather than to poor design.

Mr. Kemery states that the ordinary approved Edison plug fuse is decidedly inferior to the casing-fuse combination, but for 125-volt work experience has not confirmed this—in fact, if anything, the reverse is true, namely, that the casing-fuse combination is inferior to the plain Edison plug fuse. The casing-fuse combination, however, is believed to be reasonably safe and is, therefore, also permitted by the Underwriters.

Mr. Kemery is entirely correct in stating that the reason for limiting the use of the 0-30-amp Edison plug cut-out to 125-volt circuits was that when installed on 250-volt circuits the ordinary Edison plug fuse was frequently used in them, thus creating a serious fire hazard. It is absolutely out of the question for the Underwriters' inspection service to prevent this misuse of the Edison fuse plug, and, therefore, the use of the cut-out was restricted to circuits not exceeding 125 volts, except in the case of three-wire circuits with grounded neutrals, as previously mentioned. It is believed that this action has caused but little hardship, for in comparatively few installations was the combination plug casing and cartridge fuse used even when it was approved.

In conclusion, porcelain casings to permit the use of cartridge ferrule contact fuses in Edison plug cut-outs are approved for capacities 0-30 amp, 125 volts and 31-60 amp, 250 volts, and it is seriously questioned whether in practice any difficulties of importance have been experienced with the approved National Electrical Code standard enclosed fuses and cut-outs.

Boston, Mass. H. O. LACOUNT,
Chairman Switch and Cut-out Committee U. N. E. A.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Braking of Repulsion Motors.—I. R[illegible].—An article in which the author discusses theoretically the question whether it is possible to brake a repulsion motor in a useful way by driving it in a direction opposite to the direction in which it runs as a motor. He shows that in this case free oscillations occur, the intensity of which increases seriously in time so as to make braking impossible. This was also confirmed by experiments. In an appendix it is shown that theoretically the conditions are similar for the series motor and for the Winter-Eichberg motor.—*Elek. Zeit.*, Aug. 4.

Generators and Transformers with Small Short-Circuit Current.—J. REYVAL.—A translation in abstract of the recent German paper by Niethammer discussing the methods of Alioth, MacFarlane and Burge, Westinghouse, etc. He concludes that for alternators there is only one perfect solution, which involves the use of the induction type.—*La Lumière Élec.*, Aug. 6.

[illegible]phase Commutation Machines.—J. [illegible].—A translation of his recent German paper in which the author discusses the necessity for and possibility of a polyphase motor with economical speed regulation. This leads to the introduction of the polyphase commutator motor, which is described, and its application in connection with machines of large output explained.—Lond. *Electrician*, Aug. 12.

Lamps and Lighting.

Indirect Illumination with Tungsten Lamps.—B. M[illegible].—A paper read before the Association of German Electrical Engineers. The author has formerly shown that indirect illumination with open direct-current arc lamps with pure carbon electrodes is more economical than direct illumination with Nernst lamps and with carbon-filament lamps. He now discusses the advantages of indirect illumination by means of high-candle-power tungsten lamps and finds from tests that this is more economical than illumination with alternating-current arc lamps with pure carbon electrodes. In the tests of

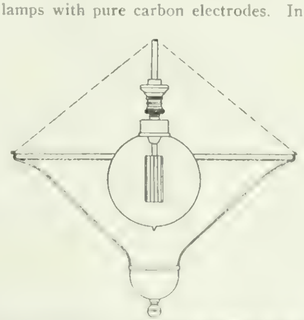


Fig. 1—Arrangement of Lamp for Indirect Illumination

tungsten lamps the suspension shown in Fig. 1 was employed. The room in which the tests were made had a height of 3.25 m (10.5 ft.); the lower part of the walls was painted with a gray blue color up to a height of 1.6 m (5.25 ft); the upper part of the walls and the ceiling were yellow white, but they were not freshly painted. Measurements were made of the [illegible] horizontal plane 1 m [illegible] the floor. The [illegible] used for complete m[illegible]

direct illumination are shown in Fig. 1, the sheet-iron reflector being provided on the inside with a white reflecting paint. Tests were first made as to the most suitable height at which the lamp should be suspended from the ceiling. The results are given in Fig. 2 for a 400-hefner-candle-power, 460-watt tungsten lamp. The ordinates give the illumination in lux, the abscissas the distance in meters from the point below the lamp; the four curves relate to the suspension of the lamp at four different heights from the ceiling, namely 30 cm, 45 cm, 57 cm and 80 cm from the ceiling. The most satisfactory results are obtained when the length of suspension from the ceiling is 45 cm (17¾ in.). When the lamp is suspended higher or lower

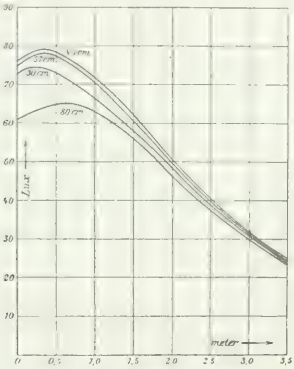


Fig. 2—Illumination Curves.

the results are less satisfactory. Tests were made then with 100-cp, 200-cp, 400-cp and 600-cp tungsten lamps, and comparative tests were made with open alternating-current arc lamps having pure carbon electrodes. While the specific consumption of indirect illumination is 0.269 watt per square meter per lux for the 400-hefner-candle-power tungsten lamp, it is 0.339 watt for an open alternating-current arc lamp with pure carbon electrodes. The tungsten lamps consume 460 watts, the arc lamps 521 watts. The mean illumination is practically the same, 44.4 lux for the tungsten lamp and 40.2 for the arc lamp. The specific consumption for indirect illumination is therefore 26 per cent less for the tungsten lamp than for the alternating-current arc lamp. It is, therefore, unnecessary to discuss electrode consumption and cost of attendance to prove that the tungsten lamp is more economical for indirect illumination. Comparative tests were then made between indirect illumination by means of tungsten lamps and direct-current arc lamps. When use was made of direct-current arc lamps with pure carbon electrodes placed in their usual position, lighting with tungsten lamps was found to be more economical. On the other hand, when in the arc lamps the position of the electrodes was reversed, the arc lamp was found to be more economical than the tungsten lamp as long as the price of energy was more than 0.75 cent per kw-hour. However, this is true only for the cost of operation, while other advantages of the tungsten lamp (greater quietness of the lamp, absence of any odor, and absence of any attendance whatsoever) are not considered in this comparison.—*Elek. Zeit.*, Aug. 11.

Physiological Effect of the Ultraviolet Rays from the Mercury Vapor Quartz Lamp. [illegible] account of experiments made in the Physiological Institute of the University of Paris on the bacteria-killing effect of ultraviolet rays from mercury-vapor lamps having quartz tubes. The killing of the bacteria is not due to the formation of hydrogen peroxide by the ultraviolet rays nor to any other chemical action caused by the rays. The ultraviolet rays of the mercury-vapor quartz lamp have wave lengths between 0.0004 mm and 0.0002224 mm. But detailed experiments of the authors show that it is essentially the rays with wave-lengths smaller than 0.000270 mm which kill the bacteria. On the other hand, while the sunlight contains many ultraviolet rays no wave-lengths below 0.000280 mm reach the earth since they are probably absorbed by the atmosphere. For this reason the ultraviolet rays in the sunlight have no bad physiological effect, while a serious effect is experienced from rays of only a little smaller wave-length, such as are emitted from artificial sources of light, like quartz lamps.—*Elek. und Masch.* (Vienna), Aug. 7.

Lighting in London.—An abstract of the annual report of F. Sumner, the engineer of the city of London. The lighting of most of the main thoroughfares by arc lamps was continued. There are in use 366 open-arc lamps of the original type, 63 flame-arc lamps, and 18 enclosed-arc lamps. The number of gas lamps at the end of the year was 2720, including high-pressure inverted gas lamps, other high-pressure incandescent gas lamps, low-pressure inverted-burner lamps, and low-pressure gas lamps.—Lond. *Electrician*, Aug. 5.

Titanium Arc Lamp.—A note on a recent British patent (18,965, 1909; July 28, 1910) of the British Thomson-Houston company (General Electric Company of this country). When arc-lamp electrodes contain titanium carbide, particles of the substance are thrown off from the arc and adhere to the glass globe and cannot be cleaned off. To prevent this, 4.5 per cent of free sulphur is mixed with the titanium carbide. The sulphur fuses with the carbide to form a compound which does not adhere to glass.—Lond. *Elec. Eng'ing*, Aug. 4.

Spherical Photometer.—E. WINKLER-BUSCHER.—A description of the spherical photometer of Ulbricht and its application for determining the mean spherical and the mean hemispherical candle-power by a single measurement. The method of calibrating the spherical photometer is also described.—*Elek. und Masch.* (Vienna), Aug. 7.

Generation, Transmission and Distribution.

Paper Mill.—A fully illustrated description of the wood pulp and paper mills of the Anglo-Newfoundland Development Company which supply paper for a number of large newspapers. The turbine plant is divided into three parts. First, there are four turbines, each of 4000 hp, driving the pulp grinders. Second, there are three turbines, each of 2500 hp, driving electric generators, supplying energy to the factories. Third, there is a set of turbines driving the oil pumps. The electric generators supply three-phase currents of 1800 amp per phase at 600 volts and a frequency of 50 with a power-factor of 0.8.—Lond. *Electrician*, July 29 and Aug. 5.

Electric Towing at Bremen.—When the city of Bremen some time ago decided to resort to electrical towing for dealing with part of the navigation at the mouth of the Weser, ordinary towing locomotives were found inadmissible on account of the special local conditions. Two tracks of rails would have been required on the crest of the wall separating the two Weser sluices, which would have entailed the necessity of strengthening the wall at considerable outlay. Moreover, the top of the wall was occupied with the control apparatus of the sluice gates, and the traffic would have been impeded by the presence of so many rails. The following plan suggested by the Allg. Elek. Ges. was therefore adopted: A single line of rails was laid close to each of the outer edges of the wall where its strength was a maximum, thus leaving the remainder of the wall crest free. The usual form of locomotive was abandoned, and, instead, the engine was designed in the shape of a gantry of sufficient height to pass over the controlling devices, operators' cabins, conductor poles, etc. The necessity of passing under a passenger bridge, which is eventually to be erected, also had to be taken into account. The motor, which is arranged on the top at the level of the cross-arm, is of the three-phase type and drives the locomotive by means of intermediate gearing. The two wheels on each side of the engine are coupled together so as to utilize fully the adhesive force. The required pull of 1.5 tons was readily obtained at the tests on delivery. The engine is manipulated by reversing controllers located on both sides immediately beside the controllers for the winches that operate the towing cable. These two winches, which are placed in the upper cross-arm cable, enable the towing cable to be let out to a length of upward of 100 m. In connection with this towing plant an

lectric lighting equipment for the sluice wall was installed. This equipment comprises 18 poles, each of which is provided with two 50-cp metallic-filament lamps, and, at the same time, carries the supports for the overhead wires feeding energy to the locomotives. The e.m.f. of the three-phase current derived from the municipal station is reduced from 7000 volts to 220 volts in a special transformer house before being supplied by means of water-tight cables through the sluices to the lamps and the overhead wires of the locomotive.—Lond. *Electrician*, July 29.

Lapland Railway.—An article giving details of the proposed electrification of the Lapland Railway, the expected saving over steam traction, and the proposed water-power developments for this purpose.—*L'Industrie Elec.*, July 31 and Aug. 5.

Hungarian Street Railways.—Statistical data on the electric street railways in Hungary in 1908. The number has remained the same as before, namely 14. However, the total length has increased from 209 km to 233 km (140 miles).—*Elek. und Masch.* (Vienna), July 24.

Trolley Wire Suspension.—HENSIG.—An illustrated article on the advantages of catenary suspension of the trolley wire for street railways.—*Elek. Zeit.*, July 28.

Installations, Systems and Appliances.

Metallic-Filament Lamps and Central Stations.—An editorial on the effect which the use of metallic-filament lamps has had on the development of the central station of Leeds in England. In spite of the fact that new consumers continue to be connected to the mains at a very satisfactory rate, the output of the station remains almost stationary, the total number of kw-hours sold during the past year being practically the same as two years ago. Since the sales of energy for motors and heating devices during this period have increased by considerably over 1,000,000 kw-hours, the great reduction that has taken place in the revenue obtained from lighting is evident. The receipts from private lighting were for the past year only $322,590 as against $404,640 two years ago, notwithstanding a large influx of new consumers. This result is largely accounted for by the increasing use of metallic-filament lamps, with their resultant economy in energy consumption. Moreover, the consumption per lamp installed is also decreasing. Thus, whereas in 1907-8 the number of kw-hours sold for private lighting per 35-watt lamp installed was 21.25, in the last year the figure fell to 17.75. This value appears to have been carefully ascertained, and is not based merely on the hypothetical 8-cp lamp. That electric lighting is also no longer a luxury can be gathered from the fact that the average price per kw-hour sold for lighting was last year only 6.04 cents, the average figure for the whole supply of 12,500,000 kw-hours being 3.82 cents. The present position, of course, will be quite altered when the change-over by consumers to metallic-filament lamps is completed. The cost of energy production is very low at Leeds. With a load factor of only 15.9 per cent, the total costs per kw-hour sold, excluding capital charges, are only 1.18 cents, fuel costing the remarkably low amount of 0.34 cent per kw-hour. A full abstract is also given of the last annual report of the Leeds central station.—Lond. *Electrician*, Aug. 5.

Wires, Wiring and Conduits.

High-Tension Cables.—L. LICHTENSTEIN.—A paper read before the German Association of Electrical Engineers on the latest progress in the manufacture of high-tension cables. This may be briefly summed up in the statement that a reliable three-conductor cable for 50,000 volts is now available with a perforation e.m.f. above 330,000 volts. The author gives the results of various experimental investigations which have been made during the last months in the laboratories of the cable works of the Siemens-Schuckert Company, relating to the energy loss in the armor of single-phase cables and the loss due to dielectric hysteresis for e.m.fs. up to 70,000 volts. A table is given for the currents which may be permitted in underground armored three-conductor cables with an insulation thickness of 17 mm for from 50,000 volts to 60,000 volts.—*Elek. Zeit.*, Aug. 4.

Transmission Lines.—F. KOESTER.—In a fifth article of his general review of hydroelectric engineering practice the author deals with high-tension transmission lines and apparatus.—*Eng. Mag.*, August.

Electrophysics and Magnetism.

Cooling Laws.—A. RUSSELL.—An abstract of a London Physical Society paper on the convection of heat from a body cooled by a stream of a fluid. Attention is directed to certain deductions made by Boussinesq from the mathematical theory of the conduction of heat in liquids. Complete proofs are given of Boussinesq's formulas, stress being laid on their limitations, and some of their practical applications are pointed out. It is proved that when a hot body is immersed in a stream of liquid flowing with constant velocity, the cooling is proportional to the difference of temperature between the body and the liquid. Newton proved experimentally in 1701 that this law was true for the case of a hot body being cooled by a draught of air. He enunciated his law with reference to the forced convection of heat from a body and not, as is often stated, to the natural free convection from it. Lorenz has shown that in special cases the natural convection of heat will vary as the 1.25th power of the difference of temperature. Compan has shown that provided the velocity of the cooling draught is kept constant between certain limits, Newton's law is very approximately true even when the difference of temperature is as high as 300 deg. C. Another deduction from the formulas proved in the paper is that the cooling is very approximately proportional to the square root of the velocity of the convection current. The author gives the solution of the problem of the heating of a liquid flowing steadily, with a velocity less than the critical velocity, through a cylindrical tube which is maintained at constant temperature. It is shown that, in many practical cases, the heating power of the tube varies as $RT\sqrt{sdkVl}$, where R is the radius of the tube, T the difference of temperature between the tube and the liquid, s the specific heat, d the density, k the conductivity, V the velocity of flow and l the length of the tube. It is proved that when a wire is immersed in a stream of liquid with its length at right angles to the direction of flow, the electric current which will fuse the wire varies as the 1.25th power of the diameter of the wire. Finally, the effect on the cooling of an electrically heated cylinder by a stream of liquid of putting an insulating wrapping round it is considered. It is shown that in certain cases the effect of this procedure is to lower the temperature of the cylinder, an effect which can be easily demonstrated experimentally. In order to simplify the mathematical work, only the case of incompressible fluids is considered. However, experimental results obtained by various physicists are quoted to show that some of the formulas are approximately true for the cooling of heated bodies by convection with currents of air.—Lond. *Electrician*, Aug. 12.

Discharges from Points in Air.—A. P. CHATTOCK.—Two papers on discharges in air from a needle point. In the first paper it is shown that when a discharge occurs at a sharp point in air at atmospheric pressure, it is possible to calculate the strength of the field in the ionizing region at the surface of the point to within 1 or 2 per cent for a positive and less accurately for a negative point in terms of the mechanical pull upon its surface; this conclusion holds when the point is supplied with ions of opposite sign to itself from a second point in its neighborhood. In the second paper the author, in conjunction with A. M. Tyndall, discusses the ionizing process at the point discharge in air and reaches the following conclusions: A supply of negative ions from without to a positively electrified point lowers the ionizing field at its surface. Positive ions supplied to a negative point are without effect when the point is new. These two facts are shown to be consistent with accepted theory. A negative point may become aged with use, but temporarily acquires the properties of a new one when bombarded with positive ions. The minimum ionizing field for fully formed negative ions is about half, and that for corpuscles about one-seventh, of the field in which ordinary positive point discharge takes place. In each case the field assumed is that at the surface of the metal.—*Phil. Mag.*, August.

Silent Discharge Through Air.—D. H. KABAKJIAN.—An account of experiments in which the main results are as follows:

A silent discharge obtained by an alternating e.m.f. and an insulating dielectric between the electrodes separated by an air space is, under certain conditions, oscillatory in character. Increasing the capacity of the system or decreasing the air space tends to decrease the amplitude of these oscillations, giving rise to smoother discharge current curves. Variations in current density or the insertion in the circuit of a resistance of the order of 33,000 ohms do not seem to affect the shape of the discharge curve. Moisture in the air diminishes the value of the discharge current for a given voltage and air space, as well as its luminosity.—*Phys. Rev.*, August.

Hysteresis Loops.—S. P. THOMPSON.—An abstract of a London Physical Society paper on hysteresis loops and Lissajous' figures and on the energy wasted in the hysteresis loop. Attempts have been made to find an explanation of the forms of the looped curves which express the hysteresis exhibited by iron and steel when subjected to cycles of magnetization. The author shows that any hysteresis loop can be analyzed into a harmonic series of closed curves corresponding to the various terms in the analysis of the current wave; their constituents are examined in the paper. A number of examples of hysteresis loops were chosen and subjected to analysis.—Lond. *Electrician*, Aug. 12.

Units, Measurements and Instruments.

Reichsanstalt.—An abstract of the report of the work of the German Reichsanstalt for 1909. The results are given of tests of the resistance standards, silver voltammeter, standard cells, meters, mercury rectifiers, electrometers, standards of capacities, methods of measuring small alternating currents, etc. The report is to be continued.—Lond. *Electrician*, July 29 and Aug. 5.

Temperature Scale.—C. W. WAIDNER AND G. K. BURGESS.—The authors discuss the best means available at present for reproducing the temperature scale between 100 deg. C. and 500 deg. C. The following table of fixed points represents the temperature scale which appears best to satisfy the available observations to 0.1 deg. for the reproduction of temperatures in the interval 100 deg. C. to 500 deg. C.:

[illegible]		[illegible]	
Tin	231.9°C.	[illegible]	[illegible]
[illegible]	[illegible]	Benzophenone	306.0
Zinc	419.4	Sulphur	444.7

As these temperatures are on the constant-volume scale, the reduction to the thermodynamic scale may be effected approximately, if desired, by adding 0.2 deg. at the sulphur point and a proportional amount at the lower temperatures, remembering that this correction is zero at 100 deg. C. All of these substances may readily be obtained of sufficient purity to give a reproducibility of 0.05 deg. C. from one sample to another.—*Bull. Bureau of Standards*, Vol. 7, No. 1; reprint No. 143.

Quadrant Electrometer.—R. BEATTIE.—The author gives an elementary theory of the quadrant electrometer, but corrects several errors in the simplified theories given in text-books. He shows especially that the controlling couple acting on an electrometer needle is not due to the suspension alone, but is a double couple, arising partly from the suspension and partly from electrical causes. In spite of the great difference between the electrometer and the moving-coil alternating-current galvanometer there is a certain parallelism between the two instruments due to the existence in each of a double control on its moving system, partly mechanical and partly electrical. In the galvanometer the electromagnetic controlling couple on the coil arises from the current induced in it by the field, and the deflecting couple arises from the current injected into it by an external source; in the electrometer the electrostatic controlling couple is due to the charges induced on the quadrants by the charge given to the needle, and the deflecting couple is due to the charges given to the quadrants by some external source. The sensibility characteristics of the quadrant electrometer are discussed, and an outline is given of the general theory.—Lond. *Electrician*, Aug. 12.

Meter Tests.—An account of tests made in the Reichsanstalt on the behavior of electricity meters on variable loads. From theoretical data it was found that the readings of meters under such conditions were not falsified by the inertia of the moving system. This statement has been experimentally verified. During the past year a large number of continuous-current meters, in which the moving armature turns in the field of a permanent magnet and is in shunt across a resistance in which the main current flows, has been systematically tested. Such meters often do not fulfill the conditions that require that the readings shall remain constant during a long period of load, but show inaccuracies or become gradually slower and slower as time goes on. This phenomenon is a natural result of the meter construction. The potential drop in meters is very small (at full load only from 10 volts to 15 volts) and the armature voltage is small, so that small alterations in the contact resistance between commutators and brushes give rise to the above-mentioned inaccuracies. J. Busch in an article formerly noticed in the Digest found, as a result of observations and tests, that these inaccuracies are due to mercury vapor. This is specially important, as mercury vapor is very prevalent in those laboratories in which the behavior of the meters is tested. From his tests it appears that so long as the brushes and commutators of the magnet motor meters do not come in contact with the mercury vapor the meters are very suitable for use. Mercury vapor causes a slowing down of the meter which increases as the load decreases. As these results did not agree with the experience at the Reichsanstalt, tests were undertaken on three new amp-hour meters, which were designated I, II and III respectively. I and II were loaded continuously with their full current, and their inaccuracies at one-fifth, three-fifths and full-load were measured at intervals of a week. I was enclosed in a closed air-tight zinc box, while II, which hung close to it, was fitted with a protective covering. During two months continuous using, I exhibited inaccuracies from the beginning and at one-fifth of full load gave results up to 10 per cent in spite of the fact that all effects due to mercury-vapor were excluded. II, on the contrary, showed a falling off of 3 per cent only during the first 14 days, and then remained constant, while removal of the protecting cap did not alter its readings. After it had been running for 10 weeks a small cup of mercury was placed in the meter, which was then closed in again. As the current warmed up the interior of the meter, the mercury vapor was given off at a fairly high rate, so that the silver commutator became covered with a gray amalgam. In spite of this the meter ran for another eight weeks without showing any noteworthy alterations in its readings. Since similar tests of meter III gave the same results, it appears that the results obtained by Busch must be attributed to other influences.—Lond. *Electrician*, July 29.

Resistance-Temperature Coefficient of Thermoelements.—In the report of the Reichsanstalt it is mentioned that for reducing to zero the resistance-temperature coefficient of a thermoelement it is best to weld the thin wire instead of soldering it,

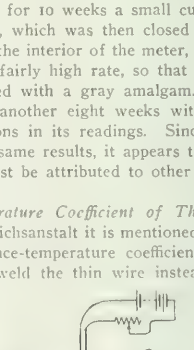


Fig. 3—The [illegible] Elements.

since all soldering material has a considerable resistance-temperature coefficient. Some observations made with this method are given. The well-known phenomenon of a manganin wire becoming coated with a copper skin when heated was observed, a resistance-temperature coefficient of about 0.00015 per degree [illegible] noted on these occasions. The manganin

wire taken from store had a resistance-temperature coefficient of only some millionths per degree Centigrade, while the resistance-temperature coefficient of constantan wire was of the same value, but negative. The resistance-temperature coefficient of constantan is not considerably affected by melting the wire. The copper covering on heated manganin wire can sometimes be washed off with nitric acid. A clean manganin wire was heated to redness in a vacuum, and in this case no copper skin appeared and the resistance-temperature coefficient remained small. There is, therefore, no danger that an accurate or slightly inaccurate instrument will become very inaccurate if overloaded. Manganin and constantan can be electrically welded in vacuo, so that if elements have an inaccuracy exceeding 10 per cent, they are more than red hot. The phenomenon was not improved by melting the wire in pure hydrogen to prevent oxidation. The difference was finally reduced by performing the welding in the following way: A manganin and constantan wire were twisted about 10 times and their ends were stretched out by two clamped-on screws *ss* in Fig. 3. The twisted part of the "bridge" was hung on two metal strips *MM* placed about 0.5 mm apart. When a suitable voltage is applied the twisted parts are melted and burnt through. The other wire parts are cooled by dropping water at *ww*, so that immediately two elements are established. In this case the difference is from 5 to 7 per thousand with this arrangement. The melting occurs very accurately, so that a large number of elements can be set up in a short time and with a small expenditure of material. The melting places give good contacts and support a tensile stress quite well.—Lond. *Electrician*, Aug. 12.

Magnetic Balance.—C. Cheneveau.—An illustrated description of the magnetic balance of MM. P. Curie and C. Cheneveau for the measurement of the coefficient of specific magnetization, or the susceptibility or permeability of feebly paramagnetic or diamagnetic bodies. The body whose magnetic properties are to be determined is suspended from one end of the arm of a torsion balance. By means of this balance there is measured the force which is experienced by the body when placed in a non-uniform magnetic field, produced by a permanent magnet the lines of force of which cross the space occupied by the body.—*Phil. Mag.*, August.

Measuring Radiation and Radioactivity.—H. L. Callendar.—An abstract of a London Physical Society paper on the radiobalance, a thermo-electric balance for the absolute measurement of radiation with applications to radium and its emanation. In the instrument heat supplied by radiation is directly compensated by the Peltier absorption of heat in a thermojunction through which a measured electric current is passed. In the simplest form of the instrument the radiation admitted through a measured aperture, 2 mm in diameter, falls on a small copper disk 3 mm in diameter and 0.5 mm thick, to which two thermo-junctions are attached, thereby forming a Peltier cross. One couple is connected to a sensitive galvanometer for indicating changes of temperature. The other is connected to a battery and rheostat in series with a milliammeter or potentiometer for measuring the current required to reduce the deflection of the galvanometer to zero. If A is the area of the aperture in square centimeters, Q the intensity of the radiation in watts per square centimeter, a the absorption coefficient of the surface of the disk, P the Peltier coefficient in volts, I the balancing current in amperes, and R the effective resistance of the couple, the equation giving the value of the radiation in absolute measure is $aAQ = PC - I^2R$. The absolute value of P is the product of the absolute temperature by the thermoelectric power. The value of R, in the small correction term for the Joule effect, may readily be determined by observing the neutral current $I_o = P/R$, for which the Joule effect balances the Peltier effect. In practice two similar disks with similar connections are mounted side by side in a thick copper box, and are balanced against each other in order to avoid changes of zero due to exposure to sunshine, or rapid variations of temperature. While the disk radiobalance has certain advantages, a cup radiobalance of high sensitiveness is also described.—Lond. *Electrician*, Aug. 1[illegible].

Telegraphy, Telephony and Signals.

Wave Detectors.—W. H. Eccles.—An abstract of a London Physical Society paper on the energy relations of certain detectors used in wireless telegraphy. The paper is a record of the results of an experimental examination into the physical properties of the electrolytic detector, the zincite rectifier, the carborundum rectifier, and a thermoelectric detector consisting of a light contact between graphite and galena. The conditions of the experiments have been generally identical with those arising in the ordinary employment of the detectors; in particular the quantities of energy given to the instruments, in the form of electrical oscillations have been of the same order in these experiments as in actual practice. Three ways of investigation are followed. The first way consists in applying to the detector an e.m.f. which is gradually increased, and measuring the current at each step. The second way is to fix the e.m.f. at some particular value, to send trains of oscillations of various energy values through the instrument, and to measure the intensity of the sound produced in the telephone on each occasion. The third way is to send trains of constant energy value through the instrument while the steady electromotive applied to it is varied, and to measure at each step the intensity of the sound produced in the telephone. These modes of investigation give curves that may be called respectively the steady current curve, the power curve, and the sensitiveness curve. The chief fact brought to light is that the power curves of all the detectors are straight lines, which suggests that all the detectors are fundamentally thermal in their action.—Lond. *Electrician*, Aug. 12.

Coherers.—W. H. Eccles.—An illustrated paper read before the London Physical Society. A method of investigating detectors is developed with special reference to the relations between the energy given to the detector in the form of electrical vibration and the energy delivered by the detector, as direct current, to the circuit of the indicating instrument. The response of the detector was measured by comparing the sound in its telephone with the sound produced in the same telephone by interrupting a measurable direct current. The results of experiments on coherers made of oxidized iron wire dipping into mercury, and on coherers made of a clean iron point touching an oxidizing iron plate, are recorded. The author puts forward the hypothesis that the properties of an oxide coherer may arise solely from the temperature variations caused in the minute mass of oxide at the contact by the electrical oscillations and by the applied e.m.f. He examines the hypothesis mathematically and shows that most of the phenomena recorded can in this way be accounted for as perfectly as the present state of the measurements permits.—Lond. *Electrician*, Aug. 12.

Radiation from Aerial.—C. C. F. Monckton.—The surging current in an aerial circuit has sometimes been called the radiation current. It does not necessarily follow, however, that by increasing this surging current the radiation is increased. Using two sparks in series a better spark can be obtained by placing a small helix of wire in contact with the central knob, but the radiation is small. There is no doubt that the appearance of the spark, using multiple gaps, is improved; but the above experiment has led the author to consider whether it is not possible that the real advantage may be fictitious.—Lond. *Elec. Eng'ing*, July 28.

Hamburg.—Janzen.—The conclusion of his long, detailed and profusely illustrated description of the new long-distance telephone exchange of Hamburg.—*Elek. Zeit.*, Aug. 11.

Miscellaneous.

Electro-Cultivation.—An account of measurements of the amounts of electrical energy involved in electro-cultivation According to some experiments conducted by Max Breslauer, of the Institute of Technology of Charlottenburg, in conjunction with experienced farmers, near Potsdam, the electric energy of the static discharges would, though small in itself, be still large compared to the electric energy supplied by the atmosphere. The experiments were made on the lines adopted by Sir Oliver Lodge in his researches. Wires of galvanized steel,

0.8 mm in diameter, were stretched about 10 yd. apart at a height of about 15 ft. over a field covering an area of 15 acres. The wires were joined to the positive terminal of a transformer whose other pole was earthed. The insulation of the wires was good, for when the current was cut off during the rain the wires remained statically charged for a measurable period. A moving-coil galvanometer was inserted into the circuit to measure the intensity of the currents dissipated in the air. The potential could roughly be determined with the aid of spark-gaps, assuming that balls 25 mm in diameter have striking distances of 1 mm per 3000 volts in dry air. The measurements proved that a considerable amount of electricity was lost by radiation or dissipation on the way from the shed in which the electricity was generated to the field. When this loss was allowed for, the square meter of field surface radiated upon would appear to receive a current of 0.43×10^{-5} milliampere at a potential of 65,000 volts; the total radiated power was 17 watts, or 0.28×10^{-3} watt per square meter. During long continued careful observations made in 1908 at the Meteorological Observatory at Potsdam, K. Kähler found that most rain and snow brought positive electricity down with them to the ground—rain more than snow—and that the currents thus received by the earth amounted to from 10^{-10} to 10^{-7} milliamperes per square meter. The electric currents artificially produced in the atmosphere would thus be 1000 or 10,000 times as strong as the normal atmospheric electric currents, and such currents might have appreciable effects though the electro-cultivation was applied for about 2000 hours during the summer only, and not throughout the year. The silent discharge might effect an oxidation of the nitrogen, and might therefore act like a manure containing nitrogen in a form in which the plant could assimilate it; however, in the absence of direct proofs speculation upon possible effects are of little value.—Lond. *Engineering,* July 29.

Brussels Exhibition.—A. Heyland.—The conclusion of his description of the various electrical exhibits at the Brussels exhibition, with special reference to German exhibits.—*Elek. Zeit.,* Aug. 11.

Regulations.—Reprints of the new set of rules for electric wiring in buildings and the new set of rules for magnetic tests of iron sheets which have already been given in the Digest. Both sets came in force on July 1, 1910.—*Elek. Zeit.,* Aug. 11

New Apparatus and Appliances

ELECTRIC LIGHTING OF AUTOMOBILES.

In no field has the tungsten high-efficiency filament worked such a revolution as in low-voltage battery lighting systems, and especially in those applicable to the portable uses of the automobile. This season has seen hundreds of gasoline-car owners replacing the smelly, bothersome oil lamps with instantaneous and brilliant electric lamps, and next year practically all of the better-grade cars will be offered wired at the factory complete for side and tail lamps. Indeed, the superlative class of machines will, in 1911, as in the present season, be equipped with all-electric lighting, searchlamps included, supplied from a miniature power plant geared to the engine shaft, with a storage-battery auxiliary for maintaining the supply of energy while the car is standing.

The advantages of electric lighting are too self-evident to need much explanation. First of all, the convenience of obtaining a good, strong illumination by the touch of a button will appeal to any automobile driver who has had to get out on the muddy road on a gusty night to light his smoky oil lamps with a fast-dwindling supply of matches. Electric lamps avoid the delay and bother of adjusting oil or gas flames, and prevent the danger of having fire around the gasoline tank or engine. In case of trouble at night, any part of the machine can be inspected safely and carefully, using a portable extension lamp instead of dangerous matches. If the electric-lighting system is of the self-contained-generator kind, the operator will have no more cares about recharging his gas tank or filling his acetylene generator and his lamps will always be ready. With electricity, glasses and reflectors remain clean and uncracked, and the quality of illumination furnished is far superior to that from oil, and equal to that from acetylene gas, without the latter's dangers.

Three systems of energy supply for the lamps on automobiles [illegible] well-marked limits of output, defining the scale on which the illumination can be used. In the order of popularity, these systems are: (1) Straight-battery lighting from storage cells; (2) self-contained system, using generator driven from engine shaft to supply lamps and to charge auxiliary battery; (3) battery lighting from primary (dry) cells—practically limited to energizing a single small lamp, as the tail lamp.

STRAIGHT BATTERY LIGHTING.

The most popular form of automobile lighting, because least [illegible] achieved, is the [illegible] storage-battery system, supplying usually the side and tail lamps from a small portable storage battery of three cells (6 volts), which is removed from the machine for charging. Batteries of from 40 amp-hours to 100 amp-hours at 6 volts are commonly employed. A pair of 8-cp tungsten lamps may be used in the side lamps and a 4-cp bulb in the tail lamp, or two 4-cp side lamps with a 2-cp tail lamp, or any other combination which the owner desires. To this equipment 20-cp or 12-cp head-lamps may be added, if the battery capacity is sufficient for this output. For such last-mentioned full-electric lighting at least a 100-amp-hour battery is advised.

As the small tungsten lamp consumes not more than 1.25 watts per candle-power, and at 6 volts consequently takes about 1/5 amp per candle, it becomes an easy matter to calculate how long a given group of lamps will be supplied from a given fully-charged battery, assuming its normal discharge rate is not exceeded. The short-filament tungsten lamps on automobiles, however, frequently attain consumptions approximating 1 watt per candle-power when the battery voltage is high, following a fresh charge, and they can be operated with satisfaction at the

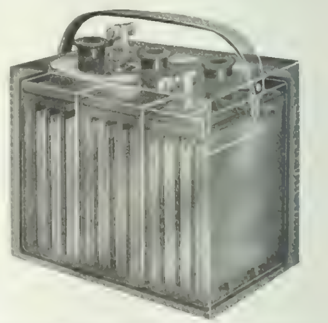


Fig. 1—Phantom View of Portable Battery.

over-voltage, although an occasional lamp, as the present market variety runs, may show a tendency to blacken after five or ten hours' operation. A battery delivering intermittent outputs of small current strength will, of course, show a greater amp-hour output than when heavy currents are demanded of it for long periods.

The three-cell, 6-volt storage batteries employed can be re-

charged from any convenient source of direct current. The average garage where electric vehicles are charged is equipped to replenish cells for a small amount, varying between 15 cents and 25 cents in cities, and rising to even $1 a charge in village districts where natural monopoly exists. At the lower rate, however, a charging business once established is profitable to the garage man or dealer, as a number of batteries can be connected in series across the 110-volt circuit, and central-station energy legitimately resold at a profit of several hundred per cent. The automobile owner who has direct-current electric lighting in his garage will find it convenient and economical to charge his battery in series with the garage lamps while the machine is being cleaned. If the garage lamps are purchased slightly under voltage for the prevailing normal potential, they will furnish a good, bright light, sufficient for the cleaning operations, at the same time the battery is being charged at practically no expense. A knife switch may be inserted in the service line, and its terminals connected to a cord and plug arranged to be inserted in the tail-lamp connection plug so that the battery can be charged without the necessity of removal from the car.

SELF CONTAINED GENERATOR SYSTEMS FOR AUTOMOBILE LIGHTING

The electric lighting system de luxe for automobile purposes is, without doubt, that employing a generator on the car itself, which may be said to supply the lamps while the engine is running, utilizing a portion of the remainder of its output to charge the battery, thus keeping the latter in readiness to energize the lamps when the car is standing still. With a system of this kind, properly regulated, good, bright lights will always be available without further attention to the lighting outfit than an occasional inspection of the specific gravity of the battery and replenishing with distilled water any evaporation that has occurred.

Such self-contained generator systems are usually comprised

Fig. 2—Lighting Generator Driven From Engine Shaft.

of the elements of a generator, a storage battery, a regulator to control the generator voltage, and a cut-out which disconnects the generator when its e.m.f. falls below that of the battery.

The generator may be driven from the engine shaft by a belt or chain, or by means of friction wheel against the engine flywheel. Where the drive is not of the positive type, the generator speed is usually prevented from becoming excessive at high engine speeds by arranging a centrifugal governor or a current relay to withdraw the friction wheel from its driving contact, or to release a magnetic clutch when a certain speed is reached. In this way, the generator is operated at nearly constant speed, regardless of the engine speed. The positive-drive class of automobile-lighting generators are belted or

Fig. 3—All-electric Lighted Automobile. Generator System.

chained directly to pulleys or sprockets on the engine shaft, usually with a multiplying speed transformation, and operate at all times at a speed proportional to that of the engine. As this speed varies between wide limits when running on high or low gear and just following cranking, some means must be provided to keep the voltage and current delivered by the generator closely approximating that suitable to charge the battery. Several means of operating the control features are available, in the generator speed itself, the generated voltage, and the current output of the machine—utilizing, respectively, a centrifugal governor, a voltage relay or a series relay. The generator field control may be effected by a properly graduated rheostat, by differential windings, or by intermittently interrupting the field supply. The generator cut-out for disconnecting the generator at low speeds may be of the voltage-relay type, or may depend upon the speed with which the machine is rotating. The principal systems on the market today are, in general, combinations of these principles of operation, some of which are patented. Following are brief descriptions of the essential operating features of the representative automobile-lighting generator systems:

The Ward Leonard system of automobile lighting employs no centrifugal devices for actuating the cut-out and the generator e.m.f. control, using instead electromagnets arranged to operate switches or contacts following changes in the e.m.f. produced or the current flowing. A feature of this system is an electromagnetic clutch through which the generator is driven from the engine shaft. The switch energizing this magnetic clutch is operated by an electromagnet whose winding is inserted in the generator lead to the battery. When the engine reaches a speed such that the generator output into the battry rises above normal value, this electromagnet opens the switch energizing the clutch, virtually disconnecting the generator from its driving shaft, so that its speed at once falls and is kept at a point where the normal current is delivered to the battery. The cut-out for disconnecting the battery from

the generator when the car speed is so low that the cells would discharge through the armature is controlled by an electromagnet with a voltage winding, so arranged that the switch is automatically closed as long as the generator voltage is high enough for charging the battery. The circuits for exciting the generator field and the clutch coils are automatically completed when the gear-shifting lever of the automobile is moved from its neutral position. This movement thus at once starts the generator and causes it to pick up with its fields excited from the battery circuit. The armature circuit is not closed to the battery until the generator e.m.f. has reached a proper value, slightly in excess of that of the battery. The magnet switches effecting the control of the generator output are mounted in a box with the batteries. Of the latter two separate outfits are furnished, one for lighting and one for ignition, respectively, arranged with a throw-over switch so that either battery can be used for either purpose. An ammeter may be installed on the dashboard, but is not a necessary adjunct of the system.

The Delano automobile-lighting system employs a positively-driven generator which runs at all times at a speed proportional to that of the engine shaft, to which it is connected through flexible gearing. In series with the main armature lead of the generator is a contact-making electromagnet which opens the shunt field of the generator whenever the current

Fig. 4—Converted Side and Tail-Lamps Receiving Energy From Battery.

output exceeds a proper value, due to the rise in generator speed. A voltage solenoid across the generator leads closes the circuit to the battery as soon as the generator has attained a speed—usually at a car speed of about 12 miles an hour—such that the generator voltage exceeds that of the battery. The generator is of the shunt type, and is self-excited from its residual magnetism on starting. When the generator speed and voltage exceed values where the current output rises above the normal battery flow, about 5 amp, the series solenoid breaks the shunt-field circuit until the generator voltage and current fall to the proper value due to the weakened field. When this has occurred the field circuit is again restored. In this way an intermittent field excitation is delivered to the generator, the output of which is correspondingly pulsating at speeds above that where its voltage generated with continuous excitation is of the proper value for charging the battery. The result, however, approximates a constant-current output, which is said to vary less than 1 amp over a generator speed range of from 900 r.p.m. to 6000 r.p.m. The control magnets are mounted in a box which may be installed in any part of the car, being connected through five leads to the wiring system.

The Esterline system of automobile lighting employs a magneto-type direct-current generator, positively driven from the engine shaft, and having the rise of its voltage at high engine speeds, limited by a differential winding on the permanent magnet of its field coils, which is connected in series with the main battery leads. As in some other systems, the disconnection of the battery from the generator when the latter's e.m.f. is less than that required to produce a flow into the battery is accomplished by a potential solenoid or relay, which has, however, the additional characteristic of a reverse-current relay, preventing back-flow through the generator armature. Combined in the same "regulator" control device which effects the generator cut-out, and which is built in as part of the generator, is the current coil, which at high generator speeds and outputs closes a switch, shunting part of the main battery input through the differential winding on the magneto field, opposing its flux to that of the permanent magnet and so weakening the field. The generator output into the battery is thus limited to the latter's normal charging current. Meanwhile the lamps, being connected across the battery, receive their energy from either the generator or the battery, depending on the condition of the circuit. The regulator is enclosed in the magneto frame, utilizing the latter's magnetization in part for its operation and also simplifying wiring connections.

The Adlake-Newbold apparatus for automobile lighting utilizes a series solenoid in the battery-charging circuit, which moves the generator-field rheostat arm against the force of a weight suspended in an adjustable dash-pot. The generator cut-out is an electromagnetic switch employing a pair of series and a pair of shunt windings. When, on starting, the generator potential rises above battery voltage, the shunt coils operate the switch, closing the generator to the battery. The contact thus formed is more firmly established by the operation of the series coils, which are then brought into action. If for any reason the current flow from generator to battery should become reversed, the reversal of the series magnets will cause the pole-pieces to repel, instantly opening the circuit. Excessive current flowing into the battery from the generator causes the series field-control solenoid to move its rheostat-arm, cutting in field resistance until the proper current output is again reached, at the speed at which the generator is being driven. The control apparatus is assembled on one board and may be mounted in any convenient position on the car.

The Apple generator contains within its frame-casing both the "cut-out" and "load-regulator" elements. The cut-out is a potential relay which closes the generator switch as soon as the speed reaches that required to produce a flow into the battery. The load regulator is said to employ an electromagnetic principle without moving parts, which maintains the current output at constant value in spite of the varying-speed operation of the driving shaft, to which the generator is flexibly geared through a chain and sprockets. A combined ammeter and voltmeter on the automobile dash enables the operator to inspect the operation of the system at any time. The "load regulator" can be adjusted to deliver a current of from 2 amp to 16 amp over a wide range of engine speeds.

The Vesta principle of regulation depends upon the action of a fly-ball governor, which at speeds below that required to charge the battery permits a cut-out switch to remain open, disconnecting the generator. At excess speeds the governor also controls the movement of the contact arm of a German silver rheostat in the generator-field circuit, diminishing the generator field strength as its speed rises, so that a current of nearly constant value may be delivered to the battery. The generator is at all times driven at a speed proportional to that of the engine shaft.

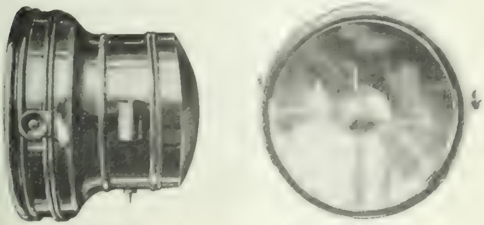
The Elba system uses a specially constructed generator with interpole field-pieces and differential windings for controlling the generator output at high engine speeds. These connections are self-contained in the generator frame and act to deliver a current of practically constant value, suitable for charging the battery. When the generator speed falls below that necessary for charging, a potential relay disconnects its armature from across the battery terminals. This cut-out is mounted in the base of a double-scale ammeter, which is placed on the dash, so that the performance of the system can be examined at any time.

The Motsinger charging generator utilizes a fly-ball governor to withdraw the friction wheel from the engine flywheel when the latter's speed exceeds a suitable value. The generator is not equipped with automatic means for disconnecting from the battery at low engine speeds, the operator being relied upon to connect in the battery and disconnect it under the proper conditions, as shown by the voltmeter.

AUXILIARIES OF AUTOMOBILE LIGHTING OUTFITS.

With a reliable source of supply of electrical energy on a car the owner or driver will find many convenient uses for his miniature power plant. Of course, in a battery-ignited car energy for sparking purposes can be obtained from the lighting outfit, although generally it is preferable to carry a separate set of cells for each purpose, as the lighting function exhausts the battery very much more rapidly than does the smaller current demanded for ignition, and at the far end of a night trip the chauffeur may find himself in a predicament with his battery drained to a point where the engine misses fire badly. Since the ignition system is usually operated with one side grounded, a ground anywhere on the other side of the lighting system will amount to a virtual short-circuit, and may drain the battery, putting both lamps and sparking apparatus out of commission. In a car with magneto ignition the presence of battery energy aboard, operating through an induction coil, will permit the car to be started on residual compression, avoiding, a great many times, the effort of getting out and cranking.

Warning devices of the class in which a racket wheel driven by a small electric motor vibrates a diaphragm in a horn also become available for use on the electrified car, and at a touch of a button the driver can substitute as loud or sharp a note as he pleases for the laborious "honk" of the hand-grip horn. Matches or flames of any kind are dangerous about a gasoline automobile, but the owner of an electrically-lighted car can equip himself with a few feet of flexible cord ending in a plug and socket, and when engine trouble overtakes him after nightfall, has only to connect up his inspection lamp and investigate the trouble in leisure and safety. Small lamps to illuminate the dials of the clock and the speedometer are conveniences for night driving. A compact fixture which is quite new is fastened to the top of the clock or meter casing and projects its light all on the dials. The whole lamp and guard are so small as to be hardly noticeable installed. A lamp in the top of the car for reading or examining maps has conveniences for night touring which few realize. It can be installed so as not to interfere with letting down the top. Light for the interior of the limousine can be supplied from the same source. Smokers find an electric cigar-lighter a useful adjunct to the car's equipment, making them independent of wind



Figs. 5 and 6—Automobile Electric Lamps

and matches. Combination cigar-lighters and hand lamps can be purchased.

Special flush-type push switches can be obtained for automobile work. These are supplied with one, two or three switches mounted under the same plate, and can be used to control the tail-lamp, side-lamps and headlamps, respectively. Between each lamp and the car wiring some kind of connection plug is usually inserted to permit the removal of the lamp without disturbing connections. These plugs are made of both the simple push and bayonet-joint types. If the "trouble" extension lamp be fitted with a prong plug, it can be inserted in the live end of any of the connection plugs, obtaining energy conveniently. Screw-base plugs for inserting in lamp sockets are not made in 6-volt sizes.

Lamps are constructed especially for electric lighting, or gas and oil lamps can be converted at small expense and are interchangeable for either illuminant at any time. The special electric lamps have no chimney openings in the top through which dust can enter, and will keep cleaner than the converted lamps. The sockets for converting oil lamps to electric have clips which fit over the wick burner, or can be secured with screw-bases, which are inserted in place of the burner. Some

Figs. 7 and 8—Miniature Lamps.

of the sockets are provided with spring supports for relieving the tungsten filaments of road shocks and engine vibrations, although the low-voltage type of filament is sturdy and seems to have excellent life in the non-protected sockets. The 6-volt and 12-volt lamps used for automobile lighting are made with both the screw base and bayonet-joint base, the latter, it is asserted, insuring a more perfect contact than with the screw base, which is likely to work loose. Means for focusing the lamps in headlamps are especially useful in securing the best carrying power of the illumination developed. Electric headlamps are now offered, containing two lamps, of high and low candle-power, respectively, the latter to be used when the car is standing at the curb or intense illumination of the street surface is not required.

Objections may be offered to the increased weight which an electric lighting system adds to an automobile equipment. A 100-amp-hour battery weighing 45 lb., however, replaces a 30-lb. compressed-gas tank, if the headlamps are converted to electric lighting, and perhaps 25 lb. of ignition batteries unless the car is wholly magneto ignited. A 40-amp-hour battery will weigh about half as much as the 100 amp-hour and can be used satisfactorily for tail and side-lamps.

In mounting the battery in the car care should be taken to have it fastened securely rather than allow it to shift with the jars of the road, which tend to shorten its life by destroying the elements. Firm mounting will also preserve good, tight contacts at the binding posts, which are essential for satisfactory operation.

Tests have shown that the cost per hour of operating a 6-volt storage-battery lighting outfit is from 35 per cent to 60 per cent of that of operating a pair of acetylene headlamps from a compressed-gas tank. It has also been proved that a 16-cp low-voltage tungsten-filament lamp carefully adjusted at the focus of an 8-in. silvered reflector will project more light onto a 20-ft. circle in a vertical plane 100 ft. ahead by nearly 100 per cent compared with a standard ¾-cu. ft. burner in a 10-in. reflector. The entire interior surface of the electric lamp is available as a reflector, and will remain clean and unsmudged.

PRIMARY CELL AUTOMOBILE LIGHTING.

The use of dry cells for automobile lighting has a limited application where only a small lamp is to be energized. Tail-lamps lighted from dry batteries are in successful use, but are practically the only such application for which these primary cells are adapted. For such lighting the cells are usually connected in series multiple. At 1.5 volts per cell a series of five gives 7.5 volts, which drops to more nearly 6 volts when supplying the relatively heavy draft of the lamp filament. Connecting additional groups of cells in multiple gives longer life

and more favorable working conditions for all of the cells Cartons are for sale at the supply houses containing 15 cells, wired up in multiple-series of five each, and connected to two binding posts, which appear on the outside of the package, and so avoid the making of any connections by the automobile operator. For a single small lamp, as the tail-lamp, where it is not desirable to invest the cost of a storage battery, dry cells may be used to advantage.

ELECTRICAL MEASURING INSTRUMENTS.

A new line of switchboard and portable ammeters and voltmeters, employing the D'Arsonval principle, has recently been developed and introduced by the Dongan Electric Manufacturing Company, of Albany, N. Y. These instruments include various styles of milli-ammeters, milli-voltmeters, ammeters and voltmeters, and are designed to meet all requirements for testing purposes and for use in central-station and storage-battery installations.

The switchboard instruments, which are manufactured in a

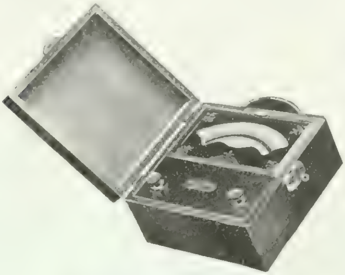


Fig. 1—Portable Instrument.

variety of designs and scales, range in size from 4¾ in. to 8¾ in. in diameter. Among these types are the horizontal edge wise instruments, the regular round-pattern switchboard type D meters and the type B-D meters, designed as medium sized, reasonably-priced switchboard instruments intended especially for storage-battery and small industrial or isolated-plant installations. These instruments have individually-calibrated, evenly-divided dials, of either the regular, central-zero, or double-scale types.

The portable instruments, which are mounted in hinged carrying cases, are especially designed to withstand the accidental

Fig. 2—Switchboard Instrument.

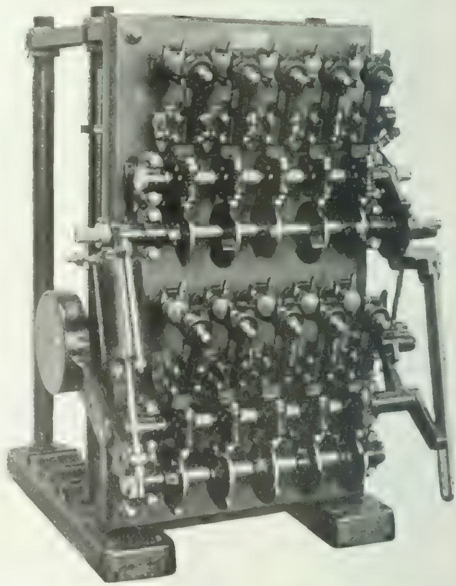
shocks and vibrations to which laboratory and testing instruments are commonly subject. The pointer, which is extremely dead-beat, travels over an evenly-divided scale, and is backed by a highly-polished reflecting surface, which avoids errors due to parallax in observing the needle's position. Friction has been reduced to the minimum possible, making the instruments sensitive to the slightest variations of current strength or potential.

ALTERNATING-CURRENT ELEVATOR MOTOR CONTROLLER.

In an alternating-current motor controller recently placed on the market by the Westinghouse Electric & Manufacturing Company to meet the conditions imposed in elevator service every operation is performed in a positive mechanical manner. The operator has complete control over the starting and stopping of the motor, while the acceleration is performed automatically at a rate than can be adjusted over a wide range at the controller, but cannot be altered by any action of the operator in the car. Any part of the controller is accessible from the front, and all of the parts subject to wear can be readily replaced. The electric contacts are of the quick-break, butt type and are protected by arc shields; there are no sliding contacts. All automatic operations are performed by the force of gravity.

The controller consists of a slate panel on which are mounted two rows of switches and their operating mechanism. The switches of the upper row serve to connect the motor primary with the line, and those of the lower row short-circuit the resistance in series with the motor secondary. All switches are alike and interchangeable. Five primary switches are used for a three-phase controller and six for a two-phase controller The switches are opened and closed by cams. In closing, each cam acts on its own switch through a buffer spring which serves as a cushion and also compensates for wear; in opening, a lug on the cam engages a projection on the switch arm and forces the switch open. The resistors for the motor secondary are mounted on the rear of the panel.

The movement of a hand rope or lever in the elevator car operates a sprocket attached to the primary camshaft.. A turn of the camshaft from the off-position closes a set of primary switches and starts the motor so that the elevator car moves up or down, according to the way the shaft is turned. The move-



Elevator Motor Controller.

ment of the camshaft simultaneously releases a catch and allows a weight, attached to an arm geared to the secondary camshaft, to fall; the arm rotates the secondary camshaft and closes the secondary switches in proper order. The fall of the weight is retarded by an air dash-pot, the piston speed of which can be so adjusted by means of a valve that proper acceleration can be given to the motor. Turning the camshaft from the off-position in the opposite direction closes another

set of primary switches and reverses the direction of rotation of the motor; the secondary switches always close in the same order.

On turning the controller to the off-position, the secondary switches are opened, the weight is raised and set ready for the next operation, and the primary switches are opened; this completely disconnects the motor from the line and stops it. The off-position is plainly indicated to the operator by a notch. Positive stops prevent overrunning beyond the full-speed positions.

This controller is made for use in connection with two-phase or three-phase slip-ring induction motors of 30 hp and less, for all voltages under 550, and for all commercial frequencies.

MAGNETIC FAULT FINDER.

The magnetic fault finder for locating "shorts" and "grounds" in three-phase and other cables shown in Fig. 1 is of interest to engineers engaged in electric light and power work. As is customary, signal current, supplied by a mechanical interrupter, is sent out, passing through the fault and returning over the sheath or adjacent conductor. This interrupter is operated from a universal motor on 110-volt mains, and is placed at the power station or cable terminal, while the explorer-and-receiver set is carried along the cable. The sound produced by the signal current is unmistakable, being sharp and intermittent. The interrupter is designed to give a maximum sound with a small testing current, the latter being only a fraction of an ampere. To get an equally loud signal current by interrupting a direct current would require from 15 amp to 20 amp. This would probably injure the fault by opening it, or leaving it with a high-resistance contact.

Sometimes tests are made with the explorer in manholes or on poles, listening for the vanishing point of the signals made by the signal current. As long as the signal is heard, the fault is beyond. When no signal is heard the fault has been passed, and the trouble man retraces his steps until he makes an exact location, or a location between manholes which is sufficient. The explorer is neutral to sheath current; therefore, when the signal current passes through the fault to the sheath the sound suddenly stops, and a close location can be made, even if all or part of the signal current keeps traveling forward to a more perfect ground ahead. Of course, when the fault is a cross between two phases there is no signal current beyond the fault.

The exploring coil used with this device (Fig. 2) locates the fault exactly. It was designed by Mr. W. A. Durgin, of the Commonwealth Edison Company, Chicago, after a series of experiments. It is a longitudinal explorer and operates in an entirely different manner from the familiar form in which the winding is parallel to the cable conductor. The windings of the longitudinal coil are perpendicular to the cable, and the coil operates from the high and low magnetic areas lengthwise along the cable produced by the twisting of the conductors. The ordinary coil, on the other hand, is influenced by the flux encircling the cable.

When a signal current goes out over one phase and back over an adjacent phase, or over the sheath, there are formed two longitudinal spiral "strips" of condensed lines of magnetic force on opposite sides of the cable. One longitudinal strip is negative and the other positive. When the explorer is placed lengthwise along the cable it bridges over from a positive area to a negative area, or from a high to a low magnetic potential; therefore, there is a heavy flux through the winding of the explorer, which causes a loud, clear signal in the receivers.

Returning on the sheath, the current produces the same magnetic effect as if the current returned on a wire in the center of the cable. As the conductors are spirally disposed about the center of the cable as well as about each other, a ground produces longitudinal high and low areas as well as a "short." If the current goes out and practically all returns over the earth the "strips" or "tufts" will not be produced, as the flux will not be crowded into close quarters, and the spiral "tufts" will not be formed. The flux will be spread over too much area and not concentrated. In this case only a practiced ear can detect a difference of magnetic potential longitudinally. However, by turning the explorer 90 deg., or across the cable, the testing current can be heard loudly, but the operator will also hear the current in the sheath.

In the longitudinal or normal position the explorer is entirely neutral to sheath current, whether in the cable under test or in adjacent parallel cables. The explorer can be adjusted, if necessary, till no sheath current is heard, by moving its position until its ends are at the magnetic potential produced by the sheath current. Then there is heard in the explorer or listening transformer only the spiral conductor current, and this permits detection of the exact point at which the current passes from the conductor to the sheath, the point being indicated by the sudden absence of sound. This point is the fault.

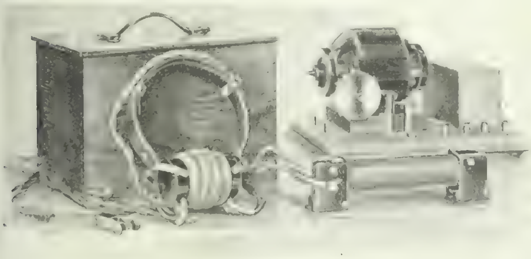


Fig. 1—Magnetic Fault Finder.

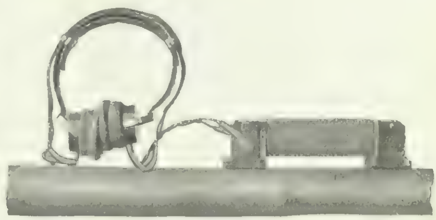


Fig. 2—Explorer.

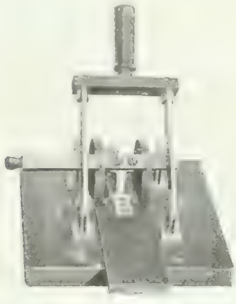
In the case of a cross or ground there is no conductor current beyond the fault, except charging current, which occurs when the fault is of considerable resistance, or the cable long and of high capacity. There are methods of overcoming the effect of this charging current, consisting of so connecting the signal current that the magnetic effect is symmetrical, except from the power station to the trouble. The end of the unsymmetrical portion of the cable, or the fault, is then easily located by the absence of the signal, as before.

This method of locating trouble has several advantages. Its operation depends in no way on the resistance of the conductor; therefore, where a conductor is burned in two, or is damaged, or has more than one fault upon it, the magnetic method locates the fault exactly. An open conductor may generally be broken down and located. Even where a Murray loop test can be made, it is said to be quicker and safer to use the magnetic plan. Time may be saved by starting a man with an explorer from each end of the cable. When one man has found the trouble the signal may be changed to notify the other man.

The apparatus, which has been introduced by Middleton Brothers, Chicago, is also used in designating cables during cut-overs or other changes. In several large cities where the apparatus has been used for about a year it has replaced the loop test.

INTERLOCKING SAFETY SWITCH MECHANISM.

The increasing use of electricity in mills, mines, factories, etc., has demonstrated the necessity for the installation of safety devices which will tend to eliminate, as far as possible, the danger of accidents. That the importance of this is recognized it is only necessary to note the large amount of legislation which has been enacted and is being considered for the protection of operatives. Provisions are already required in some states for disconnecting motors and the next step is to provide safety appliances which cannot be closed by unauthorized or malicious persons. To meet the imposed conditions the interlocking safety mechanism illustrated herewith was designed in its several forms so that it can be applied to controlling levers of practically every description. The safety switch consists of a double-pole, single-throw, knife switch between the top jaws of which is mounted a pivoted locking bar to which is fastened a substantial fiber cross-bar, and an operator's key consisting of a metal key riveted to a rectangular piece of fiber upon which is printed the following inscription: "Danger—do not touch this switch, as men are working on this circuit." The operator's name and key number may also be placed on the fiber for identification. These switches are always mounted in a perpendicular position and when the switch blades are closed in the upward position the fiber-insulated arm on the locking bar is thrown up against the terminals of the switch jaws ahead of the cross-bar of the switch blades. When the operator desires to open the motor circuit switch he pulls the switch blades out from the jaws and down to the lowest position. The act of doing this allows the fiber cross-bar (which is pushed over beyond the center of gravity by a phosphor bronze spring) to fall over the switch jaws to such a position as to cause the locking bar to engage with the locking case. This locks the fiber barrier between the switch blades and jaws effectively, preventing the blades from accidentally being closed. To close the switch the operator must place his key between the blades of the switch, inserting it in the locking case which causes the locking bar to disengage. At the same time he must raise the fiber cross-bar to the extreme upward position, after which the switch blades may be closed. The operation thus described merely applies to the opening of the circuit when the apparatus is not in service. If, however, any work is to be done on the apparatus or lines controlled by the switch the operator can place his key in the locking case before the switch is opened and the locking bar, falling into place, locks the key onto the switch, where it remains as a danger sign against the closing of the switch before the work is completed. In removing the key, when placed in this position, it is only necessary to push up the key handle with the right hand and at the same time throw up the fiber bar, taking the key from its position and closing the switch as heretofore described. This new safety switch is manufactured by the Delta-Star Electric Company, of Chicago, and is a means of protection not only from loss of life or accidents to electrical apparatus, but in reminding the [illegible] is an element of time in which the operator has time for thought. It is well known that many a field switch, exciter switch or circuit switch have been hurriedly or carelessly closed, resulting in serious damage to the apparatus which it controls.



Interlocking Switch Mechanism.

PRESS FOR CORRUGATING IRON FOR TRANSFORMER TANKS

The accompanying illustrations show the press and dies designed by the Loy & Nawrath Company, 21-29 Runyon Street, Newark, N. J., for producing the heavy corrugations in iron used for transformer tanks. With the equipment shown, corrugations from 1½ in. to 6 in. deep by 10 ft. long may be made in sheet steel 3/32 in. thick. The corrugations are made in two operations, as readily seen by dies shown in the foreground of Fig. 1. While the first-operation dies make square bends, the primary object is to lay off the sheet into accurate spacings, so that all necessity for gages is done away with, and greater accuracy as to pitch and depth secured than with the use of gages. The first-operation dies are, however, not altogether necessary, for by the substitution of gages, and a slight change in the folding, or second-operation dies, corrugations can be made in one operation. For the sake of absolute accuracy in the equipment in question, it is considered advisable by the company to add the extra operation. The press complete with the dies weighs about 50,000 lb. The crankshaft is 7 in. in diameter, and the stroke of the slide, 11 in. The machine is compound geared 28 to 1, and can be driven by belt or may be geared directly to an electric motor. Power is applied through a friction clutch which permits the operator to start or stop the machine instantly at any part of the stroke. The press is furnished with a power raising and lowering device, so that the hammer or slide can be almost instantly adjusted to suit the

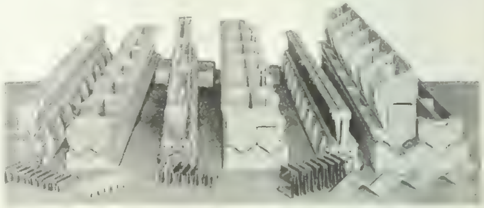


Fig. 1— Dies for Corrugating Iron.

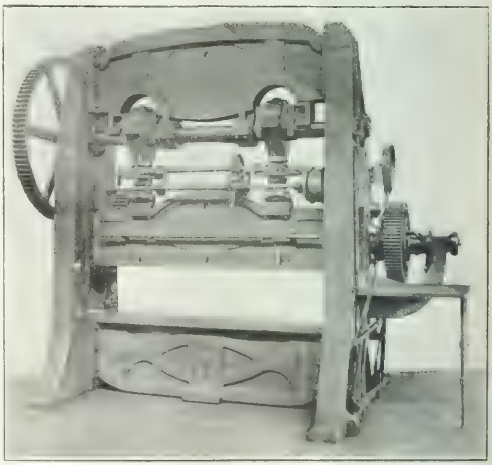


Fig. 2—Press for Corrugating Iron.

Industrial and Commercial News

THE WEEK IN TRADE.

REPORTS on conditions of trade continue to denote improvement and the general tone of the business world is undeniably improved. At the same time there is little actual increase in trading to be recorded. In many sections of the West there has been considerable increase in the volume of business done by retailers, and there is in consequence of this some revival in the orders that are reaching the wholesalers and jobbers. One of the most encouraging features of the situation is the fact that in every important trade center there are large numbers of buyers, and these generally admit that stocks in the hands of distributing merchants are rather small. Orders are being placed conservatively, however, as there is still a disposition to wait for the final maturing of the season's crops. The total volume of trade being done at the present time is about equal to that of last year, although different sections are affected irregularly. As a rule, the cereal section of the West appears to be in the best shape. In the South business recovery is more tardy, owing to uncertainty with regard to the cotton crop. Among the industries there is little change in the situation. Iron and steel mills are fairly well employed, but orders are not being received in the volume that came forward six months ago. Among the textile mills curtailment is still in force and many complaints are being received concerning the narrow margins of profit, owing to the high cost of both raw material and labor. Building operations are less active, but specifications for structural material are still fairly liberal with the steel mills. Collections have distinctly improved, especially in those sections of the West where the crop movement has already begun. The banks in these sections are well supplied with funds and are generally able to take care of the expense of marketing the crops without asking aid from the East. Business failures for the week which ended Aug. 25, as reported by *Bradstreet's,* were 235, as compared with 222 the previous week, 201 in the same week 1909, 236 in 1908, 167 in 1907 and 138 in 1906.

THE COPPER MARKET.

THERE has hardly ever been a duller week in the copper market than the one just passed. While there have been mere minor changes in the situation, and a few fractional fluctuations in the price of copper, there has been no distinct tendency and no very hopeful tone. Electrolytic copper has been quoted at 12¾@13 cents, but it is doubtful if any large amounts of metal have been sold at these figures. In fact, the advance to these

Standard Copper.	[illegible]	[illegible]	Settling [illegible]
Spot	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]

The London market, Aug. 29, was quoted as follows:

	Noon.	Close.
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

prices was made by the selling companies after considerable sales had been made at lower figures. This is not an unusual condition in the metal market. It has frequently been noted in these columns that prices have been advanced whenever a demand for metal seemed to appear. At the present moment consumers are buying very little copper, and are only taking that which is needed for immediate use. Stocks in consumers' hands are believed to be quite large, and on this account there is little anxiety shown to purchase at present figures. As yet there has been no marked revival in general trading, nor in any of those lines of trade in which copper is extensively consumed. While the electrical companies and the brass companies are doing a fair business, they are not doing any such business as would warrant the present rate of production of copper. It is not now absolutely known that any practical curtailment in production has been actually put into operation. This is another reason for consumers postponing their purchases. It is generally believed that unless the production of copper is materially curtailed the present scale of prices cannot possibly be maintained. Many of the better-posted men in the copper market are expressing the opinion that it has never been the intention of the large producers to really curtail the total of output, and that there has never been any agreement reached between the Amalgamated interests and those known as the Phelps-Dodge and lake interests. It is thoroughly understood that the copper market does not reflect actual trade conditions, and has not done so for many years. The manipulation of copper stocks in Wall Street has more to do with the quoted price of copper metal than the ordinary laws of supply and demand. Imports continue to be fairly heavy, and it now seems that the exports for August will be about 30,000 tons. The total exports for the month up to and including Aug. 29, were 25,543 tons. The daily call on the metal exchange Aug. 29 quoted standard copper as per accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Adams-Bagnall Electric Company.—The Adams-Bagnall Electric Company, of Cleveland, whose eastern office is at 40 Wall Street, reports that the business in flaming arc lamps has been very heavy during the present season. The company has put in quite a number of large installations, and its representatives declare that the use of these lamps for railroad yards, machine shops and for other large manufacturing plants is rapidly growing in popularity. Among the orders which have recently been placed are: Installation of 50 or more lamps in the Sunnyside yards of the Long Island Railroad Company at Long Island City; from 100 to 150 lamps in the new Delaware & Lackawanna Railroad shops at Scranton, Pa.; about 200 lamps for the United States Navy, to be used in the navy yards and shops at Norfolk, Va.; from 100 to 110 for the Baldwin Locomotive Works, Philadelphia; several extensive installations for the International Steam Company, to be used at its various plants throughout the country; about 100 lamps for the Maryland Steel Company at Sparrows Point, Md.; 100 for the Lackawanna Steel Company, Buffalo; 80 for the yards of the St. Louis, Iron Mountain & Southern Railroad Company at Dupo, Ill.; several hundred each to the New York Central and Pennsylvania Railroads for various shops and yards. The Adams-Bagnall company has recently had some contention with the government over the duty upon the lighting carbon used in its flaming arc lamps. These carbons, manufactured by the Jandus Electric Company, of London, contain a carbon core which is surrounded by chemicals, and the government had been holding that they were dutiable at the rate of 2 per cent ad valorem as chemicals. Last week the company's claim that the principal component part of these imports was carbon was sustained by the Board of General Appraisers, and the company hereafter will pay duty at the rate of 65 cents per hundred feet, which is the regular rate upon lighting carbons.

Business Not a "Game."—The first annual convention of the National Sales Managers' Association of America was held in Chicago on Aug. 25, 26 and 27. A number of large business houses were represented, but about the only electrical man present was C. A. S. Howlett, of the General Electric Company, who, as president of the association, presided over the convention. A number of papers were read, and there were earnest discussions of the duties and opportunities of the sales manager. By vote the association went on record as opposing the use of the word "game," so far as it is used to relate to business. Next year's convention will be held in Cincinnati.

Meridian (Miss.) Light & Railway Company.—Henry L. Doherty & Company, who recently took over the stock and management of the Meridian (Miss.) Light & Railway Company, have just placed an order for a 500-hp boiler to be added to the generating plant. After this has been done additional apparatus will also be added. The business in Meridian is being developed very rapidly.

Asks New Franchise in Montgomery, Ala.—Richard Tillis, who claims to have purchased the majority of the stock of the Citizens' Light, Heating & Power Company, of Montgomery, Ala., has applied to the City Council of that place for a new franchise for furnishing a lighting and power service in the city. It will be remembered, as has been referred to in these columns a number of times, that Henry L. Doherty & Company claim to have made a contract with Alex. Rice and others for the purchase of the majority of the stock in the Citizens' company, to consolidate that property with the Montgomery Light & Water Power Company, which Mr. Doherty owns. This contract for purchase was never carried out, and Mr. Doherty secured an injunction from the United States Court for the District of Alabama forbidding the transfer of the stock to any other than himself, until the merits of the controversy had been settled. In the meantime Mr. Rice and his friends claim to have transferred their stock to Mr Tillis, who is the principal owner of the Montgomery Traction Company. The matters in controversy have not as yet been settled in court. In the meantime Mr. Tillis has applied as above indicated for a new franchise to construct transmission lines to furnish energy for light and power in Montgomery. He announces that this franchise will be used in connection with the Citizens' Light, Heat & Power Company, if it is eventually determined that he owns that company. If, however, the court decides that the stock of that corporation must be transferred to Doherty & Company he will begin at once the construction of a new power plant under a new corporation, and promises to spend at least $500,000 in equipment and transmission lines.

American Electrical Supplies in Germany.—Consul-General Robert P. Skinner, of Hamburg, reports that while there is always a market in Germany for electrical devices not already supplied by domestic manufacturers, or which possess the elements of novelty and practical utility, the condition of the electrical industries in that country is such that German manufacturers are not only able to satisfy nearly all domestic requirements but are also exporting in immense quantities to all parts of the world. For a very considerable period, and until within the last few months, when American manufacturers obtained the benefit of the lowest rates of duty in Germany, electrical supplies from the United States were subject to import duties greatly in excess of those applied to similar goods from other countries. Owing to this and other causes, German concerns, by arrangement, are manufacturing many articles of American invention, so that within the last few months, when the telephone system of Hamburg was entirely reconstructed, with the exception of a limited number of articles imported from the United States everything was supplied by German houses, although the system, as a whole, is entirely American in conception. In this Hamburg plant, the operation of which began July 10, there are 112,700 relays that open and close the electrical current for the calling lamps, 1,000,000 meters of cable consisting of 35,000,000 meters of wire, two accumulator batteries having a capacity of 78,000 amperian hours, and 240 long-distance connections.

Chicago Sanitary District.—Practically all of the Aldermen of the City of Chicago favor the new street lighting ordinance, which it is expected will be passed at the same time as the Consolidated Traction ordinance. The lighting ordinance calls for the transfer of the city lighting equipment to the Sanitary District authorities and the installation by these authorities of 10,000 additional arc lights. The contract runs for seven years. The city has at present thirteen power stations, and their equipments are delivered for a consideration of $1.00, but at the end of seven years all the property reverts to the city. No less than 3000 arc lights must be added in each of the first two years. It is expected that the Sanitary District will issue $1,250,000 of bonds to cover expenditures upon which it will be allowed the same interest it gets on its current bond issues.

Crude Rubber Prices.—Prices for crude rubber declined slightly last week, and on Saturday were weaker than on any other day within the past fortnight. Para was quoted for "upriver fine" at $1.90 and $1.92 per lb. There were no developments in the local market further than this decline in price, and actual trading was very light. The manufacturers seem to be determined not to purchase at the present high figures. It is said that there is an impression in the rubber market in London that America is short of raw rubber for its immediate industrial needs. The consumers in this country laugh at such an idea. An authority from London, who was in this city last week, says that the situation in England is not one that involves any immediate danger. He says that while there may have been in the period of rubber excitement last spring a few companies which were unworthy of support that he thinks that, in the main, investments in rubber stocks will turn out to be satisfactory. He says that they were sold at very low prices. and that the majority of purchasers understood that it would probably be a number of years before any dividends were realized. It is the general impression in London that the development of plantations will eventually make a firm price basis for crude rubber, and that such fluctuations as have harassed the market within the past few years will soon be out of the question.

Hudson & Manhattan Tubes to Jersey.—Notices have been posted by the Hudson & Manhattan Railroad Company that service in the Jersey extension from Exchange Place to Henderson Street, Jersey City, will be started Sept. 6. The new station in New York, at 33d Street, will not be open until some time later, as the construction work has not yet been completed. A mechanical device has been adopted by the company for registering the number of passengers as they pass into the subway. It has been installed for trial at the Hoboken station. By a cut-off system of compressed air connected with an electric circuit, each passenger that passes into the station makes a record. It is said that this new machine works perfectly. It will do away entirely with the ticket chopper. Some controversy has arisen between the management of the McAdoo Tunnels and the city authorities of Jersey City. The latter last week refused to allow the tunnel company to open its station at Grove Street, Jersey City, unless a guarantee was given that only a five-cent fare would be charged from any station in Manhattan.

More Ships Equipped with Wireless.—The United Wireless Telegraph Company announces that it has closed contracts for the installation of a wireless equipment aboard the steamships *Burwindmoor* and *Burwindvale* of the Havana Coal Company. The former of these steamers, it is said, will be one of the greatest merchant coal carriers afloat. The ship was launched at Middlesborough, Eng., Aug. 8. The United Wireless officials also announce that installations are constantly being made upon coasting and lake steamers.

General Electric Company.—While no definite figures have been given out by the General Electric Company for its business for the year which ended June 30, it is generally understood that it will show an increase of about $16,000,000 over the business done last year. The business for last year averaged about $5,000,000 per month, and the total business for the current calendar year is estimated by officials of the company to be between $70,000,000 and $75,000,000. This was referred to in our issue of July 14.

Empire District Electric Company.—The new 20,000-hp steam plant of the Empire District Electric Company at Joplin, Mo., has been completed, and was started into operation last week. This gives the Empire District company all of the energy it needs at the present time for the Joplin mining district. It is said, however, by those interested in the company that the developments in that district are progressing so actively that it will not be very long before additional generating capacity will have to be added.

Edward E. Cary Company, Inc.—The entire output of the Heinrich Electric Novelty Company, of Brooklyn, has been contracted for by the Edward E. Cary Company, Inc., 30 Church Street, New York, for a period of five years. The handling of this output will be in addition to the Cary company's regular business of importing lighting carbons and electrical novelties. The Heinrich company manufactures dry batteries, flash lights, Christmas tree outfits, electric clocks, etc., and is a large [illegible] of miniature lamps.

Westinghouse Machine Company.—Actual construction work on what will be the first pair of marine turbine engines built in this country for the use of the American navy was started last week in the Westinghouse Machine Company. With the construction of this engine will also begin the building of the first two Melville-Macalpine reduction gears. The government placed the order for this engine for a collier which is being built at Sparrows Point, Md. The turbines have a capacity of 4000 hp each.

G. W. Armstrong Company.—The G. W. Armstrong Company, of 617 West Jackson Boulevard, Chicago, has been formed to manufacture and deal in electrical specialties. It is manufacturing the new Acco arc-lamp hanger, which embodies several new and attractive features, and also handles the Chicago business of the Kuhlman Electric Company, of Elkhart, Ind., manufacturer of transformers, and of Dossert & Company, of New York, manufacturers of switchboard terminals and lugs. Other electrical appliances may be taken up later. George W. Armstrong, well known as the western manager of the Excello Arc Lamp Company, of New York, is the president and general manager of the new company. Mr. Armstrong has been aggressive and successful in introducing the flaming arc lamp in the Middle West, coming to Chicago from Columbus, Ohio, in February, 1908. Associated with Mr. Armstrong in the Armstrong Company is H. Caird, also connected with the Excello company. Mr. Caird, who is a "Tech" man and an electrical engineer of practical experience, is vice-president and engineer of the new company. Both Mr. Armstrong and Mr. Caird will continue to act in their respective capacities for the Excello company.

Chicago Traction Rehabilitation.—The Chicago Railways Company is receiving bids for furnishing $1,000.000 worth of rails and ties with which to carry on the work of rehabilitation of the Consolidated Traction lines. Six thousand tons of steel rails will be bought and upward of 50,000 ties. The franchise ordinance for the merger company has not yet been passed by the Chicago City Council, but the officials of the Railways company are confident that it will be passed soon and want to be in readiness to begin work immediately. A large force of men has been engaged and the work will be pushed day and night.

To Bid on New York Subways.—It was said last week that the Bradley-Gaffney-Steers Contracting Company will put in a bid for the construction of the proposed Tri-borough subway advertisements for which will be made within a short time. This contracting firm, it is said, is backed by heavy financial interests, and rumor names the New York, New Haven & Hartford Railroad as interested in the project.

Electric Vehicle Association Incorporated.—Justice Guy, of the Supreme Court of New York City, has approved the articles of incorporation of the Electric Vehicle Association of America. The purpose of this organization is to promote the adoption and use of electric vehicles and to advance the manufacture of them.

Financial.

THE WEEK IN WALL STREET.

PROBABLY the most important discussion in Wall Street last week was the Roosevelt tour of the West. The present series of speeches that the ex-President is making throughout the country are variously considered, according to the temperament of the trader, as being destructive to any upward movement or as being absolutely harmless. There are all shades of opinion between these two extremes. There is no doubt, however, that Wall Street is apprehensive of the present campaign of anti-corporation politics. There is also much interest felt in the street in the complicated situation of New York State politics. As a matter of fact, it seems to be impossible to divorce the securities and money markets from the political situation. The movement of stocks throughout the past week was unimportant. There was no definite tendency that can be outlined, and fluctuations were irregular. As a rule the market was exceedingly dull, and a vast majority of the transactions were those of the regular traders. A few weeks ago it was believed that the outside public was showing some interest in the market, and there was some evidence that a buying movement had been commenced. During the past week there has been little to encourage the commission house man, and if the outsider has been investing to any extent in the market he has bought to hold, and has not traded upon a margin. The volume of trading has been very light, and while there has been no definite pressure to sell there has been no indication of a movement to buy. While it is generally admitted that commercial business for the moment is exceedingly dull, 90 per cent of those who do business in the financial district expect a great recovery in the early fall. Reports from both the railroads and industries show that while business is better th[illegible] to the mark set by the more sanguine prophets of the earlier part of the year. One handicap to bullish enthusiasm is the poor showing that has been made by the foreign trade reports. These indicate that our farm products are gaining little in the volume of exports, and that our manufactured wares are hardly holding their own. On the other hand, imports seem to be increasing every week. The money market continues to be in much the same situation that has been noted within the past six weeks. Call money is extremely cheap, and there is a plentiful supply of it to be had on any sort of reasonable collateral. Time money is not, however, any cheaper than it has generally been during the past few years at this period. This indicates that while the bankers are anxious to employ their surplus funds, they are not willing to tie them up for any extensive period. Quotations Aug. 29 were: Call, 1¼@2; 90 days, 3¾ per cent. The quotations in the table are those of the close, Aug. 29.

NEW YORK.

	Aug. 22.	Aug. 29.	Shares sold		Aug. 22.	Aug. 29.	Shares sold.
All. Ch.	9	[illegible]	[illegible]	Int. Met., pfd.	[illegible]	48½	6,500
All. Ch., pfd.	33	32	[illegible]	Mackay Cos.	[illegible]	85	—
Amal. Cop...	64⅞	64¾	[illegible]	Mackay C., pf.	73¼*	73¼*	—
Am. D. T...	20[illegible]*	[illegible]*	—	Man. Elev.	[illegible]*	131*	[illegible]
Am. Loc.....	34½	35	2,200	Met. St. Ry..	15*	15*	—
Am. Loc., pfd.	103½*	103½*	—	N.Y. & N.J. Tel.	130¼*	130¼*	—
Am. Tel. & C.	71½*	71¼*	[illegible]	Steel, com..	69¾	70½	540,[illegible]
Am. T. & T..	134½	134½	2,500	Steel, pfd....	116¼	[illegible]	4,240
B. R. T.....	75½	74¾	20,360	W. U. T....	61	61½*	[illegible]
Gen. Elec. ..	144	142[illegible]*	2,300	West'h., com.	59½*	59	1,3[illegible]
Int. Met.	[illegible]	[illegible]	7,000	West'h., pfd..	110*	110*	

PHILADELPHIA.

	Aug. 22.	Aug. 29.		Aug. 22.	Aug. 29.
Am. Rys.	44	44	Phila. Elec. ...	15	15
Elec. Co. of A......	11⅜*	11¼	Phila. R. T.........	18¼	18[illegible]
Elec. St. B'ty..	[illegible]	47½	Phila. Tra.	82⅝*	83[illegible]*
E. S. B'ty, pfd.	[illegible]	[illegible]	Union Trac.	43[illegible]	44[illegible]

CHICAGO.

	Aug. 22.	Aug. 29.		Aug. 22.	Aug. 29.
Chi. City Ry. ...	180*	180*	Chi. Tel. Co.	117*	118
Chi. Rs., Ser. 1......	70	70*	Met. El. Co.........	15*	15*
Chi. Rs., Ser. 2...	16[illegible]	16	Met. El., pfd...	60*	60*
Com. Edison.. ..	111	111	Nat'l Carbon	120*	12[illegible]
Chi. Subways	5[illegible]	4[illegible]*	Nat'l Car., pfd.....	117*	117*

BOSTON.

	Aug. 22.	Aug. 29.		Aug. 22.	Aug. 29.
Am. T. & T.	[illegible]	[illegible]	Mex. Tel.	[illegible]*	[illegible]
Cum. Tel.	[illegible]*	[illegible]	Mex. Tel., pfd..	[illegible]*	[illegible]
Edison E., Ill.......258½	258½	260	N. E. Tel..........130	130	[illegible]
Gen. Elec.	144	144⅜*	W. T. & T.........	15*	15*
Mass. E. Ry.......	17¼	17⅜	W. T. & T., pfd....	85*	8[illegible]
Mass. E. Ry., pfd.	[illegible]	[illegible]			

*Last price quoted.
Shares sold for week Aug. 22 to Aug.

FINANCIAL NOTES.

Pacific Gas & Electric Company.—For the six months which ended June 30, 1910, the gross earnings of the Pacific Gas & Electric Company were $7,238,538; deductions amounted to $194,470. After charging almost $600,000 for maintenance, paying operating expenses, and fixed charges, there was a surplus left of $9,043,117. A duplication of earnings for the second half year will afford a surplus of $3,500,000 available for distribution. Houses that have made a specialty of Pacific Gas & Electric securities are predicting 6 per cent dividends on common for next year. This would mean an annual disbursement of some $1,200,000; an outlay which the record of the past 18 months would indicate was not beyond the power of the corporation. The company carries a heavy bond issue, reaching a total of $58 933,542. Against this it lists assets of $113,757,660. Operating in 24 counties in the central part of the State, the corporation has been able to take advantage of the great growth of the last few years.

Westinghouse Electric & Manufacturing Company.—It is reported that the business of the Westinghouse Electric & Manufacturing Company for the months of July and August is running at a ratio which would indicate an annual business of about [illegible]. The company is now showing at the present rate of orders an actual net earning of something like $5,000,000, or 12½ per cent on its stock. There is much talk in speculative circles that the entire amount of deferred dividends upon the preferred stock will be paid before the end of the year. A large portion of the business of the Westinghouse company, like that of other electrical companies at this time, is in the line of traction apparatus and supplies.

Commonwealth Power, Railway & Light Company.—The Commonwealth Power, Railway & Light Company, Jackson, Mich., incorporated in Maine, which is the holding company of the Hodenpyl-Walbridge & Company and E. W. Clark & Company properties in Michigan, is proceeding with its business in spite of the fact that the Michigan Railroad Commission has refused to permit it to issue any bonds. The various subsidiary properties have made application to the commissioners for permission to issue mortgage bonds to cover their needs for construction and extensions. These applications have in five or six instances been granted already, and it is the belief of the owners of the properties that eventually all of the applications will be favorably acted upon. A representative of the Commonwealth Power company is authority for the statement that when all of the subsidiary companies have issued all of the bonds that they have asked for, these bonds will be deposited with a trust company, and upon them will be issued collateral trust bonds of the Commonwealth company. When this is done the original program of those who projected the Michigan merger will be practically carried out. The Consumers Power Company, of Jackson, also a Maine corporation, all of the stock of which belongs to the Commonwealth company, is the operating concern of the electric properties in the combination. This company has not as yet determined upon a definite financial plan, but will do so after the subsidiary companies have been taken care of. It is, however, at the present time developing the water power and the electrical transmission lines in the district. Work is going actively forward upon a large dam on Au Sable River. Two hundred men are at work upon this project at the present time. When completed it is expected to develop 12,000-hp. The company is also completing a 6000-kw steam station at Flint, Mich., and has half completed a 4000-kw station at Grand Rapids.

Hudson River Electric Power Company.—James R. Hooper, chairman of the bondholders' committee of the Hudson River Electric Power Company, and its seven affiliated companies, has issued a circular letter to the bondholders, in which he states that over 70 per cent of the total $11,009,000 of bonded debt is now upon deposit. The first draft of the reorganization plan has been finished, and the Public Service Commission of the Second District of New York will shortly go over the properties to ascertain the fiscal valuations. The Stone & Webster Engineering Corporation is now at work preparing an inventory and appraisement, and this task will probably be completed before Sept. 1. In speaking of the attempt that was made last winter to pass a bill through the New York Legislature, providing for the construction of a dam at Sacandaga to regulate the flow of water in the Hudson, Mr. Hooper says that the project will be again taken up at the next session. The bill passed the Legislature, but was vetoed by Governor Hughes. It is believed that the governor's objections can be overcome in a new measure.

Allis-Chalmers Company.—The preliminary report of the business of the Allis-Chalmers Company for the fiscal year which ended June 30, 1910, shows that the earnings were considerably larger than those of the twelve months preceding, and that they were only slightly under those of the 1908 report. It is understood that the net earnings, after allowing for about $1,700,000 of interest and depreciations, are between $4,000,000 and $5,000,000, which compares with $135,431 in 1909. There has been a considerable increase in the number of unfilled orders that were on hand at the beginning of the new fiscal year, although this amount does not equal the high figure that was reached on the first of July. May was the heaviest month in the present fiscal year, and with two exceptions was the largest month in the amount of new business that the company has ever taken. At the present time the company's plants are running at about 75 per cent of capacity, but it must be taken into consideration that within the past three years the capacity of the Allis-Chalmers plant has been increased at least 30 per cent.

Brooklyn Rapid Transit Company.—The annual report of the Brooklyn Rapid Transit Company, which was issued last week, showed net earnings of 5¾ per cent on the capital stock compared with 4¼ per cent a year ago. In spite of this increase in the percentage of earnings, the shares declined on the Exchange when the report was made public from 77 to 75¼. This was because Wall Street had been led to believe a more favorable report had been issued. The gross earnings of the company for the twelve months ending June 30, 1910, were $20,906,930, compared with $19,604,462 the previous year. The net earnings were $9,180,538, compared with $8,299,807. The report of President Ralph Winter indicates that operating expenses were considerably swelled by increase in wages, and by the higher prices that had to be paid for all classes of material. No important construction work was undertaken within the year. During the year there was authenticated $1,525,000 of 4 per cent refunding bonds.

Wayne County (N. Y.) Gas & Electric Company.—The Public Service Commission of the Second District of New York has authorized the Wayne County Gas & Electric Company to issue a mortgage upon its property, franchises and rights to secure the payment of bonds amounting to $750,000. The company is authorized to issue $400,000 at the present time, $107,000 of which is to discharge obligations of the Wayne County Gas & Electric Company and $206,000 to be used for refunding, at not less than par, bonds now outstanding of the Palmyra Gas & Electric Company; Newark (N. Y.) Gas Light & Fuel Company; New Light, Heat & Power Company, of Newark; Lyons Gas Light Company and Wayne County Electric Company, all of which have been consolidated into one corporation. There will also be issued $131,000 of bonds to be sold at not less than 90, the proceeds of which will be devoted exclusively to improvements upon the gas and electric properties.

Cumberland Telephone & Telegraph Company.—The report of earnings of the Cumberland Telephone & Telegraph Company for July and for the first seven months of the current year shows steady increases in both gross and net. The July increase of 8.56 per cent in gross was considerably above the average for the seven months, but notwithstanding this large gain operating expenses were only 6.44 per cent more than in July, 1909. The operating department has been well managed and the net earnings scored a gain of 11.5 per cent. Inasmuch as the company is steadily expanding and is adding new exchanges fixed charges have been steadily advancing, largely due to higher taxes. The surplus for the month of July showed a gain of 9.87 per cent. The total surplus for the seven months which ended July 31 was $1,357,003.

Northern States Power Company.—The financial make-up of the Northern States Power Company, which was described in our issue of Aug. 25, which has consolidated quite a number of Minnesota, North Dakota and Wisconsin public utility companies, is as follows: Bonds, Consumers' Power Company, first mortgage, 5 per cent, twenty-year bonds issued, $3,317,000; set aside for the retirement of like amounts of bonds issued by subsidiary companies, $2,261,000; total outstanding bonds, $5,578,000; held in treasury for future extensions and improvements, $4,422,000, making the total authorized bond issue of the company $10,000,000. Preferred stock authorized, $6,000,000; issued, $2,150,400; common stock authorized and issued, $4,000,000.

Pacific Light & Power Company.—The Pacific Light & Power Company, of Spokane, Wash., has given a mortgage for $30,000,000, which has been filed for record in Walla Walla County, to the United States Mortgage & Trust Company, of New York. This indenture covers all the holdings of the company which recently bought out the Northwestern Corporation, and is secured by twenty-year bonds, payable Aug. 1, 1930. While there is no purpose avowed in the mortgage as to use to which the proceeds are to be put, it is understood that the money is to be spent in improvements, such as building new electric railway lines, enlarging power plants, extending transmission lines and securing new properties.

Interborough Electric Company.—The name of the company incorporated to take over quite a number of public service concerns in the Upper Ohio River Valley will be the Interborough Electric Company. It is capitalized at $1,500,000, and has been incorporated under the laws of Pennsylvania. Van Horn Ely is the president of the new company. It is understood that the company has secured all of the lighting privileges of the Upper Ohio River and Beaver River Valleys. The organization of this company was referred to in the issue of Aug. 25.

United Electric Securities Company.—The directors of the United Electric Securities Company, of Boston, held a special meeting last week and voted to accept all proposals from the company's bondholders for as many of its collateral trust 5 per cent bonds of the 20th and 21st series as can be purchased with the following amounts of cash—20th series—$70,817; 21st series, $80,624. The bids received ranged from 102 to 103.

Philadelphia Rapid Transit Company.—The annual report of the Philadelphia Rapid Transit Company for the fiscal year ended June 30 last has been considered by the board of directors of that company, and will be made public within a few days. It is stated that while the earnings of the company have been running more than $2,000 a day in excess of the corresponding period of last year, the loss sustained during the winter months by the strike and other labor troubles has been sufficient to wipe out any surplus of earnings. One of the officials is quoted as saying: "If there had been no strike, we would have had a net surplus this year of about $250,000, and we are now earning at the rate of $750,000 per year more than in 1909-10, so that at the present rate we ought to run within another year something like $1,000,000 surplus."

Interborough Company Gets $2,100,000.—After a great amount of investigation, and long drawn out hearings, the Public Service Commission of the First District of New York has awarded to the Interborough Rapid Transit Company $2,100,000 as a compromise of its claims against the City of New York for extra construction work. The company claimed that this work was done in carrying out the orders of the city beyond what had been originally specified in the contract made between the city and the Rapid Transit Construction Company. The original claim of the Interurban company was $6,000,000, but after a vast volume of testimony had been taken it was scaled down to the award referred to above.

Aurora, Elgin & Chicago Railroad Company.—The stockholders of the Aurora, Elgin & Chicago Railroad Company have been notified that the annual meeting will be held Oct. 18. It is stated in the call for the annual meeting that the proposition of the directors to purchase the property of the Chicago, Wheaton & Western Railway Company will be considered and determined at this meeting, and that there will also be considered the question of changing and enlarging the objects for which the Aurora, Elgin & Chicago Railroad Company was originally created. If the purchase of the Wheaton property is approved by the stockholders, payment will probably be made in general mortgage bonds of the parent corporation.

Southern New England Telephone Company.—At the October meeting of the directors of the Southern New England Telephone Company a formal call will be issued to the stockholders for subscriptions for another issue of new stock amounting to $1,099,100. When this stock is all subscribed for it will make the total capitalization of the company $8,792,800. The company has been authorized by the Massachusetts legislature to increase its capitalization up to $10,000,000. The new stock will be issued to the present shareholders at par, and will be in ratio of one to seven. The issue of additional stock is for the purpose of raising money to carry on extensions and improvements to the plant.

American Light & Traction Company.—The handsome gain in earnings that has been shown by the American Light & Traction Company for the past year is still keeping up. The improvement in gross for July was $16,623 and the improvement in net $15,357. A conspicuous feature of the current reports is the fact that the increase in net for almost every month is about equal to the increase in gross, which shows that the company is being economically operated. At the present time the company has outstanding $9,851,000 of common stock, and judging from the net returns shown for the twelve months ending July 31 the amount earned will be almost 27 per cent.

Stock Quotation Telegraph Company.—A certificate has been filed with the Secretary of State of New York by the Stock Quotation Telegraph Company of New York increasing its capital stock from $500,000 to $3,000,000. The certificate was signed by William H. Hurst, president of the company, and Lyttleton Fox, secretary. The stockholders voted on the proposition Aug. 3.

DIVIDENDS.

American Locomotive Company, preferred, quarterly, 1¾ per cent, payable Oct. 21.

Northern Ohio Traction & Light Company, quarterly, ¾ per cent, payable Oct. 1.

Northern Texas Electric Company, preferred, semi-annual, 3 per cent; common, quarterly, 1¼ per cent, payable Sept. 1.

Rochester Railways & Light Company, preferred, quarterly, 1¼ per cent, payable Sept. 1.

South Side Elevated Railroad Company, Chicago, quarterly, 1½ per cent, payable Sept. 30.

Union Traction Company, Philadelphia, quarterly, 1½ per cent, payable Oct. 1.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Cities Railway & Light Company:					
July, 1910	[illegible]	[illegible]	$230,632	$114,872	$121,760
July, 1909	488,082	[illegible]	203,533	[illegible]	97,297
Cleveland, Painesville & Eastern Railroad Company:					
July, 1910	[illegible]	17,041	24,839	9,200	15,639
July, 1909	[illegible]	[illegible]	[illegible]	8,324	13,454
Cumberland Telephone & Telegraph Company:					
July, 1910	[illegible]	[illegible]	243,973	48,802	195,171
July, 1910	[illegible]	302,123	[illegible]	41,177	177,623
Detroit United Railway Company:					
July, 19[illegible]	938,599	586,726	351,873	180,796	183,757
July, 19[illegible]	[illegible]	[illegible]	305,134	162,050	[illegible]
Fonda, Johnstown & Gloversville Railroad Company:					
July, 19[illegible]	[illegible]	40,608	55,138		
July, 19[illegible]	85,207	34,594	50,613		
Interborough Rapid Transit Company:					
July, [illegible]	[illegible]	[illegible]	[illegible]		
July, [illegible]	[illegible]	856,015	1,159,009		
Kansas City Railway & Light Company:					
June, 19[illegible]	617,264	[illegible]	243,608	185,432	58,176
June, [illegible]	[illegible]	[illegible]	239,671	171,754	[illegible]
Keystone Telephone Company:					
Year ended June [illegible]	1,126,030	[illegible]	[illegible]	[illegible]	232,409
Year ended June 30, 1909	[illegible]	531,009	[illegible]	412,308	130,145
Lake Shore Electric Railway Company:					
July, 19[illegible]	132,032	60,084	[illegible]	[illegible]	[illegible]
July, [illegible]	[illegible]	[illegible]	[illegible]	33,786	31,748
Lehigh Valley Transit Company:					
July, [illegible]	[illegible]	[illegible]	56,781		31,473
[illegible]	101,036	[illegible]	[illegible]		11,437
Northern Ohio Traction & Light Company:					
July, [illegible]	[illegible]	[illegible]	130,082	43,357	86,726
[illegible]	227,012	[illegible]	[illegible]	[illegible]	67,970
Philadelphia Company:					
[illegible]	[illegible]	922,430	[illegible]	[illegible]	[illegible]
[illegible]	1,463,241	[illegible]	500,638	585,068	[illegible]
Rio de Janeiro Tramway, Light & Power Company:					
July, 1910	[illegible]	487,810	492,229		
[illegible]	[illegible]	390,534	265,161		
Sao Paulo Tramway, Light & Power Company:					
[illegible]	[illegible]	90,457	[illegible]		
[illegible]	[illegible]	88,620	115,782		
Tri-City Railway & Light Company:					
[illegible]	[illegible]		[illegible]	44,112	43,687
[illegible]	167,662		[illegible]	[illegible]	30,979
Twin City Rapid Transit Company:					
July, 1910	[illegible]	[illegible]	364,017	[illegible]	223,905
July, 1909	[illegible]		362,523	[illegible]	222,272
[illegible]					
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]	356,225	265,528		
[illegible]					
[illegible]	[illegible]	649,216	[illegible]	233,139	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	232,450	[illegible]

General News

Construction News.

[illegible] of the bonds and install the plant.

SELMA, ALA.—A franchise for the construction of a street railway system in this city has been granted to Ernest Lamar and associates. It is the purpose of the promoters to extend the line to the Birmingham [illegible]

BISBEE, ARIZ.—It is reported that the Bisbee Improvement Company expects to enlarge its power plant and extend service to adjacent towns.

CLARKSVILLE, ARK.—Reports are current that the City Council has granted to J. C. Wilson, of Morrillton, Ark., a franchise for water works, sewerage and an electric light system. It is understood that the electric light portion of the plant will be in operation by next February.

GRANNIS, ARK.—It is reported that J. P. Logan and A. Coyle are interested in a project to organize a company to establish an electric light plant in this city.

JONESBORO, ARK.—An electric railway franchise to construct a line in Jonesboro has been granted by the City Council to Preston Thatcher.

ESCONDIDO, CAL.—It is reported that the Escondido Utilities Company is planning the extension of its electric light and power service into the San Pasqual, Twin Oaks and San Marcos Valleys. It is estimated that the transmission and distribution system will cost in the neighborhood of $10,000. C. C. Glass is manager of the company.

GRANITEVILLE, CAL.—It is the purpose of the owners of the Birchville Mine, located a short distance from Graniteville, to rebuild the plant recently destroyed by fire, substituting electricity for steam in its operation.

GREENVILLE, CAL.—Press reports state that the Indian Valley Electric Light & Power Company proposes to extend its service to Crescent Mills and Taylorsville.

HIGHLAND PARK, CAL.—A petition from Highland Park has been filed with the Supervisors, asking that a special election be called for the purpose of voting on a lighting system for that place.

LOMPOC, CAL.—It is reported that the Lompoc Light & Power Company, which now supplies the city of Lompoc with electricity, has made a proposition to the citizens, through the Town Board of Trustees, to sell its plant to the city free of indebtedness for $27,500. It is announced that if the proposition is accepted the plant will have to be considerably enlarged.

OAKLAND, CAL.—The City Council has granted a 50-year franchise to the Southern Pacific Railroad Company for the extension of its Melrose and annexed territory branch of the ferry service lines to Standley Road. The extension, as well as all of the corporation's local lines, will be electrified.

OAKLAND, CAL.—The contract for furnishing electrical equipment for the new building of the Fire Alarm and Police Telegraph Department, now in the course of erection on Thirteenth and Oak Streets, bids for which were opened Aug. 10 by the Board of Public Works, has been awarded to the Gamewell Fire Alarm Telegraph Company, the estimate being $12,805.

OAKLAND, CAL.—The Sierra & San Francisco Power Company, of San Francisco, has applied to the Board of Supervisors of Oakland for permission to operate a telephone line throughout the county. The line is to be used by the company alone. It is also the purpose of the company to extend its power service throughout this section, installing wires for the transmission of electrical energy on the same poles with its telephone wires.

OAKLAND, CAL.—It is the intention of the Great Western Power Company, which maintains a steel tower line between Las Plumas, on the line of the Western Pacific Railroad, and Oakland, to install another line of similar character parallel to the one now in use, condemnation suits having been filed in the Superior Court of Butte County for rights of way. The new line of towers will be erected alongside those now in use and as close as possible. Work will be started as soon as the rights [illegible]

OAKLAND, CAL.—It is reported that the consolidation of the Sacramento River Power Company and the Central Heat, Light & Power Company, of Oakland, and the Merchants' Light & Power Company, of San Francisco, has been completed and that plans are now being matured for the construction of a hydroelectric plant on a site two miles below Kennett. The water will be taken from the Sacramento River at a [illegible] tunnel to the site of the power plant.

RED BLUFF, CAL. Two notices of appropriation of the waters of Mill Creek, Tehama County, for the purposes of generating power, irrigation and domestic uses, have been filed at Red Bluff, one by P. L. Hamilton, of Chico, on 10,000 miner's inches at a point 12 miles below Morgan Springs, and the other by Hal M. Parker, of Chico, on a like number of inches at a point 6½ miles below the resort.

SALINAS, CAL.—It is reported that sealed bids will be received by the clerk of the Board of Supervisors of Monterey County, Cal., at his office in Salinas up to 2 p. m. Sept. 7, for the installation of electric light and pumping plant machinery for the county hospital of Monterey County. Each bid must be accompanied by a certified check for 10 per cent of the amount bid, payable to the chairman of the board. Specifications are on file with the clerk, T. P. Joy.

SAN DIEGO, CAL.—Press reports state that plans have been drawn by the San Diego Electric Railway Company for the construction of a large power station in this city, the cost of which will be approximately $225,000.

SAN FRANCISCO, CAL.—Suit has been brought in the U. S. Circuit Court in San Francisco by U. S. Attorney Devlin on behalf of the Government to restrain the Hydro-Electric Power Company from trespassing on the Mono National Forest Reserve. As previously stated, the company had commenced work on a power plant near Bodie without having secured the permission of the Secretary of the Department of Agriculture and, believing its action to be within the law, had expressed its intention of continuing the construction, with the resultant proceedings on the part of the Government.

SANTA BARBARA, CAL.—Reports are in circulation that Henry P. Post, representing a syndicate of capitalists, is soon to apply for permission to construct a street railway that will parallel the lines of the Santa Barbara Consolidated Railroad Company. It is understood that the promoters of this proposition will, if granted the franchise, construct lines to Goleta and Montecito.

VENTURA, CAL.—At a recent election in this city a bond issue, the purpose of which is to provide funds for the installation of an electric lighting system on Ventura Avenue, was approved.

BOULDER, COL.—Press reports state that the Central Colorado Power Company, Leonard E. Curtis, secretary, whose plant in the Middle Boulder Canyon was put into operation Aug. 4, expects to at once commence the extension of its transmission lines in the mining districts. A line will be run in a northerly direction from the Promos mill to a point near Sunnyside, where it will diverge, one line running to Ward and another to Camp Albion; another line will be run from the Wolf Tongue extension to the Conger mine, making about 14 miles of new lines.

TELLURIDE, COL.—The Colorado Telephone Company is planning for the construction of a new line between Telluride and Norwood, the cost of which will be approximately $11,000.

BRIDGEPORT, CONN.—It is the intention of the Connecticut Company to build an addition to its present plant which will double the floor space. To the three large boilers now in use a fourth of equal capacity will be added, and in the new engine-room will be installed two steam turbine engines direct-connected to two 2100-kw generators.

CHESHIRE, CONN.—Bids will be received until Sept. 9 by the board of directors of the State Reformatory, addressed to John Hopkins Clark, treasurer, at the office of the Hartford *Courant*, Hartford, for electric wiring for the State Reformatory in Cheshire. William D. Johnson, Inc., architects, 26 State Street, Hartford, Conn.

WASHINGTON, D. C.—Bids will be received until Sept. 7 by the Commissioners District of Columbia, G. H. Rudolph, chairman, for furnishing underground signal and telephone cables for the electrical department of the District of Columbia.

WASHINGTON, D. C.—Bids will be received by James Knox Taylor, Supervising Architect, Washington, D. C., until Sept. 21 for furnishing and installing lighting fixtures in the U. S. buildings at Corsicana, Tex.; Columbus, Miss.; Fayetteville, N. C.; Hoboken, N. J.; Manistee, Mich.; St. Louis, Mo., and Manchester, N. H.

LAKELAND, FLA.—It is reported that $18,000 of bonds has been issued by the city of Lakeland, the proceeds to be used for the improvement of the water and light plant. For further particulars address the Mayor.

FISH HAVEN, IDAHO.—An application has been filed by Alonzo L. Cook, of Fish Haven, with the State Engineer at Salt Lake City, Utah, for the appropriation of 45 cu. ft. of the waters of Swan Creek, in Rich County, his purpose being to construct a power plant to supply Rich County, Utah, and Bear Lake County, Idaho, with electric light and power. The proposed plant will have a capacity of about 620 hp.

[illegible] IDAHO.—About [illegible] by the Nezperce Co-operative Telephone Company in changing its prairie system to metallic circuit lines.

RUPERT, IDAHO.—The towns of Rupert, Heyburn and Burley, located in the vicinity of the Government Minidoka irrigation project, are to be lighted by electricity at an early date, the power to be furnished from the plant at the Government dam. It is planned later to furnish electric power for heating purposes.

AURORA, ILL.—The Chicago, A[illegible] Railroad Company, which has recently placed in operation its newly electrified line between Aurora and De Kalb, expects to extend the line from De Kalb to Rockford, a distance of about [illegible] miles.

BELLEVILLE, ILL.—Work has been commenced by the Belleville & Mascoutah Transit Company on its proposed electric line between Belleville and Mascoutah.

CHICAGO, ILL.—Bids will be received until Sept. 7 by the Board of Trustees, Sanitary District of Chicago, Robert R. McCormick, president, for division "A" installing electric equipment; division "B" construction of tunnel and machine foundation in the city hall substation.

HILLSBORO, ILL.—The Hillsboro Electric Light & Power Company is reported to have purchased a site for the erection of a new power plant, and work of construction is to be started at once.

JERSEYVILLE, ILL.—The Alton, Jacksonville & Peoria Railway Company, which is planning to extend its lines from Godfrey to Jerseyville, expects also to erect a power station at Jerseyville which will furnish electrical energy for the entire line. The company at present leases power from the Alton Gas & Electric Company.

MOLINE, ILL.—It is announced that preparations for the formal transfer of the United Light & Power Company, of East Moline, to the People's Power Company, of Rock Island and Moline, one of the Tri-City merger concerns, have been practically concluded and that record of the sale will be filed in the Rock Island court house within a short time. Among the first improvements to be made after the transfer has been effected will be the construction of a new line to supply electrical energy to the Union Malleable Company, the new Marseilles plant, and other growing East Moline industries. The construction of this new line will represent an expenditure of about $15,000.

STERLING, ILL.—The Sterling-Moline Traction Company has awarded to the Northwestern Construction Company, Milwaukee, Wis., the contract for the construction of its proposed line between Sterling and Prophetstown, $100,000, it is said, having been subscribed toward the proposition. Preliminary surveys have been completed between Sterling and Moline. The company's plans include the construction of a power plant and dam on the Rock River at Lyndon. A. Van Petten, Sterling, is general manager.

CAMBRIDGE CITY, IND.—The citizens of this city have voted for a bond issue, the proceeds of which are to be used for the remodeling and improvement of the municipal water and light plant. It is understood that the plans contemplate the installation of considerable new machinery and equipment.

CRAWFORDSVILLE, IND.—We have been advised by the Crawfordsville Electric Light & Power Company that work upon the excavation of its new power plant has been commenced. The electrical machinery has already been purchased, and the company expects to advertise for bids on the building and stack at once. J. R. Thomas is superintendent.

FORT WAYNE, IND.—As the result of a test recently made by the city on 25 magnetite arc lamps, the invention of J. J. Woods, an order has been placed with the Fort Wayne Electric Company for 50 additional lamps, which will be installed in a short time.

INDIANAPOLIS, IND.—The Cincinnati, Madison & Western Traction Company, which is reported to have begun work on a section of its proposed electric railway between Hanover and Madison, is planning to extend the line to Scottsburg, where connections will be effected with the lines of the Indianapolis & Louisville Traction Company.

AKRON, IA.—The town of Akron, Ia., will receive bids on the installation of an electric lighting plant. Address E. H. Youngstrom, clerk.

CLARION, IA.—At a special election held at this city it was voted to sell the municipal electric light plant to W. H. Carr, the consideration being $8,500. The grant conveys to Mr. Carr the right to maintain and operate the plant for lighting and heating in Clarion for a term of 25 years, the franchise, however, not being an exclusive one. It is the purpose of the new owner to make many improvements in the system and to maintain a continuous service.

FAIRFIELD, IA.—Advices have been received from W. L. Long, superintendent of the water and light plant of Fairfield, that the city [illegible] has selected Alvord & Burdick, of Chicago, to prepare the plans for the [illegible]

MAGNOLIA, IA.—It is reported that all of the $8,000 of bonds, the proceeds of which will be used for the construction of a distribution lighting system between Magnolia and the Missouri Valley, has been subscribed, and that a 24-hour service is to be established.

PELLA, IA.—Bids will be received until Sept. 6 for a combined water and light plant, the equipment to include two alternating-current generators, two motors, two engines, three boilers, transmission line wire and lamps. Further particulars may be obtained from A. C. Kuyper, city clerk, or the Iowa Engineering Company, Clinton, Ia., engineers.

ROLAND, IA.—It is reported that W. H. Grover, of Ames, is interested in the proposed construction of an electric light plant at this city.

BELLEVILLE, KAN.—The Municipal Electric Light Plant at this city was burned on Aug. 20, and the electrical equipment is reported to have been completely destroyed.

FRANKLIN, KAN.—It is announced that a special election will soon be called at this city for the purpose of voting on a bond issue of $8,000, the proceeds of which are to be used for the establishment of a municipal electric light plant.

OAKLEY, KAN.—Sealed proposals will be received at the office of the city clerk, Oakley, Kan., until Sept. 14 for furnishing material and labor and constructing a system of water works and electric lighting, the apparatus to include one 80-hp internal combustion engine for a 50-kw unit, one 50-kw generator, switchboard, lighting equipment, etc. For detailed particulars address J. A. Switzer, city clerk, or Burns & Mc Donnell, engineers, Scarritt Building, Kansas City, Mo.

LOUISVILLE, KY.—The Louisville & Eastern Railroad Company, which has just put into operation a line between Louisville and Shelbyville, is planning to construct a line from Shelbyville to Frankfort, connecting with the Blue Grass Traction Company.

LOUISVILLE, KY.—Work has been commenced by the Louisville Lighting Company upon the removal of its poles from the underground district of the city, an ordinance having been passed that all aerial light, telephone and telegraph wires shall be placed in conduits in this section by Jan. 1, 1911.

LOUISVILLE, KY.—Bids will be received until Sept. 15 by the Board of Public Safety, Edward T. Tierney, chairman, for furnishing material and constructing an underground conduit system for the fire alarm and telegraph department; also separate bids for rubber-covered, lead-encased fire alarm cables for said department; also separate bids for installing said cables.

THIBODAUX, LA.—The Board of Aldermen of this city has accepted the plans of G. U. Borde, of New Orleans, for the proposed electric light plant. The approximate cost of the system will be about $35,000.

SKOWHEGAN, MAINE.—It is reported that at a meeting of the Board of Trade held recently in this city a plan was submitted for merging the several power rights, as now established by deed, into one new corporation; the issue of $1,000,000 first mortgage 5 per cent bonds, and the expenditure of the proceeds in acquiring the necessary property to build new dams, canals and power station.

ANNAPOLIS, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 10, William M. Smith, acting chief, for additions to power plant and distributing systems at the Naval Hospital, Annapolis, as per specification No. 1734.

BEL-AIR, MD.—It is reported that the Bel-Air Electric Company, which supplies electrical energy in parts of Hartford and Baltimore Counties, has filed an application with the State Public Service Commission for permission to issue $25,000 of bonds and $12,500 of preferred stock, the proceeds to be used in the extension and improvement of its system.

NORTH EAST, MD.—Permission has been granted by the Town Council to the American Telephone & Telegraph Company, of Baltimore, to install a conduit system throughout certain streets in this city.

HAVERHILL, MASS.—Press reports state that a reduction of 20 per cent in its lighting rates has been made by the Haverhill Electric Company, regardless of monthly consumption. Twelve cents per kw-hour will be the net rate on and after Sept. 1, as against a rate of 15 cents net now charged for the first 50 kw-hours' consumption per month.

NEW BEDFORD, MASS.—Bids will be received until Sept. 7 by the City Council Commission of City Property (W. H. B. Remington, clerk) for furnishing and installing complete lighting fixtures for the new municipal building.

PITTSFIELD, MASS.—Among the future extensions to its system planned by the Berkshire Street Railway Company, of this city, may be mentioned the following: A line from Great Barrington to the State line, where it is expected to run through the Connecticut territory to Canaan; a line from Huntington to Lee, a distance of about 23 miles, and one up Mount Greylock, between North Adams and Cheshire, Mass. Work has already been commenced on a line from Great Barrington to South Egremont.

PLYMOUTH, MASS.—It is reported that P. J. Nevins, of Haverhill, one of the promoters of the Plymouth County Gas, Light & Power Company, which was organized some time ago for the purpose of supplying electricity to the towns in the vicinity of Plymouth, is authority for the statement that a movement is on foot to reorganize the company. Mr. Nevins states that, while financial backing for the project is already available, it is deemed preferable to give residents of the towns in which the company proposes to operate the privilege of subscribing to the capital stock. It is understood that the reorganization plan will be carried to completion as rapidly as possible.

RUTLAND, MASS.—It is reported that Moulton Brothers have nearly completed the erection of a dam 400 ft. long at their power privilege on Ware River, North Rutland, at which point a new water turbine has been installed. This turbine is connected to a 100-kw alternating-current generator, which furnishes energy at 2300 volts over a 100-ft. distribution line to a motor in the wooden mill of the firm.

SHELBURNE FALLS, MASS.—Through a recently consummated deal, active control of the Shelburne Falls Electric Light & Power Company has been acquired by the Greenfield Electric Light & Power Company. The entire system is to be reconstructed and a 24-hour service maintained throughout the year.

WESTBORO, MASS.—The power plant of the Marlboro & Westboro Street Railway Company in this city is being dismantled, Judge Hitchcock of the Superior Court having decided against the appeal of the citizens for its retention. All of the machinery and equipment will be shipped to West

[illegible] Street Railway Company.

[illegible] of the Western Massachusetts Street Railway Company, of this city, in- [illegible] 150-hp boilers, and an engine-room 40 ft. x 50 ft. In the latter will be installed a 500-hp Hamilton-Corliss, cross-compound engine, directly connected to a 350-kw General Electric generator.

BESSEMER, MICH.—An electric light and power franchise has been granted to the Ashland Power Company at this city.

IRONWOOD, MICH.—Through a recently consummated deal, the control of the Twin City General Electric Company, of Ironwood, and the Ironwood & Hurley Water Company has passed into the hands of A. E. Appleyard and associates, of Ashland, Wis. It is the purpose of the new owners to make material improvements in the plants.

MUSKEGON, MICH.—It is reported that Grossman & Beoskauser, 84 Van Buren Street, Chicago, Ill., are preparing plans for a new hydroelectric plant for parties in Muskegon.

OXFORD, MICH.—The Oxford Electric Light & Water Works, H. E. Allen, superintendent, will soon be in the market for a turbine pump having a lifting capacity of 20,000 gallons per hour, to be directly connected to a single-phase motor.

SANDUSKY, MICH.—Advices have been received from F. J. Benedict, city clerk, that bids have not yet been asked for water works, sewers and electric light plant, nor have engineers for the proposed work yet been selected.

AITKIN, MINN.—At a meeting of the business men of Aitkin recently, [illegible] Street, between the Northern Pacific and Soo passenger stations. Ornamental posts are to be erected, with a cross-arm on top, each equipped with three lamps. It is estimated that the proposed installation will represent an expenditure of about $2,000. Other streets are to be lighted with incandescent lamps, such as have lately been installed.

AURORA, MINN.—The City Council is reported to have awarded the contract on Aug. 17 for supplying meters and transformers for the municipal electric light plant to the Fort Wayne Electric Company, of Fort W[illegible].

CHISHOLM, MINN.—Press reports state that the Range Power Company is having estimates prepared of the cost of installing a 6000-hp hydroelectric power plant at Little Sturgeon Falls, 12 miles northeast of Chisholm. The proposed development, it is said, will represent an expenditure of approximately $1,000,000, and may include the construction of an electric railway.

DULUTH, MINN.—It is the purpose of the National Power & Paper Company, recently incorporated at this city, to construct an electric [illegible] pulp mill in Lake County, Minn.

FAIRMONT, MINN.—Advices have been received from the Water and Light Commission, Alfred Horne, general manager, that it expects to install an additional 320-hp gas engine and generator for same, also a motor-driven pump at its water works.

HOKAH, MINN.—It is reported that the citizens of Hokah, Minn., have subscribed $1,600 toward rebuilding the dam in that city which was destroyed some time ago. The report further states that upon completion of the work it is quite probable that a power company, which will furnish electric light and power to Hokah, Caledonia, Houston, Lanesboro, Rushford and other towns in that vicinity, and will build and operate an interurban line from Caledonia through Hokah to La Crosse, will be organized by Eastern capitalists. Albert Foster, La Crosse, Wis., previously mentioned as being interested in the project, has been made chairman of the committee in charge of the proposed work.

PINE CITY, MINN.—We are advised by the Pine City Electric Power Company, R. P. Allen, general manager, that it contemplates the addition of 1000 hp in water wheels and generators, and the construction of about 40 miles of transmission line.

ST. PAUL, MINN.—It is reported that H. M. Byllesby & Company, who recently acquired control of the Northern Heating & Electric Company, will expend $800,000 in improving the plant. In addition to the extensions already noted, it is stated that an addition will be made to the plant on East Third Street, in which will be installed several large generators. New lines are also to be constructed to Merriam Park and South St. Paul.

JACKSON, MISS.—Press reports state that W. W. Womack, of this [illegible] grain mills. The reports also state that contracts for the necessary equipment have not yet been placed.

[illegible] Big Niangua Power Company. Plans for the work have been prepared [illegible] this place, is vice-president of the company.

[illegible]

president, M. M. Stephens, is endeavoring to secure $500,000 in the towns of Columbia, Mexico, Ashland and Jefferson City, the amount to be invested in stock or second mortgage bonds.

ST. LOUIS, MO.—A petition has been filed with the County Court by A. A. Busch, H. B. Hawes, C. A. Lemp and Frank Weber for permission to construct an electric railway system from the city limits to Fenton, on the Gravois Road.

BILLINGS, MONT.—It is the intention of the Billings Mutual Telephone Company to install 17,000 ft. of underground conduits.

HELENA, MONT.—It is currently reported that $3,000,000 of the proposed bond issue of the Montana Rapid Transit Company has been subscribed by W. A. Clark. It is expected that the construction of the company's line, which will be 75 miles long and will be operated by energy generated at a dam across the Missouri River near Helena, will be commenced during the fall.

MISSOULA, MONT.—A deed has been filed at this city by the Clark-Montana Realty Company which transfers to the Clark-Missoula Power [illegible] a new organization, the Clark power plant at Bonner. It is understood that the transfer was made for the purpose of facilitating the handling of the power project on the Blackfoot River. The incorporators of the new company are W. A. Clark, A. H. Wethey, W. M. Bickford, J. K. Heslet, of Butte, and C. E. McBroom, of Spokane. It is capitalized at $600,000.

STEVENSVILLE, MONT.—It is reported that Edgar S. Dorman, a prominent civil engineer of Missoula, has completed surveys for a power plant on Rock Creek, about 17 miles from Stevensville.

FREMONT, NEB.—Bids will be received until Sept. 5 by the Board of Public Works, P. A. Nelson, chairman, for furnishing a horizontal steam turbine and generator of 500 kw capacity, to be three-phase, 60-cycle, 2300 volts, and a condenser to be either of the surface barometric or jet type, together with foundations, switchboard piping and all labor and material to make a completely installed operating unit. Estimated cost complete, [illegible]

GRAND ISLAND, NEB.—Advices have been received from the Grand Island Electric Company, B. E. Sunny, president, that it expects to install as soon as possible 300 hp in either water tube or return tubular boilers of 150-lb. working pressure.

PERU, NEB.—The Peru Electric Light & Power Company writes that it is planning the installation of a series incandescent street lighting system, a day circuit and the removal of its plant to new headquarters, in which will be installed an additional boiler. Earle Fisher is president of the company.

STELLA, NEB.—Information has been received from the Stella Electric Light & Power Company, which also operates an electrically driven grain elevator in connection with its lighting plant, that it expects to install another 30-kw alternating-current generator at an early date. A. J. Wixon is manager of the company.

WOOD RIVER, NEB.—Advices have been received from the municipal electric light plant, D. D. O'Kane, city clerk, purchasing agent, that it is in the market for additional generating machinery, which it proposes to install before Nov. 1.

TONOPAH, NEV.—The Nevada-California Power Company, which is now constructing a branch transmission line to the property of the Tonopah Liberty Mining Company, at Liberty, within a few miles of the line connecting Tonopah with Manhattan, is planning for the extension of its lines to the Keane Wonder mine, near Death Valley. Arrangements are soon to be made, it is understood, for an extension of the system to Fresno, negotiations for securing the right-of-way now being considered.

NEWARK, N. J.—Application has been made by the Hudson & Middlesex Telephone & Telegraph Company, which has been organized to construct a telephone system across New Jersey from New York to Pennsylvania, for permission to install conduits along Frelinghuysen Avenue.

PATERSON, N. J.—The North Jersey Rapid Transit Company, which is building an electric railway from Paterson to Suffern, has ordered from the Westinghouse Electric & Manufacturing Company two 300-kw rotary converters, six transformers and switchboard apparatus.

LAS CRUCES, N. M.—It is the intention of the Tri-State Telephone & Telegraph Company, which recently absorbed the local telephone system, to install an entire new equipment in the exchange building which it is to erect.

LAS VEGAS, N. M.—Press reports state that the Territorial Engineer, Vernon L. Sullivan, of Sante Fe, has approved the application of J. J. Laubach, William Harper and W. J. Benjamin, all of Las Vegas, for permission to construct a hydroelectric plant in the vicinity of the Rio Grande Casas Falls, at which place a diversion dam 15 ft. in height, 35 ft. wide at the bottom and 50 ft. at the top will be constructed. The plant is expected to develop 2745 hp, and will cost in the neighborhood of $100,000.

LORDSBURG, N. M.—Arrangements are being made, it is stated, by J. Barclay and others of Moline, owners of the Eighty-five Mine, situated about four miles from Lordsburg, for the installation of a large [illegible] will transmit power to that mine, as well as for other mines and industries in the immediate vicinity.

ROSWELL, N. M.—The Roswell Gas Company and the Roswell Electric Light Company have been consolidated under the name of the Roswell Gas & Electric Company. The management of the new company has

been placed in charge of L. P. McG[illegible] formerly at the head of the Roswell Gas Company, and it is understood that future plans for improvements include the construction of a [illegible] railway in Roswell and an interurban line to Artesia.

BROOKLYN, N. Y.—Announcement [illegible] made that the contract for furnishing condensers, piping and equipment for the power plant at the Navy Yard has been awarded to the Evans-Almiral Company, of New York, N. Y., for $36,133. Bids were opened July 30.

BROOKLYN, N. Y.—Bids will be received until Sept. 6 by C. B. J. Snyder, superintendent of school buildings, New York, N. Y., for installing electrical equipment in School 44, Borough Bronx; also an addition to and alterations in Erasmus Hall High School, Borough Brooklyn.

BUFFALO, N. Y.—The contract for the electric wiring of School 11, for which bids were opened Aug. 24, has been awarded to McCarthy Bros. & Ford, 41 East Eagle Street, Buffalo, N. Y., for $3,790.

LIMA, N. Y.—Consent has been given to the Lima-Honeoye Electric Light & Railroad Company to lease to the Lima-Honeoye Light Company its railway system, electric light plant and other property located in Lima and Honeoye Falls. The Lima-Honeoye Light Company is also authorized to issue $5,000 in capital stock to improve and extend the electric distributing system.

LIVONIA, N. Y.—The Livonia Light & Heat Company has been authorized to exercise franchises and construct and maintain an electric lighting system in the towns of Livonia, Lima and Avon, Livingston County.

NEW YORK, N. Y.—An order has been granted by Judge Lacombe, in the United States Circuit Court, authorizing Frederick W. Whitridge, as receiver of the Union Railway Company, to construct an extension of that road from Westchester Avenue at East 167th Street southerly through that street, East 169th Street, Franklin Avenue, East 168th Street, Webster Avenue, East 167th Street, the transverse road underneath the grand boulevard, and the concourse to Jerome Avenue, the estimated cost of the work being about $[illegible]

SILVER SPRINGS, N. Y.—The Village of Silver Springs has been authorized to construct works for supplying to the inhabitants of that village electricity for lighting and power purposes.

WARWICK, N. Y.—The Warwick Valley Light & Power Company has been authorized to issue its 20-year, 5 per cent gold bonds to the amount of $25,000. The bonds are to be sold at not less than par, and are to be used to refund outstanding bonds, $5,029 accounts payable, and the balance for the purchase of new apparatus for use at the plant in Warwick.

SPENCER, N. C.—It is the intention of the Southern Bell Telephone Company to rebuild its plant at Spencer, as well as its lines from that city to Salisbury. It is estimated that the proposed improvements will represent an outlay of about $15,000.

EDGELY, N. D.—The Board of Trustees of Edgely is considering plans for the extension of the municipal electric light plant.

WAHPETON, N. D.—The city of Wahpeton is considering the advisability of installing a more up-to-date street-lighting system than it now has in use. It is planned to remove the old system and to erect new posts, four on a block, each side, or eight lamp posts to an entire block, on which will be installed clusters of five tungsten lamps. The system under consideration is similar to that used in Fargo to light Broadway, and the lampposts are identical with those used in the streets of Chicago.

BUCKLAND, OHIO.—The local electric light plant, for some time inoperative, has been taken over from the trustees of A. D. Horn & Company, former owners, by the City Council, and a municipal electric lighting system will soon be established.

CLEVELAND, OHIO.—The power [illegible] the Chandler & Price Company for the new addition to its plant will include one 250-kw generator, two 250-hp boilers, stokers, water heaters, etc.

EAST LIVERPOOL, OHIO.—It is stated that work on the new power plant at dam No. 8 is being rushed toward completion by Foley Brothers, of Toronto. It is understood that the building and equipment will represent an expenditure of $60,000, the building costing $20,000 and the machinery $40,000.

MOUNT VERNON, OHIO.—It is reported that plans have been perfected by the Mount Vernon Light & Power Company for the installation of a new light and power plant, and that bids for the construction of the plant will soon be advertised for.

WEST CARROLLTON, OHIO.—An ordinance has been passed by the Village Council of West Carrollton which provides for the sale of $20,000 of water and light bonds.

ZANESVILLE, OHIO.—The lines of the Zanesville Telephone & Telegraph Company [illegible] hundred thousand dollars. It is understood, also, that a new exchange building is to be erected in which automatic telephone equipment will be installed.

ARAPAHO, OKLA.—[illegible] works and electric light plant. Detailed information may be obtained from the O'Neil Engineering Company, 1503 Prætorian Building, Dallas, Tex., or F. B. Gallion, city clerk.

CARMEN, OKLA.—It [illegible] this city for the purpose [illegible] bond issue, the proceeds of which are to be used for the purpose of extending the water works and electric lighting system.

NOWATA, OKLA.—It is reported that an electric railway line is to be constructed between Nowata, Okla., and Coffeyville, passing through Delaware, Lenapah, Seminole and various other places. The enterprise has the financial backing, it is understood, of John Wattack and Banker Pollard, of the Nowata National Bank, W. V. Thraves and Judge Tillotson, also of that city.

PRYOR CREEK, OKLA.—Reports are current that E. T. Archer, engineer, Beals Building, Kansas City, Mo., is preparing plans and specifications for a private ice and electric light plant which is to be constructed at Pryor Creek.

TALIHINA, OKLA.—We have been advised by Arthur L. Mullergren, consulting engineer, Poteau, Okla., that plans and specifications have been prepared for an electric light plant at this place, the estimated cost of which is $5,000. The equipment will include a 35-kw, single-phase generator belted to a 50-hp, high-speed engine.

DUFUR, ORE.—At a recent meeting of the City Council it was decided to install electric lamps along the streets of Dufur.

FLORENCE, ORE.—It is reported that George H. Miller & Bros. have completed surveys for the construction of a water power plant near Florence, and endeavors are now being made to secure a franchise for furnishing light and power to the city.

GRANTS PASS, ORE.—Reports are in circulation that M. J. Anderson and others, of this place, are working on a large power project on the south fork of Coquille River, about 30 miles southeast of Myrtle Point, where from 5000 hp to 10,000 hp can be developed.

LAKEVIEW, ORE.—The Southern Oregon Water Power Company, recently incorporated with a capital stock of $300,000 by Spokane capitalists, will start work soon, according to press reports, on a $140,000 power plant which will furnish light for Lakeview and other neighboring communities.

MYRTLE CREEK, ORE.—It is reported that negotiations have been completed for the purchase of the plant of the Myrtle Creek Water, Light & Milling Company by J. L. Blaisdell, of Portland. The new owner's plans are said to include the abolishment of the smaller plants and the substitution of transformer substations.

NORTH BEND, ORE.—It is reported that the Coos Bay Traction Company, recently incorporated to construct an electric railway from Roseburg to Coos Bay, will commence work on its line within 60 days. The officers of the company are: G. T. Averill, president; J. H. Somers, vice-president; W. P. Evans, secretary; N. B. Campbell, treasurer; J. H. Robinson, chief engineer.

BUTLER, PA.—A 50-year franchise has been granted by the City Council of Butler to the Pittsburgh, Butler, Slippery Rock & Grove City Railway Company for the construction of a street railway in that city.

FRANKSTOWN, PA.—Appointment has been made of Dodge & Day, 608 Chestnut Street, Philadelphia, as engineers for the power plant to be constructed at Frankstown for the Penn Central Light & Power Company, E. B. Greene, superintendent, Altoona.

McKEESPORT, PA.—It is announced that T. S. Arnold, 1019 Jenny Lind Street, McKeesport, is interested in a gas producer plant proposition, either coal or water gas, the first plant to be constructed in a town of 5000 or 6000 population.

MONTROSE, PA.—Arrangements are being made by the Commonwealth Telephone Company for the construction of new lines to Susquehanna, Hallstead, Great Bend and Forest City.

NEW CASTLE, PA.—The City Council has appointed Messrs. Stritmater, Dunlap and Cukerbraum as a committee to investigate and secure options upon suitable sites for the proposed municipal electric light plant.

WAYNESBORO, PA.—An ordinance has been passed by the City Council authorizing the Bell Telephone Company of this city to place its wires in underground conduits.

WATERTOWN, S. D.—Work has been commenced by the Watertown Light & Power Company on a large new electric generating station.

HALLS, TENN.—It is reported that the Halls Light, Water & Ice Company, of this city, is arranging for the installation of a public service plant.

BEAUMONT, TEX.—It is stated that at a meeting of the City Council on Sept. 6 the application of I. D. Polk for a franchise to cover certain streets of Beaumont for the proposed Beaumont-Port Arthur interurban electric railway line will be granted. The proposed line between the two towns will be about 25 miles long.

[illegible] city.

EL PASO, TEX.—[illegible] directing that all electric light, telephone and telegraph wires within the fire limits be placed in conduits.

HOUSTON, TEX.—It is reported that a contract will soon be let by the William M. Rice Institute, of this city, Dr. Edgar Odell Lovett, president, for a new power plant.

TEXAS CITY, TEX.—The Texas City Transportation Company is

[illegible]

SALT LAKE CITY, UTAH.—It is reported that the Utah Light & Railway Company, of this city, in order to develop an electric lighting and power market in the rapidly growing towns and territories between Salt Lake City and Ogden, will extend its distribution system in Davis County.

SALT LAKE CITY, UTAH.—A meeting was recently held in this city for the purpose of considering the construction of an electric railway between Salt Lake City and Payson. Among those interested in the proposition is Simon Bamberger, president of the Salt Lake & Ogden Railway Company.

SALT LAKE CITY, UTAH.—An application has been filed with the State Engineer by Francis M. Lyman, Jr., of Salt Lake City, for an appro- [illegible] purposes. The application provides for taking the water from the stream about a mile above the main forks of the creek, and it will be piped about 5000 ft. through a wooden stave pipe line and turned back into the creek just above the reservoir. It is expected that 3500 hp can be developed.

SALT LAKE CITY, UTAH.—According to a notice received by the local United States land office, President Taft has approved the withdrawal of four power sites made in the state during the past year as follows: Along the San Rafael, Grand, San Juan and Price Rivers, affecting land for a distance of a quarter of a mile on each side of these streams. The purpose of the withdrawals is said to be to prevent the monopolization of the power sites along these streams and to conserve them in the interests of the people of the state.

ABERDEEN, WASH.—It is reported that J. B. Crary, former manager of the Grays Harbor Railway & Light Company, is interested in the probable construction of an electric line between South Bend and Raymond, on Willapa Harbor, the proposed cost of which is estimated to be about $500,000. The line is to be built with the prospect of its future extension to Grays Harbor, and the promoters of the enterprise will also engage in electric lighting and motor service business.

CHEHALIS, WASH.—A franchise has been granted by the City Council to the Twin City Light & Power Company, Centralia, to construct a street railway over certain streets in Chehalis.

GRANGER, WASH.—A 50-year franchise in this city has been granted to the Pacific Light & Power Company.

TACOMA, WASH.—Advices have been received from Hamilton F. Gronen, chief engineer, Light and Water Commission, 303 City Hall, that bids will be received on Sept. 6 for the construction of a substation in Tacoma for the Nisqually power plant, the estimated cost of which is $104,000.

WALLA WALLA, WASH.—The Pacific Light & Power Company has given a mortgage for $30,000,000, filed for record in Walla Walla County, Wash., to the United States Mortgage & Trust Company, of New York. It is reported that the money is to be employed in building new electric lines, extending existing power plants and lines and acquiring new properties.

WENATCHEE, WASH.—The interests of the Wenatchee Electric Company and the Entiat Light & Power Company, competing organizations in the Wenatchee Valley, have become identified in the purchase of the Valley Power Company, thereby forming one of the largest electrical mergers in Central Washington. The new concern is to be known as the Wenatchee Valley Gas & Electric Company, and will be capitalized at $1,000,000. Arthur Gunn, president of the Wenatchee Electric Company, will become president of the consolidation, and J. H. Stout, president and general manager of the Entiat company, secretary and treasurer. The three plants have a capacity of 6000 hp.

LOGAN, W. VA.—The electric light and ice plant of the Atkinson-White Light Company, of this place, is on the market.

BELOIT, WIS.—The Beloit Home Telephone Company, which is being reorganized at this city, plans for the construction of a new exchange building in which will be installed an entirely new central system.

BURLINGTON, WIS.—It is stated that the Burlington Brass Works, of this city, is planning the installation of electric motors in its shops, the energy for which will be furnished by the Burlington Light & Power Company. Vaughn & Meyer, Milwaukee, are in charge of the plans for improving the company's power system.

MILWAUKEE, WIS.—Arrangements are being made by Albert Trostel [illegible] provision will be made for electric motor drive.

[illegible] each direct coupled to a 250-kw alternating-current generator, will be installed at the new municipal power plant in this city. Plans and specifications are reported to be in the hands of W. G. Kirchoffer, Madison, Wis., the city's engineer.

PORT CREDIT, ONT., CAN.—The Hydroelectric Power Commission, which recently advertised for tenders for the construction of a transformer station building near Port Credit, will, in anticipation of the demand for electrical energy in the smaller towns and cities in the province, commence the erection of transformer stations at various points along its power line which will render this service possible. It is understood that factories and industrial concerns on the Credit River [illegible] struction of a distribution line to Guelph, by way of Acton, and one from Dundas to Waterdown.

GRANBY, QUE., CAN.—Through a recently consummated deal the water power rights pertaining to the Granby Carriage Company and H. Giddings & Company have been transferred to S. H. C. Miner. This transaction gives Mr. Miner control of all of the valuable water power privileges on the river, from the upper dam as far as the Granby Rubber Company's dam.

MONTREAL, QUE., CAN.—The commissioners for the city corporation of Montreal are asking for tenders for lighting the streets and public buildings of the municipality for the ensuing 10 years. In order that no one company will have a monopoly, successful tenderers may light certain parts of the city and not necessarily the whole of it. By this arrangement it is expected that a number of offers will be received. The desire of the Board of Control is that the city shall not necessarily be bound to one company unless it sends in the lowest tender.

PERDUE, SASK, CAN.—A local telephone system is to be installed in Perdue by the Town Council.

GUANAJUATO, MEXICO.—Plans are being formulated by the Guanajuato Power & Electric Company, which is constructing a transmission line to San Luis Potosi, for the construction of a substation at San Felipe, about 35 miles from Guanajuato.

MADERA, CHIHUAHUA, MEXICO.—It is stated that the Mexico Northwestern Rairoad Company expects to install an electric power plant at Madera. It will have a capacity of 4000 hp, and will supply energy for operating the company's large lumber mills and other industrial plants.

PARRAL, CHIHUAHUA, MEXICO.—Press reports state that the Palmillo Mining Company will erect a large electric power plant near the Palmillo Mine for the purpose of generating power for operating the machinery of its mine and reduction mill, power at present being supplied by a local electric light plant.

New Industrial Companies.

THE BELMONT MOTOR VEHICLE COMPANY, of Castleton, N. Y., has been incorporated by H. H. B. Ingalls, A. C. Cheney and O. D. Woodford, all of Castleton-on-Hudson. The new company, which proposes to manufacture and deal in motors, engines, etc., is capitalized at $25,000.

THE MILLS ROTARY ENGINE COMPANY, of Philadelphia, Pa., has filed articles of incorporation. It is capitalized at $100,000, and the incorporators are: F. R. Hansell, Philadelphia; G. H. B. Martin, S. C. Seymour, Camden.

THE MOCKRIDGE CONDENSER, of Newark, N. J., has been incorporated with a capital stock of $150,000 for the purpose of manufacturing the Mockridge condenser, machinery, etc. The incorporators are: G. N. Mockridge, of Belleville; A. W. Mockridge, of Jersey City, N. J., and W. D. Gibby, of Newark, N. J.

THE MONITOR TIME CLOCK COMPANY, of Syracuse, N. Y., has filed articles of incorporation with a capital stock of $25,000. The incorporators are: F. H. Johnson, W. D. Hawley and C. L. Forbes, of Syracuse, N. Y. The company proposes to manufacture and deal in clocks, time registers, etc.

THE MOORE AUTO SKID PREVENTOR COMPANY, of New York, N. Y., has been chartered by F. J. Berry, of Orange, N. J.; E. Lewin and M. Wirth, of New York, N. Y. The company is capitalized at $500,000 and proposes to manufacture motors, engines, automobiles, etc.; also to manufacture devices and appliances for the safety of automobiles.

THE MOTOR COMPANY OF AMERICA, of New York, N. Y., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing motors, engines, motor cars, motor boats, etc. The incorporators are: C. L. Holden, C. L. Scofield, J. H. Hershfield, of New York, N. Y.

THE NECHES ELECTRIC COMPANY, of Beaumont, Tex., has been chartered with a capital stock of $25,000 for the purpose of doing a general electrical contracting business. The company is a consolidation of the Neches Electric Company and the Christopher Electric Company. The officers of the company are: J. C. Christopher, president; T. E. Christopher, treasurer, and R. A. Prather, general manager.

THE NEW YORK EQUIPMENT COMPANY, of Trenton, N. J., has been incorporated by E. H. Bensel, A. J. Trier and W. J. Welsh, all of Trenton, N. J. The company is capitalized at $25,000 and proposes to do general mechanical engineering, also took making and machine work.

[illegible] COMPANY, of New York, N. Y., has been incorporated by E. J. Forhan, G. F. Martin and H. P. Jones, of New York, N. Y. The company is capitalized at $45,000 and proposes to manufacture belting and power transmission machinery.

THE PAUL B. FAUT COMPANY, of Indianapolis, Ind., has filed [illegible] of manufacturing electric lighting and ignition apparatus. The directors are: Paul B. Faut, R. W. Kumler and Walter D. Jones.

THE PENNSYLVANIA MOTOR CAR COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing various kinds of motors, engines, motor boats,

etc. Among the incorporators are: D. Hamilton, A. A. Russell, L. H. Denny, all of New York City.

THE POSITIVE SPARK PLUG COMPANY, of Mineola, N. Y., has been incorporated by Mortimer McKenzie, Paul Weidmann, both of Mineola, N. Y., and James C. Meachen, of Rockville Centre, N. Y. The company is capitalized at $15,000 and proposes to manufacture and sell machinery.

THE RAILWAY IMPROVEMENT COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 by Rufus L. MacDuffie, 30 Church Street, New York, N. Y.; George W. Fairchild, Oneonta, N. Y., and A. H. Carlisle, 74 Broadway, New York, N. Y. The company proposes to do general contracting and electrical work of all kinds and also an electrical and mechanical engineering business.

THE SMITH-MEEKER ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 to do a general electrical engineering and contracting business by Frank D. Smith, Chester G. Meeker and Charles F. Dixon, all of 125 Liberty Street, New York, N. Y.

THE STANDARD VEHICLE COMPANY, of Portland, Maine, has been incorporated with a capital stock of $5,000,000. The company proposes to manufacture and sell engines, machines for the transmission and generation of steam, electricity, etc. C. E. Eaton is president and T. L. Croteau is treasurer, both of Portland, Maine.

THE STEPHENS-CROPLEY COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000 by G. W. Stephens, F. S. Cropley and W. A. Conover, of Chicago, Ill. The company proposes to manufacture vehicles, engines and machinery.

THE TOWER ENGINEERING COMPANY, of Springfield, Mass., has been chartered with a capital stock of $50,000 for the purpose of manufacturing and dealing in machinery. J. H. Sisk, of Buffalo, N. Y., is president and treasurer, and S. J. Griffin, of Springfield, Mass., clerk.

J. H. VALENTINE COMPANY, of Syracuse, N. Y., has been incorporated for the purpose of manufacturing and dealing in motors, engines machinery, etc. It has an authorized capital stock of $20,000, and those responsible for its formation are: John H. Valentine, James F. Sanchez and Charles G. Hanna, all of Syracuse.

New Incorporations.

LIVINGSTON, ALA.—The Livingston Light & Improvement Company has filed articles of incorporation with a capital stock of $5,000, the incorporators being: J. A. McConnell, P. B. Jamison, J. O. Phillips, M. E. McConnell, C. H. Brock and J. W. McBeth.

LITTLE ROCK, ARK.—Articles of incorporation have been filed for the Arkansas and Texas Telephone & Telegraph Company with a capital stock of $3,000. The officers are: A. C. Stuart, president; C. M. Conway, vice-president, and J. E. Richey, secretary and treasurer.

NEW EDINBURG, ARK.—Articles of incorporation have been filed for the New Edinburg Telephone Company by E. T. Atwood, T. E. Mosely, A. J. Hamilton and others.

RED BLUFF, CAL.—The Tehama County Telephone Company has been incorporated with a capital stock of $200,000 to construct and operate a telephone system in Tehama County, the lines to extend southward from Red Bluff through Tehama and Corning, a distance of about 32 miles. J. P. Taft is president and H. P. Andrews, secretary and treasurer.

KIMBERLY, IDAHO.—The Kimberly Telephone Company has been incorporated with a capital stock of $50,000 by W. H. Turner, N. W. Swearinger, W. S. Martin, W. E. Lewis, E. Caliborn, F. E. Bigger and W. F. Breckton.

BEAVERVILLE, ILL.—The Beaver Telephone Company has been chartered with a capital stock of $2,000 by E. C. Regnier, Charles Fortin and S. Francoeur.

CHICAGO, ILL.—Articles of incorporation have been filed by the Adams Generating Company, of Chicago, for the purpose of operating heat, light and power plants. It is capitalized at $50,000, and the incorporators are: R. M. Stroud, M. J. Porter, I. Ryner, all of Chicago.

LITCHFIELD, ILL.—Articles of incorporation have been filed with the Secretary of State for the Litchfield Telephone Company. The company is capitalized at $30,000 and the incorporators are: B. M. Burke, W. R. Hulse, F. W. Burton.

REDFIELD, IA.—Articles of incorporation have been filed by the Redfield Mutual Telephone Association. It has an authorized capital stock of $2,000, and the incorporators are: C. W. Lambe, E. D. Kippling, L. Oxford, Preston Spillers and others.

ST. GEORGE, KAN.—[illegible]
St. George & Flush Telephone Company. It is capitalized at $20,000, and the incorporators are: A. M. Floersch, I. B. Floersch, of Manhattan, and Anton Floersch, Flush, Kan.

NORRISTOWN, PA.—Articles of incorporation have been filed for the Norristown Transit Company with a capital stock of $25,000 for the purpose of building an electric railway in Norristown on Swede Street, Airy Street and Marklay Street to the borough line, returning by the old Swede Road. The incorporators are: Charles E. Ingersoll, president; Penllyn McAllister, of St. Martin's; G. H. Frazer, of Jenkintown; E. B. Smith, of Cynwyd Valley; Gerland Holsman, of Philadelphia, Pa., and H. S. Farquhar, of Bryn Mawr, Pa.

HURRICANE, W. VA.—The Putnam Telephone Company has been incorporated with a capital stock of $5,000 by J. S. Handley and others.

CLIFTON, WIS.—The Clifton Light & Power Company has been chartered with a capital stock of $75,000 by B. W. Utman, James M. Utman and W. H. Barker.

Personal.

MR. THOMAS W. WILKINSON has resigned his connection with the Kansas City Long Distance Telephone Company to accept a position with the Missouri & Kansas Telephone Company.

MR. H. B. SWAYNE, formerly manager of the "new business" department of the Petersburg Gas Company, Petersburg, Va., has accepted the position of contract agent for the Penn Central Light & Power Company, Altoona, Pa.

MR. A. F. W. SCHALKAU, chief engineer of Siemens-Schuckert werke, Berlin, is on a visit to this country, during which he will inspect some of the more important industrial plants employing electric power in their operation.

MR. J. P. ALEXANDER, who for the past five years has been connected with the Wheeling Traction Company as purchasing agent, resigned recently to take an electrical engineering position with the General Electric Company, at Pittsfield, Mass.

MR. MENO KAMMERHOFF, director of the German Edison Storage Battery Company, Berlin, is on a visit to this country. A treatise on the storage battery from the pen of Mr. Kammerhoff will be published in several months by Julius Springer, the leading publisher in Germany of technical books.

MR. ROBERT W. ADAMS, who for the past two years has been connected with the transformer engineering department of the General Electric Company, at Pittsfield, Mass., has been transferred to the district office of this company at 84 State Street, Boston, Mass., as sales engineer in the power and mining department.

MR. ERNEST LUNN is again in the service of the Commonwealth Edison Company of Chicago as battery engineer for the operating department. Mr. Lunn resigned last winter to form a connection with the Firestone Tire & Rubber Company, of Akron, Ohio, but he found that electrical work was more to his liking, and he has now returned to his old position.

WILLIAM G. DAVIS, formerly manager of the New York office of the Westinghouse Storage Battery Company, the factory of which company was destroyed by fire last February, and the property subsequently sold, is now attached to the New York office of the United States Light & Heating Company as storage battery sales engineer with headquarters at 30 Church Street.

MR. C. E. WHITTLESEY, treasurer of the McGraw Publishing Company, was the guest of honor at a luncheon at the Engineers' Club, New York, on Aug. 26, tendered by his associates to mark the fiftieth anniversary of his entry into business life. Mr. Whittlesey began his connection with the publishing business in 1890, when he became treasurer of [illegible]

MAJOR THOMAS H. REES, U. S. A., the United States Government engineer stationed at the port of Chicago, has been transferred from that post and detailed for the next year at the Army War College in Washington. Major Rees, who has been succeeded by Major Charles S. Bromwell, until recently the Government engineer at Milwaukee, has been prominent in the discussions relating to harbor improvement in Chicago. Major Rees [illegible] spoke before the Electric Club at Chicago [illegible] months ago.

Obituary.

[illegible]

Trade Publications.

CONCRETE PILES.—Much interesting information relating to the use of concrete for building foundations is given in a 160-page catalog of the Raymond Concrete Pile Company, of New York.

ENAMELED WIRE.—The American Electric Fuse Company, Muskegon, Mich., has issued in folder form bulletin No. 311, containing a reprint of an article dealing with enameled-wire windings.

POLYPHASE INDUCTION MOTOR.—A leaflet issued by the Holtzer-Cabot Electric Company, Brookline, Mass., describes a line of small polyphase induction motors. The publication is designated as bulletin [illegible]

REFLECTORS.—Steel reflectors designed for use with tungsten lamps for street lighting service are briefly described and listed in a [illegible] Lake and Desplaines Streets, Chicago.

ELECTRIC VEHICLES.—Convincing arguments relative to the advantage of electric trucks in comparison with horse-drawn vehicles are

given in a booklet issued by the General Vehicle Company, Long Island City, New York.

ORGAN BLOWERS.—The Kinetic Engineering Company, Baltimore Avenue and Sixteenth Street, Philadelphia, Pa., has issued a neatly-prepared bulletin devoted to organ blowers arranged for operation by means of electric motors.

[illegible] use on planers to permit a rapid reversal and to avoid troubles usually present in such operations is the subject of booklet No. 2 issued by Cecil E. Lugard & Company, Chester, Pa.

TELEPHONE POWER PLANT EQUIPMENT.—Switchboard equipments, motor-generator sets, mercury-arc rectifiers; dynamotors, batteries and other apparatus used in telephone power houses are described in Bulletin 1008 of the Western Electric Company.

CONVEYING MACHINERY.—The C. W. Hunt Company, West New Brighton, New York, has issued catalogue No. 102, giving much information relating to coal-handling and hoisting machinery, conveyors, industrial railways, electric cranes, and steam hoists.

LIGHTING FIXTURES.—Catalog No. 9 of the F. W. Wakefield Brass Company, Vermillion, Ohio, is devoted to electric lighting fixtures, designed with particular reference to their use with tungsten lamps. The fixtures are illustrated, listed and briefly described.

ELECTRIC FURNACES.—Verdon Cutts & Hoult, Town Hall Chambers, 97 Fargate, Sheffield, England, have issued in bulletin form an illustrated article describing an electric furnace for conducting the well-known Bessemer processes for converting pig iron to high-grade steel.

ADJUSTABLE SPEEDOMETERS.—Direct current motors of the adjustable-speed type in which the field strength is varied by altering the reluctance of the magnetic path are described in a folder being distributed by the Reliance Electric Engineering Company, Cleveland, Ohio.

METERS.—Bulletin No. 11, issued by the Dongan Electric Manufacturing Company, Albany, N. Y., is descriptive of its new line of D'Arsonval type milli-voltmeters, milli-ammeters, ammeters and voltmeters which are manufactured in a variety of styles for testboard central-station, isolated plant and storage battery installations. Bulletin No. 12 describes the Dongan company's complete line of electro-magnetic portable and switchboard instruments.

WATER-WHEEL GOVERNORS.—The Woodward Governor Company, Rockford, Ill., has commenced the publication of a quarterly magazine called *Power Control*, the first number of which appeared in August. The publication contains 16 pages, is artistically printed and designed, and contains matter interesting and instructive to electric plants, textile, cotton and paper mills, aend other factory owners. The Woodward Governor Company began business in 1870 in small rented quarters, and in 1873 moved to a more pretentious two-story frame building. Although business grew steadily from the start, it received a strong impulse when Mr. E. E. Woodward, the present manager, took control in 1885, shortly after which date it was necessary to drop all side lines and devote entire attention to the manufacture of Woodward water-wheel governors. In 1893 it was found necessary to move into a still larger building, and in 1909 the present building was erected, which is five stories high, 140 ft long, 64 ft. wide and of reinforced concrete throughout. In addition there are two smaller buildings at present rented. There is also a large steam plant for heating and power and a hydroelectric power house supplying electric energy for industrial and lighting purposes, the latter being self-regulating and requiring no attention from the engineer except when starting and stopping. No voltage regulator is used, but a type D Woodward governor maintains the voltage constant within 1 per cent of the normal without any other regulating device.

BUSINESS NOTES.

THE ELMER P. MORRIS COMPANY has moved to 88 West Street from 90 West Street, New York.

THE VULCAN ELECTRIC HEATING COMPANY, 542 West Jackson Boulevard, Chicago, have recently acquired the entire stock and good will of the Del Sales Company, whose business it has taken over.

EXHIBIT OF MOULDED ELECTRICAL INSULATION.—During the recent annual Springfield, Mass., "exhibition week," much attention was attracted by a window exhibit by the Dickinson Manufacturing Company, of that city, which comprised a large collection of molded "sternite" and "Bakelite" forms, and also samples of rubber substitutes. The interest shown was due largely to the unexpectedly large number of applications of electrical insulation which the exhibit presented to observers.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Third annual convention Anniston, Ala., Nov. [illegible] and 23, 1910.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, Engineering Societies Building, 29 West 39th St., New York. Next meeting (semi-annual) Chicago, Nov. 14, 15 and 16, 1910.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 158 West 176th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

AMERICAN STREET & INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Next meeting, Atlantic City, N. J., Oct. 10-14, 1910.

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, John W. Corning, Boston Elevated Railway Company, Boston, Mass. Next meeting, Atlantic City, N. J., Oct. 10-14, 1910.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Next meeting, Atlantic City, N. J., Oct. 10-14, 1910.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, Little Rock, Ark.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, 509 Perry-Payne Building, Cleveland, Ohio.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago. Next meeting Boston, Mass., June, 1911.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, George B. Colegrove, 960 Monadnock Building, Chicago. Next annual meeting, [illegible] Oct. 4, 5, 6 and 7, 1910.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass. Annual meeting, Hotel Frontenac, Thousand Islands, N. Y., Sept. 6-8, 1910.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allen H. Royce, 48 King St., W., Toronto, Ont.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Indianapolis, Ind. Next meeting, Indianapolis, Ind., Sept. 22, 1910.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Acting Secretary, F. D. Morris, 323 Hagerman Bldg., Colorado Springs, Col. Next meeting, Glenwood Springs, Sept. 21, 22 and 23, 1910.

EASTERN STATES INDEPENDENT TELEPHONE ASSOCIATION OF PENNSYLVANIA [illegible]

ELECTRIC VEHICLE AND CENTRAL STATION ASSOCIATION. Secretary, H. T. Sands, 139 Pleasant St., Malden, Mass.

ELECTRIC CLUB, Chicago. Secretary, F. S. Hickok, 824 Marquette Building, Chicago. Meets every Wednesday noon, 303 Wabash Ave.

ELECTRIC CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Next meeting, Albany, N. Y., Jan. 17, 1911.

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P Vose, Marquette Building, Chicago. Next annual meeting, Chicago, Nov 3, 1910.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Credit Association). Secretary Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York Next meeting, New York City, Oct. 5, 1910.

ENGINEERING SOCIETY OF WISCONSIN. Secretary, W. G. Kirchoffer, 31 Vroman Building, Madison. Wis.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, C. H. Lembower, Reading, Pa.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., April [illegible] and [illegible], 1911.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

[illegible] OF GREATER NEW YORK. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntington, Ind.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month..

[illegible] Secretary

Frank P. Foster, Corning, N. Y. [illegible] Rochester, N. Y., Sept. 6, 7, 8 and 9, 1910.

INTERNATIONAL ELECTROTECHNICAL [illegible] body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

IOWA INDEPENDENT TELEPHONE [illegible] Secretary, W. T. This, 208 Des Moines Life Building, Des Moines, Ia. Annual meeting, second Wednesday in March each year.

IOWA STREET & INTERURBAN [illegible] Secretary, [illegible] Dubuque, Ia. Next meeting, Dav[illegible]

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Kansas City, Kan., Sept. 27 and 28, 1910.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October, each year.

MAINE ELECTRICAL ASSOCIATION. Secretary, Fred D. Gordon, Auburn, Maine.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. P. Biggs, Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, B. W. Cowperthwait, Faribault, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Railway & Light Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & [illegible] ASSOCIATION. Secretary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Schweer, Windsor, Mo. Next meeting, St. Louis, May, 1911.

NATIONAL ARM, PIT & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day 27 Pliny St., Hartford, Conn. Next meeting, New York, March, 1911.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Fred P. Vose 1313 Marquette Building, Chicago.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, [illegible] Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, L. D. Gibbs, 39 Boylston St., Boston, Mass.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Next meeting, Nov. 18 and 19, 1910.

OKLAHOMA PUBLIC UTILITIES ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla. Next meeting, Oklahoma City, Sept. 30 and Oct. 1, 1910.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next reunion, Chicago, Sept. 8, 9 and 10, 1910.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Building, Chicago, Ill. Annual meeting, [illegible], Oct. [illegible] and [illegible], 1910.

PACIFIC COAST ELECTRIC VEHICLE ASSOCIATION. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal. Next meeting, San Francisco, Sept. [illegible], 1910.

PACIFIC COAST ELECTRICAL SHOW, San Francisco, Cal., week beginning Sept. 17, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa. Next meeting, Glen Summit Springs, Pa., Sept. 14, 15 and 16, 1910.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

PITTSBURG ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburg, Pa. Meetings, fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. [illegible], Hudson, S. D. Next meeting, Redfield, S. D., Jan. 11 and 12, 1911.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1911.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Lena M. Owen, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester Center, Vt.

WASHINGTON ELECTRICAL SHOW, October or November, 1910.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S Boyd, 145 Monroe St., Chicago, Ill. Next meeting, Omaha, Neb., Octo[illegible]

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. [illegible]

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRICAL ASSOCIATION. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association. Secretary, John S. Allen, Lake Geneva, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED [illegible]

Conducted by W. F. Bessing, [illegible]

13,145. TERMINAL FOR ELECTRIC CABLES; C. W. Davis, Edgewood, Pa. App. filed May [illegible] [illegible] entry of moisture by means of a plug or thimble having a conducting [illegible] contact thereon with a flaring leakage preventing petticoat.

13,146. TELEPHONE TRANSMITTER; W. E. Harkness, East Orange, N. J. App. filed Aug. 23, 1910. Granular transmitter of the solid back type, the chamber [illegible] diaphragm and the fixed electrode is connected to the periphery of the vibrating cup by a mica diaphragm.

967,908. ELECTRIC FURNACE; J. Harden, London, England. App. filed Dec. 7, 1909. A composite terminal plate in contact with the charge faced with refracting material which is heated by the passage of the current and means for cooling the metal portion of the plate.

967,909. ELECTRIC FURNACE; J. Harden, London, England. App. filed Dec. 7, 1909. Heats the charge by an electric arc and uses a composite terminal plate in the furnace wall made hollow for cooling and faced with a refractory material and an intervening laying of carbonaceous material.

967,932. ELECTRIC SWITCH; J. Keefe, Boston, Mass. App. filed May 6, 1909. A two-push-button switch including a pivoted lever [illegible]

967,959. SECONDARY CLOCK; M. W. Obermiller, New York, N. Y. App. filed April 27, 1910. Used with current sent in one direction or in opposite directions. Makes use of an electrical magnet, a movable armature and escapement wheel and anchor, a crank and a wire between the crank and armature.

967,996. METHOD OF EXTRACTING OR ELIMINATING SULPHUR, PHOSPHORUS AND OTHER IMPURITIES FROM COAL, ORE, ETC.; L. L. Summers, Chicago, Ill. App. filed April 8, 1909. For eliminating sulphur from coal by treating the material in a finely divided condition by chemicals for oxidizing in a suitable electrolyte and then reversing the polarity of the current.

967,997. ELECTRICAL FITTING; F. A. Swan, Cliftondale, Mass. App. filed June 28, 1907. Pendent lamp socket with a button inside of the socket for relieving the strain from the terminals.

968,007. COHERER FOR WIRELESS TELEGRAPH SYSTEMS; C. Walker, Knoxville, Tenn. App. filed May 5, 1909. Compensates for temperature variations, having a screw adjustment for terminals sealed in a tube and magnetically controlled for maintaining the adjustment.

[illegible] base and [illegible] base, to close the space between the terminal attaching device and having flexible connections with the permanent attaching devices.

[illegible] Heany, East Newark, N. J. App. [illegible] through a plurality of

chambers, with an arc centrally located, the volatile products being withdrawn and the material discharged from the lowermost chamber, having an electrical heater.

968,1[illegible]. SECONDARY BATTERY PLATE; C. Bus[illegible], New York, N. Y. App. filed Oct. 27, 1909. The grid is provided with perforated bosses extending on both sides and a thin sheet has perforations registering with the bosses.

968,145. APPARATUS FOR TREATING GAS ELECTRICALLY; C. L. Gerrard, Columbus, Neb. App. filed March 4, 1907. The electric discharge is moved through the gas for the production of the nitrogen oxids from air.

968,147. ELECTRIC LAMP SOCKET; J. H. Goehst, Chicago, Ill. App. filed April 4, 1910. For signs, the socket being made into sections of porcelain on opposite sides of the supporting sign board.

968,154. PRIMARY BATTERY; C. E. Hite, Burlington, N. J. App. filed Aug. 16, 1906. Divided into a plurality of separate cells. Porous plates are interposed between the electrodes of each couple and a salt solution is contained on one side of the plate and an iron chlorid solution on the other side.

968,174. INCLOSED ELECTRIC FUSE; B. S. Luther, Newburyport, Mass. App. filed April 18, 1910. Contains an indicator wire adjacent to the fuse strip.

968,179. TROLLEY RETRIEVER AND TAKE-UP DEVICE; P. D. Milloy, New York, N. Y. App. filed Dec. 5, 1904. Actuated by compressed air with a take-up for the trolley cord so that the arm may rise and lower gradually, but if the trolley leaves the wire this throws in the compressed-air mechanism which draws down the trolley arm out of the way of the obstructing devices.

968,205. APPARATUS FOR COATING ELECTRIC WIRES; O. C. Spurling, Chicago, Ill. App. filed Sept. 27, 1907. Enameling machine with a fuse chamber at the top, a discharge pipe, a baffle plate near the discharge pipe and a water spraying device.

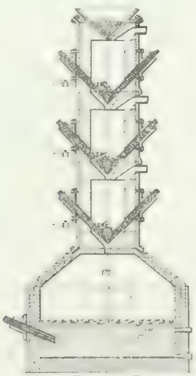
968,208. MOBILE CIRCUIT CLOSER; F. E. Town, New York, N. Y. App. filed Dec. 5, 1906. Door lock including a circuit closer actuated by an electromagnet. A block of magnetic material is arranged between the poles of the magnet and a movable piece of magnetic material acts to shunt the magnetism to close the circuit closer, the movable piece consisting of an iron tube floating on mercury which it displaces to connect the terminal.

968,217. PERMUTATION LOCK SWITCH; J. T. Whalen, New York, N. Y. App. filed Feb. 11, 1909. A latch disk, a plurality of pairs of contacts actuated by the rotation of the disk with a plurality of rotary tumblers to engage the disk and hold it from rotation.

968,231. ADJUSTING MEANS FOR THE REGULATION OF THE INTENSITY OF SOUND FOR EAR-PHONE RECEIVERS; R. J. Barber, Belemont, Mass. App. filed Oct. 26, 1909. Makes use of an adjusting ring and a stop for varying the extent of the movement of the cap holding the diaphragm.

968,247. TROLLEY GUARD; F. L. Lucas, Winburne, Pa. App. filed Feb. 28, 1910. Combined guide wheel and pivoted guard carrying a supplementary wheel, forming a double wheel trolley.

968,261. FLUSH ATTACHMENT PLUG RECEPTACLE; C. D. Platt, Bridgeport, Conn. App. filed April 25, 1910. The terminals are unattached [illegible] operative position.



968,079.—Electric Furnace.

968,[illegible] ELECTRICAL POWER TRANSMISSION; J. G. P. Thoma[illegible] [illegible] App. filed [illegible] See patent [illegible] The prime motor and two dynamos are mechanically interconnected through gearing so that the speed of its machine is determined by the speeds of the remaining two.

968,310. AUTOMATIC CUT-OUT; V. G. Apple, Dayton, Ohio. App. filed Dec. 21, 1908. A circular iron-clad electromagnet carrying a low-resistance coil and a high-resistance coil to prevent reverse flow from the storage battery to the dynamo when the dynamo voltage drops below that of the battery.

968,318. FUSE BOX; J. W. Bird, St. Louis, Mo. App. filed April 21, 1910. For electric railways with means for supporting supplies of fuse including a movable fuse carrier from which the fuse is discharged and delivered automatically by means of an operating lever [illegible]

968,358. ADJUSTMENT MICROMETER FOR SPARK COILS; E. B. Jacobson, Pittsfield, Mass. App. filed Nov. [illegible] An adjustable contact point on a movable [illegible] which can be removed and [illegible] an indicator for indicating the correct adjustment of the point

968,395. SELF-CLEANING ELECTRICAL PROTECTIVE APPARATUS; F. R. Parker, Chicago, Ill. App. filed July 31, 1908. An arrester with electrodes which are separated upon an excess of current by means of electrothermal mechanism, the electrodes being [illegible]

968,[illegible] TELEPHONE SYSTEM; [illegible] Patt[illegible], Albany, Ore. App. filed April [illegible], 1909. Operated without a central station over a single wire. Makes and brakes the main line and closes the local circuit, the closing and braking of the local circuit actuating a step-by-step mechanism which rotates an insulating drum controlling contacts for a single circuit.

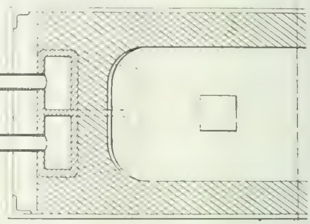
968,402. LIGHTNING ARRESTER; J. E. Petree, Richmond, Mo. App. filed Dec. 17, 1909. For telephone switchboard for grounding a series of contact either together or individually by means of a series of individually movable switch levers, which can also be simultaneously moved.

968,405. LIGHTNING ARRESTER; W. E. Phelps, Colebrook, Ohio. App. filed Feb. 16, 1910. For telephone exchanges in which a wire extends across the conductor and is connected with the ground and a lever is connected with the wire for drawing it tight to hold the conductors in temporary engagement.

968,4[illegible]. HIGH-TEMPERATURE ALARM; W. G. Pierce, Kirkwood, Mo. App. filed Nov. 4, 1909. Thermal fire alarm control in which the contacts are urged together by a coil spring and a fusible material between the coils normally prevents the contraction of these springs.

968,407. MANUFACTURE OF FILAMENTS FOR ELECTRIC LAMPS; F. J. Planchon, Paris, France. App. filed July, 5, 1907. For metallic films. Forms a compound of an acid of the metal and an albuminoid and treats the compound with a weak acid solution.

968,420. DYNAMO-ELECTRIC MACHINE; H. G. Reist, Schenectady.



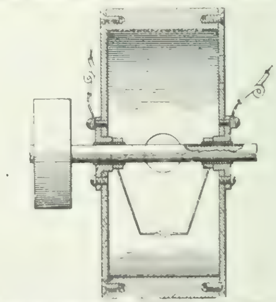
9[illegible].—Electric Furnace

N. Y. App. filed May 13, 1909. For short-circuiting devices of induction motor including a set of collector rings, brushes on pivoted brush-holders, the latter being actuated by reciprocating shifting rods with hooks and engaging the brush holders and actuated by the handle.

968,441. ELECTRIC HEATER COMBINATION; J. I. Ayer, Cambridge, Mass. App. filed Jan. 13, 1910. A heater with a flat top plate having the electrical resistance on the under side together with utensil to be heated having flanges on the bottom for retaining the parts with sliding engagement.

968,448. ELECTRIC FUSE TESTER; J. H. Cary, Portland, Maine. App. filed June 18, 1909. A containing box with a battery and bell in circuit with a pair of electrodes which are bridged by the fuse when being tested.

968,466. ELEVATOR SIGNALING APPARATUS; R. A. Griswold and J. Zang, Seattle, Wash. App. filed June 29, 1909. A plurality of [illegible] and shafts with lamps in each which are automatically



[illegible].—Apparatus for Treating Gas Electrically

lighted by the elevator as the terminal of the shaft is approached by the elevator. Any one elevator lights the lamps of the other elevators when near the end of the route.

968,468. CIRCUIT CONTROLLER RETARDING DEVICE; E. A. Halbleib, Rochester, N. Y. App. filed Dec. 17, 1909. Retarder for circuit closers consisting of a dash pot connected to a lever which carries a roller which engages an irregular cam on the circuit closer.

968,469. BURGLAR ALARM; S. Hambourger, Cleveland, Ohio. App. filed June 30, 1908. A bureau has an opening in the top in which a [illegible] closes a circuit, so that an alarm is sounded when the box is depressed or tampered with.

968,484. TELEPHOTOGRAPHY; O. O. Kruh, Schenectady, N. Y. App. filed Nov. 19, 1907. A luminous tube with a light transmitting window rendered luminous by passing a current through the tube together with magnetic means for shifting the path of the current so as to vary the intensity of the light shining through the window.

968,486. AUTOMATIC GAS LIGHTER; J. C. Landes, Collegeville, Pa. App. filed Feb. 23, 1907. Automatic gas lighter in which the movable members are sealed within the top of the casing to prevent leakage of the gas, and the burner is automatically lighted through the operation of a float.

968,492. ELECTROLYTIC CELL; P. McDorman, Dayton, Ohio. App. filed Dec. 27, 1909. Electrolytic cell for decomposing salt. Includes a vessel containing a plurality of electrodes between which the liquid flows with plates above and below permitting the fluid to converge and diverge as it flows between the plates and while the electric current is acting thereon.

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THE WIRELESS SITUATION.

It is the usual fate of colossal inventions to pass through a wretched and ill-starred youth before winningg the place that is their due. Fate cannot block their progress, however, for any long period, nor deny to them ultimate greatness. Wireless communication is a case in point, in which the vicissitudes of early life have been even more strenuous than usual. A decade of technical success has brought it to no definite place in the commercial world, and has even left it with an evil odor of fraud hanging about it, that can be dispelled only by years of effort. It is only a few months since one wireless company cut down its capital stock to avoid drowning in its own pool, so to speak, and the officers and agents of another were indicted for reputed gross frauds in their desperate stock selling campaign. It is not too much to say that no important invention has ever been the victim of more reckless and culpable exploitation, or has made less commercial returns for a large expenditure of capital. It is surely a melancholy outcome for 10 years of persistent effort, and of real progress so far as scientific advances are concerned. But the important thing is not past misery, it is rather the chance of relief; and while it is never easy to forecast the future, it is absolutely safe to say that methods capable of sending messages even now over nearly a third of the world's girdle are foreordained in the fullness of time to play a great part in the world's work.

The long period of flamboyant exploitation must definitely end before this comes to pass. When wireless companies can definitely state their net earnings in hard cash, instead of counting them up in rainbow gold for payment at the Greek Kalends, the public will begin to have loyal and effective faith in them. The time is now here in which sane conservatism is necessary if the wireless business is to take the place that is its due; and lest we be misunderstood as doubting this place, we may without hesitation say that we believe it will be a very splendid one. It will be no long time before the words flashed out in New York or London will come echoing faintly back from the antipodes ere the finger that sent them has been lifted from the key, even as the quivers of an earthquake or the air waves from a tremendous eruption bear back and back again the story of their beginnings. Within a much less period there will be no spot on land or sea whence a call for help may not go up in case of need and be heard and answered. The first work to be done is to cover the ocean by a wireless network that will bring every sail within cry of land. At present in the great lanes of sea travel a liner is practically all the time within touch of port, but it is very generally only via one or more intervening ships, while in the breadths of the waters there are vast spaces where a ship could lose herself as completely as a caraval of five centuries ago.

Then there is besides very important commercial work to be done coastwise and on land, less startling and gigantic than the conquest of the oceans, but just as important and more re-

munerative. There is a wide field of public and private business over relatively short distances which is now almost untouched. The problem of tuning seems now to have been pretty well solved, at least for those cases in which great sending energy is not demanded. Hence there need be little interference in short-distance work, and there seems to be no good reason why wireless telegraphy, and for that matter telephony, should not be soon in quite regular and commonplace use wherever a wire connection may be inconvenient, or too costly. There will be a revolution worked in communication when one can, for example, sit quietly on his yacht or in his country house, and telephone his wandering friends likewise equipped, but that revolution is impending. The methods and apparatus of wireless communications are not perfect yet, but they are quite good enough for covering a field of work much greater and more varied than has been yet attempted. But the one thing necessary to secure this outcome is for the companies engaged in wireless work to quit fighting and abusing each other, to stop wasting time and money on merely sensational stunts, and to get down to hard work in the building and installation of commercial equipment. There is even now business enough within easy reach to give every legitimate wireless concern a fair show for a decent and profitable return on all the real money invested in it. There is a good chance for much greater things in the near future if we read the signs of progress aright, but it is time to quit fooling and to get down to hard work and solid business. The work of development is now in many and competent hands; the art is of great and demonstrated usefulness, and it only remains for it to recover from the present sorry situation. Wireless has been sowing its wild oats too long; it is time now for repentance and reform.

AN ELECTRICAL ASPECT OF THE RECENT CLOAKMAKERS' STRIKE.

On Sept. 2 the great strike of 70,000 garment workers in New York City terminated in an agreement signed by counsel on behalf of the disputants. This conflict between employers and employees lasted nine weeks, and is said to have rendered 70,000 workers idle, or to have involved a loss of more than 500,000 worker-weeks. But much more notable than the industrial loss, in this case, have been the issues involved. The issues have been of great sociological importance, particularly in relation to public health, public spirit, and the utilization of electric power in industry. It has long been notorious that in the distribution of labor on contract garment working in New York there have been many incidental abuses. Principal among these was the subcontracting, whereby work is let out to individuals at very low wages. The system of underbidding thus fostered led inevitably to the execution of this work, at its lowest levels, in dirty and unhealthy rooms, where disease germs could readily attach themselves to the garments, ready for subsequent communication to the future purchaser.

The avowed purpose of the strikers was not only for an abolition of the sweat-shop conditions, but also for a closed shop. The abuses of a closed-shop system are not the same as those of a sweat-shop system, but they may be equally great. To many of the workers, however, the exclusion of the one appeared to involve the existence of the other. Upon complaint of the employers over certain destructive disorders an injunction was secured from a New York State Supreme Court in which it was ruled that a strike called to demand the closed shop was illegal as being in restraint of trade. An agreement was finally reached on the "preferential union shop," a plan which seems to offer the best features of the closed shop to the exclusion of its worst features. How this will work out in practice remains to be seen. The principal clause, however, has been the abolition of sub-contracting within the shops, together with the establishment of sanitary, arbitration and grievance boards. If these provisions can be maintained, sweatshops will disappear.

A prominent clause in the agreement was that of "free electric power" in the shops. This is a question of great importance and perhaps is the strategic key of the situation. It recalls the history of many another industry in which engineering has revolutionized conditions. Thus, in knitting, weaving, spinning, etc., the work was originally carried on at the artisan's home, either by hand, or by hand-driven tools. With the advent of steam power, hand workers could no longer compete with factory workers using large power machines. In each case home work ceased and was replaced by organized industry in a factory grouped around a power nucleus. Garment working has been one of the last industries to be evicted from the living-room of the artisan. The development of electrically-driven sewing machines in factories has, however, made the home work increasingly difficult and unremunerative, so that it has only needed a severe industrial disturbance, such as has recently transpired, to give a quietus to the miserable remains of competition between home work and factory work. The result is a distinct advance for society at large, and a step forward for electrical power distribution. The garment workers, as a class, will be promoted and benefited, although many competitors for admission into its ranks, who formerly secured a miserable connection with it, will be forced out into competition in other activities.

THE CONSTANTS OF CABLES.

In the solution of problems relating to the electrostatic capacity and self-inductance of concentric cables, it is desirable to keep in mind that the capacity of the cable considered as a condenser is directly proportional to the conductance of the dielectric, while the inductance is proportional directly to the resistance of the dielectric. It is evident, therefore, that from a knowledge of the resistance of the dielectric one can readily calculate both the inductance and the capacity. The formulas for expressing the resistance of the dielectric of a concentric cable are quite simple, but when an eccentricity exists, the modified formulas become very complicated. In an article in these columns (Aug. 25) Mr. Mayo Dyer Hersey described a simple approximate method for calculating the resistance which gives fairly accurate results when the eccentricity does not exceed certain limiting proportions. The method described is interesting not only on account of the results obtained, but even more so by reason of the reversal by the author of the usual scheme for deriving approximate formulas. Instead of obtaining initially the accurate complicated formulas and then discarding certain elements as being of "higher order" and therefore, of minor importance, the author assumes initially the existence of certain physical relations which are only approximately true, and

derives exact simple formulas for expressing their relations. In the case chosen, the method used is well justified because the results obtained differ inappreciably from the true results, and the exact error can readily be determined and allowed for. However, as a general method of solving complex problems, danger lies in applying any scheme involving the assumption of relations which do not exist. One is very apt to lose sight of the limitations and thereby obtain solutions which have no direct bearing upon the true conditions. Only in cases where the errors can easily be determined should a person use the general method of deriving approximate equations as described by the author.

ELECTROMAGNETIC MASS.

The question, "Does the mass of a body vary with its speed?" forms, in substance, the subject of an article which appeared a few months ago in the *Revue Générale des Sciences.* A reply to this question, in the negative, has more recently been published (*Engineering,* June 11) by Prof. V. Dwelshauvers-Dery. It may be of interest to our readers to learn of this discussion, and know of the views on the subject, without attempting to enter into the matter very deeply. Since the days of Newton, mechanical science has recognized the properties of inertia and of mass in all bodies. This property may be described and defined in two statements: First, a body is powerless to alter its velocity in the absence of impressed moving forces; and, second, a free body accelerates in the direction of, and in proportion to, any impressed moving force, no matter what its existing velocity may be, or the number and direction of simultaneously impressed moving forces. The first of the above two principles may be defined as the principle of inertia in matter, since it means that everybody is inert so far as concerns the power of originating motion. The second principle may be defined as the principle of acceleration and of mass, because it deals with the amount of acceleration that an impressed force will produce in a body. The principle of inertia, and the principle of constant mass, have satisfactorily explained the phenomena of moving bodies from Newton's time down to the present day, within the limits of observational precision, whether the moving body was a falling apple, or whether it was a revolving planet. The origin of mass, or why a given force produced a definite acceleration in a body, has not been known; but whatever the nature of mass might be there was no good reason to suspect that it differed with the velocity of the body. In recent times, however, physicists have brought to light some remarkable facts concerning the motion of electrified bodies.

A moving electrified body has the local properties of an electric current, and the strength of the equivalent current is the product of the electric charge and of the linear velocity. Electrical workers are familiar with the facts that the magnetic energy of an electric current varies as the square of the current, and that a current possesses inertia of self-induction, or will not change unless work is done and electromotive force applied. Applying these facts to the case of the moving electrified body, the magnetic energy of this body will vary as the square of its velocity, and the body must possess an inertia of self-inductance whereby it will not change speed unless work is done and force applied to it. There can be no doubt that a moving electrified body has electromagnetic inertia, and has electromagnetic mass, owing to its electrification. Moreover, there can be no doubt that this electromagnetic inertia and mass obey, broadly speaking, the Newtonian laws of mechanical inertia and mass. But the amount of electromagnetic inertia that a body, say, a charged pith-ball, can possess by reason of the most powerful electric charge that can practically be given to it is so small by comparison with the mechanical mass of the pith-ball that it is not in the same class. The proposition of a minute extra mass in a charged body due to its charge remained then a mere insignificant detail of speculative interest, until recent experiments pointed to the possibility of the sub-division of the atom of matter into numerous much smaller entities called corpuscles, all inherently electrically charged.

The corpuscular hypothesis of matter is not yet accepted beyond the provisional stage. If, however, we assume the corpuscular hypothesis, then it appears to follow of necessity that the electromagnetic mass of a body, instead of being a very minute quantity, present or not according as the body was charged or discharged, is always present inherently, and is large enough to account for all of the mechanically observed mass. In other words, if we accept the electric corpuscular theory of matter, we seem practically compelled to banish the existence of the hitherto unexplained mechanical mass of matter, and to substitute therefor the compulsory existence of electromagnetic inertia. A material particle absolutely at rest, on this theory, has abundant electricity but no magnetic field. A movement of the particle sets up both a current and a magnetic field. This requires work and force application. During uniform motion, the magnetic field is steady around the moving particle. Stopping the particle releases the energy in this magnetic field. The adoption of the electric corpuscular theory of matter thus turns mechanical mass out of the doors of thought, and brings in electromagnetic mass, which becomes explained in terms of magnetism and electricity, but, as yet, no further.

The Newtonian principle of inertia is quite satisfied on the electromagnetic theory, but, strange to say, the principle of constant mass is not satisfied beyond a first approximation. It has been demonstrated that according to known electromagnetic laws, the mass of a body on the electromagnetic theory would be constant, for all practical purposes, at ordinary velocities; but that at very great velocities, the mass would increase, and that at the velocity of light, the mass would be infinite; so that if a body possessed this great velocity it would not accelerate under a force directed along its velocity, although it would accelerate under a force directed across its path. Consequently, the acceleration of such a body would not be in line with the resultant of a number of simultaneously applied forces. This proposition would only be very nearly true at low speeds. It is not yet possible to decide on experimental grounds between the old Newtonian theory of constant mass and the new theory of variable electromagnetic mass, because the velocity has to be so very great before any appreciable quantitative difference is involved between them. While to the engineer the question is of no practical importance, to the physicist the question is of great importance. Unfortunately for these, it is hard to experiment with [illegible] of light

Organization of the Electric Vehicle Association of America.

Duly incorporated under the laws of the State of New York the Electric Vehicle Association of America was formally organized at a meeting held in the office of Mr. Arthur Williams, of the New York Edison Company, on Thursday, Sept. 1. An account of the preliminary meeting at which the organization of the Electric Vehicle Association of America was discussed appeared in our issue of June 16. The object of the association is to promote the adoption and use of electric vehicles for business and pleasure purposes. Three classes of membership are provided: active, associate and honorary, and the by-laws provide for branches in centers of local activity. At the meeting on Sept. 1 the constitution and by-laws prepared by a committee appointed at the preliminary meeting were adopted and officers elected as follows: President, Mr. William H. Blood, Jr., of Stone & Webster, Boston, Mass.; vice-president, Mr. Arthur Williams, New York Edison Company, New York; treasurer and assistant secretary, Mr. Harvey Robinson, New York Edison Company, New York; secretary, M. C. E. Firestone, Columbus Buggy Company, Columbus, Ohio. The board of directors is composed of the following: Messrs. H. H. Rice, Waverley Company, Indianapolis, Ind.; F. W. Smith, United Electric Light & Power Company, New York City; P. D. Wagoner, General Vehicle Company, Long Island City, N. Y.; Louis Burr, Woods Motor Vehicle Company, Chicago, Ill.; F. L. Dyer, Edison Storage Battery Company, Orange, N. J.; J. T. Hutchings, Rochester Railway & Light Company, Rochester, N. Y.; Louis Ferguson, Commonwealth Edison Company, Chicago, Ill.; W. W. Freeman, Edison Electric Illuminating Company, Brooklyn, N. Y.; F. M. Tait, Dayton Lighting Company, Dayton, Ohio; H. Eames, Studebaker Brothers Company, New York, and C. Blizard, Electric Storage Battery Company, Philadelphia, Pa.

Convention of New England, N. E. L. A. Section.

Final arrangements have been completed for the forthcoming summer convention of the New England Section of the National Electric Light Association at the Griswold, New London, Conn., on Sept. 13 and 14. Secretary L. D. Gibbs states that a large registration has already been recorded, and it is anticipated that from 250 to 300 persons will attend the gathering. Elaborate plans have been made for the entertainment of the ladies, including various boat trips to the adjacent United States fortifications, sailing and motor boating, tennis, golf and bridge. Mr. C. H. Hodskinson is master of transportation for the New England section. Four papers will be presented, the topics being as follows:

The Advantages of a Uniform System of Rate Making, by Mr. Howard Corning, Bangor Railway & Electric Company, Bangor, Maine. *Illuminated Advertising—Its Possibilities*, by Mr. L. D. Gibbs, Edison Electric Illuminating Company, Boston. *Special and Decorative Street Lighting*, by Mr. J. A. Hunnewell, Lowell Electric Light Corporation, Lowell, Mass. *Opportunities*, by Mr. Levin J. Chase, Concord Electric Company, Concord, N. H.

Most of the delegations from Boston and northern New England points will go to New London on a special train leaving the South Station, Boston, on Monday, Sept. 12, at 3 p. m. Upon arrival at New London a special boat will be run to the Griswold. Mr. Alex. J. Campbell, of the New London Gas & Electric Company, is president of the New England section.

President Taft on Water Powers.

In a prepared speech before the Conservation Congress at St. Paul, Minn., Sept. 5, President Taft, speaking of the difficult question of saving the water-power sites, said:

"The subject is one that calls for new legislation. . . . It is the plain duty of the Government to see to it that in the water-power, conditions shall be imposed that will prevent monopoly, and will prevent extortional charges, which are the accompaniment of monopoly. The difficulty of adjusting the matter is accentuated by the relation of the power sites to the water, the fall and flow of which create the power. . . .

"Serious difficulties are anticipated by some in such an attempt on the part of the General Government, because of the sovereign control of the state over the water-power in its natural condition, and the mere proprietorship of the Government in the riparian lands. It is contended that through its mere proprietary right in the site the central Government has no power to attempt to exercise police jurisdiction with reference to how the water-power in a river owned and controlled by the state shall be used, and that it is a violation of the state's rights. I question the validity of this objection. The Government may impose any conditions that it chooses in its lease of its own property, even though it may have the same purpose, and in effect accomplish just what the state would accomplish by the exercise of its sovereignty. There are also (and the Director of the Geological Survey, Mr. Smith, who has given a great deal of attention to this matter, is one of them) who insist that this matter of transmuting water power into electricity, which can be conveyed all over the country and across state lines, is a matter that ought to be retained by the General Government, and that it should avail itself of the ownership of these power sites for the very purpose of co-ordinating in one general plan the power generated from these Government-owned sites.

"On the other hand, it is contended that it would relieve a complicated situation if the control of the water-power site and the control of the water were vested in the same sovereignty and ownership, viz., the states, and then were disposed of for development to private lessees under the restrictions needed to preserve the interests of the public from the extortions and abuses of monopoly. Therefore, bills have been introduced in Congress providing that whenever the state authorities deem a water power useful they may apply to the Government of the United States for a grant to the state of the adjacent land for a water-power site, and that this grant from the Federal Government to the state shall contain a condition that the state shall never part with the title to the water-power site or the water-power, but shall lease it only for a term of years not exceeding fifty, with provisions in the lease by which the rental and the rates for which the power is furnished to the public shall be readjusted at periods less than the term of the lease, say every 10 years. The argument is urged against this disposition of power sites that legislators and state authorities are more subject to corporate influence and control than would be the central Government; in reply it is claimed that a readjustment of the terms of leasehold every 10 years would secure to the public and the state just and equitable terms.

"Then it is said that the state authorities are better able to understand the local need and what is a fair adjustment in the particular locality than would be the authorities at Washington. It has been argued that after the Federal Government parts with title to a power site it cannot control the action of the state in fulfilling the conditions of the deed, to which it is answered that in the grant from the Government there may be easily inserted a condition specifying the terms upon which the state may part with the temporary control of the water-power sites, and, indeed, the water power, and providing for a forfeiture of the title to the water-power sites in case the condition is not performed; and giving to the President, in case of such violation of conditions, the power to declare forfeiture and to direct proceedings to restore the central Government to the ownership of the power sites, with all the improvements thereon, and that these conditions may be promptly enforced and the land and plants forfeited to the General Government by suit of the United States against the state, which is permissible under the Constitution.

"I do not express an opinion upon the controversy thus made or a preference as to the two methods of treating water-power sites. I shall submit the matter to Congress and urge that one

Complementary Operation of the Telephone and Telegraph in Chicago.

One naturally thinks of the electrical transmission of messages on a commercial scale as by either the telephone or the telegraph, but the Western Union Telegraph Company, by the great enlargement of its telephone service during the last year, seems to be demonstrating the fact that it is by the combination of telephone and telegraph that the greatest efficacy in message transmission may be found. For many years a comparatively small number of telegrams have been delivered by telephone and have been sent to telegraph offices in the same way, but by the present combination it seems to be made clear that every telephone may be made the terminus of a telegraph line. From it a message may be telephoned to the telegraph office and sent to any part of the world, and an answer received in the same manner. Where conversation is desired, of course the telephone alone continues to be used, either for short or long distances, but where a short message is involved, the telephone is made the first link in the chain, or possibly the first link and the last link, and the telegraph does the rest.

To carry this modern system into effect in Chicago, the Western Union Telegraph Company has established a rather elaborate telephone department in its main office in that city. This department is placed in a gallery at one end of the main operating room, and is cut off from the noise of the telegraph instruments by a sound-proof partition. Here there is a private branch exchange with a two-position switchboard containing 30 incoming trunk lines and connected with the exchange system of the Chicago Telephone Company. The ordinary telephone business of the various departments of the telegraph company is conducted in the ordinary manner through this switchboard, which is also connected directly with the branch offices in the downtown business district within a radius of half a mile from the main office.

For handling telegrams, however, special arrangements have been made. In the telephone room are two recording tables, each with positions for 10 telephone operators who sit five on a side facing each other. In front of each operator is a miniature lamp signal system, multiplied throughout, so that any incoming call flashes a white light to all operators, while a red lamp shows that any particular outgoing line is in use. All incoming calls pass through the switchboard, and if the call is for general office business the switchboard operator makes the desired connection. If the call is to send a telegram, the operator connects with the recording tables. Instantly a white signal is flashed at each of the 20 positions, and the first free operator plugs in. This action extinguishes the other lights, so that all operators know that the call is answered and the message is being taken. The accompanying picture shows the two-position switchboard and the recording tables, although some of the operators' positions at the latter are not occupied.

Telephone Room in Main Chicago Telegraph Office.

For the delivery of telegrams by telephone there are 15 outgoing lines running directly from the recording tables to the telephone company's exchange. This provision obviates congestion of the switchboard and provides an equipment capable of receiving a total of 20 messages and delivering 15 at the same time. While the number of messages delivered by telephone is greatly in excess of those received in that way, the incoming equipment must be large, because an average of three messages can be delivered by telephone in the time consumed in receiving one.

In the telephone department of the Chicago Western Union office there are about 20 employees, the department being in charge of a trained woman supervisor. The switchboard operators do nothing but make connections, while the operators at the recording tables receive and deliver telegrams only. An effort is made to concentrate the receipt and delivery of telegrams by telephone in the main Western Union offices in Chicago; that is, the public is being instructed to telephone its messages there instead of to the nearest branch office when there is no toll charge involved.

All telegraph messages addressed to Chicago received in the main operating room go directly from the wire to the distributing table in the city lines department, where they are routed to a branch-office wire and dropped to the messenger delivery department; or a telephone number is written on the message and it is sent immediately by automatic carrier to the telephone room. The search for telephone numbers is made at the distributing table, so that the telephone operators are not delayed. Thousands of messages received daily are immediately telephoned to the person addressed, and later, on request, may be delivered by messenger. Thus the slowest link in the chain of telegraphing—that is, the messenger boy—is eliminated from the transaction to a large extent.

Mexican Electrical Development.

The Mexico Tramways Company, the Canadian concern which owns the great hydroelectric plant at Necaxa and the extensive system of electric railways in Mexico City and the federal district, has just been granted concessions by the federal government for the construction of two electric interurban lines. One of these proposed roads is to run between Mexico

and Puebla, a distance of 129 miles, and the other between Mexico and Toluca, 32 miles. These two lines will be the longest electric railways in Mexico. It is stated that the construction of these two lines will involve some heavy and costly work. They will penetrate a region that is famous for its mountain beauty, and the Mexico City-Puebla road will pass between the volcanoes of Popocatepetl and Ixtaccihualt. The concessions require the roads to be finished within 10 years. The construction work will be started in a short time and the two lines will be finished in less than three years, it is stated. The company is granted exemption from duties on all construction material that may be imported during the next five years. The concessions are for a period of 99 years. The passenger fare is fixed at 6 cents per kilometer for first class passengers, 4½ cents for second class and 3 cents for third class.

The Copper Queen and El Tigre mining companies, of Sonora, have entered into a contract by which the mines of the El Tigre company and the town situated adjacent thereto are to receive electric energy from the large generating plant of the Copper Queen Company at Douglas, Ariz. The Mexican Government has granted a concession for the construction of an electric transmission line to El Tigre from the international border line. This transmission line will be 50 miles long. The survey for the route of the proposed line has been made and the construction material ordered.

Telephone Service in the United States.

A bulletin recently issued by the American Telephone & Telegraph Company gives some interesting statistics which show the extent of the use of telephones in the various cities of this country. The figures cover 113 cities with an aggregate of more than 2,500,000 Bell subscriber's stations; or, approximately 57 per cent of the total Bell subscriber's stations in the United States. These cities contain approximately 26,000,000 people; or, about 29 per cent of the total population of the country. The statistics show that second, third and fourth class cities use the telephone more extensively than do cities of the first class. The basis of judgment being the number of telephone installations per unit of population. The table herewith gives figures for several of the cities having a high percentage of telephones installed.

City	Population	Number of Phones	Phones per 100 Population
New Orleans....	[illegible]	16,880	5.1
Louisville	[illegible]	[illegible]	4.1
Atlanta	[illegible]	14,224	[illegible]
Memphis	140,000	8,783	6.3
Salt Lake City	95,000	11,075	11.7
Richmond	115,000	[illegible]	9.9
Nashville	90,000	9,373	[illegible]
Bridgeport	100,000	6,944	[illegible]
Lowell	100,000	5,823	5.8
Houston	[illegible]	10,630	9.6
Ft. Worth	75,000	[illegible]	[illegible]

Evening Technical Courses at Brooklyn Polytechnic.

The College of Engineering of the Polytechnic Institute of Brooklyn, N. Y., announces for the season of 1910-1911 a series of evening and Saturday courses in engineering, chemistry, physics, mathematics, drawing, history, economics and languages especially designed to afford men in active practice opportunities for professional study. The courses may be taken independently or in connection with the regular courses in engineering leading to various engineering degrees. The term of study begins Oct. 3 and for those not seeking a professional degree no formal examinations for entrance are required. The courses in mechanical engineering are as follows: *Mechanical Drawing and Designing; Machine Design; Advanced Machine Design; Steam Power Plant; Works Management; Gas Power Engineering; Experimental Engineering; Steam Turbines; Steam Engineering;* and *Mechanism.* In physics and electrical engineering the following courses are offered: *Mechanics and Heat; Electricity and Magnetism; Alternating-Current Laboratory; Electrical Measurements; Direct-Current Dynamo Electric Machinery;* and *Electrotechnics.* Prof. W. D. Ennis supervises the courses in mechanical engineering and Dr. Samuel Sheldon the electrical engineering courses. The course in mathematics is designed to meet the requirements of engineers and is in charge of Dr. J. B. Chittenden.

Report of Ontario Board on Municipal Accounting Methods.

The fourth annual report of the Ontario Railway and Municipal Board, covering the year 1909, criticizes the action of some municipalities subject to its jurisdiction which fail to conform their accounting methods to the orders of the board.

The municipal corporations operating water-works plants, electric light plants, gas plants and telephone plants were asked during the year to furnish statements showing the results of the working of the utilities operated by them respectively. While in most instances the forms of report prescribed were completed and filed, with some municipalities the board found difficulty in obtaining adequate information relating to plants operated by them. The report says that some municipalities appear apathetic and indifferent in accommodating their methods of bookkeeping to meet the requirements of the board, and that other municipalities do not think it necessary to furnish any information whatever.

It is thus apparent, the board says, that it cannot be in a position to superintend properly the system of bookkeeping and keeping accounts of all the public utilities that are being operated by municipal corporations, as contemplated by section 57 of the Ontario Railway and Municipal Board act, unless some pressure can be brought to bear upon the municipalities in default to ensure the compliance, by all such municipalities, with the provisions of the statute. In some cases, where municipalities in default made application to the board to approve of debentures issues to meet the cost of additional outlays for the extension of public utility plants, the board found it necessary, in order to have full information on the questions before it, to defer certifying the debentures until the municipalities in default supplied the information required.

The board therefore renews a previous recommendation that in order to obtain the proper data and statistics necessary to intelligent analysis and study of the workings of public utilities it be empowered in cases where municipalities refuse to furnish the information required to appoint chartered accountants or other competent persons at the expense of such municipalities in default to obtain the information.

St. Lawrence-Long Sault Dam Project Halted.

From all information received it appears that the project of damming the Long Sault rapids of the St. Lawrence River, below Cornwall, is for the present shelved. Mention of this project was made in these columns for several weeks during November and December last. It will be remembered that international questions arose, and that the project met with strenuous opposition also from the shipping interests on account of the proposed dam and diversion of water. Subsequently the St. Lawrence Transmission Company filed amended plans with the various government departments interested by which it was hoped to meet the views of the opposing interests. The application of the company for the necessary authority has also been before the Waterways Commission for several months and as yet no report has been made. Under the Waterways treaty a new and permanent commission will have to be appointed, and there is reason to believe that the present body will go out of existence without having dealt with the proposed undertaking.

Stave Lake Hydroelectric Plant.

The Western Canadian Power [illegible] which Mr. R. F. Hayward is chief engineer and general manager, will commence the delivery of energy to Vancouver next April. The plant is situated 35 miles distant from Vancouver and 7 miles from Ruskin, a station on the Canadian Pacific Railroad. It is stated that the storage capacity is so great that the plant could be operated at a capacity of 100,000 hp for 90 days in the absence of any flow into the reservoir during that period.

The power house is being built in a pit immediately below the dam, from which a tail-race 60 ft. wide will be dredged for a distance of a quarter of a mile down stream. In the power house will be installed four turbine units of 13,000 hp each. These will operate from four penstocks, each 14 ft. 6 in. in diameter led from the face of the intake dam 110 ft. above the generating plant. At present plans are made for the early installation of two of these units, the other two to be put in place as soon as the market for energy demands. It is expected that the call for energy will have so developed that the last unit will be in operation early in 1912. The hydraulic work now being carried out will, when finished, be complete for four units, though only two will be installed this year. The turbine wheels will be direct connected to generators which will deliver three-phase currents at 4000 volts, which will be stepped up by transformers at the power house to 60,000 volts for transmission to Vancouver. At a receiving station there the voltage will be stepped down to 12,000 volts for distribution to local substations from which in turn it will be further distributed at 2300 volts.

Canadian Hydroelectric Commission News.

Mr. W. K. McNaught, M. P., member of the Hydroelectric Commission, at a meeting of the convention of the Canadian Municipalities in Toronto, announced that energy from Niagara Falls would be sent regularly to Toronto over the commission's transmission line on and after Oct. 1 next. Mr. McNaught also stated that the transmission of energy to Berlin would begin on Sept. 5 and the line would be completed to London on Oct. 15. On Nov. 15 the Stratford-Berlin line and all the smaller lines of the system would start transmitting energy. At present the line is finished as far as Dundas.

Mr. McNaught stated that the commission's plant and lines had been constructed without exceeding the cost as originally estimated. The estimate had been $3,749,000, and the cost would be $3,330,000, notwithstanding the fact that a protective system costing $106,000 and transformers costing $41,000 had not been anticipated, although the right of way had cost $400,000 instead of the $227,000 at first expected. The commission, according to Mr. McNaught, is now working out a plan to provide energy for Prescott, Kingston, Brockville and other eastern Ontario towns along the St. Lawrence River.

A new contract has been made by the commission for the delivery of 1500 hp additional to be used in Ottawa and Hull, the price to be $15 per horse-power per year. Some months ago the commission contracted to deliver 1500 hp to Ottawa, and this was used for municipal purposes, such as lighting, etc. Later on the order was increased by 1000 hp. The present contract will bring the total delivery up to 4000 hp.

The first test of Niagara energy over the commission's main transmission line from the Falls to Dundas was made on Sept. 1. Hon. Adam Beck, chairman, who was present at the test, declined to make any statement, preferring to await the return of Premier Whitney before announcing that the plans of the Government had upon their first trial met with success.

New York Commission News.

On Wednesday of this week the Public Service Commission, Second District, will give at Albany a hearing upon the proposition of entering an order requiring gas and electrical corporations to file tariffs and prescribing a form of such tariffs. Up to the present time only railroads have been required to file their tariffs with the commission.

On Sept. 1 the Public Service Commission, Second District, assumed jurisdiction over the operations of telephone and telegraph companies operating in the state. All telephone companies, corporations, associations, partnerships or persons owning or operating any telephone line in the state for profit whose property is valued at over $10,000 will come under the supervision of the commission. All telegraph companies, however, are within the jurisdiction of the commission.

Complaints may be made to the commission by any person or corporation aggrieved as to rates, rentals and service by petition or complaint. The commission may also make investigations upon its own motion. The commission has power to order necessary repairs and changes. All franchises and privileges hereafter granted must be approved by the commission before they can be lawfully exercised. Issues of stock, bonds and other forms of indebtedness must be consented to by the commission. The commission has power to enforce its order, rules and recommendations, and failure to comply with same may result in actions to recover penalties.

The commission has opened a New York City office in the Metropolitan Tower, and has also established an office in Buffalo. Edward B. Rogers, of Elmira, a telephone man of 22 years' experience, has been appointed chief of the division of telephones and telegraphs at a salary of $4,000 per annum

Maryland Commission News.

The Public Utilities Commission has received numerous protests against the new schedule of rates which were submitted by the Chesapeake & Potomac Telephone Company. The commission is holding the schedule under advisement and, although the company was willing to allow the lower rates to go into effect on Sept. 1, the commission decided that the old rates must prevail until the members of the commission would have an opportunity to go more deeply into the matter. There is opposition to the sanction of the new rates on the grounds that the unlimited telephone service in the business district would be abolished entirely. Many business men have appeared before the commission in person and others have sent letters urging it not to adopt the new rates. The commission will receive complaints until Oct. 24 when the matter will be given a final hearing.

Aside from the matter of unlimited service other complaints have been made against the service of the Chesapeake Company. One complainant points out to the commission that when a pay station is used the nickel must be deposited in the slot before the party who is telephoning gets the person on the wire, regardless of the fact that the party to whom he wishes to speak may not be in at the time. The same system used for long-distance calls is desired whereby the name is given to the operator and the toll is not paid until the person called is at the other end of the wire. It is believed that the commission will order this change made. Another important thing in connection with the service of the company was brought to the attention of the company. A large business house that has unlimited phone service has complained that a strict account it has kept of the number of calls used during the past year does not accord with the bill rendered by the company, and in almost every communication the commission receives the complaint is made that the subscriber has no way of ascertaining whether they are being overcharged or not. The demand is being made by some that the company be compelled to furnish subscribers with some sort of an indicator that will register the number of calls that are used.

The professional men of Baltimore have interested them- [illegible] munications have been received from prominent lawyers stating that the telephone company is compelled to furnish its patrons with unlimited service by an act of the Maryland Legislature.

A letter, reprinted in part below, from the Stewart Fruit Company, of Baltimore, illustrates the general complaint that is being voiced. "Some years ago the telephone service in Baltimore became so obnoxious that an association was formed of telephone subscribers to try to remedy existing evils. They went so far as to have a bill passed by the Legislature requiring the telephone company to furnish telephones at a stipulated price per station. The Chesapeake & Potomac Company then came out with a "metallic circuit" contract for which service it asked more money than the amount authorized by the Legislature on what it called a "grounded wire" service. For this metallic unlimited service we pay $125 per annum. We are not satisfied to be put on a call basis, and we most strenuously object to the revocation of our contract. Formerly we were allowed five minutes on long distance and toll board calls; now we are only allowed three minutes, and if we talk 16 seconds over the time, we are charged for one extra minute. We consider the telephone a public necessity and we believe the public generally should have the benefit of the best service obtainable at the least cost consistent with a fair remuneration to the stockholders on the actual amount of investment. We have one limited and three unlimited Chesapeake & Potomac telephones, together with two extensions and also a Maryland telephone and extension. The bill presented us by the Chesapeake & Potomac Company for the past month is $234.50, which bill must be paid without question. We defy anyone to check these bills, or to keep a check against them."

Massachusetts Commission News.

The New England Telephone & Telegraph Company has announced that it has accepted the ruling of the Massachusetts Highway Commission in connection with its investigation of telephone rates in the Boston and suburban district. The company will begin at once to prepare for the changes in its system which the establishment of the new rates will bring about. About 100,000 contracts will probably be rewritten. The company expects by Nov. 1 to be able to offer service in any exchange, in accordance with the new schedule, to those who desire it.

A concerted effort is being made by several suburban cities and towns at the north of Boston to secure a stay of proceedings by an appeal to Governor Draper, but in view of the thoroughness of the investigation of the Highway Commission and its engineers, Messrs. D. C. and W. B. Jackson, it is considered unlikely that the Governor will interfere. The line of cleavage between those in favor and those opposed to the new rates exists chiefly in connection with the proposed adoption of a zone system of charging. In the past the service offered on the unlimited basis between the various Boston suburbs has been probably unequaled in extent in any other city of the world, but this freedom of communication has been handicapped to no small degree in the mind of the average telephone user by the existence of toll charges between the suburbs and the Boston business district. The situation has been somewhat analogous to the offering of unlimited service between the residential portions of a city, with a toll charge of from 5 to 10 cents per call downtown. Under the new rates the toll charge to the center of Boston is to be reduced to 5 cents per call for all stations within 8.5 miles of the congested center, and to offset this restrictions will be placed on intersuburban communication. The commission also hopes to bring about a better degree of equalization in the charges for different classes of service by the use of the zone system.

The selectmen of Lenox have petitioned the Massachusetts Railroad Commission to investigate the question of establishing a 5-cent fare from any point on the line of the Berkshire Street Railway Company in Lenox to any other point on the railway within that municipality. Half-hourly car service is also requested. The board will hear the case of the selectmen of Lenox on Sept. 14.

The Railroad Commission has issued an order approving the

200 shares of 6 per cent preferred capital stock at a price of $100 per share. The proceeds are to be used for retiring an equal amount of the bonds of the company dated June 1, 1909. Upon the issuance of the stock bonds to the amount of $20,000 are to be canceled and destroyed. The 200 shares of preferred stock are to be sold at auction in the city of Boston to the highest bidder, in accordance with the desire of the directors, on the ground that the amount of the issue does not exceed 4 per cent of the company's existing capital stock.

The board has also approved an issue by the Milford & Uxbridge Street Railway Company of coupon or registered bonds to an amount not exceeding at par value $85,000, payable Jan. 1, 1918, and bearing 5 per cent interest. The proceeds are to be used in paying floating indebtedness incurred in construction and equipment.

The Massachusetts Railroad Commission gave a hearing on Aug. 30 to the Boston & Eastern Electric Railroad Company for the purpose of listening to arguments of counsel on the question of reopening the matter of granting a certificate of public convenience and necessity to the company. The board recently recommended by a majority vote that nothing be done at present to give the company a certificate. For the company, its attorney, C. S. Baxter, Esq., emphasized the large public demand for the road which has been evidenced, and contended that Chap. 630, Acts of 1910, has been improperly construed by the board.

The law in question gave the company authority to build a tunnel under Boston Harbor, for the purpose of securing a city terminal. Mr. Baxter said that the electric railway law of 1906 predicated the construction of the high-speed electric railroad in Massachusetts. In spite of the recommendations of the Boston Transit Commission and the Massachusetts Railroad Commission to the Legislature of 1910 recommending that the authorization of the Boston & Eastern tunnel be put off until later, the 1910 tunnel law was passed by a large majority, thus making it clearly known to the board and to the public that the General Court desired to have the road built and constructed without delay.

The Boston & Eastern company contends that the commission has exceeded its discretionary power and has misconstrued the action of the Legislature. Mr. Baxter said that if any commission delayed its business on account of legislation that might take place in the future, no public improvement would ever be effected. The company feels that it has a legal right to a certificate under the decision of the board two years ago, which stated that a need existed for additional facilities in the territory. The hearing was then closed by order of Chairman Hall.

A petition has been presented to the Railroad and Boston Transit Commissions by James Grant, secretary of the League of Street Car Users, asking for an investigation of the conduct and management of the Boston Elevated Railway Company. The next Legislature will consider a number of important questions bearing upon the future of the company and its relations to the community and connecting street railways. The petitioners contend that the boards should determine whether the management and conduct of the road in the past, in competition with certain other systems in part at least, and as lessee of other railways and subways for a limited period only have been so businesslike, economical and considerate of patrons' welfare as to justify the conclusion that its powers ought to be so extended as to exclude all possibility of competition. The two commissions are to report to the next Legislature upon these matters, which include the advisability of the Boston Elevated Railway Company's purchasing the West End Street Railway Company, acquiring control of other railways in the interest of operating economy and improved service, and extending the leases of the Washington Street tunnel, the Tremont Street subway and the East Boston tunnel.

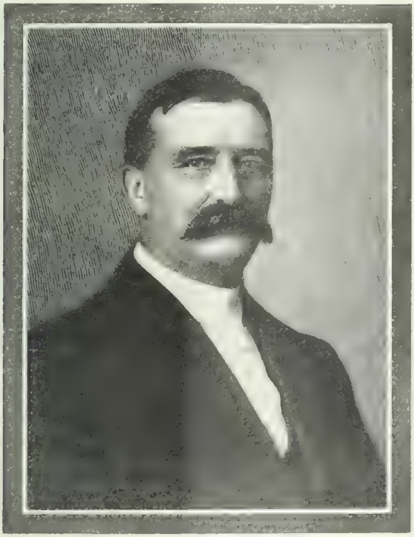
Bids have been received by the Boston Transit Commission for the construction of the Boston Common section of the Cambridge subway, including terminal arrangements at Park Street. The cost of the work will be about $290,000. Excavated material will be handled by electric trains at night after the subway

AMERICAN ELECTRICAL ENGINEERS.—XIII.

James A. Lighthipe.

James Alfred Lighthipe was born in Orange, N. J., Dec. 29, 1857, and received his education in the public schools of his native town and at Stevens Institute. In 1879 he entered the Edison laboratory at Menlo Park, where Mr. Edison at the time was engaged in perfecting the loud-speaking chalk telephone and experimenting with the carbon-filament incandescent lamp. The first Edison phonograph had just then been invented and Menlo Park was so besieged by representatives of newspapers and curious visitors that all of the serious work of the inventor and his staff had to be carried on at night.

The Edison telephone patents had just been purchased by the Gold & Stock Telegraph Company, which owned and operated the stock tickers. The subsequent sale of these rights to the Bell Telephone Company, and the substitution of the magneto bell for the battery and push button finally brought the telephone to a commercial stage, and companies were being organized for its operation in all large centers of population, both in America and Europe. This led to many requisitions on the Edison laboratory for telephone experts to direct the work of installation,



Mr. James A. Lighthipe.

and Mr. Lighthipe was, with others, sent abroad for this purpose. When he reached London, in 1879, there were approximately 500 telephones in the entire British Islands, as up to this time the telephone had been regarded merely as a scientific or experimental instrument. Antwerp was the next of the European cities to call for a commercial telephone service, and under the auspices of the International Bell Telephone Company, which controlled all the telephone patents for the Continent, Mr. Lighthipe vigorously took up the work of installing systems in the principal cities of Belgium. This occupied his attention until 1881, when he returned to London as superintendent of the British Insulite Company, and was for the ensuing six months engaged in perfecting the process of manufacturing composition insulators.

When Mr. Charles Batchelor started the Edison manufactory at Ivry, just outside of Paris, known as the Société Industrielle et Commerciale d'Edison, Mr. Lighthipe joined the staff and remained a member for the ensuing year. His next appointment was that of electrical engineer for the German Edison Company at Berlin—the Deutsche Edison Gesellschaft—with which he remained for a year as expert in connection with various installations throughout Germany. Returning to the United States, in 1884, he joined the Brush Company in New York City, and was subsequently engaged for a short time in business for himself in Philadelphia, manufacturing electrical novelties. In 1886 he accepted a position as electrical engineer for the Wilmington City Electric Company, at Wilmington, Del., and supervised the construction there of a three-wire Edison plant.

In the latter part of 1889 Mr. Lighthipe was engaged as superintendent of construction by the United Edison Manufacturing Company, with main offices at San Francisco, Cal., and acted as district engineer and local engineer for its successors, the Edison General Company and the General Electric Company. He had charge of the electric construction of the first electric railway on the Slope, which was built in Los Angeles in 1891. During his connection with the work of the General Electric Company on the Pacific Coast, Mr. Lighthipe was identified with the construction of pioneer electric roads at San José, Oakland and Sacramento, and of the pioneer long-distance transmission systems of Folsom-Sacramento, Fresno, Bakersfield and Santa Ana-Los Angeles. In one capacity or other he has been identified with the building of all the large transmission lines west of Salt Lake City.

In 1908 Mr. Lighthipe resigned his position with the General Electric Company to become electrical engineer for the Edison Electric Company, of Los Angeles, subsequently the Southern California Edison Company, a $30,000,000-organization, which operates hydroelectric plants on four mountain rivers and supplies electrical energy in Los Angeles and to 55 cities and towns in southern California. He is at present engaged in supervising the construction of a $6,000,000 steam auxiliary plant which his company is building on the ocean at Long Beach, Cal., and assisting in the preparation of plans for future hydroelectric development.

Notwithstanding his activities in the electrical field, Mr. Lighthipe has found time for other interests of a practical nature, notably the cultivation of citrus fruit. A 30-acre lemon grove at Rialto, Cal., has, under his direction, been developed to a model horticultural exhibit. Mr. Lighthipe has been a member of the American Institute of Electrical Engineers since 1894, and for the past year has been chairman of the Los Angeles A. I. E. E. local section.

CURRENT NEWS AND NOTES.

Mr. Roosevelt on Public Service Regulation.—During his Osawatomie (Kan.) speech of Aug. 31 Mr. Theodore Roosevelt declared for complete and effective publicity of corporate affairs. He continued, according to the newspaper report: "It has become clear that we must have government supervision of the capitalization not only of public service corporations, including particularly railways, but of all corporations doing an interstate business. I do not wish to see the nation forced into ownership of the railways if it can possibly be avoided, and the only alternative is thoroughgoing and effective regulation, which shall be based on a full knowledge of all the facts, including a physical valuation of the property."

Edison Favors Municipal Ownership of Homes.—A member of the Milwaukee city government reports that Edison favors the policy of the present government of that city in connection with the municipal ownership of land and dwellings. He is reported to have said: "My message to Milwaukee is that her's is a great opportunity. The city can buy the land, subdivide and improve it with streets and parks. It can build wholesome, comfortable houses, with all modern conveniences, and can put them on the market on a large scale at a cost not to exceed $800 each. At these figures the dollar-a-day man can own his own home. The city can make it certain that he will. It can borrow money for 5 per cent and sell the houses on installments at, say, one-fourth of what these working people are now paying in rents. In this way the city expends nothing and the working people will expend only one-fourth of what they are now paying for unsanitary, uncomfortable and wretched places of residence."

Quarry Street Station, Chicago.—The work of completing the Quarry Street station of the Commonwealth Edison Company, Chicago, is proceeding steadily. Five of the six 14,000-kw turbo-generators are now in service, and the remaining one will probably be in commission in a few months. Unit No. 5 is a 12,000-volt, 60-cycle machine, and is the first of this description that the company has installed. Nearly all of the large generators of this company are wound for 9000 volts.

Railway Signal Electric Lighting.—On the Baltimore and Ohio Railroad, where the Patenall and Dryden system of automatic electric lighting of lamps on the approach of trains has been in operation for several years, one of the lamps put in operation on Aug. 1, 1906, was burnt out on Aug. 5, 1910, having thus given a continuous service of over four years. During this period the lamp was lighted and extinguished, automatically, 73,200 times. The lamp was a 2-cp, 11-volt lamp, purchased at an electrical supply store.

Advertising in Foreign Languages.—In cities where there is a considerable foreign population public-service companies often find it of advantage to advertise in the daily or weekly newspapers published in foreign languages. In St. Louis, for instance, the German element is a strong one, and the German papers are carefully edited and widely read. The Union Electric Light & Power Company, the Kinloch Telephone Company and other electrical concerns find it profitable to carry conspicuous advertisements in these German papers.

Association of Railway Electrical Engineers.—As noted in the issue of Aug. 4 the Association of Railway Electrical Engineers will convene in the Hotel La Salle, Chicago, Sept. 27-30. The subjects of the papers to be presented have just been announced as follows: *Electric Lighting of Railway Cars, Axle Generating Systems, Electric Traction on Trunk Lines, Motor-Driven Machine Tools* and *The Illumination of Railway Passenger Stations and Machine Shops.* A feature of the convention will be the exhibits by the member companies of the Railway Electric Supply Manufacturers' Association.

Electricity in Equitable Building, St. Louis.—The Equitable Building at the corner of Sixth and Locust Streets, St. Louis, has been completely remodeled, and the entire supply of electricity is now obtained from the Union Electric Light & Power Company. The isolated plant located in the basement of the old building has been dismantled and removed. The building is 10 stories high and will be equipped with three high-speed electric elevators, while lighting will be furnished by about 3000 incandescent lamps. The total load will be about 290 hp.

New Aluminum Alloy.—The great British firm of Vickers Sons & Maxim have announced that it will put on the market in October a new aluminum alloy, which, it is claimed, is superior to anything heretofore known. It is the discovery of the company's chief chemist, Mr. Weeks, who says it is as strong as steel, while its weight is one-third that of brass, or only slightly heavier than aluminum. It can be rolled, drawn, stamped and forged. It is less subject to corrosion than any other aluminum alloy. The firm has patented the alloy, which is called duralumin throughout the world. It will establish a plant at Birmingham to manufacture it on a large scale.

Public Library Station in Central-Station Headquarters.—The Commonwealth Edison Company of Chicago maintains for employees a technical library and reading-room at its headquarters, the Edison Building, 139 Adams Street. This department is in charge of a trained librarian, who, among other duties, issues a weekly digest of articles in current technical literature of especial interest to central-station readers. Further, there is a station of the Chicago Public Library connected with the company's library in the Adams Street Building, and [illegible] electrical subjects on request. Plans are now in preparation for the establishment of a branch library of the Commonwealth Company in the building at 84 Market Street.

Terminal Electrification Commission for Chicago.—It is suggested by the Chicago *Tribune* that the problem of electrifying the railroad terminals in Chicago, and particularly that of the Illinois Central Railroad, which is a "persistent, stubborn and somewhat callous offender" in relation to the smoke nuisance, be referred to a commission of experts. Such a commission should be carefully chosen and provided with facilities to investigate the whole local situation, reporting a complete scheme of action. The commission plan has worked well in Chicago in carrying out track elevation of steam railroads and the rehabilitation of surface street-railway traction. A definite, practical beginning upon the plans for electrification should be insisted upon immediately, and the commission plan affords a sensible method which may be undertaken on a broad and comprehensive scale.

Haverhill (Mass.) Gas Case.—By a decree issued on Aug. 31 by the United States Circuit Court the price of gas furnished by the Haverhill Gas Light Company has been set at 90 cents per 1000 cu. ft. for the period between July 1, 1910, and July 1, 1911. The next corresponding year the price is to be 85 cents, and thereafter it is to be 80 cents, providing the company sells 450,000,000 cu. ft. at 85 cents. This decision ends a dispute which has lasted for 10 years between the company and the Massachusetts Gas & Electric Light Commission. In 1900 the board fixed the price of gas at 80 cents, and since that time the company has fought the decision on the ground that it was impossible to manufacture gas of the quality desired at the commission's price. The commission is restrained under the decree from filing suit against the company in relation to its prices, but the board's price will ultimately be adopted.

Central-Station Service for Chicago Hotels.—The Union Restaurant and Hotel, of 111 Randolph Street, Chicago, has abandoned its isolated plant, and now takes its supply of electrical energy from the Commonwealth Edison Company. Electricity is required to operate electric motors with a combined rating of between 90 hp and 100 hp, and also incandescent lamps equivalent to 1350 16-cp lamps, as well as a small number of arc lamps. The motor equipment includes an electric elevator, a large ice machine, ventilators, etc. Steam for heating is secured from an outside source. Another hotel to abandon its isolated plant and take electricity from the Commonwealth company's mains is the old Revere House at North Clark and Michigan Streets. Here the lighting equipment consists of between 700 and 800 16-cp equivalents, while motors of a total rating of about 25 hp are operated. A steam elevator is now in use, but this will be taken out and an electric elevator substituted.

Telephone Charges in London.—The annual charge for telephone connection with any exchange in the county of London within two miles of the subscriber's premises is £5 ($24.32); message fees, 2 cents for each call to a subscriber on any exchange in the county of London, and 4 cents for each call to a subscriber in any exchange outside of the county. The annual charge for connection with any exchange outside the county of London, within two miles of the subscriber's premises, is £4 ($19.46); message fees, 2 cents for each call to a subscriber on the same exchange, and 4 cents for each call to a subscriber on any other exchange. The minimum yearly amount payable by each subscriber for message fees is $7.30. The telephone trunk lines which connect the various telephone exchange areas throughout the Kingdom can be used by callers at postoffices which are connected with the trunk telephone system, as well as by subscribers and callers using telephone exchanges. The fees for the use of the trunk lines are as follows: Up to 23 miles, 6 cents; 23 to 50 miles, 12 cents; 50 to 75 miles, 18 cents; 75 to 100 miles, 24 cents; every additional 40 miles or fraction thereof, [illegible]

CENTRAL STATION AT MOLINE, ILL.

Combination Low-Head Hydroelectric and Steam-Generating System Serving Three Closely-Connected Cities.

FEW generating companies are as fortunate in having a large market for energy within easy transmission distance as is the one operating at Moline, Ill. In that neighborhood are three cities, Moline and Rock Island in Illinois, and Davenport across the river in Iowa, within a distance of from two to four miles of each other, and having an aggregate population of probably 75,000. The conditions approximate those of a large city. Careful organization has resulted in the concentration of the generating equipment in one central plant for the three cities, this plant being located in Moline, with substations in Rock Island and Davenport. The electrical installation for these towns is fairly well up to date, and hence a description of it may be of interest to electrical men.

The central station itself consists of two parts, a steam generating section and a smaller hydroelectric section. The two parts are parallel to each other about 200 ft. apart. The coal is handled mechanically, and is crushed unless screenings can be had. The grates are of the Roney and Green chain type and the coal consumption per 24 hours varies from 75 tons to 130 tons. The generating room is 287 ft. x 80 ft., and contains both engine and turbine equipments. There are three direct-connected cross-compound engine units, consisting of a 1000-kw alternator, a 1100-kw alternator and a 150-kw direct-current generator for exciting purposes. The last-named is run by a Buckeye engine at 250 r.p.m. The two large engines are Allis-Chalmers machines and the generators Westinghouse units.

Of the turbine units there are at present two. The larger has a rating of 3000 kw and the smaller of 1500 kw. The turbines are of the Westinghouse-Parsons horizontal type, and the generators are Westinghouse fan-ventilated machines. The speed of each is 1200 r.p.m.

The switchboard has 54 panels. It is of gray and white marble. The total connected load of the station is about 10,000 kw. Of this, 4000 is railway, 3000 stationary motor load and 3000 is peak lighting. This load, with the present equipment of the plant, does not leave sufficient reserve. The company is now installing a 7500-kw turbo-generator, of the same make as the above, and four new 650-hp Stirling water-tube boilers fitted with Illinois chain grates.

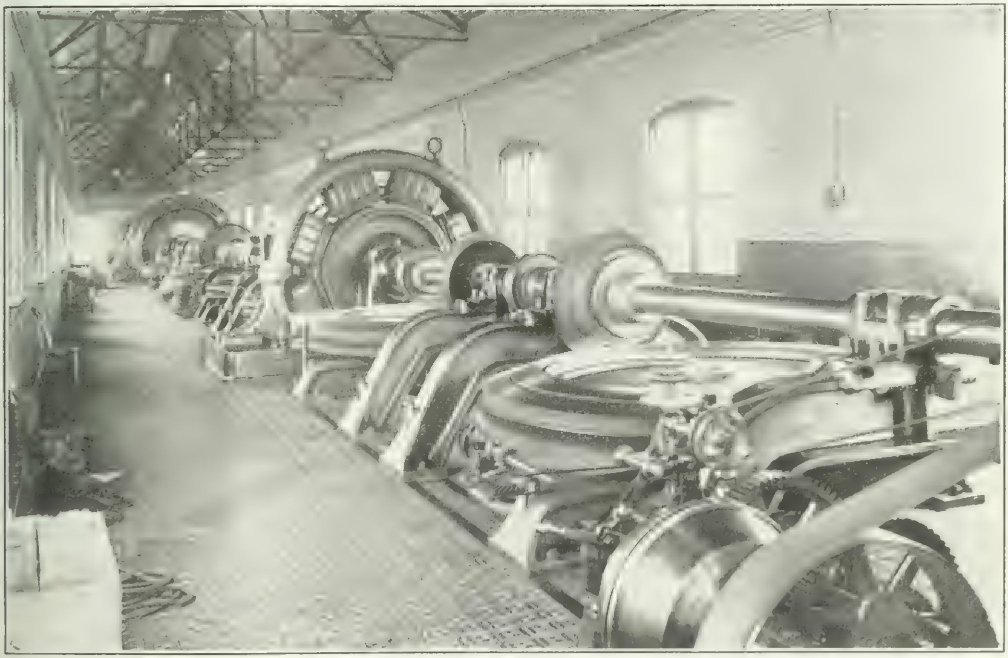


Fig 1—Interior of Hydroelectric Generating Station.

size of the hydroelectric room is [illegible] three generators, each rated at 600 kw. It was necessary to use a room of large size in order to provide for the drive shafting, because the operating head of water is so low that six turbines are required for one generator, and seven for each of the other two. The generators are directly connected to the line shaft. One of them is a direct-current machine, and the others are alternators.

The turbines are 20 in number, of the vertical type, and operate under an average head of 9 ft. at a speed of 66 r.p.m. Each turbine is rated at 100 hp. It is thus seen that the hydroelectric section comprises [illegible] by means of cross dams [illegible] represents merely the difference in level between the upper end of these and the water-power house.

In the steam section there are 11 500-hp Stirling water-tube boilers, furnishing a working pressure of 200 lb.

The primary alternating-current energy is supplied at a pressure of 4800 volts, two-phase, 60 cycles, which makes unnecessary any step-up transformers. The city of Moline is lighted directly from the central station. On the streets use is made of General Electric arc lamps and for this service there are six constant-current transformers in the station. The farthest transmission distance is about three miles to the substation in Davenport. In the Davenport substation are two 600-hp induction motors taking 54.3 amp per terminal at the primary pressure. Besides these there are three rotary converters [illegible] direct-current energy for the railway at 550 volts. The two larger converters have a speed of 600 r.p.m., with a rated ampere load of 546 each, while the smaller has a speed of 720 r.p.m., with a rated ampere load of 364. The direct-current generators

direct connected to the big induction motors are rated at 667 amp and 600 volts, and run at 580 r.p.m.

The station contains four Brush arc machines in two pairs, each pair being driven by a 200-hp synchronous motor placed between the machines. Each motor takes 17 amp at 4400 volts, and operates at 514 r.p.m. These motors are of the General Electric type, while all of the railway generators are Westinghouse machines. The rest of the Davenport arc load is carried on two constant-current transformers and mercury-arc rectifiers adjusted for 6.6 amp. There are two switchboards, the smaller having 10 panels, the larger 20. There are also two exciter sets, each driven by a 15-hp induction motor, requiring 33 amp at 220 volts. The generators furnish the customary 125-volt service, the armatures having a speed of 1200 r.p.m.

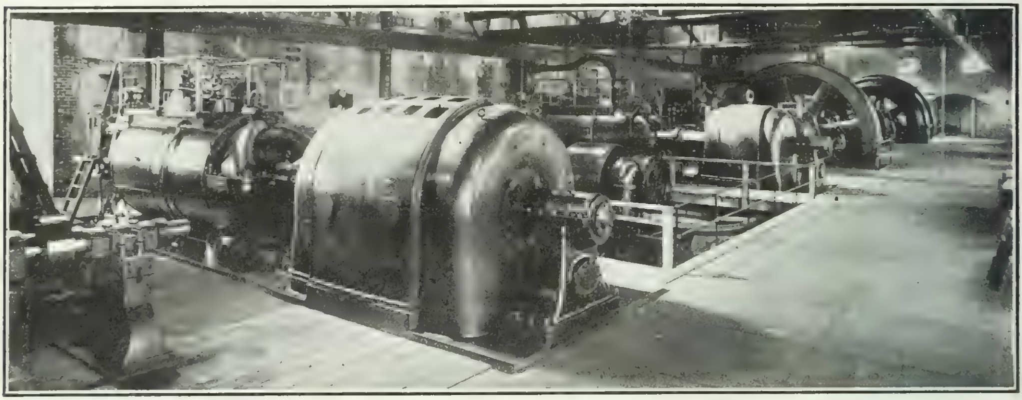


Fig. 2—Interior of Steam-electric Generating Station.

There are seven regulator transformers, three of 16.5 kw rating each, and four of 20 kw each. The regulation is 10 per cent, in 14 steps, 2200 to 220. Besides these there are 13 ordinary constant-potential oil-cooled transformers, having ratings of 150 kw, 300 kw or 500 kw, with two of 110 kw and three of 165 kw. This substation also contains a large horizontal engine-type railway generator for use in emergencies. The substation in Rock Island is so similar to that just described that a separate detailed description is not needed.

A RECENT ISOLATED PLANT INSTALLATION FOR COUNTRY RESIDENCE LIGHTING.

By W. D. Cassin.

The country estate of Mr. Edwin P. Baugh, located on the Severn River, near Annapolis, Md., has recently been improved by a large mansion equipped with every modern convenience, including a reservoir, pumping plant and electric lighting plant. A large spring, located 300 ft. from the mansion, forms the main water supply, from which the water is pumped to a concrete reservoir on a hill 170 ft. above the spring level; from here it flows to the house by gravity. Immediately adjacent to this spring is a power house built of heavy pine timbers with foundation and floor of solid concrete 2 ft. in thickness. This power house is of the dimensions and plan as shown in Fig. 1.

The mansion is equipped with a three-wire system, having the neutral wire the same size as the outside wires, and contains in the various circuits 350 incandescent lamps of 4 cp, 8 cp and 16 cp. To supply energy for these circuits a plant has been installed of the following description:

The generating unit consists of a 7-kw, 125-250-volt Westinghouse, single-bearing, three-wire, compound-wound generator, coupled direct to a Fairbanks single cylinder, 12 hp, gasoline engine operated at 360 r.p.m. This engine is especially designed for lighting service and represents the most approved gasoline engine practice, giving a speed regulation for the unit of 2 per cent from no load to full load. This unit is capable of supplying energy for 125 16-cp, 110-volt carbon lamps.

In addition to the above there is a storage battery consisting of 58 cells made by the Westinghouse Storage Battery Company and giving 116 volts pressure. The discharge capacity of this battery is 28 amp for five hours. The positive and negative plates of this battery are made of pure lead, without tin, antimony, or other alloy, with the active material formed from a Planté process with sulphuric acid as the electrolyte. This construction gives freedom from sulphation.

For controlling this outfit there is a switchboard consisting of one combination panel built of black, marine-finished slate, and mounted on gas-pipe framework. This panel carries the necessary meters and switches, as indicated in the circuit shown in Fig. 2. It will be noted from this circuit that the battery is charged from the outside, or 250-volt leads of the generator, through fixed resistance, both switches being thrown up to the charge position. It will be noted also that with the switches

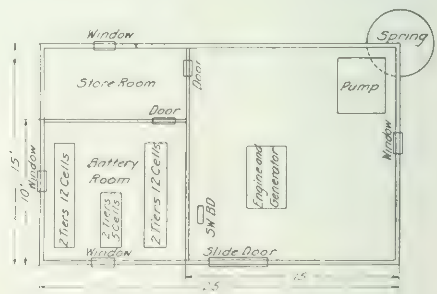


Fig. 1—Plan of Engine and Battery Rooms.

thrown up to the charge position the generator will feed the lighting circuits at the same time the battery is being charged, the battery being analogous to a 220-volt motor on a three-wire system. When operating lamps from the battery direct the switches are thrown down to the discharge position, thus tying together the two outside wires of the system and producing thereby a two-wire, 110-volt system. In this position of the switch the generator circuit is entirely open and it will be noted that the arrangement is fool-proof. It will also be noted that there are three possible ways of operating this plant: (1) Lamps operated from the generator; (2) lamps operated from the generator, the battery being charged at the same time;

(3) lamps operated from the battery direct. The two circuit-breakers in the outside leads of the generator are equipped with reverse-current relays to prevent back-flow of current from the battery. The switchboard is connected to a distributing panel in the basement of the mansion by a three-conductor, lead-covered cable laid in glazed terra-cotta conduit.

This plant has now been in operation six months and is giving entire satisfaction and proving ample in capacity to meet the

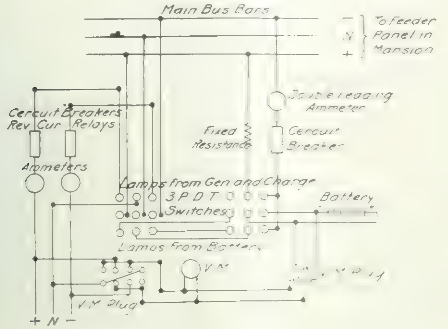


Fig. 2—Diagram of Switchboard Connections.

demands upon it. For special occasions when the greater part of the mansion is lighted the energy is furnished direct from the generator. For ordinary use the battery will furnish necessary energy for two nights without recharging.

The close regulation of the generating unit gives a very steady light entirely free from any pulsation. This plant embodies the usual feature of an isolated plant of this nature, but is of special interest on account of the three-wire feature.

WIRELESS FOR A TRANSATLANTIC AIRSHIP.

By F. M. Sammis.

THE dirigible balloon *America,* with Walter Wellman as pilot, that is to attempt the remarkable feat of crossing the Atlantic Ocean during the month of September, is being equipped with a special set of wireless telegraph apparatus by the Marconi Wireless Telegraph Company. In order better to describe this pioneer wireless equipment of an airship, and its method of operation, perhaps a few words descriptive of the dirigible itself may be helpful.

The huge cigar-shaped envelope is 220 ft. long. It has been constructed from a specially woven fabric of rubber and silk, well adapted for containing the hydrogen gas without leakage. Suspended from the gas bag by means of rope slings and steel guy wires is the car. This car is constructed entirely of steel tubing, braced with steel guy wires, and upon it and the platform which it supports are mounted the main and auxiliary gasoline engines, the former consisting of two 80-hp units and the latter developing 20 hp. These engines drive the four propellers that furnish the motive power. A huge gasoline tank, 150 ft. long and 2 ft. in diameter, is also supported by the main car body. Suspended directly underneath the steel car is an indestructible and unsinkable life boat. In a locker in the forward end of this little craft is located the wireless equipment.

Attached to the underneath side of the steel car, but insulated from it by special rope insulators, is the steel drag rope. The device, while common to the ordinary balloon, has a unique feature worth mentioning. It will, of course, be understood that the function of this drag rope is to equalize the variation in lifting power of the hydrogen gas, owing to the expansion and contraction due to sunlight and darkness. In order to combine a large amount of equalizing weight with increased storage capacity for gasoline, a number of special steel tanks have been constructed, each having a capacity of about one barrel. These tanks are made with hollow centers so that they may be slipped over the steel drag rope, one above the other; thus they can be drawn up into the car and their contents used should occasion require.

In designing the special wireless telegraph equipment for the *America* two requirements were of great importance; first, minimum weight, and second, freedom from danger in operation. In consequence of the importance of these considerations the set was constructed with an exceptionally loose coupling, and operates on energy furnished by a small storage battery which in turn is charged with a miniature gasoline engine generating set used for lighting. This little generating set is a model of compactness.

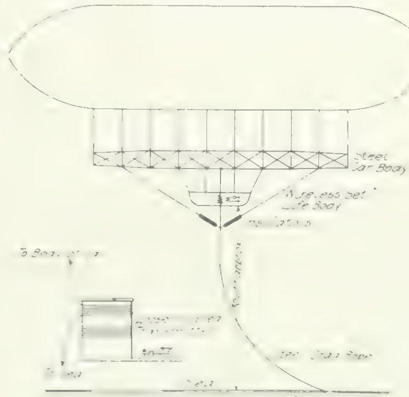


Fig. 1—Diagram of Transmitting Circuits.

Reference to the diagram will make clear the method of connection. The ground end of the secondary winding of the oscillation transformer is connected to the steel cable or drag rope previously described, the aerial end being connected to the steel body of the car. The writer feels quite safe in making the statement that this will be the first instance in which a string of a dozen cans, each containing a barrel of gasoline, has been used as a wireless antenna.

In arranging the coupling of the transmitter it was necessary to give careful attention to the fact that the steel drag rope,

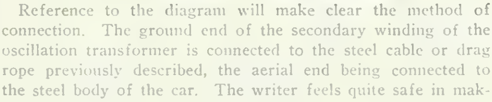


Fig. 3—Wireless Set.

which forms part of the open oscillating circuit, would be continually varying in length, dependent upon the lifting power of the hydrogen gas, thus causing a corresponding variation in its natural periodicity. A very loose coupling was finally determined upon in order to nullify as far as possible the effect of the open circuit upon the closed. The actual power used is approximately 250 watts, a standard Marconi 10-in. induction coil being used to charge the condenser. With this small amount of power the danger of troublesome sparking is

negligible, while actual tests with this set demonstrated the possibility of working from 50 to 75 miles without difficulty.

The Marconi Wireless Telegraph Company, contrary to its expectation, found no difficulty in obtaining an operator willing to make the trip, and from the many who offered themselves selected Mr. J. R. Irwin as being the one best fitted to perform the work. Mr. Irwin is undoubtedly looking for more laurels to add to those already attained from having received the famous "C.Q.D." message from the sinking *Republic*, while he was stationed at Siasconset. As an emergency auxiliary, Mr. Irwin is taking with him a large kite and a quantity of stranded copper wire, to be used as an aerial to be sent up from the life boat, should the necessity of launching it occur.

The airship *America* will send news bulletins to a New York newspaper, using the transatlantic steamships as retransmitting stations.

PRIME-MOVERS AT THE BRUSSELS EXPOSITION.

By Warren H. Miller

THE most interesting mechanical display in the Brussels Exposition is the exhibit of locomobiles or superheated steam units in the German section. Both Heinrich Lanz, of Mannheim, and R. Wolf, of Magdeburg-Buckau, are well represented. The total exhibit takes up a large hall some 80 ft. x 200 ft., most of it occupied by the Lanz and Wolf engines. The feature of the exposition is a 1000-hp Lanz locomobile direct-connected to a direct-current dynamo which furnishes the greater part of the electricity used throughout the exposition. A 500-hp Wolf machine is belted to another generator running in parallel with it, and the energy from both is distributed through a large distribution board at the end of this hall. The construction of the Wolf superheated steam unit was described in the June 2 number. The Lanz machine has been running steadily without a hitch since the exposition opened, consuming 10½ lb. of steam per brake horse-power per hour at 375 deg. C. of superheat. The writer examined the engine carefully and made tachometer tests to obtain some idea of its usefulness when driving alternators connected in parallel. The speed of the unit was 260 r.p.m. and the tachometer needle showed absolutely no variation from this speed. Under such conditions there should be no hesitancy in using them for driving 60-cycle machines connected in parallel and, of course, none at 25 cycles. The company made numerous sales for 50-cycle work with belted alternators. The coupling of the dynamo, as well as of all the other parts, such as condenser, main engine, automatic firing equipment, etc., is a new feature, most locomobiles driving dynamos by belt. The valve-gear of the Lanz machines consists essentially of four balanced pop valves, mounted under the cylinder, so as to be self-draining, the two inlet valves being on one [illegible] a second spindle along-side of it. Both spindles are actuated by a rocking-cam which actuates the inlet valves alternately, and a second cam performs the same service for the exhaust valves. The type of valve employed requires very little movement to obtain full opening of the port, has no friction, so that it requires no lubrication and requires almost no power to actuate it, being balanced. With superheated steam at 375 deg. C., and pressures of nearly 200 lb., slide valves work under severe handicaps, if at all. This caused a demand for something that would not require lubrication and would withstand superheat, hence the growth of the Lanz gear. It is by no means new, the Stevens ferryboat engine valve in this country being a very close prototype.

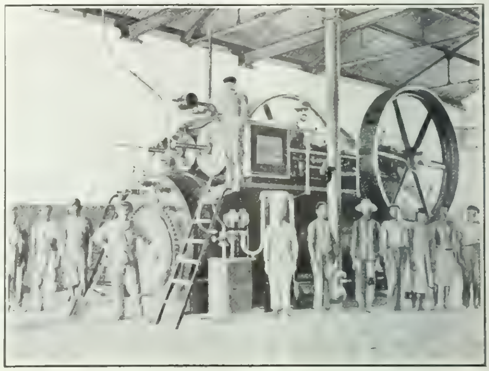


Fig. 2—Lanz Locomobile Engine.

Requiring but very little power to operate the valve, its spindle can be made correspondingly small, and the stuffing-box is of steel, into which the spindle is ground, making a good tight fit. Labyrinthine packing rings cut on the spindle suffice to check steam leakage, and this device is used on all the engines equipped with pop-valves, including all the French and Belgian makes, as well as those of Krupp, in Germany, and Tosti, in Italy, in addition to its use on locomobile units.

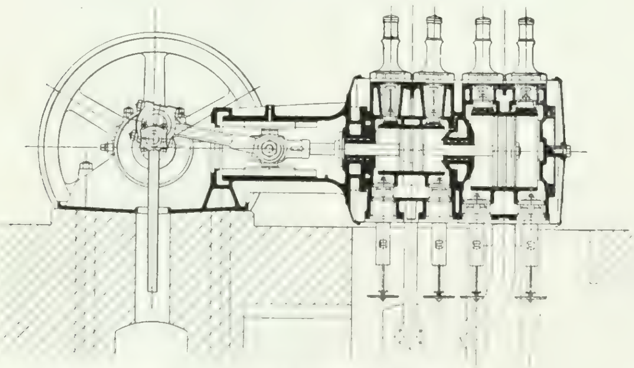


Fig. 1—Section of Engine Using Superheated Steam.

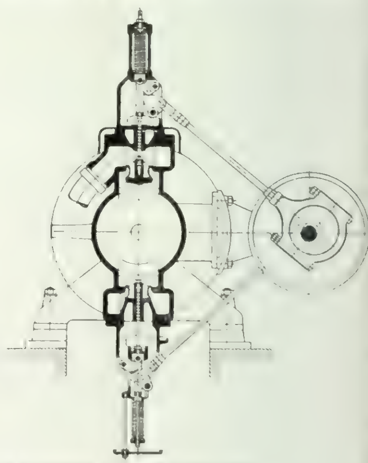


Fig. 3—Section Through Valve-Gear.

The Lanz 100-hp locomobile takes up about a floor-space of 20 by 30 ft., including the boiler. The latter is automatically fed with cheap, fine coal, without dust or dirt, so that the whole exhibit is surrounded with expensive mats and rugs. The apparatus is provided with an electrically driven condenser pump, which, although not quite as economical as the other mechanical pump driven by the engine, has the ad-

vantage that with electric energy available the condenser can be started ahead of the engine and also pump from a source lower than the condenser without filling the room with steam upon starting up. Americans are hardly as yet alive to the advantages of superheated steam in small units, from 1000-hp down to 75 hp, but units of this kind have become standard throughout Europe, the Far East, South America and the Indies. The locomotive exhibit in the same section is very fine, the Maffei locomotives of Munich deserving special notice by those interested in traction problems.

Another feature of interest to all electrical engineers engaged in industrial engineering is an electric traveling jib crane, serving the adjoining hall in the German section. At first blush it would hardly seem that a jib crane would have any place on an electrical traveler, as the two rectilinear motions cover the entire floor space, but it is the story of the gridiron city all over again. In practice the crane often stays in one restricted area for hours at a time, and every movement of stock in this space, even a 500-lb. casting, means moving the whole bridge. Now, if the bridge could be left alone and a jib swung under it the tool would be proportioned more nearly to the work and use far less energy accordingly. This crane, built by Bachem & Keelman, of Duisberg-on-Rhine, in Holland, gives this idea a practical embodiment. There is a light jib-crane, covering a circle of about 50 ft., mounted in the cage below the crane. It is integral with the "trolley" of the American traveling crane and moves across the bridge with it when wanted, but for ordinary service in moving stock within a limited range of 50 ft. the jib alone is used. For heavy loads of the full capacity of the bridge, the usual drum and sheave block are used.

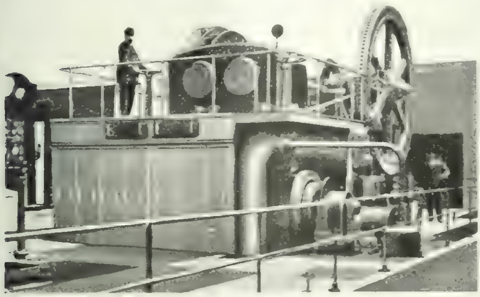


Fig. 4—Lanz Locomobile Engine, 1,000 Hp.

In the International Machinery Hall are assembled most of the latest European developments in mechanical and electrical engineering. Except in the matter of machine tools America is not represented at all, and in machine tools only by a Belgian agent. Switzerland, Holland, Belgium and England are all well represented. Bollinckx, of Belgium, has three classes of engines on exhibition showing examples of his entirely steam-jacketed, Corliss, trip-gear engines with practically no waste clearance spaces and double-sleeve turned cylinder steam jackets for saturated steam, his Lenz system pop-valve geared engines for superheated steam in a tandem compound unit of 300 hp, and his new gas engine and producer, a 100-hp unit from the gas-engine works at Buyshingen, Belgium. Any one of these three types of prime movers is a study in correct logical thinking applied to the problem of getting a hp-hour of work out of a pound of coal under the specific conditions of each engine. Bollinckx considers any Corliss engine that requires more than 15 lb. of steam per hp-hour as a poor example of what can be gotten from ordinary saturated steam with due attention to good steam jacketing and elimination of clearance wastes. The Lenz-gear, driven from a lay-shaft with cams that deposit the valve on its seat without pound or jar and permits the use of highly superheated steam, with its resulting consumption of from 9 to 10 lb. of steam per brake horse-power-hour, is very similar to all the modern Belgian and French lift-valves which one sees so much of in present European practice. In Bollinckx's engines the inlet valves are plain pop valves, and the exhaust valves are of the piston type, because the exhaust is relatively cold. The engine shown in Fig. 1, and built by Zimmermann-Hanrez, of Monceau-sur-Sambre, Belgium, has a balanced lift valve in both inlet and exhaust, due most likely to the advantage of a short lift and invariable opening. It is rated at 550 nominal hp, 750 maximum, 125 r.p.m., 850 mm stroke, 150 lb. steam pressure. In all these valves the time of the lift is varied to give the proper cutoff by the governor, the valve always lifting to its full opening of about ¼ in. to avoid wire-drawing.

In the opposite bay is the exhibit of Brown, Boveri & Company, the famous Swiss firm of electrical constructors. They give full photographic details of their new 120,000-volt transmission now being installed in the Appenines in Italy and show one of the three-phase transformers; also some high-tension condensers and equipment for an electric axle lighting system.

The most striking exhibit in the main central bay is a 5000-hp, cross-connected gas engine which covers a floor-space about 40 ft. x 70 ft. Aside from a new system of ignition, however, and the size of all working parts, this unit presents little out of the ordinary in gas-engine design. It was built by the John Cockerill Company, of Antwerp, Belgium.

There is little else that is really new in this hall, full as it is with machinery by all the famous European manufacturers. In the Holland section is a steam-driven pump with the engine cross-head on its side, the main crank set horizontally, and the centrifugal pump at the bottom of a vertical shaft-well, inside of which was the revolving shaft held in suitable step bearings. This is an excellent device for pumping water economically from artesian wells, instead of a collection of compressed-air lifts in places where the water falls to some 20 ft. below normal level when pumping. In other respects the International Machinery Hall was filled with the usual assortment of engines, boilers, machine tools, electric apparatus, marine engines, portable steam engines, small locomotives, etc., none of them presenting anything much out of the usual. The exposition is strikingly similar to dozens of the same kind held in America and in the smaller cities of Europe.

SINGLE-PHASE COMMUTATOR MOTOR.

Effect of Extra Reactance in the Armature Circuit on the Performance of the Repulsion Motor.

By Shiro Sano.

In the usual practice, the brushes of either simple or compensated repulsion motors are directly short-circuited, in order that no impeding effect shall be imposed on the short-circuiting current. However, it is interesting to see what effect, if any, will be produced by inserting an extra reactance, either inductive or condensive, into the circuit connecting the set of brushes, as is indicated in Fig. 1.

The primary winding of the motor can be considered to be composed of two parts, the transformer winding T and the field winding F, as is usually done in the treatment of this kind of motor.

Before proceeding to discuss the matter analytically it will

Figs. 1 and 2—Series Motor With Impedance in Armature Circuit.

be well to consider the fundamental nature of the effects which the extra reactance produces. In the first place, it will be seen that the extra reactance will not affect the time-phase relation of the current and the e.m.f. in the armature, for the armature winding proper will itself act as an inductance and the insertion

of the extra reactance will simply increase or decrease the whole reactance according to whether the latter is inductive or condensive reactance or capacity, and will simply decrease or increase the current in the armature without changing its time-phase relation with the e.m.f. In the second place, the appearance of an extra reactance outside the armature will cause a difference of potential between the brushes when any current exists in the circuit, where hitherto no e.m.f. was experienced when the brushes were dead short-circuited. The appearance of an e.m.f. between the brushes is simply a sure proof of the existence of a flux in the armature, the alternation of which is the real cause of the e.m.f. The above-mentioned flux will, in its course of alternation, create an e.m.f. in the transformer winding T, which will be proved below to be in time-phase with the field e.m.f. if the extra reactance is inductive and in time-phase opposition when it is condensive. Thus the insertion of an extra reactance will act in two-fold ways: to change the value of current without causing any change in its time-phase relation with e.m.f., and to create an extra e.m.f.

Since the transformer pole T and the armature act as a transformer, a little consideration will enable one to construct an equivalent circuit, corresponding to the above system, as indicated in Fig. 2, in which X_x stands for the extra reactance in the armature circuit reduced to primary terms, X_T for open-circuit reactance of the transformer coil, and X_F for the field-coil reactance. The combined reactance of the whole system will then become

$$\frac{X_T X_x}{X_x + X_T} + X_F = X_o \qquad (1)$$

If X_T be very large compared with X_x, the former can safely be neglected and the problem becomes much simplified. For this simplified case, if x is the actual value of the extra reactance, then the equivalent value in terms of the primary will be

$$X_x = (nm)^2 x, \qquad (2)$$

where n is the ratio of transformer to field circuit turns, and m the ratio of field circuit to armature effective turns. The total reactance for this simplified case will be, then,

$$X_o = X_x + X_F = (nm)^2 x + X_F \qquad (3)$$

Since X_F is independent of the line current I, the extra reactance X_x may be represented in percentage of the former. Moreover, the extra reactance may be considered as a reactance put entirely outside of the motor, being connected in series therewith. This conception will simplify the whole problem. Let

$$X_x = tX_F. \qquad (4)$$

Then the total reactance becomes,

$$X_o = X_x + X_F = (1 + t)\, X_F. \qquad (5)$$

Proceeding as in the case of an ordinary simple repulsion motor, the transformer e.m.f. E_t will be found to be,

$$E_t = 2\pi f \Phi_t n m. \qquad (6)$$

and the field circuit e.m.f.,

$$E_f = 2\pi f \Phi_f m. \qquad (7)$$

where

f = frequency of supply current,
Φ_t = flux in transformer pole,
Φ_f = flux in field pole.

The e.m.f. generated in the armature by speed action by its cutting across the field flux, in its course of revolution, will be,

$$E_d = 2\pi f \Phi_f s. \qquad (8)$$

where s is the speed of the armature with synchronous speed as unity.

Now, let q be the ratio of extra to armature reactance, then the total reactance of the armature circuit will be,

$$X_a (1 + q). \qquad (9)$$

Where X_a is the reactance of the armature proper.

Now the total e.m.f. generated by speed action will be consumed partly in the armature winding and partly in the extra reactance. Since the consumption of e.m.f. will be proportional to the value of reactance, that part of the e.m.f. consumed in the armature proper will be represented by

$$E_d' = \frac{E_d}{1 + q} \qquad (10)$$

From transformer action, the e.m.f. in the transformer coil must have the value,

$$E_t = E_d' m n. \qquad (11)$$

Combining the preceding five equations,

$$\frac{\Phi_t}{\Phi_f} = \frac{s}{1 + q} \qquad (12)$$

Combining this again with (6) and (7),

$$E_t = \frac{ns}{1 + q} E_f \qquad (13)$$

It is proved in the theory of the ordinary simple repulsion motor that the transformer and field coil e.m.fs. are in time-quadrature with each other, and it can be proved also that the extra e.m.f. above stated is in time-phase with the field circuit e.m.f. The vector sum of the three must be equal to the line e.m.f. Hence,

$$E = \sqrt{E_t^2 + (E_f + E_f')^2}. \qquad (14)$$

where E_f' is the e.m.f. created by the extra flux above stated.

Considering the case where a unit current is sent through the system E_f will be the value of X_F, and hence the total impedance can be calculated from (5), (13) and (14), thus,

$$Z = \frac{X_F}{1 + q}\sqrt{(ns)^2 + (1 + q)^2 (1 + t)^2} \qquad (15)$$

Now, t and q in above equation are not independent of each other.

From (2) and (5),

$$X_x = (nm)^2 x = tX_F.$$

and from (10)

$$x = qX_a.$$

Hence,

$$(nm)^2 q = \frac{tX_F}{X_a}.$$

But $\frac{X_F}{X_a} = m^2$ for equal magnetic reluctance in both axes.
From which

$$t = n^2 q \qquad (16)$$

Substituting this value in (15),

$$Z = \frac{X_F}{1 + q}\sqrt{(ns)^2 + (1 + q)^2 (1 + n^2 q)^2} = \frac{X_F}{1 + q} K \qquad (17)$$

K being a constant.

The primary current may be found by dividing the line e.m.f. by the impedance, thus,

$$I = \frac{E(1 + q)}{X_F K} \qquad (18)$$

Now, since the line current is in time-quadrature with the field circuit e.m.f., including the extra e.m.f. above mentioned, and the latter is in time-quadrature with the transformer e.m.f., the field e.m.f. may be taken as an equivalent reactance e.m.f. and the transformer e.m.f. as an equivalent resistance e.m.f. Then the power-factor may be obtained by dividing the equivalent resistance e.m.f. by the total e.m.f., thus,

$$\cos \theta = \frac{ns}{K} \qquad (19)$$

Power input is

$$P = \frac{E^2 ns (1 + q)}{X_F K^2} \qquad (20)$$

Torque is

$$D = \frac{P}{s} = I^2 n \frac{X_F}{1 + q} \qquad (21)$$

The ratio of the starting torque to the torque at synchronous speed is then

$$\frac{D_0}{D_1} = 1 + \left[\frac{n}{(1 + q)(1 + n^2 q)}\right]^2 \qquad (22)$$

The effect of the extra reactance will best be seen by citing a numerical example. Consider the case where $n = 3$, $q = \pm 0.05$; that is, let the extra reactance inserted be 5 per cent of that of the armature proper. The positive sign refers to the inductive reactance, while the negative sign stands for condensive reactance.

Taking X_F as unity the impedance formulas for this particular case become:

$$Z = 0.954\sqrt{9s^2 + 2.32} \qquad \text{for } q = +0.05$$
$$Z = 1.05\sqrt{9s^2 + 0.274} \qquad \text{for } q = -0.05.$$
$$Z = \sqrt{9s^2 + 1} \qquad \text{for } q = 0.0.$$

The primary current, the power-factor, and the torque for different values of s have been computed and plotted as curves in Fig. 3.

It will be seen from these curves that the insertion of an extra inductive reactance in the armature circuit will give a

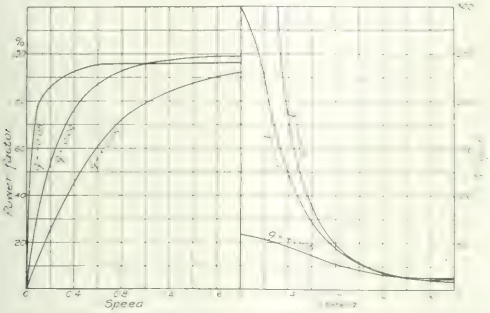


Fig. 3—Effect of Extra Reactance, Simple Repulsion Motor.

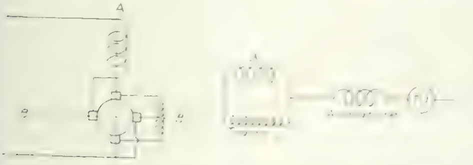
poorer power-factor at any speed than that of the ordinary motor, while the insertion of a condensive reactance improves the power-factor decidedly at lower speed, but it soon becomes "saturated," so to speak, and reaches a practically constant value which is lower than that of the plain motor after the speed exceeds a certain value which happens to be near synchronous speed for a low value of q. The starting torque for the case of the inductive reactance is very much smaller than that for the plain motor, whereas if condensive reactance is inserted it will be enormously greater. When the speed exceeds a certain value, however, the torque will be practically the same for the three cases.

From these results it will be seen that the insertion of an extra inductive reactance in the armature circuit will make matters worse, while condensive reactance will improve the performance. So much for the simple repulsion motor.

EFFECTS ON COMPENSATED MOTOR.

Consider now the case of the compensated repulsion motor with an extra reactance in the armature circuit (Fig. 4).

By the same reasoning as in the case of the simple repulsion



Figs. 4 and 5—Compensated Repulsion Motor with Impedance in Armature Circuit.

motor, the equivalent circuit for this case may be represented as in Fig. 5. By the same method as was used in the case of the simple repulsion motor, one may show that there are three different fluxes to be considered in this motor, namely:

Φ_t' created along AA by the line current (Fig. 4).

Φ_f created along BB by the line current.

Φ_t created along AA by the armature generator current.

Of these Φ_f and Φ_t' are in time-phase, while the third is in time-quadrature with them (Fig. 6).

Since these three fluxes alternate there must be three different e.m.fs. induced by the rate of change of these. Moreover, since the armature revolves, there are expected three more e.m.fs. generated in the armature by speed action. Thus one must deal with a total of six different e.m.fs. The relative time-phase positions of these are as shown in Fig. 7. It is not intended, in this figure, however, to show the exact phase relations of these six e.m.fs., but simply aid the memory by showing which of these are in quadrature with one another. That is, it is not known as yet whether two e.m.fs. are in time-phase or in phase opposition, but merely aware that the two are in line with each other.

Let x = extra reactance in armature circuit,
n = ratio of transformer to armature effective turns,
X = stationary armature reactance.

Then the extra reactance reduced to primary terms will be

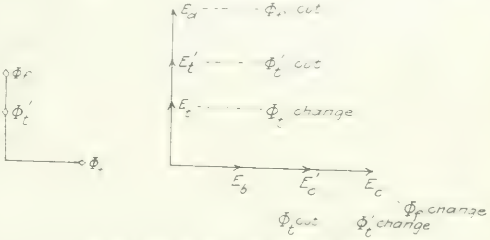
$$X_x = n^2 x \qquad (23)$$

Let $\qquad X_x = t\,X,$

and $\qquad x = q\,X$

then $\qquad t = n^2 q. \qquad (24)$

The last relation is based on the assumption that the magnetic



Figs. 6 and 7—Flux and Voltage Vectors.

reluctances of AA and BB are the same. The extra reactance in terms of primary then becomes,

$$X_x = n^2 q\,X \qquad (25)$$

This reactance, after all, appears as the reactance of the transformer coil. Since the line current passes the transformer coil and the armature at the same time, the voltage drop in the two will be, respectively,

$$E_c' = I\,n^2 q\,X,$$
$$E_c = I\,X.$$

Also from induction,

$$E_c' = 2\pi f\,n\,\Phi_t',$$

and

$$E_c = 2\pi f \Phi_t.$$

From these equations,

$$\frac{E_c'}{E_c} = n^2 q = n\,\frac{\Phi_t'}{\Phi_t}.$$

Hence,

$$\frac{\Phi_t'}{\Phi_t} = n\,q. \qquad (26)$$

Now E_a is proportional to Φ_f and the speed, while E_t' is proportional to Φ_t' and the speed. The speed in the two cases being identical, there is obtained the relation:

$$\frac{E_t'}{E_t} = \frac{\Phi_t'}{\Phi_t} = n\,q \qquad (27)$$

Thus

$$E_t' = q\,(1 + q)\,E_t. \qquad (28)$$

and

$$E_c' = n^2 q\,E_c \qquad (29)$$

E_c' is evidently in time-phase with E_c, so also is E_t' with E_t. Thus finally:

Total reactive voltage,

$$E_c + E_c' - E_b. \qquad (30)$$

Total resistance voltage,

$$E_t + E_t'. \qquad (31)$$

Now the e.m.f. along BB, induced by the rate of change of the field flux, may be represented by

$$E_b = C\,f\,\Phi_f.$$

where C is the number of conductors on the armature.

The e.m.f. along AA generated by speed action due to cutting across the field flux by the armature conductors will be

$$E_a = C\,\Phi_f\,V.$$

The counter e.m.f. induced in the armature by the rate of change of the transformer flux is

$$E_a' = C\,\Phi_t.$$

The total e.m.f. E_a is consumed partly in the armature and partly in the outside reactance. Since q is the ratio of extra to armature reactance, the total reactance of the circuit along AA will be

$$X\,(1+q). \qquad (32)$$

Now

$$E_a' = \frac{E_a}{1+q}. \qquad (33)$$

Hence, from preceding equations, we have,

$$\Phi_t = \frac{\Phi}{1+q}. \qquad (34)$$

Here one must give a different interpretation to the term synchronous speed. With an ordinary motor the synchronous speed is defined as the speed at which Φ_t becomes equal to Φ_f. However, in this motor, it seems to the author to be best to define it as not the speed at which the two fluxes attain the same value actually, but the speed which would give this relation if there were no extra reactance.

From transformer relation it is found that

$$E_t = n\,E_a' = n\,\frac{E_a}{1+q}. \qquad (35)$$

Hence

$$E_t = s\,E_a\,\frac{n}{1+q}.$$

The e.m.f. generated along BB by speed action by the cutting of the transformer flux is

$$E_b = C\,\Phi_t\,s\,t,$$

hence

$$E_b = s\,E_a' = s\,\frac{E_a}{1+q}. \qquad (36)$$

Now let

$$E_a = X$$

then

$$E_t = X\,\frac{n s}{1+q} \qquad (37)$$

and

$$E_b = X\,\frac{s^2}{1+q}. \qquad (38)$$

Finally, the total reactance becomes

$$X\left(1+n^2 q - \frac{s^2}{1+q}\right) \qquad (39)$$

and the total apparent resistance

$$R = n\,s\,X\left(q + \frac{1}{1+q}\right) \qquad (40)$$

Hence, the apparent impedance of the whole system will be

$$Z = X\sqrt{\left(1+n^2 q - \frac{s^2}{1+q}\right)^2 + \left\{\left(q+\frac{1}{1+q}\right)n\,s\right\}^2}$$
$$= X\,K'. \qquad (41)$$

Power-factor is then

$$\cos\theta = \frac{R}{Z}. \qquad (42)$$

Primary current

$$I = \frac{E}{X K'}. \qquad (43)$$

Power input

$$P = E\,I\cos\theta. \qquad (44)$$

Torque

$$T = \frac{P}{s}. \qquad (45)$$

By looking closely into the equation expressing the power-factor it will be noted that the power-factor can be improved at low speed by making q negative, that is, by inserting a condensive reactance in the armature circuit, but that if the negative value of q becomes too large the power-factor will not reach unity. The critical point which determines whether or not the power factor reaches unity may now be discussed. By examining equation (42) it will be seen that to make the power-factor unity one must put

$$1 + n^2 q = \frac{s^2}{1+q}.$$

That is,

$$s^2 = n^2 q^2 + (1+n^2)\,q + 1. \qquad (46)$$

The right-hand term must be greater than zero to make s real, or the critical point is when this is nil. Equating this to zero, therefore, we have

$$q = \frac{-(1+n^2) \pm \sqrt{(1+n^2)^2 - 4n^2}}{2n^2}. \qquad (47)$$

For example, for $n = 3$ the value of q becomes -0.111. Hence, q must be smaller (in its absolute value) than 0.111 for the power-factor to reach unity.

THE SECONDARY CURRENT

The current induced by speed action by the cutting of the field flux is proportional to Φ_f and the speed, hence

$$I_a = K''\,\Phi_f\,s$$

where K'' is a constant.

The field flux may be taken as proportional to the main current; hence,

$$I_a = k\,I\,s.$$

Now, it is clear that to have Φ_t equal Φ_f, I_a must be equal to I, and this occurs not when $s = 1$, but when $s = 1 + q$. Hence

$$I = k\,I\,(1+q), \qquad (48)$$

whence

$$k = \frac{1}{1+q},$$

and therefore

$$I_a = \frac{I\,s}{1+q}. \qquad (49)$$

There is another current in time-quadrature with this, which is the current produced by the transformer action of the transformer coil, the value of which is $I_2 = n\,I$. Hence, the total current along AA becomes

$$\sqrt{I_2^2 + I_a^2} = I\sqrt{n^2 + \left(\frac{s}{1+q}\right)^2} \qquad (50)$$

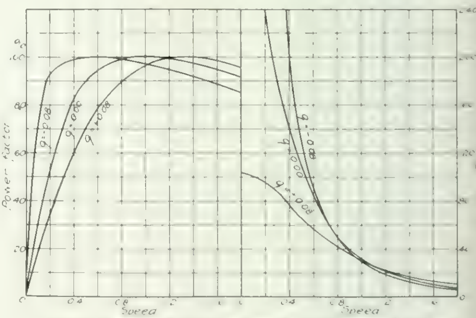


Fig. 8—Effect of Extra Reactance. Compensated Motor.

To show the effect of the extra reactance more lucidly there is shown herewith a numerical example of a motor in which $n = 3$, and $q = -0.08$, or 0.0 or $+0.08$, curves being plotted for the power-factor and the torque, as shown in Fig. 8.

It will be seen from these curves that the point of unity power-factor shifts with the change in the value of q. For $q = 0$, it occurs at $s = 1$; for the positive value of q it occurs at a higher speed, whereas for the negative value at a lower speed than $s = 1$.

The starting torque for the negative value of q becomes enormously large, while that for the positive value much smaller than that for $q = 0$. Above synchronous speed, however, the three torques become practically equal.

EFFECT OF BRUSH SHIFTING.

So far it has been assumed that the axis of the short-circuiting brushes coincides with the axis AA. It is interesting to see, however, what occurs when the axis is shifted from the usual position.

In a vast majority of compound events the total effect produced by the complex combination of events can be considered as a sum or product of two or more simple events. So also in this case one may consider the brush-shifting and the insertion of extra reactance separately and combine the two later if it is so desired. In what follows will be considered the action of brush shifting without any extra reactance in the armature circuit. This plan will simplify the case enormously.

A little reflection will convince one that the effect of brush shifting is equivalent in its action to a change in the number of field circuit turns, and in effect will be the compromise between purely compensated and the simple repulsion motor. The field flux produced by this equivalent field turns is either directly in time-phase or in time-phase opposition to that produced by the armature, according to the direction of shifting.

Let E_c' be the e.m.f. generated by the rate of change of Φ_f in the armature and E_c'' that smilarly generated in the field turns. Then,

$$E_c' = c f \Phi_f$$

as before, and

$$E_c'' = \pm m E_c',$$

where m is the ratio of field circuit to armature effective turns. The total reactance e.m.f. will then be, at standstill,

$$E_c = E_c' \pm E_c'' = c f \Phi_f (1 \pm m). \qquad (51)$$

It was found that

$$E_b = s^2 c f \Phi$$

Hence the total reactive e.m.f. at speed s is

$$E_c = E_c' \pm E_c'' - E_b = c f \Phi_f (1 - s^2 \pm m) \qquad (52)$$

At unit current E_c' may be regarded as the stationary reactance of the armature, X, so that the above equation becomes

$$X (1 - s^2 \pm m) \qquad (53)$$

It was found also that the equivalent resistance is

$$R = n s X. \qquad (54)$$

The combined impedance at speed s is, therefore,

$$Z = X \sqrt{(n s)^2 + (1 - s^2 \pm m)^2}. \qquad (55)$$

and the power-factor is

$$\cos \Theta = \frac{R}{Z} \qquad (56)$$

line current is

$$I = \frac{E}{Z} \qquad (57)$$

power input

$$P = E I \cos \Theta \qquad (58)$$

torque

$$D = \frac{P}{s} \text{ [illegible]} \qquad (59)$$

The ratio of transformer to field turns is

$$q = \frac{n}{n} \text{ [illegible]} \qquad (60)$$

Since q is the ratio of the two turns [illegible]

$$q = N \cos \alpha \text{ [illegible]}$$

where N is the actual number of turns of the stator and α is the angle of brush shift. From [illegible]

[illegible]

and

$$n = \text{[illegible]} \qquad (61)$$

$$m = \text{[illegible]} \qquad (62)$$

where n_o is the ratio of actual [illegible] to effective armature turns.

The various values of α for different values of q are:

q	3.5	3.0	2.5	2.0	1.5	1.0
α	16°	18.5°	21.75°	26.5°	33.75°	45°

A numerical example of a motor in which $n_o = 3$ is presented in Fig. 9. In this example α is taken as -16 deg., 0 deg., and $+16$ deg. for a two-pole machine.

It will be seen from these curves that the shifting of the brushes in a negative direction will shift the point of unity power-factor to below synchronous speed, while the shifting of the brushes in the other direction will shift the point

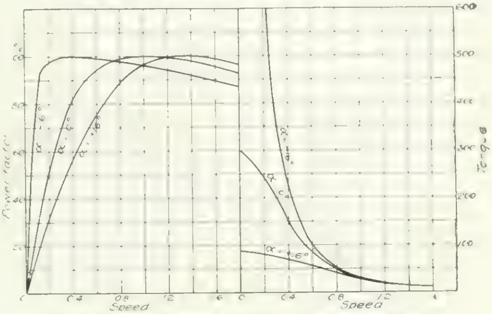


Fig. 9—Effect of Brush Shifting. Compensated Motor.

away from the synchronous speed to a higher speed. Again, the negative shifting results in an enormous starting torque, whereas the positive shifting decreases the starting torque to a much smaller value than that for $\alpha = 0$. Above synchronous speed, however, the three torques have practically the same value.

In conclusion it may be remarked that the brush shifting of the compensated motor is very much analogous to the introduction of extra reactance in the armature circuit.

In the treatment of the entire subject the author neglected the existence of ohmic resistance and the leakage reactance in any part of the motor, since the consideration of these factors would complicate the whole subject to an unnecessary degree.

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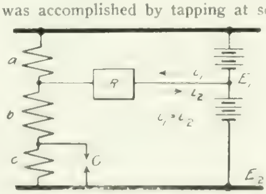
A NETWORK PROBLEM.

By Nicholas Stahl.

A rather interesting application of the network problem occurred recently in conection with a patent application in which, as indicated in the diagram, it became necessary to cause an assigned current to flow through a given resistance (magnet) first in one direction and then reversed.

This result was accomplished by tapping at some convenient



Arrangement of Circuit Connections.

point a battery or bank of lamps or point in a resistance coil. The lead, passing through the magnet in question, taps a point in a resistance circuit between buses connecting the two sources of e.m.f. The second point is alternately, by a predetermined potential difference, below and above the first tap point, reversal being effected automatically by short-circuiting a portion of the resistance circuit by means of a contact-making device, indicated at C, by a suitable instrument actuated from the fluctuating source involved. Reckoning potential differences from one end of the battery, assumed zero, let E_1 be that of the first [illegible] i_1 and i_2 are the re-

sistances in the circuit. Second tap point is assumed first at potential [illegible], and later at V_2:

or $$E_1 - V_1 = Ri = V_2 - E_2. \quad (1)$$

where i is the reversible current through the resistance R.

If x be the current in b and c in the first case, and y that in b in the second case, by applying Kirchhoff's laws, one obtains

Case 1

$$V_1 = a(x [illegible] \quad (2)$$

$$E_2 - V_1 = (b + c)x \quad (3)$$

Case 2

$$[illegible] a(y [illegible] \quad (4)$$

$$E_2 - V_2 = by \quad (5)$$

and, otherwise expressing the initial relation,

$$[illegible] \quad (6)$$

These are the only independent equations: Kirchhoff's laws for the outside circuit give merely the sum of (2) and (3) for case No. 1 and (4) and (5) for the other.

It will be observed that these five equations contain 10 quantities, so that five must be given arbitrary values to effect a solution. E_2 is, of course, known or decidable. i follows from the conditions of desired operation. From equation (4) it is seen that y must be greater than i to keep within the physical limitations of the problem. Moreover, inasmuch as the contact-making device has to break the current y, this current should be as small as possible, which conditions y, but does not fix it, as y and i are not independent.

Since it is desirable to waste as little power as need be in I^2R losses, one at least of the quantities a, b and c should be large, which is secured in effect by making V_1 and V_2 of relatively largely different values.

Inasmuch as all the quantities are essentially positive, equation (2) places an upper limit on a, for example:

$$x = \frac{V_1}{a} - [illegible], \text{ and since } [illegible] > [illegible],$$

$$\frac{V_1}{a} > [illegible];$$

or, on the assumption shortly to be made of $i = 0.5$,

$$[illegible]$$

Assume now

$$E_2 = 125;\ V_1 = 80;\ [illegible] = 120;\ i = 0.5;\ a = 150$$

Then by algebra,

$$x = 0.035 \text{ amp.} \quad y = 1.3 \text{ amp.} \quad E_1 = 100 \text{ volts}$$

$$b = 3.85 \text{ and } c = 1281.15 \text{ ohms.}$$

As a typical electrical problem, citation is made in detail to bring out three points: the determination of certain quantities (the currents x and y), as of definite (small) values, is essential to successful mechanical operation of the principle (contact making device); the avoidance of assigning arbitrary values to quantities interdependent; prognosis of physical limitation on quantities mathematically independent. Further, the labor of calculating maxima or minima is avoided by a little preliminary inspection.

Central Station

Management, Policies and Commercial Methods

PRIZES FOR SUGGESTIONS FOR IMPROVED SERVICE.

The Commonwealth Edison Company of Chicago makes a practice of offering a prize of $1 to any employee who submits a useful suggestion for the betterment of the service or of the manner of doing business. Many suggestions are received in consequence of this offer, and although a considerable proportion relate to rather unimportant details there remains a number of some value, and for these prizes are awarded. The company also offers a prize of $1 for every mistake discovered by any employee in the company's advertising matter. These prizes also excite much interest. They have a double value, for not only is the advertising matter prepared with especial care in consequence, but all employees of the company are pretty sure to read its advertisements to see if they can detect an error which will bring them in the dollar reward. By reading the "ads" carefully, the employees are kept in constant touch with the company's efforts to reach the public.

MAINTENANCE OF METERS IN SMALL PLANTS.

Mr. A. M. Richardson, of Ann Arbor, Mich., read a paper on the maintenance of meters before the Michigan Electric Association convention, at Port Huron, on Aug. 18, 1910. He took up first the increased necessity for accuracy of meters, now that tungsten lamps with low specific consumption are coming into use. A few years ago there was almost a different type of meter for every customer. To-day there are three meters in general use, all with the same constant, the meters differing only in repair parts. Not only have the makers produced a simple, easily-adjusted meter, but they have provided in the rotating standard a simple and inexpensive means of testing. The rotating standard has robbed meter testing of complication, and of many possible sources of error, and has greatly reduced the expense. While formerly several instruments and a couple of men were required to test a meter, thereby making the occasion quite a social event, to-day a more reliable job is done by one man by the use of a rotating standard.

The first essential of a system of keeping meters accurate is a certain definite part of a certain definite man's time. The work is essentially that of a specialist, and should with all other meter work be concentrated in one man's hands, thereby enabling him to get all the experience possible, and fixing the responsibility. His main possession should be: experience, intelligence, interest in the work, reliability and good standing in the community. The second essential is the headquarters for this department. A room must be set aside for the purpose of storing and testing meters. For checking the test meter an indicating wattmeter is probably the usual equipment, although every batch of new meters from the factory affords a rough check. Arrangements can possibly be made with a larger company for checking the test meter, or it can be sent back to the factory or a test bureau.

One inexpensive scheme is to mount on the test board an ordinary meter that has tested out perfect, and thereafter use it for the sole purpose of checking the test instrument. The question of extreme accuracy need not be considered at the present time, when all available data indicates that outstanding meters average 8 per cent slow. A meter found on test within 1 per cent of perfect should be left alone. In testing a meter a portable loading device will be required, as it saves much running about on the customer's premises. This device consists of a box containing lamps, flatiron units, or similar non-inductive load, so wired up to switches that any load from that of a 2-cp lamp to 25 amp can readily be obtained. Suitable printed forms must be provided for recording the results of the tests, using stiff paper to allow writing when held in the hand and for vertical filing. Meter readers appreciate having meters in convenient locations. Meter testers appreciate this still more and the quality of the meter testers' work will depend very much on the convenient location of the meters which he has to test.

The consumer's connected load is sometimes changed, and it is the duty of the meter tester to note this, and order a suitable

change in meters. It seems a general and good practice to install meter equipment for 60 per cent of the residence connected load, and 100 per cent of the business load, using no single meter, however, under 5 amp, or over 50 amp rating. Where the load is greater than 50 amp use should be made of a 5-amp meter and suitable series transformers, thereby allowing testing with ordinary equipments.

At Ann Arbor there are only two makes of meters and no meter is more than five years old. In the last five years each meter has had at least one shop test and two installation tests. With 2000 meters, one man's time is given up entirely to setting, removing and testing meters, making all special meter readings, and doing the heavy work at regular meter reading times. Most of the testing work is done during the first three months of the year when the other work is slack. The labor cost of testing a meter under these conditions is 25 cents, and is the main expense, as supplies and repair parts are almost insignificant.

DEMAND AND DIVERSITY FACTORS AND THEIR INFLUENCE ON RATES.

By J. R. Cravath.

Demand factor is defined as the highest percentage of connected load which is ordinarily in circuit. Thus, if a central-station consumer has 10 kw in lamps connected [illegible]d his highest maximum demand is 5 kw, he would be rated as [illegible]aving a demand factor of 50 per cent.

[illegible]iversity factor is commonly defined as the ratio of the sum [illegible] maximum demands of a given group of consumers at [illegible]nt times to the actual maximum demand made by the [illegible] at one time. This likewise frequently can best be ex[illegible]ed in per cent. For example, a group of 10 consumers [illegible]nnected on a certain secondary main might cause a maxi[illegible]um demand of 3 kw on the transformer supplying that main; [illegible]ut if a maximum-demand meter were installed on each con[illegible]umer's service the sum of the maximum demands recorded by [illegible]ese meters for any month might be 9 kw in certain classes of [illegible]. Expressed in per cent, the diversity factor of this load [illegible]ation to the transformer would be 33.33. This difference [illegible]en the sum of the individual maximum demands of each [illegible]ner and the actual maximum demand on the transformer [illegible] course, caused by the fact that the maximum demands of [illegible]e various consumers do not occur at the same time. In [illegible]ther words, there is diversity in time of maximum demand.

[illegible]e existence of diversity and demand factors in central-[illegible] business has been recognized since the earliest days, [illegible]gh it is only recently that these brief terms have come [illegible]se to express these relations. It may also be said that [illegible]ugh the central-station industry has been dependent for its [illegible] existence on diversity and demand factors, the study of [illegible] factors has not been as thorough as it should have been. [illegible]nly recently that much activity has been shown in the [illegible] of these factors, which have an all-important influence [illegible]e rates that central-station companies can afford to make, [illegible] hence are at the very foundation of the industry. The rea[illegible]f their importance is that so large a percentage of the cost [illegible]f supplying electric service is frequently made up of certain [illegible]xed charges, such as interest, depreciation and taxes, which [illegible]e brought about by the necessity of providing a certain in[illegible]nt to take care of a certain connected load. It is evi[illegible]nt that the larger the amount of apparatus required to sup[illegible] kw of connected load the greater must be the fixed [illegible]arges per kilowatt connected.

[illegible]e percentage of the cost of serving a consumer which is [illegible] fixed charges and the percentage due to variable operat[illegible] expenses differ according to the class of consumer. The [illegible]d charges are seldom less than 10 per cent and may be as [illegible]as 100 per cent of the cost of service. The fewer the [illegible] per year the service is used the greater the percentage [illegible]omposed of fixed charges. For example, if a certain [illegible]sumer contracts for electric service and the company installs [illegible]eters, lines, generating capacity, etc., to supply him, and if that consumer uses no electrical energy whatever during the year, the cost of serving him evidently is made up entirely of fixed charges on the investment required, plus a small amount for keeping books, reading the meter and maintaining the office. If, on the other hand, the consumer used his entire connected load 8760 hours in a year, his fixed charges should be divided into 8760 parts to determine the amount a kw-hour. The great majority of central-station customers, however, use the service but a limited number of hours a year.

The relative proportion of total expenses chargeable to the three heads—fixed, operating and consumers' charges—has been a matter of considerable investigation. It is not likely to be exactly the same for any two plants. It is of interest, however, to cite a few examples from various recent published investigations. A very thorough investigation of this division of expenses was made by the Wisconsin commission in the recent Madison Gas & Electric Company case, decided March 8, 1910. For the year 1908 the commission found by one method of analysis that 16.7 per cent of the total cost was caused by the expenses which are the same for each consumer, entitled "consumer expenses"; 21.6 per cent were expenses proportional to the demands of each consumer, and 61.7 per cent were variable operating expenses proportional to the kw-hours' output. By another method of analysis 58.2 per cent of the expenses were chargeable to output, being proportional to kw-hours, and 41.8 per cent were chargeable to demand. In the case of the Ripon Light & Water Company, decided March 28, 1910, the Wisconsin commission assigned about 39 per cent to capacity charges and 61 per cent to output charges.

In a paper before the last N. E. L. A. convention Mr. S. E. Doane gave the results of central-station cost analysis from 70 small central stations in the East, 40 small central stations in the West and two very large central stations. In this analysis it appeared that of the total cost 30.3 per cent was proportional to output, 55.1 per cent proportional to demand, and 14.6 per cent proportional to the number of consumers.

In a paper before the Missouri Electric, Gas, Street Railway and Water Association, in April, 1909, Mr. C. W. Hough gave an analysis of the cost of central-station service, taking as a basis the statistics given by the last United States census report on the electrical industry. He reached the conclusion that the total cost should be divided into consumer charges, 5 per cent; capacity charge, 35 per cent, and output charge, 60 per cent. These, Mr. Hough said, represented the average results as shown by the Government reports. The proportions chargeable to the various items should, of course, be investigated for each individual company, rather than taken from general averages, when any specific case is being investigated with a view to adjusting rates. The figures given are of interest merely as showing what figures have been obtained in some cases. If it is assumed that at least 30 per cent to 40 per cent of the average cost of serving consumers, and perhaps more, is caused by the maximum demand of such consumers, the importance of determining what actual maximum demand these consumers put upon the station is evidently important.

It is an easy matter to determine the ratio of total connected load to maximum demand on the central station where the company has a connected load of record. However, the determination of this ratio and the determination of the percentage of the total cost chargeable to fixed expenses is by no means sufficient to afford a basis for rates. In other words, averages are worth little when the character of service required by various consumers differs so greatly. The attempt must be made to determine as nearly as possible the actual demand and diversity factors of different kinds of loads in [illegible] proportion of the fixed investment charges must be carried by these different kinds. If this is not done some profitable business is likely to be lost for lack of a proper rate schedule, while other unprofitable business is obtained.

There are a number of links in the chain between the consumer's lamps and the generators at the power plant. First, [illegible] connected load to maximum de-

mand must be studied at each consumer's premises and then the diversity factors at different points between the consumer and the power plant.

Beginning at the consumer's end, the first step is to determine the demand factor or the ratio of the consumer's maximum demand to his connected load. This determines the size of meter and service wires necessary and the consequent investment. Next, in an alternating-current system, comes the diversity factor between the various consumers and transformers, which indicates the transformer capacity necessary to serve a given kind of connected load. Next is the diversity between different kinds of load whose maximum demands occur at different times. If the system is direct current, of course the transformers are omitted and the diversity factor must be taken from the consumers' services to the ends of the feeders supplying the various mains.

This subject has not been studied enough so that many figures cannot be given on the demand and diversity factors of various classes of service and the diversity factor between these classes. A compilation of some of the available figures, however, will be given in the hope of stimulating further interest in this important subject.

DEMAND FACTORS.

The Wisconsin Railroad Commission has probably carried on one of the most comprehensive series of investigations yet made to determine this demand factor or ratio of maximum demand to connected load for various classes of consumers. This commission in the case of the Ripon Light & Water Company formulated certain rates. In formulating these rates it was necessary to assume certain figures for demand factors of various consumers. These figures as fixed by the commission were based on data from a large number of other cities, but also took into account local conditions. These figures were as shown in Table I:

TABLE I.—DEMAND FACTORS ASSUMED AS BASIS OF RIPON RATES BY WISCONSIN COMMISSION IN PER CENT.

Residences, flat and rooming houses	40
Public buildings	40
Ripon College	20
Schools and churches	55
Factories	55
Hotels	60
Livery stables	60
Libraries	60
Stores	75
Offices	75
Banks	75
Saloons	75
Depot	75
Theater	75
[illegible]	75
[illegible]	100
Railway	100
Street lighting	100

The same commission when fixing the rates for Madison, by decision rendered March 8, 1910, specified that in figuring rates for Madison, the following demand factors should be used, as shown in Table II:

TABLE II.—DEMAND FACTORS ASSUMED BY WISCONSIN COMMISSION FOR FIXING RATES AT MADISON IN PER CENT.

Residence lighting, first 10 lamps	60
Residence lighting over 10 lamps or 500 watts	33.3
Stores and offices	70
Restaurants and saloons	70
[illegible]	70
Laundries	70
[illegible]	70
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Factories	55
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	100
One motor under 10 hp	90
[illegible]	80
[illegible]	[illegible]
[illegible]	[illegible]
Motor installations 50 to 100 hp	55
[illegible]	50

The Wisconsin commission has also collected data from a number of large companies using Wright demand meters by

each consumer. The demand factors obtained from these companies which use maximum-demand meters vary considerably, as will be seen by Table III, which gives the highest and lowest figures reported for various classes of business.

TABLE III.—DEMAND FACTOR COMPILED BY WISCONSIN COMMISSION FROM COMPANIES USING WRIGHT DEMAND METERS.

Stores	40 to 100
[illegible]	57 to 87
Saloons	52 to 92
Restaurants	52 to 62
Factories	[illegible] to 56
Churches	50 to 85
Hotels	28
Clubs	25
Schools	37 to 52
[illegible]	61 to 75
Livery stables	52 to 58
Lodge and dance halls	65
[illegible]	75 to 95
[illegible]	49 to 89
[illegible]	55
Machine shops	37 to 54
Blacksmith shops	66
County and federal bldg.	33 to 31

The Commonwealth Edison Company of Chicago has given considerable study to this matter of demand factors, and many figures covering different classes of consumers can be found in two papers presented by representatives of that company at the National Electric Light Association conventions. One of these, entitled "Load Factors," was presented by Mr. E. W. Lloyd at the 1909 convention. Another, entitled "Significance of Statistics," was presented by Messrs. George A. McKana and B. F. McGuire at the 1910 convention. In the latter paper demand factors for the month of January, 1910, for small and medium lighting customers summarized were as shown in Table IV:

TABLE IV.—DEMAND FACTORS—CHICAGO LIGHTING CUSTOMERS.

Offices of various kinds	72.4
Residences and barns	60
Retail stores	66.3
Wholesale stores	70.1
Billboards, monuments and department stores	85.6
Average	59.8

A similar table was given for the motor users of the company in the direct-current territory where Wright demand meters are used on each consumer's service. These showed demand factors as shown in Table V.

TABLE V.—DEMAND FACTORS—CHICAGO MOTOR CUSTOMERS.

Public gathering places and hotels	28.7
Offices	55.1
Residences and barns	69.3
Retail stores	61.2
Wholesale houses and shops	58.2
Average	59.4

The average of 59.4 per cent for motor customers is strikingly near to the average demand factor of the small and medium size lighting customers.

In the paper by Mr. Lloyd before referred to, figures on 30,729 residence consumers in Chicago show the following percentages demand factors:

Residences 0.3 kw connected load	90
Residences 0.5 kw connected load	64
Residences 1 kw connected load	48
Residences 2 kw connected load	46

DIVERSITY FACTORS.

In order to make a complete study of diversity factors, it is necessary to know: first, the consumer's connected load; second, the maximum demand of the consumer at his service or meter, third, the maximum demand which he places on the transformer or direct-current feeder supplying him at the time of the maximum demand on that transformer; fourth, the maximum demand which he causes on the feeder supplying him at the time of maximum demand on the feeder; fifth, if the system is a large one employing sub-stations, the maximum demand placed by the consumer on the sub-station at the time of the sub-station peak load; sixth, maximum demand of the consumer at the time of the generating-station peak load. The reason for studying the maximum demand at the time of the peak load at the various points named is obviously to determine the investment which must be made in the various kinds

of apparatus to serve a given consumer. For example, it is the simultaneous demands of a number of consumers which determine the size of transformer necessary to serve that group of consumers.

The most complete study of diversity factor which has been made public is contained in a paper by Mr. H. B. Gear, of the Commonwealth Edison Company of Chicago, presented before the Western Society of Engineers and the Chicago Section A. I. E. E., March 23, 1910. Mr. Gear carried his analysis as far back as the substation busbars. By combining the diversity factors given by Mr. Gear in this paper with the demand factors of residence consumers given by Mr. Lloyd in the paper already referred to, some instructive figures are obtainable, as follows:

A connected load in Chicago consisting of 100 kw in residence consumers, each of 0.3 kw connected load, will cause a maximum demand at consumer's meters of 90 kw, a maximum demand at the transformers of 30 kw; a maximum demand at the feeder panel of 16.6 kw, and a maximum demand at the time of the substation peak of 14.5 kw.

For 100 kw connected residence load, consisting of 0.5 kw consumers, demands at meters would total 64 kw; transformers 21 kw; feeders 11.6 kw, and substations 10 kw.

For a connected residence load consisting of 100 kw in consumers having 1 kw connected, each, a total connected load of 100 kw would cause demands as follows: Meters, 48 kw; transformers, 16 kw; feeders, 8.9 kw; substations, 7.7 kw.

For a group of residence consumers, each of 2-kw connected capacity, the demand would be as follows: At meters, 46 kw; transformers, 15 kw; feeders, 8.3 kw; substation capacity, 7.2 kw.

For motor load, Mr. Lloyd's paper before referred to states that the ratio of average to connected load for the entire number of motor customers was 53.5 per cent. With this figure as a basis, and using the diversity factors for scattered motor load given by Mr. Gear, a connected load of 100 kw in motors in Chicago would make the following demands: At meters, 53.5 kw; transformers, 48.5 kw; feeders, 24.2 kw; substation capacity, 21 kw.

Taking the demand figures already quoted of 66.3 per cent for retail stores in Chicago, and assuming that these figures can be safely applied in connection with the diversity figures given by Mr. Gear for commercial lighting, the following demand for a connected load of 100 kw would obtain: Demand at meter, 66.3 kw; at transformer, 39.4 kw; at feeder panel, 33.2 kw; at substation peak, 28.8 kw.

In all of the figures so far given on Chicago conditions it will be noted that the analysis is carried back only as far as the substation. The relations between the different kinds of load and the peak load on the main generating station have not been shown. This diversity between different kinds of business is very important in its influence on the generating capacity required. The following figures were obtained from some typical local curves of the Chicago system.

A typical three-phase motor circuit daily load curve in December showed that 58 per cent of the maximum load on that feeder occurred at 5 p. m., which time is approximately the time of the peak on the whole system. If this curve is a fair average, therefore, the maximum meter demand of such a motor feeder should be multiplied by 58 per cent to get the demand caused on the system at the time of the system peak load. This would give by deduction from previous motor circuit figures a station peak of 12.2 kw for each 100 kw connected motor load.

A typical residence circuit daily load curve for December, published at the same time, showed that 75 per cent of the maximum load was on at 5 p. m. The maximum load on that feeder occurred just before 8 p. m. Applying this figure of 75 per cent to the figures already quoted on Chicago residence load diversity factor, there would be a maximum demand on the station for [illegible] classes of residence load as follows: Small residences, 0.3 kw each, 10 kw station demand [illegible] dences of 0.5 class, 7.5 kw station demand; residence of 1 kw class, 5.8 kw station demand; residences of 2 kw class, 5.4 kw station demand.

The commercial lighting load in Chicago at the time of maximum demand is so different in different districts of the city that no general conclusions can be drawn.

At Detroit, Mich., according to figures published at various times regarding residence lighting conditions there, it appears that for a connected load of 100 kw, consisting of a large number of residence consumers per block, the maximum demand on the transformers would be 20 kw; that on the substation supplying that district 14.3 kw; and that on the power station at the time of the system peak 7.1 kw. From the last two figures it is apparent that at the time of the peak load on the system, only 50 per cent of the residence lighting load is on. The remaining 50 per cent comes on later, subsequent to the peak on the system.

At Madison, Wis., the load curves published in connection with the commission's decision already referred to indicate that for a connected motor load of 100 kw, direct current, the maximum demand is 26 kw, of which 16 kw occurs at the time of the station maximum peak. For alternating-current residence lighting in Madison a connected load of 100 kw is estimated to cause 50-kw maximum demand at the meters, and from 15 kw to 20 kw at the transformers. Alternating-current commercial lighting at Madison for each 100 kw connected will cause 50 kw to 55 kw maximum demand at the transformers. Taking alternating-current, commercial and residence lighting together in Madison, 100 kw connected causes about 30 kw maximum demand at time of station peak.

At Spokane, Wash., analysis of the load on a residence feeder shows that for 100 kw connected load, the maximum demand on that residence feeder would be 37 kw.

At Paxton, Ill., 100 kw connected load in direct-current motors causes a maximum demand on that power circuit of 26 kw, and a maximum demand at the time of the station peak in December of 6.5 kw.

In small towns the business of a central station can be mainly classified under three general headings. Motor service, residence service and business district lighting service. Conditions vary widely as to how much these three services overlap at the time of the station peak in December. In some towns it is probable that the motor load is almost entirely off at the time of the main peak load on the system. On the other hand, residence lighting is very likely to overlap the main peak, because of the custom of keeping stores open certain nights each week in the smaller towns. So few small companies have residence and business lighting feeders separated that information on this matter is scarce. Load curves from one residence and one commercial lighting feeder of the Wabash (Ind.) Water & Light Company for Jan. 3 showed the same value of combined residence and commercial peaks at 5 p. m. and 6 p. m., but the elements making up the peak were different. At 5 p. m. the residence load was 35 per cent of the combined residence and commercial load, while at 6 p. m. the residence load was 44 per cent.

The figures which have been given on maximum demand on the power station caused by a given amount of connected residence load show why it is that some central stations have added a large number of residence consumers without increasing the peak load demand much.

In the application of these diversity and demand factors to the fixing of rates it is, of course, necessary to know approximately the investment which the central station must make in different parts of its system under existing local conditions. In order to show the method of working out the investment required for a given class of consumers per kw of connected load, assume a hypothetical case of a residence consumer whose connected load is 0.5 kw.

Taking this consumer's connected load as 100 per cent, assume that the following demand and diversity factors have been found to apply to the local conditions under consideration: [illegible] demand at

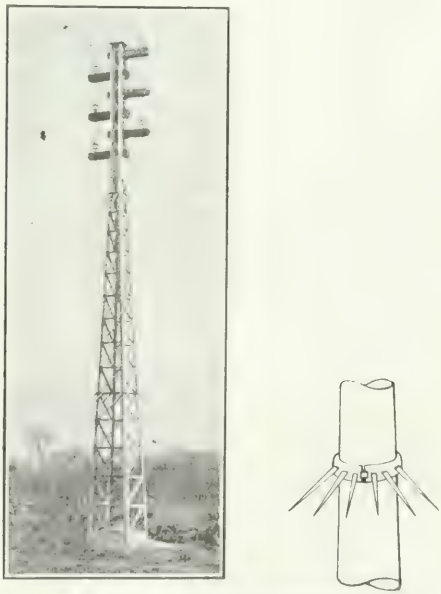
meter, 60 per cent of connected load; maximum demand at transformer, 25 per cent of connected load; maximum demand on feeder, 12 per cent of connected load; maximum demand on generating station at time of station peak, 10 per cent of connected load.

As to investments, assume meters at $12 each; transformer at $10 per kw of capacity; overhead lines at $50 per kw of maximum feeder demand, and power station at $100 per kw of maximum demand. For each 0.5 kw consumer there would then be the following investment: One meter at $12; transformer capacity, $10 × 25 per cent × 0.5 kw, or $1.25; lines, $50 × 12 per cent × 0.5 kw, $3; station capacity, $100 × 10 per cent × 0.5 kw, $5; investment for each 0.5 kw consumer, $21.25; investment per kw conncted of such consumers, $42.50. The foregoing figures begin at the consumer end and go back to the station. It is possible to calculate the investment beginning at the station end, but it is usually most convenient to figure from the consumer's end.

Wiring and Illumination

PREVENTING UNAUTHORIZED CLIMBING OF POLES.

Electric light and transmission companies are often subjected to criticism and lawsuits owing to deaths or injuries of persons who climb poles and come in contact with "live" wires, notwithstanding that the persons so doing were trespassing on the company's property. Such occurrences became so numerous in Switzerland, with its large number of electric transmission plants, that the matter was taken up for serious consideration. A commission of the Swiss Association of Electrical Engineers, comprising three directors of electricity works, decided last November to recommend to all members of the association that latticed poles be encased at least 6 ft. from the ground and that porcupine rings be attached to poles and towers in order to protect the lines from mechanical damage and the companies against accident claims. The illustrations herewith show the porcupine ring and its applications, the ring being only detachable by means of suitable socket keys. In addition, a warning shield 6.5 in. by 9.5 in. and reading "Danger to Life when touching the lines" is attached to the poles in a conspicuous place and in a substantial manner. Thus far the scheme has been fraught with good results.



Figs. 1 and 2.—Applications of Porcupine Rings.

LIGHTING OF SCHOOLS.

The formation of the Illuminating Engineering Society in the United States has been influential in stimulating an interest in school lighting in America. The eyesight returns of a number of authorities have proved that a deterioration in eyesight during school life exists, and it has been felt that this was at least partially attributable to unsatisfactory conditions of lighting.

But the conditions of eyesight in Europe have also given occasion for concern. In Germany, where some of the earliest enquiries were undertaken, the need for good lighting has for some time been realized and rules for the illumination of schoolrooms were long ago laid down by Professor Weber, of Kiel, and other observers.

In Great Britain the subject is also attracting an increased amount of attention, the more so because it is only last year that a regulation came into force according to which the London County Council undertook an official examination of the health of all children under their charge. Naturally it is being contended that an examination of this kind should include an investigation into the conditions of illumination, and the most recent reports of the London County Council Medical Inspector have contained special references to the subject. It is probable that the whole subject of school lighting will be the subject of discussion before the Illuminating Engineering Society in London shortly.

The first point is the importance of the hygienic side of lighting. During the last few years the medical profession has become firmly impressed by the importance of the influence of surroundings during school life on the health of the child and on its future career. During the years they are at school, it is pointed out, children are at a critical stage in their development and are specially sensitive to the prejudicial influences, bad illumination among the number. The importance of this question will be realized when it is stated that in the schools of London alone there are said to be over 1,000,000 children, and last year, for the first time, the medical inspection of the children became part of the official duty of the London County Council.

It may safely be said that among the other matters attended to by medical officers of health the conditions of illumination cannot be ignored. Although there is yet much to learn regarding the effect of light on vision the importance of good illumination, and the prejudicial effect of bad lighting, on the eyesight of children scarcely requires emphasis. Insufficient light accentuates the difficulties of fine work and imposes a strain even on the adult. It is specially prejudicial in the case of children. In this connection a recent annual report of Dr. J. Kerr, medical officer to the London County Council, said:

"A normal person of middle age will distinguish characters on paper in a poor light with greater readiness than a child, because the characters are more familiar to the adult and so much more readily recognized. Conversely a child requires a better light to read by than does an adult to whom reading is second nature. From a large number of experiments, the least illumination permissible on the school desk of a child has been found to be equal to 10 candle-meters (i.e., roughly one ft.-candle)."

Dr. Kerr had then examined a number of schools and reported on the lighting conditions. Only about 70 per cent of those visited could be classed as "good" and it must also be remembered that the higher standard of lighting imposed by the knowledge of good illumination which is now being acquired would, if strictly applied, probably still further reduce this figure. Until a more complete survey of the conditions of illumination in the large number of schools in London is made one cannot be certain as to how far the present conditions re-

quire modification. But it would be surprising if there were no respects in which the present conditions could be improved and the closer attention which the medical profession are now paying to the matter is likely to help to raise the standard.

Meantime there is one point on which fairly exhaustive enquiries in different countries have been made, namely, the eyesight conditions prevalent among school children; unfortunately there seems to be general agreement that the eyesight of school-children tends to become steadily worse during school life. In the United States and in Germany very special efforts have been put forward to try and check these defects. One method which has been adopted in some districts in both countries has been the appointment of a controlling board in which the architect, the medical officer and the lighting engineer co-operate, in order to assure that the conditions should be as satisfactory as possible, and to supervise the plans of all new schools erected.

Now there is at least a probability that this deterioration in eyesight is partially due to bad lighting conditions. There is much to learn as to the way in which the lighting of school-rooms should be arranged, but at least some errors are known which must at any cost be avoided.

First of all there is the necessity of providing sufficient light on each desk. As so much of the work in these schools is done during the daytime it is very important that the windows should be well placed and that the interior should have walls of a pale tint so that the light can be well distributed. In addition it must be recalled that daylight illumination varies enormously from day to day. Provision should, therefore, be made to secure enough light for the desks most remote from the window even on unusually dull days. Until one actually takes measurements one hardly realizes how much the daylight illumination varies in different parts of the room. In an office with which the writer is acquainted the illumination near the window often exceeds 100 foot-candles. Only a few feet further back it is, under the same conditions, frequently as low as 1 foot-candle. And in parts of the room more remote from the window the illumination is too low to read in comfort. Yet a casual observer would suppose from the appearance of the room that the light in all these parts was not very widely different in intensity.

Naturally the use of walls and ceiling of a light tint helps materially to reduce the disparity in illumination at different parts of the room. Some authorities have also laid stress on the value of light sun blinds in very bright weather for the purpose of diffusing the light. It is possible, with a clear sky, that one might actually *increase* the amount of light in a room by this means. Special window glass is also used for the same purpose, but this must be used with discretion. In some cases there is a tendency for the light to be thrown in horizontally in a somewhat powerful beam which gives rise to a sensation of glare. Dr. James Kerr, in some remarks at a meeting of the Illuminating Engineering Society in London recently, mentioned that he had encountered eyesight troubles due to this cause.

Another point of consequence is the direction from which the light comes. In writing, it is recognized, the light should come from the left so that no shadow is cast by the hand, and the rough rule that light should come from over the left shoulder seems to be a good one when it can be followed. In arranging the desks in a room, therefore, it seems desirable that the windows should be on the left. Many years ago Mr. Brudenell Carter showed how the contorted positions adopted by children when trying to write by badly placed lights were apt to give rise to spinal trouble.

Bright sources of light should, above all, be placed in positions such that they cannot strike direct into the eyes of the children. But when lamps are hung high up precautions must be taken to avoid the shadow of the head upon the book. A plan adopted in the schools of Munich was to arrange the windows on the left of the desks and also to place the artificial lights high up on the left so as to imitate the natural daylight conditions.

At recent meetings of the Illuminating Engineering Society there has been much discussion regarding the desirability of recommending that no lights should be used in interiors without their brilliancy being reduced to the hygienic permissible value by effective shading. Now if there is one case more than another in which a recommendation to this effect would be justified it is school lighting. One may well suggest that, whenever this can be done, the brightness of shaded lights should at least be cut down to below 5 candles per square inch. The usual recommendation that all bright lights should be excluded from the field of view is certainly good as far as it goes. But, strictly speaking, what does the "field of view" include? It is hardly possible to place a light so that it can never be seen in an interior, though one can certainly arrange that it should be *rarely* visible, especially when, as in a school, all the scholars should be looking in one direction. But, in view of the wearisome effect of occasional glimpses of bright naked lights we are surely justified in advocating shading and a minimum brilliancy, even though some loss of light be entailed thereby.

In this connection mention should perhaps be made of the inverted systems of lighting. The arrival of the powerful metallic-filament glowlamps has led to a revival of interest in this system and it certainly has one great advantage, the avoidance of "glare." But yet, apart from the question of efficiency, it must also seem now to be also recognized that there is something lacking in a room illuminated by this method. The monotonous uniform brightness it occasions is said to be wearisome to the eye, which requires rest by occasionally transferring itself to some surface less brightly illuminated than that upon which it has been gazing. Inverted systems have been effectively employed for school lighting in Munich and elsewhere, and are said to have answered very well. Possibly in some interiors the psychological effect of "flatness" may be less marked than in others. But probably it is best used only in conjunction with a certain amount of direct lighting.

It must also be recognized that in most classrooms and lecture theaters the illumination of the children's desks, of the blackboards and diagrams, and of the teacher's table, all require special attention. To flood the whole room with light, even if by so doing we succeed in avoiding excessive glare and provide as high an illumination as the circumstances seem to demand, does not seem to be the most ideal method of dealing with the problem.

And, lastly, a word or two may be said on the subject of measurement. With the higher standard of illumination which regular supervision of schools is likely to bring about, we may be sure that full advantage will be taken of modern methods of measurement. During the past few years we have seen the development of the illumination photometer, an instrument for measuring not the candle-power of the lamps installed, but *the actual illumination* furnished by them at any particular point. We may be sure that in the future the design of the illumination in interiors will not be based on any rough rule-of-thumb method specifying so many watts per square foot of floor area, etc. Such methods have their value, but merely as a preliminary guide. Intelligently utilized they may help to give an idea of the light or energy needed, but they say nothing as to *the distribution* of the light, nor do they take account of the local conditions. It seems probable that the lighting specifications of the future will take the form of definite directions for the provision of a certain minimum illumination on the desks, tables, blackboards, etc., and the conditions will be checked by the aid of illumination photometers.

Another tendency is for instruments of this class to be constructed on simpler and more portable lines. Several of the newest forms of instruments exhibited at recent meetings of the British Illuminating Engineering Society served to suggest that the design of the next few years will be in this direction of greater practical convenience rather than extreme accuracy. In time the measurement of illumination will doubtless come to be recognized as a perfectly simple and feasible process and instruments will be devised capable of being used by all interested in illumination.

ORNAMENTAL STREET LIGHTING.

At the second annual convention of the Indiana Electric Light Association, at Indianapolis, Aug. 18, Mr. E. Darrow, general superintendent of the Merchants' Heat & Light Company, of that city, read a paper on ornamental street lighting, in which he considered not only the tungsten fixtures which have recently become so popular throughout the country for curb-line illumination, but also the use of the new highly efficient arc lamps, as well as other illuminants which are of great promise, but of which at present little is known. Mr. Darrow's company inaugurated the installation of the extensive system of curb-line tungsten-fixture lighting on the business streets of Indianapolis, of which a description appeared in the issue of May 5, 1910. This is one of the largest examples of ornamental lighting in the country and has attracted much favorable comment. Before embarking on the construction of this installation, Mr. Darrow made a careful study of ornamental street-lighting systems. An abstract of his remarks on the general subject follows:

Throughout the country generally, there is fast arising a sentiment toward securing a better illumination of streets and public places, and in many cities downtown-lighting associations have been formed by the merchants, who are carrying to successful completion more effective and artistic street illumination. It has been realized by the merchants and property owners that new lighting systems were badly needed, particularly in business districts, and the outcome has been signally successful in several instances.

Kinds of Ornamental Street Lighting.—The following list shows the better-known illuminants which are available for exterior service:

1. Carbon-filament lamps in clusters or arches.
2. Graphitized-filament lamps in clusters or arches.
3. Tantalum-filament lamps in clusters or arches.
4. Tungsten-filament lamps in clusters or arches.
5. Nernst lamps, one to six glowers.
6. Enclosed arcs, direct and alternating current.
7. Magnetite arcs.
8. Flaming arc—regenerative arcs.
9. Carbide arcs.
10. Quartz-tube mercury-vapor lamps.

The efficiency, quality, color and other characteristics vary widely, the watts per candle-power ranging from $3\frac{1}{2}$ for the carbon-filament down to 0.25 for the quartz tube.

Many smaller municipalities have shown a marked preference in business districts for arches with incandescent lamps, and spaced from 100 ft. to 200 ft. apart. A good illustration of this construction is at Norfolk, Va.

After a careful investigation and many suggestions as to the design of the construction flat steel arches, with a span of 40 ft., a width of 12 ft. and a rise of 48 in. were placed across the street and attached to the iron street-railway poles every 100 ft. Ten series incandescent center-span suspension outfits were attached to each arch. The lamps and reflectors alone hang below the arch, and the whole presents a very attractive appearance in daytime. Each arch is lamped with 60-watt, 6.6-amp street series lamps with automatic cut-outs and radial-wave reflectors. The neat yet substantial design and the graceful and symmetrical curve of the arch have been a source of much favorable comment.

Cities of first grade in the past have depended largely on series arcs for their street illumination. The characteristics of series-arc systems, both direct current and alternating current, need no special comment here. The practice has been to space these lamps in single units from 300 ft. to 600 ft. apart. Four-amp arcs of this type have been used in Cincinnati for the past eight years, the city's contract calling for lamps which consume 300 watts at the lamp terminal. These lamps are spaced in the down-town district about every 300 ft.

The illumination from these 4-amp arcs has been unsuccessful and has given Cincinnati the name of one of the poorest lighted cities in the country, so that it may be said that the 4-amp, 300-watt arc is an absolute failure as an illuminant for public places or thoroughfares. The failure in Cincinnati was also accentuated by the fact that the lamps were hung too close to the ground, viz.: about 12 ft., and by the mechanical imperfections of the lamp, which caused excessive outage.

The enclosed-arc lamp is essentially an American development and the long-burning feature, in spite of decreased efficiency, has made it a popular form of street lamp. Series-enclosed lamps consuming approximately 500 watts and using 6 amp to $7\frac{1}{2}$ amp have been found quite satisfactory and reliable, when properly spaced and hung at proper height.

Metallic-flame arcs, employing some mineral element in the carbon electrodes to increase their luminous efficiency, are enjoying an increasing use in this country on account of their high efficiency and excellent light-giving qualities. They have the disadvantage of requiring more frequent attention and trimming, and to correct this difficulty practically the same series of remedies have been applied as in the infancy of the old open-arc lamp.

A comparatively new type of lamp, first brought out in Europe, but also now made in this country, is the regenerative-arc lamp. In this lamp the vapors from the impregnated electrodes are carried down, and reintroduced into the arc chamber, increasing the luminous efficiency of the flame. Such lamps may be operated for 75 hours without retrimming.

Metallic-flame lamps of the magazine type, using one or more metallic electrodes, have been deservedly successful on account of their long hours of operation, low cost of maintenance, excellent efficiency, and good distribution. Late improvements in this type of lamp give promise of a steadier quality of arc and increasing burning periods of at least 200 hours. During the past year Toledo, Ohio, has installed a large number of these

Fig. 1—Special Tungsten Street Lighting, Massachusetts Ave., Indianapolis.

arcs at street intersections, and [illegible] district on the main thoroughfares has erected two-lamp standards every 100 ft. or so. Although a flood of white light is procured, in the writer's opinion it is overdone, not artistic in any sense, and exceedingly unpleasant to the eye.

St. Louis, Mo., has now installed through the efforts of its Downtown Lighting Association a system of street illumination, using magnetite arcs. On Broadway [illegible] lamp standard has been adopted. On all other business streets one-lamp standards are used. The Broadway system has been grossly overdone and gives an unpleasant glare. The three-lamp standards are spaced approximately 60 ft. apart, or 10 standards (each of three lamps) on every block, making a total of 30 arc lamps to the block.

The effect is brilliant, but as a permanent installation is in extremely bad taste. The other business streets are illuminated by four magnetite arcs at each street intersection and one intermediate lamp on each side midway. This latter arrangement gives six lamps per city block.

The most artistic and effective illumination is the plan adopted by Indianapolis, Des Moines, Seattle, Los Angeles, and other places. In Indianapolis each block of the main thoroughfares has six standards 84 ft. apart, each standard having five individual 100-watt tungsten lamps, each enclosed in a light ground-glass of thin opalescent outer globe. Washington Street is an extremely wide thoroughfare, yet with this system a newspaper can be read at any point with ease. The illumination is very even and well distributed, and the effect is exceedingly pleasing to the eye. Similar effects have been attained in the other cities mentioned above.

The carbide arc and the quartz tube are too little known yet to have a definite place assigned to them. The titanium-carbide electrode is most promising as a means of securing a high efficiency. Titanium carbide forms the cathode and is placed below an anode of copper, the latter being inactive, and not wasting away appreciably. The light is almost pure white with a slight tinge of yellow. It belongs to the flame type and its efficiency increases with current density and with increasing length of arc. On test, a lamp of this character at 3 amp and 103 volts and with a 1-in. arc consumes only 0.228 watt horizontal candle-power. The mean spherical candle-power was 535 and the mean hemispherical candle-power 738. The efficiency shows that the titanium-carbide arcs are most satisfactorily operated on constant-current circuits, hence this lamp should be particularly adaptable to existing street-series circuits.

The European quartz-tube lamp is heralded as giving a flood of beautiful golden-white light, faintly tinged with green, and so brilliant that one can read ordinary print 300 ft. from this lamp. This little lamp has a quartz tube about 4 in. in length and develops an illumination [illegible] power. The claims of this newcomer are an efficiency of 0.25 watt per candle-power, no renewals of electrode, no cleansing of globes, and no delicate parts to get out of order. This is almost an ideal specification, but in its present form the lamp is not adaptable for interior illumination. It has a powerful actinic action and in its development of ultraviolet rays is liable to produce burns on the flesh. As an exterior illuminant, it seem to be ideal, as any harmful qualities disappear when hung 15 ft. or 20 ft. from the ground. The lamp as now manufactured is for direct current only, but could easily be adapted to mercury-arc rectifier circuits.

Fig. 2—Tungsten Standards on Monument Place, Indianapolis.

In general, it may be said that the tendency in arc lamps is away from enclosed ones of relatively small candle-power and low efficiency toward arc lamps of higher candle-power, such as magnetite, carbide, etc.

Arrangement of Lamps.—With the increasing use of powerful arcs there has come a needless distress to the man in the street. When used for street illumination such arcs should be swung high. The time has passed when high-candle-powered arcs should be thrust in the faces of pedestrians. Such glare as is evidenced on Broadway, St. Louis, or Summit Street, Toledo, is a garish display, most unpleasant to the public, and should be regulated. The glaring arc can be and ought to be abolished.

The suspension of arc lamps of the higher candle-power should not be less than 20 ft. from curb to bottom of lamp, and is preferably 20 ft. to 25 ft. for best effects. When there are no trees the position of the lamp relative to the curb is not so important, but in suburban districts which are wooded the only satisfactory position is the middle of the street. In downtown districts it is almost universal practice now to have the standards and lamps on curb lines.

Frosted globes and diffusing reflectors tend to prevent troublesome reflections and mitigate glare. Spacing of units necessarily varies with the money available in each instance and the effect that is desired. Business districts vary to extremes. St. Louis, with 30 metallic-flame arcs per city block, has probably the maximum illumination, while many cities think they have sufficient light with one 500-watt arc each 400 ft. A fairly well lighted section should have not less than two arcs at each street intersection and two midway in the block. The spacing of the post type of units varies from 60 ft. to 100 ft. or from four to eight standards on each side of the street to a block.

Cost of Operation.—In consideration of costs, renewals, upkeep, etc., it is useless to attempt comparison on the basis of charges for lamps of a rated candle-power. Open arcs, direct-current arcs, enclosed arcs, magnetite arcs, etc., valued as street illuminants may vary over 150 per cent. Watts per square foot mean nothing if one does not consider quality. Again it is hard to compare cost of glare with illumination.

Following are some of the prices which municipalities and merchants' associations are paying for street service per year:

Cincinnati, 4-amp, 300-watt enclosed arcs, $60.00	$72.00
Toledo, 300-watt, magnetite	48.00
Boston, 500-watt, magnetite	118.00
St. Louis, 500-watt, Magnetite	80.00
Indianapolis, 500-watt a.-c. enclosed	62.50
[illegible]	[illegible]
Des Moines, tungsten standards, per front ft	1.58

The National Electric Light Association has recommended the selling of illumination, rather than energy, but, unfortunately, no principles have been evolved whereby the effective lighting on two streets can be compared on a basis of illumination. A service contract for a particular and specified illuminant which has been previously tried out is the only safe way to handle street-lighting contracts at present.

It will be noted that the Norfolk, Va., decorative-arch lighting for each 400-ft. block required 3000 watts at lamp terminals. In Cincinnati there are four 300-watt enclosed arcs to the block or 1200 watts at lamp terminals. In St. Louis the Broadway special illumination shows 30 300-watt metallic-flame lamps, or a total of 9000 watts per block. In Indianapolis the standards are 12 to a block, each standard containing five 100-watt tungsten lamps and representing 6000 watts. Thus it will be seen how widely typical installations vary as to quantity and quality.

With arc lamps, under the usual conditions attendant on aerial-line construction, with average spacing of lamps, the cost per lamp erected, exclusive of station equipment, varies from $60 to $100. In underground districts the construction costs may reach as high as $250 per lamp. The cost of installing the 667 magnetite lamps in St. Louis was close to $140,000. The depreciation in this equipment is easily 10 per cent per annum.

Maintenance costs in the curb-line system of illumination, such as adopted in Des Moines, Seattle and Indianapolis, are about as follows per 1000 hours' burning, for each post carrying five 100-watt tungstens:

I. Maintenance of Tungsten Standards:

Five lamps	$5.00
Glassware	2.00
Cleaning and attendance	1.00
Operation	2.00
500 kw-hours	5.00
	$15.00

II. Maintenance of Direct-Current Enclosed Arcs:

Carbons and trimming	$1.20
Repairs and globes	.50
Depreciation	2.00
500 kw-hours	5.00
	$8.70

III. Maintenance of Metallic-Flame Arcs.

Trimming	$7.50
Repairs and glassware	2.00
Depreciation	2.00
500 kw-hours	5.00
	$16,50

IV. Maintenance of Flaming Arcs:

Carbons and trimming	$9.50
Repairs and globes	2.00
Depreciation	2.00
500 kw.-hours	5.00
	$18.50

The power required for these various systems of lighting varies from 6 kw to 60 kw per mile of roadway. An ordinary 60-ft. roadway has about 315,000 sq. ft. to the mile, and with the American average of 5 kw to 10 kw per mile, this allows a ridiculously low wattage per square foot. The power required per square foot per ft.-candle is about as follows:

[illegible]	0.3 to 0.5 watt
[illegible]	.0.25 to 0.45 watt
[illegible]	.0 06 to 0.13 watt

The radius of effective illumination of the tungsten standards used in Indianapolis is about 100 ft.; for enclosed-arc lamp, 125 ft., and for metallic-flame lamps, 300 ft.

From the above consideration it would appear that through the combined influence of public sentiment, first cost and maintenance charges, the series constant-current metallic-flame lighting units are driving all other types of illumination from the residence and suburban districts of our municipalities. However, there is a strong trend in the business sections of our more progressive cities to artistic lighting effects, as is evidenced by the many attractive forms of arches and curb-line lighting units which have been developed in the past 18 months.

A few years ago a lamp post was simply a thing to have a lamp on. To-day it is considered a factor of municipal enterprise and intelligence, and downtown merchants' lighting associations have done much to set a new standard for artistic and efficient public lighting.

[The accompanying illustrations show examples of the special tungsten street lighting installed in Indianapolis by the Indianapolis Light & Heat Company, and which, together with the generally similar installation of the Merchants' Heat & Light Company of Indianapolis, makes that city one of the best lighted ones in the country.—ED.]

NEW TELEPHONE PATENTS.

INTERCOMMUNICATING SYSTEMS.

Mr. E. R. Corwin, of Chicago, has patented an intercommunicating apparatus and system, which he has assigned to the Corwin Telephone Manufacturing Company. This system contemplates a switching device at each station, interconnecting lines and signals and an exchange line accessible to all stations and answered from a particular station, which may extend the call as desired. The patent relates to details of arrangements.

Mr. A. K. Andriana, of San Francisco, has patented improvements in his step-by-step intercommunicating lock-out system. This system employs a sending and a stepping mechanism at each station. The system is a lock-out one and in the present instance, if a switching operation be begun by moving the sender, the dial is locked against backward motion until after the receiver is restored. Again, if a signal be sent, the dial at once becomes locked against further motion in either direction until the receiver is restored.

Another lock-out system, this, however, contemplating the use of a central switching station or exchange, has been patented by Mr. L. E. Hicks, of Stinson, W. Va. This provides the usual step-by-step features and a signal to indicate the busy or free condition of the line.

COMBINATION CIRCUIT.

In talking-picture shows where a phonograph does the talking, the phonograph behind the scenes and the picture machine in front must move synchronously. Mr. G. E. Hoglund, of Chicago, has arranged a combined synchronizing and telephone circuit from the stage to the operator, which he has patented and assigned to Mr. W. N. Selig.

AUTOMATIC SYSTEM.

A patent granted to A. H. Dyson, of Chicago, and assigned to the Kellogg Switchboard & Supply Company, describes improvements in that type of automatic system where a master switch is used. In these systems, the first action of an initiated call at the exchange, is through the agency of the master switch to pick up an idle selector. It will be understood that each master switch serves a considerable number of subscribers and thus if it fails to operate there are serious consequences due to the simultaneous disablement of the whole group of lines. To obviate this in the present invention special circuits are provided so that in the failure of the usual mechanism another is automatically substituted. A further feature is the locking up of the called subscriber's cut-off relay, so that if a call be abandoned by the calling party with the called station

receiver off the hook, there will be no effect at the called station master switch to tie up a selector permanently. In this system also the complete clearing out of a connection follows the hanging up of the originating or calling station.

Letter to the Editor.

Transmission Line Calculations.

To the Editor of Electrical World:

Sir:—I wish to thank Professor Blondel for calling attention to his priority in the subject mentioned in his letter published in your issue of Aug. 25. The writer is aware that the power series for hyperbolic functions has been known to mathematicians for a considerable time, yet it seemed that the approximate methods were needlessly in vogue. This can hardly be due to other than a dislike of hyperbolic functions. The article mentioned compared the true infinite series with the finite series representing various approximations. If, by so doing, it had made the exact calculation preferable to the approximations, it would have fulfilled the writer's expectations. The writer regrets that he did not search the foreign papers with regard to the points mentioned above. The notation used was that of Dr. Steinmetz, and does not need the writer's defence.

Ithaca, N. Y. John F. H. Douglas.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Enclosed Machines.—P. Amsler.—For many purposes completely enclosed electric machines are required. If use is made of machines of standard construction simply enclosed in an air-tight casing their permissible output is only from 35 to 40 per cent of that of the open machines. To improve the conditions it is advantageous to employ forced ventilation. A fan may be provided on the rotor axle within the machine, special air channels being employed. The fan sucks fresh air through one channel and ejects it through the other channel. The present author uses this principle, but employs the base plate as an air cooler. It may contain special water-cooling pipes or simply have a corrugated surface so as to provide a large radiation surface. The machine and the base plate are enclosed air-tight. A ventilator mounted on the rotor axle drives the inside air through the machine and through the base plate, where it is cooled by the water pipes. Results of tests are given; it is stated that with relatively small extra cost the enclosed machine can be arranged so as to have the same permissible output as the open machine.—*Elek. Zeit.*, Aug. 18.

Control of Induction Motors.—A note on a recent British patent (24,269, 1909; Aug. 11, 1910) of the Siemens Brothers Dynamo Works, Ltd. For the speed control of a large polyphase induction motor use is made of a frequency-transformer to supply a current of variable frequency to the rotor. This transformer consists of an induction motor coupled to a polyphase commutator machine with slip rings. The slip rings of the induction motor are connected to the three brushes of the commutator machine which supply the variable-frequency current and the speed of the set depends on the frequency of the currents generated.—Lond. *Elec. Eng'ing*, Aug. 18.

Care of Commutators.—L. M. Jockel.—The surface of the commutator must be kept clean and smooth if good commutation is to ensue. When the machine is under load the commutator can be kept clean by the occasional application of a pad or cloth soaked with benzine, and afterward finishing off with a clean dry cloth. The use of good-quality carbon brushes obviates the necessity of lubricating the commutator, but occasionally the brushes cause an excessive noise or "hissing" and this is usually remedied by the application of paraffine wax or a slight trace of mineral oil. Paraffine wax has the disadvantage that it accumulates on the brushes along with the copper and carbon dust, and is troublesome to remove, and it also causes the machine to drop its load slightly when it is applied. The use of a slight amount of mineral oil is very beneficial in promoting a good running skin or surface on the commutator, and this treatment is applied regularly to the machines in the British Royal Navy. With special brushes such as the "morganite," a hard, smooth skin can easily be obtained on the commutator. A common trouble is the formation of flats on the commutator. These may arise from many causes, but are often due to neglected slight sparking. A frequent cause of sparking is the unequal wear of the copper commutator bars and the mica insulation. The trouble can usually be overcome by turning or grinding out the bad mica, or in some cases by sawing out the mica until it is below the level of the segments. If a lathe or emery grinder is not available, recourse must be had to hand work, and a somewhat temporary job can be made by using a file moistened with paraffine or a light lubricant. Should the flat not be very deep, it may be ground out with emery cloth or glass-paper, using a wooden pad hollowed out to the curvature of the commutator and carefully bedded to it. The brushes can be quickly bedded down by increasing the pressure on the springs, and using emery cloth. The correct pressure on the brushes is usually from 1.5 lb. to 3.0 lb. per square inch of bearing area; the pressure can be ascertained by using a spring balance. After trueing up a commutator, and rebedding the brushes, a good working surface can generally be secured by frequently cleaning the commutator and treating it with slight applications of good mineral oil or vaseline.—Lond. *Elec. Eng'ing*, Aug. 11.

Commutator Segment Insulation.—A note on a recent British patent (23,225, 1909; Aug. 4, 1910) of the British Thomson-Houston Company (General Electric Company of this country). An insulating material which will wear down evenly with the segments is composed of 237 parts of dry kaolin, 37 parts powdered glass, 88 parts green silko, 2 parts red silko and 156 parts asbestos. The mixture is made into sheets, treated with silicate of soda, and finally fired at a high temperature under considerable pressure. The compound is stated to have high dielectric and mechanical strengths, and to withstand high temperatures.—Lond. *Elec. Eng'ing*, Aug. 11.

Prevention of Syphoning of Transformer Oil.—J. C. Dow.—Oil may be syphoned out of a transformer case by the leads in two ways—by the insulation, or by the capillary action of the oil in the spaces between the wires of the flexible leads. To prevent the former all that is necessary is to remove the insulation for an inch or two above the oil surface within the case. To prevent the second action the spaces between the wires must be filled with some oil repellant. This can be accomplished by using a solid lead or by filling the flexible lead with solder; neither method prevents the oil from creeping along the surface and both require the lead to be non-flexible, at least for part of its length. It is possible, however, to fill a short section of the cable above the oil in the case with glycerine, thus preventing the oil from syphoning and still leaving the cable flexible. The cable must first be stripped of its insulation for 2 in. or more, depending on its size, the oil thoroughly removed from that section of the cable and pure glycerine run in. The oil can be removed with gasoline and this must be done thoroughly all through that section of the cable. The slight residue left from the evaporation of the gasoline will prevent the glycerine from working into the cable, but this residue can be removed with alcohol. The removal must be thorough. The alcohol should be removed before drying by means of water; while the cable is still wet, the glycerine should be worked in.

The glycerine should be as pure as possible, but it may be necessary at first to use a solution of glycerine in water to make it enter the cable. Glycerine is an oil repellant, but is an absorber of moisture, and hence this method should be used with caution on high-voltage transformers.—*Elec. Jour.*, September.

Lamps and Lighting.

High-Candle-Power Tungsten Lamps for Indirect Illumination.—B. Monasch.—After having discussed in the first part of his paper indirect illumination, the author now deals with semi-indirect illumination in which the high-candle-power tungsten lamps are simply surrounded by an opal glass globe. The specific consumption of semi-indirect illumination is only a little less than that of completely indirect illumination, while the non-uniformity of illumination is greater. Direct illumination of interior rooms with high-candle-power tungsten lamps shows the same low specific consumption as direct illumination with open-arc lamps with pure carbon electrodes. Both arc lamps and tungsten lamps when used for indirect illumination are considerably more economical than the Moore vacuum tube lamp. The following summary is given of the specific consumption of different systems of lighting interior rooms:

INDIRECT ILLUMINATION.

	Specific Consumption
Open direct-current arc lamp with pure carbon electrodes in normal position	0.188 to 0.303
Open direct-current arc lamp with pure carbon electrodes in reversed position, the positive being above the negative	0.136 to 0.220
Open alternating-current arc lamp with pure carbon electrodes	0.339
Tungsten lamp with direct-current or alternating-current	0.259 to 0.318

SEMI-DIRECT ILLUMINATION.

Open direct-current arc lamp with pure carbon electrodes in normal position	0.15 to 0.35
Enclosed direct-current arc lamp with pure carbon electrodes	0.367
Tungsten lamp with direct-current or alternating-current	0.225 to 0.260

DIRECT ILLUMINATION.

Open direct-current arc lamp with pure carbon electrodes	0.15 to 0.3
Carbon incandescent lamp	0.5 to 1.2
Tungsten lamp with clear globe	0.15 to 0.175
Tungsten lamp with frosted globe	0.22 to 0.25
Moore vacuum-tube lamp with alternating-current	0.445

In every case the specific consumption is given in watts per lux per square meter.—*Elek. Zeit.*, Aug. 18.

Drawn Tungsten Filaments.—A note on a recent British patent (3,981, 1910; Aug. 11, 1910) of the British Thomson-Houston Company (General Electric Company of this country). In order to pass a tungsten rod or wire into the die for drawing it must be pointed at the end. The metal is exceedingly hard and hence, to effect this, the wire is dropped into a bath of a fused oxidizing salt such as potassium or sodium nitrate. The chemical action points the wire and leaves a clean surface free from pits.—Lond. *Elec. Eng'ing*, Aug. 18.

Supports for Metallic Filaments.—A note on a recent British patent of F. Salzer (6658, 1910; Aug. 4, 1910). In order to protect the metallic supports, or leading-in wires, from the effects of the high temperature of the filament, the former are coated electrolytically with a thin film of chromium. The coated wires are heated to anneal the coating and render it flexible.—Lond. *Elec. Eng'ing*, Aug. 11.

Moore Vacuum Tube Lamp.—W. Wedding.—An English translation of his recent German paper on tests of the Moore vacuum tube lamp.—Lond. *Electrician*, Aug. 19.

Generation, Transmission and Distribution.

[illegible]—A lecture delivered before the Richmond Railway Club in which he compares the direct-current, the three-phase and single-phase systems for trunk railroads. Power plants will generally represent about 25 per cent of the total cost of electrification, and will usually cost about the same for the three systems. The maximum load upon the power plant might not vary greatly for the three systems, but the average load would be greatly in [illegible] the direct-current system, on account of the very large losses on the direct-current system between the power house and the trains. The conductors and substation apparatus for the transmission and distribution of electric energy along the tracks is usually the largest item of cost for the electrification of ordinary steam railroads, and is several times as large for the direct-current as for the single-phase system, and is nearly twice as large for the three-phase as for the single-phase system. The operation and maintenance cost of the substations and transmission and distribution conductors are greatly in favor of both of the alternating-current systems as compared with the direct-current system. The cost of electric locomotives and electrical equipment on motor cars will generally be somewhere between 10 and 40 per cent of the total cost of electrification of steam railroads, and single-phase locomotives will cost somewhat more than direct-current and three-phase locomotives. Reliable alternating-current railroad apparatus being available, the author concludes that it is now often advisable to substitute electric power for steam for purely economical reasons.—*Elec. Jour.*, September.

Determination of Pulley and Belt Sizes.—C. B. Mills.—An article giving a chart which permits an easy graphic solution of belt problems. Some numerical examples are added. In the second part of the article the author discusses shaft stresses. It is shown that the limitations imposed by the bearings of a motor are the principal factors in determining the smallest pulleys which may be used, good practice allowing a smaller margin of safety in these parts than in others, owing to their ability to give evidence of distress by heating long before the danger line is reached.—*Elec. Jour.*, September.

Traction.

Interurban Tramway.—An illustrated description of the new motor cars of the interurban tramway from Heddernheim to Homburg, which is a continuation of the line from Frankfurt to Heddernheim. On the latter line and within the city of Homburg an e.m.f. of 550 volts is employed on the trolley wire, while on the line between Heddernheim and Homburg 1000 volts is employed to get higher speeds. The construction of the motor cars and the switches for regulation are described and illustrated.—*Elek. Zeit.*, Aug. 18.

Electric Propulsion of Ships.—A. Blair and J. F. Wilson.—A paper read before the Belfast Association of Engineers. The authors consider a cross-channel vessel, the steamship *Londonderry*, and give particulars of the suggested equipment for electrical propulsion. Suction gas plant is proposed for generating energy for the electrically-driven auxiliaries, while high-speed turbines would be employed for the main generators. Details of the equipment are given.—Lond. *Electrician*, Aug. 19.

Installations, Systems and Appliances.

Accidents in Mines in Great Britain.—The annual report for the year 1909 of R. A. S. Redmayne, chief inspector of mines, shows that the total number of fatal accidents in the coal mines of the United Kingdom last year was 1182, compared with 1138 in the year 1908. These accidents involved the loss of 1453 lives, as against 1308 in the previous year. Only 11 of the accidents, involving the death of 13 persons, are attributed to electrical causes. Electrical accidents are accountable only for about 1 per cent of the total number of fatalities, and in all cases they occurred underground. The number of deaths due to electricity in 1908 was 15, 4 of these being above ground. Last year's electrical fatalities, therefore, show a decrease of two compared with those of 1908. As regards non-fatal accidents, 153,306 persons were disabled for more than seven days, compared with 141,851 in the previous year. Of this large total, electrical causes account for 38 cases of injury to persons working underground, and in 18 cases to workmen above ground, the figures for last year being 22 and 12 respectively. The proportion of accidents attributable to electricity is therefore 0.4 per cent. In the case of metalliferous mines, no fatal accident and one instance of injury are stated to be due to electricity, the total number of accidents in this class being [illegible] which

accidents are classified as "in a[illegible] [illegible]" 84 deaths and 4856 cases of injury are recorded, electricity being in no instance responsible.—Lond. *Electrician*, Aug. 19.

Battery Boosters for Three-W[illegible] [illegible].—A note on a recent British patent of A. M. Taylor (14,212, 1909; Aug. 11, 1910). Instead of having two separate booster armatures connected to the two sides of the system, a single booster of double the voltage is employed. This has slip-rings connected to two tappings on its armature winding, and these are connected to a choking coil or balancer to give the neutral point and to compensate automatically for fluctuations in the out-of-balance current. Further, where two boosters are arranged for series-parallel grouping, the neutral point is obtained by similar static balancers. The balancers also protect the boosters from undue rushes of current caused by external short-circuit.—Lond. *Elec. Eng'ing*, Aug. 18.

Wires, Wiring and Conduits.

Ageing of Fuses.—In reviewing the [illegible] work at the Reichsanstalt in 1909 a series of experiments on the ageing of fuses is mentioned. It frequently happens in practice that fuses undergo a considerable increase in resistance after being in use over an extended period. The Reichsanstalt has made a number of experiments upon this phenomenon at the request of the German Association of Electrical Engineers. Three causes are advanced for the so-called "ageing": (1) Change of the fuse wires by overloading; (2) pulverization of the metal under high voltages; (3) influence of the filling material. Experiments were first made with silver wires stretched in the open, the wires being 0.5 mm, 0.25 mm and 0.1 mm (20 mils, 10 mils and 4 mils) thick. A light load was sometimes applied, the wires at other times being rendered slightly incandescent with the current. At the outset all wires showed an increase of a few parts of a per cent in resistance, this result being traceable to the fact that the wires, made hard by drawing, are softened by being heated by the current. The 0.5-mm and 0.25-mm (20-mils and 10-mils) wires showed no noteworthy change in resistance either when the load applied was trifling or when it was considerable; the same can be said of the 0.1-mm (4-mils) wire, loaded with a weak current. On the other hand, the 0.1-mm wire when loaded with 2 amp suffered a permanent increase (20 per cent) in resistance, eventually fusing after 12 weeks. The metal appeared to be not simply oxidized, but also to have undergone extensive structural changes. The behavior of the test wires was independent of the manner of soldering. At present experiments are being repeated on the 0.1-mm wire with lower currents. No results are yet available as to pulverization on high voltages, or as to the influence of the inner material of the fuses.—Lond. *Elec. Rev.*, Aug. 12.

Joints of Aluminum with Copper.—A note on a recent British patent (20,106, 1909; Aug. 11, 1910) of C. J. Beaver and E. A. Claremont. It covers a box for protecting and enclosing a mechanical joint between overhead cables of copper and aluminum respectively, to prevent electrolytic action. The mechanical connector is of copper or aluminum, and over the end engaging with the cable of unlike metal is fixed a metal shell. A bush of a non-metallic material is inserted between the neck of the shell and the cable, and the shell is filled with a bitumen or wax compound. All joints between dissimilar metals are thus protected from the atmosphere.—Lond. *Elec. Eng'ing*, Aug. 18.

Safety Device for Wiring.—An illustrated description of a safety device which is being introduced in England to enable repair work to be done on overhead lines at pressures up to 7500 volts. It consists of a thick rubber trough or mat. One is placed over each of the wires near which the man is working.—Lond. *Elec. Eng'ing*, Aug. [illegible]

Electrophysics and Magnetism.

Coherers.—W. H. Eccles.—[illegible] Society paper. The author puts forward the hypothesis that the properties of an oxide coherer may arise solely from the temperature variations caused in the minute mass of oxide at the contact by the electrical oscillations and by the applied e.m.f. He [illegible]

most of the phenomena [illegible] can in this way be accounted for as perfectly as the present state of the measurements permits.—Lond. *Electrician*, Aug. 19.

Parallel Connection of a Number of Circuits.—J. Kuhn.—The author gives the general solution of the problem of finding the current in any one of n circuits connected in parallel, each circuit containing an ohmic resistance and a constant e.m.f. The author shows that the solution becomes very simple when use is made of the joint resistance or the joint conductance of all the different circuits. He then gives a general formula for determining the current in any circuit and also a simple graphical solution.—*Elek. und Masch.* (Vienna), Aug. 7.

Electric Resistivity of Alkaline Metals.—L. HACKSPILL.—An abstract of a French Academy paper on the results of measurements made with a double Kelvin bridge. The resistivity at 0 deg. C. in microhm-centimeters is 18.1 for cæsium, 11.6 for rubidium, 6.[illegible] for potassium, and 4.3 for sodium.—*La Lumière Elec.*, Aug. 3.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—A note on a new plant just opened in France for the fixation of atmospheric nitrogen by means of electric arc discharges. It is located at Roche de Rame, Hautes-Alpes, and employs the Pauling process, in which electric discharges are used between electrodes of the same kind as used in the so-called horn type of lightning arrester. Water-power is utilized; the hydroelectric installation comprises four 2000-hp units. The furnaces are arranged in two rows in a separate building. Each furnace has two arcs in series. Three-phase currents at 4000 volts with a frequency of 50 periods are employed. The phases are divided equally between three furnaces. At present the rating of each furnace is 500 hp, but this will probably be raised to 1000 hp. In normal operation the yield of nitric acid is stated to be from 60 grams to 70 grams per kw-hour. The whole plant is almost automatic, so that little hand labor is required.—*Met. and Chem. Eng'ing*, September.

Units, Measurements and Instruments.

Use of Thermo-Junction for High-Frequency Current Measurements.—C. M. DOWSE.—One of the most sensitive methods of measuring small alternating currents of high frequency is that in which the heat developed in a short, fine wire raises the temperature of a thermo-junction soldered to it, and the re-

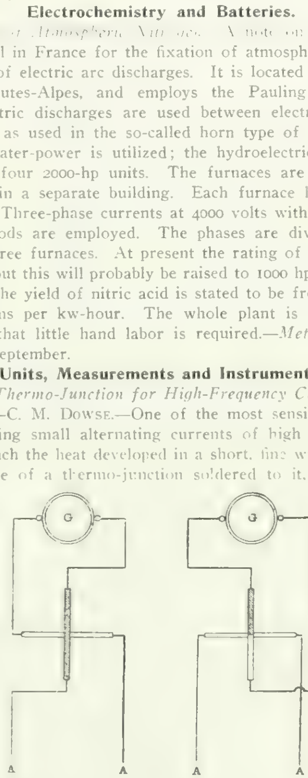


Fig. 1—Two Methods of Construction.

sulting thermo-e.m.f. is detected by a galvanometer of suitable resistance connected to the junction. If the diameter and length of the wire are kept small, variations in the effective resistance with frequency are negligible. This principle, which has been employed before by others, is used by the author for the construction of a small inexpensive portable instrument of a wide range. He prefers to make the junction of copper and eureka, because these junctions are reliable, reproducible and fairly permanent. The most convenient arrangement is to use two junctions mounted closely together on a wooden or ebonite base. There are two possible methods of construction as shown in Fig. 1. In the construction of the left-hand diagram wires of two different materials are stretched between opposite terminals and soldered at the center. The circuit in [illegible]

galvanometer G is connected to the remaining terminals, both circuits being composite. The author prefers the other arrangement shown in the right-hand diagram in which a heating wire carrying the current to be measured is stretched between opposite terminals, but the junction wires are in a separate circuit and the two ends are soldered to the center of the heating wire B. No part of the heating current now passes through the junction, but there is a possibility of an error in calibrating if the junction wires are not at the same point on the heating wire. This type is more difficult to construct than the crossed type, but it is much more satisfactory from every other point of view. Data are given on the best method of soldering. An accurate instrument of considerable range and flexibility can be constructed by combining a series of standardized junctions with the necessary plug switches and a suitable galvanometer. The arrangement is seen in Fig. 2 where A, B and C represent

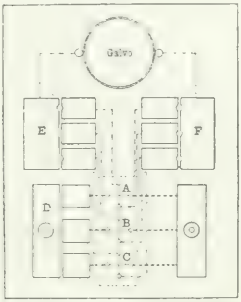


Fig. 2—Arrangement of Thermo-junction.

three junctions which can be placed separately in circuit by the plug switch D. The junction wires are joined to the galvanometer by the plug switches E and F. The circuit, including the heating wire, is as straight and short as possible and the connections should be made with stranded wire. Many useful applications can also be made of the differential action of two equally sensitive junctions, and the author has developed the method shown in Fig. 3 which enables low capacities to be

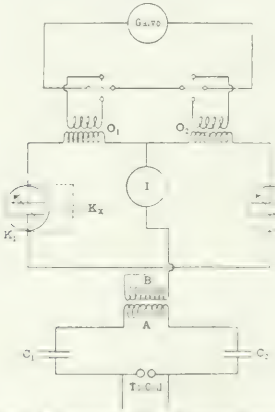


Fig. 3—Application of Thermo-junction.

balanced with ease and accuracy. A coil A which is in an oscillation circuit with capacities C_1, C_2 forms the primary of an oscillation transformer, the secondary B of which can be removed so as to vary the coupling. Connected to the terminals of B are an indicating instrument I and a pair of similar circuits each containing a condenser of variable capacity, K_1, K_2, and the primary coil of a small oscillation transformer, O_1, O_2. The secondary coils are in very close coupling and are joined to the terminals of the heating wires of two similar thermo-junctions. The junctions are in opposition and are connected to a sensitive galvanometer. The deflection is reduced to zero by balancing the variable capacities K_1, K_2, and the sensitiveness is adjusted by varying the coupling between A and B. The indicating ammeter I shows the value of the current in the main circuit, and experiment will easily show the maximum value that can be reached without burning out the junctions. After noting the readings of the variable capacities, the capacity K_x to be measured is joined in parallel with one of the variable-capacity condensers, and the capacity is varied until the deflection is again reduced to zero. The difference in the readings indicates the capacity of the condenser K_x.—Lond. *Electrician*, Aug. 19.

Electric Pyrometry.—An abstract of a paper by R. S. Whipple on recent progress in resistance pyrometry and thermoelectric pyrometry; also abstracts of papers by W. P. White on the thermo-element as a precision thermometer.—*Met. and Chem Eng'ing*, September.

Stroboscopic Disk.—K. Laudien.—After describing some well-known applications of the stroboscopic disk, for instance for measuring the slip of an induction motor, the author describes its application for demonstrating directly to the eye the angle of phase difference. For this purpose the synchronously-revolving disk is illuminated by two alternating-current arc lamps A and B. While A is connected to the alternating-current circuit in series with a non-inductive resistor, the lamp B is connected to the same circuit in series with an inductance coil. The disk then shows two light crosses, one corresponding to lamp A and the other to lamp B, and the angle between the two crosses corresponds to the phase displacement between the currents of the two lamps. The demonstration can be improved by using electrodes giving lights of different colors in the two lamps.—*Elek. Zeit.*, Aug. 18.

Current Indicator for Electric Speed-Indicating Apparatus.—A note on a recent British patent of J. Rennie (16,621, 1909; Aug. 11, 1910). This instrument consists of a compound strip of brass and iron loosely coiled up and fixed at the outer end, the inner end having a pointer attached to it. When heated up by the current, the strip uncoils and moves the pointer. The scale is attached to a second strip, which, by moving the scale, compensates for atmospheric temperature variations. A contact placed on the scale causes a bell to ring when the pointer reaches it. For use with a speed indicator the current generated by a small generator is passed through the strip.—Lond. *Elec. Eng'ing*, Aug. 18, 1910.

Testing.—In a continuation of the serial by E. F. Collins on commercial electric testing the author deals with transformer tests. In a second article by C. D. Haskins on appliances for electrical measurements the author deals with portable instruments, recording instruments, and intergrating meters.—*Gen Elec. Rev.*, September.

Telegraphy, Telephony and Signals.

Glasgow Telephone Exchange.—An illustrated description of the new central telephone exchange of Glasgow. It replaces an old flat-board exchange on the call-wire system, and is a 10,000 line central battery exchange with many new features. In the operator's cord circuit the repeating coil is dispensed with, condensers are included in the speaking circuit, and a 40-volt battery is used instead of a 24-volt.—Lond. *Elec. Eng'ing*, Aug. 18. A fully illustrated description of the same exchange was begun in Lond. *Electrician* Aug. 19.

Wireless Telephony.—P. Brenot.—The conclusion of his review of the present position of wireless telegraphy and telephony. In the present installment he deals with wireless telephony and sketches the success obtained by various experimenters He concludes, however, that wireless telephony has not yet passed the experimental stage and that it cannot compete with wireless telegraphy. Some notes are added on wireless transmission of energy to actuate certain apparatus.—*La Lumière Elec.* Aug. 13.

Miscellaneous.

Combination of German Electrical Companies.—A note on a proposed combination of interests between the Lahmeyer Elec-

tric Company of Frankfurt and the Bank for Electric Developments in Zurich. The significance of the combination is due to the fact that the latter bank is practically controlled by the Allgem. Elek. Ges. of Berlin. It is further asserted that there has been for some time past a friendly understanding between the Allgem. Elek. Ges. and the Siemens-Schuckert group, so that a general concentration of interests is predicted with a view to eliminate wasteful competition. The competition of recent years is said to have been increased considerably by the rapid growth of the Bergmann Elektricitäts Gesellschaft of Berlin.—Lond. *Elec. Eng'ing*, Aug. 11.

Electric Heating.—Goisot.—A long paper presented before the Marseilles Congress on the different systems of electric heating. In discussing the application of the Joule effect, the author deals with non-metallic resistors (carbon, silicon) metallic resistors, and metallic powders mixed with non-conducting particles. Heating of the arc and heating by the induction principle are next discussed, together with various applications of electric heating in the house and kitchen, in the laboratory, and in different industries.—*La Houille Blanche*, August.

Electric Heater.—A note on a recent British patent of F. W. Forbes (16,547, 1909; Aug. 4, 1910). Nickel or other resistance wire is wound on a grooved core of porcelain, and enclosed in a closely fitting quartz tube. Before fitting on the tube the grooves are filled up with plaster of Paris or a phosphate or silicate cement. The space between the core and the outer tube is thus filled up with paste, and this facilitates the transfer of heat from the wire to the liquid. The wire is heated before the paste sets, so that it makes a channel large enough for itself to expand in.—Lond. *Elec. Eng'ing*, Aug. 11.

Standardization Rules.—A set of rules adopted by the Union des Syndicats de l'Electricité on the rating of electrical machinery, permissible rise of temperature, overload capacity, self-regulation, efficiency, insulation tests, power-factor and frequencies.—*La Houille Blanche*, August.

Convention.—A brief account of the nineteenth general convention of the German Association of Central Stations, which was held in Kristiania. A number of regulations were adopted and papers were presented, but no abstracts of the papers are given.—*Elek. Zeit.*, Aug. 18.

Book Reviews.

Life of William Thomson, Baron Kelvin of Largs. By Silvanus P. Thompson. New York: Macmillan Company. Two Vols. 584 + 712 pages, illus. Price, $7.50.

This is a comprehensive work in which the life of Lord Kelvin is beautifully narrated and his scientific achievements appreciated by one who is himself an acknowledged authority in physical science. The impression conveyed by a perusal of these two volumes is one of wonderment at the mental activity displayed throughout a productive career of nearly three score and 10 years. Instances without number will be found in these 1296 pages of the unremitting devotedness of an intellectual giant to the advancement of his favorite studies. At the age of 16 we find Thomson in the heart of Germany reading Fourier's "Théorie Analytique de la Chaleur" instead of his Goethe or Schiller, as his father would have preferred. On his visits to London during his long professional career, Thomson always carried his "green" book with him to jot down mathematical inspirations as they occurred on the way; and when yachting over the seas in his *Lalla Rookh*, he kept manipulating differential equations as a pastime, or pondering over hydrodynamical problems that appealed to him as an analytical investigator or as a practical seaman.

The green-backed note-books to which reference has been made formed eventually a series of not less than 100 volumes, a lasting monument indeed to "the extraordinary fertility and bewildering variety of his genius." "They generally go upstairs, downstairs, out of doors, indoors, wherever he goes," writes his grand-niece." "One entry will be in the train, another in the garden, a third in bed before getting up; and so they go on at all hours of the day and night. He always puts the place and the exact minute of beginning an entry."

The numerous letters selected for publication testify to the wide range of subjects—dynamical, physical, geodetic and cosmical—which engrossed Kelvin's attention. Among his most frequent correspondents were such leaders in the scientific world as Helmholtz, Faraday, Rayleigh, Mascart and Darwin (Sir George); and to these and others he wrote freely and candidly about difficulties encountered, modes of attack and hopes of success. These letters reveal almost in every line the power and versatility of the writer's intellect and, at the same time, the kindness of his nature and the joy which he felt in the society of those whom he looked upon as his peers.

Some of these letters lift the veil off the home-circle and disclose a harmony and happiness, scenes of domestic and social felicity, that were the fitting reward of a life of upright living and high ideals.

In every one of the 26 chapters into which the "Life" is divided we see the great mathematical physicist vigorously bent on opening up avenues of knowledge; and at the same time we see the man of culture and accomplishments extracting after the manner of the honey-bee all that is best in life and bestowing it lavishly on his friends. Gentleness, unselfishness, simplicity and humility stand out as prominent traits in a character that was rendered still more beautiful by the constant adherence to deep, religious beliefs which no new-fangled theory could ever shake. "Humility without fear" was emblazoned on his coat of arms; and these pages show that the same illuminating motto was ever the guiding motive of his conduct.

In the two chapters on the Atlantic telegraph we see Thomson, though officially holding only a relatively subordinate position, ever ready to lend the assistance of his unrivaled combination of scientific knowledge with practical skill to the electrician in charge, helping him to solve the puzzling difficulties that arose with such provoking frequency in the submergence as well as in the operation of the cable of 1858. In the 39 pages devoted to the Baltimore lectures of 1884 we find the sexagenarian philosopher discussing with undiminished enthusiasm the fundamental problems of molecular dynamics before an assembly of 21 distinguished physicists whom he fondly called his 21 coefficients; and lastly in the 47 pages recounting the various incidents of the celebration of his golden jubilee as Professor of Natural Philosophy in the University of Glasgow, 1896, the representative of British science is depicted as receiving the homage of the united academies of the world with all the courtesy and simplicity of his lovable nature. It was on the occasion of these festivities that Lord Kelvin used the word *failure* as best characterizing the strenuous efforts which he had made during 55 years for the advancement of science, saying: "I know no more of electric and magnetic force, or of the relation between ether, electricity and ponderable matter, or of chemical affinity, than I knew and tried to teach my students of natural philosophy 50 years ago in my first session as professor."

Professor Thompson in commenting on this frank and startling confession points out that it sounded no note of despair nor even of pessimism; and in corroboration of the statement he quotes from a letter which Lord Kelvin wrote at the time to M. de Fonvielle in which he says: "It was not anything that I had been in the habit of teaching either in my lectures or published papers to which I referred. . . . What I feel that I have failed in has been my persevering efforts during 50 years to understand something more of the luminiferous ether and of the manner in which it is concerned in electric and magnetic forces; and it was of this that I said I know no more now than I knew 55 years ago, when I became convinced that ether was concerned in all these actions."

To the account of the life and life-work of Lord Kelvin given in the text the author adds numerous foot-notes of historic, scientific and bibliographical interest; a few of them are also well seasoned with wit and humor.

The work contains 16 plates, among which are four photogravures of the illustrious scientist. Appended to the second

volume are: (1) A list of distinctions, academic and others; (2) a list of printed books, 25 in number; (3) a list of scientific communications and addresses, 661 in all; and (4) a list of patents.

To Prof. Silvanus P. Thompson the students and admirers of Lord Kelvin all the world over owe a deep debt of gratitude for a "Life" of the great leader that is as ennobling and inspiring as it is terse in style and informing in matter.

[illegible] SANS FIL. By Prof. Dr. J. Zenneck. Paris: Gauthier-Villars. Two volumes, 994 pages, 802 illus. Price, 34 francs.

This translation from the German by P. Blanchin, G. Guerard and E. Picot, officers of the French Navy, puts Zeneck's "Electromagnetic Waves" (Elektromagnetische Schwingungen und Drahtlose Telegraphie") into a form which many engineers will find more convenient than the original. The translators have made an almost literal rendering of the German edition of 1905, but have corrected it, with the author's permission, up to February, 1908.

Dr. Zenneck prepared this work from the material of his [illegible] appeals especially to those who wish a thoroughly comprehensive reference book on wireless communication. The book aims to cover the physical principles underlying the art, and yet does not require an extended mathematical training on the part of the reader. Except in the treatment of oscillations, geometrical and simple physical demonstrations are used rather than the calculus; and even where calculus is used, the reader need have a knowledge of its rules only. However, for those who wish the more strict physical and mathematical developments, the author has included a number of theoretical notes.

Since the book treats of the fundamentals which form the basis for the careful design of instruments for ether communication and does not attempt to follow the rapidly changing detail of apparatus, it will be of value long after existing appliances have been discarded. It is possible that the partial disregard of instruments as actually arranged has led to slight historical inaccuracies—for example, Fessenden is not credited with his original work on the liquid barretter (electrolytic cell detector)—but this cannot detract from the clear presentation from the physical viewpoint. It is also possible that the author's estimates will not always coincide with those of his readers, but that can do no harm.

The French edition is published in two volumes, the first covering alternating currents of low frequencies and closed high-frequency oscillators, and the second taking up open oscillators for high frequencies, coupled circuits, wireless telegraphy and electromagnetic waves. The "technical alternating currents" are treated thoroughly, and the properties of high-frequency currents are deduced from the similar low-frequency effects, making due allowance for the changes which occur as the period is shortened, and considering the cases of damped oscillations. Under the topic of wireless telegraphy different transmitting and receiving arrangements, and six classes of wave detectors, are thoroughly discussed. The last chapter considers electromagnetic waves after the manner of light, and light waves as electromagnetic oscillations. At the end of the book are a number of tables and curves giving electrical relations which should prove very useful in the calculations which are common to wireless work.

As a whole, the work forms a valuable addition to the library of the wireless engineer and the student of electromagnetic waves.

PRINZIP UND WIRKUNGSWEISE DER TECHNISCHEN Messinstrumente für Wechselstrom. By Fritz Hoppe. Leipzig: Johann Ambrosius Barth. 86 pages, 114 illus. Price, 4 marks.

This book is Vol. IV of the author's electrotechnical series of text-books, and is devoted to the description of the fundamental types of alternating-current instruments. It includes the following types: Moving iron, or electromagnetic; hot wire, electrodynamometer and electrostatic. Special chapters are devoted to phase indicators, oscillographs and frequency indicators. Mathematics are avoided and explanations are accompanied by line drawings and diagrams which assist materially in making the principles of operation clear. The meters described are all of German design, but so far as the types are concerned the descriptions are of universal application. The treatment of frequency indicators is conspicuously German, since only the resonant vibration type is described, which type is seldom used on this side of the water. The differential coil type, so largely used here, is not mentioned.

THE MECHANICAL WORLD ELECTRICAL POCKETBOOK. 1910. Manchester: Emmott & Company, Limited. 175 pages. Price, 6d.

This is a companion to the *Mechanical World* Yearbook and is suited to the needs of mechanics and electricians. It contains very short descriptions of various apparatus, and gives directions for the wiring and installation of apparatus, testing of circuits and making simple measurements. The wiring is, of course, in accordance with the British regulations and therefore does not in all respects apply in this country. There is little tabular data in this book that cannot be found in any engineering handbook. As a useful reference book, this is far behind its companion, the Yearbook.

New Apparatus and Appliances

FLAMING-ARC LAMPS IN TUNNEL CONSTRUCTION.

By J. [illegible]

The New York aqueduct system, now in course of construction, furnishes many opportunities for the use of electricity for motors and lamps. Owing to the fact that most of the lighting is for outdoor use and for the illumination of large areas, naturally the flaming arc is the most efficient lamp to use. The Pittsburgh Contracting Company, which is constructing Section 52 at Elmsford, N. Y., in addition to using the flaming arc for lighting around shafts, stone crushers, pits, etc., has experimented with great success with flaming arcs for tunnel lighting. Mr. L. C. Brink, superintendent, together with Mr. F. A. Raven, electrician of the Pittsburgh Contracting Company, installed several Hawthorn flaming arcs in the tunnel. This type was selected because of its simple construction and [illegible] order. The current is 60 cycle, alternating, and each lamp is connected in multiple on 110 volts in connection with an autotransformer. The lamps are installed at the bottom of the hoist, at loading platforms near the drilling gangs, and at intervals of 150 ft. along the tunnel, which is 20 ft. high and 17 ft. wide.

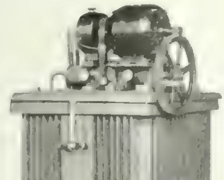
Before a blast is set off the nearest lamp is easily removed and later it is again hung on the support. This lamp is connected with the circuit by a flexible stage cable.

The contractors have found this scheme a great help, as the golden yellow light readily penetrates the foggy atmosphere of the tunnel and brilliantly lights up all parts. In fact, daylight working conditions exist 200 ft. below ground, which is a great advantage in expediting the work.

The Western Electric Company, manufacturer of the Hawthorn flaming arc, reports many sales to large contractors, who find the simple and rugged design of the Hawthorn lamp extremely well adapted to these conditions.

INDUCTION-TYPE, POTENTIAL REGULATOR.

The motor-operated, single-phase, induction regulator shown by the accompanying illustration embodies the several improvements recently made in this line by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Although the general design of these regulators remains unchanged, modifications have been made that insure not only a higher degree of satisfactory operation but longer life. The skeleton frame construction of the new type single-phase, potential regulator permits the use of a "cast-in" corrugated, sheet-metal tank, which affords a larger and more efficient radiating surface than the cast-iron tanks used with the earlier regulators, thereby insuring a low operating temperature. This type of tank is also less liable to give trouble from oil leakage, which sometimes occurs with the cast-iron tanks on account of unavoidable defects in the castings. In the latter, the leaks usually developed after the punchings and windings had been placed in position, thus causing considerable loss of labor in the work of rectification, while it is noteworthy that in the case of the "cast-in" tank a defective tank entails no other loss than the tank itself. In the earlier designs, the cast-iron tank was bored out to receive the stator punchings. As this tank was open only at the top, difficulty was sometimes experienced in obtaining inner cylindrical surfaces which would be in perfect alignment with the rotor bearings located in the cover and bottom of the tank.

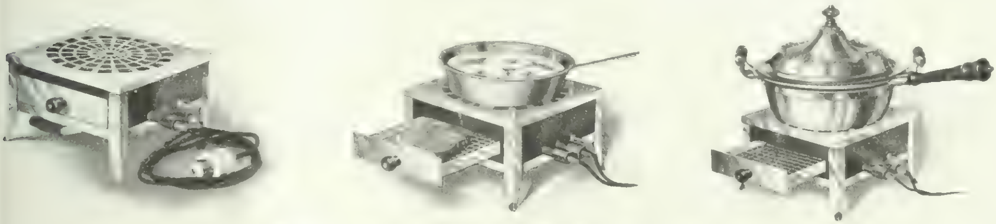


Induction Type Potential Regulator.

[illegible] have "cast-in" corrugated, sheet-metal tanks. They are similar to and possess all the advantages of the "cast-in" type of tank. They have, it is claimed, great strength mechanically, large radiating surfaces and have dirt and dust-proof qualities. An [illegible] at the top and [illegible] provided. [illegible] and water cooled. Boiler-iron cases with cast-iron bases and covers are usually used. The single-phase regulator has an inherent tendency to vibrate, but this has been overcome in the Westinghouse regulator by a careful design of the bearings and shaft. The moving element is carefully centered so that a uniform air-gap is secured. Furthermore, the tendency to vibrate is reduced due to the low point on the saturation curve at which the magnetic circuit of the regulator is worked. A very agreeable result of the elimination of the vibration is the noiseless operation of the regulator.

COMBINED ELECTRIC STOVE AND TOASTER.

In the new electric cooking device illustrated herewith a double use is made of the heat. Cooking can be done on top of the stove at the same time that toast is made on the toaster in the little drawer which slides in and out in the body of the device. One operation does not interfere with the other. The heating coils are underneath the openings on top of the stove and above the toaster in the drawer. The heating coils are made interchangeable, so that in case of accident or burn-out they may be readily replaced. Three degrees of heat are provided, consuming respectively 250 watts, 375 watts and 550 watts. The device is attractive in appearance and is finished either in black or polished nickel. By its use the breakfast eggs or cereals may be cooked on top of the stove at the same time that the toast is browning in the toaster. The device also lends itself readily for use with a chafing dish. It is made by the M-V-W Electric Manufacturing Company, Reed City, Mich. Mr. George D. Westover, an electrical man of experience, is president of this company.



Figs. 1, 2 and 3—Combination Electric Stove and Toaster.

PORTABLE ELECTRIC VACUUM CLEANER.

The Electric Renovator Manufacturing Company, of Pittsburg, Pa., which has produced several very successful portable vacuum cleaners of various sizes to suit all sorts of requirements from cleaning in large hotels and office buildings down to a moderate-sized dwelling, has brought out a portable machine, the "Invincible Junior," constructed on the centrifugal principle, which has proved to be especially applicable to vacuum cleaning. The motor and the fans are mounted on the same vertical shaft. As may be seen from the illustration, the dust collector is at the top; the fans are beneath the dust collector and the motor is at the bottom. As the motor is the heaviest part of the apparatus, this arrangement gives the greatest stability. The air is received at the very top of the machine [illegible] and dust are removed. It then passes through the centrifugal fan and is discharged into the atmosphere. The elimination [illegible] gain in increasing the life of the bearings, as there is no chance whatever for dust to get into them and cut the linings. There [illegible] there is practically no noise and no wear; this, of course, means [illegible]

in the work. The power required [illegible] at full [illegible] is delivered by a Westinghouse motor. The motor has been especially designed for this class of service by the Westing-

Vacuum Cleaner.

house Electric & Manufacturing Company, Pittsburgh, Pa. The entire equipment weighs about 65 lb. and is capable of exhausting 50 cu. ft. of air per minute.

CONTROLLERS FOR ALTERNATING-CURRENT CRANE MOTORS.

The use of alternating current and of alternating-current motors has been rapidly extended. Until recently direct-current motors only were used for crane work, and it has been necessary to furnish direct current in many plants by the use of a motor-generator set. The slip-ring alternating-current motor has characteristics which make it practicable for use with cranes, when provided with proper controlling apparatus. The Cutler-

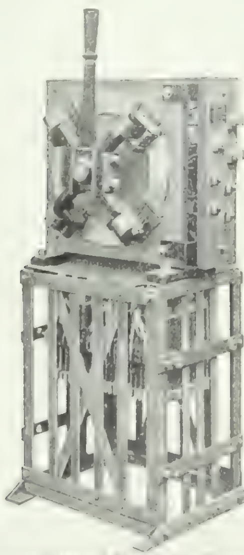


Fig. 1—Front View of Radial Arm Type Controller.

Hammer Manufacturing Company, of Milwaukee, realizing that the use of alternating-current motors is desirable and an advantage, in some cases, has developed a line of alternating-current crane controllers, which are similar in appearance to the Cutler-Hammer direct-current controllers, as the accompanying illustrations show.

The fronts are made of high grade Vermont slate, ground to a uniform thickness and carefully inspected and tested for traces of iron. The resistor used in both types is made up of

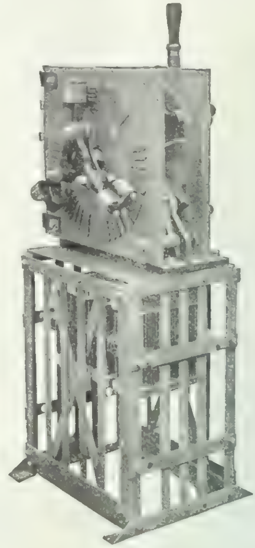
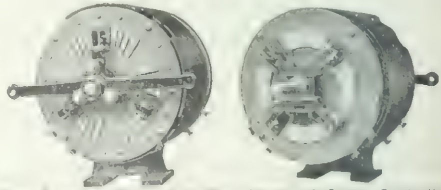


Fig. 2—Rear View of Radial Arm Type Controller.

units; in the small controller spool units are used, while the grid unit is used in the larger. The removal of a unit can be accomplished without disturbing others. The small circular-faced controller is self-contained and compact, having the resistance mounted on the back of the face plate. It can be operated from the floor by means of ropes, making it especially serviceable for use with small cranes, as in foundries, etc. The resistor for the larger type is mounted below the face place. The straight lever motion allows of easy operation and makes convenient the installation of several controllers side by side. When desired the operation can be accomplished by a bell crank and link arrangement, placing the controller at the rear or outside of cab if desired. The steel framework, supporting the controllers, combines strength and lightness and allows easy inspection and access. The contact segments are made of hard drawn copper. The screws securing them to the face plate are countersunk beneath the surface to insure a smooth and full contact. The segments can be replaced without interfering with any connection. The contract fingers are of drop-forged copper and provided with springs, arranged to give the best contact possible. Although the squirrel-cage induction motor is not well adapted for operation of cranes, yet it is sometimes



Figs. 3 and 4—Front and Rear Views of Crane Controller.

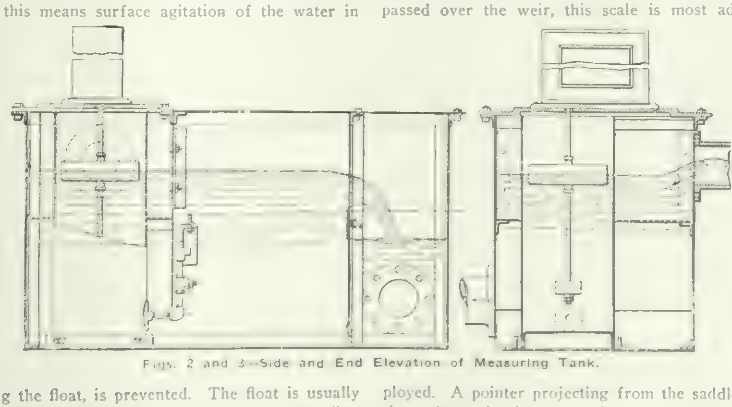
required and the Cutler-Hammer Manufacturing Company has therefore designed controllers for this purpose also. In connection with the development of these alternating-current controllers a line of brake solenoids has been developed which cut down the starting current and reduce the mechanical wear on the brake mechanism.

WATER RECORDER FOR BOILERS AND ENGINES.

The instrument for measuring and recording graphically the water delivered to boilers or condensed from engines and turbines, illustrated herewith, has been extensively used in British central stations. Its operation is based on the law of the flow of water over weirs and notches, and it employs the sharp-edged V-notch of Prof. Jas. Thompson, which form is better adapted for measuring small quantities of water than the horizontal weir or circular orifice. Another property of the notch is that its angle may be varied without impairment of efficiency, so that very small quantities of water may be measured, since the

Fig. 1—Combined Indicating, Recording, and Counting Instrument for Measuring Steam Consumption.

height of the head may be materially increased without adding very greatly to the flow if the width be decreased. In the recorder illustrated, which is manufactured by the Lea Recorder Company, 28 Deansgate, Manchester, England, a selection from notches of many different angles may be made according to the quantity of water to be measured. The recorder is actuated by a float which rises and falls with the level of the water in the V notch. Fig. 2 shows a longitudinal elevation of the apparatus, and Fig. 3 a transverse sectional elevation through the float chamber, which is in communication with the still water above the weir by means of a 1-in. pipe, controlled by a valve. By this means surface agitation of the water in



Figs. 2 and 3—Side and End Elevation of Measuring Tank.

the tank, affecting the float, is prevented. The float is usually made about 12 in. in diameter, and is connected to the recording instruments by means of a rod or spindle. The latter passes through an anti-vapor gland, and is connected to and actuates a rack, shown in Fig. 4, which gears with a small pinion that in turn actuates a cylinder upon the surface of which is a spiral groove. In this groove, the curve of which is calculated to accord with the character of the final record, travels a pin on the pen arm. It will be evident from the foregoing that as the float rises a rotary motion is imparted to the drum, which by means of the spiral on its surface, and a saddle arm, causes the pen to trace a line on the recording cylinder or drum. A scale shown on the left-hand side of Fig. 4 indicates the actual rise and fall of the water in the tank in inches. The result of this mechanism is that the instrument can be advantageously em-

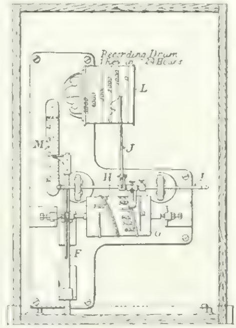


Fig. 4—Recording Mechanism.

ployed to produce daily or weekly records from which the total quantity of water passed in a given time may be easily deduced. One of the special features claimed for the apparatus is the large exaggerated scale adjacent to the coil upon the drum, which is clearly shown in Fig. 4. Where it is desirable to

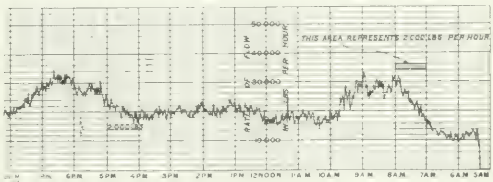


Fig. 5—Chart Made by Recorder.

obtain very accurate, instantaneous measurements of the flow, as, for instance, when testing a surface condensing engine in order to determine the consumption of steam per indicated horse-power per hour, the air-pump discharge at the time being passed over the weir, this scale is most advantageously employed. A pointer projecting from the saddle arm moves over the scale on the drum, enabling a very high degree of accuracy in observation to be obtained. It is claimed by the manufacturer that fluctuations in the float water level of 1/200 part of an inch are easily observable. In an instrument with a maximum movement of float of only 4½ in. the scale on the drum is about 20 in. long. Fig. 5 is a reproduction of an actual chart made by one of these machines in an English central station, the consumption of water by the engine being 17.[illegible] lb. per kw-hour.

Industrial and Commercial News

The Week in Trade.

REPORTS of the conditions of trade varied considerably last week, according to the sections reporting. There were many cross currents and side influences affecting local situations. As a rule, however, it is not too much to state that the general condition of business was distinctly improved. This was not only true with regard to retail trade, but an improvement was also observable among the wholesalers and jobbers. The advance of the season to the point where purchasers are receiving returns for the marketed crop always brings about a rejuvenation in business. While there is an increase of activity in a few Southern centers, this section of the country is more backward than any other at the present time, owing to the fact that the cotton crop is one of the last to be harvested and marketed, and all those sections which depend for their yearly income upon wheat and other small grains have already received the money for their crop and are consequently reviving in business. The corn crop and the cotton crop have yet to be marketed. There is every reason to believe, however, that the sections which depend upon these crops will eventually be as well provided with funds as those which depend upon small grains. As heretofore noted, the number of buyers in central jobbing cities is unusually large. These buyers have to a considerable extent displayed conservatism, but this does not mean that they are not placing fair orders with the wholesalers. It is pretty well understood that the shelves of retailers throughout the country are fairly bare of stock, and therefore purchases must be more liberal than they were last year. There continues to be some irregularity among the leading industries. There is more doing in iron and steel, but prices are lower. The textile industry is still curtailed. At the present moment there are very few labor troubles affecting the industrial world and it does not seem probable that any general demand for increased wages will be made under present trade conditions. Collections have been materially improved, due largely to the fact that many sections have received their money from the marketed crops. Business failures for the week which ended Sept. 1, as reported by *Bradstreet's*, were 179, against 235 the previous week; 166 for the same week in 1909, 210 in 1908, 130 in 1907 and 121 in 1906.

The Copper Market.

PRICES for copper were maintained last week, both in this country and Europe by the allied producing and selling interests, This was not accomplished, however, by any legitimate condition of supply and demand, but by the financial strength of the interests back of the market. During the short market week which preceded the holidays the buying, both here and abroad, was extremely light. Consumers apparently have their wants well enough supplied for all immediate needs and are

			price.
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Extreme fluctuations for this year:

[illegible]	[illegible]	[illegible]

[illegible] the steel industry operating at considerably below capacity it is the general opinion that the actual consumption of copper will show some reduction. Although this is the time of year when electrical railways generally place liberal orders for equipment and repairs in preparation for the winter traffic, there has very little of this business been announced as yet. Preliminary esti- [illegible] ... small addition to the surplus stocks carried. While there has been a great deal of talk of curtailment, it is not believed that production has been materially reduced. Imports have continued to be heavy, while both exports and domestic takings have been light. Total exports for August, as figured by the producers, will not be more than 25,000 tons, although the Metal Exchange figures place the shipments at 27,976 tons. Exports since Sept. 1 have been insignificant. Standard copper was quoted in the Metal Exchange Sept. 2 as per accompanying table.

Industrial and Commercial Notes.

Tungsten Lamps Abroad.—H. M. Hirschberg, president and manager of the Excello Arc Lamp Company, has recently returned from his annual trip to Europe. Mr. Hirschberg says that he found the conditions of electrical trade in Germany and generally on the Continent considerably better than in this country. The factories seem to be busier and the demand for electrical goods and electrical appliances he thinks is better. He says that the flaming arc lamp is being taken up very largely by municipalities for street lighting and that it is growing in popularity in this direction all the time. Another thing which he observed in Germany was the almost universal use of tungsten lamps. He declares that the use of carbon filaments in German cities has been almost discontinued. Every one uses tungsten. On the majority of the railroads in Germany tungstens are used for car lighting. Mr. Hirschberg is of the opinion that the coming season will see a great advance in the use of flaming arcs in this country.

Demand for Mining Machinery.—The Allis-Chalmers Company's record for August shows that there is no diminution in the demand for any of the lines of machinery that the company produces, and the bookings for the month show substantial gains over last year from almost every portion of the United States and Canada. One feature in the increasing demand is the growth in orders for mining machinery. One recent order of this kind was placed by the Ray Consolidated and Chino Copper companies which included four triple-expansion engines of 2500 hp each, as well as 1,000,000 lb. of transmission machinery. Other important orders were American Steel & Wire Company, 1200-hp motors and motor generators; Minnesota State Prison, three reciprocating engines with generators and 56 induction motors, and the St. Lawrence Flour Mill Company, of Montreal, complete motor equipment with a capacity of 1500 bbl. of flour per day.

Duplex Metals Company.—The Duplex Metals Company, of 149 Broadway, New York, reports that there is a continued increase in the demand for copper-clad wire for use in telephone and open distribution work. According to a representative of this company, No. 14 copper-clad steel wire is rapidly replacing No. 12 hard-drawn copper wire for open line distribution and short haul telephone work. This authority also shows that No. 17 copper-clad steel twisted pairs is now almost a universal standard for distribution purposes. This eliminates all bridling both at arrester, cable head and distributing box. On account of its small gage it is claimed that the saving is considerable in rubber installation over the old No. 14 hard-drawn copper twisted wire. The Duplex Metals Company has furnished a great portion of the wire used by the Great Northern Railroad in the telephone system which it has recently established for train despatching.

Public Service Corporation of New Jersey.—The Public Service Corporation of New Jersey has taken title to five acres of land at Tottenville, S. I., and has practically closed negotiations for an adjoining 10-acre tract. The company has announced its intention of building two ferry houses on the tract at Tottenville, and will establish a ferry service between that point and Perth Amboy. It also contemplates the erection of a $1,000,000 power house at Perth Amboy, which will furnish energy for that section and other points in Staten Island. This new work on the part of the Public Service Corporation places it in direct competition with the Staten Island Rapid Transit Company, which has heretofore had a monopoly upon the island.

Montreal Street Railway & Power Merger.—The buying of stock of the Montreal Street Railway Company, which started early in the year and [illegible] to the present, has led to persistent rumors in financial circles in Montreal that the Canadian Power Company has secured control of a majority of the stock of the railway company. The directors of the Montreal Street Railway Company have taken official cognizance of the rumors by addressing a circular to the shareholders of the railway company, stating that owing to the persistent rumors and repeated statements in the financial columns of the newspapers regarding a proposed amalgamation of the railway company with a new hydroelectric power company the directors requested the shareholders to withhold their proxies until a careful investigation could be made of the proposed scheme. The circular stated that the directors have under consideration certain negotiations and plans affecting the future of the Montreal Street Railway Company, which will be laid before the shareholders in a short time. The issuance of the circulars is taken to mean that negotiations are under way for an amalgamation of the railway company with the Montreal Light, Heat & Power Company, but it is now expected in financial circles that at the annual meeting of the street railway company in November it will be found that the Canadian Power Company interests have obtained a majority of the stock of the railway company and a change will take place in the directorate of the railway company.

Wabash River Power Company.—The assets of the Wabash River Power Company, located at the grand rapids, near Mount Carmel, Ill., formerly owned by Fort Wayne (Ind.) capitalists, have been purchased by a syndicate of Illinois, New York and Colorado financiers. Mr. J. B. Blackman, a wealthy banker of Harrisburg, Ill., is largely interested and with him are associated J. J. Henry, widely known in the development of hydroelectric properties through the West, and G. E. K. Hixson, who with others is engaged in the construction of an electric railway through the southern part of Illinois. The engineering company has not been definitely decided upon. Now that these water power holdings are in the hands of gentlemen who are experts in the development of water power, who have at their command sufficient capital, there will be no time lost in the complete development of the power of this vast body of water that has never been utilized, even since the construction of a dam at that place by the national government. The dam, which was built under the supervision of and at the expense of the United States Government, is 1185 ft. in length, having a fall of 11½ ft., and when the work of lowering the river bed below the dam, for which there has been an appropriation made by the government, is completed, the fall will be 17½ ft.

United States Lighting & Heating Company.—D. W. Pye, formerly vice-president of the Safety Car Heating & Lighting Company, who was recently elected a director of the United States Lighting & Heating Company, was last week elected president of the latter company and took up the duties of his office Sept. 1. The financial condition of the United States company is very satisfactory. The company has absolutely no indebtedness of any description, either bonded or floating, and a statement made on June 17 last showed that at that time it had on hand quick assets amounting to about $1,250,000, exclusive of its real estate, plant machinery and other property. The new plant of the company at Niagara Falls is rapidly approaching completion and the officials expect that the business will be finally established there early in the coming year, giving the company a capacity of approximately 6½ times its present output. Within the past 60 days the company has been unable, owing to the amount of unfinished orders on hand, to accept new business, except such as already had been secured under contract during the preceding six months. The dividends of 1¾ per cent quarterly are being paid upon the preferred stock, on which there is outstanding $2,500,000.

Electrification of the Long Island Road.—In connection with the opening of the East River tubes, service in which will begin this week, Ralph Peters, president of the Long Island Railroad Company, [illegible] electrification upon the north shore division beyond Woodside would not be begun until [illegible]

Athens (Ga.) Gas, Railway & Electric Company.—The Athens Gas, Railway & Electric [illegible] formed to take over the properties of the old street railway system, is preparing to extend its lines so as to take in an immense amount of territory that is not now served by traction lines. The management of the company is also pushing toward completion as fast as possible the dam and power house of the new plant at Barnett Shoals. It is stated that when completed this plant will afford the city of Athens ample power for lighting and street railway service for a number of years to come, and it will at the same time afford power for a large cotton mill with about half a million spindles, which is now projected.

Canadian Power & Paper Company.—The *Canada Gazette* contains the announcement of the incorporation of the Canadian Power & Paper Company, with a capital of $10,000,000. As the incorporators are the persons connected with the legal interests who have acted in the past for many of the enterprises of Messrs. MacKenzie & Mann, it is believed that these gentlemen are at the back of the undertaking. The powers granted are of the most extensive character and give the new company broad authority over their new enterprises, except where the interests of municipalities are concerned, in which case contracts must be submitted for confirmation by the municipalities.

Ottawa Municipal Plant Lets Contracts for $60,000.—The Municipal Electric Commissioners of Ottawa, Ont., have awarded the following contracts, aggregating about $60,000, for the new power conduit to be built from the Chaudiere Falls to the distributing station on Laurier Avenue: Transformers, Canadian General Electric Company, $12,000; cable, British Insulated Cable Company, Montreal, $16,246; conduit pipes, Eadie-Dougle Company, Ottawa; manhole covers, J. B. Maclaren, 2¼ cents per pound for cast-iron. For the most part the conduit will be placed under the boulevards, and the work of laying the pipes will be done by the city engineer by day labor.

Denver Federal & Light Equipment.—Sanderson & Porter, of New York City, have recently contracted with the Westinghouse Electric & Manufacturing Company for two 1250-kva, 2300-volt, three-phase turbo-generators to be used in the power plant of the Federal Light & Traction Company, Denver, Col. Two La Blanc condensers will be used in connection with the steam turbines. The generator fields will be excited by two 50-kw, 125-volt, 2250-r.p.m. direct-current turbo-generators to be used in connection with a Tirrill regulator. The order also includes the necessary transformers, lightning arresters, disconnecting switches and switchboard.

Electric Smelting & Aluminum Company.—Ground has been purchased at Woodbridge, N. J., by The Electric Smelting & Aluminum Company, of Lockport, N. Y., on which it is intended to build a large factory. Arrangements are also being made for constructing a dock and for securing railroad connections. The company will also erect houses on its property for its employees. The Electric Smelting & Aluminum Company is devoted to the manufacture of aluminum alloys and has been in business at Lockport a number of years.

Electricity for Woolen Mills.—The Woodside Woolen Mills, of Northboro, Mass., have recently been equipped with electric motors for individual drive operation. Energy is furnished by the Marlboro Electric Light Company. It is said that the new power which was turned on more than a week ago is giving great satisfaction and promises to work considerable economy. The boilers of the old steam plant will be used to furnish steam for the washing and drying of the raw wool.

Electrical Vehicle Association.—Among the directors of the Electrical Vehicle Association, which was incorporated in New York recently, as referred to in our issue of Sept. 1, are: William H. Blood, Frank J. Stone, Boston; Hayden Eames, Cleveland; Charles Blisard, Philadelphia; Herbert H. Rice, Indianapolis; W. W. Freeman, Brooklyn; Frank J. Gyer, Orange, N. J., and Arthur Williams, Henry C. Cushing, Jr., and Hainey Robinson, New York City.

Isthmian Canal Proposals.—The General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., will receive proposals until Sept. 10, for two 35-hp compound-wound, direct-current, 110-volt motors, and 5000 ft. of 300,000 circ. mil single-conductor stranded lead covered [illegible]

Railway Equipment.—[illegible] Company, of Washington, D. C., has recently entered an order for 20 double [illegible]

Financial.

THE WEEK IN WALL STREET.

THE short week in Wall Street, which concluded Sept. 2, was one of the dullest ever known in the history of the Street. For several days the average transactions were only about 200,000 shares. As far as could be observed, there was absolutely no outside interest in the market and the trading that was done was entirely professional. It is said that business was so slack and that trading was so highly professional that commission houses were glad to accept orders from small dealers who wanted to buy or sell odd lots. As far as the wire trading is concerned, which means the general commission orders of the country, there was absolutely nothing doing. Many of the large houses, which in prosperous times do a business of 100,000 shares a day, did less than 5,000 shares a day last week, and the absence of tenants in the handsomely furnished "Customers' Rooms" was one of the jokes of the Street. United States Steel, Reading, Union Pacific and to some extent the Interborough issues practically covered the trading. On many stocks there was not a quotation for days. The exact reason for this extreme dullness was hardly apparent. Mr. Roosevelt's tour and the tenor of his speeches throughout the West is held responsible for checking any general interest in the market. It is not so much that the Street is afraid of what Mr. Roosevelt may accomplish, but that as it is generally apathetic, it is entirely willing to wait until there seems a more favorable opportunity for investing. The money market continues to be in the same condition as has been noted for a number of months. There is little investment demand for bonds, and on this account many large enterprises which have been projected are being held up, waiting for a better chance to place new securities. Rates for money in the banks are still easy for call loans and there is no trouble about these being made on suitable collateral. Rates for time money, however, are not much cheaper than is usual at this period of the year, which indicates that banks, while well supplied with funds, are not seeking loans that will tie up cash for any long period. Quotations Sept. 2, the last day before the holidays, were call, 1¼@1¾ per cent; 90 days, 3¾@4 per cent.

NEW YORK.

	Aug. 29	Sept. 2	Shares sold.		Aug. 29.	Sept. 2	Shares sold.
All.-Ch.	[illegible]	[illegible]	—	Int. Met. [illegible]	[illegible]	[illegible]	[illegible]
Am. Can, pfd.	[illegible]	[illegible]	[illegible]	Mackay Cos. [illegible]	[illegible]	[illegible]	[illegible]
Am. [illegible]	[illegible]	[illegible]	[illegible]	Mackay [illegible]	[illegible]	[illegible]	[illegible]
Am. [illegible]	[illegible]	[illegible]	—	Man. Elev....131*		131*	—
Am. Loc.....	35	[illegible]	1,250	Met. St. Ry..	15*	[illegible]	—
Am. [illegible]	[illegible]	[illegible]	[illegible]	N. Y. & N. J. Tel. [illegible]	[illegible]	[illegible]	—
Am. [illegible]	[illegible]	71¼	—	Steel, com. [illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T..	134½	[illegible]	[illegible]	Steel, pfd. [illegible]	[illegible]	[illegible]	[illegible]
B. R. T.	[illegible]	[illegible]	[illegible]	W. U. T.....	[illegible]	[illegible]	[illegible]
Gen. Elec....	142⅞*	[illegible]	[illegible]	West'h., com.	[illegible]	[illegible]	[illegible]
Int. Met.	[illegible]	[illegible]	7,000	West'h., pfd..	110*	110*	—

PHILADELPHIA.

	Aug. 29.	Sept. 2.		Aug. 29.	Sept. 2.
Am. Rys............	44	44*	Phila. Elec.........	15	[illegible]
Elec. Co. of A.	[illegible]	[illegible]	Phila. R. T.	[illegible]	[illegible]
Elec. St. B'ty.......	47½	[illegible]	Phila. Tr.	[illegible]	[illegible]
E. S. B'ty, pfd.	[illegible]	[illegible]	Union Tr.	[illegible]	[illegible]

CHICAGO.

	Aug. 29.	Sept. 2.		Aug. 29.	Sept. 2.
Chi. City R.	180*	[illegible]	Chi. Tel. Co.	[illegible]	[illegible]
Chi. Rs., Ser.	70*	70*	Met. El. Co.........	15*	[illegible]
Chi. Rs., Ser. 2....	[illegible]	16½*	Met. El., pfd........	60*	[illegible]
Com. Edison..	[illegible]	111	Nat'l Carbon.......	120	[illegible]
Chi. Subways	[illegible]	[illegible]	Nat'l Car., pfd....	117*	[illegible]

BOSTON.

	Aug. 29.	Sept. 2.		Aug. 29.	Sept. 2.
Am. T. & T.........	134½	135	Mex. Tel	[illegible]	[illegible]
Cum. Tel...........	144½*	[illegible]	Mex. Tel., pfd......	[illegible]	[illegible]
Edison E., Ill.........	260	260	N. E. Tel..........	129¾*	[illegible]
Gen. Elec. ..	[illegible]	141	W. T. & T.........	15*	[illegible]
Mass. E. Ry........	17⅜	[illegible]	W. T. & T., pfd.....	[illegible]	[illegible]
Mass. E. Ry., pfd...	82	82			

*Last price quoted.
Shares sold for five days, Aug. 29 to Sept. 2.

FINANCIAL NOTES.

Cities Service Company.—The plan for the long-talked of holding company which has been in process of organization by Henry L. Doherty & Company for several months has finally been announced. The company is known as the Cities Service Company and was incorporated last week under the laws of Delaware. The authorized capitalization of the company is $50,000,000, to be divided into $30,000,000 6 per cent cumulative preferred and $20,000,000 common stock. The common stock has been all issued and when the transfers for the issues of the subsidiary companies that will be first taken into the combine are made there will be about $5,000,000 at once put in use. Of the remainder there has been set aside to be used for corporate purposes, within the discretion of the board of directors, $500,000, which will leave a remainder of $14,500,000 of common stock in the treasury to be used for the acquirement of additional properties. It is announced that this holding company will take over as the basis of its organization the Denver Gas & Electric Company, the Empire District Electric Company—which in itself is a combination of properties doing business in the neighborhood of Joplin, Mo.—and the Spokane Gas & Fuel Company. It is stated in the circular setting forth the plan of the new holding company that after consultation with a majority of the stockholders of the above-named companies the following basis of exchange has been decided upon: 1 8/10 shares preferred Cities Service Company and 9/10 of one share of common stock Cities Service Company for each single share Denver Gas & Electric Company; ½ of one share preferred of the Cities Service Company and ¼ of one share of common of the same company for each share of the common stock of the Empire District Electric Company; 3/10 of one share of preferred stock of the Cities Service Company and 15/100 of one share of the common stock of the same company for each one share of the common stock of the Spokane Gas & Fuel Company. It is announced that in addition to the stock offered above for transfer $1,000,000 of preferred stock and $500,000 of common stock have been underwritten for a consideration of $1,000,000 in cash for the purpose of providing the holding company with ample working capital. Henry L. Doherty & Company are to act as bankers and syndicate managers for the new company and will be paid for their services only in common stock. When the stocks of the Cities Service Company, as explained above, have been issued there will be outstanding: preferred, $8,779,650; common, $4,889,825. The balance of the securities are to be retained by the company for the acquirement of additional properties. As forecasted in the *Electrical World* July 21, this new holding company of the Doherty interests contemplates taking over quite a number of other properties in addition to those that have here been named. These include the Lincoln (Neb.) Gas & Electric Company and the Knoxville (Tenn.) Gas & Fuel Company. The Montgomery (Ala.) Light & Water Power Comopany, the Meridian (Miss.) Light & Railway Company and several other properties will probably be eventually included. Henry L. Doherty will be president of the company and his management will be much the same as that which has heretofore controlled the Doherty interests. There will be no bonds issued by the holding company, but the interest and principal of the underlying bonds of the subsidiary companies will be guaranteed.

Washington, Laurel & Berwyn Railway Sold.—The Washington, Laurel & Berwyn Railway was purchased last week at public auction by George Weems Williams, acting for the Washington, Baltimore & Annapolis Electric Railway, for $75,000. The sale took place at Laurel, Md., and was under foreclosure proceedings. The road was owned by the Washington, Baltimore & Annapolis, but has been leased and operated by the Washington Traction Company. It has never been able to earn fixed charges and some time ago was placed in the hands of receivers. When the Washington, Baltimore & Annapolis decided to build between Washington and Baltimore, the Washington, Laurel & Berwyn was purchased, but those behind the new company subsequently abandoned the plan to use this property and surveyed an entirely new route between the two cities. The road was then leased to the Washington Traction Company.

Shawinigan Water & Power Company.—During the seven months which ended July 31, the returns for the Shawinigan Water & Power Company of Montreal have shown large increases over the preceding year. The company will show at the end of the calendar year the largest record in its history. In 1909 the company paid 4 per cent dividends on its $6,500,000 outstanding stock, and the same rate has been paid this year on the $7,000,000 of stock. At the present time the capacity of the company is estimated at 100,000 hydraulic horse-power, two high-tension transmission lines with a total capacity of 20,000 hp connecting the power station at Shawinigan Falls to the substation at Montreal, a distance of 85 miles.

Mexican Light & Power Company.—The July earnings of the Mexican Light & Power Company, which is owned in Montreal, show a big improvement over those of the corresponding month last year. This is largely because the company last year was suffering from a break in the Necaxa dam. The figures for July this year show a decrease in operating expenses of $234,571. The gross earnings amounted to $578,484.

Susquehanna Railway, Light & Power Company.—The annual report of the Susquehanna Railway, Light & Power Company for the year which ended June 30 shows net earnings of $748,062, an increase of $135,701 over the previous year. After paying all fixed charges and preferred dividends, there is a balance left of $293,772. During the year the controlling interest in the stock of the Wilkes-Barre (Pa.) Gas & Electric Company was acquired. The Susquehanna company is a holding concern with headquarters in New York City. It owns and controls the United Gas & Electric Company, which in turn owns and controls electric and hydroelectric power companies in Pennsylvania, Indiana, Colorado and Massachusetts. The Susquehanna company during the year spent $686,847 for extensions, additions and betterments to its various properties.

Tri-City Railway & Light Company.—At the annual meeting of the stockholders of the Tri-City Railway & Light Company, of Davenport, Iowa, which will be held in Hartford, Conn., Sept. 15, a vote will be taken on the question of issuing $20,000,000 of new bonds, to be known as first and refunding mortgage 5 per cent bonds. A mortgage will be given by the company for the purpose of securing the payment of principal and interest of the bonds. The proceeds of the issue will be used to take up the present outstanding debt and to make additions and improvements to the property.

Washington, Baltimore & Annapolis Bonds.—The interest on the $2,000,000 issue of 5 per cent terminal bonds of the Washington, Baltimore & Annapolis Electric Railway Company, amounting to about $50,000, will not be paid. The interest was due on Sept. 1, but under the terms of the mortgage the company has 90 days in which to meet the payment. The interest payment was passed by the road on March 1 last, but on May 24 the receivers were in a position to pay it. There is a plan on foot to reorganize the property with a view to lifting the receivership.

Western Union Telegraph Company.—At the office of the Western Union Telegraph Company it is said that the business for the past three months has been steadily increasing and is now in very satisfactory shape. It was denied, however, that any new deal or combination with any other company was contemplated at this time. Rumor to this effect had been current in financial circles and was held responsible for an advance of 2½ points in the stock last week.

Commonwealth Edison Bonds.—The conversion of the bonds of the Chicago Edison Company into those of the Commonwealth Edison Company has been practically completed, $4,695,000 having been taken in exchange out of the $5,000,000 outstanding. The gain in the business of the Commonwealth Edison Company is continuous and very satisfying, and its securities were never more popular than at the present time.

DIVIDENDS.

Muscogee (Okla.) Gas & Electric Company, preferred, quarterly, 1¾ per cent, payable Sept. 15.

Northern Texas Electric Company, preferred, semi-annual, 3 per cent; common, quarterly, 1½ per cent, both payable Sept. 1.

Oklahoma Gas & Electric Company, quarterly, 2 per cent, payable Sept. 15.

Providence (R. I.) Telephone Company, quarterly, 1 per cent, payable Oct. 1.

San Diego Consolidated Gas & Electric Company, quarterly, 1¾ per cent, payable Sept. 15.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Baton Rouge Electric Company:					
July, 1910	$9,708	$6,221	$3,487	$1,945	$1,542
July, 1909	8,351	5,538	[illegible]	1,951	862
Blackstone Valley Gas & Electric Company:					
July, 1910	76,059	39,431	36,628	29,913	6,715
July, 1909	73,376	40,028	33,308	29,469	3,839
Birmingham (Ala.) Railway, Light & Power Company:					
July, 1910	216,505	109,061	107,444	......	......
July, 1909	183,187	101,974	81,213	......	......
Cape Breton Electric Company Ltd.:					
July, 1910	28,876	14,407	14,469	6,182	8,287
July, 1909	26,616	15,624	10,992	6,217	4,775
Columbus (Ga.) Electric Company:					
July, 1910	38,532	17,917	20,615	17,848	2,765
July, 1909	30,650	18,570	12,080	12,712	632
Dallas (Tex.) Electric Corporation:					
July, 1910	117,270	85,473	31,797	26,842	4,955
July, 1909	103,340	68,107	35,233	28,403	6,830
East St. Louis & Suburban Railway Company:					
July, 1910	210,844	106,158	104,686	......	266,954
July, 1909	170,250	93,371	77,879	......	131,096
Edison Electric Company of Brockton:					
July, 1910	20,500	12,478	8,022	3,787	4,235
July, 1909	18,526	11,913	6,613	3,558	3,055
Electric Light & Power Company:					
July, 1910	6,872	5,126	1,746	814	932
July, 1909	6,243	3,746	2,497	477	2,020
El Paso Electric Company:					
July, 1910	49,351	29,557	19,794	8,215	11,579
July, 1909	46,362	29,204	17,158	8,085	9,073
Galveston-Houston Electric Company:					
July, 1910	122,097	65,989	56,108	26,609	29,499
July, 1909	109,747	62,069	47,678	21,596	26,082
Houghton County (Mich.) Electric Light Company:					
July, 1910	18,043	10,387	7,656	4,488	3,168
July, 1909	16,752	10,224	6,528	4,129	2,399
Jacksonville Electric Company:					
July, 1910	46,905	26,207	20,698	9,488	11,210
July, 1909	39,300	22,353	16,947	9,367	7,580
Keystone Telephone & Telegraph Company:					
July, 1910	94,472	47,422	47,050	24,611	22,439
July, 1909	91,020	45,533	45,487	25,802	19,685
The Lowell Electric Light Corporation:					
July, 1910	31,348	19,438	11,910	4,788	7,122
July, 1909	26,227	14,732	11,495	4,134	7,361
Minneapolis General Electric Company:					
July, 1910	[illegible]	35,854	53,111	30,734	[illegible]
July, 1909	[illegible]	37,263	40,280	29,563	[illegible]
Northern Texas Electric Company:					
July, 1910	[illegible]	68,147	[illegible]	20,273	[illegible]
July, 1909	[illegible]	59,834	49,328	17,190	[illegible]
Paducah Traction & Light Company:					
July, 1910	21,577	11,697	9,880	7,023	2,857
July, 1909	[illegible]	[illegible]	[illegible]	6,624	936
Pensacola Electric Company:					
July, 1910	[illegible]	13,654	[illegible]	5,279	5,302
July, 1909	[illegible]	12,604	10,857	4,305	6,552
Puget Sound Electric Railway Company:					
July, 1910	[illegible]	102,204	80,782	51,291	29,491
July, 1909	[illegible]	[illegible]	78,487	48,508	29,979
Savannah Electric Company:					
July, 1910	59,140	[illegible]	18,197	18,192	5
July, 1909	[illegible]	38,247	[illegible]	17,444	[illegible]
Seattle Electric Company:					
July, 1910	[illegible]	261,509	[illegible]	110,375	[illegible]
July, 1909	[illegible]	305,028	287,559	108,702	178,857
Sierra-Pacific Electric Company:					
July, 1910	[illegible]	15,353	29,449	5,977	23,472
July, 1909	[illegible]	[illegible]	[illegible]	5,903	21,535
Tampa Electric Company:					
July, 1910	[illegible]	[illegible]	22,606	6,711	15,895
July, 1909	[illegible]	[illegible]	16,769	4,701	12,068

General News

Construction News.

[illegible] Southern Bell Telephone & Telegraph Company, and it is understood that upon completion of the deal a new telephone exchange will be established by the Bell company in Decatur, and the system of the Morgan company [illegible]

LEEDS, ALA.—It is reported that Col. Cobb, of Anniston, is interested in the proposed construction of an electric lighting plant at Leeds.

TROY, ALA.—We are informed that the City of Troy, Ala., expects to purchase in the near future two additional 250-kw or 300-kw, 2300-volt, 60-cycle, three-phase generators and engines and two 150-hp return tubular boilers, 150 lb. gage pressure. One seven-pane distributing switchboard for single-phase distribution from three-phase generators, each panel to have a capacity of 50 amp, will be purchased at once. A. E. Campbell is superintendent of the electric and water departments.

TOMBSTONE, ARIZ.—The Tri-State Telephone Company, which recently acquired the telephone systems formerly owned by the Bisbee Improvement Company and the Douglass Improvement Company, expects to commence work at once upon the construction of a line connecting Tombstone, Bisbee and El Paso. Connections will be made at Deming with Silver City and at El Paso connections will be established with Las Gruces and Albuquerque.

LONOKE, ARK.—Work is soon to be commenced in this city, it is reported, upon a $75,000 generating plant which will furnish energy to be distributed throughout the rice fields in the vicinity of Lonoke.

LOS ALTOS, CAL.—Press reports state that J. D. Farwell, manager of the Los Gatos Ice, Gas & Electric Company, Los Gatos, Cal., has secured a contract to install an electric light and power plant at Los Altos, and that construction work is to be commenced at once.

OAKLAND, CAL.—It is reported that Fred C. Turner, city engineer, has petitioned the Board of Public Works to bond the city for the construction of an underground conduit system. The interest on the bond is to be derived from the rental of the ducts to the Central Oakland Light & Power Company, a new concern in the local field.

TAFT, CAL.—It is the intention of the Kern County Telephone Company to thoroughly overhaul its system at this place, and make it modern in every particular. The lines of the company are also to be extended.

HARTFORD, CONN.—Announcement is made at this city that at the October meeting of the directors of the Southern New England Telephone Company a formal call will be issued to the stockholders for subscription to another issue of new stock to the amount of $1,099,100, the additional capital to be used by the company to carry on extensions and improvements to its plant. The new stock will be issued to stockholders at par, and will be in the ratio of one to seven.

NORWICH, CONN.—At a recent meeting of the Norwich, Colchester & Hartford Traction Company the contract for its proposed interurban electric line was awarded to Ahern Brothers, of Norwich. The line is to be [illegible]

PLAINFIELD, CONN.—News comes from this city that the Lawton Mills Company is installing an electric lighting system in the village which [illegible]

WASHINGTON, D. C.—Reports come from this city that Vice Consul Albro L. Burnell, of Barranquilla, Colombia, states that an electric light and power plant is to be established in Barranquilla during the present year.

[illegible] D. C., has executed a contract with the Salt River Valley Water Users' Association providing for the construction by the latter of certain features of the Salt River irrigation project, Arizona, the works upon completion to be turned over to the United States as a portion of the project. The contract includes the construction of power plants of sufficient capacity to generate a total of 9700 hp.

[illegible] for furnishing at the Mare Island (Cal.) Navy Yard the following sup- [illegible] ft. twin conductor lighting wire, 14,200 lb. sheet copper, 13,000 lb. galvanized sheet steel; also same place until Sept. 20 for furnishing at the Puget Sound (Wash.) Navy Yard 600 lb. roller brass, 3200 sq. ft. [illegible]

[illegible] machinery. Press reports state that the company has just been awarded a contract by the Government to furnish energy for Fort Barrancas.

[illegible] ing the installation of an electric light plant. For particulars address the Mayor.

ALTO, GA.—Bids will be received until Sept 30 by the executive committee of the State Tuberculosis Sanatorium, 708 Gould Building, Atlanta, Ga. (W. G. Raoul, chairman), for work at the State Sanatorium, including wiring main buildings and four shacks now under construction for electric lighting and furnishing and installing fixtures for same; constructing brick power house with metal roof 18 ft. by 24 ft.; an oil or gasoline electric generating set to supply current for 200 16-cp lamps by night and during the day a pump for raising 80 gallons of water per minute to a height of 208 ft., horizontal distance 1350 ft., size of main 4 in.; also a motor-driven pump for said service. Bidder to give name of manufacturer and furnish plans for layout and installation. R. T. McDonald, Alto, superintendent of construction.

ATHENS, GA.—The Athens Railway & Electric Company, the recently organized corporation which took over the former street railway company, is pushing work on the dam and power house construction of the new plant at Barnett Shoals. When completed the plant will afford the City of Athens ample energy for lamps and street railways, and will also fur- [illegible]

CAIRO, GA.—It is reported that the municipal electric light and water works at this city expects to double the equipment of its plant during the fall and early winter by the installation of new machinery. It is understood that contracts for the equipment have not as yet been placed.

IDAHO FALLS, IDAHO.—A reorganization of the Idaho Power & Transportation Company has been effected and J. W. Springer, of Denver, has been put in charge. A large amount of Denver capital has recently been invested in the company and it is understood that improvements and additions are to be made to the plant.

DECATUR, ILL.—The A. E. Staley Starch Manufacturing Company, which has recently awarded contracts amounting to about $75,000 to the Charles W. Gindele Company, of Chicago, for the erection of new factory buildings, will within a short time place orders for $25,000 of electrical machinery.

DECATUR, ILL.—It is the intention of the Central Union Telephone Company to expend in the neighborhood of $45,000 in extending and improving its system in this city. About 60,000 ft. of aerial cable will be strung, 5000 ft. of cable installed in underground conduits and a new multiple switchboard equipped for 600 additional telephones added to the company's exchange.

JACKSONVILLE, ILL.—Bids were opened on Aug. 30 by the Commissioners of the Meredosia Lake Drainage and Levee District, at the office of Charles W. Brown, Jacksonville, engineer for the delivery and [illegible] condensing four-valve engine of 114 hp. one 72-in. horizontal tubular boiler 18 ft. in length, one single suction 24-in. volute pump with delivery of 15,000 gallons per minute, one surface condenser of 400 sq. ft. surface, necessary auxiliaries, etc. The contract was awarded to the Erie City Iron [illegible]

[illegible] Judge H. V. Teel, secretary of the Crane Creek Drainage and Levee District, Rushville, Ill., for the delivery and installation at the pumping station of the district for the following equipment: One tandem compound [illegible] Jacksonville, is engineer for the district.

CAMBRIDGE CITY, IND.—It is announced that Paul H. White, of Indianapolis, Ind., has been appointed by the town trustees of Cambridge City as engineer to supervise the remodeling of the municipal electric light plant, for which purpose a bond issue, as previously reported, was recently voted upon by the citizens of that city. It is understood that plans and specifications for the proposed improvements will be prepared at once.

FORT WAYNE, IND.—It is reported that the Indiana Lighting Company, Lafayette, Ind., is considering the construction of a cold storage plant and boiler-room on East Superior Street, Fort Wayne.

FORT WAYNE, IND.—Application has been made to the commissioners by the Fort Wayne & Toledo Electric Railway Company for a new franchise to construct an electric railway through Allen County. The proposed line will be 42 miles long, and will connect Fort Wayne and Maysville, Ind., and Hicksville, Bryan and Toledo. R. T. Bastress, Harlan, is general manager of the company.

MARION, IND.—It is announced that the City Council has purchased [illegible]

SOUTH WHITLEY, IND.—[illegible]
[illegible] been perfected at a special meeting of the town board recently.

[illegible] IND.—[illegible] is being constructed by the Farmers' Telephone Company.

CEDAR RAPIDS, IA.—[illegible] Company has closed a contract with the Iowa City Electric Railway Company to furnish it with power for the operation of its cars, it being the intention of the latter company to install service about the first of November.

ELDORA, IA.—The Park Dam Company has been organized by E. H. Lundy, who recently applied for a franchise to install an electric light plant at this city, and George F. Wood, both of Eldora. In return for the franchise the new company proposes to construct a dam across the Iowa River and install a power plant which will furnish a day and night electrical service. It is stated that a sufficient number of signatures have been obtained to insure the success of the project and that a special election has been called by the Mayor for the purpose of voting on the franchise.

FORT DODGE, IA.—It is reported that the line between Fort Dodge Junction and Rockwell City, formerly known as the Newton & Northwestern line, is to be electrified at an early date by the Fort Dodge, Des Moines & Southern Railroad Company.

KEOKUK, IA.—Press reports state that within a short time the Keokuk & Hamilton Water Power Company, which is constructing a $14,500,000 dam on the Mississippi River, between Keokuk, Ia., and Hamilton, Ill., will be succeeded by the Mississippi River Power Company. The latter company is to be incorporated under the laws of Maine, and will be the parent organization. The Mississippi River Power Distribution Company, which was organized a year ago under the laws of New Jersey, and which is an auxiliary company, will transmit to St. Louis 60,000 hp of the 200,000 which is to be developed at the dam and turn it over to the several public utilities with which contracts have already been entered into.

MONTICELLO, IA.—Press reports state that the Monticello Electric Light Company has purchased property on both sides of the Maquoketa River at Pictured Rocks, the site to be used for the location of a dam and power house to supply energy for its electric light plant.

ELDORADO, KAN.—It is understood that negotiations have been entered into between J. H. Glazier, representing a syndicate of Kansas City capitalists, and the Commercial Club, of Eldorado, looking toward the location of an electric power plant along the Walnut River which will furnish electricity to the neighboring towns.

KANSAS CITY, KAN.—In his report to the Mayor and Commissioners, Emil Barth, special engineer, who was recently instructed to ascertain the value of the equipment of the Consolidated Electric Light & Power Company, with the exception of the Riverview power plant, also the cost of improvements to make a complete municipal lighting plant, states that it would cost Kansas City $350,000 to establish a municipal light and power plant to be operated in connection with the municipal water works. This sum covers the purchase price of the outside equipment, poles, lines and [illegible] house.

HARLAN, KY.—Plans are being prepared for the construction of an electric light plant in Harlan, to cost about $7,500. M. R. Howard, of [illegible]

FARMINGTON, MAINE.—It is stated that work on the Franklin Power Company's new generating plant at North Anson is nearing completion and that the company will soon be able to furnish electricity from the Carrabasset River, 16 miles distant, to Farmington. The work represents an expenditure of approximately $100,000.

BALTIMORE, MD.—The board of awards on Aug. 31 awarded the contract for the new heating, lighting and water plant at Bayview as [illegible] electrical apparatus to the Kingbury-Samuel Company, for $23,263; the boilers for $70,250 and the water supply machinery for $20,368 to Thomas C. Basshor & Company.

FREDERICK, MD.—It is the intention of the Frederick Railroad Company, in addition to electrifying the Thurmont division running from Frederick to Thurmont, formerly called the Washington, Frederick & Gettysburg road, to build and equip a new power house at an estimated [illegible]

[illegible] MASS.—[illegible] lagher of the board of trustees of the city's pauper institutions has petitioned Mayor Fitzgerald for an additional appropriation of $2,500 for installing a turbine engine in the new institutions boat, the George A. Hibbard, now being built at Lawley's ship yards.

[illegible] MASS.—[illegible] lighting committee is considering the advisability of keeping the incan[illegible]

FITCHBURG, MASS.—[illegible] dam across the Connecticut River at Vernon, Vt., the Fitchburg Gas & Electric Light Company is supplying energy to the Connecticut River [illegible] 1500 hp a day to the power company.

[illegible] MASS.—[illegible]
[illegible] lamp. This action was decided upon at a recent meeting of the lighting committee, with the idea of recommending to the City Council the entering into of a contract for five years on the same basis.

NORTH ADAMS, MASS.—It is stated that Weber Brothers, of this city, are installing an electric plant for lighting purposes at their factory.

NORTHFIELD, MASS.—At a special meeting held in this city recently it was voted to have the lighting committee contract with the Greenfield Electric Light & Power Company for street lamps for a term of five years at a price not to exceed $1,200 per year.

SALEM, MASS.—Work has been commenced by the Salem Electric Lighting Company in this city on the installation of its underground conduit system, which, it is estimated, will represent an expenditure of approximately $50,000. The company's plan contemplates adding each year a stated amount of conduits until all of the wires of its system are underground.

WALTHAM, MASS.—It is reported that work is soon to be commenced by the Edison Electric Illuminating Company on the installation of three-phase, alternating-current motors in the business houses and factories throughout the city where direct-current motors are now in use.

DEARBORN, MICH.—Plans are being prepared by Donaldson & Meier architects, Penobscot Building, Detroit, for a new power house and equipment for St. Joseph's Retreat, Dearborn. Two new water-tube boilers, engine and a 50-kw generator will be required.

PONTIAC, MICH.—Plans are being matured for the organization and establishment of a new telephone company in Pontiac, an ordinance having been introduced into the City Council by the Pontiac Telephone Company providing for a franchise to operate a public telephone system in the city. The promoters of the enterprise are: M. A. Rittenhouse, of Detroit; W. A. Brewster, of Pontiac, and J. E. Brondige, who is attorney for the company. It is the intention of the new concern to install a strictly up-to-date system.

[illegible] MINN.—[illegible] West Vine Street, near the company's plant, and all the switchboard appliances for the high tension wire which is to be brought in from Rapidam will run into the building, the power being stepped down to accommodate the service of the city. Later on, wires from this station will be run to Waseca, Janesville and Faribault, eventually connecting with the Cannon Falls line.

MELROSE, MINN.—A modern telephone system from this city to Barnesville is being installed by the Great Northern Railway Company. The new line is to be utilized by the company for train dispatching.

MINNEAPOLIS, MINN.—The Electric Short Line Railroad Company, of Minneapolis, has applied to the Town Council of Cosmos, Minn., for permission to construct an electric railway line in that city. A similar franchise has been asked by the company in Cedar Mills. Frank E. Reed, Glencoe, is secretary.

ROCHESTER, MINN.—It is stated that plans have been prepared by E. D. Jackson, engineer, St. Paul, for putting the electric light wires underground and installing a new lighting system in Rochester at an estimated cost of $2,000 a block.

LA GRANGE, MO.—Press reports state that the city contemplates the installation of an incandescent street lighting system. For particulars address the Mayor.

ST. LOUIS, MO.—The Springfield & Central Illinois Traction Company states that as soon as preliminary work is finished it will commence construction on its proposed interurban railway to connect Springfield, Paronee, Morrisonville, Hillsboro, Coffern, Greenville, Carlyle, Centralia, Flora, Mount Carmel, Edwardsville and East St. Louis. It will also furnish energy for lighting its headquarters, Security Building, St. Louis, Mo. Isaac A. Smith, Security Building, is one of the promoters of the enterprise.

[illegible] are planning to operate their saw mill at Lakeshore with electricity.

WHITEFISH, MONT.—Press reports state that the Whitefish-Polson Electric Railway Company has secured the right-of-way for enough of [illegible]

BAYARD, NEB.—The installation of an electric light and water works [illegible]

[illegible] by the Morris County Traction Company, of Morristown, for permission to [illegible] across northern New Jersey, via Chatham and Morristown. The company [illegible]

[illegible] East Newark, counsel.

[illegible]

[illegible] ton of sufficient capacity to furnish electrical energy for the operation of all the factories in the city.

[illegible] Public Works declined to make any arrangements with the Geneva-Seneca Electric Company, which would permit that company to make further improvements to its plant on the lake front. The plant of the company is located on what is known as Lakeside Park lands, which the city claims to own under a grant from the State. The position of the city having been sustained in the courts, the Geneva-Seneca company has been forced to abandon the proposed addition to its plant, and as a result contracts for the contemplated improvements, representing an expenditure of about $40,000, have been canceled.

HORNELL, N. Y.—The Hornell Electric Company has been authorized to issue 120 shares of its common stock of the total par value of $12,000, the proceeds to be used for the purchase of additional apparatus and the payment of indebtedness incurred in the improvement of its plant.

RIVERHEAD, N. Y.—The most modern electrical equipment is being installed by the Riverhead Electric Light Company in its power station, it being the intention of the owners to install an entire new system in place of the one now in use. The voltage is to be increased from 1,100 to 2,300, and the frequency of the alternating current will be changed from 125 to 60 cycles. This change, in addition to giving more power and greater efficiency to lamps, will permit motors to be used by Riverhead business people, a utility which could not be enjoyed with the old plant. The company also has a franchise to light Westhampton Beach, and work on a transmission line to this place is now being rushed.

ASHEVILLE, N. C.—Owing to the excessive rise in the French Broad river at this place, the plant of the Asheville Electric Company is submerged and out of commission, the city is without car service, and all of the manufacturing plants using electric power are shut [illegible]

ASHEVILLE, N. C.—The Tri-County Public Service Company, recently incorporated, has been organized with R. S. Howland, president; William Farr, vice-president and general manager, and Charles G. Lee, secretary and treasurer. The company proposes to furnish electrical service in the rural districts about Asheville, and also operate rural telephone exchanges.

CONCORD, N. C.—The Concord Telephone Company has recently completed the erection of a telephone line to Greensboro, a distance of 70 miles, and is contemplating the erection of another line to Statesville, about 45 miles in length.

CONCORD, N. C.—Work is progressing on the erection of the transmission line from Concord to the Bala Cotton Mills on Coddle Creek. It is proposed to change the motive power of the mills from steam to electricity. Power for operating the mills will be supplied by the Southern Power Company, of Charlotte, N. C. It is expected to have the line completed by Sept. 15.

CHARLOTTE, N. C.—Application has been made to the Board of Aldermen of Charlotte by the Piedmont Traction Company, of Gastonia, N. C., for a franchise to construct an electric railway system in Charlotte. The proposed line will be about 13 miles in length, and will connect Mount Holly, Charlotte and Gastonia. T. C. Lee is the engineer in charge.

CHARLOTTE, N. C.—The Piedmont Traction Company has been granted a 60-year franchise to operate a street railway in Charlotte. The company is constructing an interurban electric railway from Anderson, S. C., to Greenville, S. C., thence northward into North Carolina via Charlotte, Salisbury, and Greensboro to Durham. Arrangements are also being made by the company to build a road from Gastonia to Mt. Holly, N. C.

RUTHERFORDTON, N. C.—It is reported that the purchase of machinery for an electric generating and pumping station, for which a bond issue was recently voted upon in this city, will shortly be authorized.

WADESBORO, N. C.—It is reported that arrangements have been made whereby the development of electric power at Blewitt's Falls, near this city, will be completed. A mortgage has been filed by the committee of the Rockingham Power Company to the Old Colony Trust Company, of New York, N. Y., which will place additional funds at the disposal of the company for completion of the work. It is estimated that about $1,500,000 will be required to complete the hydroelectric development at Blewitt's Falls. Nearly $2,000,000 was spent prior to the legal entanglements of the concern.

BISMARCK, N. D.—Reports from this city state that several hundred acres of land at the site of the old post office village of Hancock, on the banks of the Missouri River, a few miles north of Washburn, have been purchased by a syndicate of capitalists for the purpose of establishing an industrial center. It is proposed to construct power plants which will supply electrical energy to the towns in the Missouri and James River [illegible] Red River Valley. The [illegible] the new town, which is to be called Energy, have already made surveys and outlined their plans.

[illegible] We are informed that [illegible] has engaged [illegible] Globe Building, Minneapolis, Minn., to take charge of the construction of its proposed power plant. The cost of the proposed work is estimated at about [illegible] of the [illegible]

AKRON, OHIO.—[illegible] of public [illegible] to expend $27,000 to procure a lighting plant for the city has been presented to the City Council.

COLUMBUS, OHIO.—Councilmen Sherman, Harper and Ross, the committee appointed to ascertain the cost of equipping the municipal electric light plant for commercial service, have reported the decision to ask Herman Gamper, superintendent of the city light plant, for data concerning the cost of the necessary equipment. When this is obtained the committee will report back an ordinance to increase the plant's equipment and to submit to a vote the question of issuing bonds to defray the cost. It has been estimated that $300,000 will be required.

JACKSON, OHIO.—Sealed bids will be received by the Board of Trustees of Public Affairs, Jackson, Ohio, until Sept. 29 for furnishing materials and construction of additions to the municipal electric light plant as follows: Two 125-hp and one 100-hp single valve, automatic engines; one 400-hp open type feed water heater and purifier; one 7½-in. x 5-in. x 6-in. standard duplex boiler feed pump; one 8-in. recording steam gage; two 75-kw, 2300-volt, 60-cycle, three-phase, revolving field, belt-driven generators, with direct-connected exciters; one direct-current generator, capable of carrying 150 4-amp, direct-current, series luminous arc lamps; one 10-amp ammeter, mounted on bracket for machine panel board; two 2300-volt, three-phase, 60-cycle generators, exciter and feed switchboard panels, to be built of blue Vermont marble; 100 direct-current General Electric series luminous arc lamps or equal quality; 100 arc lamps, absolute cut-outs and lamp hangers; 30 4-amp, 250-watt, series Mazda lamps; 30 center span, series incandescent fixtures; one 110-volt, 60-cycle, alternating-current curve-drawing voltmeter, to be mounted on bracket and pipe supports of switchboard panel. Plans and specifications are on file at the office of the board, copies of which will be supplied on application to the secretary of the board. William Olendorf is president. The Board of Trustees of Public Affairs will also receive bids for the following machinery now in the plant, or exchange in connection with bids for new machinery, etc.; one Thomson-Houston dynamo; one No. 8 Wood, arc 6.8-amp, series constant potential dynamo; one 75-kw, single-phase, 133-cycle, 1100-volt, Warren alternator, with switchboard and instruments complete; two 12 x 13, center-crank, Ball engines; 36 A.-B., 6.8-amp, series arc lamps; 35 Thomson-Houston, 9.6-amp, open arc lamps; 8 Warner, 9.6-amp enclosed arc lamps.

MOUNT VERNON, OHIO.—Advices have been received from the Mount Vernon Railway & Light Company that it expects to place contracts within the next two weeks for motor generators, pumps, piping, heater, etc., for its new power house, the contract for turbines of 800 kw rating having been placed.

NEW CONCORD, OHIO.—The installation of the machinery for the new electric light plant in this city has been practically completed. It is the intention of the company to wire the college buildings in the city for electricity, as well as many of the business houses.

SANDUSKY, OHIO.—The only proposal submitted to John Bing, director of public works, for lighting the streets, public parks and highways of Sandusky for a term of 10 years, for which bids were recently advertised, was that of the Sandusky Gas & Electric Company, which has the contract to furnish the street lighting until Jan. 1, 1912. Three bids were presented, two of which were for the street arc lamps. Under the specifications as prepared by the city the company agrees to maintain arc lamps at $73 each per year. Under the specifications on which this bid is based the present poles would have to be reset and the wiring system considerably altered. The present cost per lamp to the city is $77.50. The Gas & Electric company's other bid was on an agreement which they submitted, under which they agree to furnish service at $66 a lamp per year, providing they are allowed to do so without further changes to the pole and wire system. In case the city agrees to accept this proposition, the company will also agree to furnish the street lighting during 1911 at the $66 per lamp rate, even though its $77.50 rate contract does not expire until 1912. A third bid was upon the alternate lighting plan for the business district bounded by the north side of Water Street, west side of Jackson Street, south side of Washington Park and east side of Wayne Street, the company agreeing to erect the posts and install the incandescent lamps as called for by the specifications for $20 a post year. It is possible that the Board of Control and the City Council may take under consideration the establishment of a municipal lighting plant, should the bids submitted be regarded as excessive.

BARTLESVILLE, OKLA.—H. Askin, formerly superintendent of the Atchison Railway, Light & Power Company of Atchison, Kan., has been appointed general manager of the Bartlesville Interurban Railway Company, instead of J. Atkin, as reported in the issue of Aug. 25.

HELENA, OKLA.—It is reported that an election is to be held at this city for the purpose of voting on a bond issue, the proceeds of which are to be used for the installation of an electric light plant.

MUSKOGEE, OKLA.—At a public meeting recently called by the Commercial Club, of this city, of which Mr. Paulding is president, $100,000 was subscribed toward the construction of an $800,000 hydroelectric plant on the Grand River.

SAPULPA, OKLA.—Press reports state that the Sapulpa Electric Company has been absorbed by H. M. Byllesby & Company, of Chicago, and that the new owners contemplate the expenditure of $100,000 in improvements and extensions to the plant. Harry B. Wales, Grand Rapids, Mich., will be manager of the company, with offices at Sapulpa.

COQUILLE, ORE.—It is reported that the plant of the Coquille River Electric Company, of this city, recently destroyed by fire, is to be rebuilt.

and that the equipment of the [illegible] considerably increased, as Myrtle Point, Norway and other communities are now included in the company's system. The former equipment consisted of a General Electric generator driven by an Atlas engine.

GREENHORN, ORE.—Press reports state that the owners of the Ben Harrison mine at Greenhorn, of which Mr. A. White, president of the locomotive works at Lima, Ohio, is the principal stockholder, are making arrangements with F. A. Harmon, manager of the Eastern Oregon Light & Power Company, Baker City, Ore., for the installation of electric power at the mine.

MADRAS, ORE.—It is stated that there is a prospect of the City of Madras securing a public water system and electric light plant, as the Newport Engineering Company of Portland is interested in the proposition, and negotiations for securing a franchise for such a plant are said to be under way.

UNION, ORE.—This city, it is stated, will vote Sept. 26 on a bond issue of $71,000, the proceeds to be used for installing an electric light plant.

PANAMA.—Bids will be received until Sept. 20 by the Isthmian Canal Commission at the office of Capt. F. C. Boggs, Corps of Engineers, U. S. A., Washington, D. C., for suction dredge ladder, steel castings, steel discharge pipe, electric motors, punches and dies, electric cable, etc., according to circular 603.

WOODVILLE, PA.—Bids will be received until Sept. 15 by R. J. Cunningham, county comptroller, Pittsburgh, for installing feeder system for electric lighting of buildings at the Allegheny County Home, Woodville. Andred McMaster, Curry Building, Pittsburgh, is architect.

DILLON, S. C.—The City Council will soon vote on a $15,000 bond issue for an electric light plant.

GREENWOOD, S. C.—It is stated that the Panola Cotton Mills, recently incorporated, expects to employ electrical motors in the operation of its new plant, energy being obtained over the Greenwood transmission lines of the Southern Power Company, of Charlotte, N. C., which are to be extended to that city.

CROSS PLAINS, TEX.—It is stated that the Cross Plains Townsite Company, recently incorporated with a capital stock of $10,000, will, in connection with the proposed development of 300 acres for town lots, construct an electric light and ice plant. The construction of a water works system and cotton oil mill is also being considered. The officers of the company are: C. H. Sharman, president; H. J. Cureton, vice-president; S. F. Bond, secretary and treasurer.

FORT WORTH, TEX.—Current reports indicate that it is the intention of the Fort Worth Telephone Company to expend $200,000 in improving its system in and about this city.

FORT WORTH, TEX.—The property of the Fort Worth Light & Power Company has been acquired by J. R. Nutt, of the Citizens' Saving & Trust Company, Cleveland, Ohio. It is stated that the site for a proposed new power plant has been secured, and that engineers will at once prepare plans for its construction. Engineers are also at work on plans for the installation of an underground conduit system, it being the new owner's purpose to place all wires within the fire district in the business portion of the city underground.

FRANKLIN, TEX.—Extensive improvements in its local telephone system are planned by the Franklin Telephone Company.

TEMPLE, TEX.—The Temple Commercial Club is reported to be interested in a project to construct a telephone line parallel with the Temple Northwestern Railroad, and it is understood that the necessary funds to put the plan into operation will be secured at an early date.

TERRELL, TEX.—It is reported that the City of Terrell has voted favorably on a $10,000 bond issue, the proceeds to be used for improving the water works and electric light plant.

TYLER, TEX.—Advices have been received to the effect that the Cotton Belt Shops of this city will install a complete electrical equipment within 60 days.

TYLER, TEX.—About $10,000 is being expended by the Southwestern Telephone & Telegraph Company in improving its system at Tyler. Plans are also being considered by the company for rebuilding its lines in Calvert.

LOGAN, UTAH.—Application has been made by the Logan Rapid Transit [illegible] electric railway in Logan City. The proposed line will extend from the county boundary in Wellsville Canyon via Wellsville, Hyrum, Millville, Providence and River Heights to Logan, thence to Greenville, Hyde Park, Smithfield and Richmond to the state northern boundary. David Eccles is president of the company.

LOGAN, [illegible] Logan electric light plant by the Bullock Public Service Company, of Omaha, a proposition having been made at the same time by Mr. Bullock to the business men of Logan to take $6,000 in electric light 5 per cent bonds, on the promise that stock would be issued to the extent of one-half the [illegible] en by the Commercial Club of the city.

RICHMOND, VA.—It is announced that the Richmond Power Corporation, recently incorporated to install a plant at Midlothian for the purpose of furnishing electrical energy to Richmond and Petersburg, has absorbed the James River Coal Company, and that application for a franchise to operate in Richmond is soon to be made. S. D. Crenshaw, of Richmond, is vice-president of the company, and Major Miles M. Martin, attorney.

LOON LAKE, WASH.—Press reports state that Gherke & Sons, of the Gherke Mill Company, are planning for the installation of a light and water system at Loon Lake.

TACOMA, WASH.—Press reports state that the City Council has passed an ordinance granting to the Northern Pacific Railway Company permission to erect and maintain poles and string wires for the transmission of electric power on Railroad Avenue, this city.

FAIRMONT, W. VA.—All of the new machinery and tools to be installed by the Fairmont Mining Machinery Company in the extensions it is making to its plant will have individual electric drive. Holbert & Speeden, Fairmont, are contractors.

ALBANY, WIS.—It is stated that the Albany Electric Light & Milling Company, of this city, is having plans prepared for a power plant, with hydraulic turbines connected to alternating-current generators by shafting rope drive.

BEAVER DAM, WIS.—It is the intention of the Beaver Dam Foundry Company, of this city, to install electric equipment in its foundry, energy for its operation being supplied from the mains of the Beaver Dam Light & Power Company.

CEDARSBURG, WIS.—It is the purpose of the Cedarsburg Box & Woodwork Manufacturing Company, recently organized, to operate the machinery in the new factory which it is to erect in this city with electric motors, the energy being secured from the municipal electric light plant.

CRANDON, WIS.—Advices have been received from Clyde Warnich, city clerk, that the contract for constructing an electric light plant at this city, bids for which were opened on Aug. 30, has been awarded to the Langstad Beyer Construction & Supply Company, for $12,500. A. H. Meyer, of Appleton, is engineer.

GRAND RAPIDS, WIS.—It is stated that a hydroelectric plant is to be constructed and equipped in the early spring at Radisson, Wis., by the John Arpin Lumber Company, of Grand Rapids, Wis.

MILWAUKEE, WIS.—Press reports state that the Milwaukee Separator Company, which now operates in leased quarters, is planning to build a factory of its own which will be equipped with electric motors.

CALGARY, ALTA., CAN.—It is stated that City Engineer Child has rendered a report on the proposed development of 3500 hp in the Elbow River, the estimated cost being placed at $800,000, while the cost per hp is figured at $25.

NELSON, B. C., CAN.—Permission has been granted to the Pacific Exploration Company to erect a large electric power plant on the Pend d'Oreille River, and plans for the proposed plant, which will have a rating of 25,000 hp and will be so constructed that the equipment may be doubled, will be forwarded for the consideration of the Lieutenant-Governor in Council. The promoters of the enterprise expect to furnish electrical energy to the Pend d'Oreille Valley, the Sheep Creek and Ymir districts, and to the Orient, Chewals and Metaline districts.

PRINCE RUPERT, B. C., CAN.—The following report has been submitted by City Engineer William Mahlon Davis, formerly of Berlin, Ont., on the installation of an electric plant for Prince Rupert. The total cost of the proposed plant is placed at $8,983, which includes the following items: Sixty-kw generator with exciter switchboards, $2,000; new poles, $417; engineering and erection, $1,000; 64,118 ft. of No. 4 x No. 6 wire, $2,088; poles and cross-arms transformers, etc., $1,478; engineering and erection, $2,000. Mr. Davis has also considered the installation of a steam plant at the foot of McBride Street of sufficient capacity to provide 5000 16-cp lamps for Section 1, and a proposal for a gas-producer plant to operate a 75-kw, alternating-current generator has been submitted. The cost of the latter plant for the generation of electricty is given as $11,840, to which would have to be added the cost of pole lines and distribution, $1,000, making a total of $21,000. This proposition would provide 3000 tungsten lamps. The report has been referred to the light committee.

BRANDON, MAN., CAN.—The City Council at a recent meeting declined to accept the proposition of the Brandon Electric Light Company to operate the city's pumping station by electricity, the objection to its acceptance being based on the fact that the figures named were excessive. The company offered to operate the station with 100 hp at an annual cost to the city of $7,000, and for all power required in excess of that amount, $70 per hp for 24-hour service. The question of the installation of a municipal plant is now being considered.

BRANTFORD, ONT., CAN.—The Grand Valley Railway Company, of Brantford, Ont., will place contracts during the next two weeks for building a substation at Paris, Ont., and for equipping an 8-mile, 40,000-volt, three-phase transmission line. It will also purchase two 300-kw generating [illegible]

[illegible] fire and light committee the Toronto Electric Light Company, through the committee's engineer, presented to the city the following proposition: To purchase from the city the existing pole line on Yonge Street, giving to the city the privilege of running the fire alarm wires on the company's poles; to provide electricity for the arc lamps at present in use on Yonge [illegible] streets; to supply electricity for lamps and motors at the same rate charged in Toronto pays, and should Toronto get any reduction the same rate to [illegible]

[illegible] Parma

weeks a 350-kw to 500-kw generator. H. W. Mills, Sarnie, is general manager.

TORONTO, ONT., CAN.—The Canadian Power & Paper Company, with headquarters in Toronto, which has recently been incorporated for the manufacture of paper, proposes to develop electric power in connection with its plant. It is capitalized at $10,000,000, and the incorporators are: F. H. Phippen, Gerald Ruel, G. F. Macdonnell and others, all of Toronto.

WELLAND, ONT., CAN.—A franchise has been granted by the township of Crowland to C. J. Laughlin, Toronto, Ont., to construct an electric railway from Welland to Welland Junction.

PACHUCA, HIDALGO, MEXICO.—The Amalgamated Mining & Milling Company, of Pachuca, is reported to be interested in a hydroelectric project to be developed in connection with the 6½-mile tunnel which is being constructed in the Pachuca mining district. It is planned to construct a canal about 1400 ft. long from the mouth of the tunnel to a mountain gorge, where the large volume of drainage water will be given a fall of about 700 ft., affording the initial power for generating electrical energy.

New Industrial Companies.

THE AERIAL MANUFACTURING & SUPPLIES COMPANY, of New York, N. Y., has filed articles of incorporation and intends to manufacture aeroplanes, automobiles, hydroplanes, etc. It has an authorized capital stock of $50,000, and the incorporators are: S. Shethar, Great Neck; J. Loughran, Long Island City, and C. H. Stoll, New York, N. Y.

THE AMERICAN AEROPLANE MANUFACTURING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000, and contemplates the manufacture and sale of aeroplanes, motors, etc. Those responsible for its formation are: E. E. Freed, S. J. Lebach, New York City, and P. J. Minck, Brooklyn, N. Y.

THE BAKER SMITH MACHINE COMPANY, of San Diego, Cal., has filed articles of incorporation for the purpose of engaging in general engineering, manufacturing and electrical construction business. It is capitalized at $10,000, and its incorporators are: Robert Baker, Fred Baker, Perry Smith and others.

THE BLAKEMAN MANUFACTURING COMPANY, of Naugatuck, Conn., has been incorporated with a capital stock of $10,000 for the purpose of manufacturing electric and gas lighting fixtures, also gas and electric light supplies. Those responsible for its formation are: Nils A. Olson, C. W. Thompson, Joseph Carlson, Victor Olson, Joseph Frick, Charles O. Sundvall and Frank Johnson.

THE COLUMBIA INCANDESCENT LAMP COMPANY, of Dallas, Tex., has filed articles of incorporation and expects to do business in the state of Texas. It has an authorized capital stock of $16,000.

THE ELECTRICAL UTILITIES CORPORATION, of New York, N. Y., has been incorporated to do a general contracting business and electrical work of all kinds. It is capitalized at $10,000, and the incorporators are: Nathan Cohen, 27 West Twenty-seventh Street, New York, N. Y.; G. Cohen, 269 West 153d Street, New York, N. Y., and Norman S. Risenfeld, 141 Broadway, New York, N. Y.

GROVER & HELEKER, INC., of Syracuse, N. Y., have filed incorporation papers and propose to conduct an electrical engineering business. The new concern is capitalized at $20,000, and the incorporators are: Harry Grover, Syracuse, N. Y.; E. P. Heleker and Clarence E. Heleker, Onondaga, N. Y.

THE KERMONT INCANDESCENT LAMP COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $100,000. The incorporators are: F. M. Shive, S. E. Roberson, Harry W. Davis, all of Wilmington.

THE NORTHWESTERN ELECTRIC EQUIPMENT COMPANY, of New York, N. Y., whose purpose is to do electrical work of all kinds, act as electrical engineers and deal in dynamos, motors, etc., has filed articles of incorporation. It has an authorized capital stock of $10,000, and the incorporators are: Charles I. Taylor, Frank H. Parcells and Robert G. Redlefsen, all of 54 Wall Street, New York, N. Y.

THE STRAIGHT FILAMENT LAMP COMPANY, of New York, N. Y., has filed articles of incorporation and expects to deal in electric lamps, fixtures, etc., and do electrical work of all kinds. It is capitalized at $300,000, and the incorporators are: F. W. Greenfield, S. L. Jaffray, W. S. McCartney, all of New York City.

[illegible] ized at $10,000, has been incorporated to manufacture and deal in motors, engines, automobiles, accessories, etc. Those responsible for its formation are: John V. D. Wilson, Frank H. Deal, both of Troy, N. Y., and A. M. Powers, Cohoes, N. Y.

New Incorporations.

[illegible] to furnish electrical energy for industrial purposes, making a specialty of rice mills and irrigating plants, has been organized with W. H. Fox, [illegible] the town of Hazen and the surrounding country, expects to commence work upon the construction of its plant at once.

NASHVILLE, ILL.—The Lafferty Telephone Company has been organized for the purpose of building an independent telephone system throughout the county. C. W. Lafferty is interested in the project.

WABASH, IND.—The Lagro-Andrews Telephone Company has filed articles of incorporation with a capital stock of $26,000. The incorporators are: William C. Taylor and Daniel O. Taylor.

PORTLAND, MAINE.—The Mississippi River Power Company has been chartered with a capital stock of $500,000 by H. M. Mitchell, H. C. Wilber, Arthur Chapman and George G. Day, all of Portland, Maine.

PORTLAND, MAINE.—The Sewage & Garbage Power Company has been organized with a capital stock of $1,000,000. The company proposes to install sewage and garbage plants to be utilized for generating power and using same. Charles E. Allen, of Abington, Mass., is president and treasurer.

MINNEAPOLIS, MINN.—The Co-Operative Electric Company has been chartered with a capital stock of $25,000 by J. T. Kutchiners, H. E. Nye and J. C. Armbuster, of Minneapolis, Minn.

ROBBIN, MINN.—The Robbin Rural Telephone Company has been chartered with a capital stock of $3,500. Louis J. John is president of the company.

TIPTONVILLE, MO.—Articles of incorporation have been filed for the Tiptonville Light & Power Company with a capital stock of $7,500 by A. E. Markham, R. S. Wright, J. P. Alexander, P. J. Caldwell and J. T. Burnett.

HOBOKEN, N. J.—The Commercial Telephone & Telegraph Company has been organized with a capital stock of $15,000. The incorporators are: G. A. Berger, G. B. Fields and F. H. Schaef.

BELMONT, N. Y.—The Allegany County Telephone Company has filed articles of incorporation with a capital stock of $200,000. The incorporators are: C. Ricker, of Belmont, N. Y.; H. F. Stevens and B. H. Shepard, of Syracuse, N. Y.

NORWICH, N. Y.—Articles of incorporation have been filed by the Marquis Telephone & Telegraph Company. It has an authorized capital stock of $100,000. The incorporators are: J. B. Marquis, J. J. Ray and J. O. H. Reed, Norwich, N. Y.

OTSEGO, N. Y.—The Otsego & Delaware Telephone Company has been incorporated with a capital stock of $750,000 by H. F. Stevens, of Syracuse, N. Y.; J. E. Fraser, of Auburn, N. Y.; H. P. McDonough, of Newark, N. Y.; F. Sponable, Fort Plain, N. Y., and C. W. Hitchcock.

WATKINS, N. Y.—The Wedgewood Telephone Company has filed articles of incorporation with the Secretary of State with a capital stock of $1,000. The incorporators are: O. F. Corwin, W. T. Wakeman, Ray W. Corwin, all of Watkins, N. Y.

COLERIDGE, N. C.—Articles of incorporation have been filed by the Coleridge Telephone Company. It has an authorized capital stock of $10,000. D. H. Lambert and others are among the stockholders.

HARRISBURG, N. C.—Articles of incorporation have been filed for the Harrisburg Telephone Company with a capital stock of $10,000 by S. A. Grier and others.

THOMASVILLE, N. C.—The Lee Telephone Company has filed articles of incorporation with a capital stock of $10,000 to construct and operate a telephone system between Thomasville and Denton, N. C. The incorporators are: J. W. Lee, of Thomasville, No. 4; I. E. Lee, of Light, N. C., and others.

WOODLAND, N. C.—The Roanoke-Chowan Telephone Company, with headquarters at Woodland, has been incorporated with a capital stock of $50,000. S. A. Brier being one of the incorporators.

DUNCAN, OKLA.—The Duncan Electric Light & Ice Company, of this city, has filed articles of incorporation. It has an authorized capital stock of $75,000, and the following directors have been elected: E. S. Bessey, M. M. Dunaway, of Oklahoma City, and John C. Keys, of Cleveland.

GUTHRIE, OKLA.—A charter has been granted to the Oklahoma Public Service & Interurban Lines, a corporation which proposes to construct and maintain steam and electric railways in Oklahoma and Kansas. The cost of the proposed system is estimated at $6,000,000. The company is capitalized at $100,000 and the directors are: L. L. Brullard, A. C. Lampke, George Washington Tucker, Jr., and Harry C. Lytle, of New York, N. Y.

PITTSTON, PA.—The Jenkins Electric Company has been incorporated by R. M. Hughes, J. H. Glennon and K. J. Ross, all of West Pittston, Pa. The company is capitalized at $5,000 and proposes to supply electricity for lamps and motors.

GREER, S. C.—The Greer Light & Power Company has been chartered with a capital stock of $25,000. The officers of the company are: Z. V. Taylor, president, and E. C. Marshall, secretary and treasurer.

McCONNELLSVILLE, S. C.—The McConnellsville Telephone Company has been chartered with a capital stock of $5,000 by J. F. Ashe, J. O. More and J. M. Williams. The company proposes to erect a telephone line from McConnellsville to Chester, a distance of 12 miles.

BEACH, S. D.—The Beach Electric Company has been incorporated with a capital stock of $50,000 by J. G. Robertson, Alexander R. Robertson, both of St. Paul, Minn., and George S. Chrysler, of Beach, N. D.

MADISONVILLE, TENN.—[illegible] Morrill, R. C. Kefauer, D. E. Lourey and others.

NASHVILLE, TENN.—[illegible] made by the Tennessee Rapid Transit Company, which contemplates the construction of 110 miles of interurban electric railway to connect Nashville, Lewisburg, Springfield and Clarksville, Tenn., with an extension to Adairville, Ky. The company has an authorized capital stock of $3,500,000, and the incorporators are: Robert L. Burch, Richard T. Wilson, Joe Frank, John M. Gray and R. M. Wilson, all of Nashville, and J. Parks, Franklin.

SPARTA, TENN.—The Home Telephone Company of White County has been organized, and will at once commence the construction of a telephone system in Sparta. The following officers have been elected: S. Johnson, president; C. W. Roberts, vice-president; J. L. James, secretary and treasurer.

Personal.

MR. D. P. ROBERTS, electrical engineer at London, Ont., Canada, has been appointed electrical expert and inspector for the British Columbia Government.

MR. H. ASKIN, formerly superintendent of the Atchison Railway & [illegible]

[illegible] United States Light & Heating Company, the general office of which is at 30 Church Street, New York.

MR. J. AUERBACH, president of the Electrical Accessories Company, 1246 Broadway, New York, returned from his annual trip to Europe last week. Mr. Auerbach says that he found the electrical business in Ger[illegible]

MR. T. J. BALLARD, for some years electrical engineer of the munic[illegible] appointment at Sheffield.

MR. C. G. Y. KING, formerly mechanical engineer of the Chicago Edison Company, predecessor of the Commonwealth Edison Company of Chicago, is now again connected with the company as construction engineer of the great Northwest Station on the north branch of the Chicago River, work on which has just been begun.

MR. A. BEMENT, consulting engineer, of Chicago, was married in Berkeley, Cal., on Aug. 23 to Miss Eva Henderson, of Berkeley. During the honeymoon tour the newly married pair figured in a coaching accident on Mount Tamalpais, near San Francisco, due to runaway horses, and their friends in Chicago, who had read somewhat exaggerated accounts in the daily papers, were glad to be assured by private advices from Mr. Bement to the effect that the accident was a slight one, with no serious consequences.

MR. THEODORE STEBBINS, of Herrick & Stebbins, New York, has made a contract with the directors of the Springfield Light, Heat & Power Company, Springfield, Ohio, to manage its business. Mr. Weare Parsons has been appointed general manager of the company which will soon complete a new 6000 hp. steam turbine station. Mr. Stebbins has also accepted the management of the railway and lighting properties at Mt. Vernon, Ohio, and A. J. Darrah has been appointed superintendent at that place. These contracts do not interfere with the firm of Herrick & Stebbins.

MR. FREDERICK F. GARDNER, general manager of the Shore Electric Company, Red Bank, N. J., has been missing since August 23. Mr. Gardner's family are very much alarmed about his disappearance, and the [illegible] any information as to his whereabouts. Mr. Gardner has been identified with the electrical business for 25 years, and formerly resided at Englewood, N. J., and was connected with the Public Service Corporation. He [illegible] explanation of his absence can be furnished either by his family or by the officials of the company with which he was connected.

ETIENNE FODOR DE VARKONY.—On the occasion of the eightieth [illegible] a special honor was conferred upon Mr. Etienne de Fodor, general manager of the Budapest General Electric Company. The official Gazette of Hungary announced on that date that the King had confirmed and certified the noble descent of the de Fodor family, which action restores to the [illegible] family documents were lost during the wars and political disturbances to which Europe was subjected in past centuries, and in recognition of the scientific services that de Fodor has rendered the Emperor was pleased to [illegible]

MR. JAMES R. DEANE, a well-known electrical man in Chicago, has established the firm of J. R. Deane & Company, with office at 46 Van Buren Street, Chicago, to deal in electrical specialties. The new organization will represent the Peerless Electric Company, of Warren, Ohio, manufacturer of dynamos and motors, and the Massachusetts Electric Manufacturing Company, of West Lynn, Mass., which makes magnet wire. Mr. Deane has had an extensive practical experience in the electrical business. Beginning in the Chicago office of the General Electric Company, he was next employed in the shops of the Gregory Electric Company. Following that he formed a connection with the Northwestern Electric Company, of which he became secretary and treasurer. Later he was for some time sales manager of the Guarantee Electric Company, a position which he resigned a short time ago. Combining excellent business ability with pleasing social qualities and a cheerful outlook on the world, Mr. Deane is a man who has made friends at each step in his career—friends who will be pleased to learn he has engaged in business for himself.

Trade Publications.

McCASLIN CONVEYORS.—The Mead-Morrison Manufacturing Company, Cambridgeport, Mass., has made the McCaslin overlapping gravity bucket conveyor the subject of a handsome cloth-bound volume which is highly creditable to all concerned in the design and execution of the book. Beyond a few words of introduction, the contents consist of illustrations of recent installations of conveyors, each accompanied with a concise sentence or two pointing out the particular feature of interest to be observed. There are not far from 200 of these illustrations, which are excellently engraved from photographs, and as the dimensions of the page—8½ in. by 11½ in.—permit the cuts to be of large size, details are well brought out. One looking through these pages can, with the aid of the short notes under the engravings, form perhaps a better idea of the operation of the conveyor and an appreciation of its flexibility of application than if a considerable portion of the contents consisted of the usal descriptive text. The binding accords with the excellent paper, engraving and presswork of the book, the cloth and end papers being especially pleasing in effect.

BUSINESS NOTES.

THE JUDD OSCILLATING CLEANER COMPANY, of Chicago, which manufactures an electric washing and wringing machine, has changed its name to Domestic Equipment Company.

THE R. THOMAS & SONS COMPANY announces the opening of an office at 1255 Old Colony Building, Chicago, Ill., in charge of Mr. R. W. Harms, who has been with the company at New York for over five years.

ELMER P. MORRIS COMPANY, manufacturers of posts, poles and specialties for out-door lighting, has largely increased its office room at No. 90 West Street. The main building of its new factory at Elizabethtown, Pa., has been completed and ground has been broken for the remainder of the plant. The company reports that it has been the largest year it has ever had.

Weekly Record of Electrical Patents

UNITED STATES PATENTS [illegible]

[illegible] ELECTRIC SWITCH [illegible]

[illegible] AUTOMATIC [illegible] ton, Ohio. App. filed Sept. 23, 1907. For electric motors for pumps [illegible] cylinder and cistern.

[illegible] AUTOMATIC [illegible]

[illegible] ment of the switch.

[illegible] MEANS FOR REGULATING ELECTRODES IN ELECTRIC [illegible] [illegible] electrode and the shaft including a reversible magnetic clutch which is controlled by current passing through the electrode, the gearing giving [illegible]

[illegible]8,622. ELECTROPLATING TANK; E. R. Williams, Streator, Ill. [illegible] rack bars above it and carrying U-shaped handles, the bars being vertically adjustable.

[illegible]8,631. ELECTRIC MOTOR METER; A. Zipplies, Mosbach, Germany. [illegible] the field of the same, a shaft connected with the armature, electrically operated means to effect longitudinal movement of the shaft, a collector connected with the shaft and stationary brushes engaging the collector.

[illegible] ANNUNCIATOR; W. W. Dean, Elyria, Ohio. App. filed July [illegible] Controlled by an electromagnet with a signal and switch contact controlled by the magnet, the armature moving rectilinearly to close the switch and then rotating to operate the signal.

[illegible] PROCESS OF EXTRACTING METALS FROM THEIR ORES; W. E. Greenawalt, Denver, Col. App. filed [illegible] Improvements on prior patents by treating the ore [illegible] chlorid solution and then electrolyzing the resulting solution in the cathode compartment while maintaining a solution of sulphur dioxide in the anode compartment.

968,652. PROCESS OF EXTRACTING METALS FROM THEIR ORES; W. E. Greenawalt, Denver, Col. App. filed Jan. 16, 1906. Electrolyzes cuprous chlorid in the presence of ferrous chlorid to precipitate the copper and then applies the regenerated solution to the ore to extract more copper.

968,677. AUTOMATIC GAS FEED FOR VACUUM TUBES; D. McF. Moore, Newark, N. J. App. filed May 8, 1906. Automatically supplies gas to the vacuum so as to maintain the desired tension by means of [illegible]

968,682. ELECTRIC PERCOLATOR; L. F. Parkhurst and H. G. Weeks, Binghamton, N. Y. App. filed Sept. 27, 1909. An electric heater for the base of a coffee percolator.

968,683. ELECTRIC OVEN; L. F. Parkhurst and H. G. Weeks, Binghamton, N. Y. App. filed Sept. 27, 1909. Three separate degrees of temperature are produced in the oven by means of a switch and electric heating units attached to the pans of the oven.

968,[illegible]. ELECTROMAGNETIC DRILL; F. E. Barry, [illegible], Wis. App. filed April 24, 1908. Reciprocating drill including a plurality of motor coils in a casing, the core of plunger having a reduced central portion, a frame between the ends of the core, shaft in the frame, a rotary current shifter on the shaft which is actuated on the forward and back movement of the core to shift the current from one to the other coil.

968,796. ELECTRIC SAFETY SWITCH; C. D. Platt, Bridgeport, Conn. App. filed March 22, 1910. Double brake knife switch immersed in oil. Details.

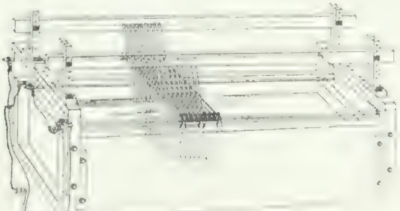
968,821. SEARCHLIGHT, PROJECTOR AND THE LIKE; H. Viertel, Charlottenburg, Germany. App. filed May 25, 1907. A carbon tube surrounds the smaller negative electrode of an arc lamp and carries a portion of the current, together with means for rotating the negative electrode.

968,845. PROCESS OF EXTRACTING METALS FROM THEIR ORES; W. E. Greenawalt, Denver, Col. App. filed April 20, 1905. Electrolyzes cuprous chlorid in the presence of sulphur dioxide and a metal chlorid other than copper chlorid.

968,876. TROLLEY WHEEL; P. F. Morrissy, N. Wise and W. A. Byrne, Auburn, N. Y. App. filed Oct. 17, 1908. Independent duplicate sections side by side, the circumference of each section being formed to provide duplicate wire engaging surfaces.

968,895. DEVICE FOR STEADYING RECTIFIED CURRENTS; P. H. Thomas, Montclair, N. J. App. filed Sept. 27, 1905. A vapor converter and a choke coil with a resistance in series with the choke coil and in shunt with the translating device with a second choke coil in the circuit of translation.

968,896. SYSTEM AND METHOD OF ELECTRICAL DISTRIBUTION; P. H. Thomas, Montclair, N. J. App. filed Dec. 8, 1906. A source of alternating current, a vapor rectifier and a storage battery



968,622.—Electroplating Tank.

across the circuit with an inductance in the path of current of the battery and a second storage battery beyond the inductance in parallel with the first battery and of the same voltage.

968,897. SYSTEM OF LIGHTING AND DISTRIBUTION BY VAPOR LAMPS; P. H. Thomas, Montclair, N. J. App. filed Aug. 20, 1907. [illegible] plurality of positive electrodes with a temporary metallic circuit through each device, a circuit in shunt to the metallic circuit with an interrupter for the metallic circuit in the shunt circuit.

968,938. AUTOMATIC ATTACHMENT FOR CLEANING ROUND CARBON OR METAL LIGHTNING ARRESTERS; W. S. Hale, Buckley, Ill. App. filed April 30, 1909. A lightning arrester having a terminal disk with a receiver hook which operates a lever which [illegible]

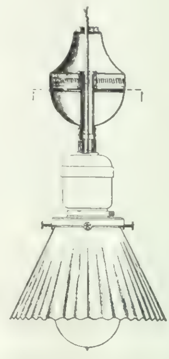
968,949. ELECTRODE AND PROCESS FOR MAKING THE SAME; [illegible] body of the electrode and containing a substance which gives off oxygen when heated.

968,950. TERMINAL CONNECTION; E. P. Jahn, Boston, Mass. App. filed May 21, 1910. For terminals of different kinds, the connection including two resilient members with a cylindrical socket, one member projecting beyond the socket and having an aperture and a slot for the terminal.

969,004. SYSTEM OF LIGHTING AND DISTRIBUTION BY VAPOR LAMPS; P. H. Thomas, Montclair, N. J. App. filed Aug. 20, 1907. A number of vapor electric devices in series, each with a negative electrode and a plurality of positive electrodes, and all of the devices connected with constant-potential mains, the several lamps in shunt as to their positive electrodes to two choke coils with a common point connected to the negative electrode of each device.

969,007. ELECTRICAL SYSTEM OF DISTRIBUTION; W. A. Turbayne, Lancaster, N. Y. App. filed Feb. 25, 1908. A main generator with a main distribution circuit, a battery and booster and a transformer with the primary in the main circuit and the secondary in series with the battery.

969,008. ELECTRICAL SYSTEM OF DISTRIBUTION; W. A. Turbayne, Lancaster, N. Y. App. filed Feb. 25, 1908. A main generator, a circuit connected thereto, a storage device and a booster connected



968,787.—Lamp Fixture.

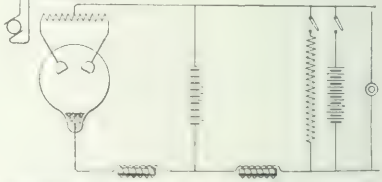
to the circuit with a transformer in the circuit, the secondary being connected with the booster armature for regulating it.

969,013. BATHING APPARATUS; G. W. Walters, Findlay, Ohio. App. filed June 11, 1909. The water tank carries an induction coil with vibrator and one electrode is in the form of a brush connected to a battery.

969,055. FOOT CONTROLLER FOR ELECTRIC MOTORS; J. F. Hammond, Prince Bay, N. Y. App. filed Sept. 23, 1908. For dental engines with a controller arm connected to a shaft carrying contacts and operated by a lever, together with two spring-actuated arms projecting in opposite direction and turning independently about the shaft, the arms bearing upon the side of the operating lever.

969,064. PROCESS OF MANUFACTURING ARTICLES WITH THE USE OF COLLOIDS; H. Kuzel, Baden, near Vienna, Austria-Hungary. App. filed March 26, 1907. For making incandescent lamp filaments by preparing a plastic mass of colloid, bringing it into the desired shape, expressing the liquid, drying and heating at a temperature below the melting temperature.

969,095. INTERCOMMUNICATING TELEPHONE SYSTEM; A. Ekstrom, Stockholm, Sweden. App. filed July 15, 1905. A plurality of interconnected stations with a transmitter and receiver and relay at each station, a source of signaling current in circuit with the relay for energizing the relay at the calling station so as to break the local



968,896.—System and Method of Electrical Distribution.

circuit and place the telephone of the calling station in circuit with that of the called station.

969,[illegible]. HOLDER FOR INCANDESCENT LAMP FILAMENTS; H. Kuzel, Baden, near Vienna, Austria-Hungary. App. filed Nov. 20, 1906. Carbid of aluminum to which a substance is added, such as manganese, which raises the melting temperature of the composition.

969,114. HAIR-DRESSING APPARATUS; C. J. Packard, Providence, R. I. App. filed March 30, 1910. Electric curling iron with a thermometer to give the temperature.

969,115. TRACK RAIL BOND FOR RAILWAYS; C. A. Parker, Fort Fred Steel, Wyoming. App. filed Dec. 21, 1909. A contact plate secured to the track rail web and a contact tin projecting from an adjacent fish-plate and pressing upon the free end of the contact plate.

969,147. FOOT-WARMING ATTACHMENT FOR ELECTROTHERMAL GARMENTS; B. R. Charles, Portland, Ore. App. filed Aug. 7, 1909. For therapeutic purposes in which a slipper-like attachment electrically heated is connected to an electrically heated garment.

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SCHEDULES OF RATES IN NEW YORK STATE.

Under the authority of amendments to the public service commissions law, effective on June 14, 1910, the New York Public Service Commission of the Second District has now undertaken the important and complex work of determining forms of schedules for rates of corporations and municipalities engaged in furnishing electric and gas service. While the provision of the statute that such schedules be filed and kept open to public inspection is not mandatory, but leaves action optional with the commission, both the First and the Second District regulating bodies have followed courses that lead to complete public knowledge regarding all rates and changes therein. Different ways have been adopted by the two commissions, although both lead to the same conclusion. The First District commission, with jurisdiction over the companies in Greater New York City, proceeded in 1908, under the general authority of the original law, to conduct an inquiry into the methods and practices of the electrical corporations; and as a result of its hearings, promulgated an order, effective on Jan. 15, 1909, prescribing the form and governing the construction and filing of schedules of rates and forms of contracts. At the same time that this order was adopted the commission also passed an order prohibiting discrimination and unreasonable preference. As both of these important orders were passed under the general powers bestowed upon the commission by the law as first enacted, they antedated the amendatory act of the Legislature, which, in strong and explicit terms, strengthened the law in these respects at its last session. The language of the new section of the law forbidding discrimination in rates follows closely, in part, the text of the order previously issued by the First District commission on this subject.

While the commissions have selected different times to enforce the policy of regulation in these matters, their unity of purpose as to the ultimate filing and publication of rates and prohibition of discrimination is assured by the present statute. The intent of the law in these respects is unquestionably wholesome and is in the best interest of the companies and the public. Publicity, one requirement of the act, will tend to establish in the separate domain of each company like rates for like service, which is another great end sought by the statute. It is less in the law than in the administration thereof by the commissions that the danger in the situation lies. And when the differences in the administration of the act by the two commissions are analyzed, a reasonable justification of the policy of each body may be offered. The First District commission, which proceeded promptly, deals largely, if not entirely, with one corporation and its controlled or allied properties, which have large financial resources and trained and able officials. But the Second District commission, which has proceeded more slowly, has, in addition to the companies located in the large cities of the state outside of Greater New York, a multitude of small plants, many of which have slight investments and earnings. To keep these companies in position to furnish the public

service desired, but for which no promise of great development, or even at times of reasonable profit, appears possible, is one of the tasks that await a judicially balanced public service commission. It is exceedingly fortunate for the struggling small companies of New York State that the chairman of the Second District commission had an experience with a small lighting and power company before he entered the public service, so that he understands the company need as well as the public need. We believe that excellent results will arise from the hearing on these subjects which took place before the "up-state" commission at Albany last week. The commission showed that it recognized the existing difficulties. The companies likewise realize the difficulties and desire to overcome them. The appointment of a joint committee enables the consideration and collection of information relating to schedules of rates to proceed with dispatch, and the final action of the commission to be determined in a manner that we hope will be satisfactory to the companies and the public.

PROBLEMS IN NETWORKS.

It is sometimes remarkable how complex an arithmetical problem may be derived from a very simple set of direct-current circuit elements. Networks of main conductors necessarily furnish complicated cases, owing to the large number of interconnected mains and feeders usually provided, and it is not surprising, therefore, that such networks call for special skill and training in their computation. But occasionally half a dozen resistances may be connected together in a definite way for some special purpose, and it is required to determine the current and potential distribution over the system, as established in accordance with Ohm's law. The complexity and number of the algebraical equations entering into the problem may well surprise the uninitiated.

If, for instance, we take the well-known and apparently simple case of a Wheatstone bridge, with four resistances, a battery and a galvanometer, it would seem, at first sight, a simple matter to compute the resistance offered by the bridge system as a whole between the battery terminals. If the bridge is balanced so that no current flows through the galvanometer, the galvanometer path might as well be temporarily removed, without thereby affecting the system, and the resistance of the remainder is easily reckoned when all four resistances are known. But if the bridge is not balanced, and current flows through the galvanometer, it is not permissible to remove the galvanometer path, on account of the disturbance which would thereby be produced in the system. The computation of the joint resistance of the five resistances in the bridge is then a task of considerable length, when attempted by the use of Kirchoff's laws in the regular way. The process occupies several pages in more than one text-book. Ordinarily, the simplest way to attack either the Wheatstone bridge problem or any similar direct-current network problem is to use the theorem of equivalent stars and deltas, whereby any three-pointed star may be replaced by its externally equivalent delta, or reciprocally. Four such substitutions are open to selection in the Wheatstone bridge case. After such a substitution the resulting network is simplified by reduction to an equivalent form of fewer elements.

In our last issue Mr. Nicholas Stahl contributed an interesting example of a simple network of five elements closely resembling a Wheatstone bridge. The problem is to proportion the elements in such a manner that the same current strength will be reversed through one of them when another has its resistance reduced in a definite manner. Various additional considerations enter into the practical problem, such as the strength of current to be reversed and the power to be expended. Although the solution by Kirchoff's laws is treated only in outline, it runs into six equations containing originally ten unknown quantities, a condition which is apt to deter the unwary.

EXAMINATION OF WATER BY ELECTRICAL METHODS.

It has long been known that pure water is, relatively speaking, a very imperfect electrical conductor, and that small quantities of dissolved substances greatly increase its conductivity. A number of physical researches have been published during the last 50 years on the conductivity of water containing small additions of dissolved substance. These inquiries have, however, been confined to the laboratory. The August number of the *Journal* of the (British) Institution of Electrical Engineers contains a communication by Mr. W. Pollard Digby, on the application of the above properties to the supervision of steam plants and water-softening plants. The water to be tested is introduced into a special V-tube of definite dimensions containing platinum electrodes. These electrodes are connected to a direct-reading mhometer, or conductance indicator. By a suitable choice of the dimensions of the V-tube the conductance of the water is decimally related in a simple manner to the conductivity, so that the latter can be read off the scale by a shift of the decimal point.

It is shown, with the aid of curve sheets containing numerous experimental tests, that the conductivity of a sample of water increases with the percentage of dissolved contents, substantially according to a straight-line law, provided that only a single salt is contained in solution. When more than one salt is added the quantitative relations are more complex. In general, however, the greater the amount of dissolved substance the greater the conductivity. Thus, taking water hardened by the presence of calcium carbonate alone, the conductivity is given as 80 micromhos per centimeter at 2 chemical degrees of hardness, and as 600 micromhos per centimeter at 18 deg. of hardness, at ordinary room temperature, with a straight-line law of variation between these limits. It is evident that the chemical analysis is the only precise measure of the degree of hardness, or of other impurity, in the water; but the electrical test, after once being set up, is very speedily and conveniently made, so that a series of comparative measurements may be made electrically which will indicate whether further analysis is needed. The paper points out that boiler water is subject to wide variation in respect of purity, its conductivity being found to vary in different cases between 11 and over 90,000 micromhos per centimeter A very fair estimate of the degree of purity in boiler water can be made in this way. The danger of priming may thus be foreseen and avoided.

According to the prevailing theory, pure water is virtually an insulator because of the powerful chemical union of the atoms in its molecules. The atoms are tied up in molecular groups, and are not free to wander with their electrical charges under the influence of an impressed difference of potential. On the

other hand, a small quantity of any electrolyte, say common salt, dissolved in the water, is immediately ionized or split up into separately electrified atoms, which are free to move in the liquid and to carry their electricity with them. The more numerous such free ions and the more readily they can move about, the greater the conductivity of the solution. The plan suggested in the paper has sharp limitations, owing to its lack of discrimination between different impurities; but, subject to that limitation it appears to be very simple and to be readily capable of application. The difference between the conductivities of water in the boiler and in the condenser of a steam plant is very significant and should be of much practical value.

FLAT RATES AT HARTFORD AND ELSEWHERE.

Readers of the frequent notes which have appeared in these columns recently regarding the adoption of the flat-rate system with maximum-demand controllers for residence lighting, may perhaps have noticed the different condition which prevails in Hartford, where the plan was first extensively tried, and in some of the Central-Western towns where it is now being adopted. The average revenue per month per consumer at Hartford is reported at $2.29, while the Central-Western stations adopting this system seem to meet with a preponderance of $1 per month consumers. This is doubtless due partially to the smaller size of the Western cities adopting the method, but is also to be accounted for by the greater prevalence of the electric light among residences in small Western cities as compared to large Eastern cities. In many Western cities the electric light is the universal illuminant for residences, except those of the very smallest class. In Eastern cities gas is much more used. In Hartford the flat-rate system is evidently being used to secure the business of a considerable number of medium residences formerly using gas. In the Western cities it is being used for securing the lighting of cottages which could not be obtained before, because of the fear of high bills under a meter system, or which business the company did not desire to secure on a meter basis on account of the low revenue per month. The interesting thing about the situation is that the controlled flat rate is effective both in securing consumers that are too small to be profitable under a meter system and also consumers that, although of fairly good demand as residence consumers go, have held back from electric lighting on account of the uncertainty as to cost.

TRANSMISSION-LINE CALCULATIONS.

Every electric circuit must enclose at least one loop in space, and this loop will contain magnetic flux, or magnetism, as soon as a current flows around the circuit. Changes in the strength of the current, and especially cyclic reversals, will necessarily set up corresponding changes in the interlinked magnetic flux, and such changes in flux linked with a conducting circuit induce electromotive forces in that circuit, according to the law of action of the dynamo machine. It thus follows that every alternating-current transmission line is the seat of self-induced e.m.fs. In other words, every alternating-current transmission line has not only an *IR* resistance drop of voltage, but also an inductance drop of voltage. In this respect a direct-current transmission line has the advantage that, except during momentary changes of load, it has no inductance drop. The disadvantage of the inductive drop is that it complicates the problem of pressure regulation over the line. In some cases the inductance drop is considerably greater than the resistance drop, and it may be difficult to maintain the proper delivery pressure on the lines at the points where power is drawn off. Moreover, sudden variations of load may greatly disturb the pressure regulation.

The resistance drop in the cases of ordinary commercial-frequency transmission is very definite. It depends only upon the strength of the current and the dimensions of the wire. For a given length of line and power to be carried engineers know that they can reduce the percentage of resistance drop to its most desirable commercial minimum, either by increasing the working voltage or by increasing the cross-section of the wire, pure metals having, so far as we yet know, definite resistivities at definite temperatures. But the inductance drop is not so sharply defined as the resistance drop. For example, both the inductance and the inductance drop may always be diminished by bringing the going and returning conductors closer together—as far as safety will permit. Again, if a single-phase aerial transmission line consists of, say, a pair of No. 0 copper wires, carried on opposite ends of one cross-arm at each pole, the two wires being interaxially separated by a distance of 4 ft., then if we split the wires so as to have two cross-arms, each carrying a pair of No. 3 wires at the same distance apart, we shall have the same amount of copper as before, with the two circuits in parallel. The resistance drop on the combination of the two circuits will not be changed, but the inductance drop will be very considerably reduced, although the charging current of the line will have been increased. This plan of splitting the circuit up into parallels has been known for some time to engineers as a device for diminishing inductive drop at the expense of extra cross-arms and insulators. A paper on the subject was read at the Frontenac convention of the American Institute of Electrical Engineers, two years ago.

In the article we print this week by Mr. Alfred Still the question of subdividing conductors in transmission lines for the sake of reduced inductive drop is discussed, particularly with reference to the grouping of the subdivided conductors. It is shown that in the case of a single-phase pair of wires, subdivided into two pairs of the same aggregate cross-section, it makes a very material difference how the two loops are supported relatively to each other. Their mutual inductive effect may be annulled, either by transpositions following the usual telephonic method or by keeping the planes of the two loops mutually perpendicular. But still better results can be attained by supporting the loops so that their magnetic fluxes shall oppose each other, in which case the inductance drop in each loop will be less than if the two loops are completely separated. Similar considerations, in lesser degree, are shown to apply to split three-phase conductors. There can be no doubt that the assignment of the spacing and grouping of conductors in an aerial transmission line is an important part of the duty of a transmission designing engineer. Of course, there are many considerations which must be kept in mind besides mutual inductance, such as voltage distance, facility for effecting repairs, structural cost of towers, lightning protection, insulator costs, and the proximity of telegraph and telephone lines. The considerations raised in Mr. Still's article deserve careful study.

Convention of the Pennsylvania Electric Association.

The third annual convention of the Pennsylvania Electric Association will convene this week at Glen Summit Springs Hotel, Glen Summit Springs, Pa. The sessions will be held on Wednesday, Thursday and Friday, with a reception on Tuesday evening. At the opening session, besides the usual presidential address and reports of officers, there will be reports of committees on overhead line construction, steam heating in connection with central stations and a paper entitled *Steam Heating*, by Mr. C. R. Bishop, Lockport, N. Y. At Thursday's session addresses will be made by Mr. W. W. Freeman, president of the N. E. L. A., and by Mr. T. C. Martin, secretary of the N. E. L. A., followed by the presentation of the following papers: *Advantageous Points in Station Operation*, by Mr. T. G. Coghlan, Scranton; *New Types of Lamps from the Operating Standpoint*, by Mr. G. E. Brett, Wilkes-Barre; and *Operation of Electric Vehicles*, by Mr. W. A. Manwaring, Philadelphia. Friday has been set aside as commercial day. Three papers are scheduled for presentation: *Rates*, by Mr. L. H. Conklin, Pottsville; *Investment Justified by Smaller Companies for Securing Power Business*, by Mr. H. M. Blake, Jenkintown; and *Domestic Appliances*, by Mr. W. A. Donkin, Pittsburgh. The entertainment committee has provided amply for the guests and ladies during the convention.

Annual Meeting of the Western Association of Electrical Inspectors.

The sixth annual meeting of the Western Association of Electrical Inspectors will be held at the Rome Hotel, Omaha, Neb., Oct. 11-13. The sessions on Oct. 11 and 13 will be given over to reports of committees on the following subjects: *Uniformity in Rulings, National Electrical Code, Outside Wiring, Theater Wiring and Show Equipment, Construction and Installation of Electric Signs, Show-Window and Display Lighting, Instructions to the Public Concerning the Safe Operation and Maintenance of Electrical Wiring and Apparatus, Underground Systems, Installation and Operation of Induction Motors, Electrical Hoisting Apparatus, Laws and Ordinances, Architects' Specifications, Signal Systems, Public Safety* and *Electric Traction Systems*. On Tuesday evening, Oct. 11, the Omaha Electrical Club will give an informal dinner to members of the association. The following addresses are scheduled for the session on Wednesday: *Rubber-Covered Wire*, by Mr. Lewis G. Martin; *The Influence of Electrical Inspection on the Operation of the Telephone System*, by Mr. A. S. Rogers; *Packing House Wiring*, by Mr. T. J. Byrnes; *The Legal and Ethical Responsibility of the Electrical Inspector*, by Mr. J. A. Rhine, and *The Tungsten Lamp*, by an engineer of the National Electric Lamp Association, not yet assigned. In the evening there will be an informal discussion on the difficulties arising in electrical inspection work. Arrangements have been made for the inspection of electrical work at convenient intervals during the convention and a visit to Fort Omaha will be made on Oct. 14. The officers of the association are as follows: Mr. F. G. Dustin, Minneapolis, Minn., president; Mr. W. J. Gilsdorf, Lexington, Ky., first vice-president; Mr. H. G. Young, Streator, Ill., second vice-president, and Mr. W. S. Boyd, Chicago Ill., secretary-treasurer.

Electric Railway Profit-Sharing Fails in British Columbia.

According to a United States consular report, the profit-sharing scheme of the electric railway company owning and operating the street cars in Victoria, Vancouver and New Westminster has failed to give satisfaction and on request of the operators was revoked on June 30, 1910. The company employs over 1000 men in these three cities.

The system, which has existed since July 1, 1903, gave a share of the profits to all employees who had been one year in the company's service. The plan was: First, a dividend of 6 per cent on capital stock of company. Then the balance of the year's profits was divided into three equal parts, of which two-thirds were given to the stockholders and one-third to the employees. Of this latter sum, in addition to their regular salaries, every employee, whether general manager, conductor, motorman, clerk or track greaser, received identically the same amount. This yearly bonus amounted during the seven years 1903-1909 to the following sums: $30, $35, $40, $45 (1907 not given), $62, and $57 per employee.

At the request of the employees the company, on June 30, definitely abandoned the profit-sharing scheme as a failure and averted a strike by adopting the following schedule: For conductors and motormen, per hour, first three months, 22 cents; second three months, 25 cents; second six months, 27 cents; second year, 29 cents; third year, 31 cents; fourth year, 33 cents; fifth year and after, 35 cents per hour. The hours of labor and rates for extra time, viz., one and one-half after 11 p. m. to 1 a. m. and double pay from 1 a. m. to 5 a. m., remain the same.

Winnipeg Opposes Minnesota Power and Canal Co.

A permit which, it is claimed, may seriously affect the flow of water in the Winnipeg River and lessen the efficiency of the Winnipeg municipal power plant at Point du Bois was recently given by the United States Secretary of War to the Minnesota Power & Canal Company to divert water from the Birch Lake basin at the Rainy River watershed into the St. Louis River. The water taken from there would be diverted from the Winnipeg and Rainy Rivers and might seriously jeopardize the city's power system. With a view to protecting the city in the matter, the Winnipeg board of control has forwarded to the International Waterways Commission a request that the permit be withheld until the effect of the diversion on the Winnipeg River can be estimated.

Subordinate Street Lighting at Boston.

After many weeks of investigation Superintendent of Streets L. K. Rourke, of Boston, has decided to advertise for minor street lighting on the basis of five-year and ten-year contracts, instead of placing a contract on a two-year basis as recently announced. Twelve thousand lamps are involved, and either gas or electricity may be used. Before the contract can be signed it will have to be approved by the Mayor and City Council, and residents of Boston will have to be heard upon the question. Mayor Fitzgerald has announced that he is in favor of a long-term contract. The existing conditions in the field of gas lighting on minor thoroughfares are entirely unsatisfactory. The work is handled by a company which has held the field for about 22 years, and the gas is purchased for use by the city only after a considerable profit has been paid to the lamp company for its part in handling the gas, which in the first instance is supplied by the Boston Consolidated Gas Company. If electricity is used in place of gas, all middlemen's profits will be obviated, and the city will secure the light at the least trouble. Automatic lamp-lighting equipment is being investigated by the Street Department, but thus far without any results which show that these devices have reached a stage of development where they can be considered genuinely reliable. In some of the outer suburbs the Edison Electric Illuminating Company of Boston has installed tungsten lamps with decided economy to the city, as compared with gas lamps. The city authorities are trying to avoid any system which would involve a large investment in lamps and mantles, or any extended maintenance organization. It is probable that there will be vigorous competition between electricity and gas for the service about to be determined.

Mardi Gras Celebration at Coney Island.

Coney Island always signalizes the close of its season by a Mardi Gras celebration lasting one week, during which time the seaside resort is crowded to its limits. On Monday night King Mal and Queen Tess were duly crowned in the great ballroom in the Palace of Fun at Steeplechase Park and later drove down Surf Avenue acclaimed by a crowd of over 100,000 people. The hilarious carnival, kept within bounds by over 800 policemen, followed with its confetti, gay decorations, myriad electric lamps, floats, etc. In addition to the regular spectacular lighting on Surf Avenue, the Brooklyn Edison Company strung over 10,000 8-cp incandescent lamps across the broad thoroughfare so that the parade literally marched under a canopy of light. The stringing of these lamps and supplying them with energy during the week is the contribution made by the Edison Company to this yearly event. The royal float was preceded by 12 flower girls and after "their majesties" came floats entitled "Cap and Bells," "Lohengrin" and "Midsummer Night's Dream" all ablaze with electricity supplied to them by means of a flexible cable and trolley, the latter running along wires on the side of the avenue. "The Cow Jumped Over the Moon," "Water Lilies" and "The Fairy Queen" were the names of the floats which followed, and Coney Island was typified by a gondola craft bucking a golden sea with a staid old man with flowing beard and long white hair. Seated behind him were Miss Columbia and Uncle Sam. After the parade the Coronation Ball was held in Steeplechase Park. The festival will close on Saturday of this week, bringing to an end the Coney Island season.

A Turbine-Electric Locomotive.

A turbine-electric locomotive, making use of the combination of steam turbine and electric generator and motor elements, which has been employed to advantage on some turbine-driven vessels, was recently constructed at Glasgow, Scotland, and has been tested on the Caledonian & North British Railways. The boiler is of the usual locomotive type and supplies steam to an impulse turbine running at 3000 r.p.m., which drives a direct-current generator. By rheostatic control of the generator field the generator output may be varied in pressure from 200 volts to 600 volts, and is used to operate four series railway motors whose armatures are mounted on the four main driving axles of the locomotive. The steam is superheated during passage from the boiler and is returned from the turbine to a condenser which delivers it to the hot-well for reuse in the boiler. The tank water is used for condensing purposes only, being circulated in a closed cycle by a turbine-driven pump, and passed through a cooling radiator on the front of the locomotive, where its temperature is lowered by the blast of air caused by the train's motion, assisted by a fan. Forced draft on the stack is supplied by the same small turbine-driven blower, which is arranged to deliver the heated air from the cooler coils to the firebox. All of the control apparatus is conveniently grouped in the engineer's cab, speed control being effected by manipulation of the generator field rheostat and by means of the series-parallel connection of the four motors.

Planchon Metallic Filaments.

A patent was granted Aug. 23 to Mr. F. J. Planchon, Paris, France, on a process for making metallic filaments which, it is claimed, enables a filament to be made of more regular dimensions and resistance than by other processes. The base of the filament is one of the earth metals, such as tungsten, tantalum, molybdenum, etc. An aqueous or alkaline solution of an albuminoid material is mixed with a solution of an alkaline salt of one of the metals, and the whole then poured into a weak acid solution. The precipitate thus obtained is washed and is then ready to be [illegible]

20 grams of albumen in alkaline solution may be mixed with 100 grams of tungstic acid in the state of tungstate of sodium. This compound is then poured into 1 liter of a solution of hydrochloric acid. The precipitate obtained weighs 110 grams and contains 80 per cent of tungstic acid. Casein may be used instead of albumin. The precipitate thus obtained is then made into a plastic mass and filaments formed from it. After the filaments have been thus formed and dried, they are heated by any suitable means, air being excluded, to such a temperature that they become conductors of electricity. The filament is then subjected to a final operation which consists in raising it progressively to a high temperature by means of an electric current in a vessel in which a vacuum has previously been formed, or which contains a gas which is inert or one at least which exerts no action upon the metal which enters into the initial composition.

The Cedar-Pole Industry.

While poles of steel or iron, and lately of reinforced concrete, are used to some extent in supporting outdoor wires and apparatus conducting electricity, wooden poles still predominate very largely in installations of this character in the United States. In 1907 it was estimated that 32,000,000 wooden poles were in use in the pole lines of the country and that about 2,500,000 poles were required annually for renewals alone, to say nothing of those installed on new work.

White cedar, coming largely from Michigan, Wisconsin and Minnesota, predominates as the wood used for poles. As the cedar forests or swamps are cut over, poles produced of this wood are gradually becoming scarcer and higher in price. This is particularly true in the case of the larger sizes; 65-ft. poles were recently quoted at $35 each, which is double the price at which they could have been obtained a few years ago. Cedar forests which are cut to obtain poles are cleared off entirely and the smaller timber which is not available for poles is made into ties, fence posts and material for shingles.

Work of cutting the trees begins in the early fall, and large camps containing many men are established in different cedar tracts. The cost of maintaining these camps has greatly increased of late years, and, moreover, the distance of hauling the trees to the railroads to be loaded on cars and taken to the concentrating yards is constantly increasing. Where possible, poles are floated down stream to some convenient shipping point, but as the cedar forests are cut over near the streams, shipment by water is becoming greatly curtailed and in many districts has been practically abandoned.

After the trees are cut down in the woods the bark is taken off and the butts and tops are sawed off square, while the knots are trimmed smooth. These operations are sometimes performed at concentrating yards, where the poles are also sorted and assembled into piles for shipment. At these yards the cedar is also seasoned, for a pole seasoned from 12 to 15 months will last much longer than fresh-cut timber which has not had a chance to dry out thoroughly. Experiments made under the direction of the United States Government show that winter-cut poles weigh about 38.9 lb. per cubic foot; seasoned 10 months they weigh 25.5 lb. per cubic foot. The average time necessary for the growth of a 30-ft. white cedar pole is placed at 190 years.

White cedar is valued for poles because of its comparative durability in contact with the soil, its minimum weight in comparison with strength, and its straightness coupled with relatively small size and little taper. The wood must be soft so that the spikes of a climber may enter readily, and at the same time it must have strength to support considerable weight. These qualities are admirably combined in white cedar. Chestnut, oak, pine, cypress and other woods are also used for poles, but white cedar is generally esteemed the best.

In ordinary soil, without butt treatment, white cedar poles are expected to last from 18 to 20 years. The average depth of setting of a 35-ft. pole is about 5 ft. A 20-ft pole is set from

$3\frac{1}{2}$ to 4 ft. in the ground, and this depth of setting increases with the length of the pole, so that for an 80-ft. pole the depth of setting would be about $7\frac{1}{2}$ ft.

American cedar poles have a wide reputation, and they have been shipped to South America, to Egypt and some other foreign countries.

Winter-cut poles are considered better than those cut during the summer. The cut of the winter of 1909-1910 showed some reduction compared with the number of poles cut in the last few winters. It is probable, owing to prevailing prices, that the cut of poles during the coming winter will also be somewhat curtailed.

Underwriters' Tests.

In a paper presented Aug. 26 before the annual convention of the International Association of Fire Engineers, Mr. W. H. Merrill gave an account of the objects of tests and investigations at the Underwriters' Laboratories at Chicago. These laboratories are operated under the direction of the National Board of Fire Underwriters and have branch offices in 32 other cities in the United States and Canada.

Up to the present time the Laboratories have examined and issued reports on over 5000 different subjects or appliances, each report representing from one to a dozen series of investigations and experiments. Summaries of the Laboratories' reports are promulgated on printed cards filed according to classifications, and cabinets containing these cards are maintained at the offices of the principal boards of underwriters and inspection bureaus in the United States, at many of the general offices of insurance companies, by some insurance firms, certain municipal departments, and at the local offices of the Laboratories in large cities. Much of the information is also freely distributed by means of lists of approved and permitted devices promulgated by the National Board of Fire Underwriters, and the results of the work in many classes of appliances are furnished directly to building owners, architects, users and all other persons interested by means of the Laboratories' labeling system, under which goods are inspected at factories by Laboratories' engineers and stamps or labels attached to such portions of the output as are found constructed in accordance with standard requirements.

By means of this service the quality of goods, in factories where approved articles are made, is carefully observed and the use of labels restricted to such portions of the output as meet in all essentials the standard of efficiency shown by the sample originally tested and on which approval was based. Experience has shown that an inspection and checking system of this nature can be efficiently operated under the Laboratories' direction without calling upon the manufacturer to give undue publicity to his manufacturing process or subjecting him to any embarrassment or annoyance.

This service which carries the statement of the Laboratories as a manifest on the goods themselves, and which is safeguarded by competent inspectors at the factories where the goods are turned out; by special agents going from one inspection office to another; by reports carefully scanned by examiners and engineers at the head office; by frequent examinations by Underwriters' inspectors in the localities where they are installed, and by rival manufacturers noting closely the quality of their competitors' wares when labeled—is proving itself the best solution yet devised of the many perplexing problems incident to bringing to the consumer the opinion of some one in authority on the merits of devices and materials in respect to the fire hazard.

The consumers' interest in obtaining these expressions through this channel is becoming more and more apparent. No such remarkable growth as the record shows in this branch of the work could have been possible without popular approval. [illegible] supplied inspectors—a noteworthy number, when it is considered that the inspection service has been in operation less than five years.

Proposed Tariff Order of New York Commission.

A hearing upon a proposed order to require gas and electrical corporations to file tariffs and prescribing a form for such tariffs was held before the New York Public Service Commission, Second District, at Albany, on Sept. 7. The commission was represented by Chairman Stevens and Commissioners Carlisle and Sague. Chairman Stevens presided.

In asking the electrical corporations, gas corporations and municipalities to have representatives at the hearing, Mr. J. S. Kennedy, secretary of the commission, requested certain advance information relating to commercial electric service for light, heat and power. The answers to these requests were before the commission.

In calling the meeting to order Chairman Stevens stated that the meeting was called because of amendments to the law enacted by the Legislature and effective this year. He called attention directly to Sections 65 and 66 of the Public Service Commissions law as amended, and read subdivision 12 of Section 66, which relates to the power given to the commission to require that full schedules be filed with the commission and be printed and kept open to public inspection. This section of the law, and any action that might be taken thereunder, was simply a provision for making rates public.

Attention was then directed by Chairman Stevens to Section 65 of the law as amended, which forbids unjust discrimination. The hearing was called for the purpose of bringing up for discussion what should be done by the commission under these sections of the law, and how the matter should be handled in the manner clearly indicated by the Legislature and yet most conveniently for all interested. The matter of forms for schedules had received some attention by the commission before the answers from the companies had been tabulated. When the commission asked its force to tabulate the number of different forms, rates and rate agreements it was assured that such a task would mean a postponement of about four months. It was, therefore, thought best to continue with a conference with the companies and not to attempt to make a tabulation showing the differences in conditions prevailing with the companies. Such inspection as had been given to the answers of the corporations showed that rates were absolutely heterogeneous, and had been made because of some competitive condition or because some one desired a rate or a form of contract for some special reason.

If judgment could be based on the returns before the commission, Chairman Stevens said there had been absolutely no scientific rate-making in this state as a whole. It seemed as if it would be in the interest of the companies to make a careful investigation as to what constituted reasonable and just rates for electric service. The apparently haphazard methods that were in existence should be abandoned. Unquestionably there was a large amount of discrimination at the present time.

Mr. Robert M. Searle, vice-president Rochester Railway & Light Company, said it had been felt by some that the situation which had now arisen would develop, and meetings had been held in various parts of the state from time to time to discuss the subject. A meeting was held recently at Syracuse of a committee of the Empire State Gas & Electric Association, of which Mr. J. C. DeLong, vice-president of the Syracuse Lighting Company, was chairman. As far as the Rochester company was concerned, it thoroughly approved of the action of the commission and was glad to file its schedule. It thought the law sane and well drawn, and was glad to have discrimination abolished. He thought the best course would be to have a joint committee representing the companies and the commission to study the entire situation and develop the facts with the least unjust criticism.

Mr. J. C. DeLong, vice-president of the Syracuse Lighting Company, said that at the meeting of which Mr. Searle spoke the question was considered at length. The sense of the meeting was that, if the plan met the approval of the commission, a joint committee should be appointed.

Chairman Stevens said that, while the development of a

uniform schedule was perhaps the starting point, a great many other questions would arise. The system of charging a flat rate for electricity prevailed originally and still existed to some extent, and it might be asked how it was possible to have such a system without discriminatory rates. He knew that many companies could not have been started in the first instance without discriminatory rates, but a little sense and judgment would enable such companies to get their affairs into shape without tearing up their whole systems. Every company would have some difficult adjustments of its affairs to make in order to conform to the law as it now stood, but the commission would like to know just what the difficulties were. It was best to thresh out the difficulties in public. A great many matters appeared to be discriminatory which were not so at all. There ought to be a discussion as to what constituted discrimination. Where would the law affect each company? The commission did not want to put in force a schedule that would lead the companies to say the next day that the order would tear them to pieces, when so radical a result could be prevented by a rational interpretation of the law.

Mr. W. R. Addicks, Westchester Lighting Company, said that not many of those who were asked to attend the hearing had in mind that a discussion of rates would take place.

Chairman Stevens said that if he had led those attending the meeting to think that the discussion would turn on the amount of the rate, he had not expressed the thought of the commission. The question was whether in making schedules rates should appear on their face discriminatory when they are not so in fact. Many of the schedules of the companies were very badly discriminatory on the face of them.

Mr. Morris B. Cohn, Jr., representing the Buffalo & Niagara Falls Electric Light & Power Company and the Cliff Electrical Distributing Company, said that he would not like to have any form adopted which would exclude the flat rate. One of the companies had built up a large business with flat-rate customers who were given the option of having either a flat rate or a meter. On behalf of the distributing company he suggested that no rates be filed for customers using in excess of 150 hp or 200 hp. Most of the customers of that company purchase from 5000 hp to 10,000 hp and it was impossible to know in advance what their requirements would be. For instance, the company has some contracts for the sale of 500 hp, allowing the customers the right to take 500 hp or 1000 hp more. One customer took 10,000 hp at certain rates with the right to additional power. The Niagara Falls Hydraulic Power & Manufacturing Company owned land and was, therefore, able to deal with customers who sought locations for plants. If the company could not change rates in 30 days it might not be able to make contracts. Two exceptions should be made in any order the commission might issue: First, rates should not apply to any contract made heretofore, and, second, in sales of power in excess of 100 hp a filed rate should not be required. The lighting company was in favor of filing its rates and did not now discriminate or want to discriminate unless a flat rate should be held discriminatory

Mr. Searle referred to a large company in Rochester which had an option from a steam company. The Rochester Railway & Light Company had to make a decision immediately as to what rates it would offer in competition for this business. If it should be in a position to announce a rate immediately and to say that the commission would revoke the rate if de-[illegible]red discriminatory it would still be in a position to protect [illegible] usiness. The business was a competitive on.. He had [illegible] that one rate might be justified where a manufacturer kept [illegible] at night but did not affect the peak load, because the [illegible]t, added to the profit of the whole business, tended to re-[illegible] the average. For instance, the Ontario Light & Traction [illegible] operating in [illegible] and it would be [illegible] the rate of a large cu[illegible] [illegible] a man who had to have the lighting service but could not [illegible]eet the company competitively, the existence of business of this character would give Canandaigua citizens as a whole a lower rate because it would contribute to the profit of the entire property.

Mr. DeLong asked Mr. Cohn whether the company, in offering a customer the option of flat or meter rates, pointed out the advantages of the two systems.

Mr. Cohn said that the effect in each particular case was always pointed out.

Mr. Fred B. Corey, of the Niagara, Lockport & Ontario Power Company, said there were a great many objections to any hasty action upon a rule under which schedules should be filed. His company transacted chiefly a wholesale business. It was not a generating company and was not to any great extent a distributing company. It purchased from one source under a contract which extended about 50 years at a fixed price. At present it was delivering under contracts which, in the main, required large blocks of power for periods ranging from 10 years to 30 years, and extending over a territory of 170 miles or 180 miles as far as Syracuse on the main lines and latterly to other points at distances from the main lines. The question of whether a flat rate was discriminatory would affect that company, and it would not want a decision holding such a rate discriminatory. It was buying on that basis from a company on the Canadian side of the river and it had to sell somewhat on the basis on which it purchased. It seemed to him that contracts for purchase and for sale would have to be recognized and carried to their completion. He assumed that no state statute could interfere with such contracts without violation of the Constitution of the United States. The question of what constituted a discriminatory rate was a very serious one, and that company had a vast amount of difficult questions to solve before it would be in a position to comply with a rule of the commission requiring it to file schedules.

Mr. M. W. Offutt, general manager of the Schenectady Illuminating Company, said that it seemed to him that it might work harm to publish rates at once. He believed that all companies had special rates, and that if the publication should be delayed somewhat they would be only too glad to endeavor to dispose as rapidly as possible of such special rates as they might have. A great many rates, although appearing discriminatory on their face, were actually not discriminatory at all and would be gladly granted other customers under like conditions. Companies also had existing contracts to complete.

Mr. F. B. H. Paine, general manager of the Niagara, Lockport & Ontario Power Company, said that the very greatest service could be rendered by the completion of a classification which would determine what business was essentially retail in nature. It was increasingly difficult to know what constituted wholesale business, also the jobbing business. In order not to disrupt the methods and finances of the companies such a classification must come after the interval of an educational season.

Mr. C. M. Wood, owner and manager of the Elizabethtown Electric Light Company, said that the plant had about 700 lights in the summer season and about 300 in winter, and that it could not give small rates at either time of the year.

Chairman Stevens said that the object of the conference was not to consider rates. The principal reason was to avoid discrimination.

Mr. Cohn said that Mr. Paine had suggested the classification of retail and large consumers. This did not seem to him to clear up the difficulties which he had mentioned. Since he had become connected with the Buffalo properties he had drawn seven contracts for large blocks of power, and not one was like the others. While the price was approximately the same, the terms were expressed to suit the ideas of the consumer and induce him to locate.

Mr. L. W. Emerick, vice-president of the Fulton Light, [illegible]
certain rates of that company were discriminatory. He thought they were not, but the commission might say they were discriminatory. The company needed the business and the busi-

ness could be secured at certain rates. The company had no desire to discriminate; it had no so-called scientific rates, and he was frank to say that the company had not felt able to develop a scientific system of rate-making. He would like to know the attitude of the commission before filing and publishing his rates.

Chairman Stevens then read subdivision 2 of Section 65 bearing on the subject of discrimination. He said that it would require a good deal of study to determine under the statute what conditions and circumstances were alike. The question had arisen in a case affecting a company on Long Island where the commission held that no discrimination existed if the summer customers were charged more than the winter customers.

Mr. F. H. Mather, general manager of the Nassau Light & Power Company, spoke of a company made up of the property of several smaller companies. At the time one company was taken into the consolidation its rate was lower than the rates of the other properties, and the commission asked whether the rates prevailing in the territory served by this particular company would be raised and expressed the feeling that no advance ought to be made. Therefore, the company had been taken into the consolidation with a certain moral, if not a legal, obligation that the rate would not be raised.

Chairman Stevens said that schedules would require thought. Discrimination resulted from applying one rate and then changing it with conditions. The companies would be helped if they would decide upon their conditions first and then make their rates to conform therewith. To avoid any misapprehension he would state that while the commission was there to enforce the law, and must enforce the law, it had designed, and he hoped always would design, to help the companies in their difficulties. First the commission desired to secure the best service which conditions in the community permitted, but it did not expect anybody to render such service without receiving fair compensation. One thing which had led to an outcry against public-service corporations was the existence of discrimination. People believed that if service could be afforded to John Doe at one price it was robbery to charge anyone else a higher price. With study a great deal of the misunderstanding of such conditions would be dispelled. What the commission desired to do was to work for the excellent and commendable results prescribed in the statute.

Chairman Stevens then suggested a recess for a few minutes in order that the companies might appoint a committee in accordance with the suggestion of Mr. Searle. The appointment of the committee would provide a desirable means of going into the questions involved in detail.

Mr. Searle said that the committee which had considered the subject realized the difficulties of the small companies and that the Empire State Gas & Electric Association had done everything in its power to help such properties.

The companies thereupon held an informal meeting and decided upon the following committee: Mr. J. C. DeLong, vice-president Syracuse Lighting Company; Mr. J. T. Hutchings, general manager Rochester Railway & Light Company; Mr. I. T. Cowling, engineer Westchester Lighting Company; Mr. F. B. H. Paine, general manager Niagara, Lockport & Ontario Power Company; Mr. A. C. Smith, sales engineer Cataract Power & Conduit Company; Mr. T. R. Beal, secretary and manager Poughkeepsie Light, Heat & Power Company; Mr. M. W. Offutt, general manager Schenectady Illuminating Company.

After the recess Mr. C. H. B. Chapin, secretary of the Empire State Association, announced the appointment of the committee and said that the understanding was that the committee could add to its number as it saw fit.

Mr. DeLong said that the committee would co-operate with the members of the commission or such representatives as it might appoint to join with the committee to consider the difficulties and in bringing about the proposed results.

Chairman Stevens thought that no member of the commission should be a member of the committee, as the commission should be free to pass on the results without being in the position of having taken any part in the proceedings. The commission appointed as its representatives on the committee: Mr. H. H. Crowell, electrical engineer; Mr. C. F. Hunter, chief electrical inspector, and Mr. W. E. Griggs, chief of the division of tariffs.

In closing the hearing Chairman Stevens said that the commission did not desire to proceed arbitrarily in the matter. It desired to prevent discrimination, but in the best manner and with the least injury to everybody concerned.

Opening of the New York Terminal of the Pennsylvania Railroad.

On Sept. 8 that portion of the gigantic and monumental terminal of the Pennsylvania Railroad Company devoted to the Long Island Railroad was opened to public traffic. The New York station of the Pennsylvania Railroad and its approaches extend from the east line of Tenth Avenue, New York, to points in Thirty-second and Thirty-third streets respectively 292 ft. and 502 ft. east of the west line of Seventh Avenue. The station proper, which is the largest structure devoted to passenger service in the country, if not in the world, covers two city blocks, Seventh Avenue and Eighth Avenue from Thirty-third to Thirty-first Street, and one intersecting street, Thirty-second Street, and has an area of about 8 acres; its cost is estimated at $12,000,000 and the cost of the entire work from Harrison, N. J., to Long Island, including the tunnels under the East River, North River and across New York City, is stated to be in the neighborhood of $111,000,000. The station building is 774 ft. long, 433 ft. wide, with an average height above the street of 69 ft. and a maximum height of 153 ft. The main waiting room is 277 ft. long, 103 ft. wide and 150 ft. high. The concourse is 340 ft. long and 210 ft. wide. There are 21 standing tracks at the station and 11 passenger platforms, providing 21,500 ft. of platform adjacent to passenger trains. Within the station area, which from Tenth Avenue to the normal tunnel sections east of Seventh Avenue comprises 28 acres, there is a total of about 16 miles of track.

The service plant for the installation of machinery for lighting, heating and ventilating the station and for operating the interlocking system is located in a separate building south of the station on Thirty-first Street. The power station to supply the electrical energy for the operation of the tunnel line and the Long Island Railroad is situated in Long Island City near the East River, and was described in these columns Nov. 4, 1905. The station can accommodate six generating units of 5500 kw, the standard adopted for future work, and two of 3000 kw for lighting the tunnels. The ultimate capacity of this station when extended will be about 105,000 kw.

The requirements for heating the plants and cars in the yards very largely determined the make-up of the service plant required to supply other service. The necessary 60-cycle alternating current for lamps and motors could easily have been obtained from the main generating station at Long Island City, where electricity is generated at minimum cost, and might have been delivered through transmission cables laid in the railroad tunnels under the East River. It was not, however, feasible or desirable to transmit the required heat to the terminal through these tunnels. It was, therefore decided to provide a steam supply near the terminal to generate all the heat for warming, and for this purpose the service station was built, where all the electric generating apparatus, pumps, compressors and auxiliaries required for terminal service are operated from steam boilers, the resulting exhaust steam being generally sufficient to provide the desired heat for the building; live steam being used for car heating. The distance of this station from an economical supply of condensing water precluded the use of any but the non-condensing type of prime

mover, and confirmed the utility of exhaust steam as a means of supplying the needed heat to the terminal with the greatest economy.

During the summer months, and as a relay against accident, two electric transmission cables passing through the East River tunnels and connecting with two 3000-kw, 60-cycle turbo-generators in the main station at Long Island City supply electricity to the service station. This arrangement not only insures constant service, but permits balancing and the transfer of load between the boilers of the service station and those in the generating station in accordance with the varying demand for exhaust steam. The same 60-cycle turbo-generators are also used for supplying energy for lighting the tunnels. In the service station are also located the necessary 25-cycle electrical transforming and converting apparatus for supplying the electric locomotives in the terminal zone with the necessary energy for train propulsion. This is transmitted at 11 000 volts from the Long Island City generating station.

The general arrangement of the equipment in the service station is as follows: The eastern half of the main floor at the street level is occupied by the railway power substation. The western half comprises the boiler-room. The pumproom is in the next level below the boiler-room and contains water-storage tanks and all the pumps for the boiler-feed and general water supply system and the fire service. The engine-room, which is below the power-room, extends the full width and depth of the building, and accommodates the turbo-generators, air compressors, elevator pumps, central heating plant and ammonia compressors. In the basement below the engine-room are the piping connections of the engine-room units and hot well. The economizers, coal storage and conveying apparatus are in the space immediately over the boiler-room. The pump and engine rooms below the street level are artificially ventilated by two Sturtevant fans, which are capable of supplying 45,000 cu. ft. of air per minute. The general lighting of the building is by Nernst lamps, with occasional incandescent lamps where the amount of illumination needed is not large.

Fig. 1—Terminal Station of the Pennsylvania Railroad Company in New York.

In the boiler room are five [illegible] Babcock & Wilcox boilers designed to carry steam at 200 lb. pressure. The furnaces are equipped with shaking grates for burning No. 1 buckwheat coal. Forced draft is provided by a pair of direct-connected, engine-driven blast fans, and the furnaces, flues and economizers have been laid out to prevent as far as possible the discharge of ashes and cinders. A brick chimney, 11 ft. in

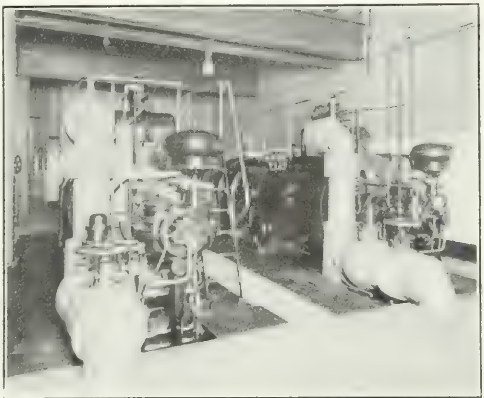

Fig. 2—Turbo-Generating Sets in Service Station.

diameter, resting upon the roof frame, rises about 50 ft. above the roof so as to carry the products of combustion above the surrounding buildings. Fuel is handled and stored by a system of belt conveyors and skip hoists. These are capable of handling 100 tons of coal per hour, and this unusually large equipment has been provided for the quick emptying of coal cars so as to liberate the track room for passenger-car storage. The bunker capacity provided is 1000 tons. The coal is delivered from hopper-bottom cars on the southernmost track in the station area and discharged through steel hoppers into the conveying, hoist and distributing systems, all of which can be operated from one point by a [illegible]. The ashes are drawn from the ash pits [illegible] which dump into a reinforced-concrete storage bunker located underneath the sidewalk. The [illegible] from the bottom of

this bunker into a car on the coal track siding. An electric winch is provided for shifting the coal and ash cars.

The heating of the terminal station is accomplished by hot water, which is forced through the enclosed circulating pipe system to heating coils in the terminal station, through which air is forced by fans into the various rooms. The water circulating pumps are of the horizontal, single-stage, motor-driven centrifugal type. A sufficient and certain supply of water for

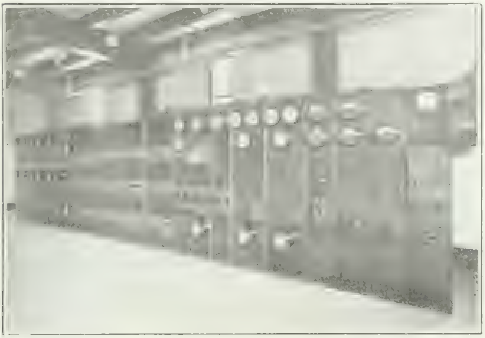

Fig. 3—Main Switchboard in Service Station.

all station purposes has been provided, and for emergencies an aggregate storage-tank capacity of about 100,000 gal. is provided in the service station and terminal station.

Located in the engine-room are two 1000-kw, 60-cycle, three-phase, 240-volt turbo-alternators, which can be used for lighting the terminal at any time when need of more exhaust steam for heating or any other reason makes this desirable. The alternators are excited by two motor-driven, 40-kw generators located near the main switchboard on the street level, and a 60-cell battery of 400-amp-hour capacity serves for relay excitation. The service switchboard comprises altogether 17 panels, divided into a generator section for controlling the alternators, transformers, exciters, storage battery and regulating devices; a section controlling 24 lighting feeders, and a third section controlling 12 motor feeders. The generator switches are electrically operated. The two principal 60-cycle

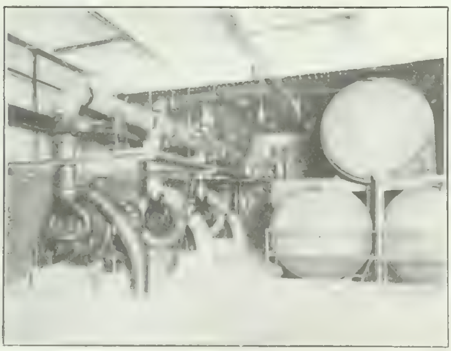

Fig. 4—Hot Water Circulating Pumps.

services for the terminal are lighting at 240 volts and the operation of motors at 420 volts. The 1000-kw alternators connect directly with the lighting busbars, and the 11,000-volt service from Long Island City is transformed to 240 volts through one set of three 500-kva, air-blast transformers, also coupled to the lighting busbars and to 440 volts for motor service through three 750-kva, air-blast transformers.

The compressed-air plant located in the engine-room comprises two cross-compound, steam, two-stage air compressors for operating the automatic and interlocking switching and signaling systems and other air devices.* There are also two smaller motor-driven air compressors for train-brake testing and two locomotive-type compressors for supplying air for cushioning hydraulic elevator tanks. The refrigerating apparatus for cooling storage boxes for kitchens and restaurants and for cooling the drinking water for the entire terminal station consists of two ammonia compressors, each of 40 tons refrigerating capacity, together with condenser, brine cooler, drinking-water storage tank of 1800 gal. capacity, filters and duplex water and brine circulating pumps. The latter are of the motor-driven centrifugal type, with a capacity of 125 gal. a minute. The drinking-water plant is designed to handle a maximum consumption of 750 gal. an hour, and motor-driven centrifugal pumps are provided. To dispose of the garbage and other refuse from the kitchen and restaurants, together with street sweepings, etc., an incinerating plant is installed in the basement of the service station, having a capacity to burn 16 tons of wet kitchen garbage in 24 hours.

The eastern half of the main floor level of the service station

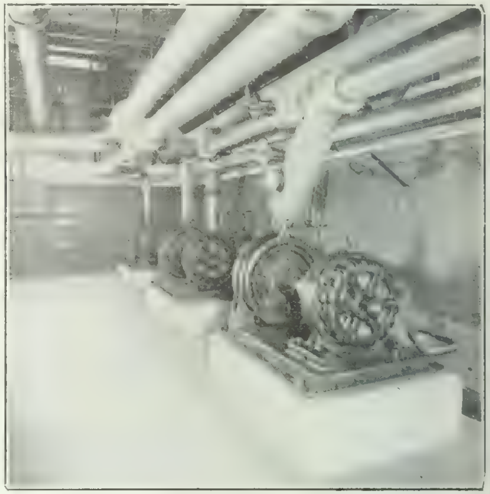

Fig. 5—Boiler Feed and House Service Pumps.

contains three 2000-kw rotary converters, nine 750-kw, air-blast transformers and two switchboards, one of 10 panels carrying all the control apparatus for 25-cycle feeders and rotary and outgoing third-rail feeders; one of five panels controlling the incoming 60-cycle feeders from Long Island City, the distribution circuits to the service station board and the two transformers supplying the signaling and interlocking system with primary signaling current at 2300 volts.

The terminal is heated by the indirect system, and the ventilation in all rooms is accomplished by mechanically exhausting the air from them. The offices, shops, stores, waiting-rooms, storerooms, restaurants, etc., are connected to exhaust fans driven by three-phase, 440-volt induction motors. The toilet and retiring-rooms are connected through a separate system of ducts to exhaust fans, and the kitchen and service-rooms are similarly connected to another separate system of exhaust fans. In all there are 21 ventilating fans, having a capacity of exhausting 13,980,000 cu. ft. of air per hour. Each is belted to its own motor, the total aggregating 84½ hp.

For various electrical services in the terminal station there are provided three-phase, 60-cycle current at 240 volts for lamp circuits; three-phase, 60-cycle, 420-volt current for general motor service, and 650-volt direct current for electric eleva-

tors and dumb-waiters. There are 19 three-phase feeders for distributing energy to the lighting circuits, and 6 three-phase feeders for general motor service. These, together with sub-feeders and branches for all services, are of triplex or duplex, rubber-insulated cables run in metal conduit.

The combined candle-power of all of the lamps in the terminal service station and yard area is 512,000. Generally speaking, the illumination throughout the terminal building is effected by Nernst lamps. These are variously grouped in rooms of different type and size according to the general character of the illumination desired, the fixtures most usually employed for the larger spaces being the side-bracket type, which are placed at heights that best conform to the interior architectural treatment. In the main waiting-room, which is 150 ft. from the floor to the highest point of the ceiling, there are, besides the side brackets, a number of floor standards placed in parallel rows. Each of these standards is equipped with a group of tungsten lamps. Chandeliers and small table candelabra are used in the dining and lunch rooms. The main concourse is

Fig. 7—One End of Main Waiting Room.

illuminated by clusters of large Nernst lamps grouped about the tops of the main columns, with large chandeliers located in the centers of the main spaces. The principal open spaces are lighted by large Nernst lamps placed as high as possible, while the offices and smaller rooms are illuminated by single-glower Nernst lamps.

Incandescent lamps are used for office corridors piping galleries, toilets and closets. A few tungsten and Cooper-Hewitt lamps are used in the drafting rooms, and flaming-arc lamps are to be installed in the railroad yard west of the post office. The large clocks are to be illuminated by Moore tubes. In the complete lighting system there is used the equivalent of 633,000 ft. of single conductor wire and cables of various sizes

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[illegible] ft. of [illegible] [illegible] throughout the terminal [illegible] motors in each subdivision as shown in the table.

Most of the fans are arranged for hand control, while many of the pump motors are fitted with automatic control. The general motor service distribution system utilizes an equivalent of 27,000 ft. of single-conductor cable laid in about 12,000

Fig. 6—Rotary-Converter Substation in Service Building.

ft. of metal conduit. The service plant power and lighting service utilizes about 57,000 ft. of wire and 26,500 ft. of metal conduit. The distribution for two of the four sump pumping

Fig. [illegible]—[illegible] Tracks.

[illegible] ice because of the distance of the former from the station, which is 1700 ft. and 2400 ft., respectively. These two plants are served by 11,000-volt, 60-cycle, three-phase feeders, one re-

quiring two 240-hp motors and the other being fitted with two 100-hp motors, both outfits being supplied with transformers of suitable rating, automatically controlled by switches actuated from floats. The other two sump pumping installations are nearer the station and are supplied with energy from a 420-volt circuit.

Liberal provision has been made for the distribution of telegraph and telephone wires to all sections of the terminal, together with separate sets of wires for call bells, for the 38 watchmen's time-recording stations, the master clock and general station time-clock system, for telegraph typewriter instruments used in reporting the arrival and departure of trains and for signals between the train dispatcher gatemen and train conductors. There is also a complete installation of fire-alarm signals with 20 boxes and three indicating stations.

The elevators and lifts in the terminal station comprise 10 electric elevators for general passenger service; 21 baggage elevators and 11 passenger elevators of the hydraulic type for handling baggage and passengers from the station platforms to the main waiting-room. There are also two groups of three dumbwaiters running from the restaurants to the kitchens, these being operated by electric motors from 650-volt direct-current circuits.

A special passenger entrance to the terminal station is provided between Thirty-fourth Street and the exit concourse level running through the block toward Thirty-third Street, where ingress to the concourse is obtained by a flight of steps, egress upward being by an escalator. The escalator is 4 ft. wide and has a capacity for about 180 persons per minute. It is operated by a 30-hp, 60-cycle induction motor.

To provide for the necessary electrical energy for the station terminal tunnels and movement of trains some changes were made in the Long Island City power station. The furnaces of the boilers were remodeled so as to use ar improved type of Roney stoker, and new arches of special type were provided. By this means the boiler horse-power has been increased about 50 per cent. In addition, two 8000-kw steam-turbine-driven, 25-cycle generators and two 3000-kw, 60-cycle turbo-generators have been installed. These turbines are of the Westinghouse type, and are fitted with jet condensers of the Le Blanc type. A 75-kw motor-generator set has been provided for exciting the 60-cycle turbines, and a substation installation comprising three six-phase rotary converters, each connected with three 750-kw, air-blast transformers, has been installed. The original system of busbars and oil switches was modified to a considerable extent. The total capacity of the main generating units in the Long Island City station is now 32,500 kw for train propulsion; 6000 kw for tunnel and terminal lighting and for motor circuits, and 6000 kw for substation apparatus and third-rail supply. Substations for railway supply are also located at the Hackensack portal of the North River tunnel and at Harrison, N. J. Each is equipped with three 2000-kw rotaries.

All of the work connected with the mechanical and electrical engineering, together with the civil engineering design for the construction at the terminal station, was assigned to Messrs. Westinghouse, Church, Kerr & Company, of New York. The work was performed under the direct supervision of Mr. George Gibbs, at one time first vice-president of Westinghouse, Church, Kerr & Company, and consulting engineer of the Long Island Railroad Company, and now chief engineer of the Pennsylvania Tunnel & Terminal Railroad, in charge of the department of station construction and electric traction.

Flat Rate for Residence Lighting at Indianapolis.

The Merchants' Light & Heat Company, of Indianapolis, is about to begin an aggressive campaign for residence business, making a flat rate of 1 cent per watt per month for the maximum demand for which the consumer contracts. The minimum contract taken under this arrangement is $1 per month.

Convention of International Association of Municipal Electricians.

The fifteenth annual convention of the International Association of Municipal Electricians was held at Rochester, N. Y., Sept. 6, 7 and 8. At the opening session on the morning of Sept. 6 the convention was welcomed by a representative of the municipality, to whose address Mr. C. E. Diehl, of Harrisburg, Pa., responded.

At the afternoon session the first paper taken up was one on "Underground Work," by Mr. Clarence R. George, city electrician, Houston, Tex. The subject was treated generally and the conclusion arrived at that the pole line is no longer a necessity in the business districts of either large or small cities, and that the time is at hand for city governments to ask that all unsightly and dangerous poles be removed and all wires placed under the surface of the streets. Mr. George says that, judging from the number of inquiries he has received during the past year, the smaller cities are awakening to the fact that unsightly poles and wires must soon be a thing of the past. It was suggested that when city electricians are called upon by councils to give an opinion on the subject they should point out the advantages of underground circuits incident to immunity from storms, less cost of maintenance and uninterrupted service. In the discussion of Mr. George's paper Mr. W. H. Landreau, of Mount Vernon, N. Y., illustrated the value of membership in the association by stating that it had enabled him to put in an underground system more complete and at a lower figure than had ever been attained before, this latter statement being based upon the authority of a telephone engineer of the American Bell telephone company.

Mr. T. C. O'Hearn then presented a paper giving the result of tests made in Altoona, Pa., and under his own supervision in Cambridge, Mass., to determine the danger to firemen when a stream from a hose strikes a live wire. The tests showed that at a distance of 10 ft. or over the man at the nozzle receives no appreciable shock.

At the morning session Sept. 7 Mr. Walter M. Petty, of Rutherford, N. J., presented a paper on lightning protection. As a protection against the inductive effects of a lightning discharge the ideal method is to have the lines permanently grounded, as in that case an inductive charge can do no damage. The next best thing is to provide a ground connection with some sort of an air-gap between the lines and the earth. Moreover, as a high-tension current from another circuit may follow a lightning discharge, there should be some sort of protective device, which in the event of high tension affecting the line, will open the circuit and prevent damage. He advised grounding fire-alarm and police boxes as a protection to the public against danger from lightning and high-tension currents and static discharges. Mr. Petty stated that he has installed over every box a lightning arrester consisting of five cylinders of non-arcing metal, placed about 1/16 in. apart, the center one of which is grounded. Since the installation of this type of arrester eight years ago there has been no damage whatever to fire-alarm boxes. The discussion following this paper was principally as to the advisability of grounding the shell of all fire-alarm boxes, and the president appointed a committee to make a study of the subject and report at the next meeting.

At the morning session Sept. 8 Mr. R. A. Smith presented a paper on "City and National Code Rules." He said that after 12 years' experience in inspection work, and having had a chance to observe the methods of the insurance inspector, he has come to the conclusion that every municipal electrical inspector can, in the interest of the taxpayer, give strict attention to the National Electrical Code, and that his relations with the underwriters' inspector can well afford to be cordial. The city inspector can also serve the interest of the taxpayer and his department by insisting that he accompany the underwriters' inspector when reinspections are made in his territory, as this will facilitate the work of correcting defects and enable

the city inspector to point out clandestine work. It is also advantageous to the taxpayer to get notice from the city inspector along with that of the underwriters, in case any defects exist, he then being assured that his interest is being looked after.

The afternoon session was devoted to the election of officers, with the following result: President, Mr. H. C. Bundy, Watertown, N. Y.; first vice-president, Mr. J. S. Craig, Toronto, Can.; second vice-president, Mr. J. W. Kelly, Jr., Camden, N. J.; third vice-president, Mr. John G. Kreatz, Buffalo, N. Y.; fourth vice-president, Mr. John Berry, Indianapolis, Ind.; secretary, Mr. C. R. George, Houston, Tex.; treasurer, Mr. C. E. Diehl, Harrisburg, Pa. Invitations for holding the next convention were received from St. Louis, Washington, Chicago and St. Paul, and the latter place was selected for the next convention.

The last session was held in the morning of Sept. 9 at which Mr. H. C. Bundy, of Watertown, N. Y., presented a paper on the "Relation of the Telephone to the General Organization of Fire Department Service." The trouble, he said, that usually prevails with fire-alarm telephone systems would not be tolerated for one moment by any city, village or town with a fire-alarm telegraph system. If the latter were as uncertain in as many ways as the telephone, it would be considered absolutely inadequate and unfit for fire service, and would be thrown in the junk pile. In the discussion the consensus of opinion was strongly opposed to telephone fire calls. Following the paper was one by Mr. A. S. Hatch on "Low Power Factor," which was not discussed.

At the conclusion of the session Mr. W. L. Ellett, on behalf of the members, presented a silver service to Mr. Frank P. Foster, of Corning, N. Y., the retiring secretary.

Convention of Northwest Electric Light & Power Association.

The third annual convention of the Northwest Electric Light & Power Association was held on board the *Queen*, one of the ocean boats running from Seattle to San Francisco. There were about 100 members present, representing the various electric light and power companies operating in Washington, Oregon and Idaho, about 50 of whom were accompanied by their wives and daughters. Boarding the boat late Friday evening, Aug. 26, the party proceeded to Tacoma, where they were the guests on Saturday morning of the Tacoma Railway & Power Company, which placed automobiles and sight-seeing cars at their disposal.

On Saturday at 2 p. m. the first business session was held. President Arthur Gunn in opening the session congratulated the membership on the growth of the association and on its increasing effectiveness. He referred to the policy upon which the association was based, namely, that a small company with small capital and a management consisting of a single man has the same rights and the same voice in the management of the association as the large company with a big executive staff. In point of fact, the balance of power in the association is held by the small company, the managers of which come in the closest touch with the public; and the breath of life of a public service corporation is its close and harmonious relations with the people it serves. He urged upon members that now is the time to use their influence toward the selection of capable and honest men as members of law-making bodies, and for the education of the public mind to favor sane and just legislative measures. The smaller companies, he said, should not belittle their influence nor their usefulness; man for man the heads of these companies have a public influence greater and a responsibility as great as any leader in finance.

Mr. W. J. Grambs then presented a paper entitled "Notes on Rate Making," in which he advocated a careful analysis of all the costs entering into electrical service, and the determination from these data what should be a strictly equitable rate for each class of service. In practice, however it would not be possible to arrange a rate system in accordance with the figures thus obtained, as it would not only be complicated, but would be considered as unreasonable through bearing hard on some classes of consumers and giving what would be considered undue advantages to other classes. A proper plan is to formulate, with the guidance of the results of the analysis, a practical system which will give the least possible dissatisfaction. Mr. Grambs divided the various elements of cost into a fixed consumers' charge for meter reading, billing, etc.; a capacity charge, which covers overhead financial expense, general expense and salaries, and other items due to the capacity of the station and pertaining to the distributing system; an output charge, which includes operating supplies and expenses varying with the output of the station. The operating fixed charge is based on the effect of the consumer's demand on the peak load, and the distributing charge varies with each class of service. Mr. Grambs is of the opinion that the readiness-to-serve system, based on maximum demand, together with the primary and secondary rate system, combines the features that should enter into an equitable rate system.

In the discussion of Mr. Grambs' paper Mr. M. C. Osborne said that the fact was clearly brought out that a universal rate system for lighting is not possible, and that this is also true of a universal power rate. All the rates of the Washington Power Company are based upon maximum demand, but difficulty has been experienced with the maximum demand meters, which he finds sometimes operate unsatisfactorily. These meters moreover, can only be used in the larger installations, and the company is at a loss when it comes to ordinary services. The rate originally adopted by his company is $3 per kilowatt per month for maximum demand, plus 5 cents per kw-hour, but later it was found desirable to make some additional allowance for high-load factors. There is also a quantity discount; the rate is net up to $50 per month; for the second $50, 10 per cent off; the second $100, 20 per cent off; the third $100, 30 per cent off; the fourth $100, 40 per cent off, and over $400, 50 per cent off. Mr. Osborne said that for a small town he had made a rate of $4 per month per kilowatt, plus 7 cents per kw-hour, without discount, and that this was working out very satisfactorily.

Mr. Benson brought forth the fact that the terms of franchises affect the adoption of rate systems. In his case the company is confined to a straight kw-hour rate, which can only be changed by going to the City Council. Mr. Gunn pointed out the desirability of manufacturers getting out a maximum demand instrument that can be sold at a small cost, the present instruments being entirely too expensive to use except on the largest installations. Mr. Moody said that there is now an instrument on the market called a watt-demand indicator which also takes into consideration the power-factor, and has the advantage of influencing consumers to use apparatus which have a high power-factor. In referring to the criticism of the demand indicator, he said that this would not apply if the instrument were properly selected for the service in which it was to be used, and that in the case of large currents it should be used in connection with a current-reducing device. Mr. Grambs gave a concrete example showing how the adoption of the tungsten lamp would reduce the lighting income, and said that it is of the utmost importance to every central station to adopt some kind of a demand-rate system.

Owing to the lengthy discussion on Mr. Grambs' paper it was 6 o'clock before the session adjourned. During the session the orchestra which the association had taken along gave an open-air concert on the afterdeck for the ladies, the boat cruising around the waters of Commencement Bay. In the evening a dance was given in the parlors of the Tacoma Hotel, and at 1:30 a. m. the delegates again boarded the boat and started for Everett.

Arriving at the latter city, the party was given an automobile trip around town by the Everett Railway, Light & Power Company, and at 10:30 started for Vancouver. This day was a holiday with the delegates and no sessions were held, the boat

passing through the San Juan Islands, which are in probably the prettiest stretch of water on Puget Sound. At high noon King Neptune, properly attired, arrived on board with his attendants; all passengers were called to the hurricane deck, where the master-at-arms discovered among the number four from east of the mountains who had never been initiated into the mysteries of deep-sea sailing, and these were promptly seized, bound and blindfolded, and amid impressive ceremonies were propelled down a canvas chute into a canvas tank of salt water which Neptune's attendants had kindly provided. Their indignation was only exceeded by their wrath, but both were quickly extinguished by the prompt application of the fire-hose. Mr. Winters, of the General Electric Company, made an able Neptune, but has decided to postpone a contemplated trip east of the mountains.

In the afternoon Mr. Buck, of Monroe, was indicted for selling electricity for 3 cents per kw-hour with no competition. A jury was impaneled and the trembling culprit haled before Judge Osborne and an impartial audience of sellers of electricity who loudly demanded that the defendant be hanged; he was given a fair trial. His attorney pleaded insanity as a defense, the culprit was proven guilty, found insane, and sentenced to furnish all necessary and unnecessary liquid refreshments for the court and jury during the remainder of the trip, which sentence, with the assistance of the master-at-arms, he diligently carried out.

Entering the port of Vancouver at 6 p. m. the delegates received an aerogram from the British Columbia Electric Light & Power Company welcoming them to foreign soil. Representatives of this company and the city of Vancouver received them at the dock and they were promptly placed aboard automobiles and sight-seeing cars and taken around the city, after which they were entertained at the Vancouver Hotel and by an exhibition run of the automobile fire apparatus of the city.

In the morning the delegates were taken by tally-hos through Stanley Park, which is the finest natural park in any city of the West. At 2 o'clock, while the orchestra played "God Save the King," the *Queen* slowly steamed from the port of Vancouver with every person aboard singing the praises of British Columbia hospitality.

Immediately after getting under way a session was called for the presentation and discussion of papers. The first paper read was that of Mr. A. C. McMicken on "Methods of Obtaining New Business." Mr. McMicken in his paper sketched some of the successful methods of obtaining new business that are in vogue throughout the country, and laid stress upon the selection of competent solicitors and the systematization of their work. He also favored the technical study of prospective customers' requirements, the giving of free engineering advice and holding demonstrations showing the economy and convenience of various electrical current-consuming devices.

Mr. D. L. Huntington then presented his paper on "Depreciation." After discussing the various methods of arriving at depreciation charges, Mr. Huntington advocated a method whereby the various parts of a plant having approximately the same rate of depreciation are grouped together, the depreciation of each group being then accurately determined and the percentage fixed that should be annually written off for each group. In the case of real estate, the increase in the value of land should be credited against the depreciation charge for such property.

Following the reading of Mr. Huntington's paper, the convention went into executive session, where President Arthur Gunn presented a paper on "Employers' Liability and Employees' Compensation," and matters relating to proposed legislation were taken up and discussed. After discussion, it was recommended that the following provisions should form part of any legislation on employers' liability:

1. Compensation for injury must be universal for all industrial accidents, except possibly when owing to serious and wilful misconduct of the workman injured.

2. [illegible] earning capacity and to the partial or entire disability with respect to earning power.

3. The rate of compensation for injury must be fixed by law and must not be left to contract terms between employer and employee.

4. It must be made secure by Government supervision and compulsory insurance.

Early in the evening a short stop was made at Bellingham, after which the delegates met to elect officers for the ensuing year. Mr. Douglas Allmond, of Anacortes, was the unanimous choice for president, and Mr. Norwood W. Brockett the present secretary and treasurer, was re-elected. The following vice-presidents and new members of the executive committee were then chosen: Vice-president for Oregon, Mr. H. V. Gates; vice-president for Idaho, Mr. F. M. Shields; executive committee: Messrs. M. D. Spencer, Eugene, Ore.; J. S. Thornton, Aberdeen, Wash., and L. B. Faulknor, Olympia, Wash.

On Tuesday morning the boat entered Anacortes, where a short stop was made, after which she was headed for the return trip to Seattle. In the afternoon the ship was turned over to the ladies on board, who, in accordance with all traditions of their sex, promptly organized a mock wedding. Again was Mr. Osborne called into service and, properly attired, he made a solemn and dignified minister. Mr. Winters, arrayed in the neat but somewhat snug uniform of the purser, puffed out his chest covered it with medals, kissed the awaiting bridesmaids and steeled himself for the ordeal of groom. Mr. Brockett was attired in a petticoat, skirt, shirtwaist and other articles appertaining to a real bride. With the orchestra playing Mendelssohn's wedding march, the military groom and the heavily veiled bride slowly approached Mr. Osborne, who united them in unholy wedlock with a sugar-coated doughnut for a ring. The ceremony was followed by a few impromptu stunts, including a very clever address by Mr. Gates, and at 6 o'clock a thoroughly happy and contented crowd disembarked at Seattle, Wash.

The convention was a success in every way and especially in the fact that the members became thoroughly acquainted and were given every opportunity for discussion. During the entire trip groups of men would gather at various parts of the ship exchanging views and discussing questions of operation and business. It was through these personal discussions and the opportunities given each delegate to obtain aid in the solution of his particular problem by the experience of other delegates who had met and overcome similar difficulties that the greatest good of the convention was accomplished.

Old-Time Telegraphers' Reunion.

A joint meeting of the Society of the United States Military Telegraph Corps and the Old-Time Telegraphers and Historical Association was held in the Auditorium Hotel, Chicago, on Sept. 8. Col. William Bender Wilson, of Philadelphia, president of the first-named society, called that body to order first, and delivered his annual address. He strongly urged the passage of a bill pending in Congress providing that any person who served 90 days or more during the Civil War as a military telegraph operator be considered, in the administration of the pension laws, to have been mustered into the United States military service. The bill, which is in the custody of the committee on military affairs, refers to persons who have received, or are entitled to receive, certificates of honorable service in the Military Telegraph Corps of the Army of the United States.

Mr. David H. Bates, secretary and treasurer, reported the death of 20 "comrades" during the year, while 12 new members were elected, some of the latter being sons and grandsons of members. There are 272 members of the Military Telegraph Corps now living, and 230 are members of the so- [illegible] donation from Mr. Andrew Carnegie, who is an

honorary member of the society, 89 members or their widows receive a pension of $12 a month.

The officers of the society were re-elected as follows: President, Col. William Bender Wilson, Philadelphia; vice-presidents, William L. Ives, New York, and Charles A. Tinker, New York; secretary and treasurer, David H. Bates, New York; executive committee, Col. R. C. Clowry, New York; William R. Plum, Lombard, Ill.; Col. A. B. Chandler, New York; William J. Dealy, New York; Charles A. Tinker, New York; Richard O'Brien, Scranton, Pa.; John Wintrup, Philadelphia, and Marion H. Kerner, New York. The president and secretary are members of the executive committee ex officio.

The business meeting of the Old-Time Telegraphers and Historical Association was called to order by Mr. G. A. Cellar, of Pittsburgh, who invested the president of the association, Mr. W. J. Floyd, of Chicago, with the miniature of Prof. S. F. B. Morse, which is always worn by presiding officers at the annual meetings of the organization. This miniature was selected by Professor Morse himself and presented to his daughter, who was lost at sea. Soon afterward it came into the possession of James Douglas Reid, author of the "History of the Telegraph," who presented it to the society to be worn by successive presidents.

After routine business had been transacted, Atlantic City was selected as the place of holding the joint meeting of 1911. Col. Wilson was elected president of the Old-Timers, this being the first time one man has been president of both societies. The other officers elected were: Vice-president, W. A. Sawyer and C. A. Meize, both of Philadelphia; secretary and treasurer, F. J. Scherrer, New York.

Mr. E. P. Griffith, of Jersey City, called attention to the accomplishment of Charles Minot general superintendent of the Erie Railroad, in causing to be sent from Turner, N. Y., 48 miles from New York, in the year 1851, the first telegraphic train order. Acting in conjunction with the Association of Railway Telegraph Superintendents, the Old-Timers appointed members of a joint committee to solicit funds to erect at Turner a suitable monument commemorative of the event. Mr. Griffith, who is superintendent of telegraph for the Erie Railroad, Jersey City, N. J., is chairman of the committee. Subscriptions will be acknowledged in the *Telegraph and Telephone Age*.

On Sept. 8 and 9 the Military Telegraphers and the Old-Timers enjoyed themselves with sight-seeing and various social features. They "followed their leader," who was usually Mr. W. J. Floyd. An enjoyable feature was a luncheon on Sept. 9 at the Hotel Moraine, Highland Park, as the guests of Mr. F. W. Cushing, formerly prominent in the electrical business. The reunion wound up with a banquet at the Auditorium, at which Mr. B. E. Sunny was toastmaster and for which Mr. A. S. Hibbard wrote an original song, "The Signal of the Key," sung with feeling to the time of "Tramp, Tramp, Tramp, the Boys Are Marching."

Convention of the Association of Edison Illuminating Companies.

The twenty-sixth annual meeting of the Association of Edison Illuminating Companies was held at Hotel Frontenac, Thousand Islands, N. Y., Sept. 6, 7 and 8. As is probably well known, the sessions of this association are held behind closed doors and it is only within recent years that information and some papers have been released from time to time by the press committee. The valuable reports presented at these meetings are in reality heart to heart talks setting forth the defects of apparatus as brought out in service and the discussion is more or less of a cross-examination of manufacturers, so that publicity of either would destroy the confidential relations which the association tries to maintain with the manufacturers of apparatus, lamps, etc., used by the Edison companies.

At the opening session the presidential address, reports of the executive committee, treasurer, committee on meters, committee on storage batteries and of the lamp committee on tests by the Electrical Testing Laboratories on the Edison storage battery made under the lamp committee's supervision were given, in addition to the reading of a paper on *The 1910 Edison Storage Battery*, by Mr. W. E. Holland, and a paper entitled *Purchase Inspection of Central-Station Apparatus*, by Mr. F. M. Farmer. The afternoon session was devoted to the consideration of the following papers: *Recent Employers' Liability Legislation as Affecting Central Stations*, by Messrs. E. M. Atkin and H. M. Edwards; *Reasonable Profit—Its Definition, Collection and Distribution*, by Mr. J. V. Oxtoby; and *The Welfare of Workers—Some Notes on European Conditions*, by Mr. Arthur Williams.

Mr. Thomas E. Murray, in his presidential address, gave a brief history of the electric lighting industry and traced early central-station development. As the nucleus around which the activities of the member-companies have crystallized in the electric lighting department of the business, attention was first directed to this application. The gradual changes in metering from a lamp-hour basis to the ampere-hour basis and finally to the kw-hour basis, he said, have resulted in giving the customer all the advantages accruing from improvements in lamp efficiency, so that the use of the tungsten lamp was expected to bring about a reduction in the consumption of electrical energy. The immediate effect was restrained in great measure by the higher cost of the lamp; but the result has been in some cases a reduction in the kw-hours sold of sufficient moment to offset the regular yearly increase of output and in many cases at least reducing it so that the net figures show a lessened rate of increase in the output.

Mr. Murray said, on the other hand, that in many cases, notably stores, the tendency has not always been to reduce the energy consumption to a minimum, but rather to divide the saving, part only going in the direction of economy and part toward an increased quantity of light and improved quality. The ultimate effect, he feels, will be altogether beneficial to the central stations and there is every prospect that metal-filament lamps will, in future, be less fragile and liable to premature breakage and will have a longer life with a minimum of deterioration in candle-power. The prices also will be lowered with better facilities for manufacture and a greater demand, and the ultimate result must be to place the central station in a stronger position than ever before.

In the arc-lighting field the effect of flame-arc lamps, etc., on the station business has been notable, although there is a distinct tendency to displace the reliable, but inefficient, enclosed-arc lamp by single high-candle-power tungsten lamps or clusters of smaller lamps. Where such a substitution has taken place the energy consumption has been reduced from 25 per cent to 50 per cent. For minor street illumination the advent of the high-efficiency lamps has enabled central stations to enter a field hitherto held by gas companies.

On the subject of residence lighting Mr. Murray said that lowered costs of meters and customer's connection equipment, from both the investment and operating standpoint, reduction in the outlay for street mains and services and lowered cost to the customer for interior wiring through some cheaper method of installation should make possible an enormous expansion of output, the station fulfilling in a larger measure the rôle of a general public utility.

The ever-widening range of commercial applications of the electric motor and the increasing appreciation of its efficiency, economy and convenience have produced an enormous increase in the station output, and the possibilities of further expansion in the supply of electrical energy for this purpose appear to be without limit, new applications for the electric motor being developed daily. In particular, Mr. Murray pointed [illegible] ice, the electrification of railroad terminals and the operation [illegible]

at some length on the sale of electrical energy for charging storage batteries in electric vehicles, especially heavy trucks and light delivery wagons. The need of electric garages giving expert battery attention was voiced, and it was suggested that central-station companies might finance and perhaps operate garages at convenient points in their territory.

Operating, as Edison companies do, in large cities the question of the isolated plant cannot be ignored, for, as Mr. Murray said, if the economic theory on which the existence of the central station is predicated is sound, then there should be no room for private plants in large cities except under very unusual conditions. The extent to which isolated plants flourish is taken by Mr. Murray to indicate unfavorable operating conditions on the part of the central station or lack of flexibility in its rate schedules. The business is competitive and, according to the speaker, it should be secured if need be at a smaller margin of profit than the average business, or even without profit if absolutely necessary; and such a policy, if attacked by the rate supervising authorities, should be vigorously defended as an inherent right of the enterprise to meet competitive conditions.

How to employ the idle generating and distributing apparatus throughout the year was next discussed and Mr. Murray regrets that on the whole no important industry has yet appeared that could utilize that valuable potential by-product of the central station—off-peak generated energy. The most immediate and evident combinations which present themselves are the joint operation of central heating plants or of ice-making plants in conjunction with central-station service. Central heating plants being the subject of a separate paper, Mr. Murray passed on to a brief reference to the problem of ice making as an industry which it may be advantageous to operate as an auxiliary to an electric generating station.

The conditions which determine the best location for an ice-making plant are not dissimilar from those that receive attention in determining upon a favorable site for a central station. The energy required for the operation of the plant and the handling of the ice on a large scale is from 50 kw-hours to 55 kw-hours per ton of ice. The daily load factor in such an ice plant would be very high and would notably increase the load factor of the station supplying the electrical energy to drive the ammonia compressors, pumps and cranes. It would appear, therefore, that the energy necessary to operate an ice plant could be obtained with a very small extra central-station investment and at a very low production cost. Neglecting the small extra station investment, it is estimated that the cost for energy if figured at 1 cent a kw-hour would represent about 60 per cent of the total operating expenses of the ice plant, excluding all interest on investment, depreciation and fixed charges; and at ½ cent per kw-hour would represent approximately 40 per cent of the operating cost of the plant. It has been estimated that the total ice consumption in the United States is approximately 35,000,000 tons a year, of which 25,000,000 tons is natural ice and 10,000 000 tons machine-made ice. Mr. Murray maintained that the ice-making industry as an adjunct to the central-station industry was worth the careful study of the managers of operating stations located in large cities.

His conclusions were that electricity for lamps and motors is destined to further and further expansion; that electric heating is of relatively small immediate importance and is not likely to make large demands upon the stations in the near future, but that new, and still undeveloped, applications are likely to cause large demands for energy, and that central stations operating independently or in some kind of productive combination with allied service have in store for them a future development of great importance.

At Wednesday's sessions the following program was followed: Reports of committees on the *National Electrical Code*, high-potential disturbances, and steam turbines, together with the presentation of the following papers: *Canvassing by Telephone*, by Mr. T. I. Jones; *Ideas, Suggestions and Meth-* [illegible] by Mr. J. D. [illegible] *Breakdown Connections to Isolated Plants*, by Mr. M. F. McAlpin; *The Heating Problem in Its Relation to Central-Station Service*, by Mr. R. P. Bolton; *The Promise of Electrified Agriculture*, by Mr. E. D. Edwards; *Characteristics and Operation of Relays for Tripping Oil Circuit-Breakers*, by Mr. A. S. Loiseaux; *Report of Committee on Electric Heating and Kindred Uses*, by Mr. J. F. Gilchrist; *Display Street Lighting in Toledo, Ohio*, by Mr. W. E. Richards; *Measuring Demand—Discussion on Power-Factor as Affecting Rates and Demand*, by Mr. R. S. Hale, and *An Analysis of Diversity Factor*, by Mr. H. B. Gear. On Wednesday evening a dinner was given at which Mr. and Mrs. Thomas A. Edison were invited guests.

At the last session on Thursday morning reports of the committees on incandescent lamps and electric vehicles and a supplementary report of the committee on storage batteries and electric vehicle batteries were made, in addition to the reading of the following papers: *Experience with Lamp Renewals*, by Mr. L. A. Ferguson; *The Electric Vehicle as a Promoter of Central-Station Business*, by Mr. P. D. Wagoner, and *The Illumination of Streets*, by Mr. P. S. Millar. The election of officers followed, the old officers being re-elected as follows: President, Mr. Thomas E. Murray, New York; vice-president, Mr. Charles R. Huntley, Buffalo, N. Y.; secretary, Mr. N. T. Wilcox, Lowell, Mass.; treasurer, Mr. Louis A. Ferguson, Chicago, Ill.; and assistant secretary, Mr. Walter Neumuller, New York.

Massachusetts Commission News.

The joint board, consisting of the Massachusetts Railroad, Harbor & Land, Metropolitan Park and Boston Transit Commissions, will begin to hold hearings on Sept. 22 upon the various improvement questions referred to it by the last Legislature. Among the subjects to be considered will be the electrification of steam railroads within the Boston district and the proposed extension of Boston Elevated influence in the transportation systems of Eastern Massachusetts. The joint board, popularly known as the "Big Four," will also consider the relation of the proposed Boston & Eastern Electric Railroad to the electrification of railroads at Boston, and will deliberate regarding the desirability of a tunnel under the city of Boston to connect the North and South Stations and form a part of an improved system of handling suburban traffic. The transportation companies are agreed that the service in the new tunnel will be handled by electricity, and this means that the general electrification of the railroads within the suburban district cannot much longer be deferred.

The chairman of the joint board is Mr. George G. Crocker, of the Boston Transit Commission. To facilitate its work the joint board has divided its membership into three committees. The electrification matters will be specially assigned to Messrs. G. W. Bishop, E. C. Benton, E. U. Curtis, S. M. Mansfield and G. F. Swain. The present plan is to hold hearings on successive Thursday afternoons until the end of the year, soon after which the joint board is required to report to the Legislature upon the topics assigned, with recommendations as to desirable legislation in 1911. One of the most important duties laid upon the board is the drafting of a bill which shall provide for electrification within a specified time. The steam railroads are required to report their conclusions as to feasibility and methods to the joint board by Nov. 1.

The Mayor of Brockton has petitioned the Railroad Commission to require the Old Colony Street Railway Company to establish transfer stations at various points within the city at the time of the Brockton Fair.

The Ayer Electric Light Company, through its president, Mr. Alfred Clarke, has appealed to the Massachusetts Gas & Electric Light Commission against the recent action of the local board of selectmen in granting a franchise to the Connecticut River Transmission Company to erect poles and wires within the town. The filing of the appeal brings to the front again the question of a division of the power market between a local central station and a hydroelectric company within

economic radius of a given territory. In the cases of the Fitchburg and Worcester companies, the board's recommendation that the Connecticut River Transmission Company confine itself to customers having connected loads of 300 hp and over, or annual energy consumptions of not less than 450,000 hp-hours, appears to be working most satisfactorily. The definition of the limits of the power market in the cases of smaller towns, however, if any is to be determined, remains unsettled. It is probable that the policy of the board, as laid down in the Fitchburg and Worcester cases, will be extended so far as is necessary to protect the interests of existing small companies, and at the same time to encourage the entrance of transmitted power into communities that will be benefited by its utilization by consumers in considerable bulk. The outstanding decisions of the commission upon this general question are of a definite character and can readily be applied to communities of widely varying population and power demands, with the modification of the market limit necessitated by each case. On account of the exhaustive evidence presented to the commission in the Fitchburg and Worcester cases, it is probable that subsequent questions of this kind will be threshed out with a relatively small amount of expert testimony before the commission, and the line of procedure appears well marked.

New York Commission News.

The Public Service Commission, Second District, will this week give hearings as follows: To the Avon Electric Company on the approval of its franchise from the town of Geneseo. Cataract Power & Conduit Company, Niagara Falls, on an application for authority to issue $178,000 in 5 per cent bonds, to be secured by a first mortgage.

Maryland Commission News.

The Maryland Public Service Commission took up the complaint of Marion G. Dinsmore and others against the fares charged by the United Railways & Electric Company, of Baltimore, for transporting passengers from Howard and Franklin Streets, in the city, to Sparrows Point. At the original hearing it was agreed, in order to give the commission a clear insight into the matter, that the complainants should submit to the officials of the Railways Company a list of interrogatories touching upon matters relative to which specific information is desired. This has been done, but it appeared last week that neither the questions nor the answers thereto were specific enough. Hence the case was postponed until amended and more specific interrogatories can be filed and the company has had time to answer.

The agitation against the proposed rates for telephone service which were submitted to the commission some weeks ago by the Chesapeake & Potomac Telephone Company is growing more pronounced each day and the commission is receiving numerous letters of protest from telephone subscribers who are objecting to the new schedule of prices. The Merchants' and Manufacturers' Association, perhaps the most important commercial organization in the state, is making a thorough study of the entire telephone question, but has not yet communicated with the commission on the subject at all. While many of the individual members of the association are opposed to the new schedule of prices, yet the organization will not be heard from until it has had time carefully to study the situation from all sides.

The chief objection to the proposed schedule of rates is, as stated previously, the abolishment of unlimited service in the business section. The president of the Gottlieb-Bauernschmidt-Straus Brewing Company, Mr. George H. Stickney, in a communication states that while at first sight there seems to be an element of unfairness in making the patron who possibly uses his telephone 100 times a day [illegible] uses his only 10 times a day, such apparent unfairness, he believes, is altogether unreal when properly considered. His argument is as follows:

"A telephone company is a public-service agency, and it as well as the general public, is the gainer by the extensive use of the telephone. A man's own use of his telephone is no measure of its service to him. A retailer, for example, may have occasion to use his telephone but a few times a day, yet he is vitally interested in having 'phones widely and cheaply in use, so that as many customers as possible may call him up. He might suppose that a measured service might reduce his telephone bill, but it might easily, by shutting off the more frequent use of the 'phone by his patrons, cost him considerable business. In this sense every business house, no matter how few its out-going calls, is vitally interested in making the use of the telephone generally more common and more cheap. A measured service will not only greatly curtail the general use of telephones, but the experience of those of us who have tried it shows that it causes more friction and suspicion and belief in corporate mendacity than the proverbial gas meter. The consumer of measured telephone service, unless he keeps a special clerk for that exclusive purpose, has no way of keeping check on his calls. He is at the mercy of the company. We use a number of telephones, some under old contracts for unlimited service and some under the limited or measured service system and we know from our own experience how unsatisfactory the latter system is."

Canadian Hydroelectric Commission News.

On Sunday and Monday, Sept. 4 and 5, the commission's double transmission line from Niagara Falls to Dundas, and the single line from Dundas to Berlin, were put through a test under 165,000 volts. Hon. Adam Beck, chairman of the commission, stated on the following day that the test showed unmistakably that power could be safely transmitted at the high voltage, which was 55,000 volts higher than the regular voltage of the line when in continuous operation by the commission, which will be 110 000 volts. This test, he said, means that power will be transmitted and supplied to the various municipalities at a price much lower than was furnished in the estimates made by the commission some years ago. Mr. Beck stated that the whole of the transmission line would be finished and in operation before the end of this year. He would not speak of the situation west of London, Ont., as this was a matter of government policy with which the commission has nothing to do.

Contracts have been let at Galt, Ont., for the remodeling of the old board ot works building on Dickson Street, which will be used as a distributing station for the hydroelectric power.

Wisconsin Commission News.

The commission has approved the revised schedule of rates filed by the Milwaukee Electric Railway & Light Company. The new schedule covers charges for electric service for commercial, residence and display lighting and for power in the city of Milwaukee. Since there was no increase in rates involved, there were no public hearings, and the company merely exercised its option under the law.

Reductions have been effected in some branches of the service by the readjustment, but there is no general reduction. The revised schedule, however, contains two features which are of special interest, namely, reduced rates for that class of service defined as "off-peak" service and also for what is called the "ten-seven" service, or service during the hours 10 p. m. to the following 7 a. m. Following are the main points of the new schedule:

STANDARD RATES.

The company offers a standard rate to all consumers who sign the standard form of contract providing for service for

one year or more. This rate consists of a demand plus an energy charge and is computed on the following basis:

A demand charge, payable in equal monthly installments, as follows: $42 per year for each kilowatt of demand of the first 10 kw; $30 per year for each kilowatt of demand of the next 50 kw; $24 per year for each kilowatt of demand in excess of 60 kw.

An energy charge as follows: 5 cents per kw-hour for the first 100 kw-hours consumption during month; 4 cents per kw-hour for the next 900 kw-hours consumption during month; 3 cents per kw-hour for the next 3000 kw-hours consumption during month; 2 cents per kw-hour for the next 6000 kw-hours consumption during month; 1.5 cents per kw-hour for all energy consumed in any month in excess of 10,000 hours.

The foregoing rates apply to all consumers utilizing the company's service for commercial lighting and receiving free renewals of the company's standard lamps. These rates, less ½ cent per kw-hour, are also to apply to (1) all consumers utilizing the company's service for the operation of electric motors and not receiving any free renewals, and (2) to all consumers who use the service for any purpose and who do not receive free lamp renewals.

The revised schedule provides that the maximum rate of charge for service during any month shall not be greater than the rates that would be obtained under the existing increment rate schedule, which ranges from a charge for lighting service of 12 cents per kw-hour for the first 100 kw-hours during any month to 3 cents for all energy in excess of 30,000 kw-hours during any month. This includes the 5 per cent discount allowed for prompt payment. The existing increment rate for power service ranges from 8 cents per kw-hour for the first 100 kw-hours per month to 3 cents for all energy in excess of 600 kw-hours during any month.

LIMITED OR "OFF-PEAK" SERVICE.

The foregoing rates for lighting and power service, respectively, less one-half the "demand" charge, are to apply to all consumers contracting to utilize and utilizing the company's service at times during the calendar day other than during the hours of the month specified as follows:

Hours during which service shall not be used: October, 5:30 p. m. to 7 a. m.; November, 5 p. m. to 7 a. m.; December, 4:30 p. m. to 7 a. m.; January, 4:40 p. m. to 7 a. m.; February, 5:20 p. m. to 7 a. m.; March, 6 p. m. to 7 a. m.

"TEN-SEVEN" SERVICE.

The foregoing rates for lighting and power service, respectively, less three-quarters of the demand charge, shall apply to all consumers contracting to utilize and utilizing the company's service only during the hours 10 p. m. to the following 7 a. m.

MINIMUM MONTHLY PAYMENT.

The minimum monthly payments are to be the monthly installments of the annual demand charges, provided that the minimum monthly payment is not greater than the minimum monthly charge that would be made under the existing schedule, as follows: For lighting service a minimum payment of $1 and in addition thereto 25 cents for each glower of each Nernst lamp installed, and $1.50 for each arc lamp installed; for power service, a minimum charge of $2 for an installation of 2 hp or less, nominal rated capacity, and in addition thereto $1 for each horse-power or fraction thereof of rated capacity in addition to the first 2 hp.

MEASUREMENT OF DEMAND.

In the application of the "standard rate" the consumer's demand is to be determined by measurement or assessment as follows:

(A) Lighting Service (commercial lighting).—(1) In installations of 1 kw connected and less the demand is to be determined as 100 per cent of the first 300 watts connected, [illegible] 300 watts, except where tests indicate the demand to be larger than that computed on this basis. (2) In installations greater than 1 kw connected the demand is to be measured.

(B) Power Service.—The demand of a consumer using the company's service for power shall be determined as the maximum rate at which energy is used for any continuous period of 15 consecutive minutes, as shown by an integrating wattmeter.

(C) Residence Lighting Service—To consumers contracting for service for one year or more for residence lighting service with free renewal of the company's standard lamps, the following rate is to be used: (a) Primary charge of 12 cents per kw-hour for (1) the first 4 kw-hours consumed per month for each of the first four active rooms; (2) the first 2½ kw-hours consumed per month for each of the active rooms in addition to the first four. All rooms counted as active except three bedrooms, bathrooms, basement, garret, closets and back porch. (b) Secondary charge of 5 cents per kw-hour for all energy in excess of that paid for at the primary rate in (a) up to a total of 100 kw-hours and 4 cents per kw-hour for the next 900 kw-hours.

The schedule contains a flat rate for display lighting when on yearly contract. The monthly payments range from $3.35 for a 300-watt installation to $92.25 for a 10-kw installation when the service is given from dusk to 11 p. m. For midnight service the rates range from $3.80 to $101.40, respectively.

SHORT-TIME RATE.

To consumers obtaining service for periods of less than one year the charge for service is to be computed according to the existing increment rate schedules, with the prompt payment discount of 5 per cent applied, as follows:

Lighting Service.—First 100 kw-hours during any month, 12 cents per kw-hour; second 100 kw-hours during any month, 10 cents per kw-hour; third 100 kw-hours during any month, 8 cents per kw-hour; next 300 kw-hours during any month, 6 cents per kw-hour; next 14,400 kw-hours during any month, 4 cents per kw-hour; next 15,000 kw-hours during any month, 3.5 cents per kw-hour; all energy in excess of 30 000 kw-hours during any month is at the rate of 3 cents per kw-hour.

Power Service.—First 100 kw-hours during any month, 8 cents per kw-hour; second 100 kw-hours during any month, 6 cents per kw-hour; third 100 kw-hours during any month, 5 cents per kw-hour; next 300 kw-hours during any month, 4 cents per kw-hour; all energy in excess of 600 kw-hours during any month is at the rate of 3 cents per kw-hour.

The company offers a discount of 5 per cent of the first $25 on all bills and 1 per cent discount on amounts in excess of $25 for payment within 10 days of date and where a special discount is not specified in the schedule. The above revised schedule of rates went into effect Sept. 1.

Upon application of the Sheboygan Light, Power & Railway Company the commission has revoked the certificate of authority to issue $114,000 of bonds, granted Jan. 24, 1910, and has now issued a certificate allowing the company to issue $205,000 of stock. The issue is to consist of 2050 shares of common stock of par value of $100 each. This stock is to be issued in exchange for an equal amount of outstanding indebtedness against the company which was incurred by reason of the company having expended its revenue for extensions and additions to its property.

CURRENT NEWS AND NOTES.

Electric Signs in New York.—The erection of a high and monumentally, extremely ugly tower at Times Square, New York City, exclusively for displaying advertising, has started a discussion in the newspapers in which considerable criticism is directed against unsightly electric signs. The city superintendent of buildings has suggested an amendment to the building code which will give authority to city officials to regulate the placing of signs on the sides and tops of buildings

One Hundred and Sixty-five Thousand-Volt Transmission.—The Canadian Hydroelectric Commission has made a successful experimental test of its double line from Niagara Falls to Berlin under a voltage of 165,000. The chairman of the commission intimated that the working voltage may be raised from 110 000 to that of the test.

Chicago Electric Club.—The Chicago Electric Club held its first meeting of the fall Sept. 7 at the usual place. Mr. F. M. Bushnell, manager of the Illinois Maintenance Company, gave a very interesting talk on some of his observations and experiences during a two months' vacation trip to Europe. Mr. Bushnell was so entertaining that the vote of thanks which was passed included an invitation to give another talk on the same subject at some later meeting.

Interesting Gift to A. I. E. E. Library.—Mr. Thomas A. Edison recently presented to the library of the American Institute of Electrical Engineers the diary of Prof. S. F. B. Morse. The book contains 45 pages of copies of official correspondence with the United States Treasury by Morse as superintendent of electromagnetic telegraphs, followed by eight pages of personal notes. The dates range through 1843 and 1844, while some of the later entries were made in 1848.

Marconi Transatlantic Station.—The transatlantic Marsoni station at Glace Bay, N. S., recently opened covers 150 acres of ground. The fan-shaped aerial wires are 6000 ft. long and about 1000 ft. wide, and are supported by 30 masts each 250 ft. high. The instruments are of the most powerful make, having a radius of 3000 miles, although in communicating with the Clifden station the electromagnetic waves have only 1700 miles to travel. The rate for land messages is 17 cents per word, including land tolls.

Name for Indianapolis "White Way."—A prize of $25 offered by the Indianapolis Commercial Club for the best and most appropriate name for the new Indianapolis electric street lighting was won by Mr. A. D. Kelley, who suggested "Broadways and Brightways," which term has been adopted. Among other names suggested were "Bright Lights," "Miles of Light," "Great Tungsten Way," "Lightest, Whitest, Brightest," "Glow Path," "Streets of Sparkling Splendor," "Streets of a Thousand Lights" and "The Vendetta of Night."

British Institution of Consulting Engineers.—The Institution of Consulting Engineers now in process of organization in Great Britain is the subject of considerable correspondence in English engineering journals. The proposal that engineers shall only be admitted to the institution after examination is very strongly criticised by one of our English electrical contemporaries, which says that a consulting engineer should be a man of wide knowledge and experience, and to subject him to an examination would be intolerable. A matter of much criticism has been the proposal that membership shall be confined to engineers who have previously been admitted to the Institution of Civil Engineers. One proposition is that, instead of the body now being formed, a Royal Institution of Engineeers should be established, which would be entirely independent of any of the present engineering bodies.

New York-Washington Underground Telephone Service. —At the meeting last week [illegible] graph and Telephone Conference, Mr. J. J. Carty, chief engineer of the New York Telephone Company, presented a paper giving particulars of an underground cable to be laid this fall between New York and Washington, which will be used for both telephone and telegraph service. It was stated that the cable will later be extended from New York to Boston. It was also stated that with the system of operation to be used three telephone conversations will be possible over each of the cable circuits at once without interference of any kind, and simultaneously six independent telegraph messages may be sent without interfering with each other or with the telephone conversations. This system, it was added, will be applied to the overhead telephone circuits between New York and Chicago.

Southern Power Company's Auxiliary Steam Plants.—The Southern Power Company, of Charlotte, N. C., will build three auxiliary steam plants as reserves for its hydroelectric service. It is reported that one of these, having a capacity of 10,000 hp, will be erected in Durham.

Electrical Cooking on War Vessels.—After elaborate tests the Navy Department has installed electric ranges and electric bakers on the *Dixie*, and is considering electric cooking upon practically all the battleships and cruisers. The tests of these cooking devices were made at the Navy bakery school near Newport, R. I.

Taxes Not to be Taken Out of Workingmen's Wages.—A Chicago judge has directed that the wages of conductors and motormen on the Suburban Electric Railway be raised from 25½ cents to 29 cents an hour. Officers of the company declared that the line does not earn enough money to pay its taxes. "Then the property ought to be sold," said the judge. "You should not expect the workingmen to pay the company's taxes."

Connecticut Public Service Commission.—President Mellen, of the New York, New Haven & Hartford Railroad, has announced that he is not opposed to the enactment of a proper law for a Connecticut public service commission. He believes that "the Legislature properly may in language to be chosen with a deliberate care commensurate with the importance of the subject declare and define the legal duties to the public of those who furnish commodities or services to the general public; and that legislative machinery may properly be created and maintained which will with practical certainty bring to light and correction any violations of the laws so enacted." Referring to court reviews of the decisions of such a body he said that a trial of intricate commercial questions in the existing courts will be unsatisfactory because of technical procedure and necessary delays, and suggested the idea of the establishment of a court of commerce for the trial of such cases, in which the procedure shall be simple, sensible and speedy.

Pure Mathematics.—In an address before Section A (mathematics and physics) of the British Association at its recent Sheffield meeting Prof. E. W. Hobson, chairman of the section, said that there exists a widespread impression among physicists, engineers and other men of science that the effect of recent developments of pure mathematics, by making it more abstract than formerly, has been to remove it further from the order of ideas of those who are primarily concerned with the physical world. "The prejudice that pure mathematics has its sole *raison d'être* in its function of providing useful tools for application in the physical sciences—a prejudice which did much to retard the due development of pure mathematics in this country during the nineteenth century—is by no means extinct. But a great department of thought must have its own inner life, however transcendent may be the importance of its relations to the outside. Even with a view to applications, if mathematics is to be adequately equipped for the purpose of coping with the intricate problems which will be presented to it in the future by physics, chemistry and other branches of physical science, many of these problems probably of a character which we cannot at present forecast, it is essential that mathematics should be allowed to develop itself freely on its own lines. Who knows what weapons forged by the theories of functions, of differential equations, or of groups, may be required when the time comes for such an empirical law as Mendeléeff's periodic law of the elements to receive its dynamical explanation by means of an analysis of the detailed possibilities of relatively stable types of motion, the general schematic character of which will have been indicated by the physicist?"

Meter Tests.—Of 28 electric meters tested on complaint in August by the New York City Public Service Commission 1 was fast and 27 were slow; of 179 gas meters tested, 53 were fast.

Flaming Arcs for Coast Lighting.—The U. S. Lighthouse Board has installed a number of flaming-arc lamps in lightships. The first installation was made on the Ambrose Channel lightship, New York Bay.

Train Despatching on the Lackawanna Railroad.—The use of the telegraph in the despatching of trains on the Delaware, Lackawanna & Western Railroad has been entirely discontinued. Trains are now despatched by telephone altogether, and the service is said to be superior in all respects to the telegraph. The company is operating 271 telephone stations on its system, and is now establishing a telephone message system for the transaction of service business.

Cheap Telephone Service in Australia.—Dr. Alexander Graham Bell, who spent the summer in Australia, is reported to have been impressed with the cheapness of the Australian telephone service. Public telephones may be used at a penny a call and rates for private instruments are also low. Dr. Bell, with Mrs. and Miss Bell, was the recipient of many social attentions, which they returned in a measure by giving a reception in Sydney in the quarters of Mr. H. D. Baker, the American vice-consul-general.

Electric Railway for Ore Transportation in Brazil.—Construction work was recently begun on the first of two 25,000-kw hydroelectric generating stations on the tributaries to the Doce River, in Brazil, which will furnish energy for an electric railway, 400 miles in length, between Victoria and Itabira, in the state of Minas Geras. The region penetrated by the new electric railway is a mining country producing large quantities of iron ore, the transportation of which to the coast will be the principal business of the new road. In building the road about 250 miles of existing narrow-gage steam roadbed will be utilized, the track being converted to standard gage. The railway is being constructed by British interests which own the iron-ore workings, and the electrical equipment will be of English manufacture.

Invention.—In a recent address before the British Association Professor Hobson, in referring to mathematical invention, said that a most interesting account has been written by one of the greatest mathematicians of our time, M. Henri Poincaré, of the way in which he was led to some of his most important mathematical discoveries. He describes the process of discovery as consisting of three stages: the first of these consists of a long effort of concentrated attention upon the problem in hand in all its bearings; during the second stage he is not consciously occupied with the subject at all, but at some quite unexpected moment the central idea which enables him to surmount the difficulties, the nature of which he has made clear to himself during the first stage, flashes suddenly into his consciousness; the third stage consists of the work of carrying out in detail and reducing to a connected form the results to which he is led by the light of his central idea. Professor Hobson concludes, it thus appears, that, after all, a mathematician is a human being, not a logic-engine. He might have added that the process of invention described differs little from that of the industrial inventor.

Electric Light and Gas Heat.—An article in a gas publication having for its purpose to instruct gas men how, in competition with electricity, to combat the "heat argument which you find so hard to meet" suggests as one reply—"Where we have light we have heat." As an illustration, though not a very apposite one from the gas-heat standpoint, the case is cited of a large restaurant in Philadelphia "where, for the past three years, all the electric incandescent lamps are changed in June to lamps of half the regular size, and are not changed back until October. The manager of this place proved conclusively that people would not go into a brilliantly lighted interior on the hot summer days because of the association in their minds of 'light and heat.' A gas lighted store with an average of 15 to 20 foot-candles intensity would be hotter than an electric lighted store with an intensity of 2 foot-candles."

British Post Office Telephone and Telegraph Increases.—The Post Office Department of the United Kingdom now transmits 250,000 telegrams daily. Its telephone business has also increased rapidly, 123 new exchanges having been opened in 1909. The number of subscribers increased 12 per cent and the number of calls 15 per cent during the last year. The National Telephone Company, which is the principal operating company in the British Isles, has arranged to transfer all of its rights and properties to the government before the close of 1911, the terms of the transfer having been already agreed upon. Within three months, the Postmaster-General reports, the number of wireless messages received and sent has been doubled. Following the recent purchase of wireless-telegraph stations along the coast it is the future plan to have a complete ring of such stations encircling Great Britain and Ireland.

Municipal Plant Operation at Amsterdam.—The receipts of the municipal electric light plant at Amsterdam, Holland, amounted to $550,098 during 1909, according to the American consul there, Mr. Frank W. Machin. For the same year the expenditures totaled $217,458, and after paying interest to the amount of $84,408, writing off $159,190, and putting aside a reserve of $2,894, there remained a balance of $86,148. The total amount of electricity delivered for lighting and motor service was 16,176,359 kw-hours, of which 8,003,063 kw-hours went to private parties, 2,010,265 kw-hours to the municipality (except street cars), and 6,163,031 kw-hours to the street-car service. For lighting purposes private parties paid at the rate of 5 cents per kw-hour and the municipality 4.5 cents; for motor service, private parties paid 3 cents and the municipality 2.7 cents. For its operating energy the street-car service paid [illegible] cents.

New Encyclopædia Britannica.—The University Press, of Cambridge, England, announces that it has taken over the publication of the Encyclopædia Britannica and will issue a new and complete edition about the end of the present year. This edition—the eleventh—has been under preparation for some years, and will comprise 28 volumes, printed on India paper and bound in flexible leather. By the use of this thin paper the set will be reduced in weight from 200 lb. to 60 lb., and the shelf room from 6 ft. to 2 ft., while the flexible binding will enable a volume to be held open cover against cover. All of the volumes will be issued simultaneously. The work has been taken over by Cambridge University, not as a commercial enterprise, but in accordance with an educational policy which has led to its publication of the Cambridge Modern History, the Cambridge History of English Literature, and the collected works of leading men of science, such as Rayleigh and others.

Federal Control and Limited Franchises for Water Powers.—The recent National Conservation Congress in St. Paul adopted a platform demanding national control of the country's natural resources. In relation to water-power development the congress thus expressed itself: "Recognizing the vast economic benefit to the people of water-power derived largely from interstate sources, streams no less than navigable rivers, we favor federal control of water-power development. We deny the right of the states or the federal government to continue alienating or conveying water by granting franchises for the use thereof in perpetuity and we demand that the use of water rights be permitted only for limited periods with just compensation in the interests of the people. We demand the maintenance of the federal commission empowered to deal with all uses of the waters, and to co-ordinate these uses for the public welfare in co-operation with similar commissions or other agencies maintained by the states."

CENTRAL-STATION AT ATTLEBORO, MASS.

Steam Turbines Displacing Reciprocating Engines in Installation of Moderate Size.

THE popularization of electricity in a manufacturing community of moderate size is a problem of much interest on account of the diversity of service required to secure a good per capita revenue. The technical problems of station design and distribution are also likely to be somewhat varied in a compact community where central-station service has been given for many years. An interesting example of a progressive organization serving a town of about 16,000 inhabitants is afforded by the Attleboro Steam & Electric Company, of Massachusetts, which supplies electricity to a territory located about 33 miles south of Boston on the main line of the Providence Division of the New York, New Haven & Hartford Railroad. The town of Attleboro is one of the most noted centers of jewelry manufacture in the United States. Electrical service has been supplied to it since 1888, when the present company was organized. From small beginnings the service has been extended from year to year until at the present time the company is supplying electricity to about all the manufacturing establishments in the community, there being but three steam engines other than those in the station in the town. Street, residential and [illegible] lighting [illegible] whose gross earnings for the year ending June 30, 1909, were [illegible]526.18, or about $5.35 per capita. The present connected motor load is about 2000 hp, or 1 hp to every eight residents of the town.

The generating station of the company is located on the banks of a 37-acre pond about 1¼ miles north of the business center. The plant illustrates the tendency of the steam turbine to supersede the reciprocating engine even in moderate capacity installations, and affords an interesting example of central-station evolution. The building is a brick and steel structure about 140 ft. long by 80 ft. in maximum width, and it contains an engine-room at the left, a turbine-room in the center and a boiler house at the right. At the south end of the boiler house a 130-ft. circular brick stack is installed to provide natural draft for the plant, and the coal supply is received from cars which are hauled to the plant by an electric locomotive of the Interstate Consolidated Street Railway Company. These cars are run upon a trestle outside the boiler house, from which the fuel is dumped into a storage yard having a capacity of about 6000 tons.

Coal is fired to the boilers by hand, and the boiler-room is provided with a firing aisle 18 ft. wide. A set of scales is provided between the coal pocket and the firing aisle. The company burns approximately 4000 tons of New River coal per year, and the present cost is $4.03 per ton delivered at the bin. In order to facilitate clean firing there are placed opposite the various batteries of boilers hard pine bulkheads set in the floor for a height of about 3 ft., and each barrow load of coal is delivered against the bulkhead, the fireman working from the barrier toward the boilers. This avoids strewing the entire boiler-room floor with ill-assorted piles of coal, and a clear passage is left behind the partition for the barrows of coal brought in from the storage yard and delivered to the platform scales. The boiler-room is 80 ft. long by 40 ft. wide, and now contains 1600 hp of B. & W. boilers equipped with a Spencer damper regulator, and connected with an 1800-hp Green fuel economizer. The economizer is installed in a bay at the west end of the boiler-room and its scrapers are driven by a 2-hp. 110-volt Westinghouse induction motor. The economizer raises the feed-water temperature from 160 deg. to about 225 deg.

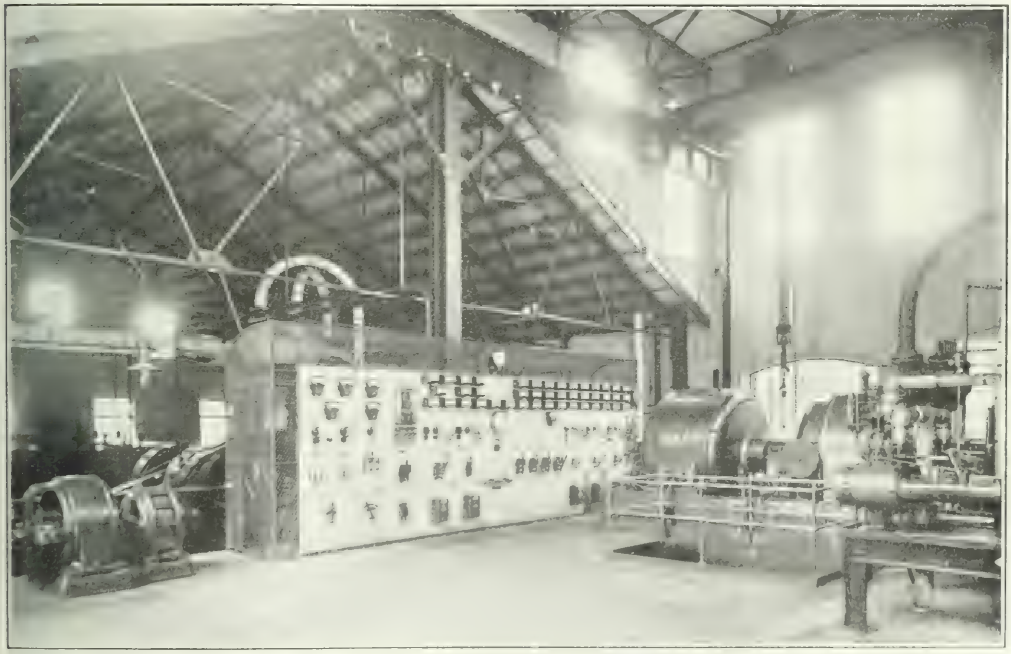


Fig. 1.—Turbine-Room of Attleboro Steam & Electric Company.

The turbine-room is shown in Fig. 1 and the engine-room in Fig. 2. [illegible] and two direct-connected units, all the generators being of the three-phase type, wound for 2300 volts and delivering 60-cycle current. The total generating capacity of the engine-room is [illegible]

& Sims simple engine, a 250-kw alternator driven by a McIntosh & Seymour horizontal, tandem-compound, condensing engine, and a 500-kw machine coupled to a Lane & Bodley cross-compound engine. All the station wiring is run in conduit. Each unit is provided with a separate exciter operating at 125 volts, the exciter being belt-driven from the engine flywheel or alternator shaft. The 100-kw machine is ordinarily run only from 1 a. m. to 4 a. m.; the 250-kw set is run on Sunday evenings, and the 500-kw set is held in reserve in case any of the other equipment gets into trouble. Each of the two larger alternators is a revolving-field machine of General Electric make.

The turbine-room adjoins the engine-room, but the floor level of the latter is about 5½ ft. above the former, in order to provide space for auxiliaries below. There are two 750-kw horizontal Curtis turbines installed, each being wound for three-phase, 2300-volt, 60-cycle current delivery. The turbine-room is served throughout its entire length by a 15-ton Northern hand-operated crane. The station output is measured and con- [illegible] across the station parallel to the length of the turbine-room. At the rear of, and below, this switchboard is the older engine equipment of the plant, and in order to provide for proper synchronizing a synchroscope is installed on each side of the board. The back of the switchboard is heavily screened in to protect both the service and employees. The turbines are of the four-stage type, and at the time the photograph was taken but one machine had been set up. The switchboard was placed parallel to the direction of turbine-room expansion in order to facilitate operation under all anticipated future conditions, although this involved cutting off part of the view of the older portion of the station from the new section. It is probable, however, that the older equipment, shown in Fig. 4, will before long give way to the more modern turbine apparatus, and it is likely that the station load will be almost entirely handled by the turbine units. In fact, only a small portion of the load has been carried by the engines for many months, although the company has but recently substituted the horizontal type of turbine for a vertical installation.

Fig. 2—Source of Water for Condensing Purposes.

The older portion of the station is built with a corrugated-iron roof, while the turbine-room is provided with a tar and gravel concrete roof. An extra exciter is provided in connection with the old Armington & Sims engine, so that in case the plant becomes shut down for any cause the turbines can readily be excited. Normally the excitation of the turbines is supplied by a 27-kw, 125-volt generator driven by an induction motor. An additional exciter will shortly be installed and operated by a 500-hp synchronous motor which is designed to raise the power-factor of the station from 65 per cent to about 90 per cent.

A special feature of the turbine-room is its lighting. This is accomplished by 80 carbon lamps of 16-cp and 110-volt rating, the lamps being mounted on the under side of the crane girders, spaced 24 in. apart on centers and hung about 25 ft. above the floor. The walls are cream-colored and a portion of this installation is shown in Fig. 1. The turbine-room also contains two Worthington duplex boiler-feed pumps automatically controlled by a Squires governor installation. Above the pumps are installed 12 16-cp lamps at a height of about 12 ft. A National feed-water heater is also installed in close proximity to the turbine set. All the station steam auxiliaries are supplied at 100 lb. pressure through a Mason reducing valve, while the main units are supplied at 150 lb. pressure and 125 deg. superheat.

Condensing water is supplied from the pond shown in Fig. 2, the circulating pump being about 9 ft. below the high-water mark of the pond. The circulating water is handled by a Kingston centrifugal pump coupled to a Westinghouse vertical engine. A 27-in. vacuum is obtained in the summer and a 29-in. vacuum in winter, a Bulkley barometric condenser being installed. The pond shown in the illustration, Fig. 2, is provided with a dam 40 ft. long, and flash boards can be used to raise the head 1 ft. more when necessary. The injection water is provided through two 30-in. pipes, which are carried underground to two concrete wells 8 ft. deep and 6 ft. in diameter, from which delivery is made to the condenser equipment. Valves are provided in the terra-cotta pipes, outside the power house, and screens are installed at the entrance of the intakes and also at the wells. The discharge water from the condenser is delivered by two 30-in. pipes into a canal 420 ft. long, 20 ft. wide and 8 ft. deep, which turns the water back into the pond as indicated in Fig. 2. The transformer shown in the photograph is connected to a motor-driven ice-cutting equipment installed in an ice house adjacent to the pond.

The plant is well provided with locker and toilet-room accommodations. A repair shop, 25 ft. long by 15 ft. wide, is installed at one end of the engine-room, and there are a grinder, drill and lathe group-driven by a 3-hp, 110-volt induction motor located on a framework about 8 ft. above the floor. A small power-house stockroom is also in use, with 24 bins marked for various fittings and supplies. Oil barrels are handled in the plant by placing them in a wooden cradle which runs on wheels and can be easily moved by hand.

Fig. 3—Office and Display Room.

The old engine-room contains three 75-light tub transformers for the street-lighting system, a current of 6.6 amp being used in this service. The circuits are controlled by plug switches mounted on three panels equipped with watt-hour meters. Rubber mats are provided for floor service in front of the panels. To guard against accidents when linemen are at work outside of the station, the company requires each man to place a red tag on the proper plug, and no one is allowed to remove this tag except the person who places it in position. The tag

is 4[illegible] in. long by 2[illegible] in. wide [illegible] the end of a wooden plug soaked in paraffin. [illegible] tag is used by trimmers. The red tag states [illegible] is working on the line, and the green tag is [illegible] for its service.

The cost of production at the [illegible] plant, exclusive of fixed charges, is given in the [illegible] for the years ending June 30, 1908 and 1909, the [illegible] from the returns of the company to the [illegible].

COST OF ELE[illegible]

Kw-hours manufactured	[illegible]	[illegible]
Coal consumed [illegible]	[illegible]	[illegible]
Cost of coal per ton	[illegible]	[illegible]
Fuel cost	[illegible]	[illegible]
Rentals	[illegible]	[illegible]
Oil and waste	[illegible]	[illegible]
Water	189.16	[illegible]
Wages at station	[illegible]	[illegible] 42
Station building repairs	6,278.78	[illegible],717.08
Steam equipment [illegible]	[illegible]	108.95
Electrical equipment [illegible]	[illegible]	981.05
Apparatus and [illegible]	35.73	[illegible]
	[illegible]	234.18
Total manufacturing cost	[illegible]	[illegible]
Average cost of manufacture per kw-[illegible]	[illegible]	[illegible]

The company sold 1,645,[illegible] [illegible] 1,791,842 kw-hours in 1909, the [illegible] kw-hours and 1,170,568 kw-hours [illegible]. The fuel cost per kw-hour was 0.85 cent in the [illegible] in the second. The [illegible] cost per [illegible] 1909, 0.7 cent. The station [illegible]

same each year. The difference in the cost of production in the two years was due largely to the decreased price of coal in 1909, the fuel economy of the plant remaining substantially the same in each case. The increase in the output helped the company to reduce the unit cost also. One striking feature of the plant's service is the relatively large amount of motor load [illegible] motor requirements [illegible] per cent of the energy sales in 1908 and [illegible] per cent in 1909. It is anticipated that the cost of manufacture will be [illegible] further as [illegible] the load continues to grow. The company shares its economies with its customers by making liberal reductions in rates as the energy consumption [illegible].

The company has effected economies in its distribution system by making, for several years past, thorough studies of the energy losses in the various lines. Through the personal efforts of Mr. Edgar Tregoning, general manager, these losses have been cut down from a total of 25 per cent to [illegible] per cent, the work having been done largely by comparing meter readings at the station with the readings on customers' premises and also by examining different lines as regards their loads and drops, rearrangement of transformer services and substitution of larger for small scattered transformers.

On June 30, 1909, the company had 23[illegible] transformers in service, the most common size taking care of 12 lamps, of which [illegible]

Fig. [illegible]—Engine Room in Older Part of Attleboro Station

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

use and 60 of the 20-light size, which was the next in number operating. At the present time the company has 113 motor customers with an aggregate of about 226 electric motors in service, the size varying from ¼ hp to 50 hp, and the average rating per motor being 8.85 hp.

The offices of the company are located at 40 North Main Street, in the center of the town, and are unusually attractive for a small organization. Fig. 3 shows the interior of the office, covering that portion of it which is devoted to the exhibition and demonstration of apparatus and the supply of lamps to customers. The offices are furnished in the Mission style and cover a frontage of about 20 ft. On each side of the entrance is a display window containing electric flatirons, induction and other motors, electric stoves and toasters. An electric sign bearing the designation "Light and Power" is hung across the sidewalk in front of the office, the sign being about 14 ft. long. Inside the offices are a demonstration table with appropriate switches and outlets for the operation of small apparatus, a section containing an electric washer, vacuum cleaning equipment, luminous radiator, chafing dishes and other heating equipment, and a large cabinet containing a variety of electric cooking utensils. The outer office is about 25 ft. long by 15 ft. wide, and is lighted by a 500-watt tungsten lamp equipped with a bowl-shaped reflector. At one side of the office is a counter above which are placed lamps and shades of various types, including 11 outlets wired for service. In the center is hung a meter equipped with a socket into which can be screwed different sizes and types of incandescent lamps or small heaters to show the prospective customer the relative energy consumption of different equipment. Behind the counter is a cabinet equipped with 16 storage bins properly labeled and containing different sizes and styles of incandescent lamps. The bins are provided with oval hand-holes, there being no hinges on the outside covers of the bins. The absence of the hinges gives a larger capacity per bin and no time is lost in selecting the right style of lamp. The exhibit also includes a demonstration ammeter and watt-hour meter, electric ironing board and other household apparatus. The private and general offices of the company are located at the rear of the outer office, including a private office for the general manager and provision for the storage of records.

The accompanying table shows the energy rates of the company for motor circuits, which vary from a net price of 7 cents to 1¾ cents per kw-hour, according to the consumption. The company prints its rates upon a neat card of vest-pocket size. In order to keep its data in convenient form the company has in use a bulletin board containing strips of cardboard showing the name of each customer on motor circuits and the number and rating of motors in service on his premises. The

Fig. [illegible]—Exterior View of Station.

load includes motors in printing, pumping, carriage shop and tool-making establishments, the operation of passenger and grain elevators, newspaper presses, blacksmith shops and other miscellaneous service. The company's peak load in 1909 was 1450 kw. The average load is now about 600 kw. The load from the jewelry factories is heaviest from August to January, there being considerable night work in the shops in the latter part of the season.

There are about 31,000 16-cp equivalents connected to the system for commercial and residential lighting service. There are also 110 commercial arc lamps in operation on the system at 110 volts, alternating current. The company charges 14 cents per kw-hour with a minimum monthly charge of $1 to residential customers and 10 cents per kw-hour for commercial lighting, with the foregoing minimum charge. The motor load includes two small refrigerating plants in market service operated by 3-hp and 5-hp motors. Although the company has made no special effort to push the sale of electric flatirons by giving any specified free trial there are now about 435 irons in service. In the street-lighting service are 119 arc lamps of the 6.6-amp

Attleboro Steam and Electric Co.

RATES FOR ELECTRIC POWER

List Price 10c per K. W. Hour, or 7½c per H. P. Hour

K. W. hrs. used per mo.	Equiv. Avge. H. P.	Discount per cent.	Net price per K. W. hour. Cents.	Net price per H. P. hour. Cents.	Net price per H. P. per yr. (3000 hrs.)	Min. Amt. monthly bill.
475	2.53	30	7.	5.25	$157.50	$33.25
650	3.46	35	6.5	4.87	146.10	42.25
850	4.53	40	6.	4.5	135.00	51.00
1050	5.60	44	5.6	4.2	126.00	58.80
1200	6.40	47	5.3	3.975	119.25	63.60
1400	7.46	50	5.	3.75	112.50	70.00
1600	8.53	53	4.7	3.52	105.60	75.20
1800	9.60	56	4.4	3.3	99.00	79.20
2000	10.66	58	4.2	3.15	94.50	84.00
2200	11.73	60	4.	3.	90.00	88.00
2400	12.80	62	3.8	2.85	85.50	91.20
2800	14.93	64	3.6	2.7	81.00	100.80
3200	17.06	66	3.4	2.55	76.50	108.80
3500	18.66	67	3.3	2.475	74.25	115.50
4000	21.33	68	3.2	2.4	72.00	128.00
5000	26.66	69	3.1	2.325	69.75	155.00
6500	34.66	70	3.	2.25	67.50	195.00
8500	45.33	72½	2.75	2.062	61.86	233.75
12500	66.66	75	2.5	1.875	56.25	312.50

MINIMUM CHARGE:

For 10 H. P. in motors and less, $1.50 per H. P. per month
For 11 H. P. in motors up to 24, 1.25 per H. P. per month
For 25 H. P. in motors and more, 1.00 per H. P. per month

Fig. 6—Table of Energy Rates for Motors.

size and 396 tungsten series lamps of 40-cp rating. The following table gives various statistics of the company's service for the year ending June 30, 1909, which is the last for which returns have been made to the public authorities:

RESUMÉ OF ATTLEBORO STEAM & ELECTRIC COMPANY'S OPERATION, YEAR ENDING JUNE 30, 1909.

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
" " commercial lighting	38,136.88
Average earnings per kw-hour sold	0.0485
" " power	[illegible]
Gross earnings per capita	5.35
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Operating expenses	41,460.72

The officers of the company are: President, Mr. John Joyce, Boston; treasurer, Mr. Vincent Goldthwaite, Wellesley, and manager, Mr. Edgar Tregoning, Attleboro.

HYDROELECTRIC STATION NEAR YPSILANTI, MICH.

The Superior generating station of the Eastern Michigan Edison Company, utilizing a 17-ft. fall in the Huron River about 2 miles from the city of Ypsilanti, operates in parallel with several water-power stations on this river and with steam plants belonging to the company, which by its network of transmission and distribution lines supplies electrical energy for lamps and motors to the suburban region within a radius of 60 miles of Detroit.

The site occupied is that of an old mill which was destroyed by fire a number of years ago. A portion of this early mill structure is to be seen at the left of the accompanying illustration, which is reproduced from a midwinter photograph. The foundations in part were available for constructing the plant, and the turbine compartments occupy the wheel pit of the early structure. The dam is of timber crib construction, rock filled, and has a spillway 165 ft. in length. The average flow of the Huron River at the point where the station is located is about 400 cu. ft. per second, diminishing to a minimum flow of 120 cu. ft. per second. The flood discharge sometimes equals 4000 cu. ft. per second.

The generating equipment comprises a 450-kw umbrella-type General Electric 2300-volt, 60-cycle, three-phase alternator directly driven by a special Leffel Sampson water turbine 71 in. in diameter, and a 200-kw belted horizontal generator of the same manufacture. The smaller machine is driven by a 54-in. standard Sampson turbine through bevel gearing and belt connection, having been installed in this way as the result of an immediate demand for additional power, and the desire to make use of these machines, both of which were on hand. The speed of the 450-kw unit is controlled by a Holyoke oil governor, while the 200-kw generator is equipped with a Woodward mechanical governor. The output of the generating apparatus is stepped up to the transmission potential, 23,000 volts, by three 333-kw General Electric oil-cooled transformers located in a small transformer cabin directly behind the water-power plant. This output is combined with that of other stations at Argo and Geddes, and is fed into the transmission network leading to the neighboring towns.

The Superior generating station is operated under the Washtenaw division of the Eastern Michigan Edison Company, of which division Mr. R. W. Hemphill, of Ann Arbor, is general manager. Prof. Gardner S. Williams acted as engineer for the construction of this station.

View of Superior Water Power Plant of Eastern Michigan Edison Company, Near Ypsilanti.

TRANSMISSION LINE CALCULATIONS.

Inductance of Electric Transmission Lines as Affected by the Subdivision of the Circuits and the Arrangement of the Conductors.

By Alfred Still.

THERE are reasons in favor of transmitting large amounts of electric power through two or more sets of wires quite distinct from mechanical considerations or the increased security against a total shut-down in the event of accidents. It is proposed to indicate in this article the manner in which the inductive drop of pressure may be reduced by substituting, for a single set of transmission lines, two or more sets of suitably arranged lines of a correspondingly reduced cross-sectional area. As to whether or not the subdivision of the transmission lines into two or more parallel circuits would be justifiable in practice must necessarily depend upon economic and other considerations which it is not proposed to touch upon in this article.

SINGLE-PHASE SYSTEMS.

In Fig. 1 the two conductors of a single-phase transmission are shown, with distance D between centers of wires; the current may be considered as going out through conductor 1

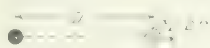


Fig. 1—Two Conductors of Single-Phase Transmission System.

and returning through conductor 2. In each case the diameter of the wire is assumed to be $2r$ and the current I amp.

The coefficient of self-induction per mile run of *single conductor* is

$$L_m = 0.7410 \log \frac{D}{r} + 0.08046, \qquad (1)$$

where L_m is the coefficient of self-induction expressed in millihenrys, or thousandths of a henry. The coefficient of self-induction for the loop formed by the two parallel wires will be twice as great, but it will be found convenient to consider each conductor as producing a flux independently of the other.

Formula (1) takes into account the flux of induction within the material of the conductor, but in the case of overhead conductors transmitting power at high pressures, in which case the distance between wires is always large relatively to the diameter

of the wire, the constant 0.08046 may be omitted from the formula without introducing any serious inaccuracy, and by introducing this simplification it is an easy matter to derive the

[illegible] (2)

which gives the induced volts per mile of conductor carrying a current of I amp. In this formula f stands for the frequency in cycles per second, and the usual assumptions in regard to the sine law of time-variations of current and e.m.f. have been made.

For the purpose of comparing different arrangements of circuits, the frequency may be assumed constant in all cases, and if m be put for the quantity $0.004655 f$, the formula can be written,

[illegible] D [illegible]

This formula alone is sufficient to indicate that an improvement in the matter of inductive voltage drop is to be expected if, instead of transmitting the total current I through one pair of conductors, there be provided two or more pairs of conductors spaced sufficiently far apart to prevent mutual inductive effects, each pair being of sufficient cross-section to carry one-half or one-third of the total current, as the case may be; because, although the quantity log $\frac{D}{r}$ will increase slightly on account of the reduction in the dimension r, this increase will not be of nearly so much importance as the reduction of I.

Numerical Example.—In order to illustrate the above point a few examples will be worked out based on the following assumed data:

Total current, $I = 100$ amp.

Diameter of single conductor to transmit the total current, $2r = 0.5$ in.

Frequency, $f = 60$ cycles, from which $m = 0.2793$.

Distance between centers of wires (corresponding to a pressure of about 50,000 volts), $D = 70$ in.

If the transmission line is divided into two equal sections, the current in each section will be 50 amp, and for equal total weight of copper (leading to the same ohmic drop of pressure), the radius of each conductor will be $r \div \sqrt{2}$. Similarly,

Fig. 2—Four Conductors Arranged in a Square.

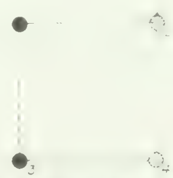


Fig. 3—Another Arrangement of Conductors in a Square.

if there are three equal sections, the current will be 33.33 amp, and the radius of the conductors $r \div \sqrt{3}$.

The induced volts as given by formula (3) work out as follows for the three conditions:

Single pair of lines,

$$e = 68.34 \text{ volts} \qquad (4)$$

Two pairs of lines of equal total cross-section,

$$e = 36.25 \qquad (5)$$

Three pairs of lines of equal total cross-section,

$$e = 25.00 \qquad (6)$$

These figures show that the inductive drop of pressure on a single-phase transmission may be reduced by splitting up the current and transmitting along two or more pairs of lines spaced sufficiently far apart to prevent appreciable magnetic interference between the sets of lines; and the reduction of the inductive drop is very nearly in proportion to the number of subdivisions of the single line.

Although electric transmission systems have been arranged with [illegible] lines spaced sufficiently far apart to avoid magnetic interference, such an arrangement is necessarily costly. Consider, therefore, two alternative arrangements, shown in Figs. 2 and 3, by which a single circuit can be split up into two parallel circuits, the four wires being carried on the one set of poles with the spacing between the individual wires as small as possible—that is, such that in no case shall the distance D between outgoing and return conductors be less than the minimum determined by the voltage of the supply.

In Fig. 2 is shown a symmetrical arrangement with the four conductors of equal cross-section occupying the corners of a square; the outgoing conductors are marked 1 and 3, and the return conductors, 2 and 4. Even if the two circuits 1-2 and 3-4 are connected in parallel at both ends of the line, the symmetry of the arrangement will insure that the total current will divide itself equally between the two sets of conductors. The effective or resultant magnetic flux surrounding any one conductor will, for the same reason, be equal to that which surrounds any one of the remaining three conductors. It will, therefore, suffice to calculate the e.m.f. of self-induction generated in any one conductor.

Consider the conductor 1, in which there is the current $\frac{I}{2}$. If the other outgoing conductor, 3, were situated anywhere on the dotted circle of radius D, passing through 2 and 4, then the magnetic effect of the current in 3—so far as conductor 1 is concerned—would counteract the effect of the return current in either 2 or 4. On the basis of the data previously assumed, the flux round 1 would generate an e.m.f. of 36.25 volts, as in equation (5). If, on the other hand, conductor 3 were coincident with 1, there would be the condition of the full current I in the conductor 1, the whole of which would be returning at a distance D, and the induced volts would be 68.34, as given in equation (4). With the conductor 3 situated at a distance $\sqrt{2}D$ from conductor 1, as shown in Fig. 2, the resultant effective flux surrounding conductor 1 may be considered as the difference between the flux due to a current I up to a distance D less the flux due to a current $\frac{I}{2}$ up to a distance $\sqrt{2}D$; and this resultant flux would produce a back e.m.f.

$$e = mI \log \frac{D}{r \div \sqrt{2}} - m\frac{I}{2} \log \frac{\sqrt{2}D}{r \div \sqrt{2}} \qquad (7)$$

On the data previously assumed, the e.m.f. is

$$e = 72.5 - 38.39 = 34.11 \text{ volts.} \qquad (8)$$

Thus, by arranging the conductors of the divided circuit in the manner shown in Fig. 2, which permits of the four wires being supported on the one set of poles, a better result is obtained in regard to inductive voltage drop than if the two circuits had been run entirely separately; the voltage drop in this latter case being 36.25, as in equation (5).

If, on the other hand, the position of one pair of conductors be assumed to be reversed, as indicated in Fig. 3, then the magnetic flux in the loop formed by the outgoing and return conductors 2 and 3 has no effect on the conductors 1 and 4, and the effective flux surrounding any one conductor is clearly that due to a current $\frac{I}{2}$ returning at a distance $\sqrt{2}D$: the induced volts per conductor will be 38.39, this being the value of the second term in formula (7). With an arrangement of conductors, such as in Fig. 3, it is obvious that the conditions are worse than if the two circuits are quite distinct, because a portion of the flux produced by one pair of conductors, such as 3 and 4, passes also through the loop 1-2, thereby increasing the inductive drop in these wires.

POLYPHASE SYSTEMS

The satisfactory results obtained in regard to inductive drop when a single-phase circuit is split up into two circuits arranged as indicated in Fig. 2, suggest that a somewhat similar arrangement might be adopted with advantage in the case of polyphase transmissions. An arrangement of wires suitable for three-phase transmission is shown in Fig. 4. Here the three-phase line is supposed to be split up into two parallel [illegible] circuits, 1, 2, 3 and 1', 2', 3'. The arrangement

being symmetrical and all conductors being assumed to be of equal size, the same amount of current will be carried by each of the six conductors, provided the load is a balanced one, such as is usual in the case of a three-wire, three-phase scheme.

With the arrangement of wires as in Fig. 4 the minimum distance D is maintained between all wires at different potentials, and the currents in conductors, such as 1 and 1′, placed at opposite ends of a diameter will be of the same time-phase and equal in magnitude.

It will be interesting to work out a numerical example based on the data already assumed in connection with the single-phase transmission, namely, a total current of 100 amp per phase and a minimum distance D of 70 in. between conductors at different potentials. The points to bear in mind are:

(1) That owing to the symmetrical arrangement of the conductors, with the rotation of the phases always in the same direction, the total effective magnetic flux round any one conductor is the same (except in regard to phase) as that which surrounds any one of the other five conductors. The calculations can therefore be made for only one conductor, such as No. 1.

(2) That the current in any outgoing conductor, such as 1, may be considered as returning through the five remaining conductors, due attention being paid to phase relations.

(3) That the resultant of the currents in conductors 2′ and 3′, or the resultant of the currents in conductors 2 and 3, is equivalent to a current equal to that in conductor 1, but exactly opposite as regards phase. The total effective flux round conductor 1 may, therefore, be considered as the resultant of three component fluxes:

(a) A flux due to a current $\frac{I}{2}$ returning (through 2′-3′) at a distance D; plus (b) a flux due to a current $\frac{I}{2}$ returning (through 2-3) at a distance $\sqrt{3}D$; less (c) a flux due to a current $\frac{I}{2}$ returning (through 1′) at a distance $2D$.

The numerical values for the induced volts are found to be: $(a) = 36.25$ [being the same as in equation (5)]; $(b) = 39.47$; $(c) = 40.40$; and $(a) + (b) - (c) = 35.23$.

If two separate three-phase lines spaced a considerable distance apart were substituted for the arrangement in Fig. 4, the induced volts per mile per conductor would be as given in equation (5), namely, 36.25, assuming the triangular arrangement of wires, with distance D between them. The arrangement shown in Fig. 4 is therefore slightly better from the point of view of inductive drop, notwithstanding that both sets of wires can be run on the same pole line with no greater spacing between wires than the minimum distance D determined by the voltage between phases. The figure 35.23 volts for the split three-phase system may be compared with 34.11 volts as given in equation (8) relating to the single-phase transmission with two circuits. It is clear that in either example, the drop in volts per conductor in the undivided circuit, with each conductor of sufficient section to carry the total current of 100 amp, would be 68.34, as given by equation (4).

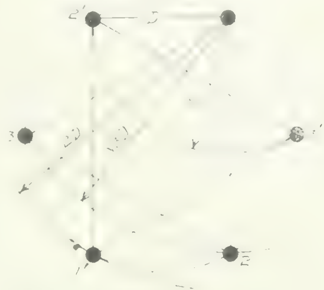


Fig. 4—Arrangement of Conductors for Three-Phase Transmission.

Central Station

Management, Policies and Commercial Methods

THE "ELECTRIC CITIES" OF MICHIGAN.

The recent completion of the hydroelectric plant on the Menominee River by the Menominee & Marinette Light & Traction Company was marked by a movement to attract manufacturing plants to the twin cities, to which the name "The Electric Cities" has been locally given. To this end the following rates for motor service have been fixed:

A service charge of 50 cents per month for each horse-power of nominal rated capacity of motor, or less, and 3½ cents per kw-hour for installations of 20 hp or less; 3 cents per kw-hour for installations of over 20 hp and under 50 hp; 2½ cents per kw-hour for installations of 50 hp and over, and under 75 hp; 2 cents per kw-hour for installations of 75 hp and over, and under 100 hp; 1½ cents per kw-hour for installations of 100 hp and over, and under 200 hp; 1 cent per kw-hour for installations of 200 hp and over, and under 500 hp; ¾ cent per kw-hour for installations over 500 hp. On bills paid before the tenth of the month a discount of 10 per cent is allowed.

SECURING NEW BUSINESS BY CO-OPERATION WITH BOARDS OF TRADE.

The cultivation of friendly relations with local boards of trade has for some years been recognized as a desirable policy in the administration of public-utility corporations. By such means opportunities are frequently presented for the spread of a most desirable form of publicity concerning the status of public utilities as permanent and valuable business organizations in a community. An article in the Providence Board of Trade *Journal* illustrates how the advantages of electric power for factories can be pressed home to the community by a medium circulating among persons of the widest industrial influence. This article describes the power service of the Narragansett Electric Lighting Company, showing how the cost of an elaborate generating and distributing plant requires productive operation for as much of the 24 hours as possible. It then passes to the numerous applications of electric motors in large and small fields in the city of Providence, making special reference to the recent work of the company in the textile field, in the replacement of 1675 hp in steam engines within a few months, changing of factories to the electric drive, and the ability of electricity to intensify production in the printing plant. In Providence oyster craft and sea-going coal vessels are unloaded by central-station power, 40 woodworking establishments use electricity, and 68 printers and newspapers, 20 church organs, 20 coffee-roasting establishments, and many other factories are on the Narragansett lines. The article concludes with a short description of the company's power engineering work, including a quotation from this journal as an outside authority commending the company's organization and power sales methods. Four cuts are also given of recent elec- [illegible]

A CENTRAL-STATION EXHIBIT.

One of the attractions at the recent Canadian National Exhibition in Toronto was the booth of the Toronto Electric Light Company, 13 ft. x 43 ft. The ceiling of the booth was studded with 60-watt tungsten lamps with prismatic reflectors. On the roof of the booth was a sign, 20 ft. high by 14 ft. wide, of an electric flatiron surmounted by two rockets that broke into stars, flashing alternately with the words, in 14-in. letters, "Electricity Makes the Sad Iron the Glad Iron."

On exhibition in the booth, which had floor dimensions of 13 ft. x 43 ft., were two vacuum cleaners operated by 5-hp and 2-hp motors respectively, an electrically-operated cash register, adding machines, washing machines, portable vacuum cleaners, electric flatirons, toasters, water heaters, waffle irons, percolators, heating pads, luminous radiators, electric signs, and numerous other devices typifying the convenience and flexibility of electricity as a lighting, heating and driving agent.

The booth was decorated in white and gold. Handsome rugs covered the floor and the public were invited to avail themselves of the chairs and tables where coffee and toast were served gratis. A technical man was in charge, assisted by solicitors and demonstrators from the sales department of the company. The number of orders taken during the exhibition was very gratifying and a large volume of future business is expected to result.

CONTROLLED FLAT RATE AT SUPERIOR, WIS.

The Superior Water, Light & Power Company, of Superior, Wis., has started putting in the system of flat-rate charging with excess demand indicators or controllers among a number of its smaller and least profitable residence consumers. Mr. William H. Winslow, secretary and general manager of this company, says that he hopes to have this class of consumers fairly well changed over to a flat-rate basis within the next six months. The majority of the consumers who are going on the flat-rate basis are contracting for the minimum amount of 100 watts with only a few taking a higher amount. The rate is 1 cent per watt per month.

In order to handle the electric flatiron business on these flat-rate contracts, a separate flat-iron circuit is connected back of the excess controller, and for this service a flat rate of 50 cents per month is charged. So far, a large proportion of the flat-rate consumers thus secured are old consumers changed over from meters, but there are some new consumers, and later on Mr. Winslow is confident that the company will get many entirely new consumers. He has no doubt but that the business secured in this way will be profitable.

Under this flat-rate system with controllers which will flicker the light whenever the amount contracted for is exceeded, the consumer pays 1 cent per watt per month for the maximum demand for which he contracts. For example, if he pays $1 per month, he is entitled to draw at one time from the company's service 100 watts. Should he turn on enough lamps to exceed this amount, the controller will begin to interrupt the circuit at intervals and flicker the light, thus notifying him to turn off the excess lamps.

Under this system the company is insured a revenue of $12 per year per kilowatt of maximum demand at the consumer's premises. The consumer, on the other hand, is not restricted as to the kw-hours he uses. As he is practically obliged to use tungsten lamps to keep his maximum demand within the limit of the controller, he will be reasonably careful about waste of electricity and will turn off lamps when not needed in order to save lamp renewals. The company is saved the trouble of maintaining and reading meters for these numerous small consumers.

While it may seem strange at first thought that these small consumers will voluntarily sign a new form of contract, agreeing to pay the company as high an annual amount as they were paying on a meter basis, this fact is easily accounted for by the eagerness of the average person to be free from the fear of running up large bills when on a meter basis, and by his desire to know exactly in advance what the electric light service will cost.

CONCERNING COURTESY.

The National Light & Improvement Company, of St. Louis, which operates a number of central stations, has issued to its employees a circular with the above title, a reprint of which follows:

This company considers that each one of its representatives possesses above the average the essential faculty of being courteous. To those who cultivate and exercise this faculty the company extends its congratulations and its thanks; to those who do not fully appreciate its importance, careful consideration of the following is suggested:

First. The principle that underlies courteous treatment of others is simply that of doing unto others as you would have them do unto you.

Second. In a highly complex and technical business such as ours there are many things that you, with your training and daily experience, understand with perfect familiarity, but which the public do not understand; therefore, do not assume that the public should comprehend them without asking questions, but when inquiry is made of you give the courtesy of a reply just as full and clear as you can make it, and without any suggestion of superiority, born of greater knowledge.

Third. Words are only one means of expression and manner is quite as important; therefore, remember that a kindly and courteous manner is not only the sign and mark of a self-respecting man, but it is to your words what oil is to machinery in making them move effectively to their purpose.

Fourth. True courtesy is no respecter of persons. It remembers that "A man's a man for a' that," and gives the civil word and the helping hand quite as readily to the ill-clad stranger as to an official of the company.

Fifth. Courtesy is not only something the public have the right to expect of you, but it pays. It pays in the friends it makes you personally and as a representative of the company. It pays in minimizing the friction of your life, as well as that between the company and its patrons. It pays in raising your standing with the company. It pays in the personal satisfaction resulting from having done the right and kindly thing by your "neighbor."

It is the wish of the management of the company that all its representatives, whose work brings them into contact with the public, may appreciate and fully measure up to their duty and privilege in this respect.

A CO-OPERATIVE ARGUMENT AT FARGO.

The Union Light, Heat & Power Company, of Fargo, N. Dak., recently published an advertisement in the Fargo *Daily Forum* which contains so many well-worded arguments on the close relations between the gas and electric service, and the prosperity of a city, that some of the paragraphs are here given verbatim, as being suggestive to other companies.

When you tell a stranger that you have good gas and electric service, it helps the city.

When you tell a prospective citizen that the gas and electric rates are fair, it helps in getting him to come to Fargo.

And when the man with money to invest here learns that the gas and electric company has the faith and energy to make all necessary improvements and extensions that fact is another boost for Fargo.

The Union Light Company believes in publicity and believes in co-operative effort.

It believes that its work is vital and important and a very powerful factor in the development of the community.

The company knows that it has many public obligations to perform, and it wants to fulfill these obligations in the most satisfactory way and to the last detail.

Our organization can grow only as the city grows; therefore,

we are keenly interested in the growth and prosperity of Fargo.

We are willing to do our full share in adding to the present achievements of Fargo—to put our shoulder to the wheel and push with all our might in the determined co-operative effort which is necessary to municipal advancement.

As we see it, our part of this great co-operative work calls for prompt improvements and extensions to the gas and electric property whenever required; the rendering of good service at all times; the charging of rates that are fair both to patrons and ourselves, and striving always to give our patrons the advantage of meritorious inventions in the fields of electricity and gas.

Neither the best service nor the lowest rates can be possible unless the company is maintained in a reasonably prosperous financial condition.

Cities that grow rapidly require frequent outlays of new capital for extensions and improvements to the gas and electric properties.

Investors must be given a fair assurance of a fair return or they will not lend support to enterprises whose undertakings are cast in narrow lines; who cannot shut down in dull times, and who cannot move from one part of the country to another to suit conditions.

The Union Light, Heat & Power Company is one of the companies controlled by H. M. Byllesby & Company, of Chicago. The general manager at Fargo is Mr. Samuel Kahn.

CENTRAL-STATION RATES.

By Harry G. D. N[illegible].

It is now quite generally agreed that the practice of making rates for electricity in a given city on a basis of those in some neighboring city, regardless of conditions, is past, and that certain principles of rate making may be laid down which will apply to all cities, whether large or small, and practically all stations, regardless of size. A rate to be correct must be satisfactory to the two parties to whom it relates, namely, the central station and the consumer. In order to be satisfactory to the central station it must (1) yield a reasonable profit; (2) be easily calculated, thus simplifying the rendering of bills; (3) be easily adapted to all classes of service; (4) be easily raised or lowered from time to time, as the case may require, without interfering with the principles on which it was made.

To be satisfactory to the consumer the rate must (1) be as low as possible; (2) be equitably divided between the various classes of consumers; (3) be easily understood by the consumer.

The fundamental principle governing the making of a system of rates is: The income derived must yield a reasonable return on the investment used in serving. As a corollary to this may be added: Each class of service must be self-supporting.

Most fair-minded people grant the former statement, but are not willing to grant the latter, and right here it must be stated that many phases of rate making are a matter of opinion. Well and good, so long as the final result is net returns. In many cases it is somewhat doubtful what are net returns and what are "overdivided dividends."

The practice of dividing cash balances and forgetting the existence of fixed charges and depreciation still exists, partly through managerial ignorance and partly through desire. Starting with the fundamental principle one naturally inquires, What investment or basis should be considered in measuring the rate of return and what is a reasonable return? Both of these subjects have been the object of speculation throughout the country in court decisions, public service commission hearings, and stockholders' meetings, and all competent authorities do not yet agree.

In analyzing this term "investment," the items which may be included are: (1) Present physical value of the property used and useful for furnishing the service; (2) Going value and good-will; (3) Franchise value; (4) Investment to date as shown by the books of the utility.

As to the first mentioned item, this is largely a matter of opinion. At first sight it hardly seems as though a consumer should pay a return on property which is apparently not now used in giving service, and which has entirely disappeared. But when it is remembered that measurement by results rather than by methods is the only reasonable method of comparing such matters, it is seen that the present value could not exist without the original value once having existed by virtue of the original investment. It is true that the consumer contributes to the maintenance of the investment by the charging off by the utility of maintenance costs to operating expenses, and the question then arises as to whether or not the consumer is receiving the service guaranteed him by the condition of the apparatus at the time of its installation.

"Physical value" is a broad and uncertain term. Competent appraisers have agreed in some cases and in others have been quite far apart. Usually some value can be settled upon by arbitration which is reasonably satisfactory to all parties concerned.

"Going value" is a term usually misunderstood, and authorities disagree on its definition. A recent investigator has stated it clearly as the "cost to produce a gross income." Much has been said and written on this item and it is not the purpose of the writer to go into the matter in detail. Like "good will" and "franchise value" much depends upon local conditions, and whether or not these are to be included in the sum on which the return is to be based must be settled by the merits of each specific case.

The rate of return, to be called "reasonable," presents a more formidable problem than the question of the "investment." Indeed, it often seems questionable that the return should be limited, in a public utility any more than in any other business, in spite of the fact that the utility depends upon a public franchise for its existence. True, it uses the streets, but does it use them more than the butcher and the grocer? And does it not pay taxes in the same proportion as its business associates in other lines? Let it not be forgotten that the stockholders of the public utility corporation invested their money without any assurance of return of either interest or principal, and with a large degree of physical hazard staring them in the face. Granting that the business is a natural monopoly, it has been found to the advantage of the public that this is so, and it could not exist as such if the profits were as large as many imagine, for, like the grocers and the butchers, it would soon be discovered that there were fair profits for more and competition would soon spring up on all sides. The rate of return must, therefore, be left to the judgment of the ratemaker, who must study carefully the conditions affecting his particular case. In many states, at the present time, he is saved the trouble by the public service commission, whose fairness as yet there is no cause to question.

Having given operating expenses, and fixed charges, and having considered the questions of investment and return, the problem remains to develop an equitable system of rates.

It may be here stated that a correct system of rates need not have any direct consideration of the use to which the electricity is put. That is, the schedule should not state a certain rate for signs, another for motors, another for domestic service, etc. If the schedule is properly worked out these take care of themselves automatically.

In this connection, the chief principle to bear in mind is that every expense must be met by a charge made in exactly the way it accrues.

It is quite generally agreed that in a public utility there are three main classes of expenses: (1) Fixed expenses, or those which remain fairly stationary for long periods of time, and go on whether electricity is used or not; (2) semi-variable expenses, or those which vary slowly as the load varies; (3) variable expenses, or those which vary directly with the load.

For the average utility it is sufficient to consider only two classes of expenses, namely fixed and variable, merging the semi-variable into these two.

Two classes of charges should be made to meet the fixed expenses, namely, (a) service charges, and (b) demand charges. Similarly one charge is made to meet the variable expenses, and this is a kw-hour charge depending upon the consumption as shown by the watt-hour meter.

Modern thought in the development of rate making has brought to the attention of both the central-station manager and the consumer the distinctive characteristics of "service," that feature of illumination by electricity which has to do with the presence of light on demand, without regard to the extent of the demand. The best example of this is in the telephone business of to-day, where nothing but service is sold.

Working on a basis of the principles stated, it becomes a comparatively easy matter to make fair and basic rates after the necessary information is at hand. At this point much depends upon the classification of expense accounts carried. These may be so arranged that the information required for making rates may be quickly obtained. The uniform systems of accounts prescribed by the various public service commissions have been designed with this feature in view and have served their purpose remarkably well. The following items should be considered as fundamental in a general classification for electric utilities: (1) Production, or manufacturing expense; (2) transmission; (3) distribution; (4) consumption; (5) office; (6) general; (7) fixed, and (8) extensions.

It will be noted that these accounts are arranged in the order of the direction of travel of the energy from the power house to the consumer, and the arrangement carries a better comprehension of the classification than would otherwise be had.

Referring to what precedes it may be said that the cost of "service" is the cost of maintaining pressure at the consumer's meter, so that he may use electricity on demand. In other words, it is the cost of keeping the wheels turning. It is difficult to isolate from this the cost of "demand," for the question arises, "How many wheels shall be kept turning?" or "How many kilowatts shall be considered as available at the 'service' cost?" This must be governed by local conditions, but, in general, the principle may be laid down that the smallest hypothetical power plant which will maintain pressure at the services of all connected consumers shall be the fundamental unit for calculating the service expenses so far as the generating plant is concerned. Naturally this is a theoretical consideration and must be estimated and calculated by proper investigation. The fundamental distribution unit may be similarly considered. The expense of "service" will then consist of: (1) Interest, maintenance, and depreciation of the hypothetical apparatus used in maintaining pressure at the consumers' meters; (2) wages of sufficient labor to operate the hypothetical plant; (3) cost of coal, water, oil, and miscellaneous supplies to operate the hypothetical plant; (4) office expenses incident to the necessity of the operation of such a plant.

By proper investigation, the above information can be obtained for practically every electric plant in existence and would naturally vary under different conditions. How then is this service expense to be distributed as a charge among the consumers? It seems reasonable to say, equally, in view of the fact that each consumer, regardless of his demand, is equally dependent upon this item of "service." To obtain the charge per consumer, therefore, for service alone, divide the total expenses of the hypothetical plant by the number of consumers.

The next charge to be determined is the demand charge. This has presented problems which have been difficult of solution. Any approximation to the truth, however, is better than the "roughshod" rates of the past. In connection with this, some separation must be made between a maximum demand occurring during the peak load and one occurring during the light load. In a general way the total 24-hour period of operation may be divided into two parts: the period of light load, usually occurring from 12 midnight to about 6 in the evening, and the period of heavy load, usually occurring from 6 in the evening to 12 midnight. In certain cases it may be advisable to [illegible]

The expenses of light-load and heavy-load demand may now [illegible]

operate certain units in the power plant during the light load and certain additional units during the heavy load. The expenses of demand, therefore, are due to the necessity of having and operating these respective units.

To summarize, the light-load demand expenses are made up as follows: (1) interest, maintenance and depreciation of physical equipment over and above the hypothetical "service" plant, necessary to meet the light-load demand; (2) wages of additional labor to meet the requirements of this demand; (3) certain office expenses and other expenses appearing in specific cases, and growing out of the requirements of this demand.

In a similar way the expenses of heavy-load demand can be isolated and calculated, they being those incident to the existence and operation of the physical plant over and above those of the "service" and the "light-load demand" expenses.

Having found in this way the light and heavy-load demand expenses, the average demand expense per consumer can be found by dividing the total demand expenses by the number of consumers. This is not of any special value, as the consumers all have not the same demand. It becomes necessary to distribute these expenses among the various consumers in a reasonable and equitable way. Here is the most difficult part of scientific rate making.

Many schemes for this apportionment have been proposed, among them the following: (1) Demand taken at a certain percentage of the consumer's connected load; (2) whole connected load considered demand; (3) demand meters used; (4) demand estimated by result of special investigation in each case; (5) excess meters used; (6) printing attachments for meters used.

Various other schemes have been proposed, but none has been satisfactory. Taking the above mentioned cases separately it may be concluded that anything proportioned on the connected load cannot possibly be correct, as a consumers demand is absolutely independent of this. In fact, the maximum possible demand even cannot be based on this in view of the ease with which a consumer can suddenly change all of his 8-cp lamps to 16 cp or borrow flatirons, etc., from his neighbor without the knowledge of the central station. Of course, under any system of demand apportionment except metering this latter case may interfere.

There probably is no question but that this problem can be settled for all time by the employment of curve-drawing ammeters or printing attachments, but the expense involved in this is prohibitive. It is probable that the time is not far distant when satisfactory demand attachments will be available at very little or no more cost than the present wattmeters. After all is said and done it is probable that the most satisfactory way of determining the demand at present is by special investigation as to the requirements of individual consumers. This can always be done by inspectors, or even by solicitors, and need not be taken up oftener than, say, once a year except where special cases require. Some difficulty may be experienced in adjusting the charges for new consumers, but these can be taken care of with the proper information at hand.

The chief difficulty with this system arises from the fact that consumers, comparing their demand charges, will claim discrimination, but this even happens with our present meter and flat-rate systems, and cannot be avoided under any circumstances, for the simple reason that it is a psychological matter and has nothing to do with the sale of electricity or any other article.

Having determined the demand expenses and the principle of apportionment, how shall these be applied to consumers' monthly bills? The simplest method of doing this is to charge each consumer in proportion to his demand, basing the charge on the total maximum consumers' demand, not on the switchboard maximum demand. For example, suppose the total maximum consumers' light-load demand is found to be 50,000 kw and the heavy-load demand is 100,000 kw, and any given consumer has an estimated light-load demand of 0.5 kw, this being the maximum yearly. Then this consumer pays a light-load demand charge of 0.5/50,000 of the total light-load demand expenses. Similarly, suppose for the same consumer the heavy-load de-

mand is 1 kw. Then, in addition to the service charge, the light-load charge, and the electricity charge (to be considered later) the consumer pays 1/100,000 of the heavy-load demand expenses. The question arises as to whether these demand expenses shall be apportioned monthly or yearly or for some other period. On account of their approximate nature and the difficulty of monthly investigations of demand it would not be advisable to attempt to change these charges oftener than once a year and not necessarily then. Further, such changes would be seriously misleading to the consumer and all kinds of trouble would accompany such action.

In addition to the service and demand charges worked out above an energy or electricity charge must be made. Manifestly this will be very small per kw-hour and will be based on the expenses arising over and above all the other expenses discussed above, and will be practically the cost of coal and water alone. To arrive at this charge simply divide the expenses referred to by the kw-hours sold (not generated) and the result will be the cost per kw-hour to the consumer including the distribution losses.

To summarize, each consumer's monthly bills will be made up of the following charges: (1) Service charge; (2) light-load demand charge; (3) heavy-load demand charge, and (4) energy charge.

It should be noted that consumers' monthly bills need not necessarily have these charges so isolated and stated. Indeed, no end of questions would have to be answered if this were done. It is, however, simply an itemized statement of what the consumer gets for his money, and it is peculiar to note that the less he knows about what he is paying for the better the central station gets along with him. The simplest way to render bills would probably be to combine all the fixed charges and state them as one fixed charge and add the energy charge.

In summarizing what has been said above, the writer believes that he has proved the statement that rate schedules should not be based on the use to which the energy is put except insofar as this use affects the maximum demand. Further, it is seen that with such a rate the advent of high-efficiency lamps is more likely to result in increased net profits than losses, due to the release of capacity and the [illegible] lower the present rates but very slightly.

Wiring and Illumination

CONSTRUCTION OF A LARGE SPECTACULAR DISPLAY SIGN.

A spectacular electric sign, 150 ft. [illegible] more than 5000 tungsten lamps, was the feature of the decorations during the recent Knights Templar conclave at Chicago, Aug. 8-13. This huge display, an electrical representation of the official badge of the order, was erected on the Grant Park lake front, at a point opposite Jackson Boulevard, and was operated from dusk to dawn during the week of the conclave. Adding to the intrinsic beauty of the badge design, various parts of the spectacle were in constant motion, with jewels flashing and ribbons waving. A preliminary account of the plans for this display, together with the decorations of Templar week, was published in these columns on July 21. The present article, however, deals with some of the interesting dimensions and problems of the construction of this great sign as actually completed.

The structure on which the lamps were mounted was of steel, 155 ft. high and 64 ft. wide across the word "Welcome" at the bottom. Some general idea of the magnitude of the display will be gained when it is recalled that the top third of the emblem was 40 ft. x 28 ft. overall, and that the letters in "Chicago, 1910" were 3 ft. high. In the middle section the height from the knights' heads to the horses' hoofs was 18 ft. The overall dimensions of the crosses in the bottom pendant were: 38 ft. high and 35 ft. wide. The word "Welcome" at the base of the sign was spelled in steady-burning red 4-cp tungsten lamps, and was 10 ft. high.

The total number of lamps in the sign was 5120, almost 1000 extra lamps [illegible] the original design, to heighten

Fig. 1—Day View of Knights Templar Badge Sign, Chicago.

the effectiveness of the display. The majority of the lamps in the sign were 4-cp, 5-watt, 11-volt tungstens, operated 10 in series across the 110-volt, direct-current mains. Low-voltage tungsten lamps were also employed in all the on-and-off flashing displays, with the exception of the "chaser" effects, in which

Fig. 2—Night View of Knights Templar Badge Sign, Chicago.

[illegible] of bowl-dipped lamps in parts of the sign, in this way illuminating to advantage the colored surfaces of the sign through the clear hinder parts of the lamp globes, while the lamps themselves showed as points of colored light in the midst of the illuminated surfaces.

[illegible] the design of the official conclave badge. The helmet and the design in the

top third were studded with bowl-dipped yellow lamps, with green emeralds at the sword-hilts, while the lettering at this point was formed of clear-globed sign tungsten lamps. By means of a flasher device, the eagle's wings were flapped in a realistic manner, and the ribbon in the eagle's beak waved in the breeze. Framing the eagle and the letters "K" and "T" were circles of light, appearing to revolve first in one direction and then the other, and changing color at each reversal. This reversal with simultaneous color change is a novelty in sign operation. The mounted knights in the middle section were formed of blue-dipped 10-volt tungsten lamps, arranged in double parallel rows along the lines of the horses' heads and feet. By flashing on and off these rows successively the steeds were made to prance. The entire fields of the three superimposed crosses in the lowest section were made to shimmer by alternate waves of light and shade originating at the center and passing to the outer margins; meanwhile the jewels in the crown sparkled, giving the whole design the appearance of catching changing slants of sunshine.

As the sign was operated, the top section was flashed on first, its parts in motion, followed by the middle section, two seconds later, and finally by the pendant section. All parts of the display were then extinguished simultaneously, to be flashed on again in the same succession 15 seconds later. The word "Welcome" was steady-burning. The flashing of the huge sign was accomplished by individual flashers for each of the three sections, continuously driven by 1/8-hp motors, the separate flashers being supplied with energy at the proper intervals for the successive appearance of the sections, by a three-contact carbon-switch master flasher mounted on the first platform. A platform behind each section of the sign carried its corresponding flasher, and three men were in attendance on the sign at all times to insure proper operation of flashers and the renewal of fuses or broken filaments. The top-section flasher comprised 48 contacts, the middle one 28 contacts, and the bottom flasher 36 contacts. The sign was operated continuously from dusk to daybreak, as it was believed that the many strangers in the city during the week could locate their bearings to advantage if they chanced to cross Jackson Boulevard at any point and could see the familiar, huge sign at its head. Energy for the operation of the sign was brought in over a service run of 750 ft. of No. 4-0 copper conductors, from the 110-220-volt supply mains of the Art Institute Building, a block distant.

The construction of the 133-ft. display required 12 tons of steel, 5000 ft. of 0.75-in. steel stay-cable, 22 cu. yd. of crushed stone, 16 cu. yd. of sand, and 80 bags of cement. The sign stood opposite what is notoriously the windiest corner in Chicago, and as it presented about 2500 sq. ft. of surface, involved a neat problem of wind-bracing in the soft made-ground of the park. When erected, however, the sign was braced to withstand a wind velocity of 100 miles an hour, which would have entailed a pressure of 50 lb. on each square foot of surface. Beside being guyed from 13 deadmen—10-in. x 10-in. timbers, 10 ft. long, buried 8 ft. underground—it was further stayed from the front by three cables fastened to concrete piers set in the ground, and from the rear by anchoring under the Illinois Central embankment wall. The structural portion of the sign was erected complete in six days.

The electrical decorations for the Knights Templar conclave employed in all 26,000 lamps. The outlay for the various displays was about $48,000. The decorations were planned by Mr. G. B. Coffin, of the conclave committee, and Mr. S. W. Van Nostrand, of the Thomas Cusack Company, and the installation was executed and supervised by Mr. W. F. Becker, superintendent of the electrical department of the Cusack company. The Commonwealth Edison Company supplied the electrical energy for the displays.

SPECIAL ILLUMINATION AT DEEPER WATERWAYS CONVENTION.

The Narragansett Electric Lighting Company furnished electricity for a striking illumination in connection with the third annual convention of the American Deeper Waterway Association, which opened on Aug. 31 at Providence, R. I. Dorrance Street, one of the principal business thoroughfares, was festooned with longitudinal and transverse wreaths of greenery and incandescent lamps between Weybosset Street and Exchange Place, the City Hall and the Providence Opera House also being decorated with American flags and chains of incandescent lamps. About 1360 clear-bulb lamps of from 8 cp to 16 cp were installed on Dorrance Street, the transverse festoons being about 35 ft. apart and the lamps approximately 2 ft. apart on centers. The lamps were all supplied with service on 250-volt multiple, direct-current circuits. At each end of the illuminated section of Dorrance Street a large electric arch marked "What Cheer," in illuminated letters, was installed. The illumination was especially striking when viewed from the plaza in front of the New York, New Haven & Hartford Railroad station, the civic center of the city. H. B. Rust & Company, of Providence, were the wiring contractors.

ORNAMENTAL STREET LIGHTING IN THE MIDDLE WEST.

Even a casual traveler through the Central and Western States will not have failed to remark the change that has taken place during the last three years in the appearance of the business streets of many towns and cities after nightfall. Where, a

Fig. 1—Ornamental Tungsten Lighting, Second Ave., Minneapolis.

few years ago, these same streets were dark and dismal, files of promenaders now saunter up and down under the inviting illumination of special ornamental street posts, examining the contents of shop windows and making selections that will next day become bona fide purchases. Ornamental lighting of the

Fig. 2—Series Tungsten Ornamental Street Lighting, Broadway, Gary, Ind.

city streets, whether done by the merchants to attract business, or by the citizens themselves as part of the regular city illumination, has been found to work surprising changes in the character and amount of trade in the section benefited.

In some instances, as a result of the installation of special lighting, new business centers have been established, and patronage almost lifted bodily, as it were, from one part of a city to another, leaving to the discomfited merchants on the dark streets only the resort of equipping their own curbs with ornamental lighting to wrest back the departed business. City growth and property values have thus actually been affected in more than one community by such intangible factors as illumination and the determination of the less-favored merchants to transpose the business center to their own locality. Usually, of course, ornamental street lighting [illegible] business district acts to increase the effectiveness of the store windows in suggesting needs before unthought of, and in this way stimulates purchases. The attractive street invites more people to use it as a promenade, enhancing the value of the abutting property according to the well-known law that the number of passers is an index to the worth of the site.

Fig. 3—Tungsten Fixtures, Monument Place, Indianapolis, Ind.

In general, two attractive arrangements of the lighting units for special street illumination have received the approval of numerous installations. These are the arch system and the post or standard system. For this class of lighting the first-named system was probably the earliest erected on a large scale, but the pillar arrangement has of late become the more popular in some quarters where the arch system formerly was in the majority. This changing appreciation in favor of the posts is doubtless accounted for by their superior and more uniform sidewalk illumination by night, and the better daylight appearance of the street so equipped. It is interesting to observe, however, that where one progressive city has adopted one or the other forms of lighting, and has its example followed by others in the same region or state, these latter invariably select the kind of construction chosen by the pioneer city. Good examples of this tendency are the numerous arch installations in the Michigan towns about Grand Rapids, and the post lighting that has become quite standard in the West and Northwest since Minneapolis set the pace on a large scale.

Arch construction has taken two different forms. One type utilizes curved iron pipe in a practical arch that spans the street from curb to curb. The other type of arch, first installed in Grand Rapids, Mich., employs a span wire from building to building or post to post, from which, by means of hangers of suitable lengths, the lamps are suspended in a curve which simulates in appearance an actual arch at night. The same suspension scheme is sometimes varied by arranging the lamps in a straight line or in festoons. The arch construction was in

ORNAMENTAL STREET-LIGHTING INSTALLATIONS.

						INSTALLATION			[illegible]		
City	Fixtures	[illegible]	[illegible]	Distance between Fixtures Feet	Watts per Front Foot	[illegible]	[illegible]	[illegible]	[illegible]	Cost per Fixture per Year	Cost per Front Foot per Year
Aberdeen, S. D.	Posts	[illegible]	[illegible]	[illegible]	3.0	Elec. Co.			[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0					[illegible]	[illegible]
[illegible]	[illegible]	2 60-w. 1 [illegible]	[illegible]			Elec. Co.	$60.00		[illegible]	[illegible]	
Appleton, Wis.	Arches	75 8-c.p. Carbons	[illegible]	[illegible]	15 0		35 00	$0.46			
Aurora, Ill.	Posts	2 [illegible] 1 [illegible]	[illegible]	[illegible]	5.2	[illegible]	180 00	3.60	[illegible]		
[illegible]	[illegible]	10 75-w	[illegible]	[illegible]	[illegible]					12 [illegible]	[illegible]
Billings, Mont.	Posts	[illegible]	[illegible]	[illegible]	1 [illegible]						
Buchanan, Mich.	Posts	2 40-w [illegible]	160	[illegible]	3.0	City	45.00	[illegible]	City	[illegible]	[illegible]
Chicago, Ill.	Posts	[illegible]	240	[illegible]	4.8	Elec. Co.		[illegible]	Merchants	[illegible]	1 [illegible]
Chicago, Ill.	Posts	[illegible]	300	[illegible]	6 0	Elec. Co.			Merchants	109.10	2 [illegible]
Des Moines, Iowa	Posts	[illegible]	500	[illegible]	[illegible]	Owners	85 00	[illegible]	Tenants	69.50	1 [illegible]
Ft. Dodge, Ia.	Posts	5 100 [illegible]	500			Owners Tenants		[illegible]	Tenants	84.00	
Ft. Wayne, Ind.	Posts	[illegible]	[illegible]			Owners	40 00		City		
Gary, Ind.	Posts	[illegible]	[illegible]	[illegible]	4 4	Owners	70 00	[illegible]	City	75.00	1 50
[illegible]	[illegible]	14 75-w	1050	[illegible]	5.3	Merchants	50 00	2 50	Merchants	98.00	0 49
[illegible]	[illegible]	[illegible]	750								
[illegible]	[illegible]	2 60-w 1 100-w	220	[illegible]	2 2	Elec. Co.			Commerci'l Club	55.20	0.55
[illegible]	[illegible]	[illegible]	[illegible]	500	0 5						
Holland, Mich.	Arches	80 5-w 20 40-w	800	[illegible]	4 0		40 00	0 20	City	62 50	0.31
Indianapolis, Ind.	Posts	[illegible]	500	[illegible]	[illegible]	Elec. Co.	88 30	1 05	Merchants		
Joliet, Ill.	Posts	4 60-w	240	[illegible]	[illegible]	Merchants	87 50	1 25	City		
[illegible]	[illegible]	10 75-w	750	[illegible]	[illegible]	[illegible]	106 00	1 50	Merchants	88 20	0 68
[illegible]	[illegible]	3 100 w	[illegible]	[illegible]	[illegible]	City	45 00	1 25	City		
[illegible]	[illegible]	3 8-c p Carbons	[illegible]	[illegible]	[illegible]		100 00	0 87			
[illegible]	[illegible]	5 100 w	500	[illegible]	[illegible]	Owners	127 50	2 13		58 50	0 97
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	Owners	145.00	[illegible]	[illegible]	125 00	1 25
[illegible]	[illegible]	10 75-w	750	[illegible]	[illegible]	[illegible]					0 75
Oakland, Cal.	Posts	Carbons	550	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0 485
Seattle, Wash.	Posts	1 100 w	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]			
[illegible]	[illegible]	5 100 w	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			
Van Wirt, Ohio	Arches	15 8 c p Carbons	[illegible]				[illegible]				
[illegible]	[illegible]	10 60 w	[illegible]	[illegible]	1 3	City					

[illegible] days of the latter illuminant series lamps of large filament section were employed successfully on the arches, 14 or more being connected across 220-volt mains.

From the first, the post construction has employed multiple lamps, although some cities have had such discouraging experiments with tungstens, even when flexible suspension was resorted to, that the high-efficiency units have been abandoned in favor of the old-style carbon lamps, as in some Pacific Coast cities. In the majority of places, however, 110-volt multiple tungsten lamps have given good service mounted rigidly on the fixtures. Perhaps the only large series tungsten installation on pillars is that on Broadway, Gary, Ind., where the lamps are energized through constant-current transformers from 6600-volt mains.

An accompanying table gives the significant details of a number of representative special lighting installations which have been described at various times in the *Electrical World*. In each instance the type of fixture is given, the lamps and wattage per fixture, and the distance between posts or arches. In the case of the latter the frontage of both sides of the street is taken into account in computing the watts per foot and the costs per foot. The figures in some of the cost columns vary widely, and yet are significant, as such variations are always accountable to special local conditions.

The arrangements under which the installation has been made differ for various places. In some cities the downtown ornamental lighting is part of the general street-illumination system, and the entire community is taxed indirectly to erect and maintain the installation. In other cases the merchants and tenants of abutting buildings have taken the proposition into their own hands, asking the property owners to erect or contribute to the erection of the standards, as it is considered that these enhance the property values of the streets benefited, or arranging to meet the cost of erection, as well as of maintenance, themselves. Under other conditions the electric company of the city is the promoting agency of the improved illumination, frequently erecting the posts as its own investment and holding the merchants to a contract period of several years at a definite sum, at the end of which time the posts either revert to the city or business men's leagues or remain the property of the company.

NEW TELEPHONE PATENTS.

TRUNK CIRCUITS.

It is well understood that the present-day common-battery system is much surer and less cumbersome in its operation than the magneto system. Because of this, if it becomes necessary to interconnect subscribers of the two systems, the grade of service furnished is at once reduced to that of the magneto, unless special means be provided to get the benefits of the automatic signals of the common-battery system. A patent granted to Mr. C. S. Winston, of Chicago, and assigned to the Kellogg Switchboard & Supply Company, has these benefits in view. The trunk is outgoing at the magneto office, and therefore, according to modern operating systems, disconnection begins there. Accordingly, a signal lamp is provided which follows the hook switch of the distant common-battery subscriber. As soon as the magneto operator clears the trunk an automatic disconnect lamp is displayed before the distant trunk operator.

The trunk circuit described in Mr. C. E. Hague's patent, assigned to the Stromberg-Carlson Company, provides for the control of the ringing of a distant exchange subscriber by the operator at the calling end. Selective ringing is contemplated and therefore the trunk operator must set a ringing-switch key for each particular trunk and call. The picking up of the outward end of the trunk by the calling operator connects the ringing current to the trunk. Ringing is then done through automatic commutators until cut off by the response of the called station.

STATIONS ALONG HIGH-VOLTAGE LINES.

Where the telephone is used along high-voltage transmission lines the electrostatic charges induced upon the telephone conductors have been found sufficient to produce serious shocks. To avoid this a high-insulation telephone transformer is now frequently used to guard the telephone user. It has been found that where there are many stations the transformers shunt out the signaling current. Mr. John B. Taylor, of Schenectady, N. Y., introduced a switch by means of which the transformer may be cut off except when required for talking. The switch does not affect the bells, which are at all times left connected. This patent has been assigned to the General Electric Company.

LETTERS TO THE EDITOR.

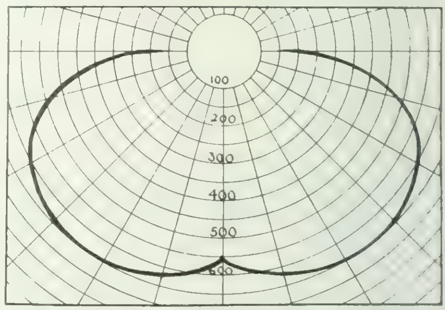
Illumination of Large Areas by Tungsten Lamps.

To the Editor of Electrical World:

SIR:—The article in your issue of July 28 describing a large installation of flaming-arc lamps used at the U. S. Army Tournament at Chicago during the Fourth of July celebration is of especial interest to illuminating engineers in that it presents almost the first reliable data yet obtained relative to the performance of flaming-arc lamps under actual service conditions.

To recapitulate, the arena was 600 ft. long by 400 ft. wide, or 240,000 sq. ft. in area. Eighty 550-watt flaming arcs of 3000 rated cp were installed. From an average of 35 illuminometer readings made at seven different stations on the field, it was found that the intensity of light varied from 0.71 to 1.35 foot-candles, the average being slightly under one foot-candle. This intensity of light corresponds to an efficiency of 0.185 watt per lumen, or 5.4 effective lumens per watt, a constant which should be of value when planning similar installations of flaming-arc lamps.

Another interesting point in connection with this installation was that, as the lamps weighed nearly 35 lb. apiece, the heavy steel cables which supported them were called upon to withstand



Distribution Curve of 500-Watt Tungsten Lamp.

a strain of 15,000 lb. each. The lamps were suspended at a height of 35 ft. above the field, and a wagon carrying a ladder 45 ft. high was used to facilitate the daily trimming and cleaning of the arcs. The entire equipment of 80 lamps was installed at a cost of approximately $5,000.

Since incandescent lamps are now being manufactured in very large sizes it might be of interest to your readers to know just what can be accomplished by their use under circumstances similar to those cited above. The cut shows the distribution curve of a 500-watt tungsten lamp equipped with an enameled steel reflector. This lamp operates normally at an efficiency of 1.15 watts per horizontal candle, or, with a well-designed reflector, at 0.9 watt per mean lower hemispherical candle-power.

Based on the assumption that each flaming arc in the forementioned installation was to be replaced by a 500-watt tungsten lamp, accurate determinations of the resultant illumination

were made by the "point-by-point" method. It was found that the intensity of light on the field would vary from 0.78 to 1.008 foot-candles, with an average for 54 stations of 0.94 foot-candle, an intensity but slightly less than that obtainable from the flaming arcs. The average candle-power of tungsten lamps throughout their rated life of 1000 hours is in most cases fully equal to the initial; hence the calculated value of 0.94 foot-candle would, no doubt, check very closely with actual illuminometer tests.

Aside from the slight saving in current consumption, the first cost of installation would appear to be the great advantage of using tungsten lamps in work of this character. The list price of the 500-watt lamp is but $5.50, and as comparatively light cables and supports would prove adequate where such units were installed the entire cost of a permanent installation should not exceed $1,000.

One serious criticism was made in regard to the flaming arcs which would apply with equal force to tungsten units as above described. From the distribution curve it will be noted that a considerable amount of light is given off at angles just below the horizontal; this was also true of the flaming arcs, spectators having been forced to shade their eyes in order to see distinctly when viewing distant parts of the field. There is no doubt, however, that a reflector designed to correct this fault will soon be available.

Cleveland [illegible]

The Marconi Company and Wireless Telegraphy.

[illegible]

SIR:—I have read carefully the editorial which appeared in your issue of Sept. 8 on the subject of "Wireless Telegraphy," and while agreeing with a large part of what is written setting forth that wireless telegraphy and the wonder of the art have been used by unscrupulous people to further their own ends and bleed the too unsuspecting public, I think that those who have been working to perfect the art without regard to the stockjobbing end should receive due consideration.

I admit that my company has been used, without its permission or consent, for the purposes exposed in the article above referred to, and that, much to the regret of my directors and others properly interested in the development of the art, many foolish and untrue representations have been made by jobbers and dealers in stock for their own ends to deceive the public and induce purchases of stock at inflated prices.

The reduction of the capital stock in my company was recommended by the directors, not "to avoid drowning in its own pool," but because in the proper open market the price of the stock had ruled at a very low point for some time previously, and because by such reduction of capitalization very considerable saving would be secured in taxation and other ways.

True it is that ten years have passed by since wireless telegraphy first made itself known to the people generally, but in the art during that time many and unforeseen difficulties arose which have taken time, large expenditures of money and intense work on the part of the leaders to overcome.

My company has never "counted its earnings in rainbow gold," but has yearly published true and correct balance sheets, and the last issued (a copy of which is herewith enclosed) shows, after writing 10 per cent off the installation account ($12,936), that there was placed to the credit of profit and loss account $3,701 over and above all proper charges and expenses.

The system is now come into an actual and proper position whereby the work of the past 10 years shows the object which was aimed at all along to be about accomplished. In June of the present year the station at Glace Bay, N. S., having been put in perfect order (after the disastrous fire which took place there about this time last year) the system was opened for general business between that station and the station at Clifden, Ireland. During the following months improvements were made at both the above stations, to-day communication is established on a perfectly commercial basis, and we are now receiving and transmitting perfectly and with proper despatch messages for business men of New York to any part of the United Kingdom at the rate of 17 cents per word, a considerable reduction on the existing cable rates.

The rate of speed, New York to London, being quite equal to any cable using land-line connections for transmission to the cable points of departure, and the accuracy being as perfect as any cable service, the only thing which may in any way interfere with the work of the stations is overcrowding, as the stations, being merely duplex stations, cannot take unlimited business; but even that matter has been properly provided for in contracts with business houses.

[illegible]

[illegible]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Control of Induction Motors.—A note on a recent British patent (7822, 1910; Aug. 18, 1910) of Siemens Brothers Dynamo Works. The rotor current of the polyphase motor to be controlled is fed into the alternating-current side of a rotary converter, and the continuous current generated is supplied to a direct-current motor coupled to the rotor of the main motor. The starting resistances of the main motor are placed in series between the rotor and the rotary converter, so that the armature of the latter forms the neutral point for starting up. As the rotary converter is excited before the main motor is started up, the rotor currents run it up in step with the main motor, so that synchronizing apparatus is not required.—Lond. *Elec. Eng'ing*, Aug. 25.

Short-Circuiting Device in Induction Motors.—A note on a recent British patent of J. H. Holmes & Company (17,520, 1909; Aug. 18, 1910). The switch for short-circuiting the rotor winding when the machine has reached its full speed rotates with the rotor, and is held in its closed position by springs. The switch is held open during starting by means of an external handle, which brings rubbing surfaces into contact and draws the contacts apart. When the switch is in the closed position there are no rubbing surfaces in contact.—Lond. *Elec. Eng'ing*, Aug. 25.

Interpole Machines.—[illegible] article on difficulties experienced with interpole machines. While the author does not deny that the interpole machine has enabled economical speed regulation within rather wide limits, he emphasizes that there are distinct limits for the operation and that these cannot be transgressed except by the use of completely compensated motors, like that of Deri.—*Elek. Anz.*, July 24.

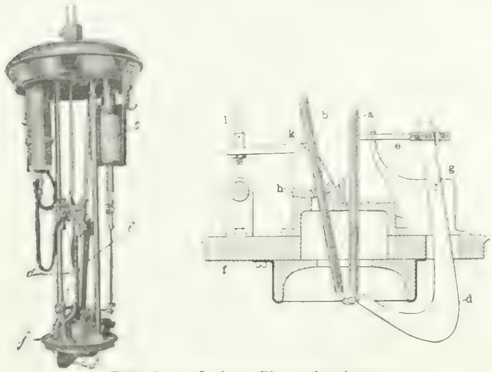
Converters.—B. JACOBI.—A review of the different types of rotary machines for converting alternating current into direct current, namely, motor-generators, rotary converters and cascade converters, with a discussion of their relative advantages [illegible]

Turbo-Generators.—E. G. BRUNSWICK.—The conclusion of his very long review of the methods of construction of commercial turbo-generators, giving notes on compensating machines, the losses in interpoles, etc., and a table summarizing the principal dimensions of the standard turbo-generators built [illegible] *Elec.*, Aug. 25.

Lamps and Lighting.

[illegible] carbon rests on a support below the economizer, there being

no clockwork feeding gear. As shown in Figs. 1 and 2, one carbon *a* (in the direct-current lamp the negative) is perpendicular, and the other carbon *b* is inclined and is swung for striking and regulating by means of a sliding collar *h* on the base plate *f*. This collar is pivoted at *k*, and is swung by the rod *l*, which is attached to the plunger of the series solenoid. The holders of the two carbons are mechanically linked together and feed down as the carbons are consumed. The tip



Figs. 1 and 2—New Flame Arc Lamp.

of the perpendicular carbon rests on a swinging support *d* pivoted at *g*. Between the upper arm of the support and the carbon is a pin *e*, which is pressed against the carbon and prevents it from bearing on the lower support with the full weight of the carbons and holders so long as the tip of the carbon rests on the lower arm. When the carbon burns away, the support swings just sufficiently to release the pressure of the pin *e*, and this allows the carbon to feed slightly so that the tip again rests on the support. By supporting the carbon chiefly from the side in this manner, the breakage of the point is avoided. The support is very massive so as to conduct the heat away quickly from the end, and further, the arc itself is some 5 mm distant from it, so that it does not require frequent renewal. The lamp can be used on either alternating-current or direct-current circuits without any alteration. The specific consumption is given as 0.13 watt per candle-power. An important feature of the lamp is the provision of an automatic arrangement whereby one of the carbons is dropped out of its holder when the carbons have burned down to a certain point. The fire-clay economizer is supported from the base plate by a metal ring, as shown in the second diagram. On the left of the plate is an electromagnet for providing the necessary weak field to steady and expand the arc. The carbons fit the apertures in the base plate very closely, and it is practically impossible for any fumes to rise into the body of the lamp. Further, a careful system of ventilation is provided for. An inner globe close to the arc is well swept by the air currents, and is thus kept free from deposit. Air enters at the top of the outer globe, passing down between the two globes up through a perforated ash tray in the bottom of the inner globe, and from thence up all around the economizer to the outside of the lamp. Ordinary metal-cored flame carbons are used in these lamps, but with alternating currents only one need be mineralized. The lamps burn singly on 65 volts or any number may be run in series. The short-hour pattern gives from 8 to 10 hours on one trim, the long-hour pattern from 16 to 18 hours. For special purposes, a double-carbon pattern can be obtained. The mechanism of this lamp is identically the same as that described above except that it is in duplicate, and a change-over arrangement is provided so that directly one pair of carbons is burned out the other pair is switched in without any interval, so that the change-over is hardly noticeable. From 32 to 38 hours' burning is obtained with this lamp.—Lond. *Electrician*, Aug. 26

Engineers' Society of Milwaukee. The author first gives a review of the different new metallic-filament lamps and arc lamps which have been introduced for street lighting in recent years and then discusses the selection of candle-power and distance between lamps in street lighting. In the outlying or suburban districts of large cities, and in small towns, one can safely say that a tungsten lamp of 80 cp at each street intersection gives far better illumination on the street than the customary arrangement of an arc lamp on every other corner. In larger cities the question is not so easy to decide. In all street-lighting work it is the point of minimum illumination half way between the lamps which should always receive the first consideration. The author asks whether we can see as well when facing a few large lamps of high candle-power as we could when facing a larger number of lower candle-power lamps. It is a fact that bright lamps within our range of vision, when there is but little surrounding light, have the effect of greatly reducing our ability to see clearly. But what bearing this has on the question of the use of large arcs at street intersections versus small units is not known. The author suggested that this should be tested experimentally.—*Jour. Assoc. Engin. Societies*, July.

Assorting Metallic Filaments.—B. Duschnitz.—Before the loop-formed, sintered metallic filaments can be united to the leading-in wires it is necessary to measure the resistance of each filament. These measurements must be made in the filament factory before the filaments are transferred to the lamp factory. The measurement is difficult in view of the brittleness of the filament. The author describes a new simple instrument for measuring the resistance, the principal feature of which is that the connection of the ends of the filament to the terminals of the measuring circuit is almost automatic.—*Elek. Anz.*, July 28.

Metallic-Filament Lamps.—B. Duschnitz.—The first part of an article giving a review of new arrangements brought out during the past year of mounting the metallic-filament loops within the globe.—*Elek. Anz.*, Aug. 14.

Generation, Transmission and Distribution.

Schaffhausen.—The city of Schaffhausen, in Switzerland, has three stations, called A, B and C, of which the last one, station C, has been provided with a storage lake capable of supplying sufficient water to furnish daily 980 hp for 10 hours. Data are given on the equipment of station C and on the storage lake.—*Elek. Kraft. u. Bahnen*, July 24.

Traction.

Booster Excitation.—J. Jonas.—When a storage battery is operating in parallel with a generator the object is that the generator should carry a constant load and the battery should discharge to supply the excess current required or should be charged when the load decreases. This object cannot be fulfilled by simple parallel connection of battery and generator on account of the difference between the charging voltage and the discharging voltage of the battery. For this reason a booster may be connected in series with the battery supplying an additive positive or negative voltage according to the load and thus aiding the discharge or charge of the battery. The arrangement is shown in Fig. 3 if the exciting winding *b* is omitted for the present. The connections shown are known as the Pirani arrangement. *G* is the generator, *B* the battery, *Z* the booster, *E* the exciter for the booster, and *M* the motor which drives *Z* and *E*. *a*, *c*, *d*, *f* and *h* are the excitation windings. The characteristic feature is the differential excitation *fh* of the exciter *E*. *f* is connected in series with the regulator *R* across the busbars and therefore gets a constant exciting current, while the winding *h* is in parallel with the shunt *sh*, so that the current passing through *h* is proportional to the current *J* in the network. The excitation *h* is opposite to the excitation *f* and the windings are so designed that when the current in the network reaches the average value the resulting joint excitation of *f* and *h* is zero. Since the booster *Z* is excited solely by *c*, the excitation of *Z* is also zero at this moment and no additional voltage is generated. The battery, therefore, neither supplies current nor receives current when the load in the net-

work has the average value. But when the load decreases, the excitation of h is stronger than that of f and c is now so excited that the voltage of the booster Z is added to the voltage of the battery B. On the other hand, if the load is below the average value the excitation of f is greater than h and the additional voltage of the booster Z is reversed so that the battery is now being charged. The operation of this arrangement is strictly symmetrical for charging and discharging so that the load of the generator is maintained constant. But the arrangement is dangerous for the life of the battery because in general the ratio of the maximum permissible charging current to the maximum permissible discharging current is about 0.5. If the battery is not made correspondingly large it may be hurt by

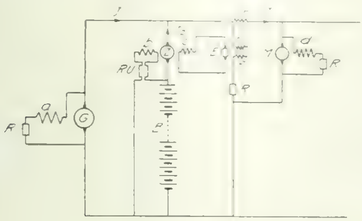


Fig. 3—Booster Excitation.

unduly high charging currents. This is avoided by the device of the author and Bull, who have added to the Pirani arrangement the excitation b, as shown in Fig. 3. The voltage impressed on the terminals of b is approximately constant and the arrangement is so made that the action of b is opposite to that of c. When the load has the average value, the excitation of the booster must be zero, that is, the winding c must have an equal (though opposite) exciting current with the winding b. In this case the exciter E must, therefore, supply a certain current so that the ampere-windings of f and h no longer balance each other when the load has the average value. When the load increases above or decreases below the average value by equal amounts, the excitation of E is increased or decreased, but not by equal amounts, on account of the curved shape of the characteristic curve of the exciter (which is practically a straight line for decreasing current and a bent curve for increasing current). The excitation of c is, therefore, not changed in the same degree by equal increase or decrease of load, and the conditions can be so chosen that the ratio of the maximum permissible charging current to the maximum permissible discharging current has the desired value of 0.5. With this arrangement it is possible to reduce the size of the battery quite considerably.—*Elek. Kraftbet. u. Bahnen*, Aug. 4.

Monorail Gyroscope Traction [illegible]—[illegible].—The author, who is the technical head of the proposed Scherl monorail gyroscope traction system, discusses some points in a recent critical article of Schimpff. He emphasizes especially that a high-speed railroad using speeds up to 200 km (120 miles) per hour is impracticable with two-rail tracks on account of the difficulty in building the roadbed and of the accurate laying of the rails. For such high-speed railroads he, therefore, concludes that the single-rail system must be used, but he thinks it has a further field of usefulness even with lower speeds, since the cost of erection and maintenance of the roadbed is considerably reduced. He finally replies to several criticisms of Schimpff.—*Elek. Kraftbet. u. Bahnen*, Aug. 14.

Anti-friction Bearings and Power Consumption.—A. B. [illegible]ITZER.—An illustrated account of car tests in Philadelphia with anti-friction bearings, showing a decrease of power consumption and of heating of the motors. The anti-friction armature bearings appear to have been of most service in reducing the heating of the motors, while the anti-friction journal bearings were most effective in reducing the power consumption per ton-mile.—[illegible]

Direct-Current Interurban Railway.—An illustrated description of the Southern Cambri[illegible] vania, which is another example of the use of the 1200-volt direct-current trolley system on an interurban road.—*Elec. Rail'y Jour.*, Sept. 3.

Installations, Systems and Appliances.

Restricted-Hour Supply of Power.—P. J. Pringle.—An article on the possibilities of the restricted-hour system of power supply. In the introduction the author refers to the suggestion of A. M. Taylor that the consumers should install storage batteries on their premises and purchase a restricted-hour supply from the undertaking at an especially low figure. The author thinks that this proposition will find favor in future. He then discusses at some length the experience of the central station with which he is connected with respect to restricted-hour power supply. Ordinarily factory hours will not conform with the no-peak hours of the central station, but the author has known cases where timber works have altered their hours of working to adapt themselves to the restricted hours. He refers to the sale of energy for refrigerating purposes and points out that it is important always to consider whether large consumers might be transferred to the restricted-hour supply. As to the price to be charged, it should include the fuel cost based on the cost for the additional units turned out, a proportion of the cost for repairs and maintenance, and a small proportion of cost of management, rents, rates and taxes. Many undertakings would find that 0.6 cent to 0.8 cent would cover the whole of the above costs. In the central station with which the author is connected the ordinary prices for energy supply are on the maximum-demand system of 6 cents and 2 cents, giving a price per kw-hour decreasing to about 3 cents. For large consumers the price is reduced to 2 cents flat rate. The prices that the restricted-hour kw-hour is sold at are as follows:

For a consumption up to 20,000 kw. hours per annum.	All units at 2.00 cents
For a consumption exceeding 20,000 up to 40,000 per annum	All units at 1.875 cents
For a consumption exceeding 40,000 per annum up to 65,000 per annum	All units at 1.75 cents
For a consumption exceeding 65,000 per annum up to 100,000 units per annum	All units at 1.625 cents
For a consumption exceeding 100,000 per annum	All units at 1.50 cents

By plotting the curves of the maximum loads and the hours of same for, say, the last two years, and then plotting against these quarter-hourly, half-hourly, and longer if necessary, the loads previous to and after these, the maximums, a very good idea can be obtained as to when the restricted hours should commence for the various months and the kilowatts available. Local conditions of demand will, of course, affect this considerably. In the author's station the hours of restriction that have been decided upon are as follows:

[illegible]	[illegible]
October 16th to October 31st	5.00 p. m. to 7.30 p. m.
November 1st to November 15th	4.15 p. m. to 7.30 p. m.
November 16th to January 15th	3.45 p. m. to 7.30 p. m.
January 16th to January 31st	4.30 p. m. to 7.30 p. m.
February 1st to February 15th	5.00 p. m. to 7.30 p. m.
February 16th to February 28th	5.30 p. m. to 7.30 p. m.
[illegible]	[illegible]
March 16th to March 31st	6.30 p. m. to 7.30 p. m.

Wednesday, being early closing, and Saturday (other than those coming in Christmas week), if specially desired, are allowed to be unrestricted. No restrictions are made from April 1 to Sept. 30. As to the enforcement of the restricted-hour system the author has found that he could rely with safety upon certain customers adhering to the restricted hour. In other cases time switches are to be used. The article is to be concluded.—Lond. *Elec. Rev.*, April 26.

Stockholm.—E. Andreason.—The first central station of Stockholm, in 1892, was designed to supply direct current to the business district of the city and it has still steam-driven dynamos of an aggregate capacity of 1360 kw. The increasing demand necessitated the erection of a new plant which was opened in 1903, and produces three-phase currents at 6000

volts and 25 cycles for transmission by underground cables to five substations, of which the Tule station with 9000 kw capacity is the largest one. The three-phase currents are transformed there into direct current by means of non-synchronous motor-generators. The intention is to change the original direct-current generating station also into a substation. The power plant is located at the Värta harbor in a very convenient situation for the supply of fuel, the removal of ash, and supply of condensing water. The original equipment of the power plant consisted of five three-phase generators, each of 1500 kw, of which three are driven by steam engines and two by steam turbines. In 1909 it became necessary again to enlarge the station, and there are now in the course of erection two turbo-generators, each of 6000 kw. The equipment of the plant is described and illustrated by various diagrams.—*Elek. Kraft.* [illegible] July 21.

High-Tension Insulators.—W. WEICKER.—The first part of an account of experiments extending over seven years on the discharges of high-tension insulators. The author first points out that for the breakdown of an insulator the maximum and not the effective voltage is decisive. But most of the electrostatic high-tension voltmeters give the effective value of the voltage. When using them it is therefore necessary to know exactly the ratio of effective to maximum value, and attention must be paid to the fact that in tests of this kind distortions of the voltage curve changing the above ratio, may often occur. The author gives some notes on determining directly maximum voltages by means of a spark-gap. He then deals with the arrangement of the insulator during the test and the effect of temperature, air pressure, and humidity. The effect of humidity on the spark voltage of a large insulator is shown

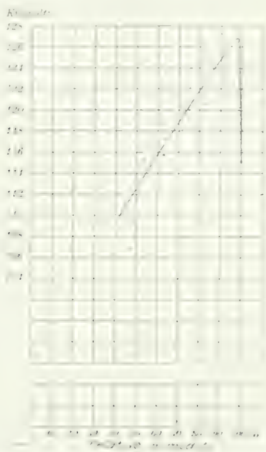


Fig. 4—Tests of High-Tension Insulators.

in Fig. 4. It shows that the insulation resistance increases with increasing humidity until the condensed steam precipitates on the insulator. At this moment the sparking voltage decreases rapidly for all sizes of insulators. The illustration shows the sparking voltage of a 40,000-volt insulator as a function of the relative humidity of the air. The author then discusses discharges during rain and describes the arrangement of tests with artificial rain. The paper is to be concluded.—*Elek. Zeit.*, Aug. 25.

Wires, Wiring and Conduits.

Temperature Coefficient of Resistance of Copper.—J. H. DELLINGER.—The values in common use for the temperature [illegible] 0.00369 to 0.00409, where a_0 and a_{20} are defined respectively by [illegible] and R_0, R_{20} [illegible] resistances, respectively, at 0 deg. C., at 20 deg. C. and at t deg. C. The present paper gives the results of an investigation made in the Bureau of Standards as to the variation of the temperature coefficient in different samples of copper and its possible relation to the conductivity. The results show that there are variations of the temperature coefficient, and that to a fair accuracy the relation of conductivity to temperature coefficient is a simple proportionality. Thus, annealing is known to increase the conductivity of hard-drawn wire and annealing increases likewise the temperature coefficient by an exactly proportionate amount. Samples varying in the amount of chemical impurities vary in conductivity, and their temperature coefficient is substantially proportional to the conductivity. To prove this the author calculated the ratio of C of the temperature coefficient a_{20} to the "per cent, conductivity" where the "per cent conductivity" is figured on the assumption that 100 per cent conductivity corresponds to the arbitrary standard resistivity of 0.153022 ohm per meter-gram at 20 deg. C. The results show that the values of C are very nearly constant in the different samples, varying from 0.003926 to 0.003956, the mean value being 0.00394. The main result of this investigation may, therefore, be expressed in the form of the following practical rule: "The 20 deg. C. temperature coefficient of a sample of copper is given by multiplying the number expressing the per cent conductivity decimally by 0.00394." The rule can be put in a remarkably convenient form for reducing the results of conductivity measurements to a standard temperature, viz.: "The change of the resistivity per degree C. of a sample of copper is 0.000598 ohm per meter-gram or 0.00681 micro-ohm per centimeter cube." The last two constants are independent both of the temperature of reference and of observation and also independent of the sample of copper. In view of these results measurements of conductivity may in certain cases be replaced by measurements of the temperature coefficients. This may be useful, especially for odd shapes, short samples, wires that have been distorted or bent, and for the estimation of chemical purity.—*Jour. Franklin Institute,* September.

Electrophysics and Magnetism.

Dimensional Formulas of Physical Quantities.—CARL HERING.—A paper giving tables of physical quantities arranged in the order of their dimensions, all those of the same dimensions being brought together, and those of nearly the same being close neighbors. The dimensional formulas are arranged in groups. All the quantities containing the factor length (L) form the first group. In this group they are arranged in the order of the exponent of L, beginning with the smallest. The letters are given preference in the following order: L, M (mass), T (time), etc. In the second group the quantities are similarly arranged in the order of the exponent of mass; in the third of that of time. In the fourth they are classified according to magnetic permeability; in the fifth according to electric inductive capacity; in the sixth according to temperature; in the seventh according to angle, while in the last group they are classified according to no-dimensional quantities.—*Jour. Franklin Institute,* September.

Direct Current from Geissler Tubes.—A note on some observations made by H. A. Perkins in experiments with so-called electrodeless discharges. When the Geissler tube excited by an alternating current of 60 cycles was equipped at the ends with electrodes connected to a galvanometer it was found that a direct current passed through this circuit. For exciting the tube the author used a transformer giving a secondary voltage of 2000. One pole of the secondary winding was connected to earth and the other pole to a metallic ring surrounding the Geissler tube at one point. The production of direct current is connected with changes of the luminosity of the tube. The phenomena depend greatly on the pressure in the [illegible] July 21.

Electrochemistry and Batteries.

Separation of Oil from Water.—R. ELLIS.—An account of experiments on the reactions in the separation of oil from

condenser water by electrolysis according to the Davis-Perrett process.—*Jour. Society of Chem. Industry*, Aug. 15.

Units, Measurements and Instruments.

Localization of Faults.—D. Shirt.—An article in which the author describes a particular method of applying the Murray test. Cases frequently occur in fault localization by the loop

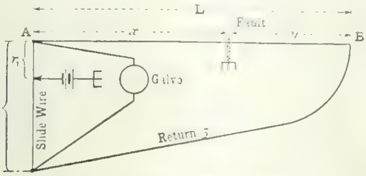


Fig. 5—Localization of Faults.

test where it is found necessary to employ a return of different section of length from that of the faulty cable. In this case the ratio of the resistances of the two conductors or the diameter and number of wires in each cable must be measured or estimated. By the simple expedient of taking a loop test from each end of a faulty cable it is unnecessary to know the resistance of the return or even of the line, if it does not vary in section, provided the resistance of the loop remains constant. Further, leakages to earth from the return itself become partially compensated for, because the calculated position of the fault will always lie between the two resultant faults due to such leakages. Let AB (Fig. 5) represent a faulty cable of constant section and resistance L, divided by a fault into two sections x and y. Let the resistance of the return be z. Let us also assume that a slide-wire bridge is used to carry out a Murray loop test at each end. At the end A balance will obtain when the slide wire is divided into two portions, such that $r_1 : S = x : x +$ [illegible]. Similarly at the [illegible] balance will obtain when $r_2 : S = y$ [illegible]. Hence $x = \frac{r_1 L}{r_1 + r_2}$.

Obviously this equation is also true if we express x and L in units of length (yards, for instance) and $r_1 r_2$ in number of divisions of slide wire from the points A and B, respectively. Neither the resistance of the return nor the total length of slide wire enters into this equation. It is, therefore, clear that when the resistance of the return is high compared with that of the faulty cable, we may, by adding a resistance in series with the slide wire, increase the values for r_1 and r_2, which might otherwise be too small to read to the required degree of accuracy. This added resistance must not, of course, be altered throughout the tests, and should, if possible, be of the same metal as the slide wire itself, otherwise errors may be introduced by possible differences in temperature at the testing points. This test, with simple correction, may often be ad-

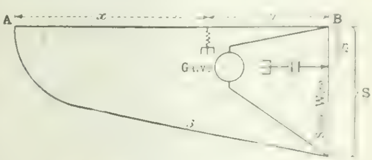


Fig. 6—Localization of Faults.

vantageously employed in fault localization on multicore or concentric cables where a sound return is not available, but in this case it is necessary to [illegible] sistances of the line and return conductors where great accuracy is desired. A typical case of this kind would be where a fault had developed on one [illegible] cable and the insulation of the other conductors had fallen considerably owing to the ingress of water or the development of excessive heat at the fault. Fig. 7 illustrates diagramatically a case of this kind, only the two conductors used for the test being shown. Let f_1 and f_2 be the fault resistances of the conductors AB and A_1B_1, respectively, f_2 being high as compared with the resistance of the loop. Let $x + y = L =$ the resistance of AB. Let $p\,(x + y) =$ the resistance of A_1B_1, where p is the ratio of the resistance of A_1B_1 to that of AB. Let $a =$ the resistance from A to the resultant of the faults $f_1 f_2$, as found

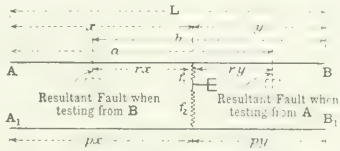


Fig. 7—Localization of Faults.

by test from A, BB_1 being coupled together. Let $b =$ the resistance from B to the resultant of the faults $f_1 f_2$, as found by test from B, AA_1 being coupled together. Let $r = \frac{f_1}{f_1 + f_2}$ [illegible] p). Then $X = a$ [illegible] y and y [illegible] b [illegible] rx. From these equations we obtain $X =$ [illegible]. We may again express x and L in units of length, and a and b in the number of slide-wire divisions from the points A and B to their respective points of balance. The distance between the resultant faults is rL. Therefore, if by P we represent that length of slide wire which corresponds to the conductor AB, namely, $\frac{S}{1 + P}$, then $r = \frac{a + b - P}{P}$. The value of x is indeterminate when $r = 1$, that is when $a = b = P$, and the smaller r becomes the nearer x approaches to the value $\frac{aL}{a + b}$. A numerical example is given. —Lond. *Electrician*, Aug. 26.

Measuring Very High Voltages.—A note on a method of C. E. Guye and A. Tscherniavski. The electrostatic voltmeter is placed in a box containing a compressed gas. Since the discharge potential is approximately proportional to the gas pressure it is possible to measure much higher voltages with the same distance between electrodes without producing a spark. The constant of the instrument is approximately independent of the gas pressure, so that the latter may not be measured, but is only maintained so high that there is no spark discharge and no electric effluvium between the electrodes. If air damping is employed, the damping effect may be regulated by variation of the gas pressure.—*Elek. Anz.*, Aug. 11.

Silver-Aluminum Alloys.—W. Broniewski.—An account of tests of the electrical properties of silver-aluminum alloys, giving the curves of variation of conductivity, temperature coefficient and the thermoelectric power with change of the proportion of silver in the alloy. For pure metallic silver the author finds a temperature coefficient of the electric resistivity between 0 deg. C. and 100 deg. C. = 0.00415.—*L'Industrie Elec.*, Aug. 25.

Mercury Motor Meters.—Roentsch.—A description of the Hookham mercury motor meter and an account of the results obtained with it in small installations.—*Elek. Anz.*, Aug. 28.

Induction Meters.—H. W. L. Bruckmann.—An illustrated account of experiments with the alternating-current induction meter with special reference to its theory. The author emphasizes especially the proportionality of speed with current and voltage and with frequency and the suitability of phase [illegible]

Telegraphy, Telephony and Signals.

Automatic Telephone Exchange.—Grabe.—An article in which the author discusses the relative commercial advantages

of hand-operated, semi-automatic and automatic telephone exchanges and shows that the commercial superiority of any of these systems depends on the size and the arrangement of the plant. Under the conditions which exist in Germany with respect to the size of the exchanges, wages of the employees, etc., he concludes that in most cases the automatic system is superior to the semi-automatic system and the latter is superior to the hand-operated exchange. "The introduction of automatic or semi-automatic operation is a progress of civilization which can no longer be retarded."—*Elek. Zeit.*, Aug. 25.

Wireless Telegraphy.—P. SCHWARZHAUPT.—An English translation of his recent German paper on abnormal transmission of electromagnetic waves. Wireless telegraph stations whose normal range is 100 km (60 miles) may under certain conditions be heard at a distance of 1000 km (600 miles) or more. This phenomenon of abnormal range occurs only at night. This is probably due to the low ionization of the atmosphere after sunset. Toward sunrise the distance that can be reached takes its normal value. Data are given on the variation in intensity of transmission during the journey of a steamship. With regard to atmospheric disturbances the following observations were made: The disturbances always begin in the afternoon, reaching their maximum toward midnight and disappearing almost completely by sunrise. They are most frequent in tropical climates. They are more violent in summer than in winter, in consequence of the more frequent thunderstorms. They are particularly noticeable in the neighborhood of high mountains, e. g., the Red Sea, the coasts of Italy and Spain. In the Mediterranean Sea the disturbances in winter are relatively weak.—Lond. *Electrician*, Aug. 26.

New Apparatus and Appliances

A NEW DIRECT-READING WATT-HOUR METER.

Mr. G. M. Willis, the Chicago meter expert, has produced a new integrating watt-hour meter with several interesting features. The instrument, which is small and compact and presents a neat appearance, is provided with a glass case so that the user can see the "wheels go round." Further, the dial is direct-reading in the literal sense, the reading in kw-hours being shown in plain figures. The meter can be read by anyone at any time, no technical skill or arithmetical calculation being required.

Referring to Fig. 1, which is a general view of the meter as installed, it will be seen that the index, under words "kilowatt-hours," reads 11, indicating that at the time the photograph was made 11 kw-hours of electrical energy had passed through this particular meter. The number 11 shown will remain constantly exposed until the next kw-hour has passed through, when it will change, practically instantaneously, to 12, and so on. The figures show full completed kw-hours, never quarter or half positions. The reading of the meter is so simple that it is believed that customers of central-station companies will have confidence in it, bringing about more harmonious relations. The Willis meter may be used for either direct current or alternating current of any frequency in commercial use without readjustment of any kind. The guaranteed accuracy is 1 per cent plus or minus from full load down to 5 per cent of full load. The meters start on very light load, all sizes up to 20 amp starting when the small filament of a Hylo lamp is put into circuit.

The meter is 5¾ in. wide, 10½ in. high and 5⅜ in. deep. The glass cover can be readily removed, but is effectively sealed against tampering. The meter is dust-proof, moisture-proof and insect-proof, and is compensated against temperature changes. The index has a resetting device and may be set at zero in a few moments. If a recalibration is desired it can be effected by means of the light-load and full-load adjusting devices shown in Fig. 2, which is a picture of the instrument with the glass cover removed.

The Willis meter is of the motor type, with an armature described as "about as big as a plum." The commutator brushes have a micrometer adjustment. The armature revolves at a speed directly proportional both to the volts and amperes on the service. It drives a train of gears, accurately cut and gold plated. The train of gears ends in a rising and falling shaft, which, when it gets up to a certain point, falls. In falling it changes a figure on the index to the next one above. A re-

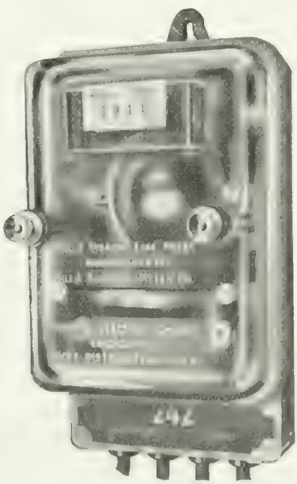


Fig. 1—Direct-Reading Watt-Hour Meter.

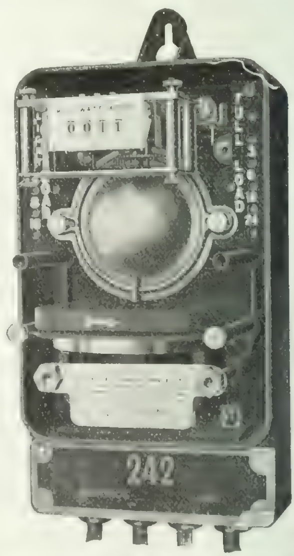


Fig. 2—Meter with Glass Case Removed.

volving disk, acting as a friction clutch and tending to be stopped by a permanent magnet, is provided. It is like the balance wheel in a watch, and is really the timing element of the meter and regulates its action. There are no worm gears and no pivot bearings. Full ball bearings are used, and friction that bugbear of meters, is said to be reduced to a negligible quantity. An aluminum composition is used for parts where iron or steel would be susceptible to magnetism.

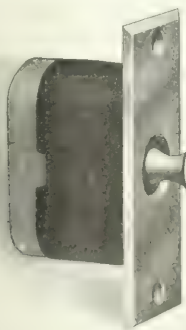
Adjustment is made by changing the resistance and number of turns of the starting coil. This is done by plugs which cut out or short-circuit pieces of the calibrating resistance. The arrangement is such that on the side marked "full load" an adjustment of 10 per cent may be had on the speed of the meter at full load. On the "light-load" side similarly an adjustment of 10 per cent may be had for light-load readings. No manipulation of magnets is necessary for adjustment of the meter.

The new meters are made for from 5 amp to 800 amp and from 55 volts to 550 volts. Considerable variation in voltage will not affect the accuracy of readings. For instance, the 110-volt meter can be used on a circuit ranging from 90 volts to 125 volts. All meters are of the same size, the difference being in the winding. Meters of a rating above 100 amp are connected in shunt and not directly to the circuit. Standard 6-ft. leads are furnished on all meters with which a shunt is required. The Willis meter is made by the Willis Electric Meter Company, and the Federal Electric Company, of Chicago, is the sole distributer.

NEW AUTOMOBILE BATTERY SWITCH.

The Cutler-Hammer Manufacturing Company, of Milwaukee, has recently put on the market a small switch designed primarily for use on automobile battery circuits. The rating of the switch is 10 amp at 80 volts, which is higher than any other of its kind and makes it useful for service on other low-voltage circuits where a small and compact switch with large capacity is desired.

This switch is operated by a push bar which moves the contact piece with a positive and firm action. The position of the push bar indicates at all times whether the switch is "on" or "off." The mechanism consists of only three moving parts, the coil spring, contact piece and push bar, operating in the



Automobile Battery Switch.

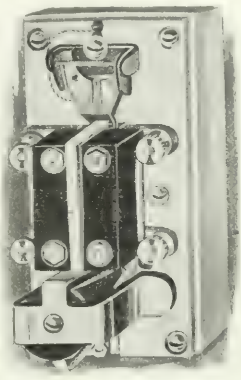
same manner as the Cutler-H[illegible] switches which were put on the market several years ago.

Very little time is needed for installing these switches, the round ends, shown in the illustration, fitting the hole made by an ordinary bit, so that practically no chiseling is necessary. The depth of the switch is only 1 3/16 in., making it suited also for surface mounting by p[illegible] in gangs spacing strips are furnished, which facilitate installation, insure proper alignment and prevent binding of the push bar and flush plate. The arrangement of the contacts on the back makes it possible to run a common return wire across the backs where several switches are used, which, it is claimed, is a decided advantage.

Flush plates, which are in the several standard finishes, are furnished separate from the switch, so that it is possible to arrange combinations of switches without carrying as large a stock as is necessary when the plates are an integral part of the switch.

SELF-CLEANING LIGHTNING ARRESTER.

An interesting type of carbon lightning arrester designed for protecting telephone circuits has been placed upon the market by the Anderson Electric & Manufacturing Company, of Wichita, Kan. A review of former protecting devices will show



Self-Cleaning Lightning Arrester.

that the most common and the most popular form is the one in which two carbon blocks are separated by a thin piece of perforated mica. In that form the lightning is expected to make connection with the ground by means of an arc and the ground connection may become permanent or not, depending upon the intensity of the lightning stroke. When a permanent ground is formed it becomes necessary for the lineman first to locate the particular arrester that is at fault and then remove the ground connection. An attempt is first made to remove the connection by slightly tapping the arrester on the outside. This action will in all probability loosen and shake out any small particles of carbon that may have fallen into the gap, causing the connection.

The Anderson type of arrester is said to contain the commendable features of the present type of carbon arrester and in addition to reduce the maintenance expense and give more efficient protection.

It may be said to be one of the first low-voltage line protective devices containing moving parts. It consists of three carbon blocks, the two line blocks being mounted on a porcelain base. The third or ground carbon block is floated between the two line blocks, being pivoted at one end and attached at the other to the armature of an electromagnet. The coil of this electromagnet is connected in series with the line on the inner end of it, so that the magnet is itself protected against lightning although, as it is low in ohmic resistance and the wire on it is larger in size than that used on the bell-ringer in the telephone, such protection is hardly necessary.

At the first thought it would seem that the introduction of a magnet into the line circuit would cause an impedance and interfere with the high frequency talking currents on a telephone line, but the impedance effect has been practically eliminated by a copper shell placed over the core of the magnet.

By referring to the accompanying illustration it will be noted that the magnet causes the ground carbon to oscillate between

the line carbon blocks every time a ringing current is sent over the line. In other words, the arrester does several times a day, mechanically, what the lineman does manually to the carbon arresters, which he must free from ground connections.

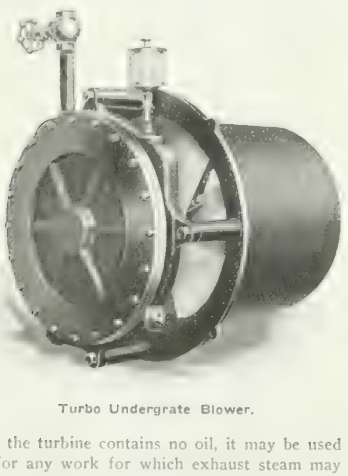
The coil of the electromagnet acts as a choke coil to force small static charges to ground. It should be noted, too, that many strokes of lightning will operate the electromagnet automatically directly after a charge goes through the arrester. No micas are needed because the arrester is so constructed that use is made of a thin film of air as an insulator.

TURBO UNDERGRATE BLOWER.

A turbo undergrate forced-draft blower which will be of interest to those desiring to increase their boiler or stack capacity, or those experiencing difficulty in properly burning their fuel, has recently been placed upon the market by the B. F. Sturtevant Company, Hyde Park, Mass.

The blower consists of a single-stage impulse steam turbine direct-connected to a propeller type fan. The bucket wheel of the turbine is a solid steel forging carefully machined, the steam buckets being milled on the periphery of the bucket wheel. The steam nozzles are made of Tobin bronze and are held in place by composition draw-up nuts. The construction of the steam case gives great accessibility for inserting, removing or cleaning the steam nozzles. An ample dust-proof phosphor-bronze bearing and thrust washers are provided with oil-cup lubrication. The construction of the bearing makes it possible to renew the bearing at a small cost. The built-up fan consists of six polished sheet-aluminum blades rigidly fastened with copper rivets into a bronze hub, which is finished all over to secure the proper balance necessary for high rotative speeds. The stationary members of the blower set are constructed of cast-iron parts of ample strength and rigidity.

The blower is said to be practically silent in operation and to require a minimum amount of care and attention, as it can be controlled by hand-damper regulation or by regulating valves operated by the boiler steam pressure. As the exhaust



Turbo Undergrate Blower.

steam from the turbine contains no oil, it may be used to best advantage for any work for which exhaust steam may be put, such as feed-water heaters, heating, etc. When discharging into the ash pit it produces excellent results with coals that would ordinarily cause serious trouble by clinkering. The wall thimble which forms anchorage for the set can be placed with equal ease in the front, side or back wall of the brickwork of the boiler setting. The blower sets, the manufacturer claims, can be applied with excellent results to power plants that fall under the following classification: Electric light and railway power plants that need increased draft during the peak of the load; power plants that have outgrown their stack capacity and need 25 per cent to 50 per cent increase in boiler horse-power; heating systems for hotels, department stores, flats, schoolhouses, etc., and small plants that need an increase in boiler horse-power.

WAVERLEY 1911 ELECTRIC-VEHICLE MODELS.

The leading Waverley Electric for 1911 is a four-passenger brougham, model 81, resembling in many respects last year's model 75-C, but with a few important differences. Thus, the body of the car is built in a single piece, 3 in. wider; the front has swelled side panels with rounded-front quarter French plate glass, and the general effect of the car is larger, roomier, more luxurious and more distinguished. There is increased luxury also in the interior furnishings. Imported broadcloths, broad laces and English goat morocco are used exclusively in this car. Two toilet cases are supplied, one with watch and vinaigrettes for ladies' use, the other with match-safe and cigar-holder. A handsome flower vase adorns one window frame and a convenient umbrella-holder is attached to the door panel. A shaft-driven odometer is supplied with each car.

The mechanical equipment includes the Waverley high-efficiency shaft drive, now in its third year of actual use by owners. The principal feature of this drive is the use of herringbone gears connecting parallel shafts, a device peculiar to the "Silent Waverley," that has high endorsement from gear experts. The controller is based on the principle of knife-blade contacts and has an interlocking device that makes it impossible to change the speed direction with the power on or to start on any speed but the low—thus preventing jerking and jumping when the car starts.

The Waverley motor, which is stated to give 360 per cent of turning power for every 100 per cent of overload, forms part of the equipment. The full elliptic springs weigh 178 lb. and measure 31½ ft. in the length of the main leaves alone.

Next to model 81 in the point of newness, though actually surpassing it in novelty, is model 78, Waverley electric roadster, a car that was introduced last year, but only in a tentative form. Numerous alterations and improvements are embodied in this year's model. The body, for instance is low-hung. There is a roomy, comfortable rumble seat at the rear, with a step to reach it. The length of the car has been increased to 114½ in. and the wheel base to 96 in. A change has been made in the shape of the cape top and everything done has contributed to the appearance and practical convenience of the car, which now has so much the appearance of a gasoline roadster as to deceive even an expert at first glance.

Twenty-five miles an hour is the speed available and the mileage has been made adjustable to the needs of the owner. If more than 100 miles on a charge is required the company is prepared to equip the car with an Edison battery, for which, however, an additional charge is made.

The principal change made in the 1911 model 75-C, four-passenger brougham is the low hang of the body, obtained by a new form of spring suspension that brings the sill 2 in. below the tops of the full elliptic springs. This accentuates the ease of entering and leaving the brougham and adds to its convenience. Lamps of new and handsome design have been supplied and the length of the fenders forward has been increased. No noticeable changes have been made in the mechanical equipment, which in this and other late Waverley models is identical with that of model 81.

The Waverley coupé model 70-C, the Waverley victoria-phaeton model 76, and the Waverley stanhope model 74 show the same changes as model 75-C. On the Waverley runabout model 69 a continuous fender has been substituted for the separate wheelguards previously shown. These are the most notable changes made in Waverley models for 1911, the thoroughly satisfactory service rendered by all their 1910 models having made few radical improvements possible or desirablle.

Industrial and Commercial News

THE WEEK IN TRADE.

DEVELOPMENTS in trade conditions during the past week have been distinctly favorable. The crop reports have improved and the proximity of crop maturity is lending encouragement to fall purchasers. There was a much larger distribution of fall goods by jobbers and wholesalers, and retailers in almost all parts of the country are making more cheerful reports. This improvement in the retail business is, of course, not entirely universal, although almost all sections report some betterments. The best advices come from the West, where the marketing of the earlier crops has been almost unprecedented. Prices have been unusually high, and the movement of the crops has been unusually early. This, of course, helps all lines of trade and very materially strengthens collections. In many sections of the West, too, there have been state fairs and festivals, which always result in increased buying. In the Southwest there is still some inclination to delay making heavy purchases, owing to the uncertainty as to the final returns from the cotton crop. In Texas some cotton has begun to move toward the market, and this has improved trade conditions. The industrial situation is regarded as somewhat better. Reports from the iron and steel trade are more cheerful, and there is indication of some resumption in the textile industry, where curtailment was almost universal. Numerous small-lot orders have been placed in the pig-iron market, indicating that manufacturers are preparing for better business during the fall. Pig-iron prices have remained about stationary, and there are still very large stocks on hand. The extreme dullness in the securities market seems to have very little effect upon business conditions generally. Failures for the week ended Sept. 9, as reported by *Bradstreet's*, were 173, as compared with 179 the previous week, 191 in the same week in 1909, 191 in 1908, 172 in 1907 and 164 in 1906.

THE COPPER MARKET

ALTHOUGH the Copper Producers' Association statement for the month of August was in some respects the most encouraging that has been given out during the year, it has failed to dissipate the lethargy which has dominated the market for the past several weeks. The figures were to some extent a surprise, although it was generally forecast that the surplus stocks of metal would show some reduction. The

Standard Copper:

	Bid.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]
December	12.20	12.25	[illegible]

The London market Sept. 12 was as follows:

	Noon.	[illegible]
Standard copper, spot	[illegible]	[illegible]
Standard copper, future	[illegible]	[illegible]

Extreme fluctuations for this year:

	[illegible]	Lowest.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

effect of the statement has been nullified in a measure by a feeling of distrust concerning the significance of the figures. The remarkably heavy deliveries reported into domestic consumption were not convincing, in view of the well-known fact that melting had actually decreased. It is thoroughly well known in the copper market that the brass manufacturers and the electrical industries used less copper during the month than in some of the months immediately preceding, yet the domestic deliveries were quoted as higher than any month since January with the exception of April, and practically equalling that month. The production of copper was the highest ever recorded for a single month, and almost equalled in daily average the record-breaking month of June. Export deliveries were also a trifle in advance of what had been anticipated. Probably the least inspiring feature of the report was the increase in production, which came at a time when many of those interested in the market had been led to [illegible] that [illegible] attempts at curtailment were being made by some of the larger interests. There will hardly be as much faith again in curtailment stories. The figures of the report showed that the production for August had been 127,803,618 lb., an increase of 9,433,615 lb. The total deliveries, domestic and foreign, are given as 129,563,051 lb., an increase of 13,447,709 lb. The surplus stock on hand in this country is given as 168,881,245 lb., a decrease of 1,759,433 lb. Actual business during the past week was very light, although it is said that some concessions were made to attract buyers after the association figures were made public. Imports continue to be fairly heavy, and the average for September will probably be equal to that of August. Exports for the month, including Sept. 12, amounted to 9491 tons. The daily call on the metal exchange Sept. 12 quoted standard copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Susquehanna River Power in Baltimore.—It is reported that the Consolidated Gas, Electric Light & Power Company, of Baltimore, has finally closed a contract with the Pennsylvania Water & Power Company for electric power from the McCall Ferry plant on the Susquehanna River. The contract, it is also stated, involves over $500,000 and the Consolidated is to be furnished with something like 20,000 kw. President J. E. Aldred, of the Pennsylvania Water & Power Company, has already been selected as a director in the Consolidated company and a short while ago he succeeded in purchasing about $2,500,000 of the company's stock and this gives him a voice in the management of affairs. The annual meeting of the Consolidated will take place next month, at which time it is expected that some important changes will be made in the board of directors of the corporation.

General Electric Switchboards.—Among recent switchboard orders of the General Electric Company are the following: Consolidated Copper Company, Kelvin, Ariz., 14 generating panels, 2200 volts and 44,000 volts, and two 10-panel boards for substations. Metropolitan Railway Company, Reading Pa., 19 panels for readers, railway load and alternating-current feeders; 22-panel, 5625-kw controlling bench board; 25 panel benchboard for incoming line and rotary-converter panels, and 16-panel board for main substation; Atlantic City Electric Company, 24-panel benchboard, 18 panels for synchronous motors and arc machines and 16 motor-generator and arc-machine panels; Rochester Coal & Iron Company, Punxsutawney, Pa., one 18-panel and one 14-panel substation switchboards.

Telephones for China.—In answer to an inquiry from the United States, an American consul in China reports that a city with a population of about 55,000 has no telephone service. There are also a number of smaller places within a radius of 25 miles, also two cities of considerable importance which could easily be reached by outside lines. The consul thinks it doubtful if a concession could be secured, but forwards the name of the electric light company in that city which might be interested in the introduction of a telephone service. Further details may be obtained (file No. 5476) upon application to the Bureau of Manufactures, Washington.

Mobile Electric Company.—The report of the Mobile Electric Company for the past year shows considerable increase in earnings, and a very satisfactory growth in business. At the end of the year the company had a total of 5195 consumers and it was furnishing 3494 of hp for motors. About 12,000 hp is generated by the company for both power and lighting purposes. The company has connected with its lighting circuits almost 100,000 incandescents. H. M. Byllesby & Company, of Chicago, operate the plant.

Boston Street Lighting.—Superintendent of Streets Rourke, of Boston, has withdrawn his advertisement for a two-year contract for street lighting by gas, and will shortly [illegible] contract for lighting by either gas or electricity. He will also ask bids for equipping a station to enable the city to establish a municipal plant.

Platinum Demand Improving.—Cyrus Osborne Baker, president of Baker & Company, platinum refiners, has recently returned from Europe, where he had spent two months at German health resorts. Mr. Baker says that the platinum situation, both in Europe and this country, is considerably improved over this time a year ago. The demand for platinum is quite good, and the price has advanced to about $33 per ounce. Both for electrical work and for dental work the demand has considerably increased. As far as the situation in Russia is concerned, Mr. Baker is of the opinion that the banks which carried the majority of the crude platinum are in an easier financial condition, and that at this time there will be nothing done by the Russian government to place an arbitrary minimum price upon the metal, a course which was threatened some months ago. A great amount of platinum was carried in the Russian banks at something like $25 per ounce, and when the demand was light and the market price was below this figure the bankers were uneasy; but now that the demand has improved and the price is well above the average of the bank loans the situation is entirely changed. Baker & Company are now manufacturing large quantities of platinum rivets for electrical contacts, and these are being purchased by instrument makers who formerly bought platinum wire and manufactured their own parts. In this way the electrical manufacturer sustains no loss from waste. Mr. Baker believes that the demand for platinum will continue to be good throughout the coming season, but does not anticipate any very considerable advance over the present price.

Municipal Plant at Penticton, B. C.—As a result of the purchase of the irrigation system by the municipality of Penticton, B. C., from the Penticton Water Supply Company last month, the town will shortly have a complete domestic water and electric light and power system installed. Municipal Engineer Latimer has been instructed by the council to make a preliminary report upon the cost of installing such a plant. An estimate of the potentialities of the three great reservoirs, now the property of the municipality, has just been made. It is stated that at Ellis Creek reservoir 240 hp is available, while it will be possible to generate at least 300 hp from Penticton Creek reservoir. All told there will be sufficient water available to furnish a domestic water, light and power system for a population of about 8000. As soon as the engineer's report is prepared, by-laws will be submitted to the people.

Marconi Wireless Service.—The Marconi Wireless Telegraph Company announced last week the opening for public service of the wireless stations at Glace Bay, N. S., and Clifden, Ireland. Messages will be accepted for the United Kingdom at the rate of 17 cents per word. They will be forwarded over land lines to Glace Bay for transmission to any point in the United Kingdom. The service has not yet been extended to the Continent. The stations at Glace Bay and Clifden being merely duplex stations, a possible delay may occur owing to the overcrowding of traffic. It is announced that if the congestion becomes so serious that messages will be unnecessarily delayed, they will be forwarded by cable and that the extra cable toll will be charged to the sender, who will be duly notified.

Lehigh Valley Transit to Build.—R. P. Stevens, president of the Lehigh Valley Transit Company, of Allentown, Pa., announces that he has finally secured the signing of all borough franchises and township agreements which will permit the company to build a new line from Quakertown to Perkasie. For the past ten years the company has leased the property of the Quakertown Traction Company and has operated its cars over these tracks. This lease will now be canceled and the new line built at a cost of about $200,000. The funds for this new construction work will come from the proceeds of newly issued capital stock. Some months ago the stockholders voted to increase the capitalization to $15,000,000

Electrical Cooking Apparatus.—A party in Mexico informs an American consul that he desires catalogs of electrical cooking apparatus suitable for use in a launch. The consul thinks that if the inquirer secures a suitable appliance others will adopt the idea as there are many launches and motor boats in his district. By referring to file No. 5481 further information may be obtained from the Bureau of Manufactures, Washington, D. C.

Central Georgia Power Company.—The syndicate which had in charge the disposal of the $3,000,000 of bonds of the Central Georgia Power Company, of Macon, has disposed of the entire issue and the books are closed. The hydroelectric plant which the company has been constructing on the Ocmulgee River, 36 miles from Macon, is almost completed, the transmission lines are constructed and operations will probably be commenced in October. This plant is expected to generate about 12,000 kw and contracts have been taken for the disposal of the energy to the Macon Railway & Light Company and to a number of mills along the line of transmission. J. G. White & Company, New York, were the constructing engineers

General Electric Erie Plant.—Contracts have been closed by the General Electric Company with the National Fire Proofing Company for the construction of two large buildings on the tract of land recently acquired at Erie, Pa. These buildings, as was officially stated in the *Electrical World* of April 14, will be used for a gray iron foundry and for a pattern shop and pattern storage room. The buildings will be 800 ft. long and of fireproof construction. It is asserted at the office of the General Electric Company that these are the only buildings that are contemplated on the site at Erie at the present time, and that no plans have as yet been formulated for the construction of an elaborate manufacturing plant at that point.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Ruston, La.; Tillamook, Ore.; Bridgeport, Cal.; Bessemer, Ala.; Berea, Ohio; Birmingham, Ala.; Connersville, Ind.; San Francisco, Cal.; Davenport, Ia.; Ortonville, Minn.; Cadillac, Mich.; Russell, Kan.; Mount Vernon, Ohio; Missoula, Mont.; Gilbert, Minn.; Woodbine, N. J.; Hudson, N. Y.; Melrose, Minn.; Chippewa, Ont., Can.; Milwaukee, Wis.; Ashland, Wis.; Marinette, Wis.; Klamath Falls, Ore.; Beaver Dam, Wis.; Redmond, Ore., Vicksburg, Miss., and Carlyle, Ill.

Anderson Carriage Company.—W. C. Anderson, president of the Anderson Carriage Company, manufacturers of the Detroit electric vehicles, and of the Elwell-Parker Company, of Cleveland, denies emphatically the report that the General Motors Company controls these corporations. Mr. Anderson says: "Not a dollar of the capital stock of either of these two companies is held or owned by anyone connected with the General Motors Company." He also states that both of the companies he represents have been prosperous during the year and are not contemplating any new financing. He says that neither company intends to adopt a policy of retrenchment.

Westinghouse Electric Company Shipments.—The shipping department of the Westinghouse Electric & Manufacturing Company announces that all records in the company's history have been broken within the last two months. In July the shipments, it is said, were 10 per cent greater than in any previous month, and in August the shipments exceeded those of July by about $300,000. It is estimated that the August record will reach in the neighborhood of $3,500,000. Owing to favorable trade arrangements it is said that the company is receiving better prices than last year and that earnings will consequently show a very satisfactory increase.

Hudson & Manhattan Railroad.—The Hudson & Manhattan Railroad Company opened last week its new extension in Jersey City to the Henderson Street station. This extension adds slightly more than a mile to the McAdoo tunnel system, and prepares the way for the final extension of the line to Newark. Only about ½ mile of tunneling will now have to be done in order to connect the system with the Pennsylvania Railroad, over which the entrance will be made into Newark. For August the tunnel system carried 3,536,712 passengers, a daily average of 114,000. This is an increase of about 24 per cent over the same month last year.

Allis-Chalmers Installation in Porto Rico.—The Allis-Chalmers Company has sold quite a large gas producer plant for use upon the Fortuna sugar estate near Ponce, Porto Rico. This installation, which is now being shipped, consists of three 200-kw generators direct-connected to gas engines, together with the complete gas producer plant, switchboard and other accessories. The purchase was made by the Quanica Centrale, which is the corporation operating the sugar plantation, and involved [illegible]

Electrification in Chicago.—President Hughitt, of the Chicago & Northwestern Railroad, will make an announcement it is said, at the annual meeting of the stockholders of the company next month of the plans for the electrification of the Chicago terminals. An official of the company is quoted as saying that the new passenger station was constructed with the change from steam to electricity in view. It is believed that Mr Hughitt's plan will advise extensive electrification work.

Penn Central Light & Power Company.—It is said that contracts are now being made by the Penn Central Light & Power Company, of Altoona, Pa., for the delivery of energy from the hydroelectric plant on the Juniata River near Huntingdon. Work upon the dam at this point is about completed. This hydroelectric property was purchased by the Pennsylvania Hydroelectric Company from the old Juniata Water & Water-Power Company. All of the bonds of this company are owned and pledged under the mortgage of the Penn Central Light & Power Company. The completion of this work will add to the Penn company's capacity from 4000 hp to 5000 hp.

Monorail Line Completed.—The monorail traction line which is being constructed by the Monoroad Construction Company between Bartow Station, on the New York, New Haven & Hartford Railroad, and City Island will probably be ready for service within the next few days. Since the accident which occurred in July at the first attempt to run this line the entire superstructure has been rebuilt. G. J. Scott has been placed as engineer in charge of construction, and everything has been done to make the new system entirely safe.

Telephone Dispatching for Virginian Railway.—The Virginia Railway has recently put into operation a telephone train dispatching circuit between Roanoke, Va., and Deepwater, W. Va. This system has proved so satisfactory that the company contemplates immediately extending a similar service to all of its other divisions. The apparatus was furnished and the installation made by the Western Electric Company. Gill selectors are used. The order for this installation was referred to in our issue of April 28, 1910.

Financial.

The Week in Wall Street.

FOR the five days' business in the Wall Street stock market succeeding the Labor Day holidays there were sold 1,036,259 shares. This is probably the low record for any similar period of time and is but little more than an average of 200,000 shares a day. The general explanation offered by Wall Street interests for this unusually dull condition in the market is that the Street is in "a waiting attitude." There has been, however, no satisfactory explanation offered as to exactly why the Street is waiting or exactly what it is waiting for. In some

NEW YORK.

	Sept. 2.	Sept. 12.	Shares sold.		Sept. 2.	Sept. 12.	Shares sold.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All. Ch., pfd.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Amal. Cop.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75*	[illegible]
Am. D. T.	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	34[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——
Am. Tel. & C.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T.	[illegible]	[illegible]	2,700	Steel, pfd.	116¼	[illegible]	[illegible]
[illegible]	74[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gen. Elec.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	8,750	West'h, pfd.	110*	[illegible]	[illegible]

PHILADELPHIA.

	Sep. 2.	Sept. 12.		Sept. 2.	Sept. 12.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	P. R. T.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CHICAGO

	Sep. 2.	Sept. 12.		Sept. 2	Sept. 12.
[illegible]	[illegible]	[illegible]	Chi. Tel. Co.	118*	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Nat'l Carbon	120*	[illegible]
[illegible]	[illegible]	[illegible]	Nat'l Car., pfd.	117*	[illegible]

BOSTON

	Sep. 2.	Sept. 12.		Sept. 2.	Sept. 12.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	N. E. Tel.	130*	[illegible]
Gen. Elec.	141½	143*	W. T. & T.	15*	[illegible]
[illegible]	[illegible]	17¾*	W. T. & T., pfd.	83*	[illegible]
[illegible]	[illegible]	[illegible]			

*Last price quoted.
[illegible]

offices you hear the explanation made that the clouded political situation is the trouble with business in the security market; in other offices it is just as confidently asserted that politics has nothing to do with the case, and that the whole trouble is lack of public confidence. This latter explanation is, of course, true, but is merely a juggling of terms [illegible] waiting are practically the same thing. None of the explanations give any clear reason as to why, under present commercial and financial conditions, there should be a general public lack of confidence. [illegible] market is [illegible] which diminishes from day to day, at best represents nothing more than the efforts of a few professional speculators to make a living. The trading is limited to a few stocks, and outside demand for either speculative or investment purposes is entirely absent. During the past week there was some indication of a better inquiry for American securities in the foreign market. Houses that handle this character of trade were considerably encouraged, but there was really very little buying consummated. Some of the bond houses also thought that there were indications of a better demand for bonds, but market transactions did not show much improvement in actual sales. In banking circles it is generally the opinion that the money market will pass through the fall demand for crop moving with less difficulty than usual. While there has been considerable reduction in surplus reserve in the banks, rates for money are still very easy for call loans, and time money rates are no higher than is to be expected at this season of the year. Quotations Sept. 12 were: Call, 1 [illegible] 2 per cent; 90 days, 4 @ 4[illegible] per cent. Quotations in the table are those of the close Sept. 12.

Financial Notes

Montreal Public Utility Merger.—Quite a number of statements have been made concerning the proposed terms of the control of the Montreal Street Railway by the Canadian Light & Power Company. It is understood that the Street Railway company shareholders will be given 4½ per cent mortgage bonds in exchange for their stock holdings at the rate of 250 for the latter, supplemented by a bonus of probably 50 per cent of bonus stock, while the Canadian Power shareholders will receive bonus stock only at the rate of 150 for their holdings. The securities of the two companies are: Street Railway, 4½ per cent bonds $4,420,000 authorized and issued, common stock (paying 10 per cent) $18,000,000 authorized, $10,000,000 issued; Canadian Light & Power Company, $4,000,000 bonds, $6,000,000 common stock, all issued. The deal, which has been carried out mainly by J. W. McConnell, of Johnston, McConnell & Allison, is one of the largest ever undertaken in Montreal, and it was conducted with such circumspectness that no one could be certain what was going on or who was back of it till too late to offer opposition. It is, however, reasonably certain that some of the largest shareholders of the Street Railway have assisted in the negotiations. That the terms given above are correct is admitted by some of the largest interests. The bond issues will probably remain as at present and the new stock will be distributed as follows: To Street Railway shareholders, $25,000,000 in exchange, $5,000,000 in bonus; to Canadian Power shareholders $9,000,000 in exchange. This gives the new company to start with $8,420,000 bonds and $39,000,000 common stock. The proposed merger is being opposed by some of the Street Railway directors, but it is said that others are favorable. The final vote will be given by the shareholders of the Montreal Street Railway at the annual meeting on Nov. 2.

Denver Gas & Electric Company.—A statement has been issued by the Denver Gas & Electric Company covering its operations for the year which ended April 30, 1910. This report shows that the growth in gross earnings was $214,306, and that the surplus and reconstruction reserve was swelled during the year from $1,383,321 to $1,878,504. The increase in the sales of gas amounted to almost 100,000 cu. ft., and the gain in the sale of energy to 3,548,038 kw-hours. The increase in electric energy was equal to 12 per cent in quantity and to 8.7 per cent in dollars. Beginning the first of this year the company reduced its rate to meter users to 9 cents per kw-hour with a discount of [illegible] per cent for payment within [illegible] days.

Sapulpa (Okla.) Electric Company Sold.—H. M. Byllesby & Company, of Chicago, have purchased the Sapulpa Electric Company which operates the central station business at Sapulpa, Okla., and will hereafter operate and manage the property. The plant is a new one, but it has not been able to serve more than half of the demand. The new purchasers will at once install a 500-kw generating unit which will more than double the present capacity. Sapulpa is in the heart of the oil and gas belt. The [illegible] in bonds.

Massachusetts Lighting Companies.—The stock of the [illegible] Gas Light Company has been purchased by the Massachusetts Lighting Companies. The property is in ex-[illegible]

General Motors Company.—It is said that the General Motors Company, the holding concern of many automobile manufacturing companies, has found it necessary to curtail its activities to a considerable extent on account of the difficulty in providing working capital, and also on account of the falling off in the demand for automobiles. A vast amount of contemplated construction work will be indefinitely held up. The capital stock of this company was increased last November to $60,000,000, and the net earnings of the company for 1910 have been estimated at $12,000,000. The purchase of raw material and payment of wages require a vast amount of working capital and the company has been obliged to borrow liberally. In connection with the reports concerning this company, it is said that liberal concessions in price have been made to Canadian purchasers of automobiles.

Sale of Rockingham Power Property.—Advertisements were published last week announcing the sale at auction in New York, Oct. 5, of the property of the Rockingham Power Company in North Carolina. The property consists of a hydroelectric development almost completed on the Pee-Dee River at Blewett's Falls, near Wadesboro, N. C. The property is now offered for sale by the reorganization committee which purchased it at foreclosure sale July 14, 1909. The upset price for the sale is fixed at $1,000,000. It is said that more than $2,000,000 has already been spent upon the construction work, and that $1,500,000 will be required to complete it. The newly organized company is expected to take the property over and a mortgage has already been given to the Old Colony Trust Company, of New York, to cover an issue of bonds.

Philadelphia Rapid Transit Condition.—The Philadelphia Rapid Transit Company is now showing a steady improvement in its earnings. Its condition is much better than at any time within the past year. The annual report which will soon be made public will show that the year's deficit as charged against income will be about $1,300,000. It is estimated that the loss in fares during the time of the strike was $1,500,000 and that at the same time extraordinary expenses were incurred to the amount of $800,000. The strike loss will be fully taken care of by the issue of new securities, and will not be carried along upon the books of the company. It is said that at the annual meeting of the stockholders there will be no change in the personnel of the board of directors, except that a city director will be elected in place of George H. Earle, Jr., who has resigned.

Standard Gas & Electric Company.—The Standard Gas & Electric Company, which was incorporated under the laws of Delaware last spring to hold the stock of a number of gas and electric properties throughout the West which are operated by H. M. Byllesby & Company, of Chicago, has declared a dividend of 1¾ per cent on its preferred stock for the quarter ending Aug. 31. The Standard company has outstanding $1,100,000, 6 per cent bonds, $1,027,000 preferred and $6,334,000 common stock. Its total receipts from the subsidiary companies on the stock taken over, for the year ending Aug. 31, would have been $204,364, which would leave the company, after paying interest on its bonds, a balance applicable to dividends of $138,364.

Asks Sale of Baltimore Refrigerating Plant.—A petition was filed in the Circuit Court of Baltimore last week by Richard B. Fentress, through Attorney Edward C. Carrington, Jr., for the sale of the Baltimore Heating & Refrigerating Company. It states that Mr. Fentress, as one of the largest bond and stock holders, has the right to ask for the sale of this property upon default of a mortgage deed of trust, which is said to have occurred. According to the petition, it has been shown by the receivers that the business cannot be carried on profitably. It also declares that they have not the money needed for improvements.

Birmingham (Ala.) Railway & Light Company.—The gross earnings of the Birmingham Railway & Light Company for July show the same gratifying ratio of increase over comparative months last year that has been shown since the beginning of 1910. The total for the month was $216,505, which is $33,318 more than the total for the previous July. At the present rate the company will earn for the year a surplus of more than 11 per cent on the common stock. The territory served by the company is growing rapidly in both business and population.

Electric Securities at Auction.—Among the securities sold at the regular weekly auction last week were: $2,500 Elmira Water, Light & Railroad Company 5 per cent bonds at 98½; $2,500 United Gas & Electric Company first mortgage 5 per cent bonds at 94; $4,000 Niagara Falls Power Company 6 per cent bonds at 102; $2,000 International Traction Company 4 per cent bonds at 60; three shares Niagara Falls Power Company, $100 par value, at 116, and three shares United Gas & Electric Company, $100 par value, at 85.

Massachusetts Traction Consolidation.—The Union Street Railway Company, of New Bedford, Mass., and the Dartmouth & Westport Street Railway Company, of the same city, have petitioned the State railroad commissioners for approval of terms of agreement whereby the latter concern is to be absorbed by the former. The Union Street Railway Company seeks to issue 5000 shares of additional capital stock, which is to be exchanged for the stock of the Dartmouth & Westport company.

Burke Electric Company.—The annual meeting of the stockholders of the Burke Electric Company was held this week at Erie, Pa. The annual report of the company for its fiscal year, which ended April 30 last, shows a surplus, after payment of $15,000 in preferred dividends, of $79,322, which added to the previous surplus makes a total surplus of $103,982. The balance sheet of the company shows total assets of $1,467,443.

Iowa Telephone Franchise.—The Union Electric Telephone & Telegraph Company, of Davenport, Ia., has applied for an amendment to its franchise ordinance that will permit it to sell its property to the Iowa Telephone Company, the Bell concern. The independent company installed an exchange and service about eight years ago which cost in the neighborhood of $800,000 and has never, it is said, been a profitable venture.

DIVIDENDS.

Canadian General Electric Company, Ltd., preferred, semi-annual, 3½ per cent; common, quarterly, 1¾ per cent, both payable Oct. 1.

Duluth-Superior Traction Company, quarterly, preferred 1 per cent; common 1¼ per cent, both payable Oct. 1.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable Oct. 1.

Phelps-Dodge & Company, quarterly, 2½ per cent, payable Sept. 29.

Philadelphia Traction Company, semi-annual, 4 per cent, payable Oct. 1.

Twin City Rapid Transit Company, quarterly, preferred 1¾ per cent; common 1½ per cent, both payable Oct. 1.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	18,883	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	..	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.	7,678	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	1,396,312	[illegible]	[illegible]	673,700
[illegible]	[illegible]	1,300,623	[illegible]	...	..
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	123,015	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	79,005
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	172,039	[illegible]
Scranton (Pa.) Electric Company:					
[illegible]	[illegible]		26,381	[illegible]	[illegible]
[illegible]	[illegible]	..	22,986	8,893	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	67,789	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	44,113
[illegible]					
[illegible]	[illegible]		[illegible]	[illegible]	5,315
[illegible]	[illegible]	.	4,623	[illegible]	[illegible]

General News

Construction News.

BESSEMER, ALA.—It is reported that the Tennessee Coal, Iron & Railroad Company contemplates the construction of a large electric light and power plant in Bessemer in the near future. The proposed plant will supply electricity for lamps and motors for the five furnaces, the rolling mill, the mines on Red Mountain and for all industries in the Bessemer district.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company is reported to have engaged C. F. Pattillo, of Birmingham, Ala., electrical engineer, to take charge of the installation of the equipment in its new plant. The cost of the plant is estimated at $100,000, work on which will begin at once.

BIRMINGHAM, ALA.—The Coosa River Electric Power Company has applied to the City Council for a 30-year franchise to supply electricity for lamps, heat and motors in Birmingham. The power plant of the company is to be located at "Ten Island" shoals on the Coosa River, work to begin on the system before Jan. 1, 1913, and to be completed within three years. The company agrees to supply electricity for lamps by meter, the maximum rate not to exceed 9 cents per kw-hour, with a discount of 10 per cent for cash payment. Further discounts to be allowed as follows: On all bills amounting to more than 25 kw-hours per month a discount of 15 per cent will be allowed; on 150 kw-hours, 20 per cent; 250 kw-hours, 25 per cent; 30 per cent will be allowed on all bills calling for more than 400 kw-hours per month; 35 per cent for more than 500 kw-hours; 37½ per cent on more than 1000 kw-hours; 40 per cent on more than 1500 kw-hours; 42½ per cent on more than 2000 kw-hours; 45 per cent on more than 2500 kw-hours; 47½ per cent on more than 3000 kw-hours; a discount of 50 per cent will be allowed on all bids calling for more than 3500 kw-hours per month. To private consumers 1200-cp arc lamps will be supplied at the rate of 36 cents per night, to burn until 12 o'clock, with a 10 per cent discount for prompt payment. The company also agrees to furnish arc lamps of 2000 cp to the city at a rate not exceeding $60 each per year, provided the city will contract for not less than 500 lamps for a term of five years, and to furnish electricity for incandescent lamps for the city at 5 cents per kw-hour.

MONTGOMERY, ALA.—Application has been made to the City Council by C. F. Woodward and associates for a franchise to construct and operate a street railway in Montgomery from the railroad station to the city limits.

OPELIKA, ALA.—Contracts for equipment for the municipal electric light plant and water works system have been awarded as follows: For engine to the Ball Engine Company, of Erie, Pa., for $2,950; for generator to the Fort Wayne Electric Works, Fort Wayne, Ind., at $3,250; to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for street lamps at $1,118, and transformers for $1,782; to the Worthington Company for steam pumps, for $1,650; centrifugal pump and motors to the Platt Iron Works Company, at $1,928; for boilers to the Casey Hedges Company, at $2,250 and stand pipe to the Chattanooga Boiler & Tank Company, for $6,804. The contract for construction work was rejected. It has not been definitely decided when the contract for construction work will be readvertised. The J. B. McCrary Company, of Atlanta, Ga., has charge of the work.

PRESCOTT, ARIZ.—The Arizona Power Company is planning to erect a new transmission line from the Verde Valley to Prescott, by the way of Jerome, a distance of 40 miles. The cost of the line is estimated at [illegible].

HEBER, ARK.—An electric light plant has been installed in the mill of the W. B. Baker Lumber Company.

IMBODEN, ARK.—The local electric light plant has been purchased by Mrs. R. S. Nash, of Jonesboro, [illegible] Nash will assume control of the plant. Mrs. Nash has secured a 50-year franchise to operate the plant.

LITTLE ROCK, ARK.—Application has been made to the City Council by the Orgenta Street Railway Company, of Orgenta, for a 50-year franchise to use the Free Bridge and lay its tracks on Main Street and [illegible] Street in Little Rock.

STEPHENS, ARK.—The plant of the Stephens Canning & Manufacturing Company is reported to have been purchased by E. R. Smith, [illegible] an electric light plant. Equipment has been ordered.

ALHAMBRA, CAL.—The City of Alhambra has entered into a contract with the Pacific Light & Power Company for lighting the streets [illegible] cents per kw-hour and to install a complete copper wire distributing [illegible]

BRIDGEPORT, CAL.—[illegible]

Power Company will be extended to Hawthorne, Rawhide and Wonder, Nev., where contracts have already been placed for power. It is expected that the power plant at Jordan will be ready for operation by the middle of September.

LOS ANGELES, CAL.—The City Council has passed an ordinance providing for the issuing of $3,500,000 in electric light bonds, which were voted at a special election held Aug. 19, 1910. The proceeds are to be used to continue work on the aqueduct system from a point in Owen River Valley to San Fernando Valley.

OAKLAND, CAL.—The Central Oakland Light & Power Company has applied to the Board of Public Works for permission to erect pole lines along certain streets in the central part of the city.

POMONA, CAL.—The City Trustees have instructed the South California Edison Company to install incandescent street lamps on East Third, Fourth, Fifth, Kingsley, Palm, Laurel, Williams, West Fourth, West Holt, North Garey, Palms and Illinois streets.

REDONDO, CAL.—A movement is on foot to install an ornamental street lighting system on Catalina Avenue in this city.

SACRAMENTO, CAL.—The Sacramento Electric, Gas & Railway Company is contemplating extensive improvements to its railway system, including double tracking on certain streets in Sacramento. The construction of a car line on E Street is also under consideration.

SAN FRANCISCO, CAL.—Plans have been completed by the San Francisco Gas & Electric Company for the construction of a reinforced concrete storage battery station to be erected on Minerva Street, to cost about $10,000.

SAN FRANCISCO, CAL.—Papers have been filed in the superior court in Alameda County showing a consolidation of the Home Telephone Company of San Francisco and the Home Telephone Company of Alameda County, under the name of the Bay Cities Telephone Company. Both companies were controlled by the same parties. The merger marks the beginning of a more vigorous campaign for business. On the Alameda side of the bay the company is extending its trunk lines all through the recently annexed territory, where it proposes to make extensive extensions and improvements, which will involve an expenditure of more than $500,000. On the San Francisco side the lines of the company will gradually be extended down the peninsula as far as San Jose, to connect with the service from the Oakland side to Hayward and to points south.

SANTA BARBARA, CAL.—The Santa Barbara Gas & Electric Company has awarded the contract for the construction of an addition to its power house to J. M. Williamson. The building is to be 50 ft. x 100 ft. and will cost $7,709.

SANTA BARBARA, CAL.—The Arlington Hotel Company is reported to be receiving bids for the installation of an electric lighting system and power plant in its new hotel now being erected. A. B. Benton, 114 North Spring Street, Los Angeles, Cal., is the architect.

WINEVILLE, CAL.—The Pacific Light & Power Company is extending its transmission line from Upland to Wineville, a distance of 11 miles. It is understood that the company also contemplates the erection of a substation in the vicinity of Cucamonga.

NEW BRITAIN, CONN.—Preparations are being made by the Housatonic Power Company to extend its transmission lines from Gaffney's Corner to Ibell's Corner to supply the residents of that section with electricity for lamps. The company will also extend its system in Newington from the Children's Home on Cedar Street to the Tuberculosis Hospital at Ridge Road.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 20, for furnishing at the navy yards and naval stations the following supplies: Washington, D. C., schedule 2865—Two double-feed water heaters and purifiers. Also until Sept. 27, Puget Sound, Wash., schedule [illegible]

JACKSONVILLE, FLA.—Tentative plans for the construction of a new power station for the municipal electric plant are being considered by the Board of Bond Trustees. The new power house will be erected on the property recently purchased on Talleyrand Avenue and will cost about [illegible] Engineering Company, of Philadelphia, Pa., and include the cost of removing the machinery from the present plant to the proposed new structure. The trustees are also considering the question of taking over the commercial lighting business of the Jacksonville Electric Company on Jan. 1, 1911, under the terms of the franchise recently granted the company, whereby the city will come into possession of the electric lighting [illegible] the board of trustees.

[illegible] plants. The cost of the work is estimated at about $40,000. H. L. [illegible]

[illegible] Johns Light & Power Company, which furnishes electrical service and operates the street railway in St. Augustine. Extensive improvements are contemplated to the electric light and street railway systems.

ROCKY FORD, GA.—The Oheechee River Electric Power Company would like to secure prices from manufacturers and supply houses for contractors' plants for the following material to be used in connection with the construction of its proposed hydroelectric developments: Concrete mixers, pumps, wire cables, steam shovels, trucks, barrows, dump cars, second-hand rails, gasoline engines and dirk rigs. D. Z. Zeigler is consulting engineer.

CARLYLE, ILL.—Bids will be received until Sept. 20 by John C. Lampen, city clerk, Carlyle, Ill., for the construction of an extension to the power house of the municipal electric light and water plant; the installation of one 200 to 225-hp water-tube boiler, or two horizontal tubular boilers of 110 to 125-hp each; one 150-kw, alternating-current generator, direct connected to engine; one 200 to 225-hp self-oiling, automatic engine, with all attachments, and laying 5544 ft. of 4-in. water mains and connecting same with the city water works system. Bonds to the amount of $13,000 have been issued for the above improvements. Plans and specifications are on file at the office of the city clerk.

DECATUR, ILL.—The contract for surface condensing equipment for the municipal electric light plant has been awarded to Henry R. Worth- [illegible]

GALVA, ILL.—E. W. Smith, manager of the Kewanee Light & Power Company, is reported to have submitted a proposition to the Council offering to purchase the local municipal electric light plant. If the proposition is accepted the plant in Galva will be dismantled and electricity for operating the local system will be supplied from the Kewanee plant.

LA SALLE, ILL.—The Business Men's Association, it is reported, is considering the question of installing a new lighting system in the business district. For further information address J. E. Malone, Jr., secretary.

LYONS, ILL.—Sealed proposals will be received by the President and Board of Village Trustees until Sept. 20 for furnishing and erecting a deep well pump, motor and accessories. Blank forms of proposal and specifications may be procured at the office of W. B. Ewing, engineer, 1003 Chamber of Commerce Building, Chicago, Ill., or at the office of A. E. Depew, village clerk, Lyons, Ill.

MATTOON, ILL.—The Mattoon City Railway Company has filed a certificate with the Secretary of State changing its name to the Central Illinois Public Service Company. The new company is a consolidation of the Central Illinois Traction Company, the Mattoon City Railway Company and the Mattoon Heat, Light & Power Company. The new corporation proposes to extend its service to surrounding towns, to be supplied from the central station in Mattoon.

SADORUS, ILL.—The Sadorus Telephone Exchange Company is reported to have purchased a site for its proposed new exchange building, work on construction of which will commence in the near future. Robert Evans is manager.

BRAZIL, IND.—The City Council has decided to make a test of the efficiency of the tungsten lamps for street-lighting purposes with a view of replacing the present lamps with tungsten lamps throughout the city.

CHESTERTON, IND.—The Sal Mountain Asbestos Company has entered into a contract with the Michigan City Gas & Electric Company, of Michigan City, Ind., whereby the last named company is to supply the asbestos company electricity to the amount of 350 hp for a term of years. The service is to be supplied from the Michigan City plant and will require the erection of a new transmission line from Michigan City to Chesterton, which is to be completed within 60 days. It is said that under the terms of the contract the asbestos company is to pay [illegible] per month for the service.

CONNERSVILLE, IND.—All bids received Sept. 1 for furnishing material and constructing complete pumping station and other buildings, reservoir, removal of old machinery, laying water mains and specials, drilling wells, furnishing vertical motors, electrical centrifugal unit, turbo-generator unit with surface condenser, etc., and tubular boilers for the municipal water works plant were rejected owing to the prices being too high. New bids will be received by William Reeder, city clerk, until Sept. 19 for the above work. J. B. Marvin, of Frankfort, is consulting engineer.

GREENFIELD, IND.—The contract for the installation of a 150 to 175-hp engine in the municipal electric plant was awarded to the Buckeye Engine Company for $2,278. Ora Myers is Mayor.

INDIANAPOLIS, IND.—A new street lighting system has been installed by Woodruff Place, a resident corporation, consisting of lamp standards, each carrying five tungsten lamps.

INDIANAPOLIS, IND.—The Union Railroad Company, which operates a belt railway system with from four to eight tracks around the City of Indianapolis, has awarded a contract for the installation of a complete telephone system for the Belt road.

INDIANAPOLIS, IND.—Plans have been approved by the Indiana Railroad Commission for the largest interlocking system in the world. The system, which will be controlled by electricity, is being installed on [illegible]

[illegible]

been granted a franchise by the City Council to construct and operate an electric railway on Churchman Pike, Legrand Avenue, Shelby Street, Virginia Avenue, Washington and Maryland Streets. Work on construction of the railway has commenced.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Traction Company has been granted a permit for its new power house to be erected at West Tenth Street and White River. The cost of the power house is estimated at $280,000, and the boilers and smokestack, $119,000. The Bedford Stone & Construction Company has the general contract.

INDIANAPOLIS, IND.—The Indiana Northwestern Traction Company is reported to have secured all franchises and rights of way for its proposed interurban railway which is to connect Cedar Lake, Hammond, Crownpoint and Chicago. It is understood that work will commence on construction of the road in the near future. Eugene Purtelle, 222 La Salle Street, Chicago, Ill., is president.

LADOGA, IND.—It is reported that William and Henry Goodbar have purchased the stock of the Ladoga Electric Light Company, owned by George and E. Hanns. J. E. Lidikay is president of the company.

NEW ALBANY, IND.—The contract for lighting the streets of the city has been awarded to the United Gas & Electric Company, of New Albany, Ind., for a term of 10 years beginning Jan. 1, 1911, under the terms of which the company is to furnish 270 lamps at the rate of $55.44 each per year, with 3 per cent discount for payment within 15 days.

PARKER CITY, IND.—The Town Council and Commercial Club are reported to be interested in a project to establish a municipal electric light plant in Parker City.

PLYMOUTH, IND.—Surveys are being made for the proposed electric railway from Bremen to Mishawaka. Neff Brothers, of Bremen, Ind., are interested in the project.

SOUTH WHITLEY, IND.—The Town Board has awarded the contract for the installation of a new 150-kw generator in the municipal electric light plant to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., at $3,800.

SULLIVAN, IND.—The Sullivan County Electric Company is reported to be making preparations to supply electricity in Shelburn, Ind., for lamps and motors. The service will be furnished from the plant in Sullivan.

TERRE HAUTE, IND.—An ordinance has been introduced in the City Council favoring the proposition to establish a municipal electric light plant at a cost of about $800,000. A report in regard to establishing a municipal electric plant has been submitted to the Council by George C. Morgan, of Chicago, Ill., electrical engineer.

CHARITON, IA.—It is reported that the City of Chariton proposes to lease its municipal electric light plant for a term of 25 years.

DAVENPORT, IA.—Preparations are being made by the Davenport Locomotive Works for the construction of a new power house at a cost of about $30,000.

DAVENPORT, IA.—Preliminary surveys have been completed by the Walsh Construction Company for the proposed interurban railway which is to connect Blue Grass, Stockton, Durant, Wilton, Moscow, West Downey and Iowa City.

DOWS, IA.—Investigations have been made in Dows by C. W. Gibson, of the Straight Electric Company, of Des Moines, Ia., with a view of establishing an electric light plant in this place. It is said that a proposition will be submitted to the City Council by Mr. Gibson asking for a franchise to operate an electric plant and contract to light the city. If satisfactory terms can be made work will commence immediately on construction of the plant.

IOWA CITY, IA.—The Iowa City Electric Railway Company has entered into a contract with the Cedar Rapids & Iowa City Electric Light Company to supply electricity to operate its cars in Iowa City. J. O. Schulze is general manager.

MASON CITY, IA.—Negotiations have been closed whereby the Western Electric Telephone Company has secured the majority of the stock of the Hancock County Rural Telephone Company. The last-named company has exchanges in Britt, Garner and Kenawa and toll stations in 12 smaller towns in Hancock and Wright Counties.

ROLAND, IA.—The installation of an electric lighting system in Roland is reported to be under consideration. It is said that negotiations are now under way for a connection with the system of the Nevada Electric Company, of Nevada, Ia.

ROLFE, IA.—The Rolfe Telephone Company is placing its wires underground in Rolfe at a cost of about $7,000.

WEBSTER CITY, IA.—[illegible] is reported to be advocating the construction of a dam across the Boone River by the city.

COUNCIL GROVE, KAN.—It is reported that E. C. Wendorff has been granted a franchise to construct and operate an electric light system in Council Grove.

FORT SCOTT, KAN.—Plans are being considered by the Mutual Telephone Company for improvements to its local system, which will include extensions to its distributing system.

HOPE, KAN.—It is reported that the proposition to issue [illegible] in bonds for the installation of an electric light system will be submitted to a vote. Electricity for operating the system will be supplied from Herington municipal electric plant.

RUSSELL, KAN.—Sealed bids wi[illegible] th[illegible] city clerk un[illegible] Sept. 16 for furnishing materials and construction of electric light plant and water works system, separate [illegible] is [illegible] as [illegible] For furnishing material and labor, except as outlined in subsequent items, and construction of electric light and water works systems. (2) For furnishing all material and constructing concrete clear water well and filter house. (3) For cast-iron pipe and special castings. (4) For hydrants and valves. (5) For furnishing material and erecting tower and tank of 50,000 gal. capacity, 125 ft. high. (6) For one vertical, triplex, single-acting pump, having a capacity of 500 gal. per minute; one horizontal centrifugal pump, with a rating of 300 gal. per minute, and one motor for operating centrifugal pump. (7) For furnishing electrical equipment. (8) For furnishing and erecting one internal combustion engine for 75-kw unit. (9) For furnishing and erecting one 50-hp gasoline engine. (10) For furnishing and installing mechanical filter of 400,000 gal. capacity. (11) For high speed steam engine for direct connection to 75-kw unit. (12) For furnishing 8-in. wooden pipe. (13) For furnishing all material and erecting brick chimney 80 ft. high by 42 in. in diameter. Plans and specifications are on file at the office of the city clerk and at the office of Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo.

WINFIELD, KAN.—The Southwestern Interurban Railway Company is reported to have commenced work on construction of a power plant in Hackney. The plant when completed will supply electricity for operating the entire railway system of the company.

CADIZ, KY.—The electric light franchise recently ordered sold by the City Council has been purchased by Alexander Brothers, of Cadiz. It is expected that work on construction of an electric light plant will begin in the near future.

FRANKFORT, KY.—Arrangements are being made by the Central Home Telephone Company for extensive improvements to its local system, which will involve an expenditure of about $50,000.

HARLAN, KY.—The Harlan Telephone Company is reported to be contemplating extending its telephone line from Harlan to Evarts, a distance of 20 miles.

PINEVILLE, KY.—It is reported that rights of way are being secured by the Bell County Home Telephone Company for the construction of an independent telephone line from Pineville to Straight Creek, and from Pineville to Harlan, 40 miles in length.

RUSTON, LA.—We are informed that the City of Ruston is in the market for a 50-kva generator direct connected to engine. R. H. Brooks is superintendent of water and light plant.

BALTIMORE, MD.—The Maryland Electric Railways Company is contemplating extending its railway from Morley Station, Baltimore, to a point on the Magothy River in Anne Arundel County. J. F. Heyward, of Baltimore, Md., is general manager.

BEL-AIR, MD.—The Public Service Commission has authorized the Bel-Air Electric Company to issue capital stock to the amount of $14,200 and $25,000 in bonds, the proceeds to be used for extensions to its system. The company now supplies electrical service in Bel-Air and is planning to enlarge its field.

CAMBRIDGE, MD.—The Cambridge Gas & Electric Company and the Cambridge Light & Power Company have consolidated under the name of the Cambridge Gas, Electric Light & Power Company. It is understood that the new management contemplates establishing a day service and other improvements to the service and plant. The officers of the new company are: E. C. Carrington, president; John G. Mills, secretary, and William H. Medford, treasurer.

BOSTON, MASS.—The contract for installing electrical system in Curtis Hall has been awarded to the Dolan Electric Company for $4,417.

BOSTON, MASS.—Sealed proposals will be received by M. J. Fish, superintendent of public buildings, of Boston, Mass., until Sept. 19, for furnishing new electrical fixtures for the new library building located at Sedgwick Street, Jamaica Plain. Forms of proposal can be obtained at the office of the superintendent Room 30, Old Court House, Boston, Mass.

CHESHIRE, MASS.—The Berkshire Street Railway Company is erecting a transformer station in Cheshire to equalize the distribution of power along its lines, especially on the Dalton and Hillsdale circuits.

MILFORD, MASS.—A fra[illegible] Attleboro & Woonsocket Street Railway Company to extend its railway in Milford.

NORTH ADAMS, MASS.—Weber Brothers are installing an electric light plant to supply electricity to light their factory. A Westinghouse generator is being installed.

SHELBURNE, MASS.—The Greenfield Light & Power Company, which recently took over the plant and holdings of the Shelburne Falls Electric Light & Power Company, is erecting a new distributing system to replace the one now in use. When completed electricity for operating the local system will be supplied from the Gardner Falls station of the Greenfield Light & Power Company.

BRONSON, MICH.—At an election held recently the citizens voted in favor of the proposition to purchase the electric plant of W. H. Friedrich & Company and install a water [illegible] a cost of about $19,000.

CADILLAC, MICH.—We are [illegible] until Sept. 27 by George Johnston, city clerk, for repairs to the Cadillac water and light plant, which was recently damaged by fire. The cost of the work is estimated at from $6,000 to $8,000. R. E. Elsner, of Cadillac, is engineer.

GRAND RAPIDS, MICH.—The Board of Public Works has awarded the contract for furnishing and installing turbo-generators, condensers and exciters for the new municipal electric light plant to the Allis-Chalmers Company, of Milwaukee, Wis., for $28,220.

HOLLAND, MICH.—It is reported that the Bay View Furniture Company, of Holland, Mich., is contemplating building an addition to its plant 80 ft. x 100 ft. The machinery will be equipped for electric motor drive.

OWOSSO, MICH.—A resolution will be introduced at the next meeting of the Council providing for the establishment of a municipal electric light plant in connection with the water works system. It is estimated that the plant can be installed at a cost of about $30,000 and will save the city from $3,000 to $5,000 per year. The Commonwealth Power Company now furnishes electrical service in this city.

BRECKINRIDGE, MINN.—The Wahpeton-Breckenridge Street Railway Company is reported to be contemplating extending its railway system across the prairies next spring. The proposed extension is said to be a beginning of an interurban railway which will eventually connect Great Bend, Hankinson, Lidgerwood, Sisseton and Watertown.

FERGUS FALLS, MINN.—It is reported that the installation of an auxiliary steam power plant has been proposed to the Otter Tail Power Company.

GILBERT, MINN.—It is reported that J. B. Thompson is contemplating the installation of an electric light plant to cost about $20,000, for which an application for a franchise has been made.

GRAND MEADOW, MINN.—It is reported that the town officials are considering the question of granting a franchise for the construction and operation of a lighting system in Grand Meadow.

MELROSE, MINN.—Plans are being considered to increase the output of the municipal electric light plant, which will include the installation of an 80-hp engine and a 30-kw generator. F. J. Wesser is city clerk.

MINNEAPOLIS, MINN.—It is reported that plans have been approved for the construction of the high dam by the Federal Government in the Mississippi River, between St. Paul and Minneapolis. The proposed dam will develop about 15,000 hp and will cost about $230,000.

ORTONVILLE, MINN.—Preparations are being made by the Minnesota River Improvement & Power Company to begin work on the construction of the first of its reservoirs in the near future. The first of the proposed dams will be built at Big Stone Lake, where 600 hp will be developed; the second dam will be erected near Ortonville at the lakes of Lac qui Parle and marsh, making a large lake 26 miles long and one mile wide; it is estimated that 8000 hp can be generated at the second dam; the third dam will be located at Redwood Falls, where 11,000 hp will be generated. It is reported that negotiations are under way for the sale of $500,000 in bonds, the proceeds to be used for the construction of the dams. The cost of the entire work is estimated at about $1,000,000. John H. Diers, of Blakeley, is secretary of the company; F. C. Irwin and W. H. Weibeler, of Belle Plaine, are among the directors.

PAYNESVILLE, MINN.—The Village of Paynesville is reported to have awarded the contract for the rebuilding of the power house of the municipal water and light plant. The cost of the work is estimated at [illegible]

CLEVELAND, MISS.—The local electric light and power plant, which was recently purchased by Nott & Ward, of Cleveland, Miss., and the Southern Coal Company, of Memphis, Tenn., will be incorporated under the name of the Home Light & Ice Company. J. H. Fewell, of Cleveland, is manager of the company.

VICKSBURG, MISS.—Proposals will be received at the United States engineer office, Vicksburg, Miss., until Oct. 20 for steel hull, self-propelling hydraulic dredge, steel pontoons and pipe line, and also for the component groups thereof, including steel dredge hull, steel pontoons and pipe line, upper works, steam plant, propelling machinery, electric plant, pumping engine, condenser plant and evaporator, sand pump, suction pipe and ladder, cutter head, gear and engine, winches and refrigerating plant. For further information apply to Capt. S. Smith, U. S. engineer office, Vicksburg, Miss.

KANSAS CITY, MO.—The City Commissioners are considering the question of calling an election to be held in January or February to vote on the proposition to issue bonds for the construction of a municipal electric light plant. The engineer employed by the commission to investigate the cost of a municipal electric light plant to be operated in connection with the municipal water works system has reported that such a plant could be operated with profit if electricity is sold at 5 cents per kw-hour. It is stated that after Jan. 1 the city will be in a position to issue $700,000 in bonds. A plan has been suggested to purchase the distributing system and lamps of the Consolidated Electric Light & Power Company and erect a power plant at the Quindaro water plant.

ST. JOSEPH, MO.—The St. Joseph & Savannah Interurban Railway Company is preparing plans for equipment for its proposed power house, for which contract for construction was recently awarded.

MISSOULA, MONT.—Arrangements are being made by the Montana Independent Telephone Company for completing its circuit to Mullan, Idaho.

[illegible]

be asked about the middle of November. E. S. Dorman, of Missoula, [illegible]

SHERIDAN, MONT.—A. B. Preston, of St. Johns, Mich., is reported to have been granted a franchise to install an electric light system in [illegible] be in operation by January, 1911.

ZORTMAN, MONT.—The power house and electric light plant of the Ruby Gulch Mining Company is reported to have been destroyed by fire.

BEATRICE, NEB.—Plans are under consideration by R. Iams, of Clay Center, Kan., and associates for the construction of an interurban railway to connect Beatrice, Neb., and Wichita, Kan., 200 miles in length. It is said that application for a charter will soon be made.

BLUE HILL, NEB.—At a special election held recently the citizens voted in favor of the proposition to issue $8,000 in bonds, the proceeds to be used for the installation of an electric light system in connection with the water works plant.

FAIRBURY, NEB.—Sealed bids will be received until Oct. 15 at the office of the supervising architect, Treasury Department, Washington, D. C., for construction, complete, including plumbing, gas piping, heating apparatus and electric conduits and wiring, of the United States post office at Fairbury, Neb., in accordance with plans and specifications, copies of which may be obtained from the custodian of site at Fairbury, Neb., or at the above office. James Knox Taylor is supervising architect.

OMAHA, NEB.—Sealed bids will be received by the Board of County Commissioners of Douglas County until Sept. 24 for electric wiring and installing conduit for power and light wires and also conduits for telephone wires in the Douglas County court house according to plans and specifications on file at the office of the county clerk and John Latenser, architect, 632 Bee Building, Omaha, Neb., copies of which may be obtained from the architect, upon deposit of $50 to insure return of same. Bids must be submitted on blank forms, which will be supplied on application to the county clerk or the architect. Bids will also be received on the same date for the installation of three passenger elevators in the Douglas County court house, one culinary department elevator and one elevator for jail, plans and specifications for which are on file at the office of the county clerk and at the office of the architect. D. M. Haverly is county clerk.

O'NEIL, NEB.—It is reported that an electric light plant will be operated in connection with the creamery now being erected by R. W. McGinness, of Lincoln, Neb.

JOHNNIE, NEV.—Plans are being considered by the Johnnie Mining Company, which is controlled by A. D. Myers and associates, for the installation of an electric power plant at Amaragosa station, from which electricity will be transmitted to its mine in Johnnie, 13 miles distant.

GILMANTON, N. H.—The installation of an electric light plant at the Hodgdon farm, near Gilmanton, is reported to be under consideration. The proposed plant will supply electricity for lighting this village and the summer colony at Crystal Lake.

WOODBINE, N. J.—Plans are being prepared by Stearns & Castor, of Philadelphia, Pa., for the equipment for the power plant to be built for the Baron de Hirsch School at Woodbine, N. J.

ALBUQUERQUE, N. M.—The Citizens' Traction & Power Company has decided to operate electric cars instead of gasoline cars in connection with its proposed street railway system in Albuquerque. A. W. Hayden, of Albuquerque, N. M., is interested in the company.

ALBANY, N. Y.—The Federal Telephone & Telegraph Company has filed a certificate with the Secretary of State showing an increase in its capital stock from $6,000,000 to $10,000,000. B. G. Hubbell is president and Byron L. Moore, secretary of the company.

BROOKLYN, N. Y.—The Commercial Construction Company, 24 State Street, New York, N. Y., has secured the contract for installing electric equipment in addition to and alterations in Erasmus Hall High [illegible]

BUFFALO, N. Y.—The Lafayette Hotel Company is contemplating the construction of a power plant adjoining the new addition to the Lafayette Hotel on Ellicott Street, Buffalo, N. Y.

COXSACKIE, N. Y.—It is reported that the American Valve Com- [illegible] with two 100-kw generators direct connected to a 125-hp Ideal engine. The new equipment will include a lighting plant and a vacuum steam [illegible]

[illegible] Company has recently taken over the system of the East Springfield Telephone Company. The Otsego & Delaware company has taken over all of the telephone companies in Delaware and Otsego Counties. The [illegible]

[illegible]

tions may be seen and blank forms of proposal obtained at the office of the New York State Training School, Hudson, N. Y., and at the office of Franklin B. Ware, state architect, Albany, N. Y.

NEW YORK, N. Y.—The contract for installing electric equipment in Public School No. 44, Borough of Bronx, has been awarded by C. B. J. Snyder, Superintendent of Schools, to I. Frederick Jackson, 94 [illegible] Street, New York, N. Y., for $9,098.

NEW YORK, N. Y.—The Erie Railroad Company is reported to be contemplating improvements to its yards at Meadville, Pa., Kent, Ohio, and Jamestown, N. Y. It is understood that new equipment will be purchased, including electrical apparatus and probably air compressors, pneumatic appliances, etc.

NEW YORK, N. Y.—Bids will be received by the Commissioner of Street Cleaning, Department of Street Cleaning, room 1403, 13-21 Park Row, New York, N. Y., until Sept. 21, for furnishing materials and installing an electric elevator in stable "A," at Seventeenth Street and Avenue C. Blank forms and further information may be obtained and plans and drawings seen at the office of the Street Cleaning Department, 13-21 Park Row, Borough of Manhattan. James F. Lynch is deputy and acting commissioner.

NEW YORK, N. Y.—Judge Lacombe in the United States Circuit Court, on Sept. 6, issued an order authorizing Frederick W. Whitridge, receiver of the Union Railway Company, to expend about $65,000 of the funds of the company to procure a contract with the City of New York for franchises to construct, maintain and operate an extension of its system in the Bronx. The proposed extension is to connect existing lines and to extend from Westchester Avenue and 167th Street to East 169th Street, to Franklin Avenue, to 168th Street, to Webster Avenue, to 167th Street, to transverse road under the Grand Boulevard and Concourse, to Jerome Avenue.

RAY BROOK, N. Y.—Sealed proposals will be received by Martin E. McClary, president Board of Managers of the New York State Hospital for Incipient Tuberculosis, Ray Brook, N. Y., until Sept. 23, for construction, heating, plumbing and electric work for employees' building at the New York State Hospital for Incipient Tuberculosis, Ray Brook, N. Y. Drawings and specifications may be seen and blank forms of proposals obtained at the above hospital and at the office of Franklin B. Ware, Albany, N. Y., state architect. Only bids for the entire work will be received.

ROCHESTER, N. Y.—The contract for supplying power for operating the Brighton pumping station in Rochester has been awarded to the Rochester Railway & Light Company at $53 per horse-power per year. T. H. Yanger is superintendent.

ROME, N. Y.—Preparations are being made by the Rome Home Telephone Company for the erection of a new exchange building in Rome. The company also expects to place its wires in conduits in the business part of the city.

SOUTHPORT, N. Y.—The Elmira Water, Light & Railway Company is contemplating the extension of its Pennsylvania Avenue line in Southport, for which a franchise will soon be asked.

BREVARD, N. C.—The Brevard Light & Power Company is erecting 4 miles of transmission lines for the purpose of supplying electricity in the suburban districts. The company purchases energy for operating its system from the Cascade Power Company, of Brevard, N. C. The service is supplied from the generating plant located on Little River, 7 miles distant. J. W. Chapman is secretary and manager of the Brevard Light & Power Company.

CHARLOTTE, N. C.—The owners of the Simpsonville Cotton Mill, at Simpsonville, are erecting a large addition to the mill. The equipment will be increased from 8192 spindles to 25,088 spindles and from 200 looms to 600 looms. Electricity will be used to operate the mill.

HENDERSON, N. C.—The power plant of the Hendersonville Light & Power Company, located at Big Hungary, 4 miles out of the city, was badly damaged by the flood recently. It is understood that orders have been placed by the company for two new steam turbines.

HIGH POINT, N. C.—Preliminary surveys are being made by the Southern Power Company for erection of the proposed transmission line from High Point to Asheboro and Randleman. The company proposes to supply electricity to manufacturers in Asheboro and Randleman and other towns in Randolph County.

NEWBERRY, N. C.—The new mill of the Oakland Manufacturing Company will have a capacity of 20,000 spindles and will be equipped for electrical operation. Electricity for operating the plant will be furnished by the Southern Power Company. Lockwood, Greene & Company, of Boston, Mass., are architects and engineers.

BEREA, OHIO.—Bids will be received at the office of the clerk of the Trustees of Public Affairs of the Village of Berea, Ohio, until Sept. 24, for furnishing material, construction and installation of machinery at the municipal electric light plant, as follows: One 325-hp engine, for direct connection to a 250-kw generator, one 250-kva generator, one 150-kva generator, one 75-kva generator and switchboard, in accordance with plans and specifications, which will be furnished on application to the clerk. O. R. Stone is clerk of Board of Trustees.

DAYTON, OHIO.—Plans are being considered by the Dayton, Covington & Piqua Traction Company to extend its system from Union to [illegible]

[illegible] OHIO.—[illegible] by the Mount

Vernon Railway & Light Company [illegible] an 800-kw condensing plant, work on which will begin immediately. A. N. Davrah is superintendent.

NEW LONDON, OHIO.—The installation of additional boilers in the municipal electric light plant is under consideration. E. B. Newkirk is chief engineer.

WEST MILTON, OHIO.—L. A. Parsons, owner of the Stillwater Valley light, heat and power plant, is contemplating extending his transmission lines to neighboring towns in the near future.

YOUNGSTOWN, OHIO.—The contract for installing an electric plant to supply electricity for the court house and jail of Mahoning County has been awarded to the Bruce MacBeth Company, of Cleveland, Ohio. The plant will have an output of 300 hp and will cost about $31,000.

CARMEN, OKLA.—At an election held Aug. 29 the proposition to issue $15,000 in bonds, the proceeds to be used for the construction of an electric light and water plant, was carried. B. E. Carter, of Carmen, Okla., is engineer in charge.

SAPULPA, OKLA.—The plant and holdings of the Sapulpa Electric Company have been purchased by H. M. Byllesby & Company, of Chicago, Ill. Preparations are being made by the new owners to install a 500-kw generating unit, which will more than double the output of the plant.

BROWNSVILLE, ORE.—The Albany Interurban Railway Company has been granted a franchise to construct and operate an electric railway in Brownsville. The proposed railway will be about 85 miles in length and will connect Albany, Sweet Home, Lebanon, Brownsville and Holley. P. A. Young is interested in the project.

COQUILLE, ORE.—The Coquille River Electric Company is installing a new electric plant to replace the machinery recently destroyed by fire. It is expected to have the plant in operation by Oct. 1.

FREEWATER, ORE.—The City Council has granted the Pacific Power & Light Company a franchise to construct and operate an electric light and power plant in Freewater.

KLAMATH FALLS, ORE.—It is reported that the Crater Lake Company acting in conjunction with the Federal Government contemplates the installation of an electric power plant at the lake to be used by the company and the Government jointly. The proposed plant will supply electricity to propel the launches on the lake, operate the refrigerating plant and for other uses around the hotel. It is also proposed to replace the present gas machines with electric automobiles, if the roads are not too rough.

PORTLAND, ORE.—The Portland, Eugene & Eastern Railway Company expects to place contracts for the construction of five miles of new track during the next few months. R. E. Welch, of Portland, Ore., is general manager.

REDMOND, ORE.—The City Council is reported to have granted the Crook County Water, Power & Light Company a 20-year franchise to construct and operate an electric light and power plant in Redmond. It is understood that the company will soon commence work on the construction of the Cline Falls project, where it is estimated that 25,000 hp can be developed. A 7500-hp unit will be installed at first.

TILLAMOOK, ORE.—The Tillamook Electric Light & Fuel Company is contemplating the construction of a hydroelectric power plant at Munson Falls, nine miles south, where 250 kw will be developed under a 570-ft. head. Plans are also being considered by the company to extend its electrical service to Bay City, seven miles distant, this year, and to Whalen, a distance of 28 miles, next year. William Spaulding is treasurer and manager.

ELIZABETHTOWN, PA.—The contract for the construction of power house, reservoir, three dams, feed mains, supply mains, water mains, water lines, two miles of macadamized road, etc., in connection with the Masonic Home at Elizabethtown, Pa., has been awarded to John Goll & Company, of Philadelphia, Pa., for $51,676.

GLASSPORT, PA.—Announcement has been made that the United States Glass Company has decided to abandon the project to increase the power plant of its Glassport factory and had contracted with the Allegheny County Light Company to furnish 250 hp in motors for operating the extensions to the works. The company will also supply electricity for 600 lamps for the factory.

NORTH WALES, PA.—It is reported that preliminary surveys are being made for the proposed electric railway to connect the Philadelphia division of the Lehigh Valley Transit Company at North Wales and the [illegible] and Western Railway [illegible]

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company is reported to have decided to abandon its plan to enlarge its Delaware Avenue power house and proposes to install additional machinery at its [illegible]wer plant at Thirty-third and Market Streets. It is estimated that the [illegible]pany will save about $240,000 by adopting this plan. The cost of [illegible] [illegible]ted.

[illegible] [illegible]pany at its gas plant at Charlotte and Washington streets. Plans [illegible]

[illegible]

Pa., has sold the plant and holdings of the Greenville Traction Company and the Greenville Electric Light & Power Company, of Greenville, S. C., to parties identified with the Southern Power Company. The street railway system includes about 14 miles of track. The consideration is reported to be about $500,000.

FAIRFAX, S. D.—It is reported that the Fairfax Electric Light & Milling Company, which has recently changed hands, is contemplating extending its electrical service to Bonesteel and Herrick, S. D., and to Butte, Neb.

LEAD, S. D.—The Homestake Mining Company is reported to have awarded a contract to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for the equipment for its new power house in Spearfish Canyon. The plant will cost about $1,000,000 and will develop more than 4500 hp.

JACKSON, TENN.—The contract for wiring the United States postoffice building has been awarded to Hebrick & Lawrence, of Nashville, Tenn.

FLATONIA, TEX.—Preparations are being made for the construction of an electric light plant in Flatonia. T. M. Spinks and associates are interested in the project.

FORNEY, TEX.—The Forney Electric Light Company has filed an amendment to its charter changing its name to the Forney Light & Ice Company.

GOLIAD, TEX.—The installation of an ice plant is reported to be under consideration by the Goliad Water & Light Company.

GREENVILLE, TEX.—S. A. Price, Albert Emmanuel, W. F. Bredenbach and associates, all of Dayton, Ohio, have accepted the 50-year franchise recently granted them by the City Council to construct and operate an electric railway in Greenville. The Greenville Railway Company has been organized by the promoters to carry out the project. The cost of the proposed railway and power plant is estimated at about $250,000. Albert Emmanuel is president of the company.

SHERMAN, TEX.—The Grayson Telephone Company, of Phoenix, Ariz., has been granted a permit to do business in Texas. The Texas headquarters of the company will be located in Sherman.

BURLINGTON, VT.—The Board of Aldermen has adopted a resolution reducing the price of electricity for lamps from 10 cents to 5 cents per kw-hour, provided the minimum charge is not less than 50 cents per month and the maximum charge does not exceed $6 per month. An appropriation of $1,000 was made to extend the lighting service.

NORFOLK, VA.—The Larchmont Transit Company has been granted a franchise to operate a public service automobile line between Norfolk and Larchmont, a suburb of Norfolk. T. M. Bellamy is president.

LAKE HEAD, WASH.—It is reported that the Wheeler-Reese Company, of Tacoma, Wash., is contemplating the construction of a new timber-cutting plant at Lake Head, to replace the one that was burned. Electric motor driven machinery will be installed.

MEADOW LAKE, WASH.—It is reported that arrangements are being made by the Washington Water Power Company for the installation of an electric lighting system in Meadow Lake.

PORT TOWNSEND, WASH.—Plans are being considered to develop the water power of the Elwah River in Clallam County to furnish electricity in both Clallam and Jefferson Counties. Mr. Aldwell is interested in the project and has secured a number of contracts to supply power in that section. A contract has also been signed by the Western Steel Corporation for energy to operate its large plant in Irondale. Work will soon commence on construction of the proposed plant.

SEATTLE, WASH.—The contract for the construction of the new power house for the Schwager & Nettleton lumber mill on the east waterway has been awarded to Mark Odell.

SEATTLE, WASH.—The City Council has granted the Seattle Electric Company permission to extend its tracks on North Fortieth Street, Wallingford Avenue and other streets in Seattle.

SPOKANE, WASH.—It is expected that the plant of the William Musser Lumber & Manufacturing Company will be rebuilt on a larger scale. An electric plant will be installed to furnish electricity for lamps and motors.

TACOMA, WASH.—The contract for the construction of the substation in Tacoma for the Nisqually power plant was awarded, Sept. 6, by the Light and Water Commissioners to Blows & Tuell, of Tacoma, Wash., for $103,824. Hamilton F. Gronen is chief engineer of the Nisqually power plant.

TACOMA, WASH.—The timber cutting plant, planing mill, shingle [illegible] Tacoma, Wash., are expected to be rebuilt this fall. Steam turbines will probably be installed in the new plant and the machinery equipped for electric motor drive.

[illegible] in Fairmont by the Willetts Company, of Pittsburgh, Pa., for the pro[illegible]

[illegible] Company permission to construct and operate an electric power plant in [illegible]

[illegible] factory will be equipped for electrical operation. Electricity for operating the plant will be purchased from the Ashland Light, Power & Street Railway Company.

[illegible] Dam Light & Power Company to extend its service to Horicon. A subsidiary company has been organized under the name of the Horicon Light & Power Company, which has recently been granted a franchise to operate an electric system in that place. Energy for operating the system will be supplied from the local plant. Plans are also being considered by the Beaver Dam Light & Power Company to extend its transmission lines to Minnesota Junction and Juneau to furish electricity for lamps and motors in both towns.

BROWNSTOWN, WIS.—The contract for installing a 25-hp gasoline engine and an 18½-kw generator and furnishing and erecting pole line was awarded to J. C. Hood, of Monroe, Wis., for $2,571. John Jones is village clerk.

ELDORON, WIS.—It is reported that the Eldoron Light & Power Company, recently organized, is contemplating the installation of a public service plant in the near future.

GREEN BAY, WIS.—The John P. Dousman Milling Company is reported to be contemplating the installation of a 150-hp motor to operate its mill during the low water periods.

HORICON, WIS.—The City Council has voted to grant the Horicon Light & Power Company a franchise to construct and operate an electric light and power plant in Horicon. The company is a subsidiary of the Beaver Dam Light & Power Company, of Beaver Dam, Wis., which will supply electricity from the Beaver Falls plant to operate the local system. It is expected to have the Horicon plant completed and in operation within six months.

JANESVILLE, WIS.—It is reported that the Janesville Electric Company is contemplating improvements to its plant, plans for which are being prepared by D. C. & William B. Jackson, of Chicago, Ill.

MARINETTE, WIS.—It is understood that the Lignum Chemical Company will require a battery of boilers and a line of alternating-current motors for its new plant at Marinette, Wis.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company is contemplating an addition to its Commerce Street power house 80 ft. x 144 ft., to provide space for the installation of steam turbine units. The company is also planning to erect a new substation 40 ft. x 57 ft. on the South Side of Milwaukee.

WAUSAU, WIS.—The contract for the electrical equipment to be used in the Forest Service ground-wood laboratory at Wausau, Wis., has been awarded to the Crocker-Wheeler Company, of Ampere, N. J., for $18,870.

POINT GREY, B. C., CAN.—The Municipal Council on Aug. 22 granted the British Columbia Electric Railway Company a franchise to construct and operate a street railway system throughout the municipality.

WINNIPEG, MAN., CAN.—The City of Winnipeg will receive applications until Oct. 1, 1910, for the position of business manager of the municipal hydroelectric power plant. M. Peterson is secretary of Board of Control.

MONCTON, N. B., CAN.—It is reported that a company, associated with an English company, which has been drilling for oil in New Brunswick has purchased the charter of the Moncton Street Railway Company and has leased from the city its gas and electric plants. It is said the company will utilize gas for operating the pumping station of the city water works system and also for operating the power plant of the street railway system.

CHIPPEWA, ONT., CAN.—The Norton Carborundum Company is reported to be preparing plans to increase the capacity of its plant at Chippewa, Ont. Six electric furnaces will be installed.

YORKTON, SASK., CAN.—W. E. Skinner, of Winnipeg, Man., consulting engineer, has been engaged to take charge of the construction of the proposed municipal electric light plant, for which bonds to the amount of $35,000 were recently voted.

PARRAL, CHIHUAHUA, MEX.—The Palmillo Mining Company, of Parral, is reported to be contemplating the erection of a large electric power plant near the Palmillo mine to supply electricity for operating the machinery in its mine and reduction mill. The company at present secures electrical service from the local electric plant.

New Industrial Companies.

[illegible] SWITCH COMPANY [illegible]

[illegible] MANUFACTURING COMPANY [illegible]

THE [illegible]

[illegible] capitalized at $[illegible] and proposes to deal in electrical supplies.

THE FREEMAN MANUFACTURING COMPANY, of Alexandria, Ind., has been incorporated with capital stock of $15,000 for the purpose of establishing a plant for the manufacture of generators, heating and lighting appliances and apparatus.

THE HOYT ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated by Elmer S. Vancamp, E. V. H. Shocking and E. T. Hoyt. The company is capitalized at $50,000 and proposes to manufacture and deal in mechanical and electrical appliances and devices.

THE JETT-WHITE ELECTRIC COMPANY, of Evansville, Ind., has been incorporated with a capital stock of $[illegible] for the purpose of manufacturing and selling merchandise of an electrical character, establishing and maintaining supply houses for all kinds of electric equipment and devices. The incorporators are Charles S. Jewett, Elmer S. Wise and [illegible] M. Hastetter.

YE MOTOR SHOP, of Connersville, Ind., has been incorporated by Frank B. Ansted, Herman M. Williams, William F. Doyle and A. A. Ansted. The company is capitalized at $10,000 and proposes to deal in motor vehicles of all kinds; also accessories and electrical supplies, etc.

THE SCHROEDER MANUFACTURING COMPANY, of Newark, N. J., has been incorporated to conduct a mechanical and electrical engineering business. It is capitalized at $200,000, and the incorporators are: John E. Heim, Arthur A. Schroeder, Hugo Beopple, Jr., all of Newark, N. J.

THE STRAIGHT FILAMENT LAMP COMPANY, of New York, N. Y., has been chartered with a capital stock of $300,000 by Frederick Greenfield, 305 East 161st Street, New York, N. Y.; Stuart L. Jaffray, 25 South William Street, New York, N. Y., and William S. McCartney, 149 Broadway, New York, N. Y. The company proposes to manufacture and deal in electric lamps, fixtures, etc.

C. R. TEABOLDT & COMPANY, of New York, N. Y., has been incorporated by E. Brooks, C. R. Teaboldt and G. F. Aitken, of New York, N. Y. The company is capitalized at $50,000 and proposes to manufacture and deal in motors, engines, machinery, etc., and in vehicles of all kinds.

THE WILKINSON FOUNDRY & MACHINE COMPANY, of Philadelphia, Pa., has been incorporated with a capital stock of $200,000 by Joseph C. Laird, John J. McGuirk and Charles S. Wilfong. The company proposes to manufacture and deal in automatic stokers and machinery.

Personal.

Mr. ARTHUR I. HUNTING has been appointed superintendent of the municipal lighting plant of West Boylston, Mass.

MAJOR GEORGE O. SQUIER, U. S. A., has been detailed by the War Department to attend the Harvard aviation meeting and report his observations.

MR. C. E. SCRIBNER, of the Western Electric Company, was a delegate at the meeting last week in Paris of the International Telegraph and Telephone Congress.

DR. E. F. NORTHRUP has accepted an appointment as assistant professor of physics at Princeton University, where he will make a specialty of physical and electrical measurements.

MR. EDWARD SCHILDHAUER, electrical and mechanical engineer for the Isthmian Canal Commission, is in the United States, enjoying his annual leave of absence. Mr. Schildhauer was formerly on the engineering staff of the Edison company in Chicago.

MR. J. B. KENYON, of the Sheldon School, Chicago, gave a lecture Sept. 6 on "Salesmanship" to the members of the engineering department of the National Electric Lamp Association, Cleveland, Ohio, in the large auditorium of the association's new engineering building.

PROF. GEORGE W. PATTERSON, of the electrical engineering department of the University of Michigan, Ann Arbor, Mich., is in Europe on a leave of absence for one year. He will visit technical schools and electric railway plants of importance in Great Britain, France and Germany.

MR. JOHN J. CARTY, chief engineer of the New York Telephone Company, was a delegate at the International Telegraph and Telephone Congress, held last week in Paris, and presented a paper giving an account of an underground cable to unite New York and Washington, and which will be used for both telephone and telegraph service.

MR. ROBERT I. JONES, who for the past three years has been connected with the contract department of the Allegheny County Light Company, Pittsburgh, Pa., resigned recently to accept a position with the Excess Indicator Company, Westinghouse Building, Pittsburgh, manufacturers of flat-rate controllers.

MR. FRED. MILES has resigned as city electrician of Atlanta, Ga., to accept a position with the Paulding Power Company. Recently the office of city electrician was made elective, and in resigning his unexpired term Mr. Miles said he did not wish to become a politician, which would be necessary if he had to prepare to enter political campaigns for re-election.

[illegible] *B[illegible]* asks us to correct [illegible] in a recent notice in

this column of which he was the [illegible], it was stated that he was formerly electrical engineer of the municipal central station, Sheffield, Eng. Mr. Ballard served under Mr. S. E. Fedden, the electrical engineer of the plant, as chief outside construction and distribution engineer. Prior to his connection with the Sheffield plant he had obtained an extended experience in an executive and technical capacity with English municipal and company central stations.

MR. WILLIAM H. ROSECRANS has opened an office as a consulting engineer at 110 La Salle Street, Chicago. Associated with him are Messrs. Irving E. Brooke and Alfred H. Marshall. All three of the gentlemen named were formerly connected with The Arnold Company, of Chicago, where Mr. Rosecrans was in charge of hydraulic and hydroelectric work. The new organization is engaged in purely engineering practice relating to steam, water power, railway, electric, water works, irrigation and drainage plants. Mr. Brooke devotes his attention largely to steam, railway and electric work and Mr. Marshall to irrigation and hydraulic design.

MR. M. S. SEELMAN, JR., the new editor of the N. E. L. A. *Question Box*, has been associated with the Edison Electric Illuminating Company of Brooklyn for the past nine years, in charge of the advertising and some other commercial activities of the company, during which period the business of that company has been multiplied by six. In 1906 Mr. Seelman was the winner of the first prize of $500 offered in a competition by the Co-operative Electrical Development Association for the best paper on the "Organization and Conduct of a New Business Department Suitable for Central Stations in Cities of 50,000 Population or Under." Mr. Seelman has been active in association work and has presented a number of papers before the N. E. L. A. and also the Association of Edison Illuminating Companies and has taken part in many discussions. Prior to his connection with the electric lighting industry Mr. Seelman had been in newspaper work for a number of years. He has taken up his new work with great zeal and energy and his first contribution appears in the September "Box."

Obituary.

MR. FREDERICK F. GARDNER, whose disappearance from his home in Red Bank, N. J., was referred to in our last issue, was found dead about six miles south of that city Sept. 7. Mr. Gardner was general manager and chief engineer of the Shore Electric Company, of Red Bank. He was born in Newark about 45 years ago and became connected as a young man with the Bergen County Gas & Electric Company, subsequently becoming manager of the Englewood branch. He retained this position for a number of years after the company was taken over by the Public Service Corporation. Recently he had been superintending the erection of a new power plant in Red Bank and had been seriously affected by overwork and worry. He [illegible] months old son.

Trade Publications.

INTERPOLE MOTORS.—[illegible] collection of catalog parts published by the Electro-Dynamic Company, Bayonne, N. J. Various applications of adjustable-speed direct-current motors for driving machine tools are described and illustrated.

ELECTRIC COOK STOVES.—The simplicity, cleanliness and convenience of electric heat for cooking are attractively set forth in an illustrated booklet describing the Hughes electric cook stove, issued by the manufacturer, the Hughes Electric Heating Company, at 226 West Superior Street, Chicago.

ELECTRICAL SUPPLIES.—The Mohawk Electrical Supply Company, Syracuse, N. Y., whose motto is "Electricity does everything—we sell the supplies," is mailing to its friends an illustrated folder describing its facilities for business and enumerating the representative lines of goods in which it deals.

VEHICLE MOTORS.—The advertising of vehicle motors is attractively outlined in a collection of copy suggestions prepared by the Westinghouse Bureau of Publicity, which have been issued to central stations enclosed in a striking cover. Several of these advertisements have appeared in the popular magazines.

ELECTRICAL SUPPLIES.—Julius Andrae & Sons Company, Milwaukee, Wis., has issued a semi-centennial souvenir illustrative of the growth of the concern since its founding in 1860. The booklet contains pictures of the various quarters the firm has occupied, together with portraits of those who have shared in its business success.

GAS ENGINES.—Bulletins "S" and "T" of the Bogart Power Engineering Company, Chamber of Commerce Building, Buffalo, N. Y., have for subjects respectively single-cylinder and single and double tandem gas engines. The former are built in sizes from 20 hp. to 100 hp. and the latter 50 hp. to 500 hp. An illustration is included of the details of the improved magnetic-electric igniter fitted to the engines.

KELLER DUPLEX VACUUM CLEANER.—The Keller Manufacturing Company, Twenty-first Street and Allegheny Avenue, Philadelphia, Pa., has issued a pamphlet describing the Keller duplex vacuum cleaner. This is a stationary apparatus, which may be placed where most convenient, and is operated by a ¼-hp motor placed in the base of the machine. The vacuum at which it operates is over 8 in. of mercury and the displacement of air is 45 cu. ft. per minute. It is equipped with two diaphragm pumps, one above and the other below the motor.

GROUNDING.—Paragon Bulletin No. 1, issued by the Paragon Sellers Company, of 60 Fifth Avenue, Chicago, Ill., contains some interesting information about the grounding of electrical structures. The company named makes the Paragon ground cone, and the many uses and adaptations of this convenient device are set forth. One interesting feature is a plan of a modern transformer substation showing the connection of ground cones for grounding lightning arresters and other purposes. Diagrams showing the groupings ordinarily employed for polyphase transformers are also given, as well as information relating to the protection of station equipment and various circuits.

THE MECHANIGRAPH.—With this title Topping Brothers, 122 Chambers Street, New York, have issued in elaborate form an account of a process for making drawings instantly transparent for blue printing. The apparatus consists of a pair of electrically warmed rolls, a bath, also electrically warmed, a series of traveling tapes and a pair of dryer rollers. The drawing to be treated is run between the first pair of rolls, which pass it through a bath of "transparantor" liquid, whence it passes over moving tapes to the drying rollers. By this process a drawing on any kind of paper, even though in pencil, can be blueprinted, thus obviating the making of tracings.

BUSINESS NOTES.

THE [illegible] ELECTRIC COMPANY, Pittsburg, [illegible] taken over the local agency for the Moloney transformer, made by the Moloney Electric Company, of St. Louis.

THE INTERNATIONAL ACHESON GRAPHITE COMPANY has opened a Southern branch in Atlanta, Ga., owing to the large use in the South of gredag, oildag, aquadag, and its pure powdered graphite.

MR. C. C. HEEB has been appointed manager of the Syracuse branch house of H. C. Roberts Electric Supply Company, of Philadelphia. Mr. Heeb has been with the company for eight years and has a wide acquaintance in the electrical field, particularly in New York State.

Weekly Record of Electrical Patents

UNITED STATES PATENTS [illegible]

[Conducted by W. T. [illegible]]

969,1[illegible]. DYNAMO; L. A. H[illegible] [illegible] For regulating [illegible] current generators by changing the phase between the no-load [illegible] of the dynamo and the [illegible] regulator which varies the exciting current in proportion to the load current and the angle between the load current of the alternator and the no-load e.m.f.

969,193. GOVERNOR; W. J. Richards, Milwaukee, Wis. App. filed April [illegible] [illegible] operation of the motor compressor.

969,[illegible]. TURBINE BLADING; M. [illegible] ford Bridge, near Sheffield, Eng. App. filed Feb. 24, 1908. For welding turbine blades to their shafts by threading the blade through a washer prior to welding, thus preserving a smooth path for the working fluid.

969,261. METALLURGICAL FURNACE; S. Z. De Ferranti, Grindleford, Eng. App. filed April 7, 1908. For producing steel. Includes [illegible] the magnets inductively mixing the metal.

[illegible] ELECTRIC CONTROLLER PLUG; [illegible] Ill. App. filed July 16, 1909. For regulating current for the use of doctors, etc. The plug contains resistance material in powdered form, the resistance being varied by screwing the plug into the receptacle.

[illegible] APPARATUS FOR OPERATING [illegible] W. K. Howe, Buffalo, N. Y. App. filed Oct. 11, 1906. For signals of the slot type operated by a motor and latch mechanism and slot [illegible]

969,336. LIGHTNING ARRESTER; F. M. Butler, David City, Neb. App. filed Jan. 21, 1910. Self-adjusting arrester with a receptacle having cavities separated by a wall of less height than the depth of the cavities, the cavities containing mercury.

969,345. SYSTEM OF ELECTRICAL DISTRIBUTION; F. S. Culver, Madison, Wis. App. filed June 9, 1909. For controlling current [illegible] battery, which latter is disconnected when the voltage drops below the charging voltage, together with an improved centrifugal switch for automatically connecting the generator field.

969,361. CIRCUIT PROTECTING APPARATUS; J. E. Graybill, York, Pa. App. filed Sept. 15, 1906. Tablet or junction board carrying a [illegible] secured by resilient bands.

969,387. GRID FOR STORAGE BATTERIES; F. M. Michael, Easton, Ohio. App. filed April 1, 1910. Double grid for storage batteries constructed to reduce the weight, being the shape of a wire basket of hollow wires interwoven.

969,393. COMBINED TELEPHONE AND PROTECTIVE ALARM SYSTEM; J. G. Nolen, Chicago, Ill. App. filed May 9, 1907. Alarm [illegible]

969,403. HOLDER FOR TELEPHONE RECEIVERS; C. R. Phillips, Philadelphia, Pa. App. filed Oct. 9, 1909. Attached to a desk to support the receiver by a swinging arm so as to permit holding the receiver by said arm instead of using the hand.

969,409. HIGH-VOLTAGE RECEPTACLE AND PLUG; F. J. Russell, Brooklyn, N. Y. App. filed July 21, 1909. A receptacle with a socket, an insulating post in the socket with a slot at one end and contacts at opposite sides and a plug with a tongue engaging the slot and contacts which co-operate with the contacts on the socket member.

969,414. ALARM SIGNALING SYSTEM; J. E. Shepherd, Chicago, Ill. [illegible] independent pipes passing through the fire area and having pressure responsive devices which operate the signal, one of the pipes responding to trouble and both to fire.

969,423. PIPE JOINT; J. R. Tanner, Pittsburgh, Pa., and Daniel B. Banks, Baltimore, Md. App. filed Jan. 28, 1910. For preventing electrolysis in pipes by means of an insulating coat between the [illegible] ends of the pipe together.

969,466. SAFETY DEVICE FOR HEATERS; I. Filson, Springfield, Ohio. App. filed Nov. 8, 1907. Heaters employing gas as fuel, the gas outlet being actuated by va[illegible] shut off the gas supply.

969,472. DYNAMO-ELECTRIC MACHINE; F. C. Hall, Wilkinsbu[illegible] [illegible] plurality of concentric collector rings supported on arms within [illegible] cylin[illegible]

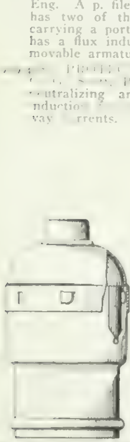
[illegible] ELECTRIC SWITCHING APPARATUS; [illegible] cago, Ill. App. filed Feb. 13, 1909. For connecting lamps in series or multiple by means of a rotary member carrying insulated contacts which are interconnected electrically and brushes engaging with the various contacts separately or simultaneously so as to connect them in various relations.

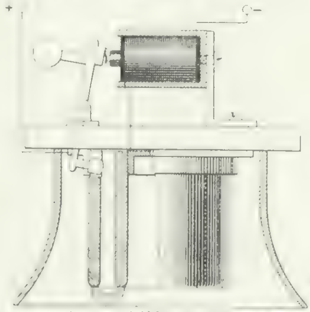
969,486. SOCKET-SHELL; A. S. Lynne, Bridgeport, Conn. App. filed July 5, 1910. Overlapping inter-engaging locking tongues face each other, the raised tongue on one member lying in depressions in the other member.

969,492. INSULATED PIPE COUPLING; S. E. Peeples, Washington, D. C. App. filed April 14, 1909. For gas and electric fixtures to prevent the moisture of condensation and surplus white lead from [illegible] forms a moisture collecting pocket within the main pipe.

969,493. ELECTROMAGNET MECHANISM; H. Pierson, Manchester, Eng. App. filed Oct. 3, 1908. An iron yoke with three pole pieces, has two of them in which a magnetic flux is induced by a coil carrying a portion of the main current and the remaining pole piece has a flux induced therein by a shunt across the main current. A movable armature is actuated by the fields.

[illegible] PROTECTIVE MEANS FOR ELECTRICAL CIRCUITS; [illegible] neutralizing and preventing disturbances due to electromagnetic induction [illegible] currents. The feede[illegible]





969,486.—Socket-Shell. 969,510.—Self-Regulating Arc Lamp.

tions which are connected to conductors for a short distance parallel to the signaling conductor and nearer to it than the distance between the signaling conductor and the feeder conductor.

[illegible] MEANS FOR NEUTRALIZING [illegible] IN [illegible] TRANSMISSION CIRCUITS; [illegible] Pittsburgh, Pa. App. filed July 9, 1906. Two electrical circuits are located within a magnetic field and a transformer with a primary winding is located in one of the circuits and a secondary winding in the other with an ohmic resistance in shunt with the primary winding and an inductive resistance in series therewith.

969,509. CONTROLLER FOR ELECTRIC MOTORS; R. F. Baetlocker, Manchester, Eng. App. filed Dec. 24, 1909. Oil immersed controller, [illegible] hinged thereto, which latter supports a controller and carries contact terminals engaging the terminals in the tank.

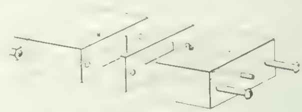
[illegible] ARC LAMP [illegible] located one within the other and an igniter located at a point remote [illegible]

969,512. DRY CELL; A. N. Barron, Cleveland, Ohio, and W. G. Waitt, Fremont, Ohio. App. filed March 26, 1910. A zinc cup with an absorbent lining, a carbon electrode and battery composition packed in the cell around the electrode and a disk embracing the electrode and fitting within the cup.

969,513. CONTROLLER FOR ELECTRIC MOTORS; H. L. Beach, Wilkinsburg, Pa. App. filed Feb. 10, 1909. A rotatable shaft carrying a spider which carries a drum segment of insulating material and contact signals, together with a resistance member on the spider and electrically connected to the contact segments, and a plurality of stationary contact fingers engaging the contact segments.

969,515. ELECTRICAL CONTROLLER; C. E. Bedell, Wilkinsburg, Pa. App. filed Jan. 5, 1907. A controller with co-operating switch members, one rotatable for varying the speed and axially adjustable to govern the direction of rotation of the motor.

969,523. AUTOMATIC STARTING DEVICE FOR MERCURY VAPOR RECTIFIERS; F. S. Chapman, Pittsburgh, Pa. App. filed Oct. 5, [illegible] Means for overcoming the initial high resistance of the



[illegible] Lightning Arrester.

rectifier and a governing switch therefor, together with a switch for altering the direct-current circuit of the rectifier and a device actuated by the current therein for operating the switches successively.

969,525. MERCURY VAPOR RECTIFIER; F. Conrad, Swissvale, Pa. App. filed Sept. 20, 1906. For starting rectifiers, the latter having two positive and two negative terminals with alternating-current connected between the pairs of positive and negative terminals and neutral points connecting to a distributing circuit.

969,527. PRINTING TELEGRAPH; A. C. Crehore, Yonkers, N. Y. App. filed Aug. 15, 1904. The transmitter and receiver are keyboard mechanisms and two line wires are used operating independently with a ground return for each. Each wire selects and operates one of six secondary relays.

969,542. APPARATUS FOR CHARGING STORAGE BATTERIES. A. S. Krotz, Springfield, Ohio. App. filed Jan. 12, 1905. Two opposing magnets operate upon a movable core, one of them being in shunt and the other in a circuit of constant potential with means for varying the differential magnetic pull of the magnets of the core.

969,547. OZONIZER; O. Linder, Chicago, Ill. App. filed June 18, 1910. Includes a stationary circular electrode, a rotating electrode adjacent thereto in the form of a fan and a supplemental fan in line therewith which creates an air draft to remove the ozonized air.

969,581. ELECTRIC SWITCH; B. C. Webster, Bridgeport, Conn. App filed May 20, 1909. Snap switch including a rotary shaft on which a disk is loosely journaled, a spring connected to the disk whose tension can be adjusted, and a commutator loosely mounted on the shaft and connected to the spring.

969,583. SYSTEM OF MOTOR CONTROL; H. E. White, Schenectady, N. Y. App. filed May 18, 1908. A plurality of electrically controlled switches, closed successively with a maintaining circuit for the switches and an overload device, ineffective as to all the switches except the last one, so that the switches close in succession and open in succession as long as no overload exists.

969,584. CONTROL OF ELECTRICALLY OPERATED SWITCHES; H. E. White, Schenectady, N. Y. App. filed Feb. 27, 1909. A plurality of contactors operating in succession, a plurality of auxiliary switches each controlling a contactor and electromagnets energized from the power circuit to control the closing and opening of an auxiliary switch.

969,585. CONTROL OF ELECTRICALLY OPERATED SWITCHES; H. E. White and E. R. Carichoff, Schenectady, N. Y. App. filed Feb. 27, 1909. A plurality of contactors for connecting successively, with actuating magnets therefor, and auxiliary switches co-operating with certain of the contactors with means for holding the auxiliary switch open while the co-operating contactor is open. For use with master controllers on electric railways.

969,607. CIRCUIT CONTROLLER; K. L. Curtis, Boston, Mass. App. filed May 4, 1910. Knife switch in which the pivoted blade moves a stop so as to enable it to be engaged with one of two sets of contact members.

969,608. DYNAMO-ELECTRIC MACHINE; J. Le C. Davis, Pittsburgh, Pa. App. filed Dec. 14, 1908. An improved field having auxiliary windings for opposing armature reaction and creating a commutating field.

969,617. KEY SOCKET FOR ELECTRIC INCANDESCENT LAMPS; G. W. Goodbridge, Bridgeport, Conn. App. filed Oct. 2, 1908. Has an insulating body, a switch therein, and a screw shell thereon with a central contact plate.

969,622. ELECTRIC FURNACE; J. E. Hewes, Plattsburg, N. Y. App. filed Sept. 7, 1905. The body of the furnace has two electrodes directed toward each other and a traveling trough-shaped hearth in sections which moves through the furnace in a line.

969,676. TELEPHONE LINE WIRE DETACHER; J. K. Tomlinson, Pickaway, W. Va. App. filed Dec. 29, 1909. For detaching wires in thunderstorms by pulling a rope outside of the house which separates two terminals, preferably cup-shaped, in the line wires.

969,723. PUSH-BUTTON SWITCHES; C. D. Platt, Bridgeport, Conn. App. filed June 14, 1909. Two-push-button switch with shaft, blade carrier and spring for oscillating it and latch for locking the blade carrier in either extreme of its movement.

969,738. CONTROL OF ELECTRICALLY OPERATED SWITCHES; H. E. White, Schenectady, N. Y. App. filed Feb. 27, 1909. A power circuit with a plurality of contactors for operating in succession to effect certain connections, a plurality of auxiliary switches, one for each contactor, a plurality of electromagnets each co-operating with an auxiliary switch and connections so that a contactor in closing decreases the effective turns in the electromagnet of the auxiliary switch.

969,750. ELECTRICAL RELAY; E. E. Clement, Washington, D. C. App. filed Sept. 10, 1906. For telephone exchanges with a return bar secured to the core of the electromagnet, an armature pivotally carried by the bar, contact springs carried by the bar and an operating connection between the armature and the springs.

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NEW YORK, THURSDAY, SEPTEMBER 22, 1910.

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THE ELECTRIC LIGHT CONVENTIONS.

Elsewhere we print accounts of two of the most successful electric light conventions of the year, namely the semi-annual meeting of the New England Section of the National Electric Light Association, and the annual meeting of the Pennsylvania Electric Association, a body also affiliated with the national body. If the value of state and sectional electric light organizations needed demonstration, the proceedings of the present meetings appear to indicate clearly the extreme usefulness of such bodies when their program is confined to the specific discussion of electric light situations actually confronting their members. One of the good effects of their affiliation with the national organization is that many matters which formerly figured on their programs and not of pressing or timely importance, or which for proper treatment require systematic investigation such as only the resources of the greater body can command, may now be left for consideration at the annual N. E. L. A. convention. Many matters most vitally affecting central stations acquire different aspects in different sections of the country, and if they are to be treated specifically rather than in general terms, they must be considered so far as possible with relation to local conditions. We need merely point to the vastly different conditions in regard to rate-making, for example, in a state like Wisconsin or New York, and in one like Pennsylvania or Rhode Island. Affiliation with the National Electric Light Association has been viewed with apprehension by some state organizations, as likely to circumscribe their activities. If we are to judge from the two meetings of last week, such affiliation has, in fact, resulted in a vast extension of activity of a kind most beneficial to the central stations represented.

Naturally the question of rate-making occupied a prominent place on both programs, and quite naturally also its discussion developed the usual diversity of opinion. The introduction of the tungsten lamp has brought more attention to bear on the subject of rate-making than it received in the previous central-station period of twenty years or more, but little has thus far resulted practically from the discussion of the question during the past several years. Possibly one reason for this condition is that the end sought has been a uniform rate system of general application—one which can be everywhere applied and by the smallest as well as by the largest central stations. The present as well as other recent discussions of the question seem to indicate clearly the impossibility of devising any system of rates that will attain this ideal. Nevertheless, we hope the subject will continue to be the leading one at electric light meetings, in order that all the principles involved in rational rate-making may become clearly defined and co-ordinated, not only for the instruction of central-station men, but through them in turn, for the instruction of the public. Competition, franchises, ordinances public utility regulation, local feeling and other considerations will determine how nearly a system devised to be strictly fair to the central station as well as to the public can be introduced; but the central-station man should be conversant with all the principles involved in rate-making in order to know how to formulate

intelligently a system best adapted to his local conditions. Mr. Blood in his remarks at the New England meeting touched on this phase of the matter when he said that actual rates should not be discussed so much as the underlying principles of charging; and as a basis for dealing with the public on the subject of rate-making he pointed out the desirability of educating it to the fact that the central station does not deal in a commodity but in a service. Any rational rate system must be based upon the idea of service, and consequently the desirability of educating the public to this idea should be thoroughly recognized by the central-station man. We regret that space will not permit touching on other interesting features of the two conventions, but in closing we cannot refrain from reference to the surprising objection—especially from the central-station standpoint—offered at one of the meetings to the tungsten lamp on the grounds that "it has a tendency to over-illuminate, because customers substitute a large clear-bulb tungsten for the ordinary 16-cp carbon lamp!" Evidently there are some central-station men who are not in sympathy with the slogan, "More light for the same money."

COMPARATIVE LIFE TESTS OF INCANDESCENT LAMPS.

If the opinion of the ordinary householder were asked as to the longevity of the incandescent lamp he operates from lighting mains, he would probably say that no law existed in the matter and that it was almost as much a question of chance as in throwing dice, especially when tungsten lamps were used subject to severe handling. The ordinary householder, however, rarely records his lamp-hours, seldom inspects his renewals, ignores sudden death caused by accidental breakages, and does not always enjoy a very nearly uniform potential difference at his lamp terminals. When, on the other hand, lamps of the same batch in manufacture are submitted to careful inspection for defects, are next carefully measured for specific consumption, and are then counted out for working hours to 80 per cent of initial mean horizontal candle-power, on mains of carefully maintained pressure, it is remarkable how closely they will agree.

It is a common colloquialism to say "as like as two peas" when we connote a high degree of quantitative similarity, but anyone who has made a careful examination of peas, as they come fresh and unassorted from the garden without being subjected to the demeaning influence of the sieve, knows that the average pea is remarkably different from its neighbor. What we ought to say on such an occasion is "as like as two incandescent lamps after being sorted in a testing laboratory." Unfortunately, the metaphor was stereotyped before the incandescent lamp illumined a benighted vegetable market. In fact, we can truthfully go further and say that the determination of the average lifetime of incandescent lamps, under scientific methods of testing, demands a higher precision in voltage and voltmeters than any other electrical industry, a tenth of 1 per cent being a quantity to be reckoned with. Something of the same precision quality is the joint property of large groups of similar human beings. An individual does not possess the property of precision in duration of life. The individual may die in early youth or survive a century. Nevertheless, a large community of individuals living in unchanged conditions possesses jointly this remarkable property of dying at a definite predeterminable age. The precision with which a million people die at an average predetermined age is worthy of the highest admiration. But in order to attain this precision the records must be kept with scientific care.

On page 665 of this week's number appears an interesting article by Messrs. Clayton H. Sharp and Preston S. Millar on the subject of comparative life tests of incandescent lamps. In this article attention is called not only to the agreement between the average lifetimes of twin lamp-batches in the same testing laboratory, but also to the agreement between average lifetimes of twin lamp-batches, as compared in different laboratories on opposite sides of the Atlantic. It is shown that the average disagreement between average group lifetimes is about 1.5 per cent when the number in each group is from 100 to 300, about 3 per cent when the number is from 50 to 100, and about 4.5 per cent when the number is from twenty to fifty. According to the theory of purely accidental errors, the increase in precision with the size of the group should be more marked than these numbers would indicate, so that other sources of disparity may be suspected. The agreement between the average lifetime of the British and American tests is the more remarkable, because the number of lamps in each group was so small. There were only six lamps in each batch, and two batches contained one lamp that behaved so differently from the rest as to call for expulsion. That is, one American lamp "slumped" and one British lamp "boosted," but these eccentricities of behavior were noticeable almost from the start.

THE ELECTROSTATIC CAPACITY BETWEEN EQUAL PARALLEL WIRES.

In electrostatics we have ever presented to us the sharp limitations of our quantitative knowledge and mathematical methods. If a pair of conductors, say, a pair of cubical tin biscuit boxes, are supported on insulators at a definite distance apart in air, in a certain geometrical relation to each other, the electrostatic capacity of the condenser formed by the boxes is beyond existing mathematical capabilities to determine, except in the particular case when two faces are opposed squarely at a small intervening distance. But Nature works out the results instantly, and the capacity can always be measured experimentally within the degree of precision permitted by the method and apparatus of the measurement. Nor is it only in electrostatics that the baldness of our mathematical ignorance appears conspicuously when the hat of complacency is lifted in the presence of truth. As a celebrated mathematical optician once remarked, a beam of light takes less than a millionth of a second to select its path through a compound lens of given dimensions and qualities of glass; whereas a skilled mathematician may have to spend a month in computing it.

There are, however, certain simple geometrical forms in condensers for which the electrostatic capacity has been safely computed, and one of these is a pair of equal and parallel cylinders situated in a uniform insulating medium. This case is strictly represented by a pair of straight parallel equal wires *in vacuo*, and is represented with sufficient precision for practical purposes by a pair of equal wires suspended in air at a uniform distance apart, on insulators, from pole cross-arms. The formula for the linear electrostatic capacity of such a system has been known for at least thirty years in its specific application and for half a century in its general application. The strict formula, as originally produced, was somewhat lengthy to compute with, but a short cut, using anti-hyperbolic functions, was first published about a year ago by Blondel. To

simplify the computation, two or three different approximate formulas have been in vogue among electrical engineers. These simpler formulas give results that are entirely satisfactory for engineering purposes when the interaxial distance between the wires is not less than a dozen times the wire diameter. As a general rule, in overhead wire construction the interaxial distance is usually over a hundred times the diameter. In such cases the difference between the results of the strict formula and the approximate formula is microscopic. If, however, the approximate formulas are applied to cases in which the wires are not many diameters apart, serious error may be involved, the amount depending on which particular approximate formula is used.

In the article by Messrs. Harold Pender and H. S. Oosborne which we publish this week the gravity of the error due to forcing one of the approximate formulas down to a ratio of interaxial distance to diameter as low as 1.087 is duly signalized. The inexpediency of whipping a lame horse has long been advertised by moralists. It may, however, be pointed out as some extenuation in the case considered that the lameness of the horse was clearly made evident to all beholders, because the tables of capacity in question cited on their faces the particular formula to which they owed their birth. The article substitutes for the lame approximate formula a shorter and more rigid formula, using the recently developed antihyperbolic method. The article also develops in a very interesting way the new and beautiful proposition that the surface density of the charge upon a pair of equal parallel wires is in all cases an ellipse. When the wires are brought close together the ellipse is flat and long drawn out, but when the wires are many diameters apart the ellipse degenerates into a simple circle of uniform charge distribution.

STATE OR NATIONAL CONSERVATION?

There seems to be a general agreement that our natural resources are in sad need of conservation, but the friends of the conservation policy are apparently becoming divided into two hostile camps, one holding to the idea of national control, the other utterly repudiating it and insisting that the states, and the states only, have a right to deal with the matter. It is the old doctrine of states' rights in another of its innumerable phases. A letter from Mr. Percy H. Thomas in the current issue brings to notice an interesting situation which seems not unlikely to arise at any time and which has an important bearing on the question of responsibility in conservation. The hypothetical case is that of the conflict of hydraulic rights on an interstate stream. Suppose under state authority vested rights had been secured and development had been made near the state border. Next, assume a later development with large storage capacity a short distance upstream, but over the border of the state. It is perfectly clear that the later upstream plant in utilizing its storage could practically cripple the older plant further down, and in the normal course of operations, without any malicious intent, would be very likely to do so. We call to mind several streams in which this situation is very likely to arise. Now, if the hydraulic laws in the respective states happen to be identical, the rights of the parties would be very easily determined, but if they were materially different questions would probably arise which could be solved only with great difficulty, particularly if the stream did not happen to be a navigable one.

Rights of interstate streams have been from time to time before the courts in long-drawn litigation, but there is not yet any body of precedent which seems to be capable of dealing with perfectly possible cases of interference which are very likely to arise. Congress undoubtedly has authority to legislate on the subject under its general interstate authority, even if the stream is not a navigable one; but unless it does so a situation might arise at any time which would be perilously acute, if, following a line of development which is now well marked out, the upstream plant in our supposed case should be owned by the state and leased to an operating company. The private corporation downstream would then find its path through the courts blocked in a conflict with a sovereign state. Such possibilities point strongly toward the federal control in spite of the very natural tendency to depend in such cases on the police powers of the state and local self-government. There are many streams along the Appalachian and Rocky Mountain watersheds which might become involved in the situation that our correspondent considers.

In still other ways, interstate difficulties may be found in the conservation situation from the hydraulic standpoint. It may be necessary or desirable to safeguard the watersheds of one state in order to protect the water-powers of another, a situation in which national control would be effective, while action by the states would probably be very difficult to secure. These facts bear heavily against state control, even supposing that efficient state action in protection of the rights of its own citizens could readily be obtained. There is grave doubt in the minds of many whether state governments as a whole are not more readily influenced by large private interests than is the national government. We could mention several states in which it is generally understood that many bills have to receive the assent of influential railway presidents before they are permitted to become law. Influences so potent as these may be exercised in favor of conservation or they may not; and while powerful influences are constantly at work on Congress, we have faith to believe that their authority seldom or never extends so far as we have just intimated. The interests of all people, irrespective of their residence in any particular state, will be affected by the conservation policy carried on within the boundaries of the United States; and long previous experience in this country with state legislation indicates that where general interests are involved, uniformity of action throughout the territory of the United States is the only means by which effective action can be attained.

Congress has been cautious and properly so in taking important action under its general right to protect the public welfare, but it looks very much as if, in the matter of conservation, a point had been reached when such action would become highly desirable. State control, if prompt and effective is perhaps to be preferred on general principles to national control, since the general theory of our government is based on the preservation to the fullest practicable extent of local rights. Yet in cases of possible or probable conflict between local rights it is the general tendency to harmonize the differences through Congressional action, for which there is ample though somewhat ill-defined authority in the constitution. Certainly in the important issues of conservation that are now under discussion there are so many features involving interstate rights that dependence solely upon state action would appear to be chiefly effective in promoting litigation.

Additional Single-Phase Equipment for the New York, New Haven & Hartford Railroad.

In the annual report of the Boston & Maine Railroad, just issued, it is stated that plans are being prepared for the electrical equipment of the Hoosac Tunnel. The statement calls renewed attention to the electrification plans of the New York, New Haven & Hartford Railroad because, owing to the control of the Boston & Maine Railroad by the New Haven road, the work of electrification will be conducted by the electrical engineering department of the New York, New Haven & Hartford Railroad Company.

The New York, New Haven & Hartford Railroad has at present in consideration or under way five electrification plans, [illegible]

First, the equipment of the Hoosac Tunnel, which is about 25,000 ft. in length and consists of two tracks.

Second, the electrical equipment of the New York, Westchester & Boston Railroad, which extends from 180th Street or Adams Street, in New York, to the corner of East Fulton Street and Columbus Avenue, thence across the present New Haven tracks to North White Plains on the north and New Rochelle on the east. At 180th Street, New York, the road will connect with the present subway, for which it will act as a feeder. This line is twenty-one miles in length and consists of two tracks and four tracks.

The third electrification plan is that of the Harlem River branch from New Rochelle to Morrisania and consists of six tracks.

The fourth is the extension of the present electrified section of the road from Stamford to New Haven, consisting of four tracks.

The fifth is the equipment of the Boston terminal and the electrical zone around Boston.

It will be of great interest to learn that a decision has been reached to use the single-phase system at 11,000 volts on all of these systems, including the Hoosac Tunnel.

The section comprising the Hoosac Tunnel line to be equipped will be from North Adams, which is beyond the west portal, to the immediate vicinity of the east portal. Both freight and passenger trains will be hauled through the tunnel by electric locomotives equipped with motors of the conductively-compensated single-phase type.

The locomotives, of which there will be five, will be somewhat similar to those used on the main branch of the New Haven road. The only difference will be that the direct-current features of the main-line locomotives, required for operation on the New York Central tracks between New York and Woodlawn, will be eliminated; that is, the Hoosac Tunnel locomotives will be "straight single-phase." Energy will be obtained from a station which will be erected by the company. This station will have a rating of 600 kw in two 3000-kw turbine units. An 11,000-volt overhead system will be erected in the tunnel, which has a height of 18 ft. or a clearance of slightly more than 4 ft. above the cars. Work has already been commenced on this installation.

Messrs. Stillwell & Putnam, of New York, have been retained as constructing engineers for the electrical equipment of the Hoosac Tunnel, under the direction of the engineers of the New York, New Haven & Hartford Railroad Company.

The second electrification plan mentioned is that of the New York, Westchester & Boston, which will also be single phase, but the service will be entirely by motor cars. From 75 to 100 cars will be required. The ratio of motor cars and trail cars has not yet been finally determined. This will also be a "straight single-phase" road, without direct-current complications, and 11,000 volts will be used on the trolley. It is interesting to learn that before the adoption of the single-phase system on the New York, Westchester & Boston Railroad the New Haven road secured from Messrs. Stillwell and Putnam a report on the proper system to use. The decision of these engineers was in favor of the single-phase, at 11,000 volts, similar to that used on the main line of the New Haven Railroad.

Authorization to equip the Harlem River branch of the road for 11,000-volt, single-phase operation was made by the directors some time ago.

The extension of the main line electrification from Stamford to New Haven has been authorized by the directors, but will not be undertaken until some of the other work described above is further advanced.

All the engineering work mentioned is under the engineering department of the New Haven railroad, of which Mr. E. H. McHenry is vice-president and Mr. W. S. Murray is electrical engineer.

The Fort France Electric Power Question.

On the recent visit of Premier Sir Wilfrid Laurier to the Canadian West, the citizens of Fort France took occasion to bring to the attention of the Premier their grievance with respect to the development of power at that point by the Ontario & Minnesota Power Company, known as the Backus interest. It was generally supposed that this question was settled by the action of the Dominion Minister of Inland Revenue, some three months ago, in granting a license to the Backus company for the exportation of power from Canada, but the license is subject to revocation at will by the Dominion government, and, in any event, runs out in March, 1911. In the address presented by the acting Mayor to Sir Wilfrid a plea was made for an equal distribution of power generated at the falls, with a request that the licenses recently granted be revoked on the ground that the company had not lived up to its agreement regarding the price of energy supplied to the users on the Canadian side.

The Ontario & Minnesota Power Company has developed at Fort France 21,000 hp. Of this amount 14,000 hp has been developed from the American side of the river in the form of hydraulic power and 7000 electrical hp has been developed from the Canadian half of the stream. The hydraulic power is being utilized in the grinding of pulp for the extensive paper mills established at International Falls, on the American side, and it is contended that it has been the intention of the company to utilize the electrical power developed on the Canadian side for manufacturing wood pulp into paper. The people of Fort France some time ago took alarm at the prospect of having all the power diverted to the building up of United States industries and made a vigorous fight last winter to induce the Dominion government not to grant the license for the exportation of power which had been applied for by the Ontario & Minnesota Power Company.

The company, however, secured from the Ontario government a statement of its willingness to see 6000 hp exported under certain conditions. The Dominion government, with whom actually rested the right to authorize the export of power, refused to give permission for the exportation of so large an amount of power, but gave a license for the exportation of 3500 hp (being half of the amount developed on the Canadian side), subject to the provision that it was revocable by the Dominion government at will and that, upon demand, prices for the power on the Canadian side of the river must be made which would be acceptable to the Minister of Inland Revenue. The license was only for a limited period and expires next March.

The Dominion statute of 1905 giving the company its rights in Canada provides that half the power generated shall be used in Canada, and the statute of 1907, defining the conditions under which power may be exported, gives the Dominion government the right to fix the Canadian price for power before permitting export to the United States. In granting the temporary license this year the Canadian government did not fix the price.

It is now claimed that no quotation lower than $30 per annual horse-power has been obtainable by either town or individuals from the company for use on the Canadian side of the river. There is also no hydraulic power development on the Canadian

side, so that small industries must rely on electric power, which alone is procurable on the Canadian side.

The town corporation wants the Canadian government either to fix prices immediately for the power retained in Canada or else cancel the contract; also, to take such steps as may be necessary to ensure that upon the termination of the license the original arrangement that half the power generated at this point on the river should be utilized in Canada be enforced.

Sir Wilfrid Laurier, in his reply to the delegation, promised that the rates for Canadian power should be fixed immediately upon his return to Ottawa, and he made the general pledge that before the permanent policy of the government was decided upon the whole matter would be carefully considered with a view to seeing that the people of Fort France obtained fair consideration. On the large question of the exportation of electric power, Sir Wilfrid took the ground that, on general principles, it should never be allowed.

Electrical Service at the Harvard-Boston Aviation Meet.

Telephone service played a leading part at the recent Harvard-Boston aviation meet in the Squantum district of Quincy, which lasted from Sept. 3 to 15, attracting visitors from many parts of the world. Probably for the first time in the history of the sporting world the entire news report of an event of such international importance was sent out entirely over telephone lines. On account of the decision of the management of the meet to hold the contests and exhibitions at Squantum instead of in the vicinity of the Harvard Stadium there was insufficient time for the installation of telegraph poles and circuits, and emergency measures had to be taken by the New England Telephone & Telegraph Company. The company's plant department at Quincy provided temporary connections between the Dorchester exchange of the Boston district and the aviation field by means of a 30-pair lead-covered cable from the main line to a central point in the rear of the grandstand. From there connections were made to various points about the field, about 2400 ft. of cable being required. The Boston daily papers were provided with direct lines to the press boxes in front of the grandstand, and by this means bulletins were transmitted to the various offices as the events occurred. This service proved to be invaluable in view of the dependence of the various events upon the weather conditions.

For the use of the various officials at the meet exchange service sets were installed in the treasurer's office at the main gate, at the main office in the Administration Building, and in the portion of the field devoted to the parking of automobiles instruments were installed for pay-station service in a tent. Connections were made by underground wires from the cable terminal near the grandstand. At regular intervals in the rear of the grandstand four pay stations were installed and there were also four pay stations in the Administration Building for general public use. Quick connections were maintained between the field and the Blue Hill Observatory in Milton, so that changes in wind velocity and other atmospheric occurrences could be gaged in the shortest possible time before flying began and during the contests. The most striking feature of the service was the provision of a special connection from the field to the Hull Life Saving Station, arranged at the request of Chairman Glidden, of the contest committee, for the purpose of receiving instantaneous reports from Boston Light when the aviators passed out and in in the turn around the lighthouse. These reports followed a wig-wag signal given by the keeper of the light to the life-saving station, the time being taken by chronometer.

The Old Colony Street R[illegible] feeder from Atlantic to the aviation field, and maintained a heavy extra car service on the line. At the close of each day the funds received at the [illegible] Shawmut Bank, Boston, in [illegible] batteries of the aero[illegible] station service.

Rate Regulation in Indianapolis.

According to the opinion of the city attorney of Indianapolis, Ind., the board of public works of that city has the right to intervene between the Indianapolis Light & Heat Company and consumers and prevent the former from establishing unjust and discriminating rates. While the city's authority is limited in the premises, according to the opinion of the city attorney, "The company has the right to fix its rate to any consumer so long as there is no unjust discrimination, and has a right to classify its rates subject only to the maximum fixed in the contract; but the board of public works has the right to cause it to establish certain rates and then make them public for the information of the general public under the provisions of the franchise. The board only possesses the right to prevent unlawful discrimination by requiring the light and power company to afford an established publicity of its classified rates or giving all of a class the same rate."

The controversy arose when the central station gave a less rate to patrons in districts of the city where competing companies had their lines than to patrons in districts where there was no competition. In a test case the court decided that the board of public works had a right to prevent any discrimination against patrons in districts where no competing lines were established.

The Montreal Lighting Controversy.

After an adjournment lasting nearly three weeks the arbitrators hearing the case of the Montreal Light, Heat & Power Company against the city of Montreal reconvened in the City Court House on Sept. 13. Immediately, upon the request of the attorneys for the city and with the consent of counsel for the company, the arbitrators adjourned further hearings until Oct. 4 to permit the city's representatives to consider the making of a proposition to the company that if accepted would, without further delay or hearings, permit an amicable settlement of the present lighting controversy. This new situation was doubtless brought about by the opening of bids for city lighting on the day previous.

Some weeks ago the Montreal company formally notified the city that unless some other and more definite arrangement were entered into it would discontinue all street lighting in the city of Montreal proper, where no definite contract price existed, beginning Nov. 1, 1910. The city promptly retaliated by issuing specifications and calling for bids for the exclusive lighting of all the streets of the city of Montreal on flat rates, and municipal buildings and motor demands on meter rates, for a period of ten years beginning Nov. 1, 1910, the number of street lamps specified as at present required being 1650 arc and 500 incandescent, of different candle-power. The specifications are unusually definite and in some points rather unique, as may be noted from the following:

A Standard Arc Lamp shall mean a direct-current series luminous arc lamp (magnetite) with an internal concentric reflector with clear globe, consuming not less than 6.6 amp at a voltage of from 75 to 80 at the lamp terminals, and equipped with electrodes of the best quality obtainable.

A Standard Arc Lamp shall mean a direct-current series luminous arc lamp (magnetite) with an internal concentric reflector with clear globe, consuming not less than 4 amp at a voltage of from 75 to 80 at the lamp terminals and equipped with electrodes of the best quality obtainable.

[illegible] the illumination given by the standard arc lamps described above when measured at a point between 200 ft. and 300 ft. horizontal distance from the lamps, using as a standard of light a fixed calibrated 16-cp incandescent lamp and a standard photometer screen or a standard luminometer.

Standard Incandescent Lamps shall be 40-cp and 80-cp (mean spherical) tungsten lamps (series) and shall be equipped with reflectors and brackets approved by the superintendent of the light department.

The Standard Candle-Power of Incandescent Lamps shall mean that no incandescent lamp shall be continued in service after its candle-power has declined below 90 per cent of the initial candle-power of that of the standard under which it is installed.

Tests of Lamps in Service Conditions.—For the purpose of determining whether the standard illuminating power is being furnished, tests shall be made on lamps under service conditions; such measurements to be made at a point between 200 ft. and 300 ft. distant from the lamp, using as the standard of light an incandescent of 16 cp, calibrated in fixed position, and a standard photometer screen fixed in a horizontal position at a distance of 5 ft. above the level road surface, or a standard luminometer. The result of such tests shall show illuminating power equal to or greater than that obtained by tests for standard illuminating power, as provided for above. In measuring the illuminating power of fluctuating lamps, readings shall be taken of the maximum and minimum illuminating power and the arithmetical mean of the averages of such two sets of readings shall be considered to be the illuminating power of the lamp under test. The mean normal unobstructed illumination at any point nearer the lamp than the test point shall not be less than that determined at such point.

The Contractor shall at all times maintain the standard illuminating power during each and every lighting hour during the period of the contract, which may be checked by the superintendent of the light department or his authorized representatives at any time during the continuance of this contract; and the contractor shall furnish the superintendent or his representatives, for the purpose of making such tests of illuminating power, current and voltage, access at all times to all lamps and to the contractor's stations, if required. In order to facilitate the securing of such information as is required by the superintendent the contractor shall install where convenient in his station, on each and every lamp circuit, a curve-drawing wattmeter of approved type, which shall furnish a record of the input in watts to each circuit throughout the hours of operation of each and every day. Such record shall be delivered to the superintendent of the light department each day with the reports provided for below.

Deductions and Penalties for Part of the Light Stoppage.—If a lamp or lamps be extinguished or not lighted during a portion of the night exceeding sixty minutes the superintendent of the light department shall deduct from the bills of the contractor half the amount which the contractor would be entitled to receive if such lamp or lamps had been lighted during the whole night; for each and every lamp which shall be extinguished or not lighted for 120 consecutive minutes the superintendent shall deduct the full amount which the contractor would be entitled to receive if such lamp or lamps had been lighted the whole night.

Deductions and Penalties for Inferior Light.—The superintendent of the light department shall deduct two nights' pay for every lamp not up to the standard or two nights' pay for each lamp upon a circuit not up to the standard, and three nights' pay for any lamp which the contractor shall fail to light during any night; provided that the superintendent of the light department may, if the circumstances require in fairness that a less deduction be made, remit part of the penalty imposed by this section, subject to approval by the board of commissioners.

Patrol and Inspection by Contractor.—The contractor must maintain at his own expense an efficient system of patrol for inspecting lamps during the hours that they should be burning, so that any lamp which fails to burn properly shall be promptly reported and put in order or immediately replaced. It is understood by the contractor that the utmost diligence shall be used in order that the streets, avenues, parks and public places shall be efficiently lighted, and to this end a sufficient number of men shall be employed as inspectors so that each lamp may be examined at least three times per night.

Daily Reports to Superintendent of the Light Department.—The contractor shall each day before 3 o'clock p. m. make a written report to the superintendent of the light department stating the number and location of any lamps extinguished or not burning, by whom reported, whether by citizens, police or city's inspectors, giving the time when each lamp was replaced and again started burning, and the said report shall also state the cause for each lamp being extinguished or failing to burn; if any of the said lamps are extinguished by reason of the failure of the current to supply said lamps, or for any other reason, his report shall contain a statement of the cause of such failure to supply current.

Proof of Fulfilment of Contract.—It is agreed that on and after the first day of each and every month, during the term of the contract the contractor shall furnish proof to the satisfaction of the superintendent of the light department that he has fully performed and fulfilled this contract and all the particulars and conditions aforesaid, during the preceding month, and particularly that he has operated and maintained the lamps as provided for in these specifications, and that all lamps have been kept clean and in good state during all the time that the lamps were required to be kept lighted. Upon so doing, the superintendent shall certify and in his certificate state the amount to which the contractor shall be entitled for all duties performed in such preceding month; and the account so certified, after being approved by the board of commissioners and the city comptroller, shall be duly paid by the treasurer. Without such proof to the satisfaction of the superintendent he shall not sign any certificate, and without such proof being furnished by the contractor he shall not be or become entitled to any payment in respect to services which were required to be done or should have been done in such preceding month.

The specifications provide for all-night, every-night lighting (4000 hours per year). No bid was to be considered unless accompanied by a certified check equal in amount to 10 per cent of the total amount to be received by the bidder, in case of a contract, during the first two and one-half years of the life of the proposed contract.

When the bids were opened by the board of control at 12:15 noon on Sept. 12 it was found there were five bona-fide bidders, all of whom had complied with the requirements of the specifications in submitting their tenders. The lowest bidder apparently was the Provincial Light, Heat & Power Company, which bid $67.50 for the 6.6-amp and $54.80 for the 4-amp, 1650 arcs, with gradually increasing rates for a less quantity—the specifications permitting the dividing of the total city requirements and awarding parts to separate bidders. The next highest bidder was the Montreal Light, Heat & Power Company, of which the Provincial Light, Heat & Power Company is said to be a subsidiary or controlled company. The Montreal company's bid for 6.6-amp arcs was $72.70 for the total number ranging up to $91.50 for 500 lamps or less, and for the 4-amp lamps was $63.15 and $82.26, respectively. It is claimed that the cost to the city will be practically the same if either the Provincial or Montreal company's bid is accepted, as acceptance of the former company's prices will allow the latter company to continue its present and relatively high-priced contracts with the outlying districts. On the other hand, the specifications provide that any company whose bid is accepted, but which has existing contracts in any part of the city of Montreal, must waive such contracts and accept all city business at the uniform price bid.

This clause, apparently aimed at the Montreal company, explains why that company makes a higher bid than the Provincial company, the figures submitted by both companies "having originated in one mind," according to the newspaper published reports of interviews with Mr. J. S. Norris, the general manager of the Montreal company. The Montreal company's bid for 40-cp and 80-cp tungsten lamps was $16 and $23 per year, respectively, and for lighting the buildings, by meter, 5 cents per kw-hour for all the business, with increasing rates for less proportions. The price for 2200-volt alternating-current power was $25 per unit in units of 150 hp and over.

The new company in Montreal, the Dominion Light, Heat & Power Company, bid for about a quarter of the business at

$85 and $75, respectively, for the 6.6-amp and 4-amp arcs; $10 and $20, respectively, for the 40-cp and 80-cp incandescents and 8 cents per kw-hour by meter. The St. Paul Electric Light & Power Company bid for a small portion of the lighting at $90 and $75 for the arcs and $15 and $25 for the incandescents. The Saraguay Electric & Water Company bid $95 and $78 for the arcs and $27 and $34 for the incandescent. The Canadian Light & Power Company, which is building a 20,000-hp hydro-electric plant on the St. Lawrence River above Montreal with the idea of supplying that city, made no tender for the city lighting, presumably because its plant will not be prepared to deliver anything before the spring of 1911 and the city contract must be taken up Nov. 1 next.

In explanation of the low prices made by the Provincial and Montreal Light, Heat & Power Companies, Mr. J. S. Norris, speaking for both companies, stated that the "disparity between the bids of these companies and the other tenderers, representing from $20 to $30 per arc lamp, is easily accounted for. Apparently the other tenderers have included (and properly so) capital charges on pole and line equipment entailed in the distribution of the arc-lighting service, and having regard to this, their prices would not be too high. Our company, in the estimation of our costs, excluded capital charges on street equipment and to this extent the citizens are the beneficiaries.

"The capital costs entailed in the distribution of the whole of the street-lighting service, as tendered by us, amount to not less than $300,000, the annual interest and depreciation charges on which for the life of the proposed contract must be calculated at 15 per cent at the least; that is, 5 per cent for interest and 10 per cent for depreciation and obviously amount to $45,000, which, divided into 1650 lamps, will give you the saving per lamp conceded to the city in our tender.

"Should the supply of street lighting not be properly charged with this expense? Yes, of course, it is a proper charge, and if circumstances required us to erect poles and lines to supply the street-lighting service we would be obliged to include this expense, but inasmuch as our pole and line equipment is already installed and is used for the supply of our commercial and incandescent service as well, we have eliminated this expense, and, as pointed out, the citizens are the beneficiaries.

"This saving of $15,000 a year," concluded Mr. Norris, "for ten years represents close to half a million dollars, so that it cannot be denied that we have not merely given the city a most liberal proposition, but we have offered to supply the service at a figure which under ordinary circumstances would be considered below cost."

The board of control took the bids under advisement and will make the award later.

Electrical Exhibits at Pure Food Show.

At the Domestic Science and Pure-Food Exposition being held in Madison Square Garden, New York, Sept. 17-24, there are a number of electrical exhibits in operation demonstrating how closely akin to cleanliness and purity electric heating devices are. The New York Edison Company shows a dining-room and kitchen entirely equipped with electrically heated appliances and a number of ladies, under the supervision of Miss Keinz, are busy preparing delicacies and plain food for consumption at the show. The booth is spotlessly white and prettily outlined with electric flowers. The General Electric Company also has on exhibition a complete line of domestic appliances and has lady demonstrators preparing various articles of food in its kitchen and dining-room. Vacuum cleaners in various sizes are shown by the Duntley Manufacturing Company, of New York and Chicago, whose demonstrators are arrayed in white. The usual models of the Shredded Wheat Company, of Niagara Falls, are on hand turning out "Triscuits" for the edification and nourishment of the crowds, for, as is well known, electricity is employed at the Niagara factory in preparing and baking these biscuits. The United States Navy exhibit includes a huge electri[illegible] the United [illegible] steamship *Dixie* and an electric dough-mixer, potato-peeler and food-mixer. This particular exhibit was the subject of a recent favorable report by a Naval Board, which investigated electric cooking with a view to its adoption on warships.

Electric Vehicle Advertising Campaign.

The extensive combination advertising campaign originated by the Electric Storage Battery Company for the benefit of the central-station electric-vehicle industry has developed so successfully that it has now been deemed advisable to place its further development in the hands of the newly formed Electric Vehicle Association of America. The Storage Battery Company, as mentioned in a previous issue, has successfully worked up the details and secured the hearty co-operation of electric-vehicle manufacturers and central-station managers, a considerable number of whom have already deposited with the Battery Company their contribution to the advertising fund. The large publicity given to the electric vehicle by this combination scheme should unquestionably result in a great increase in sales of electric vehicles, which means a permanent source of revenue for central-station companies.

Committee on Schedules in New York.

The committee on gas and electric schedules appointed at the hearing before the New York Public Service Commission for the Second District at Albany on Sept. 7 has effected its organization. Mr. J. C. De Long, Syracuse Lighting Company, is chairman and Mr. Charles H. B. Chapin, secretary of the Empire State Gas & Electric Association, is secretary. The committee has sent a letter to all companies under the jurisdiction of the Second District commission in which it says:

"In the course of its deliberations the committee will probably meet in different parts of the State for the purpose of consulting with the companies in various sections in order to become acquainted with the peculiar conditions under which they are operating. The committee may find it desirable to ask the companies for certain information from time to time. It is hoped that in all matters which may come up the companies will feel entirely free to discuss all of their conditions with the committee, stating any objections they may have to the preparation and filing of schedules of rates, as it is only through the very candid discussion of the matter that a decision can be arrived at which will be absolutely fair to all."

Cedar Poles and Their Treatment.

At the regular weekly luncheon of the Electric Club, Chicago, Sept. 14, the speaker was Mr. E. L. Clark, president of the Valentine-Clark Company, of Chicago, whose subject was "The Cedar-Pole Industry." A considerable portion of the address and the discussion that followed was devoted to the butt treatment of wooden poles.

Mr. Clark, who was introduced by Vice-president Niesz as the dean of the cedar-pole industry in Chicago, began by complimenting the club as a representative organization of electrical men, many of whom are engaged in active competition in their everyday activities. He gave a brief history of the business of producing wooden poles, and showed how it received a great impetus by the development of the electric light and telephone industries in the '80s. Previous to that time the principal demand for poles had been from telegraph companies. The term "Michigan cedar" is applied to poles obtained from Michigan, Wisconsin and Minnesota, and the poles now obtained are not of so good a grade as those of ten or fifteen years ago. Poles are produced and graded in 5-ft. lengths, and to be merchantable they must be sorted in concentrating yards.

Good Michigan cedar poles are becoming scarcer. Formerly they were largely shipped by water, but now it is probably true that 90 per cent of cedar poles are shipped by rail from the points of production. Western cedar poles are now coming in,

particularly in the case of long poles, which are hard to obtain in Michigan cedar. In the case of Western poles, which are obtained mainly from Idaho and British Columbia, the cost of freight to the Chicago market is a serious item. For instance it costs $4 to bring a 40-ft. Western cedar pole from the nearest available point to Chicago.

Referring to engineers' specifications in the matter of poles, Mr. Clark remarked that these were becoming increasingly strict, particularly in relation to butt, top and intermediate dimensions. He asked the engineers present to remember that poles are produced by nature, and not to ask the impossible. It takes 100 years to produce a 30-ft. pole 7 in. in diameter at the top.

Glancing at the future, the speaker said that in a comparatively few years first-quality Michigan cedar poles will be a thing of the past. It will be necessary to use either steel or concrete poles, or else develop the Western product. Western cedar has not the long life of Michigan cedar, and poles of this wood will have to be butt-treated. In this way the life can be doubled. Pole material is still in existence in the West in large quantities, but the average telephone or electrical engineer seems timid in specifying Western cedar. The Western cedar, however, is much cheaper and it is possible to pay the freight and subject it to an impregnating treatment and still sell it almost as low as the price asked for a Michigan cedar pole of equal size but untreated. Butt treatment, therefore, seems to be indicated as a positive necessity in the future of the cedar-pole industry.

There was a general discussion, and in answer to a question Mr. Clark recommended the open-tank method for the treatment of pole butts. In this method the pole is immersed for from 6 ft. to 8 ft. from the butt in any one of half a dozen first-class compounds, applied hot. The time of impregnation is about eight minutes, and the hot oil is applied at a temperature of about 205 deg. Fahr. By capillary attraction the impregnating compound enters the wood and poisons the food supply of any attacking germ life, so that the pole is measurably preserved from decay.

Mr. E. N. Lake asked about the brush treatment, and Mr. Clark answered that while that was better than nothing, it was necessary to apply the oil hot so that it might be light and penetrate the wood thoroughly.

Mr. H. A. Mott inquired about the practical results of tests, and Mr. Clark in answer mentioned that treated poles had been in the ground in Denver for seven years. No symptoms of dry rot have been exhibited. The oil follows all openings in the wood no matter how minute. The difference between treated and untreated poles in Denver has been marked and entirely in favor of the former.

Mr. James H. Delany asked what compound Mr. Clark recommended for butt treatment, and was told that he favored high-boiling oil or coal tar, or, as it might be otherwise described, the essence of creosote.

Mr. George H. Lukes said that apparently the time is coming when all poles will be concrete or steel. This will be particularly hard for electric-light companies, because it is sometimes necessary for their men to work on the lines when some of the wires are "alive." For that reason the electric-light companies think that all the remaining stock of Michigan cedar timber suitable for poles 30 ft. long or over should be preserved for their exclusive use. This modest request excited some amusement.

Mr. Lake asked when the visible supply would be exhausted, and Mr. Clark said that during the lifetime of men now living it is probable that a certain quantity of smaller poles of Michigan cedar will be available. But the trees are so slow-growing that reforestation is hardly practicable. About the only large supply now existing is in Idaho and British Columbia. Michigan cedar poles are cut as near to the ground as possible, but a different policy is followed with Western cedar. There, if a 40-ft. pole 8 in. in diameter at the top is wanted, the woodman selects a suitable tree, finds out where the trunk is about 8 in. in diameter with the bark off and cuts it down 40 ft. below that spot. This method, which seems wasteful, results in a considerable accompanying production of large saw-logs not available for use as poles.

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission gave a hearing on Sept. 16 upon the petition of the Worcester Electric Light Company for authority to issue 2000 additional shares of stock of the par value of $100, the price being fixed by the directors of the company at $180 per share. President George T. Dewey, for the company, stated that the funds to be raised by the issue are to be devoted to improvements in connection with the establishment of a new steam turbine plant at Curtis Pond, in the southern portion of the city. Expansion of business and the necessity of further economies in generation have rendered the old station on Faraday Street inadequate. The general design of the new station, which is now under construction, was recently described in these columns. Mr. Dewey said that additional funds will be required later for the construction of the plant itself, but that the present petition covers the cost of land and improvements in connection with the water supply at Curtis Pond, underground conduit and cable construction between the old and the new stations, and remodeling of the old station to serve as a distributing center. Forty and twenty-duct conduit is to be installed. The southern and easterly portions of the city are to be served directly from the new plant. The cost of the new station will probably be in excess of $500,000.

President Dewey discussed at some length the action of the directors in placing the price of stock to be offered to existing holders at $180 per share. The present dividend rate is 10 per cent on the par value of $100, so that the new shares, if issued at $180, will net a return of about 5.5 per cent. He considered this return entirely reasonable and in fact necessary, in view of the present rates to borrowers of money, which are close to 6 per cent in Worcester. The securities of the Worcester company are largely held at home, and the new investment is a large one for a city of 150,000 inhabitants. If a high price is put on the stock, dividends must be paid in proportion, and the public has to bear the effects of a high price. The city of Worcester charges the full tax rate on the actual money value of the improvements, and in addition the company is obliged to face the prospect of a heavy shrinkage in the value of its old plant, which has been carried on the books for many years. Mr. Dewey said that the situation is much the same as though the company were to begin the business of generating electricity anew. There is no expectation of increasing the dividend, but the high cost of living makes the old returns of 4 and 5 per cent seem too small. Chairman Barker stated that there was much force in the suggestions made with respect to the rate of return on investments, but queried whether the board, in view of its action in placing several 10 per cent stocks at a price of $200 per share, would be justified in allowing the Worcester issue at $180. He added that the volume of securities issued might alter the case. Mr. Dewey closed by stating that the rates on money tend to increase, and emphasized the amount of investment in Worcester which will have to be charged off by the building of the new plant. He said that companies charging off liberal depreciation are apt to be criticised by municipal authorities, and that the assets of the company per share are about $184. General Schaff, of the board, commended the stockholders for retaining their local control of the company a year ago when it was vigorously sought by outside interests. Messrs. M. J. Whittall and J. C. MacInnes, of the board of directors, pointed out the difficulties of paying 10 per cent in the face of such large investments. The hearing was then closed.

In connection with the designation of Prof. George F. Swain as expert in charge of the validation to be made by the State of Massachusetts of the property of the New York, New Haven & Hartford Railroad Company, Mayor Fitzgerald, of

Boston, has issued a statement expressing his regrets that Professor Swain's attention will be diverted for a considerable period from the urban transportation problems at Boston which are before the Railroad and Boston Transit Commissions. Mayor Fitzgerald contends that additional transportation facilities are needed between the city proper and the South Boston, Dorchester and Brighton districts, and that the members of these commissions ought to devote the maximum possible time to the consideration of such problems. Professor Swain is a member of the Transit Commission and is consulting engineer of the Railroad Commission, and the validation which he will make of the New Haven property will be one of the most comprehensive in the history of American transportation.

The Railroad Commission has granted the Boston & Northern Street Railway Company the right to carry freight in the town of Chelmsford.

The Boston Consolidated Gas Company and the East Boston Gas Company have petitioned the Gas and Electric Light Commission for approval of a contract which they have entered into, under which the East Boston company is to purchase gas from the Boston company for a three-year period beginning Dec. 1, 1910. The gas is to be sold at the rate of 40 cents per 1000 cu. ft., plus $3,500 a year for the use of mains in Chelsea. A public hearing will be given by the board.

The Massachusetts Railroad Commission gave a hearing on Sept. 14 upon the petition of the Selectmen of Lenox for the establishment of a 5-cent fare on the lines of the Berkshire Street Railway Company within the town. Mr. Bentley W. Warren, of Boston, counsel for the company, stated that the present through fare between Lenox and the city of Pittsfield is 15 cents, and that if the petition were granted it would be reduced to 10 cents. He stated that the company appreciated what the people of Lenox had done for it, but that it was not correct to compare facilities in Pittsfield, a rapidly growing city, with those which could be afforded in a small town like Lenox, which has a summer population of 6000 and a winter population only half as great. A 10-cent rate from Lenox to Pittsfield would give the company a return of only 1 cent per passenger-mile, which cannot be sustained under present conditions. In the larger cities where such a rate obtains the average ride is shorter. Great density of traffic is needed to make a rate of 1 cent per mile pay. The company is willing to concede a 5-cent fare, including a transfer, from the center of Lenox to New Lenox, but it cannot afford to reduce the fare to 10 cents from Lenox to Pittsfield. The board took the case under advisement.

Canadian Hydroelectric Commission News.

At a public meeting held at Guelph, Ontario, Canada, on Sept. 13 to discuss the People's Railway project, Hon. Adam Beck, chairman of the Hydroelectric Commission, expressed the opinion that when the transmission line of the commsision from Niagara Falls to the western Ontario municipalities was supplying energy the municipalities would pay for the energy on the basis of the amount actually used and not on the amount contracted for. He hoped that in a couple of years the commission would be able to achieve this result.

On Sept. 13 the city of Berlin was illuminated with electricity conveyed over the commission's line from Niagara Falls, being the first of the cities within the union to be supplied with Niagara energy. The energy is transmitted at 110,000 volts, being stepped down to [illegible] Berlin and retransformed into 550 volts for street-railway purposes and 500 volts for operating the corporation's arc lamps lighting the streets. The illumination was in the nature of a test of the line and lasted for an hour and a half with signal success.

Hon. Mr. Beck stated at the meeting in Guelph that as a result of the saving on the price of the equipment furnished the commission, the price to be charged for energy in Guelph will be $21.79 per horse-power per year instead of $24. The equipment was supplied for $307,000 less than the estimates.

New York Commission News.

The Public Service Commission, Second District, has authorized the Southern New York Power Company to issue $24,000 of its capital stock at par in payment of all the property, assets and franchises of the former Walton Electric Light Company, of Walton, N. Y., and $2,100 in payment of all the property, assets and franchises of the Mulkins Electric Light Plant, also situated at Walton. The company in its application asked for permission to issue $40,000 common capital stock, par value $100 a share, to purchase franchises and property of Walton Electric Light Company.

The Red Hook Light & Power Company, of Red Hook, Dutchess County, has been authorized to take over franchises from Mr. John H. Sharp in the towns of Germantown, Livingston and Clermont, Columbia County, and also to exercise the rights and privileges under these franchises. The company is also authorized to execute a first mortgage upon all its property, assets and franchises to secure the payment of $150,000 in bonds, payable in fifty years, bearing interest at 5 per cent. The company is authorized at the present time to issue $10,000 of its bonds at not less than par in exchange for $10,000 first mortgage 5 per cent bonds now outstanding on the property of the corporation; also $60,000 of bonds to be sold at not less than 80 to pay for indebtedness incurred in the construction of new lines and equipment.

The Municipal Gas Company, of Albany, has been authorized to exercise franchises granted by the town of Bethlehem for furnishing electricity upon and along the Albany and Greene Turnpike and upon and along all public roads and highways intersecting said Albany and Greene Turnpike in the town of Bethlehem, Albany County.

The Public Service Commission, Second District, has appointed Mr. Walter I. Sweet, of Port Richmond, Borough of Richmond, New York, to be assistant chief of the division of telephones and telegraphs at a salary of $3,000 per year, to be in charge of the New York office. Mr. Sweet is 45 years of age and has had extensive experience in telegraph, railroad and telephone service. In 1906 he was district manager of the Jersey City district of the New York & New Jersey Telephone Company and two years later upon the merger of the functional and territorial organization with the New York Telephone Company became local agent in charge of the commercial department of the company and was the senior officer of the company in that district.

Mr. William G. McAdoo, president of the Hudson & Manhattan Railroad Company, sent a proposition to the Public Service Commission of the First District for the construction and operation of a subway line connecting the Thirty-third Street station of his system with the Hudson Terminal station at Cortlandt Street. It is suggested that this line be laid out under Broadway from Thirty-third Street to Fourteenth Street, thence under University Place, Wooster and Church Streets to the Terminal buildings. It is proposed that the line be constructed on the city's credit and leased upon terms similar to those of the present subway. Mr. McAdoo also intimated in his letter that his company might become a bidder for the construction and operation of the proposed Broadway-Lexington Avenue subway.

Commissioner Bassett announced last week that if the Inter- [illegible] tory arrangements to build a line down Seventh Avenue from Forty-second Street south to the Battery, the Pennsylvania Railroad would submit a proposition to build a subway of its own from the City Hall to Times Square, connecting with its new station.

The Public Service Commission, Second District, will dusing the present week hear the complaint of Mr. John Snyder, of Albany, against the Municipal Gas Company of that city as to charge for electric energy. The application of the Poughkeepsie Light, Heat & Power Company, the Newburgh Light, Heat & Power Company and the Hudson Counties Gas & Electric Company for leave to consolidate will also be heard.

Wisconsin Commission News.

The Railroad Commission has devised a schedule of rates for electric service for the municipal plant of Jefferson. The investigation was carried out because the present rate schedule appeared to be unsatisfactory to municipality and consumer alike.

The electric plant was found to have cost new about $59,721 and has a present value of about $50,815. The total operating expense amounts to $8,629 when depreciation is computed at 4.5 per cent and interest at the rate of 3.5 per cent. The total amount is $9,227 on the basis of 4.5 per cent interest.

The gross earnings of the plant for the year ended June 3, 1910, were $8,741, of which the earnings from public service or street lighting were $1,590; from commercial consumers, $6,971, and from rent of building $180. This total amount slightly exceeds the amount of operating expenses when such expenses include interest at 3.5 per cent, but falls short when a higher rate of interest is used.

The present rates are based upon consumption only and do not recognize the question of demand.

From an analysis of the operating expenses the apportionment (excluding the consumption expenses) into capacity and output expenses for both commercial and street lighting is as follows:

	Capacity	Output	Total
Commercial lighting	$3,320.36	$2,745.75	$6,066.11
Street lighting	664.23	1,406.64	2,070.87
	$3,984.59	$4,152.39	$8,136.98
Consumption	492.85		492.85
	$4,477.44		$8,629.83

Of the total capacity cost $664.23 is chargeable against the street lighting service and $3,320.36 plus $492.85 or $3,823.21 is the commercial lighting charge. This is on the basis of 3.5 per cent interest, which seems the most reasonable under the circumstances.

Under the present rates the street lighting department receives but $1,590 annually for the 106 32-cp lamps operating on a moonlight all-night schedule. This amount is less than the total cost of operating them.

An analysis of the earnings and operating expenses shows that while a reduction in rates might be offered, the rates should be so readjusted as to distribute more equitably the burden of expense and that the charge for street lighting should be increased in order that this branch of the service shall have its just share of the total cost of operation.

The total consumption during the year by the commercial lamps was 51,745 kw-hours. Prorating the output expense, $2,745.75, over this consumption, gives an output cost per kw-hour of 5.3063 cents.

The total connected commercial lighting load is approximately 160 kw. With 50 per cent active the capacity expense per kilowatt of active connected load is $3,813.21/80 = 47.66$. If the plant is operated for only one hour per day the capacity expense per kw-hour is $47.66 divided by 365, or 13.58 cents. The table of unit costs computed as above is as follows:

	Capacity	Output	Total
[illegible]	[illegible]	[illegible]	[illegible]

From an analysis of the consumer data and of conditions existing in the city of Jefferson, together with the results obtained above, it appears that a primary rate of 16 cents per kw-hour for the first sixty hours' use per month of the active connected load and a secondary rate of 10 cents per kw-hour for all current used in excess would best meet the situation. A discount of 10 per cent for prompt payment can be offered.

In Class A, consisting of residences, rooming houses and public buildings 40 per cent of the total connected load is to be considered active. In Class B, consisting of schools, churches and industrial establishments closing not later than 6 p. m., 60 per cent is to be considered active. In Class C, consisting of stores, offices, livery stables, hotels, saloons, banks, etc., 75 per cent is to be considered active.

The rate for all 32-cp incandescent lamps operating on a moonlight all-night schedule is increased to $18 per lamp per year.

The commission recommends that all meter rentals be abolished and that a uniform minimum bill of 50 cents be charged all consumers.

The Sheboygan Railway & Electric Company has been authorized to issue $600,000 of 5 per cent gold coupon refunding and improvement bonds. These are to be issued in denominations of $500 and $1,000 each and the total issue is to be secured by a mortgage and trust deed executed to the Wisconsin Trust Company, of Milwaukee. Of the total $440,000 is to be used for retiring or refunding an outstanding bond issue to the amount of $400,000 and $160,000 for the purpose of paying an outstanding floating indebtedness. The balance is to be used for the erection of new car barns and the purchase of additional rolling stock, machinery, etc. The bonds are to be sold for not less than 75 per cent of the par value.

The North Milwaukee Light & Power Company has been authorized to issue 500 shares of common stock of the par value of $500 each. The funds derived from the sale are to be used in paying an outstanding indebtedness incurred by reason of additions to property and also to provide for extensions in the future.

Maryland Commission News.

Richard B. Fentress, of the Baltimore Electric Light & Power Company, announced last week that all opposition to the development of the Fentress-Mediary lighting franchise had been withdrawn and that he would soon be prepared to deliver electrical energy to consumers in Baltimore and thus introduce competition in that field. Mr. Fentress' announcement came after an order had been filed in the United States Circuit Court dismissing his bill of complaint against John M. Van Dyke, supposed to represent Standard Oil interests, who owned one-half of the franchise and who was understood to be opposed to the development of its business. According to Mr. Fentress' statement, there is now no obstacle in the way of the development of the franchise, and he says that he is prepared to spend $2,500,000 for erecting a suitable plant and distributing the power. The Public Service Commission has unofficially announced that before these plans can be carried out it will be necessary to have them approved by the commission. Under the Fentress-Mediary ordinance the city gave a franchise right for a company to compete in the electric lighting field with the Consolidated. In view of the existence of this ordinance there was speculation as to whether or not the Fentress interests could start in without supervision.

AMERICAN ELECTRICAL ENGINEERS—XIV.

Otto E. Osthoff.

Otto Ernest Osthoff was born in Cleveland, Ohio, October 4, 1874. At the age of six years his parents removed to the town of Delphos, Ohio, where he received a common and high school education. At the age of sixteen he entered Adelbert College of Western Reserve University, Cleveland, Ohio, and pursued classical studies for a period of three years, and then went to the Case School of Applied Science, Cleveland, Ohio, where he completed an advanced course in physics and mathematics, graduating in 1896 with the degree of B. S. In addition to the regular course, studies were incidentally pursued in mechanical, electrical and hydraulic engineering. Mr. Osthoff's graduating thesis was based on a research having for subject the relative coefficient of expansion of hydrogen as com-

pared with oxygen, the work having been done under the guidance of Dr. Miller, professor of physics in the Case School of Applied Science, and Dr. Morley, of Adelbert College. While at the university he gained the Reid prize in physics, given annually by Dr. Reid, of Johns Hopkins University, to the student passing the best special examination in physics, and also obtained the highest average grade in all studies in the sophomore year. Mr. Osthoff served as editor-in-chief of the college annual, *The Differential*, and was also instructor in physics for one year while following regular studies.

After graduation in 1896 Mr. Osthoff entered the employ of the Willard Storage Battery Company, of Cleveland. During his first year's connection with this company he pursued post-graduate studies and in 1897 received from the Case School of Applied Science the degree of E. E., the subject of the post-graduate thesis being "The Design of Central Station Storage Batteries." He remained with the Willard Company for several years, assisting in the development of its storage battery plates, etc., and in 1900 entered the employ of the Electric Storage Battery Company, of Philadelphia, in its construction department. He remained in this department for a year, doing considerable work in New York City and Brooklyn, and then went to Chicago as western engineer of the company at its Chicago office.

O. E. Osthoff.

In 1902 Mr. Osthoff became associated with Mr. H. M. Byllesby, of Chicago and upon the organization of H. M. Byllesby & Company was made a vice-president, director and the chief engineer of that company. He has been identified with H. M. Byllesby & Company ever since, having direct charge of the engineering department, which embraces all engineering pertaining to steam, electricity, water-powers, water works, etc., and is also concerned, as an officer and director, in the development of the general policies of the company. In addition, he is vice-president and director of the Interstate Light & Power Company, Galena, Ill.; vice-president and director of the Northern Idaho & Montana Power Company; director of the Tacoma (Wash.) Gas Company; director of the Fort Smith (Ark.) [illegible] of the Bitter Root Mountain Water Company, and an official and director of the Chicago Securities Corporation.

Representing H. M. Byllesby & Company, Mr. Osthoff has [illegible] Duluth, having had general charge of the recent large extensions there of the water works and municipal gas plant, and designed and constructed the new artificial gas works for the United States Steel Corporation in the new town of Gary, Ind. He has had general supervision of the design and construction of the water power electrical plants built at Sioux Falls, S. D.; Mankato and Cannon Falls, Minn.; Somerset, Wis.; Big Fork, Mont., and several others still in the stage of preliminary design. He has also had general charge of the design and construction of the new steam plants at San Diego, Cal.; Oklahoma City, and Muskogee, Okla.; Mobile, Ala.; Fort Smith, Ark.; Ottumwa, Ia., and some half-dozen steam plants recently constructed for the Northern States Power Company, operating in Minnesota, including the city of St. Paul; also steam plants for Oshkosh, Wis., for the Interstate Light & Power Company, Galena, Ill., and Platteville, Wis., and three steam plants for the Northern Idaho & Montana Power Company operating in the states of Montana, Idaho, Oregon and Washington. Mr. Osthoff has also had general supervision of the design and construction of the crude oil gas works at San Diego, Cal.; water and coal gas plants at Oklahoma City, Muskogee and Enid, Okla.; five coal and water gas plants controlled by the Northern States Power ompany; and new gas works at Tacoma and Everett, Wash.; Springfield, Ore., and Oshkosh, Wis.

Mr. Osthoff is an associate member of the American Institute of Electrical Engineers, and member of the Western Society of Engineers, American Water Works Association, American Gas Institute, National District Heating Association, American Academy of Political and Social Science, American Civic Alliance and American Association for the Advancement of Science. He is also a member of the Union League Club of Chicago, University Club of Chicago, Lawyers' Club of New York City, Arlington Club of Portland, Ore., and of the Greek letter scientific society, Sigma Xi.

CURRENT NEWS AND NOTES.

Railway Electrical Engineers.—As previously announced, the annual convention of the Association of Railway Electrical Engineers will be held at the Hotel La Salle, Chicago, on Sept. 27 to 30 inclusive. The association is composed of the electrical engineers and chief electricians of steam railroad companies, and a good program has been prepared. Incidentally there will be an exhibit of electrical appliances for the benefit of the railroad men. Mr. W. E. Ballentine, of the Willard Storage Battery Company, 320 Dearborn Street, Chicago, is in charge of the exhibits.

Explosion in Boston Elevated Power Plant.—An unusual accident occurred in the Harvard power station of the Boston Elevated Railway Company in the early morning of Sept. 16 in the form of an explosion of the intermediate receiver of a vertical cross-compound engine driving a 2700-kw direct-connected railway generator. The accident occurred at the time when the morning load was coming upon the station and the engine platform was demolished, with some damage to the station building and roof. The watch engineer in charge of the plant at the time was severely injured. Service from the plant [illegible]

New York I. E. S. Meeting.—At the first regular meeting of the season 1910-1911 of the New York Section of the Illuminating Engineering Society, which will be held Oct. 13, the subject of "Street Lighting" will be discussed. Mr. Preston S. Millar will present a paper on this subject, which will be illustrated by miniature street models and lighting equipments. Mr. V. R. Lansingh will give an informal talk on a new Holophane street-lighting unit, which will be illustrated by lantern slides showing installation and illumination data. It is expected that the subject of street lighting will be thoroughly treated in the general discussion.

No Oklahoma Convention This Year.—It had been planned to hold a meeting of the Oklahoma Public Utilities Association in Oklahoma City on Sept. 30 and Oct. 1. It has been decided, however, to abandon this proposed meeting, and there will be no convention of this association until next year.

Low-Priced Meter.—According to the *Bulletin* of the National Electric Light Association, one of the electrical manufacturing companies is making rapid progress on a low-priced alternating-current meter—presumably a watt-hour meter—which will be placed on the market within the next six months.

Colorado Electric Club.—At the weekly luncheon of the Colorado Electric Club on Sept. 8 a talk was given by Senator Charles Hughes, of Colorado, on the development of electrical industries in the State during the past decade. At the luncheon on Sept. 15 Mr. Joseph Tuttle, past-president of the Sons of the American Revolution, gave a talk on the early history of Colorado and the contest of the powerful Hudson Bay Company for the territory including it.

Murray Printing Telegraph.—In order to extend knowledge of the Murray printing telegraph systems, the inventor, Mr. Donald Murray, Midway Park Works, London, England, has begun the issue of *The Murray Printing Telegraph Journal,* which will be published at irregular intervals two or three times a year. In addition to giving information as to the progress of the Murray system, now used in the British telegraph service, practical articles will be printed on the adjustment and maintenance of Murray apparatus and on the principles of printing telegraphy in general.

Gas Company Advocating "Amber" Light.—The People's Gas Light & Coke Company, of Chicago, is attracting some attention by extensive advertising of "Amber Light—A New Discovery." The "new discovery" is a Welsbach mantle that does not give a greenish glare. A house-to-house campaign to demonstrate the advantages and possibilities of the "new" light is announced. Fixtures, including shade, mantle, burner and chain-pull ignition, are sold at $1.60 each. The color of the light is due to the chemical constituency of the mantle, giving the yellowish shade advertised as "amber."

Smoke Nuisance in St. Louis.—The smoke inspector of St. Louis promises an active campaign to abate the smoke nuisance in that city. The Business Men's League and other commercial organizations have pledged their support. In carrying out his work, Mr. Parker, the smoke inspector, has procured photographs of the smoking chimneys of a number of industrial power plants and some of these have been reproduced in the daily papers. By an interesting coincidence one of these pictures is given directly under an "ad" of the Union Electric Light & Power Company pointing out the advantages of central station power service. Of course, the substitution of central-station service for small isolated power plants would have a marked effect in reducing the production of smoke.

New York State Water-Powers.—In a recent report of the New York Water Supply Commission it is estimated that, neglecting the Niagara and St. Lawrence rivers as international streams, the total water-power of New York State is 1,500,000 hp, of which 620,000 hp is in use and 880,000 hp is undeveloped. It is further estimated that the State could obtain an annual profit of $1,400,000 by developing the unused water-powers, the estimate being based on an annual rental value of $5 per annual horse-power. Moreover, an additional population of 1,000,000 would be supported by the utilization of the water-power. The commission recommends that the State should authorize the issue of $20,000,000 to develop the water-power now going to waste on the basis of repayment from future profits.

Germans Attack Patent Agreement.—The Association of West German Manufacturers at a recent meeting adopted resolutions calling on the government to give notice to the United States of the termination of the patent agreement made Feb. 23, 1909, on the ground that it is detrimental to the interests of German inventors, patent owners and German industries generally. Failing this a revised patent law, which shall deprive Americans of certain privileges they now enjoy under the international agreement, is asked. One of the charges made in support of the protest against the patent agreement is that some American manufacturers purchase German patents solely in order to keep out the German-made inventions covered, at the same time suppressing their manufacture in this country.

McCall Ferry Electric Power for Baltimore.—Superintendent McCuen of the Department of Lamps and Lighting of Baltimore has received a letter from the Pennsylvania Water & Power Company stating that the company will be unable to supply the city of Baltimore with electric current. The city had been considering the purchase of electrical energy at a low rate from the company, which is developing the water power at McCall's Ferry. The Pennsylvania company stated that it had already disposed by contract of all the energy it will be able to supply in Baltimore, presumably to the Consolidated Gas, Electric Light & Power Company. The Baltimore County Commissioners have decided to grant the Susquehanna Transmission Company of Maryland permission to cross certain public roads in the Eleventh and Fourteenth districts with its electric wires. The company will convey electric power from McCall's Ferry to Baltimore. The transmission line is being rapidly pushed to completion.

Kansas Electrical Convention.—In addition to the papers appearing on the preliminary program of the thirteenth general meeting of the Kansas Gas, Water, Electric Light & Street Railway Association, as printed in our issue for Aug. 25, page 420, the following papers will be presented: *The Heating Values of Kansas Crude Oils, Fuel Oil Residues and Distilled Oils,* by Prof. P. F. Walker, Lawrence; *Central Station Methods of Securing New Business,* by Mr. J. D. A. Cross, Chicago; *Comparative Cost of Oil and Coal,* by Mr. W. E. Sweezey, Junction City; *Transformers,* by Mr. E. L. Buchanan, Chicago; *Rates (Water Works),* by Mr. J. H. Rathert, Junction City; *Value of Pure Water,* by Mr. R. E. McDonnell, Kansas City, Mo.; *The Cost of Electric Light,* by Mr. J. T. Skinner, Lawrence; *Holophane Illumination,* by Mr. T. C. Hawkins; *How to Get Motor Business,* by Mr. W. R. Murrow, Independence, and *The Advantage of a Sales Department,* by Mr. J. B. Kennedy, Wichita. The meetings will be held in the Mercantile Club Rooms, Kansas City, Sept. 27 and 28. Mr. M. T. Flyn, of Kansas City, is the president and Mr. James D. Nicholson, of Newton, is the secretary.

Denver Electric Show.—Among the features of the Denver Electric Show next month will be a 150,000-volt transformer in connection with a high-frequency coil capable of a voltage of several million with enormously high frequency and giving a discharge in the air of upward of four feet. This will be used with various pieces of apparatus to demonstrate high-frequency phenomena, such as lighting electric lamps through the body, lightning effects, lighting of vacuum tubes, etc. Wireless telegraph and telephone sets, X-ray apparatus and the telautograph will be exhibited, Thomson electromagnetic phenomena demonstrated and an electric water forge operated. There will also be an electric welding machine in which a bar of iron 2 in. in diameter will be welded. During the show there will be a rejuvenation of the Sons of Jove, which will take place on Oct. 11. One of the important sections will pertain to mining, in which will be shown electrically operated every machine used in that industry. Electric pumping in irrigation will be made a feature, both as to exhibits and through the presence of experts to instruct visitors interested in the advantages and economy of the electric motor for this purpose.

TURBINE STATION OF THE BISBEE IMPROVEMENT COMPANY.

Interesting Results Obtained in the Operation of a Small Arizona Oil-Burning Plant, with Details of Losses and Their Distribution.

By I. A. R

BISBEE, Ariz., is a copper-mining town with about 18,000 inhabitants, situated in the southeastern part of the State. Five years ago there was not a steam turbine in operation and but little electricity was used in either mines or town. To-day there are three turbine plants in operation. The Calumet & Arizona Mining Company's plant has three Westinghouse turbo-generators installed. These are rated at 1000 kw, 500 kw and 300 kw, respectively. The Copper Queen Consolidated Mining Company's new plant has three Curtis vertical turbo-generators installed. These are each of 500 kw capacity. The Bisbee Improvement Company's plant has one Allis-Chalmers 500-kw and one Westinghouse 300-kw turbo-generator installed. The latter plant, being the one which supplies electricity to the city, is the one described in this article.

The power plant is located about a mile from the town proper, and the structure, which is built of pressed brick, is 140 ft. long by 41 ft. wide, and contains both the electric generating and the ice-manufacturing machinery. Crude oil is used exclusively for fuel. Nearly all of this is supplied from Texas. The specific gravity of this oil is 0.89 or 28 deg. Beaumé hydrometer. The heating value of the oil is about 19,300 lb.-Fahr. units with moisture and sediments of a little more than ½ per cent. The oil is delivered in tank cars, from which it is run by gravity into the company's tanks. From these tanks it is pumped by an electrically-driven, triplex pump to the oil heater, which is made like a feed-water heater, with the exhaust steam going through it. From this it goes direct to the oil burners. New patented oil burners have been installed recently. These burners, which have been found to use 2.2 per cent of the steam generated for vaporizing the oil, are much superior to the burners formerly used, which required over 4 per cent of the steam generated. The new burner also gives a much better distributed flame and the combustion of the vaporized oil is so complete that smoke is seldom seen to issue from the stacks.

At the present time four boilers are installed in the boiler room. Two of these are water-tube safety boilers of the Stirling type, one of 407 hp and the other of 295 hp capacity. The other two boilers are of the old horizontal, return-tubular type, and each boiler is rated at 125 hp. Space is provided in the boiler room for one more Stirling boiler of 400 hp rating. The Stirling boilers are used regularly and the horizontal tubular boilers are held in reserve. Each boiler has its own smokestack. The mean temperature in these stacks is about 400 deg. Fahr., the draught being about 0.45 in. of water column with dampers nearly closed. The boiler feed water consists of the cooling water from the surface condensers. This water has a temperature of about 100 deg. Fahr., and after being automatically weighed it is passed through a feed-water heater which raises its temperature to about 170 deg. Fahr., and it is then delivered to the boilers. There is considerable lime in the water, and for the prevention of boiler scale a boiler compound has been used with fair success. Steam at a pressure of 150 lb. per square inch is delivered to the turbines and ammonia compressor Corliss engine. The quality of this steam as measured by a throttling calorimeter is about 98.75 per cent dry.

The generating units are of the revolving-field type operating at 3600 r.p.m. and generating two-phase, 2300-volt, 60-cycle alternating current. The generator fields are excited by two motor-driven exciters, and one small Curtis steam-turbine-driven exciter is held in reserve in case of complete shutdown. Only one of the generators is usually run at a time, the other being held in reserve, thus insuring an uninterrupted service. The steam turbines are an improvement over the reciprocating engines formerly used in greater reliability of service, one of the steam turbines having run nearly a year without stopping. The two turbine units now used also require only as much floor space as one of the reciprocating-engine units formerly used.

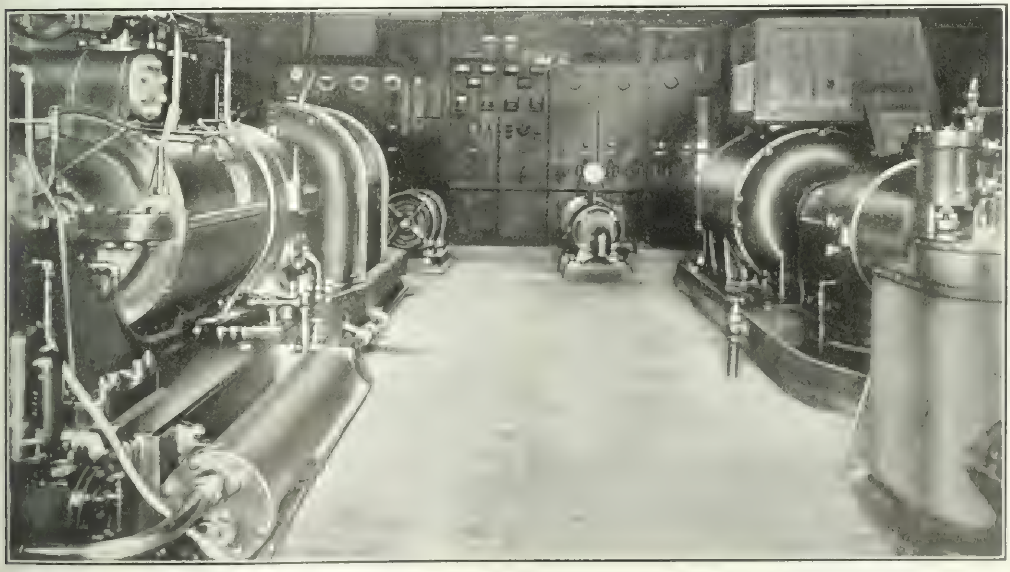


Fig. 1—Turbo-Generators in Bisbee Improvement Company's Plant, Bisbee, Ariz.

The switchboard, of nine black enameled slate panels, is equipped with a synchronizer, a frequency indicator, an automatic Tirrill voltage regulator, automatic overload-release oil switches and all standard indicating and recording instruments usually found in installations. Choke coils and two sets of lightning arresters are connected to the outgoing lines to protect the switchboard instruments and generators against the violent lightning storms so frequent during the latter part of the summer.

Two surface condensers of the Alberger type are used for the steam turbines, the one for the 500-kw unit having 1600 sq. ft. of surface and the one for the 300-kw unit 1000 sq. ft. of condensing surface. The condensers are supplied with cooling water from a brush-type cooling tower by motor-driven centrifugal pumps. The dry-vacuum pumps and the hot-well pumps are steam driven, the exhaust steam from these pumps, together with that from the feed-water pump, being passed to the feed-water heater. The condensation from the steam turbines, being free from oil and other impurities, is used for ice-manufacturing purposes. A 1300-sq. ft. surface condenser of the Wheeler type is used with the ammonia compressor engine. The pumps for this condenser are all steam-driven and run condensing.

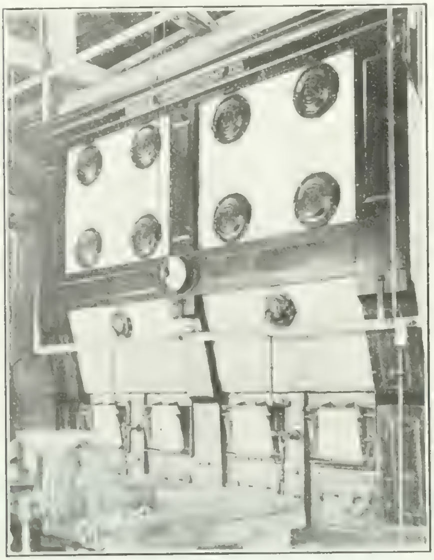


Fig. 2—View of 407-H.P. Boiler.

All the steam pumps in the power house, including those in the ice-manufacturing department, were tested recently for steam consumption. This was done by connecting a small home-made surface condenser to each pump to be tested and weighing the condensed steam on a platform scale. Most of the pumps used such an excessive amount of steam for the work done that it has been decided to replace them with electrically driven triplex pumps.

The turbines were tested recently for steam consumption and the results of these tests are given below in tabulated form and also by curves. The 300-kw turbine is new, having been in service only a few days before these tests were taken. The 500-kw turbine has been in service about 2½ years. In the turbine guarantee the manufacturers specified a 27-in. vacuum referred to a 30-in. barometer, and as the barometer at this altitude at the time the tests were taken measured only 25 in. of mercury, the steam consumption in the tests was correct to the equivalent steam consumption at 22 in. vacuum. These corrections were made from curves furnished by the turbine manufacturers. The vacuum was in all cases measured by a mercury column. The quality of the steam used by the turbines was measured once during each test by a throttling calorimeter.

The exhaust from the turbines was pumped from the surface condensers into tanks of known capacity, and the weight of this was figured with reference to its temperature. The leakage of the turbine water seals and the condenser leakage were measured for each test and deducted from the weight of exhaust water in the tanks. The volume of cooling water was measured by placing a weir in the water trough before it enters the cooling tower, and these measurements were checked by calculations from the rise in temperature of the cooling water from inlet end to discharge end of the condenser. The switchboard instruments were tested and corrected before the tests were taken. The exciter unit being driven electrically from the turbine under test, by energy registered on the switchboard instruments, it was thought proper to deduct the excitation energy from the average indicated load. The duration of each test was one hour.

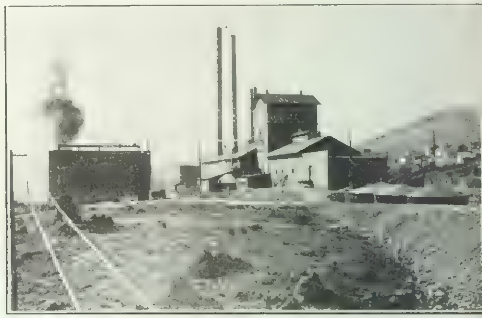


Fig. 3—Cooling Tower, Oil Tanks and Transmission Lines.

An accurate record is being kept of the boiler room, and the amount of feed water, fuel oil and water blown off from the boiler is reported daily. The blow-off water is calculated from

TABLE I.—TESTS OF 300-KW STEAM TURBINE.

	Test 1.	Test 2.	Test 3.	Test 4.	Test 5.	Test 6.
Average r.p.m. of turbine..	3660	3660	3660	3660	3630	3620
[illegible]	138	137	138	133	135	136
Quality of steam—% dry..	98.62	98.62	98.62	98.62	98.62	98.62
Ave. temp. cool. water in...	72	71	79	75	81	81
[illegible]	84	84	96	96	112	117
Volume cooling water in cu. ft. per minute	61.8	61.8	61.8	61.8	61	61
Barometric pressure....................	25	25	25	25	25	25
[illegible]	23.5	23.25	23	22.7	21.4	20.9
Ave. temp. exhaust Fahr................	89	85	99	103	110	119
Total cu. ft. exhaust........	43.336	47.57	57.89	65.76	101.29	105.33
Weight of exhaust per cu. ft.	62.14	62.18	62.03	62.02	61.89	61.75
[illegible]	2692.9	2957.9	3591	4078.4	6268.8	6504.1
Less seal leakage, lb	70	84	62	60	42	40
[illegible]	18	18	18	18	18	18
Net weight exhaust, lb............	2604.9	2855.9	3511	4000.4	6208.8	6446.1
[illegible]	65	79	113	146	238	255
Less consumption of generator field in kw	3	3	3	3	4	4
Load credited to turbine..........	62	76	110	143	234	251
[illegible]	21.66	25.33	33.36	48.66	79.33	85
Steam consump. per kw-hour.....................	40.07	37.58	31.92	27.97	26.53	25.64
Dry steam con. per kw-hour.....................	39.52	37.06	31.48	27.58	26.16	25.29
Dry steam per kw-hour corrected to 22 in. vacuum.	41.70	38.77	32.64	28.29	25.59	24.36

measurements on the gage glass and this is subtracted from the water fed to the boiler when figuring evaporation. No allowance has been made, however, for the oil required to heat this water up to the temperature at which it is blown off.

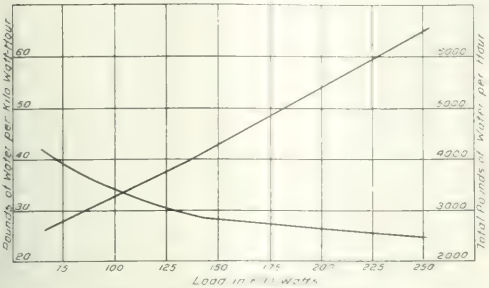


Fig. 4—Test of 300-Kw Steam Turbine.

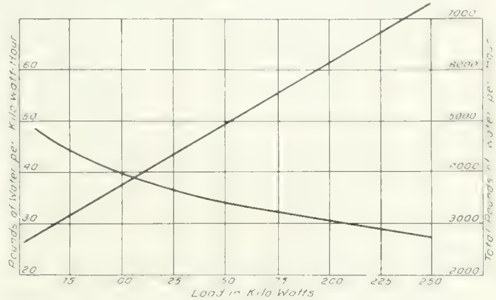


Fig. 5—Test of 500 Kw. Steam Turbine.

The boiler-room record for the month of March, 1910, is shown in Table III.

Using the tests taken on the steam turbines, pumps and ammonia compressor engine as a basis of calculation, it was found that the steam generated was used as shown in Table IV.

power-plant switchboard, is very good, and this, together with the reliable continuous service, has won many new customers for the company. The rates are fixed according to the average consumption of the customer, and in no case does this rate exceed 20 cents per kw-hour.

For the year 1909 the records for generating and transmitting electricity are shown in Table V.

The electrical energy recorded on the customers' meters was apportioned as shown in Table VI.

TABLE II.—TESTS OF 500-KW. STEAM TURBINE.

	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Average r.p.m. of turbine	[illegible]	3620	3610	[illegible]	[illegible]	[illegible]
Ave. steam pres. throttle	[illegible]	[illegible]	137	[illegible]	136	136
" " " inlet	[illegible]	[illegible]	26	[illegible]	53	[illegible]
Quality of steam—% dry	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ave. temp. cool. water in	70	[illegible]	78	79	[illegible]	[illegible]
" " " " out	80	87	91	98	99	103
Volume of cooling water in cu. ft. per minute	96.4	96.4	96.4	96	96	95
Barometric pressure	25	25	25	25	25	28
Average vacuum	24.12	23.12	22.8	21.8	21.3	[illegible]
Ave. temp. exhaust Fahr.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	117
Total cu. ft. exhaust	43.865	[illegible]	67.33	103.277	102.14	121.207
Weight exhaust per cu. ft.	62.28	62	62.08	61.89	61.81	61.78
Total weight exhaust, lbs.	[illegible]	[illegible]	4180	6391.8	6313.3	7488
Less turbine seal leakage	132	[illegible]	[illegible]	[illegible]	82	70
Less condenser leakage	4	4	4	4	4	4
Net weight exhaust, lbs.	[illegible]	[illegible]	[illegible]	[illegible]	6227	7414
Ave. indicated load kw.	61	69	[illegible]	[illegible]	218	255
Less consump. gen. Field kw.	4	4	[illegible]	[illegible]	[illegible]	[illegible]
Load credited to turbine	[illegible]	65	[illegible]	[illegible]	[illegible]	250
Load in % of normal rating of turbine	[illegible]	[illegible]	[illegible]	[illegible]	42.6	[illegible]
Steam consump. per kw-hour	[illegible]	45.66	39.58	32.19	29.23	[illegible]
Dry steam per kw-hour	44.99	45.11	39.10	[illegible]	28.88	[illegible]
Dry steam per kw-hour corrected to 22 in. vacuum	48.52	46.98	40.26	31.11	28.15	27.80

Curve "A," in Fig. 6, shows the average indicated load for each of the 24 hours in the day during the month of June, and curve "B" shows the same for the month of December. The curve in Fig. 7 shows the salable output for each month of the year. In calculating this curve each month was taken as if consisting of 30 days.

Besides the smaller transmission lines to the suburbs there are four main lines of No. 00 copper wire, carrying the elec-

TABLE III.—BOILER-ROOM RECORD.

Water fed to boilers, lb.	4,320,547
" [illegible]	51,588
" evaporated into steam, lb.	4,268,959
Fuel [illegible]	318,347
[illegible]	13.41
Temperature of feed water, Fahr. deg.	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Evaporation from and at 212° Fahr., lb.	[illegible]

tricity a little more than a mile to the corner of the company's building near the center of the city. An oil switch, installed on the primary wires and located in the telephone exchange in this building, is used for switching the circuits on and off for all arc and incandescent street lamps. All service is metered, and the meters for the city are installed on the primary wires near the oil switch in the telephone exchange. Electricity for all business houses and residences is supplied through pole transformers. The voltage regulation, which is controlled by the automatic potential regulator on the

The losses are distributed about as shown in Table VII.

There are in all 70 transformers of the old type connected to the lines. These range in sizes from ½ kw to 25 kw, and the calculations of core and copper losses were based on

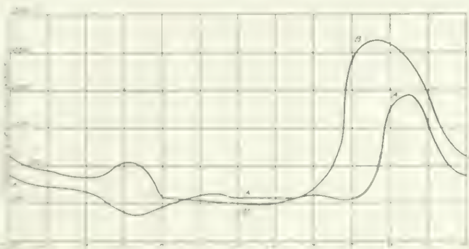


Fig. 6—Average Daily Load for June and December.

curves furnished by the manufacturers. The meter losses were found by carefully measuring the watts consumed by the shunt coils of each type of meter in service. No attempt was made to calculate the losses in the series coils, and these [illegible] in the table. There are in all 933 meters in service, and of these the shunt coil losses were found to be as shown in Table VIII.

The company makes it a practice to test its meters as often as practicable, leaving no meter in service more than a year without being tested. All the meters are tested before being put in service, and those that have been in service as long as a year are tested on the customer's premises, a rotating standard being usually employed for this purpose.

The company also makes a practice of testing all the electrical apparatus received. A comparative efficiency test of five electric flatirons recently received from different manufacturers was thus conducted with results as given in Table IX. This test, which consisted of evaporating ½ lb. of water, was conducted as follows: A small tin pan containing ½ lb. of water was placed on an asbestos mat and the cold iron was placed on two small pieces of wire in the bottom of the pan. The circuit was then closed and the iron left standing on the wire pieces until the pan was nearly empty, when the wires were removed and the iron was placed on the bottom of the pan until all the water was evaporated. The initial temperature of [illegible]

TABLE [illegible]

[illegible]	Lb. Steam	Lb. per Kw hour
[illegible]	2,876,526	[illegible]
[illegible]	148,800	[illegible]
Condensation pump	49,104	[illegible]
[illegible]	89,468	1 14
" steam for boiler feed (78.44 per cent)	184,773	2 35
Total used in electric department	3,348,671	[illegible]
[illegible]		
Compressor engine and condenser pump	730,392	
[illegible]	13,550	
Water pump for ice manufacture	89,280	
[illegible]	[illegible]	
Proportion of general work (21.56 per cent)	24,591	
" steam for boiler feed (21.56 per cent)	50,787	
Total used for ice department	[illegible]	
Boiler Room		
[illegible]	[illegible]	
[illegible]	[illegible]	
Total steam for boiler feed	[illegible]	
General Work		
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible] supply tank	88,560	
Total used for general work	114,059	

TABLE V.—RECORD FOR 1909.

Recorded at power house switchboard, kw-hours		861,110
Used for exciter motors, kw-hours	51,370	
Used for circulating water pump motors, kw-hours	65,665	117,035
Amount salable, kw-hours		[illegible]
Recorded on customers' meters		[illegible]
Lost and unaccounted for energy		[illegible]
Loss, per cent		[illegible]

TABLE VI.—DISTRIBUTION OF LOAD.

	[illegible]	Per cent of Energy Sold
Stores, theaters, etc.	142,472	[illegible]
Saloons, billiard, etc.	114,645	[illegible]
Residences	86,263	[illegible]
Hotels, rooming houses, restaurants, etc.	72,349	13 0
Electric motors	61,218	11 0
City street lamps	48,975	[illegible]
Churches, schools and Y.M.C.A.	22,261	[illegible]
Company's power plant lighting	8,348	[illegible]
Total	556,531	100

TABLE VII.—[illegible]

	Kw-hours	Per cent
[illegible]	[illegible]	6 7
[illegible]	96,730	13 0
Meters' potential coil losses	27,112	3 7
[illegible]	[illegible]	1 8
Total	[illegible]	25 2

The cost of generating, transmitting, metering, administration, accounting and collecting for the electrical energy sold during the year 1910 is divided as indicated in Table X.

TABLE VIII.—LOSSES IN SHUNT COILS OF METERS.

Type of Meter	Loss per Meter-Watts	No. of Meters in Service	Total Loss in Watts	Total Loss per Year Kw-hours
"A" (Induction)	3.085	648	1,999.08	17,512
"B" (Commutator)	5.33	143	762.19	6,675
"C" (Induction)	2.06	89	[illegible]	1,606
"D" (Induction)	2.43	38	92.34	809
[illegible]	6.17	15	92.55	810
Total		933	3,129.50	27,412

The company tries to get all the latest and best electrical apparatus on the market and to get the customers interested in these by advertising and pointing out to them the advantages and great conveniences in using these devices. The tungsten lamp and the electric flatiron have thus come into common use, and a great number of small motors and heating devices of all descriptions have been installed. Several electric vacuum cleaners, washing machines, dough mixers, etc., have also lately been introduced with success. It has been found that these devices have resulted in better satisfied customers, as well as in larger sales of electrical energy.

TABLE IX.—POWER CONSUMPTION OF ELECTRIC FLATIRONS.

[illegible]	Power Taken, Watts	Time Consumed, Minutes	Watt-minutes
"A"	630	24	15,120
"B"	460	29.5	13,570
"C"	560	27.5	15,400
"D"	485	31.75	15,398
"E"	[illegible]	26.25	15,225

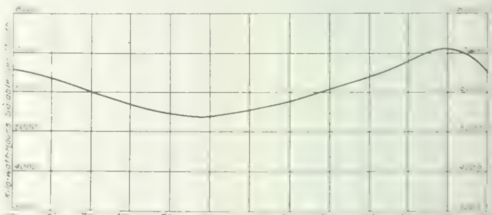


Fig. 7—Salable Production for 1909.

TABLE X.—DIVISION OF COSTS.

	Per cent	Per cent
Power Plant Expense		
[illegible]	31 36	
Water	[illegible]	
Labor	10.33	
Repairs	[illegible]	
Depreciation	11 36	
[illegible]	48	
[illegible]	76	
Other expenses	1 49	
Total power plant expenses		66 28
Transmission Expense		
[illegible]	[illegible]	
Horses, line wagon, etc.	1 17	
[illegible]	6 07	
Materials for line repairs	[illegible]	
[illegible]	[illegible]	
Other expenses	[illegible]	
Total transmission expense		[illegible]
Meter expense		[illegible]
Free street lamp maintenance expense		[illegible]
Administration expense		[illegible]
[illegible]		6 10
General expenses (not included in the above)		[illegible]
Total expenses		100 00

COMPARATIVE LIFE TEST OF INCANDESCENT LAMPS.

By Clayton H. Sharp and [illegible]

VERY little information is to be found in the technical literature of the subject regarding the accuracy with which, under good conditions, the life of incandescent lamps can be determined by life-test experiments. There is probably in the minds of many an impression that life-test results represent only a rough approximation to the truth and that the results of one period on a given set of lamps may be quite different from those obtained at another time. It is true that in few, if any, fields of testing work can worse results be obtained than are sometimes got in the life testing of incandescent lamps. Life tests conducted by men of insufficient experience or of insufficient training to appreciate the manifold precautions and the great care which must be taken in order to secure accurate results are practically worthless. Life-test results obtained, however, in a properly equipped and properly operated laboratory for the purpose should be accurate and consistent, and the results obtained in one such laboratory should agree with those obtained in another laboratory. Those actively engaged in life-test work in properly equipped laboratories have long known that consistent results were possible in their own work and have demonstrated it by tests.

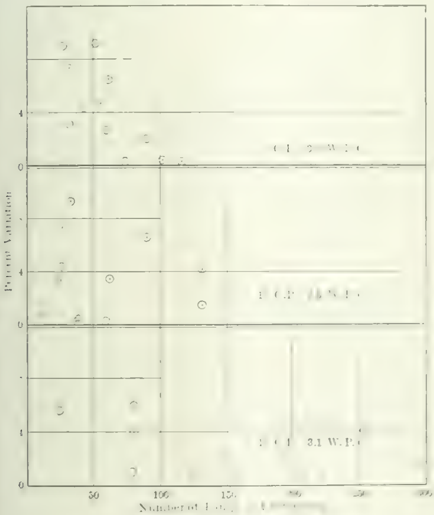


Fig. 1—Discrepancies in Life-Test Results.

Fig. 1 is offered as an illustration of the concordance obtained in tests made at different times in one laboratory, the [illegible] being abstracted from a part of the 1908-1909 testing [illegible]ds. It is the practice, whenever feasible, to divide a [illegible]up of lamps which are to be life tested, placing half of them upon test immediately, and starting the test upon the other half [illegible] the lamps approximately two weeks later. Fig. 1 shows [illegible] differences between the two groups so tested. Each circle [illegible] the diagram indicates by its location the difference between [illegible] average useful life values of two particular groups, the [illegible]ber of lamps composing each of the groups being found by [illegible]rence to the scale of abscissas. The comparison is a valid [illegible] in each case, because the lamps forming any two groups [illegible] burned at the same watts per candle initially, and were [illegible]ted from the product of the same manufacturer, and as [illegible]

[illegible] 3.1 initial watts per candle, which appear at the bottom of the plate, it will be seen that most of the differences lie within 3 per cent, the most notable exception being that two groups, numbering 253 lamps each, differed by 4 per cent. Examination of the records shows that one of these groups contained by chance much the larger proportion of lamps having defects which result in very short life. Indeed, it is fair to say that with regard to all of the larger variations indicated upon this diagram a similar explanation accounts for a large part of the differences noted.

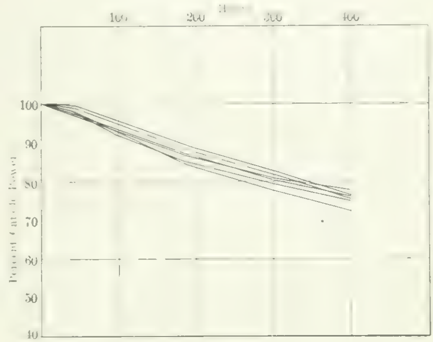


Fig. 2—English Lamps Tested at National Physical Laboratory.

In the case of the 16-cp, 3.5-watt lamps the differences were found to be somewhat larger, due to the well-established fact that these lamps are less uniform in their performance than are the 16-cp 3.1-watt lamps of the product here represented. The smaller carbon filament lamps are notably less uniform than the 16-cp lamps, which is easily apparent from the diagram, in which the variations are appreciably greater than those noted for the larger lamps.

In general, the diagram illustrates the fact that concordance of test results may be expected to vary considerably with the number of lamps represented in a test group, and with the uniformity of the product from which the test group is selected. Furthermore, if variations in the lamps tested could be eliminated, the concordance of the test results would be entirely satisfactory.

As to whether concordance can be expected in the results of life tests [illegible] in different laboratories widely separated from each other information has been entirely lacking. In view of this fact a comparative life test was agreed upon between the National Physical Laboratory, of London, England, Dr. R. T. Glazebrook, F.R.S., director, and the Electrical Testing Laboratories, New York. The results of this test, while not entirely con-

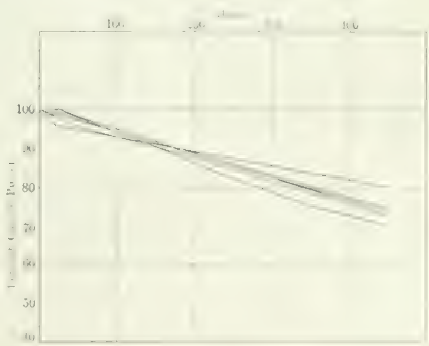


Fig. 3—English Lamps Tested at Electrical Testing Laboratories.

clusive because of the small number of lamps tested, are presented here as throwing light upon the subject of the obtainable accuracy in this class of work.

As a preliminary to the life test a comparison was made of standards of candle-power and of electromotive force, as follows:

The Electrical Testing Laboratories sent six standardized incandescent lamps to the National Physical Laboratory whereby a direct comparison of candle-power standards was achieved. The National Physical Laboratory sent a Weston normal cell of its own construction to the Electrical Testing Laboratories for purposes of comparison of the electrical units. At the time the test was made the international agreement as to the value of the unit of candle-power had not been entered into by the National Laboratories of England, France and the United States. Consequently, there was an outstanding difference in the value of the candle-power units in use, which, as shown by

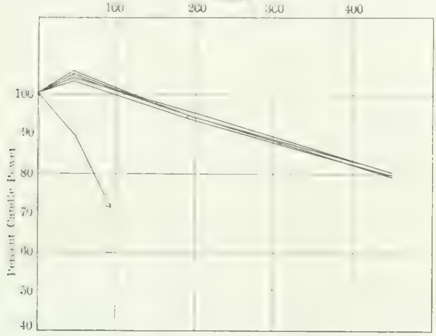


Fig. 4—American Lamps Tested at National Physical Laboratory.

the standard lamps, amounted to 1.1 per cent. In conducting the tests all electrical and photometric measurements were reduced to a common basis.

In preparation for the test 12 lamps of 16 cp were selected in each laboratory. These lamps were very carefully rated initially. The English lamps were burned for some hours before measurements were made. The lamps of each group were rated as nearly as possible at the same watts per mean horizontal candle-power. Six lamps of each of these groups were retained at the laboratory where prepared, and the other six were shipped to the other laboratory. Thus each laboratory had six of its own lamps and six of the other laboratory's lamps. The lamps were carefully re-rated at the other laboratory, and thereby a further check of the concordance of standards was obtained. The initial ratings of the English and American lamps as determined at the N. P. L. and E. T. L. are given in the following table:

TABLE I.—INITIAL RATINGS.

	American Lamps. Values [illegible] at			British Lamps. Values [illegible] at	
No.	E. T. L.	N. P. L.	No.	N. P. L.	E. T. L.
1	[illegible]	3.10	1	[illegible]	3.09
2	[illegible]	[illegible]	2	[illegible]	[illegible]
3	[illegible]	[illegible]	3	3.10	[illegible]
4	3.11	3.10	4	3.10	[illegible]
5	[illegible]	[illegible]	5	3.10	[illegible]
6	3.11	[illegible]	6	3.10	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]

It will be noted that the rating of the British lamp No. 2 was quite different at the Electrical Testing Laboratories from what had been found at the National Physical Laboratory.

The rating tests being completed, and the results compared the actual life test was begun. In both laboratories the life test current was alternating, and the regulation of voltage wa very close. The limit of voltage variation of their life-tes lines is given by the National Physical Laboratory as ±½ per cent. The voltage of the Electrical Testing Laboratories lines certainly did not vary by more than this amount. Th lamps were burned at their rated voltages as given by th laboratory in which they had been prepared until their candle power had dropped somewhat more than 20 per cent below th initial value. Individual life curves were drawn for eacl lamp, and are reproduced in Figs. 2 to 5.

The American lamps tested at the E. T. L. burned initiall at 3.09 watts per candle as against 3.10 watts per candle fo the corresponding lamps at the N. P. L. An allowance o + 7 hours has been made in the measured life of these lamp to correct for this variation.

The final results are summarized in Table II. The America lamp which "slumped" in the N. P. L. tests has been disregarded. The average life value for each group is taken as th average of the lives of the individuals composing the group:

TABLE II.—LIFE VALUES.

	N. P. L. Test	E. T. L. Test	Difference
English lamps	312 hours	341 hours	29 hours — 9 3[illegible]
American lamps	434 "	434 "	0 "
English lamps, No. 2 out	312 "	315 "	3 " 1%

The concordance of the results on the American lamps i surprising. The difference in the case of the British lamps i greater, but still the agreement is satisfactory. If we eliminat from the results the British lamp which showed a consumptio

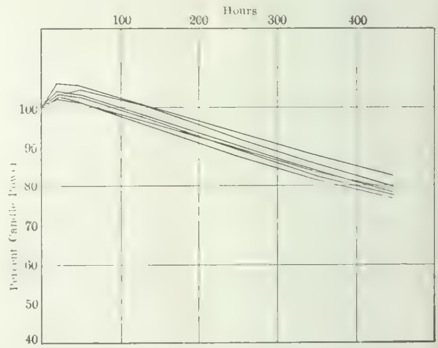


Fig. 5—American Lamps Tested at Electrical Testing Laboratories

of 3.18 watts per candle at the E. T. L., and which had there fore an unduly long life, the comparison becomes considerabl more favorable. The average of the British lamps tested i the E. T. L. is then 315 hours and the difference between th N. P. L. and E. T. L. values is only three hours, or 1 per cent As has been said above, the results of this test are not entirel conclusive because of the small number of lamps involve This point is emphasized by the data in Fig. 1. However, whe irregular lamps are eliminated and data are reduced to th same basis as far as possible, a valid comparison of the result of the respective laboratories' methods may be expected. I is safe to say that if there were any radical or considerabl discrepancy between the results of life tests conducted at th National Physical Laboratory and the Electrical Testing Labo ratories, a test of the character here described would almo certainly disclose it. No discrepancy having shown itself, i is fair to assume that none exists, and that the life-test result [illegible] these two laboratories may be taken as equivalent [illegible]

follows, moreover, that any two laboratories properly equipped and conducted may be made to agree in their results in life-testing lamps.

In conclusion, the fact should be emphasized that no comparison is possible between the quality of the British and that of the American lamps on the basis of this test. The spherical reduction factors of the two groups of lamps were quite different, so that the two groups actually burned at quite widely different watts per mean spherical candle, or watts per lumen. Moreover, as has been said, the British lamps had been burned for a considerable period before the beginning of the test.

An account of this test, from the point of view of the National Physical Laboratory, is given by Messrs. Clifford C. Paterson and E. H. Rayner, M.A., in the London *Electrician*.

Electrical Testing Laboratories.

THE ELECTROSTATIC CAPACITY BETWEEN EQUAL, PARALLEL WIRES.

By H. PENDER AND H. S. OSBORNE

In the *General Electric Review* for July, 1909, and in the succeeding numbers, is published an extensive series of tables of transmission line constants, covering a wide range of sizes and separations of wires. On the editorial page of the July number this statement is made regarding the computation of these tables:

"The formulas customarily used, and which involve approximations that lessen the labor of calculation at the expense of refinement, have not been employed. Accurate formulas have been used wherever the error would otherwise have affected the result within the limits of the retained digits."

It appears, however, that this statement requires some qualification. Table II (published in the July *Review*) gives values for the capacity between a pair of solid wires for sizes of wire from No. 4-0 to No. 15, and for distances between centers from ⅜ in. to 180 in. The formula given for the computation of these values is

$$C = \frac{3.677}{\log \frac{D}{r}} \text{ microfarads per 1,000,000 ft.} \qquad (A)$$

where D = distance between centers of wire and r = radius of each wire.

This formula, as is well known, is an approximate one, and is a close approximation only for relatively large values of $\frac{D}{r}$. The result of applying it to [illegible] Table II of the *Review* series, is to introduce an error which is serious for a considerable part of the table, and which amounts, in the worst case, to [illegible]

An exact formula[1] for the capacity between two equal cylinders must take into account the non-uniformity of the distribution of charge on the cylinders; such a formula is found by considering the charges to be concentrated at the inverse points of the cylinders, and is given by the equation

$$C = \frac{3.677}{\log\left[a + \sqrt{a^2 - 1}\right]} \text{ microfarads per 1,000,000 ft.} \qquad (B)$$

$$\text{where } a = \frac{D}{d} = \frac{\text{Distance between centers of conductors}}{\text{Diameter of either conductor}}$$

This exact formula is not very formidable, and it is, moreover, practically solved for one who has within reach a table of hyperbolic cosines[2], for

$$ln\left[a + \sqrt{a^2 - 1}\right] = \cosh^{-1} a$$

(when ln represents the natural logarithm). The exact formula in its simplest form is then

$$C = \frac{8.467}{\cosh^{-1} a} \text{ microfarads per 1,000,000 ft.} \qquad (C)$$

Values for the capacity have been computed from equation (C) for all cases given in Table II of the *General Electric Review* in which the error introduced by the use of their equation (A) exceeds 0.2 of 1 per cent, and are collected in Table I. These values have been carefully checked, and are believed to contain no error greater than 0.1 of 1 per cent in magnitude.

The values given in this, or in any other table of capacities, may be extended to sizes and distances beyond the scope of the table by remembering that if the distance between the centers of the wires be doubled, and the wires be taken six sizes larger, the capacity remains nearly the same. That is, the capacity between two No. 18 wires 6 in. apart is nearly equal to the capacity between two No. 12 wires 12 in. apart.

From curve B, Figs. 2 and 3, may be read the magnitude of the error caused by the use of equation (A) with any given value of the ratio of the diameter to the distance apart of the wires. It is seen that the error amounts to ½ per cent for two No. 4-0 wires spaced 12 in. apart, and increases very rapidly as the separation of the wires decreases below this value.

TABLE I.—ELECTROSTATIC CAPACITY OF CONDENSER FORMED BY EQUAL PARALLEL WIRES.

$$C = \frac{8.467}{\cosh^{-1} a}$$ microfarads per million feet of line (two million feet of wire).

Distance apart Inches	000	000	00	[illegible]	1	2	[illegible]	4	[illegible]	6	7	8	9	10	11	12	13	14	15
[illegible]		....	[illegible]	15.44	11.26	9.185	7.882	6.962	6.264	5.713	5.262	4.883	4.562	4.282	4.037	3.820	3.627	[illegible]	[illegible]
[illegible]	20.45	12.97	10.12	8.498	7.405	6.603	5.985	5.485	5.073	4.723	4.422	4.161	[illegible]	3.724	3.540	3.374	3.224	3.086	2.960
[illegible]	7.906	6.978	6.270	5.725	5.271	4.891	4.568	4.288	4.043	3.825	[illegible]	3.456	3.298	3.154	3.022	2.901	2.790	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	4.731	4.428	4.166	3.935	3.729	3.544	3.378	3.227	3.089	2.963	2.847	2.739	2.640	2.548	2.462	[illegible]
2	3.939	3.733	3.548	3.382	3.230	3.092	2.965	2.849	2.742	[illegible]	2.642	2.463	2.383	2.307	2.237	2.170	2.107	[illegible]	1.992
3	[illegible]	[illegible]	[illegible]	2.907	2.795	2.691	2.595	2.506	2.423	2.345	2.272	2.203	2.138	2.077	2.020	1.966	1.914	[illegible]	1.819
4	[illegible]	2.852	[illegible]	[illegible]	2.551	2.465	2.385	2.309	2.238	2.171	2.109	2.050	1.994	1.940	[illegible]	[illegible]	1.797		
5	2.752	2.651	2.558	2.472	2.390	2.315	2.243	2.176	2.113	2.054	1.998	1.944	1.894	1.846	[illegible]				
6	[illegible]	[illegible]	[illegible]	[illegible]	2.273	2.204	2.140	2.079	2.021	1.967	1.915	1.866	1.820						
7	[illegible]	[illegible]	[illegible]	2.250	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.899	1.851	1.805							
8	2.386	2.311	2.240	[illegible]	2.110	2.051	1.995	1.942	1.891	1.844	[illegible]								
9	2.309	2.238	2.172	2.109	2.050	1.994	1.941	1.891	1.843	1.797									
10	2.245	2.177	2.115	2.055	[illegible]	[illegible]	[illegible]	[illegible]	1.802										
11	2.189	2.125	2.065	2.009	1.955	1.904	1.855	1.809											
12	[illegible]	[illegible]	[illegible]	1.968	1.916	1.867	1.821												
[illegible]	[illegible]	1.972	[illegible]	[illegible]	1.824														
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]															
21	1.876	1.829	1.784																
24	1.822	1.777																	
[illegible]																			

See General Electric Review, [illegible]

The formula

$$C = \frac{3.677}{\log \frac{D}{r}} \text{ microfarads per 1,000,000 ft.}$$

is frequently given as an exact formula, even in standard text-books and in papers before the American Institute of Electrical Engineers. The reasoning customarily used in deriving this formula is somewhat as follows:

[illegible]

[1] See Alexander Russell, Alternating [illegible] Cambridge University Press, [illegible]

[2] [illegible] Van Nostrand, [illegible]

Given two wires (Fig. 1), whose axes are parallel and separated by a distance D, each of which has a radius r charged with Q units and $-Q$ units, respectively, of electricity per unit length. Assume that the two charges are uniformly distributed over their respective cylinders. (This assumption is not true except for small ratios of $\frac{D}{r}$.) Under this condition the electrostatic field intensity at any point P external to the wires

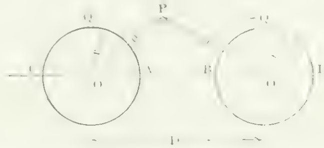


Fig. 1—Cross-Section of Parallel Cylinders of Equal Radius.

is equal to that which would be produced by two changes Q and $-Q$ per unit length concentrated on the axes O and O' of the wires, and is hence given by the equation

$$F = \frac{2Q}{x} - \frac{2Q}{x'} = 2Q\left(\frac{1}{x} - \frac{1}{x'}\right)$$

The potential V is $-\int F dp$; hence the potential difference between the two cylinders is found by integrating between B and A, and is equal to

$$V_0 = 4Q \ln \frac{D-r}{r} \qquad \text{(D)}$$

It is evident, however, that if instead of choosing B and A as the limits of integration, one had integrated from E to C, the formula for the potential difference would become

$$V_0' = 4Q \ln \frac{D+r}{r} \qquad \text{(E)}$$

Evidently the true value for the potential difference between the two wires can be neither of the values given by (D) and

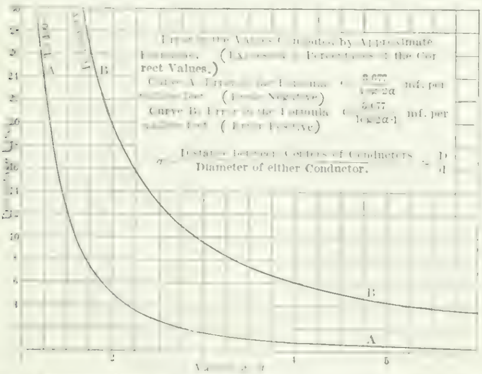


Fig. 2—Comparison of Formulas for Capacity Between Long Parallel Cylinders of Equal Radius.

(E), but must be somewhere between those two values. It might then be reasonably expected that the simple equation,

$$V = 4Q \ln \frac{D}{r} \qquad \text{(F)}$$

which is a sort of logarithmic mean between the two extreme equations, (D) and (E), would give more accurate results than either of them.

Such is indeed the case. The equation for the capacity between two wires obtained from equation (D) is

$$C = \frac{3.677}{\log (2\alpha - 1)} \text{ microfarads per 1,000,000 ft.} \qquad \text{(G)}$$

and that obtained from equation (F) is

$$C = \frac{3.677}{\log 2\alpha} \text{ microfarads per 1,000,000 ft.}$$

where α, as before, is the ratio of the distance between centers to the diameter of the wires. Figs. 2 and 3 show the error introduced by the use of equations (G) and (H) for different values of α, expressed as percentages of the correct value of the capacity. It is seen that equation (G), that used in the

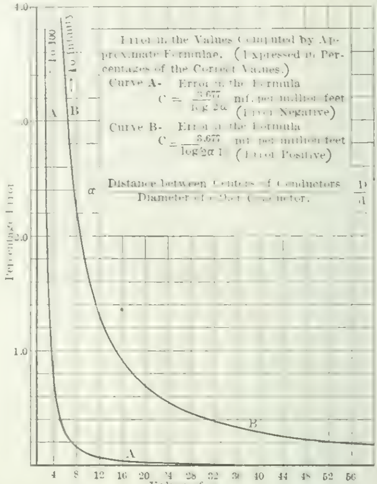


Fig. 3—Comparison of Formulas for Capacity Between Long Parallel Cylinders of Equal Radius.

General Electric Review, introduces an error which is in all cases very much greater, and in the limit (when $\alpha = 1$) is infinitely greater than that introduced by equation (H). Equation (H) is hence not only simpler than equation (G), but it is also more rational and much more exact.

The equation

$$C = \frac{3.677}{\log 2\alpha} \text{ microfarads per 1,000,000 ft.} \qquad \text{(H)}$$

gives values which are lower than the correct values, and which become seriously in error for values of α less than 5 or 6.

The error in this approximate formula for very small values of α does not seem remarkable when one considers the actual

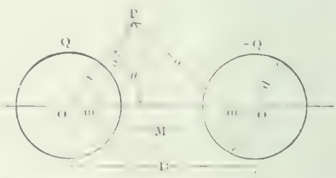


Fig. 4—Cross-Section of Parallel Cylinders of Equal Radius.

distribution of charge on the conductors in these cases. This actual distribution of charge may be calculated as follows:

Given two parallel wires (Fig. 4), having charges of Q and $-Q$, respectively, per unit length. Let O and O' be the centers of the wires, and m and m' their inverse points. Then

$$(Om)(Om') = \left(\frac{d}{2}\right)^2$$

or

$$M^2 = D^2 - d^2$$

Take polar coördinates (r, θ) about O. Then the potential at any point P is

$$V = 2Q \ln \frac{x'}{x} = Q \ln \frac{r^2 + \left(\frac{D+M}{2}\right)^2 - r(D+M)\cos\theta}{r^2 + \left(\frac{D-M}{2}\right)^2 - r(D-M)\cos\theta} - Q \ln \frac{d}{D}$$

where A and B represent the numerator and the denominator, respectively, of the antilogarithm.

Then

$$\frac{1}{\cdot} = \frac{2M}{AB}\Big[\Big(\cdots \Big) \cdots 2rD\Big]$$

or when $r = \frac{d}{2}$, i.e., at the surface of the wire

$$\Big(\frac{dV}{dr}\Big)_{r=\frac{d}{2}} = \frac{2M}{AB}\Big[\cdots \cos\theta - dD\Big]$$

Moreover,

$$AB = \Big[r^2 + \Big(\frac{D+M}{2}\Big)^2 - r(D+M)\cos\theta\Big]$$
$$\Big[r^2 + \Big(\cdots \Big) \cdots - M \cos\theta\Big]$$

Hence, when $r = \frac{d}{2}$, AB reduces to the form

$$AB = \frac{\cdot}{4} \cdots d\cos\theta]^2$$

Hence

$$\Big(\frac{dV}{dr}\Big)_{r=\frac{d}{2}} = \frac{\cdots M}{\cdots \cos\theta\, d}$$

the surface density of the charge on the conductor is then

$$\sigma = -\frac{1}{4\pi}\Big[\frac{dV}{dr}\Big]_{r=\frac{d}{2}}$$
$$= \frac{Q}{\pi d}\,\frac{M}{D - d\cos\theta}$$

Or since $M = d\sqrt{a^2-1}$, where $a = \frac{D}{d}$

$$\sigma = \frac{Q}{\pi d}\,\frac{\sqrt{a^2-1}}{a - \cos\theta}$$
$$= \sigma_0\,\frac{\sqrt{a^2-1}}{a - \cos\theta}$$

where $\sigma_0 = \frac{Q}{\pi d}$ = average surface density of the charge.

This is the polar equation of an ellipse having its major axis in the line connecting the center of the two wires, and one focus at the center of the wire in question, the other focus being a distance $\frac{2\sigma_0}{\sqrt{a^2-1}}$ toward the other wire. The surface density of the charge at any point P on the surface of the wire

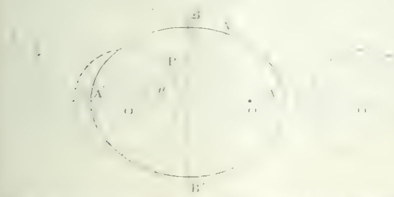


Fig. 5—Distribution of Charge on Two Long Parallel Cylinders.

is then equal to the radius vector OV of the ellipse having one focus at O, the other focus a distance OQ toward the other wire, the major axis $AA' =$ and the minor axis $BB' = 2\sigma_0$.

It is apparent from the ellipse (Fig. 5) that the ratio of maximum to minimum density is $\frac{OA}{OA'} = \frac{a+1}{a-1}$. For large values of a, then, the charge is distributed very nearly uniformly, and the equation

$$C = \frac{3.677}{\log 2a}\ \text{microfarads per 1,000,000 ft.}$$

gives very accurate results. For small values of a, however, the ratio of maximum density to uniform density is large, giving a distribution very far from uniform. Fig. 6 shows the distribution for this case ... centers. In this case a equals 1.087, and the ratio of maximum density to minimum density of charge is 24. Almost the entire charge on each conductor is on the side nearer the other conductor. Considering this fact it does not seem strange that the approximate formula, which assumes a uniform distribu-

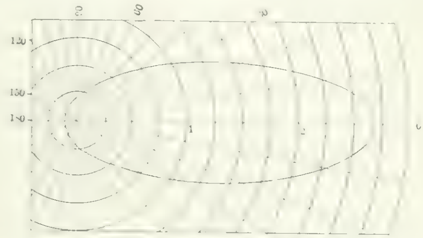


Fig. 6—Surface Density of Charge.

... volts between wires.

$$\sigma = \frac{\cdot}{\cdots \cosh^{-1} a}\,\frac{1}{\pi d}\,\frac{\sqrt{a^2-1}}{a - \cos\theta}$$

Where V ... c.g.s. electrostatic units and d in centimeters; $a = 1.087$.

tion of charge, gives a result which is 47 per cent below the actual value.

The criticism which has been made of the values given in Table II of the transmission line constants in the *General Electric Review*, which gives the capacity between solid conductors, applies also to Table XVI, which gives the capacity between stranded cables. In this case even the formula (C) cannot be relied upon to give perfectly exact results, for the surfaces of the conductors are no longer cylindrical.

The tables of charging current are, of course, in error to the same extent as those of the corresponding capacities. In this connection it should be remembered that for small values of a the capacity of a three-phase line ... cannot be assumed to be equal to $\frac{2}{\sqrt{3}}$ times the corresponding single-phase value. As far as the authors know, however, no accurate formula has yet been developed for three-phase capacity, so one must perforce be content with approximations.

Summary.

(1) The exact formula for the capacity between two parallel cylindrical wires of equal radius is

$$C = \frac{3.677}{\log\left[a + \sqrt{a^2-1}\right]}\ \text{microfarads per 1,000,000 ft.} \quad \text{(B)}$$

or

$$C = \frac{8.467}{\cosh^{-1} a}\ \text{microfarads per 1,000,000 ft.} \quad \text{(C)}$$

where $a = \frac{D}{d} = \frac{\text{Distance between the centers of the conductors}}{\text{Diameter of either conductor}}$

(2) For values of a of 10 or greater, the approximate formula

$$C = \frac{3.677}{\log 2a}\ \text{microfarads per 1,000,000 ft} \quad \text{(H)}$$

introduces an error of less than 0. of 1 per cent.

(3) The formula

$$C = \frac{\cdots}{\log(2a-1)}\ \text{microfarads per 1,000,000 ft.} \quad \text{(G)}$$

is much less accurate than formula (H), and should, therefore, not be used.

(4) The distribution of charge on either of two parallel equal wires may be represented by an ellipse constructed in the manner shown in Fig. 5 ... The density of charge may be calculated by using the formula

$$\sigma = \cdots \quad \text{(J)}$$

This equation is in electrostatic c.g.s. units.

(5) A considerable portion of the tables of capacity and of charging current printed in the July, 1909, number, and in [illegible] numbers, [illegible] Review, is seriously in error, due to the use in computing them of an approximate formula. The top line of Table II of capacities is displaced one number to the right, and the first three values given are slightly smaller than those which would be computed from [illegible]

THE ELECTRICAL EQUIPMENT OF AN AIRSHIP.

By Frank B. Rae, Jr.

Equipping an airship with a complete lighting system, telephone system and wireless outfit is not an everyday affair with the average electrical man, so perhaps a description of the plant which has just been put aboard the Wellman-Vaniman transatlantic dirigible *America* will prove sufficiently unusual to be interesting.

The *America* was briefly described in these pages Sept. 8, page 559, in connection with an article on the wireless system used. She is 228 feet long, has a lifting power of 2400 pounds, carries 1800 gallons of gasoline, is propelled by two gasoline motors of 80 hp each, and on her attempt to cross the Atlantic Ocean will be manned by a crew of six. The details of her construction were worked out by Mr. L. T. Vaniman, who was associated with Mr. Walter Wellman in his attempts to reach the North Pole by airship from Spitzbergen in the summer of 1909. The electrical equipment, however, was designed and installed by Mr. B. R. Whelan, of the Buckeye Electric Company, assisted by Mr. J. R. Irwin, of the Marconi Wireless Telegraph Company. The difficulties they had to overcome were many, for transatlantic airship construction has not reached a point where methods and materials are standardized, and each problem had to be solved as met.

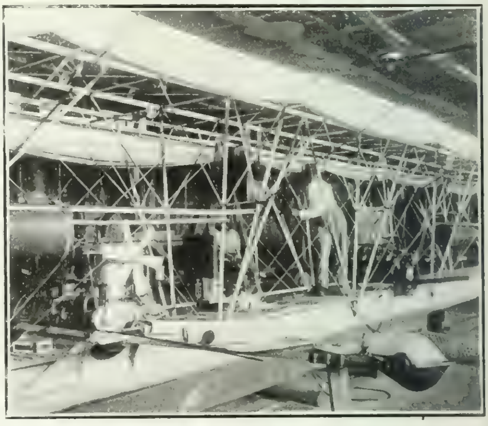
The equipment consists of a ¼-kw, shunt-wound, 10-amp., direct-current Hawthorne generator of 1500 r.p.m.; a 12-cell storage battery; a three-station automatic telephone set; a special Marconi wireless outfit, having a range of about seventy-five miles, and eight 20-volt, 25-watt tungsten lamps equipped with Holophane steel reflectors. The conductors used were of special make on account of the necessity for extra-strong insulation.

The two main difficulties in designing the installation were the necessity for perfect insulation and flexibility of the generator. The insulation problem arose from the fact that the steel frame or nacelle of the ship serves as the aerial of the wireless station. The other difficulty was caused by the necessity of providing against the stoppage of any one or two of the three engines, in which event the generator would have to be moved and connected to a live engine. To procure adequate insulation, a special conductor was specified, consisting of No. 8 gage stranded copper covered with a fine asbestos shield and immersed in rubber solidified to a coating of ⅛ in. thickness. This was then spun with jute to give tensile strength and the strands woven, encased in fabric and treated to fireproof solution. On puncture test this insulation withstood 26,000 volts between terminals. The flexibility of the generator entailed the building of three frames, one at each engine, and providing three sets of pulleys and belts to secure the proper speed at each engine. To devise adequate circuits to take care of this portable feature, multiple cable was run from the forward to the after engine and a double-throw switch installed so as to open this multiple at such times as the generator is being operated for reverse position, thus avoiding all chance of grounding on the nacelle.

The Marconi apparatus is operated in multiple with the lamps, and the fluctuation, which is comparatively slight owing to the small power, 250 watts, is taken care of by the use of extra-heavy copper. The circuit is so devised that, should the battery fail, both the wireless apparatus and the lamps can be operated from the generator direct. The main switchboard is located, as may be seen from the picture, midway between the two main engines. In addition to the switchboard instruments, however, the wireless operator is supplied with special instruments to note his discharge and the generator will of course be run only upon his instructions. The wireless station is located in the lifeboat, which will be swung under the nacelle of the airship, where it will be away from the noise of the motors. The connections between the nacelle and the lifeboat are centered in a master plug which can be broken in an emergency, thus safely and quickly severing all electrical connections.

The picture here reproduced shows Mr. J. R. Irwin, the wireless operator and electrician of the expedition, standing at about the middle of the nacelle. In the foreground is one of the shafts for driving the helices or propellers. The nearest engine is of 80 hp. Farther along the car is the service engine of 10 hp which will operate an air pump to refill the bag as the gas escapes, thus keeping the balloon from becoming deflated and losing rigidity. The service engine also operates winches for handling material between the lifeboat and the nacelle, and may further be used to drive the generator if necessary. Directly beside the service engine is the hatchway through the steel tank which lets down to the lifeboat in which are the storage batteries and wireless apparatus. Beside this hatch is the switchboard and farther back is the second engine.

The lighting equipment consists of eight 20-volt, 25-watt tungsten lamps in Holophane steel reflectors located in the nacelle over the working platform. A lamp is provided for the binnacle, one for log, one over each of the three engines, two at the observation cabin in the stern of the ship, and one in the lifeboat for the wireless operator. The lamps are burned at somewhat more than their rated voltage, as the transatlantic trip will be short and it is desired to secure exceptionally brilliant illumination for short periods. On this account also Holophane reflectors were employed to increase the efficiency to the maximum.



Electrical Equipment of the Dirigible, America.

As may well be imagined, the wiring of the *America* was a most careful piece of work, every foot of conductor, every joint and every connection being tested independently by both of the engineers in charge. The cable, where exposed, is carried in porcelain cleats screwed to large wooden blocks which are lashed to the nacelle with insulated cordage. Where it is necessary to run along the framework or through the steel tank covers, the cable is encased first in flexible duct and then in ⅛-in. fiber tubing. The switchboard also is well insulated from the frame of the ship by wood rubber and heavy fiber between each connection and the steel tubing to which it was lashed. If the *America* fails to reach Europe it will not be from any fault of her electrical equipment.

FALL CONVENTION OF NEW ENGLAND SECTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Abstracts of Papers and Discussions.

The fall convention of the New England Section of the National Electric Light Association was held at the Griswold Hotel, Eastern Point, New London, Conn., on Sept. 13 and 14. About 250 persons were in attendance, including ladies and listinguished guests, and the meeting was marked by an informality characteristic of a large house party, which contributed much to the personal enjoyment of those present. President and Mrs. Alex. J. Campbell, of New London, were ntiring in hospitality, and the work of Messrs. C. H. Hodskinson, Boston, master of transportation; Wm. M. Lewis, Rockville; F. S. Price, Boston, and E. R. Davenport, Providence, members of the committee on entertainment, was responsible for a large share of the enjoyable time which everyone reported. Secretary L. D. Gibbs, Boston, officiated in nimitable fashion at various social events, and the interest of he business sessions was enhanced by the presence of President W. W. Freeman and Executive Secretary T. Commerford Martin of the National organization.

Most of the party reached New London on the afternoon of he twelfth, delegations from Providence, Boston and points north arriving on three special parlor cars attached to the o'clock New York express from Boston. President Campbell, of the New England Section, met the train at New London, nd the party disembarked waving about a hundred New England Section pennants by way of salutation. The usual teamer trip was then made to Eastern Point, and the evening as spent in delightful interchange of greetings, informal echnical discussions, walks on the moonlit shore and dancing. The hotel had been specially kept open for the convention, and he number of other guests was so small as to afford the naximum degree of pleasure from the gathering. The usual eception was omitted.

Registration of members and guests began on Tuesday norning, and before the opening of the business session the ntire party participated in a flag raising on the lawn of the otel, the halliards being arranged so that each one in a large emicircle could help in pulling the Stars and Stripes into lace, the proceedings being much enlivened by the performnces of an amateur drum and fife corps equipped with toy orns, peaked paper caps and miniature drums. As the flag as raised it was followed by a large blue and white New England Section flag 20 ft. long and 10 ft. and 5 ft. wide, a uplicate being flown over the hotel at the same time.

The business session was called to order by President Campbell, who welcomed the party in the most cordial fashion, and urged that the discussions of the papers be of the freest character. Secretary Gibbs then read his report, pointing out the value to the section of its permanent headquarters and assistant secretary in Boston, at the Edison Building, and urging the membership to make the fullest use of the facilities there offered. At the time of the first annual meeting of the section in March, 1910 there were 564 members, and on Sept. 1 there were 688, showing a gain of 68 class B members and 7 in class E.

President W. W. Freeman, of the N. E. L. A., was then introduced. After expressing his pleasure at the welcome extended, he stated that the question of organization is being given special consideration in the association at the present time. He urged the desirability of securing more company memberships, since at present there are less than half of all the companies in the country on the rolls of the association, although from 90 per cent to 95 per cent of the capital invested in the industry is in the organization. Mr. Freeman said that the influence of the organization ought to be larger in the industry and throughout the country as a whole, and the three objects of education, inspiration and protection can better be attained if the organization of the association is comprehensive throughout the United States. He then referred to the plan to have standing committees cover the entire field of central-station work so that loose ends may be taken up and gaps in the educational work of the organization avoided. Inspiration plainly comes from combined efforts, while in regard to protection, the parent organization really stands in the relationship of the big brother to the geographical and company sections. It is desirable to reach the point where the national organization will wield an influence throughout the country capable of affording ample protection to all the member companies in the vicissitudes of their careers. Mr. Freeman then pointed out the advantage of handling many local matters by company sections, and concluded by congratulating the New England Section upon its rapidity of growth and its pioneer work in showing that loss of identity does not accompany membership in the national body.

President Campbell then delivered his address, which emphasized the responsibility of the New England Section in the face of its growth, touched upon the benefits of the permanent headquarters, and outlined the plan for the interchange of opinions and experiences through the headquarters as a clearing house. It appeared to be the better plan to maintain headquarters in a single place rather than to attempt to locate quarters wherever the presidency of the section happened to be each year. Brief reference was made to the forthcoming establishment of the Thomas Davenport memorial by the Vermont Electrical Association at Brandon, Vt., on Sept. 28 and 29. President Campbell referred briefly to the project to erect an engineering club building in Boston and the desirability of favorable consideration of the matter, and closed with a short discussion of the importance of the topic of central-station rates at the present time. He emphasized the value of campaign to increase and diversify loads upon revenue, and pointed out the tendency of State commissions to adopt restrictive decisions in rate cases, so that it is most important for all companies to be able to defend their rates before these tribunals. The introduction of the tungsten lamp has presented many important questions for solution, but perhaps the subject of rates is the most vital confronting the industry at present. Whatever the New England Section does in the matter of rates will be noted with interest by the commissions. In conclusion Mr. Campbell spoke of the reappearance of flat rates for certain lines of work, and pointed out that previous ideas on the subject are in a state of flux.

A paper was then read, the writer being Mr. Howard Corning, treasurer of the Bangor Railway & Electric Company, on "The Advantages of a Uniform System of Rate-Making." Following this was a discussion by Messrs. A. B. Lisle, W. H. Blood, Jr., W. L. Mulligan and R. W. Rollins. Abstracts of the papers and discussions are printed in another column.

The committee on the Thomas Davenport celebration then made its report, and the section voted to accept it. A tablet to the memory of the inventor who produced the first successful electric motor, in the year 1834, will be unveiled at Brandon, Vt., on Sept. 28. The committee was composed of Messrs. E. D. Blackwell, Brandon, Vt.; W. G. Meloon, Dover, N. H., and F. D. Gordon, Lewiston, Me.

The committee on statistics and information, Mr. R. W. Rollins chairman, reported that success had attended the effort to establish a clearing house of information at the Boston headquarters of the section. Questions of contracts, prices, life of lamps, heating problems and construction matters have already formed a considerable part of the inquiries and a body of data of no little value is being accumulated.

Telegrams of greeting were received from Past-president James E. Davidson, of Portland, Ore., and C. H. Hodskinson, Boston.

Mr. T. Commerford Martin, executive secretary of the association, was then called upon. Mr. Martin pointed out the remarkable recent growth of the national body, which had 3200 members only a year ago, but which now has 5792 enrolments. It appears neither wise nor safe to print less than 7000 sets of the *Proceedings* this year. One of the most important matters considered by the association this year has been a classifica-

tion of accounts, one copy of which has been sent to each company in the organization. There has been much valuable interchange of information among the companies that have adopted this classification. Mr. Martin said that each president had brought some special idea to the association, and that the present executive had been particularly happy in co-ordinating and correlating the committee work, avoiding sporadic and spasmodic efforts and the promotion of hobbies. He touched upon the growth of company sections, noting an attendance of over 400 at a recent meeting in Brooklyn within the confines of a single company. Mr. Martin emphasized the fact that no attempt has been made by the association to force additions to its membership. Nebraska and Georgia have been welcomed into the ranks within the past three months. Speaking of the problem of admitting representatives of municipal plants to membership, Mr. Martin said that the association had taken a firm stand against this policy on account of its conviction that the municipalization of public service is attended by disadvantages, wastes and ills which render private enterprise the proper custodian of the electric lighting and power industry. Concluding he said that the smaller companies are the ones which naturally benefit most from membership in the association, and that all should be brought into the organization for the good of the art.

On Tuesday afternoon the entire party enjoyed a steamer trip to Fisher's Island N. Y., where Fort Wright was visited through the courtesy of the commanding officer, Lieut.-Col W. F. Rafferty, U. S. A. The party were given an opportunity to inspect in detail the installation and operation of 10-in. and 12-in. disappearing rifled guns of the most modern type; the barracks were visited and a competitive mortar battery drill was given for the benefit of the visitors. The hospitalities were concluded by a concert on the parade ground in front of Officers' Row, the music being rendered by the Eleventh Artillery Band, one of the most noted organizations of its kind in the service.

A banquet was held at the Griswold in the evening, and at its conclusion President Freeman, of the national association, was called upon for a word of greeting, after which Secretary L. D. Gibbs gave a most interesting lantern-slide talk upon "Illuminated Advertising," a résumé of which is given elsewhere in this issue.

On Wednesday morning the ladies of the party were given a delightful automobile ride in the vicinity of New London, including a visit to the Plant estate and the Pequot section of the city.

The business session Wednesday morning opened with a discussion of Secretary Gibbs' paper on illuminated advertising, in which Messrs. H. T. Sands, F. B. Ras, J. J. Dawes, E. R. Davenport, G. W. Teffeau, F. W. Prince, C. R. Hayes, J. E. Spike and W. H. Blood, Jr., participated. Votes of thanks were then passed to Lieut.-Col. Rafferty, U. S. A., and various gentlemen in New London for hospitalities rendered the convention. President W. H. Blood, Jr., of the Electric Vehicle Association of America, then outlined the purposes and possibilities of that organization.

A paper was then read by Mr. J. A. Hunnewell, general superintendent Lowell (Mass.) Electric Light Corporation, on "Special Decorative Street Lighting." Following this was a long discussion in which Messrs. Sands, A. T. Holbrook, J. J. Dawes, C. R. Hayes, A. B. Lisle, Bryan Ray, E. P. Roweil, Rollins, E. J. Richards, Lewis Schwabe, Addis, Townsend and Blood took part. A résumé of the paper and discussion is given in another column. The final paper of the convention was by Mr. Levin J. Chase, manager of the Concord (N. H.) Electric Company, his topic being "Opportunities." There was no discussion, and the convention adjourned at noon.

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UNIFORM SYSTEM OF RATE MAKING.

In opening his paper on "The Advantages of a Uniform System of Rate-Making" Mr. Howard Corning, treasurer Bangor Railway & Electric Company, emphasized the increasing importance of the subject of rates in the face of enlarged demands for electric service by the public and stated that bene- [illegible] the public at [illegible] the attitude of central-station managers and the basis upon which charges for electricity are made. When electricity was first introduced the method of charging was of the simplest, and everyone understood it, and to-day a company starting in a small town will make all its rates of the simplest character. In large communities the variety of service offered as well as the variety of the demand upon the plant require a more complex system of charging.

Mr. Corning stated that simplicity of rates is one of the most valuable elements of any system, but that it can be carried to such an extent that it will hinder the growth of the company and work injustice to customers. It was his opinion that rates will be multiplied as business grows, provided always there is some broad ground on which such differences in rates can be founded. Out of fifty replies to recent inquiries, about twenty admitted the maintenance of special rates, and practically all were willing to abandon them. It is probable that some of these so-called special rates were in reality founded on some broad difference which could be satisfactorily explained.

It would appear from this that it would not be a difficult matter to find some basis on which a general agreement on rates could be founded. The Bangor company feels that special rates which cannot be justified by varying conditions are not good policy for any public-service company. It may be that two or three divisions of rates may be sufficient, inasmuch as the classification will be very general, but under any number of heads into which rates are divided there ought to be at all times special considerations which perhaps it is best to leave to individual companies in order that they may meet local conditions. There are marked differences between steam-plant and hydro-electric-plant conditions, to say nothing of the wide variations in the cost of coal between inland and seaport towns. Again, a central station may be a few miles from the population served instead of in the center of the community, necessitating the maintenance of a high-tension transmission line with transformer and line losses. There is also a wide variation in the franchises under which different companies operate, not only as between cities and towns, but as between states. Again, there are some companies which serve a very much larger population in the summer than in winter, the result of which is a very much higher rate than if there were a normal ratio between summer and winter business. These points indicate the objections which occur against any attempt on the part of the National Electric Light Association to bring about a general agreement of rates. It is desirable, however, to take up the questions of broad classifications of service, and the best principles upon which charges for such service can be made. Mr. Corning closed by saying that he had been unable to find any discussion of classification which would apply to a territory such as one group of states or a single state. He felt that if the New England Section could arrive at some classification of service on which the member companies could make charges according to the demand and their ability to serve it would be a great benefit in helping to solve the rate problem.

DISCUSSION.

Mr. A. B. Lisle, general manager Narragansett Electric Lighting Company, Providence, R. I., said that he knew of no other form of public service in which the rate question is so pressing as in central-station work. The water companies recognize the readiness-to-serve charge by a fixed rate per faucet plus an additional charge for extra faucets. The telephone companies have found the necessity of a moderate initial charge plus a message rate. Gas companies are not involved in this question to any extent on account of their ability to store their product. Mr. Lisle considered it impossible to make a detailed plan for a uniform system of charging, but any approximation to it is greatly to be desired in its effect on the standing of a company in its community. It is out of the question to attempt to make a system of rates which will apply to the small and large city equally. Simplicity of rates is the most desirable consideration. It is hard to make rates which are equally fair to the long-hour and the short-hour user. It may be well to graduate rates according to the size of the towns, but it

is most important to avoid multiplication of charges and complexity in their arrangement.

Mr. W. H. Blood, Jr., of Stone & Webster, Boston, pointed out the permanence of rate problems. He felt that actual rates should not be discussed so much as the underlying principles of charging. The great trouble is that the central-station man thinks he is selling a service, while the public thinks it is buying a commodity. These two ideas must be harmonized, and an aid to that result will be the improvement in the load factor. The electric vehicle, ice-making, water heating by the Therol system, etc., should help in the matter. The three fundamental objects to be sought in rate-making should be simplicity, nondiscrimination and profit. Mr. Blood did not feel that there is much prospect of ever making the demand system plain to the public, although companies must make some kind of a readiness-to-serve charge and then institute a low kw-hour rate since the public is familiar with all purchases on a commodity basis. Discounts may be based on quantity used. Uniformity in the system of charging is more important than a slight amount of discrimination.

In discussing the general subject of rates Mr. R. W. Rollins, general manager of the Hartford Electric Light Company, submitted an interesting by-product in the form of a contributed paper upon the question of a reasonable return for public utilities. Mr. Rollins said that it is probable that at the next session of the Connecticut Legislature a public-utilities commission will be established and the consideration of a proper law in this connection must include some very important facts not ordinarily given sufficient publicity. Interest on government bonds varies from 2 per cent to 4 per cent according to their life and applications. Mortgages on such properties as electric light and railway companies vary from 4 per cent to 6 per cent, and of late the best classes are offered freely at 5 per cent. In order to attract investment in electric light and power companies the capitalist must be offered some advantages over and above what he can obtain with good security without any business risk for money invested in such corporations at about 5 per cent, otherwise he will simply buy the bond instead of taking his chances in a somewhat precarious and variable business. A well-managed electric company which tries to supply the public at the lowest possible price has to bear in mind three sources of expense: First, it must be remembered that its machinery, owing to the fluctuations in its value from excessive wear and tear and from improvements, depreciates steadily. Second, changes in income growing out of improvements in lamps have steadily cut down income on the meter basis. Third, it is necessary to employ very high-priced skill in management, a class of labor which is dearer than any similar class used by corporations, and which arises from the risks of the business and the necessity of a good deal of scientific knowledge which can only be acquired at high-priced schools.

Such a company, if faithfully serving its community at the lowest prices, ought to earn at least 5 per cent over and above the interest on the capital invested at 5 per cent. Three per cent of the capital invested is needed for the maintenance of the company in an up-to-date condition, and this allowance is made in Hartford and was reported to the government in relation to the corporation tax. In a growing town service rendered necessitates a steady increase of capital for supplying new machinery and new means of furnishing current. In Hartford the street commission has decided that about two miles of underground construction should be built yearly. This method of distribution does not increase the revenue of the company and should be paid out of earnings, otherwise there will be a steady and large depreciation of assets, as the old lines must all be taken down. As to other developments for an increased business it is a question whether new capital should steadily be added on which earnings must be made in order to obtain cash, or whether these should be obtained from earnings on the present capital, and this ought to be considered from a local point of view in every case.

Closing, Mr. Rollins said that the foregoing figures are not in any way adapted to propositions where money has been wasted or where stock has been watered in order to obtain unfair returns, but are based on an actual outlay and actual returns as experienced in Hartford.

Mr. W. L. Mulligan, Springfield, Mass., cited the difficulties encountered in quoting a rate to the owner of similar stores in a considerable number of cities in New England. A study of the rates in force in twenty-nine such stores owned by the same organization showed that it was impossible to find any two of the stores where the rates were the same. The need of investigating this topic was apparent. It was later voted to have the president appoint a committee on rates to report at the next convention in March, 1911.

ILLUMINATED ADVERTISING.

Mr. L. D. Gibbs, superintendent of advertising, Edison Electric Illuminating Company, Boston, in his paper with the above title stated that it was needless to argue in favor of electric signs, but he called the attention of the audience to the possibilities of stereopticon lectures as an aid to public-utility companies in educating the public regarding their work. About 100 lantern slides were shown and the author's discussion of the subject took the form of a lecture on a lecture, a typical talk to a popular organization being outlined. Mr. Gibbs stated that the matter of creating a better understanding of corporate problems and methods is extremely important. Every locality has numerous clubs, business men's, clubwomen's organizations, improvement associations and church societies which always have more or less difficulty in filling out their programs for the winter's work. Lectures in which the operation of a public utility is described are always popular, and in the past two years a noteworthy campaign in this direction has been made in Boston, not only by the Edison company, but by the Boston Elevated Railway Company. The growth of the company, what is being done for the general welfare of the public, fundamental principles of electrical applications, early apparatus contrasted with new, latest types of current-consuming devices, and particularly domestic applications, described with lantern slides leave the audience in a very happy frame of mind and are of great value to the company's good will. After the framework has been built and the illustrations secured, from all sources the following subjects can easily be handled, practically with one set of slides: "The History of Electric Lighting"; "The Past, Present and Future of Electricity"; "Electricity and the Servant Problem"; "Store, Window and Sign Lighting": "Electricity the Physician of the Future"; "The Conservation of Our National Resources"; "The Home Electrical"; "Factory Lighting and Power"; "How a Raindrop Makes an Electric Light," etc.

In reviewing a typical lecture Mr. Gibbs exhibited a series of slides showing the usefulness of electricity in the home from early morning to midnight, including breakfast-table cooking, power applications, bell-ringing, sewing-machine and many other services, concluding with the application of the electric heating pad after the post-theatrical rarebit. In conclusion the author discussed electrical display advertising with numerous slides as a text, pointing out that originality and suggestion are the vital considerations. This type of advertising does not have to be purchased by the reader, and its cost is a minimum considering the "circulation."

DISCUSSION.

Mr. H. T. Sands Tenney Companies, Boston, said that electric sign and window advertising reaches a larger number of people than newspaper publicity. Mr. F. B. Rae, New York, called attention to the anti-sign campaign now in progress in New York City, and Mr. F. C. Bates, New York, emphasized the need of using good taste in all sign work. Mr. J. J. Dawes, Pawtucket, voiced the need of diplomacy in pushing sign installations on account of the possible hostility of the newspapers. Mr. E. R. Davenport, Providence, R. I., reviewed recent experiences in which the advertising of certain types of liquid refreshments had aroused so much hostility on the part of the public that the city authorities had passed severe ordinances greatly restricting the opportunity to install and maintain even the most unobjectionable signs. The Providence law now prohibits the erection of any sign advertising a product not made or sold in the particular building where it is displayed. Mr. G. W.

Teffeau, Rockville, Conn., stated that a similar stringency exists in Washington, D. C., and Mr. F. W. Prince, Hartford Electric Light Company, cited agitation by a local art society which had greatly injured the electric sign business in the city. Mr. F. B. Rae New York, raised the question of refusing to supply energy to signs advertising liquors, following the practice of certain magazines which refuse objectionable business. Mr. C. R. Hayes, Fitchburg, doubted if it would be practicable to discriminate in this way, and Messrs, H. T. Sands and E. R. Davenport agreed that it would be difficult formally to refuse to give this service, although it can be avoided in solicitation, according to Mr. J. E. Spike, Cambridge.

SPECIAL DECORATIVE STREET LIGHTING.

In introducing his paper entitled "Notes on Special Decorative Street Lighting" Mr. J. A. Hunnewell, Lowell Electric Light Corporation, contended that the rush to special or decorative street lighting is largely an hysteria resulting from too long suppression of efficient, complete and satisfactory street illumination. The possibilities of rearrangement are most attractive. Properly lighted streets are the best customer on the company's lines, and the service should be fostered more faithfully than that of the largest store. Too often municipalities have been unwilling to pay for the latest or best system or else the personal equation of the heavy taxpayer has played too large a part in the location of the lamps. The burden of responsibility in many cases lies with the central station, which may have at times failed to recommend the efficient system needed. Ninety per cent of the citizens see the electric light company in its street illumination. The best lighted street carries the greatest crowd, increased lighting increases traffic, and where traffic is densest the property value is highest.

The improvement will be greatest in the business section and the important question is whether the city or the merchants will pay for it. Over 75 per cent of such improved lighting in all Western cities has been paid for by the merchants themselves. Whether the merchants or the city pay for the improved lighting the people must be informed upon the subject. The newspapers will aid with descriptive accounts of what other cities are doing and point to local possibilities. These accounts may be accompanied by effective advertising in local papers by the central station, outlining tentative plans for an installation and benefits to be derived. It will not be difficult to find some party among the merchants or in the city government that will gladly carry the attack along, and a judicious amount of personal solicitation by the company among property owners and merchants will bring up the rear. At the proper time the proposed system can be installed along some typical block or street that the contrast and improvement may be seen. It may pay to provide a band concert the night the trial installation is lighted. The best time to broach the matter is when the street-lighting contract is about to be renewed.

Mr. Hunnewell advocated eliminating the spectacular and in cities with narrow, crooked or shaded streets using tungsten instead of arc lamps. Arc lamps do not lend themselves to strictly decorative lighting, but produce good illuminating results and minimize the number of poles and fixtures on the streets. If economy is imperative, trolley poles may be utilized. It is imperative that the system shall consist of a continuous line of light. Ornamental standards should be selected that carry the lamps in a pendent position to avoid shadows. The paper concluded with a terse description of the ornamental street lighting now in use in some fifty-four cities, mostly of the Middle West, including a tabulation of its cost, origination, principal dimensions, hours of burning, etc. The arch and festoon system, Daniels boulevard system, tungsten cluster and arc methods of ornamental lighting were reviewed, and representative installations illustrated by photographs. The author stated that the best decorative street lighting he had seen is at Indianapolis, and the details of the service were given, especial emphasis being laid upon the use of pressed-steel posts supporting five 100-watt tungstens in opalescent diffusing globes, with provision for controlling each block by switches and for operating one lamp only per cluster late at night.

DISCUSSION.

Mr. H T. Sands, Boston, touched upon the need of more civic pride in securing proper street lighting and favored the ornamental post with tungsten lamps for the service on the ground of its dignity. Luminous arcs do not appear desirable for New England ornamental service. He considered the Indianapolis plan expensive. At Mishawaka, Ind., the cost is much less, the total investment being from $1.30 to $1.50 per duct foot. There the merchants clubbed together and presented the city with the equipment and the latter maintains the service. The Indianapolis merchants pay about $1.05 per front foot per year. Ornamental brackets holding four lamps and 5 ft. long can be used on trolley poles at a cost of about $28 each.

Mr. A. T. Holbrook, New York, said that the Indianapolis work was marked out block by block. A prominent merchant in each block was furnished with a petition to the lighting company asking the latter to furnish a given number of lamps and brackets at $1.05 per front foot per year. This rate pays for the fixtures in three years, and nets a rate of about 5 cents per kw-hour for energy used. Practically the entire business section of the city is thus equipped. A somewhat similar plan is being tried in Altoona, the rate being $1.44 per front foot per year. Five blocks have now been equipped.

Mr. J. J. Dawes, Woonsocket, R. I., thought that merchants in New England would not be willing to pay for special street lighting on the front-foot basis. He felt that special street illumination might conflict with sign lighting. Mr. C. R. Hayes, Fitchburg, Mass., stated that store-window lighting on flat-rate, long-hour lines tended to improve street illumination as a whole. Its logical sequence is sign work, followed by additional street service. Mr. A. B. Lisle, Providence, cited the use of 10-amp magnetite arc lamps for temporary service in place of flame lamps, without requiring circuit changes of a costly character. Mr. H. T. Sands, Boston, said that there is no harm done if extra street lighting does curtail sign lighting The sale of energy is the desideratum. Messrs. Sands and Holbrook stated that neither sign nor window lighting in Indianapolis had interfered with the other. Mr. F. B. Rae, New York, said that as an extreme case there was practically no window lighting in St. Louis on account of the powerful illumination of the streets. Mr. E. P. Rowell, Plymouth, Mass., corroborated this, and pointed out instances of how difficult it is to get farmers to pay for extra street lighting in their village center. Mr. E. J. Richards, Gardner, Mass.; Mr. W. M. Lewis, Rockville, Conn.; Mr. D. F. Townsend, Woonsocket, and Mr. Schwabe, of Windsor Locks, cited instances of the tungsten lamp replacing arcs with resulting better street lighting. The inhabitants of small towns often object to the removal of arc lamps on account of their "urban" effect, but usually a demonstration circuit of tungstens converts the most sceptical. In Windsor Locks four 60-cp tungsten lamps replaced each arc in two blocks with an increase of 9 per cent in street illumination and a reduction of 30 per cent in energy supplied. Mr. Addis, Brattleboro, said that there is danger of merchants in New England economizing too much on inside lighting if the front-foot basis of charging is proposed for extra street illumination. The discussion was closed by Mr. W. H. Blood, Jr., Boston, who condemned electric sign lighting as a necessary evil. He said that, in his opinion, sign lighting is on the wane; that the billboard crusade logically includes the electric sign, and that it is a passing, objectionable business. It would pay central-station managers to devote more attention to the great variations in the amount of energy used in street illumination per square foot of highway area. A recent study showed that there were variations of 500 per cent in this work. He advocated building up the load by other means, and felt that many other lines of expansion are better worth following in the way of energy-consuming devices.

President Campbell commented on the importance of the spirit of civic improvement and the desirability of the section's acting in accord with it, and called upon Mr. L. J. Chase, manager of the Concord (N. H.) Electric Company, to read the final paper of the convention

PUBLIC POLICY.

In his paper, entitled "Opportunities," Mr. Chase discussed in inimitable fashion his experience as a central-station manager after about twenty years in an entirely different business and without previous technical training. He described his efforts to remove the natural prejudice which the public is prone to cherish against a public-service corporation, and made a powerful plea for liberal conceptions in dealing with the public, condemning in the most positive manner adherence to hidebound traditions, rules, precedents and systems, many of which were created to meet conditions that no longer exist. Among the practices criticised were the use of technical terms in talking with customers, holding aloof from ordinary commercial enterprises, hesitation to break away from routine methods and lose a dollar to get two back, disputing with customers over matters of trifling importance and making trivial charges for trivial services. The paper outlined the efforts of the writer to align the company with the progressive elements of the community and the enforcement of patience, courtesy and dignity between employees and in public dealings. Personal relations with customers were fostered, and their importance was reviewed, particularly with reference to the conversion of hostile critics into stanch friends. The importance of adapting one's attitude to the customer instead of treating all men alike was touched upon, good relations with the press and city officials were urged, and the paper closed with an eloquent plea for mutual helpfulness and confidence between employer and employee and the placing of the business upon the highest plane compatible with a sound commercial policy. The paper formed a fitting climax to the convention, illustrating in a marked degree the power of personality in the successful administration of central-station service.

CONVENTION OF THE PENNSYLVANIA ELECTRIC ASSOCIATION.

Abstracts of Papers and Discussions Presented at the Meeting.

The third annual convention of the Pennsylvania Electric Association was held at the Glen Summit Springs Hotel, Glen Summit Springs, Pa., on Sept. 14, 15 and 16. The convention was the most successful ever held by the organization and in point of attendance was said to be the largest given by any geographical section of the National Electric Light Association. The sessions were held in the chapel located in the park at the rear of the hotel, and were very well attended. On the evening prior to the actual work of the convention a reception was held in the parlors of the hotel.

PRESIDENT'S ADDRESS.

In his address at the opening session, the president, Mr. E. L. Smith, of Towanda, briefly related the short history of the association, stating that at its organization three years ago there were one dozen members, while the membership at the present time, including all classes, totals 464. He outlined the progress made in the art during that time and called attention to the present financial stability of the industry. The necessity of a new-business department in even small stations was emphasized, and Mr. Smith dwelt on the cordial relations existing between the national body and the state organization, giving in substance the policy of the national body toward the geographical sections, and the particular fitness of each to carry on certain specific branches of work for the furtherance of the industry. The Question Box, he felt, was of inestimable value and he advised all [illegible] uniform methods of accounting as outlined in the report of the national committee having that work in charge. In concluding his address he recommended the appointment of two additional standing committees [illegible] on lamps. The organization [illegible] mittees on overhead-line constr[illegible] in connection with central stations. The recommendations of the president were later carried into effect by vote of the association.

The report of the executive committee and that of the secretary and treasurer were followed by the presentation of the report of the committee on overhead-line construction. This followed along the same lines as last year's report, with the addition of a criticism of the report of the committee on the preservation of wooden poles and cross-arms and a general report on the joint occupancy of pole lines by telephone and electric light companies based on Mr. Paul Spencer's paper read at the 1908 convention of the N. E. L. A. at Chicago. The report was divided into five sections, as follows: (1) Criticism of the report of the national committee on overhead-line construction; (2) report on the specifications for line construction on poles jointly used by electric light and telephone companies; (3) criticism of the national report on the preservative treatment of poles and cross-arms; (4) the sag and span question, by Messrs. Wendle and Robertson; (5) specifications for insulating friction tape.

OVERHEAD LINE CONSTRUCTION.

While studying the report to the national organization, the committee was greatly impressed with the necessity of keen criticism from the men actually familiar with the details of secondary construction, the numerous minor faults and troubles experienced in the operation of a secondary system of distribution, and the methods employed in overcoming these troubles. This clearly shows that the line foremen and trouble finders must be consulted before the report can be of any value, as it covers a section of the work which has heretofore been left almost entirely to such men, which may account for the lack of uniformity in construction methods. The state committee brought out the points which seemed of greatest importance to it, adhering to the various divisions followed in the national report. Under "Poles and Pole Setting" the committee has nothing new to offer except the suggestions that where lines are built on private rights-of-way or in the rear of houses, etc., the use of smaller poles than are specified for ordinary line construction is desirable. On the stringing of secondary wires nothing of importance is recommended; but in the installation of transformers, fuse blocks, etc., the committee has some recommendations of moment. The Pennsylvania state committee feels that under certain conditions the grouping of transformers on a secondary system is desirable for lighting residential districts, and suggests the following: Transformers should be fused on both the primary and secondary sides. The transformers should be fed from a separate primary loop, which can be disconnected either by a switch or a fuse so as to permit the re-fusing of the transformers should they fail, due to a heavy circuit. No heavy loads should be connected, such as churches, halls, etc., as the connecting of such loads will account for many of the troubles formerly experienced by the grouping of transformers. The question is one which will require considerable study by the local engineer, for if load conditions are carefully figured on it is felt that by banking transformers a considerable saving in the transformers connected can be effected. The method suggested for the erection of transformers is in accordance with standard practice. The wiring on transformer poles should be done with a wire not smaller than No. 6 rubber-covered and it is suggested that all primary leads running to transformers should be coiled near the transformer with not less than six turns, each turn having an approximate diameter of from 2.5 in. to 4 in. The advisability of inserting these turns in the primary leads was seriously questioned at the St. Louis convention of the N. E. L. A.

On [illegible] "Wh[illegible]" the committee is a unit in the opinion that it is done to protect from heavy short-circuits rather than overload conditions. It felt that the association should express a decided opinion on the matter in order that manufacturers should be familiar with the conditions under which their transformers will be operated. The committee is of the opinion that the use of lightning arresters is largely one of faith, although no doubt their proper

installation has avoided many accidents. The methods of installation as authorized in the national report are not questioned, except that the committee does not think it advisable to use the grounded neutral of a secondary system for a lightning arrester ground, as it is extremely likely that many lightning discharges would enter buildings, causing considerable damage. The installation of lightning arresters, in the opinion of the committee, depends on local conditions, and the number required is largely a matter of conjecture; the advisability of frequent installations depending on the amount of trouble that has been experienced, which may warrant the outlay of considerable money to afford what may be termed "safe operating conditions."

With reference to the section on "Consumers' Services" the suggestions in the national report are in accordance with the ideas of the state committee except that the latter feels that open cable running, securely fastened on insulated fixtures between the end of the secondary leads of the transformers to an iron pipe extending up the pole 10 ft. from the ground, is not a first-class method and should be avoided, as the saving effected by such an installation is very slight and the method unsafe.

The section of the national report dealing with "Railroad Crossings" is of interest, according to the committee, but has no particular bearing on ordinary line construction methods. The Pennsylvania state committee wishes to go on record as stating that, in its opinion, it is unwise to furnish special construction of any kind over railroads where such lines are for ordinary voltages only, or voltages up to and including 6600-volt systems, including under this heading constant-current series lighting systems.

Regarding the joint use of poles the committee recommends that the joint use of poles be avoided wherever possible and that every company endeavor to maintain a clear right-of-way of its own, making all extensions on its own poles and avoiding the attachment of poles of the other company. This, in the opinion of the committee, will without doubt furnish the most satisfactory operating conditions for both companies. The committee then briefly states a few of the important points brought out, with the recommendation that where joint agreements are found necessary the specifications of the N. E. L. A. be carefully studied. The committee feels that the clause relating to the vertical runs of cables upon poles should be changed to prohibit the running of wires down the pole except when such wires are attached to the ends of the cross-arms, which will place them in such a position as to be entirely removed from possible contact with linemen climbing the pole. Some changes are recommended in the voltages of lines on joint poles as follows: Constant-potential metallic circuits not to exceed 6600 instead of 5000; alternating-current series circuits not to exceed 7500 instead of 5000 as heretofore.

With reference to the report of the committee on the preservative treatment of poles and cross-arms the state committee found this the most difficult to criticise, for the reason that it had been so ably prepared by men who have made a careful study of the subject. The committee concludes that ordinary paint will preserve the life of the timber to a small degree and that brush treatment with a preservative oil is of much greater benefit. It also suggests the advisability of the various companies throughout Pennsylvania considering the matter of treatment of poles having in view the erection of a plant run on a co-operative basis under the supervision of competent men, who will not be bound to any one system or grade of preservative.

In view of the inconsistencies of the present formulas and solutions for sags and spans, investigations were made into the fundamental factors involved in an exact solution of the sag question. Through the courtesy of the Philadelphia Electric Company Mr. W. L. Robertson was enabled to make careful observations and collect data for accurately determining the form of curve assumed by a suspended wire and other fundamental data. These have formed the basis of extended researches and calculations, and while the solution is now in tables and data are in shape for use by the ordinary lineman. While these data seem to upset the practice of many years, they bring up many questions of importance heretofore entirely ignored. The committee then took up the question of spans and sags at crossings and the general conditions of the work at such points imposed on electric light companies by the railroads. It concludes its report with specifications for insulating friction tape for outside work prepared from data furnished by tape manufacturers and also from specifications prepared by the American Telephone & Telegraph Company. The specifications were not printed in time to submit them to the various manufacturers before the convention.

DISCUSSION.

Needless to state, the report elicited a very lengthy discussion. Mr. E. F. McCabe, of Lewistown, questioned the committee on the pin recommended and the climbing space mentioned in the report, and asked if a company would be expected to change its construction every so often to meet the latest specifications.

Mr. G. E. Wendle, of Williamsport, felt that the committee had handled the question of wire crossings over steam-railroad tracks in a kid-glove fashion. The question asked in the report "Are the requirements of the various railroads reasonable?" is only the beginning of the questions which should properly be asked concerning this situation, in his estimation. A more important question is, "Do the requirements laid down for foreign wires crossing railroad tracks require construction which is more rigid than the construction employed by the railroads themselves in carrying their wires over their own rights-of-way?" Mr. Wendle felt that the present requirements were fundamentally based upon an absurd degree of safety and that the answer to the questions must, to a large extent, determine the legal standing of the contentions of the railroad companies to regulate such wire crossings and to insist upon spans, sags, tensions and general pole construction at such points. From an examination of a number of crossings constructed by railroad companies and consisting of their telegraph and telephone lines, he would seriously question the justice of the contention of the railroad companies. As a matter of fact, he said that there was no remote effort on their part to string wires and guy poles to withstand any heavy sleet storm, with the result that every storm means miles of poles and wires down. The demands made by the railroad companies on the various members of the association were, in Mr. Wendle's judgment, grossly unjust and arbitrary and not warranted by the existing construction methods of the roads in their own line work. In view of these conditions the speaker said it was advisable to determine the proper practical system of construction not only for railroad crossings, but for all parts of electric light lines. The courts demand not only good construction in overhead lines, but that it shall be made with the "highest practical degree of care." It, therefore, behooved the association to collect such a mass of data covering actual crossings erected and maintained by railroad companies that from the data thus obtained comparison can be made between the actual construction of the railroads and that demanded by them of the electric light companies. These data should be accompanied by sketches and contain the length of span, size and kind of poles, diameter and length of poles, length and size of cross-arms, methods of fastening cross-arms and wires, size and kind of wires, sag of wires under some determined weather conditions, and if possible should also contain a record of any breakdown of wires or poles. Mr. Wendle suggested that the question of railroad crossings be given over to a committee that could take up the matter with the railroad companies in the state with a view of having the matter permanently settled so that smaller companies may know exactly what construction is desired. The railroads are demanding more and more from member companies obliged to cross their tracks, and it is not expedient for the lighting company to make concessions upon concessions.

On the question of joint-pole construction Mr. Wendle maintained that, as a rule, pole-line agreements have been made

cially where the overhead distribution systems involved are of any considerable extent. As a general proposition Mr. Spencer's specifications (N. E. L. A. paper) form a complete and valuable document, but it was questionable to his thinking whether any small company is able in its distribution system to approach the requirements of the specifications. Much of the trouble is due to the fact that years ago the Bell company selected the upper position for its wires, while of late years the company has placed its wires below those of the lighting company. Where it is possible to reconstruct the entire system of both companies the specifications noted by Mr. Spencer would make a first-class system for joint-pole lines. In his city it is a very difficult matter to get new construction put up in accordance with the requirements of the joint-pole-line specifications without any consideration of existing work, and as the maintenance of the high-grade conditions in the original joint-pole construction is subsequently left in the hands of the linemen, it is almost impossible without excessive cost of inspection to keep the work in first-class condition and free from interference. The only way to keep up the standards of construction is by inspections thoroughly made and entered into suitable records. In Williamsport a proposition has been made to the Bell company whereby systematic inspections of all places where lines of both companies approach each other will be made by both companies, and where the lines are within less than the minimum distance agreed upon note will be made of such points in the records and whichever company is at fault must at its own expense remove the wire or wires. Wiremen guilty of infraction of orders with reference to this point will be dismissed, and it is hoped by such vigorous action that the sharp practice of some linemen will be eliminated. Mr. Wendle does not believe that any low-tension or high-tension wires should be run down a telephone pole in the open manner provided in the standard specifications of the N. E. L. A. All connections of electric light or telephone wires which are run vertically down a pole should, in his judgment, be carried through conduits of solid insulating material exclusively. To protect against accidental contacts with grounded messenger cables or other grounded telephone cables where these are below lighting wires, Mr. Wendle suggested that, in addition to the cross-arm provided for in the standard specifications, a suitable board or boxing should be secured to the cross-arm immediately above the messenger cable so that a lineman could not touch any portion of his body against either the messenger cable or aerial cable and at the same time touch one of the electric light wires above or below such telephone cable.

With reference to the clearances, sags, spans, etc., applying to wire crossings and proximities between the various independent overhead systems, Mr. Wendle pointed out that oftentimes it was impossible or inexpedient to make joint agreements. Where there are many competing companies in a town each with its pole lines, the question of proper clearances and construction is practically ignored. In view of the possible danger to life and property by reason of accidental contact between various systems of wires, the speaker asked if it were not advisable to consider carefully the question of proper specifications for all crossings and proximities for extensive overhead distribution systems. The questions to be considered and decided in such specifications are: (1) Maximum permissible length of span at the crossing or proximity; (2) minimum size of wire permissible; (3) proper sag to be given for the given span and size of wire, and (4) minimum clearance which must be given in the original construction and subsequently maintained between the separate wires at the point of crossing or proximity. A careful consideration of such points by the association would go far toward standardizing existing construction and provide against careless or reckless work in the future. The standard set by the association would receive careful attention by the courts and would probably render valueless the evidence of dishonest experts. Taking up these points in order, Mr Wendle submitted the [illegible]

imity will exist, the span should be short. If possible, it should be limited to 100 ft. so that No. 6 wire can be used with safety and at reasonable sags. By using such a short span the telephone companies could use properly insulated wire of moderate size to cross over electric lighting systems wherever such crossing or proximity is necessary. (2) Without question the smallest size of soft-drawn copper wire to be permitted is No. 6 for electric circuits and No. 9 hard-drawn wire with proper insulation for telephone wires or for telegraph wires. (3) On the question of proper sag there is room for considerable latitude as to the proper sag for definite stresses, but there is no question that a sag of from 3 per cent to 3.5 per cent of the span for temperatures of from 50 deg. to 70 deg. Fahr. during construction is safe. With such a sag a slight movement of poles and arms will not seriously affect the sag in the center of the span. He illustrated this point by an example from actual test on a special 25-ft. model. In addition to the actual provisions for center sag, special precautions should be taken at all wire crossings or proximities against movement of poles and arms. Whenever the poles carrying crossing wires are at bends in the line, special guying must be done to insure against movement of poles or arms due to irregular line stresses. (4) Minimum clearances between independent systems of lines at points of crossing or proximity should be at least 24 in. Mr. Wendle went into the matter of clearance at some length in order to elucidate the point made. His company has no hesitancy in saying that specifications covering proper construction and maintenance of wires at crossings and proximities backed by the Pennsylvania association and by the N. E. L. A. would have been of inestimable value in convincing the judge of the justice of his company's complaint in a recent issue before the court.

The national or state committee, he said, had not touched upon overhead line construction for parallel, co-linear pole lines, but merely dismisses the subject with the statement that it should be avoided. Unfortunately, parallel and co-linear lines are not so easily disposed of, and so far as his experience is concerned there is no legal process by which a company having a proper franchise for the erection of poles and wires can be stopped from constructing a parallel and co-linear line if it so desires, and where it is a competing company it usually so desires. He cited the development of the wire situation in Williamsport, where competing telephone and lighting companies maintained pole lines and where parallel and co-linear lines became a regular feature of the overhead construction.

In view of this and many other existing installations, he suggested that rigid specifications covering such lines be drawn up. These specifications should designate (1) the proper location of "junior" poles with reference to the existing "senior" poles and lines; (2) the minimum clearance to be obtained between the lowest wires of the junior company above the line of the highest cross-arm of the senior company; (3) the minimum difference which is permissible between the length of spans of the junior company and the length of spans of the senior company; (4) the sags to be placed in such junior lines; (5) the duty of the junior company in regard to the protection of the wires of the senior company where the poles pass through such wires. Under the last head it should be determined whether it is the duty of the junior company to provide standard cross-arms on its poles and to which cross-arm the wires of the junior company shall be attached so that the position of its poles in the wires of the senior company is practically maintained. Also, in case changes must be made or work done on the lines of the senior company in order properly to construct the junior line, whether the junior party shall be at the total expense of such necessary changes or work. (6) In all work submitted by the various overhead line committees particular attention has been paid to the original construction, and anybody following the specifications and suggestions of the committee cannot but secure thoroughly first-class construction. After the original construction is done some obligation rests upon companies to inspect and maintain [illegible]

In all accident cases which have been decided upon by the courts the language of the decision invariably implies responsibility for proper or adequate inspection and it further requires that not only shall pole lines be constructed, but that they shall also be "maintained with the highest practicable degree of care." This is a very broad standard of electric light companies' duties and as the court has not any standard upon which to base opinion, the question of the adequacy of inspection, according to Mr. Wendle, is usually left to the jury and the electric light companies foot the bills. He maintained, therefore, that it was time for the practical operating men in the lighting business to formulate safe and reasonable specifications or regulations governing this portion of the work, so that such regulations can be submitted to the court in cases where inspection and maintenance questions are involved, and in case experts are called that their testimony must be largely confirmatory of the regulations formulated by the association. Such specifications must have positive influence with judges and juries.

A representative of the Bell Telephone Company of Pennsylvania outlined as one of the advantages of employing standard specifications for overhead line work the possibility of quick transfer of material, in case of emergency, between properties in various parts of the country. On the question of joint pole lines he said the Bell companies were willing to meet the electric light companies half way under ordinary conditions. Voltages of 5000 and over on constant-potential systems are feared by telephone managers because of their possible effect on the service. A cross at this potential may mean, besides the risk to human life, a fire whose destructive effect, while large, is small compared with its effect on the company's service and patrons. The company on the other hand does not object to joint occupancy with constant-current systems having potentials not higher than 10,000 volts, provided the current is not over 7.5 amp. The speaker cited two systems that cause induction troubles on long-distance telephone lines, namely, a three-phase, star-connected system with grounded neutral and a single-phase railway system.

Mr. E. B. Greene, of Altoona, took exception to the statement of the committee that lightning arresters were not dependable and also to the method of grounding to pipes. He said telephone companies could hardly expect to get good service out of their lines in close proximity to a star-connected grounded three-phase system unless the grounds were well made with copper and coke somewhat after the fashion recommended by the fire underwriters in the National Electrical Code. His company's transmission line, which is 80 miles long, gave telephone companies trouble; but when the type of ground specified was installed no further complaint was heard. Prior to that time also it was necessary during thunderstorms for two men to be stationed at the circuit-breakers to keep them closed; but since the change of ground no breakers have come out during such storms, nor have any transformers been lost.

It developed in the discussion that the Public Service Corporation of New Jersey has an excellent system of keeping pole-line records and that Washington, D. C., possesses good specifications for joint-pole lines, etc. For the purchase of material it was admitted that the specifications of the American Telephone & Telegraph Company are excellent.

Mr. A. R. Granger, of Chester, agreed with Mr. Wendle on the necessity of some standard construction for railroad crossings and also felt that joint-pole lines were advantageous in many localities. He cited an instance where a company exercised the right of eminent domain where permission to erect poles was refused and desired to know if any member companies had ever resorted to this right.

CENTRAL-STATION STEAM HEATING.

A paper entitled "The Development and Application of Central-Station Heating," by Mr. C. R. Bishop, of the American District Steam Heating Company, of Lockport, N. Y., was then read by its author. Mr. Bishop referred to the fact that Pennsylvania possesses a greater number of cities having district heating service than any other State and could also lay claim to the greatest or most extensive steam-distribution system in existence. He compared the heating systems of the early and present periods and said that operating reports of companies keeping accurate records prove that transmission losses in a properly constructed and well-insulated steam main are very low. The loss, he claimed, is constant whether only 5 per cent or 100 per cent of capacity is being transmitted, and that the amount of condensation per square foot of steam main surface is increased or decreased directly in proportion to the degree of perfection of the insulation. He then outlined the requisites of a good system. That district steam heating is profitable, he claimed, is shown by the fact that in Pennsylvania there are more companies operating central heating plants exclusively than there are companies operating both electric and steam plants and utilizing the exhaust for commercial heating purposes. At present there are twenty-two companies in the State engaged in the distribution and sale of electricity and exhaust steam and the growth is in favor of combination plants. Comparing the results of a company operating a combination electric and steam heating plant for three successive years, the author gives the following data:

	1906-1907	1907-1908	1908-1909
Fuel burned during heating season, lb..	32,032,000	28,311,830	28,376,600
Electricity generated, kw-hours........	2,336,766	3,803,039	4,368,100
Steam receipts......................	$51,785.23	$59,355.16	$65,972.52
Cost of fuel, water, labor and supplies...	$48,174.48	$43,391.40	$44,178.90

Many combination plants operating in towns of less than 3000 inhabitants are deriving satisfactory profits upon investments in heating plants also. The author pointed out that if a district steam heating plant is operated in connection with an electric light or railway plant very little, if any, additional power-house equipment is required and no additional power-house employees unless the electric operation is not on a basis of twenty-four-hour service. Companies not operating a day electric circuit find that the addition of steam heating utilizes profitably their investment in boiler plant for a much greater number of hours and further assists in increasing the load factor at the plant with resulting increase in boiler economy.

The verbal report of the committee on steam heating in connection with central stations was then presented by the chairman, Mr. M. J. Fogarty, of the Erie Company, Erie. Nothing of moment occurred in the steam-heating field during the year, so the committee had nothing new to offer other than the paper of Mr. Bishop, which was prepared at its suggestion.

DISCUSSION.

Messrs. E. J. Kiefer, of Easton; R. L. Lloyd, of Philadelphia, and G. E. Wendle of Williamsport, questioned the author on certain points, such as line losses, method of charging, reliability of meter, overhead charges in a steam-heating system and meter rate where coal costs from $2 to $2.25 per ton. Mr. Bishop in replying to these said that the line losses vary from an average of 0.046 lb. to 0.043 lb. per square foot per hour. Steam meters in New York are tested by the Public Service Commission and the percentage of error ranges from 4 per cent to 0, depending on the load. He said that steam meters should be tested yearly in summer and in any case should be oiled and cleaned. This work can be done in summer by the meter reader. Flat rates show higher fuel consumption in the station than meter rates and with less heating. Where steam is sold by meter the radiators are shut off in warm weather rather than the windows opened to effect the necessary decrease in heat. The rate should be high enough even where meters are installed to bring about the economical use of the heat. The rate where coal is worth $2.25 per ton, he said, should range about 60 cents per 1000 lb. of condensation.

RELATIONS WITH N. E. L. A.

Thursday's session was opened with an address by Mr. W. W. Freeman, of Brooklyn, president of the National Electric Light Association, who, with Mr. T. C. Martin, secretary of the association arrived the night before from the convention of the New England N. E. L. A. Section. Mr. Freeman stated that the officers of the N. E. L. A. would bend all their energies this year toward the upbuilding of a strong national body and would make a special effort to enroll the small electric light companies—not because of any financial benefit, but because of the prestige and influence they would give to the organization in making it truly representative of the entire electrical industry. In this work much reliance would be placed on the state organizations. He hoped also that the testimony of the existing state branches would be instrumental in bringing additional geographical sections into the national body. The difficulty lay in convincing present state organizations outside the national body that merging with the national would not mean loss of identity or curtailment of privileges, but rather a larger field of operation and greater benefits. Many state organizations also included in their membership municipal plants, and inasmuch as the operation of such stations is essentially at variance with and antagonistic to private enterprises as represented in the membership of the N. E. L. A., merging was impossible until the municipal plants were dropped. This was another stumbling block which must be overcome. Mr. Freeman outlined the scope of work which state organizations can best do and said the best results are obtained by a co-ordination of local organizations into the national body.

Mr. T. C. Martin followed Mr. Freeman in an address giving statistical data of the national body and announcing that the Nebraska association has applied for membership and was now affiliated with the national body and that the Georgia association was also expected to join with the national body this fall. The N. E. L. A. he said was fast assuming a federal basis and composition, and state bodies would eventually rule and dominate the organization. He referred to the "Question Box," "Solicitor's Handbook," and the classification of accounts, advising all Class A members to follow the system, so that good results might be obtained from a comparison of accounts of various stations and interchange of data compiled according to the same system. He also pointed out the advantages of company sections to the stations themselves in having employees actively interested in the work.

CENTRAL-STATION OPERATION.

Mr. T. G. Coghlan, of Scranton, then presented his paper, entitled "Advantageous Points in Central-Station Operation," in which he touched briefly on some essential points in power plant work. The total boiler-room cost per kw-hour generated, he said, was the best comparison of the commercial efficiency of different fuels. The men employed in the boiler-room should be specially fitted to become skilled attendants, and to this end should be systematically trained. The boiler-room, he maintained, is the point of greatest waste and yet no other department exercises so little care in the employment of men. The remuneration should be sufficient to attract good men, because cheap labor in the boiler-room is the most expensive help a station can have. Mr. Coghlan emphasized the necessity of a complete system of boiler-room and engine-room records and said that unless the system was adequate a manager could not know just what the station is doing all the time, and if any change in the economy of operation occurs cannot trace the cause and take advantage of it. He outlined a system of records which he thought should suffice and though it might be thought by some to be rather complex and require high-class engineering skill to ascertain the various data, he said it was, in fact, simple to carry out. Efficiency, he claimed, cannot be maintained by guesswork, and an Orsat apparatus in the boiler-room for testing flue gases was just as necessary to an engineer as a steam-engine indicator. The first saves the company dollars, while the second merely saves dimes. Bright fires, clear stacks, good cards, absence of leaks, etc., do not always indicate [illegible] heat units might be wasted heating excess air and the plant be more of a "hot-air factory" than an electric generating station. He also outlined the requirements of a good engine-room log book.

Various other points, such as the inspection and cleaning of boilers, treatment of feed water, repairs to brickwork, baffles and fittings, inspection of valves, engines, etc. were touched upon and their importance accentuated. The author pointed out that it is not the amount of oil used in lubrication that costs, but the amount wasted. The oil should be extracted from waste used in wiping and cleaning, filtered and again used, while the waste itself should be put in a tank and thoroughly boiled out, after which it should be passed through a ringer and placed on a drying rack. The advantage of cleanliness, not only with reference to its effect on the station employees, but also on the life of the apparatus, was pointed out, as well as the desirability of equipping all apparatus with safety appliances and safeguards. The last point touched upon was the building up and maintaining of a thoroughly efficient and reliable organization of men running the plant, from the ash men to the engineer; and as the organization as a whole depends upon each individual, care should be taken in the selection of men and in their training. The author finds that in central-station practice it is necessary to develop the talent and to employ only such men as can be improved and advanced. Reliability in men, he said, is brought about by a knowledge of the confidence of their superiors and increased and strengthened by their superiors' confidence in them.

DISCUSSION.

Mr. R. S. Orr, of Pittsburgh, took exception to the chemical method recommended of purifying feed water for boiler purposes as being too costly. He said it was cheaper to allow deposits to take place in boilers and to remove them from time to time mechanically. The expensive systems usually installed do not remove all impurities and the deposit which forms must afterward be removed anyway. The scale can be chipped or knocked from a boiler mechanically at a cost which is less than the interest and depreciation on an elaborate chemical system. Any acid in water, however should be first neutralized by the addition of soda or barium hydrate.

Mr. J. S. Wise, of Hazleton, said that it would depend on local conditions whether the water should be purified before it went into the boiler or whether the scale should be allowed to accumulate and be finally removed mechanically. He himself uses a compound which causes the scale-forming ingredients to collect in the shape of a soft mud which is easily blown out.

Mr. E. L. Franklin, of Easton, said that the apparatus and system suggested in Mr. Coghlan's paper were too costly for small stations. Moreover, to be of any benefit, the data so collected would have to be studied, and this required time. Where the station has a small output, the advantage of an elaborate system calling for expensive testing apparatus was questionable. In his station the purification of water does not entail much labor, since surface condensers are employed in connection with steam turbines so that such troubles are minimized. He felt, however, that the logical way to get rid of scale was to nullify its effects before it got into the boiler, and not after. It took time to scale a boiler, and the loss of the services of the boiler was an item of moment, not to mention the loss incurred while the scale is forming. In Pennsylvania, he said, he noticed that scale formed very quickly at certain seasons and not at all at other seasons. This he attributed to rains and droughts. On this account he claimed that the feed water should be analyzed weekly and the compound changed to meet the changed conditions. The analysis of flue gases, he said was important because a loss of 1 per cent meant that $3.50 per month might be profitably added to the wages of a fireman who could eliminate the loss. Many plants have losses far greater than 1 per cent, however. He said that the trend of practice is to design furnaces to burn the coal and boilers to utilize the heat to best advantage. He called attention to the advantages of the "Dutch Oven" furnace and also to the advantages of cleanliness in the engine-room and boiler-room of a station.

NEW TYPES OF LAMPS.

The second paper at Thursday's session was prepared and read by Mr. G. E. Brett, of Wilkes-Barre. Its title was "New Types of Lamps from the Operating Standpoint" and it was prefaced by a brief history of the developments in electric lighting down to the advent of the flaming arc and tungsten incandescent lamps. The flaming-arc lamp, while attractive to the general consumer, he said, did not prove to be as successful from an operating point of view as might have been supposed, due primarily to the short life of the electrodes and the low voltage of the arc. While the light was of unusual value commercially, it was questionable, where the central station had many lamps to maintain, whether the advantages gained in illumination were sufficient to compensate for the additional expense required in operating the lamps. The series-luminous arc lamp, he said, opened up a very large field which operating companies were not slow in seeing and taking advantage of. The 4-amp magnetite lamp consuming 320 watts as against 480 watts in both the alternating-current and direct-current, series enclosed arc lamps also showed a gain in lighting distance of from 60 ft. to 100 ft., both lamps being at the same height. The luminous-arc lamp, he claimed, is being largely used for street lighting with very satisfactory results and is destined to be widely employed. From the operating point of view it is a question in the minds of some engineers as to the current value to be established for the most satisfactory results. Some feel that it would be better to give a higher current consumption, thereby increasing the standard of illumination, and it is proved that where it is possible to do so it is better to give the consumer the increased illumination at practically the same price than to decrease it in proportion to the standard in vogue at present. In operating arc-lighting systems one primary reason advanced against the increased current consumption is that leaks showing up on small current systems have a tendency to increase operating troubles very materially. While it is true according to the author that the lower ampere system can be constructed and operated at less cost, it is very questionable whether this is altogether as safe, as the smaller size of wire which can be employed with less current has less tensile strength. Therefore, it would be more liable to damage and destruction from sleet and wind storms, which are the operators' greatest troubles. The higher amperage luminous arc both from an operating and commercial point of view he believed to be far more satisfactory for a street-lighting system than any so far devised. There is nothing more pleasing to either municipal or individual consumers than to show them in a practical way that they are getting twice the amount of illumination without additional expense. Coming to the tungsten lamp the author felt that its use in street lighting is fast coming to the front, and that it will in congested districts eventually supplant the arc lamp system. The standard multiple tungsten lamp has, however, not proved very satisfactory for outdoor lighting thus far, due to vibration causing excessive breakage. As a more satisfactory solution, the lower voltage lamps may be employed and run in multiple series. He then described the method of hanging these lamps as employed in Wilkes-Barre, which scheme has been illustrated and described in these columns some time ago. Regarding what part of the thoroughfare should be lighted, the author stated that according to some the lamps should throw the light into store windows, according to others on the sidewalk alone, while others maintain they should light the street proper. The author said it was none of these singly, but all of them together; in other words, the entire vista. His company found after repeated experiments that the center of radial illumination, where posts are employed, should be from 12 ft. to 14 ft. above the sidewalk. If the lamps are lower the light will shine in the eyes of the pedestrian, and if higher the illumination will not be strong enough. It has been found that a cluster of five globes, four 12 in. in diameter and one 16 in., each fitted with the most approved 100-watt tungsten, will give more light for less money than any other scheme. The standards may be placed 75 ft. to 100 ft. apart to eliminate dark spots. The author next discussed the choice of suitable posts which were not over-ornamental, and followed this by references to the tungsten sign lamp situation. He said a tungsten lamp was better for a sign than the old carbon-filament lamp, in addition to being less costly to operate.

DISCUSSION.

It was pointed out by a few of the speakers that the tungsten lamp has a tendency to over-illuminate, because customers substituted a large, clear-bulb tungsten for the ordinary 16-cp carbon lamp. Mr. H. N. Muller, of Pittsburgh, said that this could not be prevented at present unless lower voltages obtained. He said that the W-filament in tungsten sign lamps, to which reference was made, has, owing to the numerous points of support, been abandoned by the manufacturers in favor of the V-shaped filament, the latter being more practical.

Mr. Cooper, of the National Electric Lamp Association, said that the point brought out by Mr. Brett, that it was the entire vista which should be illuminated by the posts, expressed the situation exactly. Moreover, the tungsten street lamp was also applicable to outlying and suburban districts as well as in congested districts. The spacing of the posts and their height would depend on the width of the street, very wide streets requiring posts higher than was stated in the paper.

Mr. G. H. Stickney, of the General Electric Company, said that the new lamp brought with it new problems which some stations tried to avoid, but which, as it is impossible to do so entirely, must be controlled. The new units should be installed so that they would be a benefit to the station and consumer alike. He cited the new developments in arc and incandescent lamp fields both of which have run side by side. In some cases these lamps have been placed on a competitive basis and in others on a complementary basis. The arc lamp is better in some cases than the incandescent lamp, and vice versa. Central station men, he said, should understand the characteristics of both and adapt them to their needs.

Then followed a long and animated discussion regarding the tungsten lamp in connection with gas and gasoline lamps. Messrs. W. W. McCleary, of Pittsburgh; W. C. Anderson, of Plymouth; E. F. McCabe, of Lewistown; F. S. Nicholson, of Sayre; G. H. Stickney, of Schenectady; W. W. Freeman, of Brooklyn, and others joined in the discussion, which was afterwards expunged from the records by vote, owing to the information it might afford to the gas interests in acquainting them with the shortcomings of their product and apparatus.

OPERATION OF ELECTRIC VEHICLES.

The last paper at Thursday's session was prepared by Mr. W. A. Manwaring, of Philadelphia, and in his absence was read by the secretary, Mr. Van Dusen Rickert. It was entitled "Operation of Electric Vehicles," and pointed out the advantages of the electric over the horse-drawn vehicle. Many data worked out from records of vehicles, batteries and tires used in an electric light company's service were included as being of interest to those considering the adoption of the electric vehicles. These vehicles, the author stated, were purchased in 1905 and 1908, and could not be compared with the more modern vehicles of to-day. In concluding his paper the author emphasized the fact that the most important point in the maintenance and operation of the electric vehicle is the proper care of the batteries. Where batteries are looked after, he said, there was no trouble in proving that the electric was far superior to the horse-drawn vehicle.

DISCUSSION.

Mr. W. W. White, of the Philadelphia office of the General Vehicle Company, in opening the discussion, pointed out wherein the modern vehicle surpassed in every respect the vehicles mentioned in the paper from which the data were obtained. His company's product, he said, was standardized and was guaranteed. A thin-plate battery is now used which possesses a greater output per pound and a larger overload capacity. The renewals are guaranteed not to cost above a certain sum, and the cars are regularly inspected.

Mr. R. L. Lloyd, of the Philadelphia Electric Company, referred to the recent run of commercial vehicles between Phila-

delphia and Atlantic City, an account of which, with statistical data of performances, appeared in these columns at the time, and cited the case of a Baker vehicle equipped with Edison batteries which made a run of over 200 miles on a single charge.

Mr. E. F. McCabe asked for information concerning the comparative overhead charges of electric and gasoline vehicles, and Mr. White answered that the depreciation was less in an electric than in a gasoline car; the tires lasted longer because of the better acceleration of the electric, the maintenance was less, and altogether the gasoline car could not approach the electric vehicle for general city commercial work. Mr. White also answered questions of Mr. Wendle, of Williamsport.

COMMERCIAL DAY.

Friday was set aside as "Commercial Day," with Mr. D. T. Campbell, of Scranton, presiding. The first paper presented was written by Mr. H. M. Blake, of Jenkintown; Messrs. W. R. Power, of Tyrone; A. H. S. Cantlin, of Allentown; E. H. Davis, of Williamsport, and F. M. Noecker, of Renovo, collaborating. The paper was read by Mr. Granger.

INVESTMENT JUSTIFIED BY SMALLER COMPANIES FOR SECURING POWER BUSINESS.

In this paper Mr. Blake assumed that the subject is intended to cover the permanent investment in generating and distribution equipment and not the expenditure for soliciting, engineering services, etc., incident to securing business, which expense is chargeable to operation. The question applies equally to large companies as well as to small ones; that is, that the investment justified depends entirely upon the rate of interest desired and as to whether each particular situation will give this return or not, which in turn depends on the price to be charged for energy and also to the load and distribution factor. The author is of the opinion that the value of power business has been much overestimated by most managers under the assumption that power business is off-peak business, and therefore the returns from this business should only cover interest and depreciation on the investment directly necessary to take on this particular business plus the bare manufacturing cost of energy. This reasoning is correct as applied to certain specific lines of business where the station management can control the situation, such as in supplying power for municipal water works or for business confined to the summer months. Another theory advanced by some managers is that the cost of new extensions should be paid for in two years. This plan was advocated at last year's convention; but the author cannot see, however, on what reasoning such a rule could be based or why it should apply to a small company and not to a large one, except that perhaps the large company would have more opportunity to make use of the investment for other consumers in case the business originally acquired should prove unsuccessful. An investment, then, would not be justified by a small company if the business for which the investment was made was uncertain, or where a long-term contract could not be secured, or if no other business could be secured in the district in case the business for which the investment was made should fail. In the event of a fairly long-time contract (say five years) not being renewed, the company would still be justified in making the investment, as at the end of the contract term sufficient other business should have developed along the extension to pay interest on the investment.

Aside from the special cases of off-peak business above referred to, all business taken on by any company should be made to cover its proportion of plant investment and other fixed charges. According to the author, the theory of making low power rates to ten-hour consumers is not correct, as there are very few instances where such consumers do not overlap the load peak during the winter months, and therefore this should be classed as peak business. Mr. Blake said that a moderate-sized station in a city of 25,000 inhabitants, having a maximum load of 500 kw and a load factor of 25 per cent, would, with sufficient reserve apparatus and a well-constructed distribution system, cost approximately $500 per kilowatt; but, as many stations of this character grew on the instalment plan and made some costly mistakes, the actual investment would be nearer $750 per kilowatt. Before making any expenditure to take on new business 8 per cent of $500 cost should be allowed for depreciation, plus 6 per cent on $750 investment, or $85 per annum per kilowatt of station capacity. The station load being roughly 25 per cent of customer's maximum load, $21.25 per kilowatt demanded should be received to warrant the station in taking on business at all. On an operating basis of 10 hours a day or 54 hours a week the fixed charge would be ¾ cent a kw-hour; for 5 hours a day, 1½ cents, and for 1 hour a day, 7½ cents per kw-hour. This is in addition to the interest and depreciation on the extension necessary to take on the business and the cost of manufacturing energy. Thus the investment justified depends almost entirely on the length of hours of operation or load factor and the price which may be obtained for delivered energy. In supplanting isolated or competing plant service part of the cost of replacing one type of motor by another must also be met, so that with small companies an extremely high load factor or high rates are necessary conditions for taking on the motor load. The author maintains that investments made to protect present business against competing plants or isolated plants can be justified even without any immediate financial returns.

In estimating allowable investment based on prospective returns Mr. Blake says one very important fact must not be lost sight of. The improvement in the station load factor due to the increased motor load will in most instances result in decreasing the kw-hour operating expense for all energy sold and thus increase the station net earnings materially even though the motor-load is taken on at bare cost.

In considering the investment justified the author finds a number of the smaller companies have a tendency toward supplying two-phase or three-phase service with its multiplicity of lines, transformers and meters to small motors where single-phase service would answer the purpose quite as well. Roughly speaking, no company of the size above referred to should supply anything but single-phase service for motors smaller than 5 hp unless the customer is willing to guarantee the same minimum guarantee that would be expected of a 5-hp motor. After considering business requiring investment, he says, it must not be forgotten that a large amount of business can be got on the existing circuits without any additional investment whatever, such as coffee mills, dough mixers, ice-cream freezers, fan motors, dental motors, sewing-machine and washing-machine motors, flatirons and cooking utensils. This class of business is being overshadowed by the enthusiasm to secure larger power business whereas in reality it should receive first consideration.

DISCUSSION.

Mr. E. F. McCabe agreed with the author that any investment justified by a small company is also justified by a large company. The expense for acquiring a motor load, the returns from which would offset the investment in two or even more years, is justifiable. He did not agree with the author on the undesirability of much ten-hour business and said that any business that would increase the station-load factor without lowering the power factor should be encouraged by a low rate. Five hundred dollars per kilowatt for average stations and $750 for old stations, he claimed, was too high and had nothing to do with the question anyway. Customers should not have to pay for dead wood; a turbine station can be installed at a cost of about $75 per kilowatt and a plant with reciprocating engines for about $125 per kilowatt. He felt that in many instances distribution costs could be reduced by installing high-tension motors. The power-factor of the system could also be improved by the installation of group drives rather than of small individual motors. In the case of direct-current motors fed from an alternating-current station, he suggested that instead of replacing the motors with alternating-current machines, a synchronous motor-generator set be installed. The motor could be made large enough to bring up the power-factor of the system.

Mr. E. H. Davis, of Williamsport, wanted to know what proportion of gross receipts could be expected of motor customers in an ordinarily well-managed station. He also wished to find out how isolated plant business was acquired and how much a company could afford to spend to acquire such a load. Mr. Hubbell, of Carbondale, said his company receives about 15 per cent of its gross income from motor customers. Mr. F. Woodring, of Titusville, said his company receives from 30 to 35 per cent of its gross revenue from motor customers and had only been acquiring a motor load one year. In this his company was greatly assisted by the motor manufacturers. The average return from group drives is $35 per hp-year and from $12 to $15 from individual drives. His company displaced gas engines and has a standing offer of $150 for every 35-hp engine taken in exchange for electric motors. His company, operating in an oil country, finds a ready market for these old engines. Mr. F. M. Nocker, of Renovo, said the motor business of his company represented about 30 per cent of its gross revenue, the figure included municipal lighting also. On some motors the return varies from $60 to $75 per hp-year and many yield a revenue of from $40 to $60 per hp-year.

Mr. W. A. Donkin, of Pittsburgh, said his company had to pay more than $150 for a 35-hp gas engine. In such cases the company must make the best deal possible under the circumstances. His company had displaced a 400-hp steam plant which fed about 350-hp in motors. It allowed $2,000 for the apparatus in energy and considered it a good investment, the guaranteed consumption on a five-year contract being $6,000 per annum.

Mr. E. F. McCabe said that in his territory customers have told him that they paid less for energy than for the repairs on gas engines. Mr. W. A. Donkin said there are good and bad gas engines and cited a case where he displaced a gas engine by an electric motor, and although the service was more reliable the gas engine won out in the end on low cost of operation.

Mr. Lloyd, of Philadelphia, said an answer to Mr. Davis' question would depend on the locality of a station, stating that in his district the lighting load yielded the entire income.

Mr. E. B. Greene, of Altoona, answered in a like manner. In manufacturing communities the motor load might represent 75 per cent of the station's gross income. In Altoona, where water is brought in cars 100 days of the year and where at such times the water costs more than the station is able to earn, a motor load could hardly be expected. Nevertheless, his company had succeeded in acquiring a load the income from which represented 15 per cent of the gross earnings.

Mr. E. F. McCabe pointed out the advantages of an instrument which would indicate the maximum demand of a motor installation in apparent power much like the Wright demand meter used for lighting installations, and asked if any member companies had or knew of such a device. The graphic meters, he said, were too expensive. Mr. Richardson, of the General Electric Company, said his company builds a maximum power indicator, which measured true watts; but this is not a cheap instrument.

Mr. E. H. Davis wanted to know what rate member companies held isolated plant business on. He said his company had a maximum rate for such loads which was low; but it found difficulty in holding the business even at from 2½ to 2 cents per kw-hour.

Mr. W. A. Donkin took exception to the statement of the author that the theory of the ten-hour service is not correct. Only from 5 to 10 per cent of his company's motor load comes on the evening peak and it has 20,000 hp connected. He is certain his company can take ten-hour business at a very low rate and earn money. Ninety per cent of his company's non-peak load is in reality non-peak. Messrs. McCabe and Granger spoke of morning peaks which some stations had.

Mr. E. L. Franklin said that peaks should have careful attention. The peak shifts with the motor load in Easton and as more business is acquired the peak will eventually come in the afternoon rather than in the evening. The ultimate development in the power business will make what are now valleys, peaks, he thinks. Mr. Donkin believes that the peak will always manifest itself in the evening, but that peaks are no longer feared. For some years managers used to worry about how they would carry the Christmas load, but as they increased their motor loads it seems that the Christmas peak question disappeared. The only question in Mr. Blake's paper that needed solution, he said, is "How much can a small station afford to pay per kilowatt of load?"

Mr. Granger recalled the speech of Mr. Samuel Insull, of Chicago, in which he referred to off-peak business afforded by water works and gave his experience in hurrying from Atlantic City to acquire the pumping load in his city only to find that new engines were ordered for the pumping plant while he was at the seashore. Mr. Orr doubted if fixed charges should be made against motor business which is off-peak. Mr. Lewis, of Scranton, gave his experience in trying to displace a gas engine in a stone yard by an electric motor without success because of the monthly minimum charge.

DOMESTIC APPLIANCES.

A paper with this title was next presented by Mr. W. A Donkin, of the Allegheny County Light Company, of Pittsburgh, who said that in the frantic effort to acquire motor loads many stations had overlooked the possibilities for increasing the revenue from existing installations through small domestic appliances. A 450-watt iron, for instance, yields a revenue of $1 a month and there are very few stations having day circuits which could not easily place 100 irons. The author divided domestic appliances into two classes, those which may be operated from lamp circuits and those requiring a separate circuit, and limited his paper to those in common use. The electric iron, he claims, is unquestionably the best revenue producer of the small appliances, and the general conditions covering its introduction, sale and maintenance apply to the many other appliances manufactured for domestic use. In discussing the methods employed the author said his company found, particularly in the natural gas territory, that the use of an electric iron by a new customer unfamiliar with its operation, together with the naturally excessive use of light during the first month, runs up such a bill as usually to result in his abandoning the use of the iron, forever being antagonistic to the use of other electrical appliances and also curtailing the use of energy for lamps. His company bills the iron after a thirty-day or sixty-day trial and during 1909 placed 2069 irons, over half of which were retained and paid for. Realizing that the price asked for a good portable vacuum cleaner, $125 to $150, is more than could be expected of the average customer, the Allegheny County Light Company organized a rental cleaning department and purchased twenty-five machines, which were rented at $2 a day delivered. The company now has 100 vacuum cleaners in use, the revenue from which is large. Operating in a territory with natural gas selling at 27½ cents per 1000 cu. ft. all reference to the cheapness of electric heating is avoided while the other qualities are accentuated. The company hopes to compete with natural gas as soon as a reliable electric fireless cooker appears. The maintenance of these domestic appliances in proper operating condition after installation is one of the most important features of this branch of the service, otherwise a slight defect will lead to the abandonment of the device. Mr. Donkin called attention to the need of a better arrangement of interior wiring for domestic appliances to overcome the unsightly flexible cord dropping from a handsome dome in the dining-room, for instance. He said that advertising unquestionably increases the sale of domestic appliances, although direct results cannot be estimated. The sales of domestic appliances by his company in 1908 doubled the sales of 1907, while in 1909 the increase was 17 per cent over the previous year. During the seven months of 1910 the sales amounted to double the entire sales of 1909. The author also included papers by Messrs James E. Pyle and Thomas C. Walsh.

DISCUSSION.

Mr. E. B. Greene said that sixty days was too long a time to have an iron on trial and that in Altoona the time had been reduced to fourteen days. A double card system is employed, a card being left with the iron by the solicitor, who calls the next week and writes on the cards the remarks of the housewife. Ninety-seven per cent of the irons sent out were sold and with less than 3000 residences wired there are 2460 irons in use. The load on Tuesdays is 400 kw in excess of other days and comes on after breakfast and lasts until about 4:30 in the afternoon with a drop in the curve from 11:45 a. m. to 1:30 p. m. The business from domestic appliances, he said, is permanent if customers understand the use of the devices and these in turn suit the home hibit. In answer to a question of Mr. Davis, Mr. Greene said that it cost the company 50 cents to introduce an iron, not counting delivery.

Mr. Wendle cited the experience of his company in Williamsport with the electric flatiron, stating that his company had acquired a liberal education while the manufacturers received all the money. It was felt at first that 75 cents or $1 would cover the expense of introducing the iron; but the company found that it would have been cheaper for it to have given the irons away. At present a high-school boy is employed on salary and commission to introduce the irons. The speaker agreed with Mr. Greene that fourteen days was sufficient time for trial. When his company allowed sixty days it was necessary to carry a large stock of irons. He said he noticed that when stores gave things away there was always a rush of people, so he tried a scheme of getting a customer to pay $4 for an iron and giving him a receipt calling for a credit of $1 on any electric light bill, which plan met with remarkable results. Irons sold by contractors were also accompanied by credit receipts. The main point about electric irons, he said, is to get them used.

Mr. McPherson, of Easton, said that the revenue received from the use of irons could not be determined accurately. As to the expense of introducing them, he claimed, there should be none since a good salesman would dispose of them with profit to the company and himself. He did not believe in spending the revenue from a two-years' use of a device in introducing it.

Mr. Hubbell, of Carbondale, asked concerning the repairing of irons and many vouchsafed the information that the usual method is to charge the cost of the material and labor. The rates for energy in Altoona, Mr. Greene said, are 8 cents for the first 26 kw-hours and 4 cents for all energy in excess of that amount, which gives irons a 4-cent rate. The rate for energy at Williamsport is 10 cents for the first 15 kw-hours and half that amount for all in excess. Mr. Orr cited some instances where the desire for electric domestic appliances was the sole cause for the introduction of electricity in a number of residences in the Pittsburgh territory.

ELECTION OF OFFICERS.

After the discussion on Mr. Donkin's paper and before the reading of the paper on "Rates" the association went into executive session. When the routine business was transacted the report of the nominating committee was presented and acted upon with the following result: President, Mr. A. R. Granger, of Chester; vice-president, Mr. R. S. Orr, of Pittsburgh; secretary and treasurer, Mr. Van Dusen Rickert, of Pottsville; additional members of executive committee, Messrs. M. J. Fogarty, of Erie; W. C. Anderson, of Plymouth, and F. M. Noecker, of Renovo.

Mr. Albert R. Granger, the president-elect of the Pennsylvania Electric Association, was born in Philadelphia, April 1, 1875. In 1891 he entered the employ of the Edison Electric Light Company, of Philadelphia, and in the successive merging of the various electric undertakings in the Quaker City he was made superintendent of the Wissahickon Electric Light Company and later manager of the Diamond Electric Company. He afterwards became manager of the Beacon Light Company, of Chester, Pa., and in addition has recently been made vice-president and general manager of the Delaware County Electric Company, both of the latter companies being controlled by the Philadelphia Electric Company. His experience for the past twenty years with both the largest and some of the smallest companies in the State has particularly fitted him for the office of president of the association. Mr. Granger through the Beacon Light Company was one of the charter members

President-Elect A. B. Granger.

of the Pennsylvania Electric Association and has served on the executive committee since its inception and during the past year as vice-president. He is identified prominently with all the local electrical organizations and is a member of the Lee Lee Temple, Oasis of Philadelphia.

RATES.

The paper prepared on this topic by Mr. L. H. Conklin, of Pottsville, was read in his absence by Mr. H. G. Glass. The author frankly admits that the question of rates has resulted in a great diversity of opinion and that each man rides his own hobby to his heart's content. He presented some arguments in favor of a more concerted and thorough study of the question by the Pennsylvania association in the hope of starting united action. The author referred to Mr. Doane's paper before the St. Louis convention of the N. E. L. A. as showing the interest in the subject and the necessity of facing the problem presented by the introduction of the tungsten lamp. If stations recoup their losses, due to existing customers changing to the new lamp, simply by the addition of new business as fast as existing revenue is decreased, they simply lessen the possibility of greater profits to come, and mortgage the future to tide over the present. The central station, he said, ought not be made to bear the whole burden of the saving made possible by the use of the tungsten lamp. One might think that the tungsten lamp has opened up possibilities for new business not otherwise attainable, when in reality it may have caused him to put forth greater endeavors to get business where before he believed it did not exist. The author feared that under many rates schemes, losses will eventually occur, since it does not alter the facts if they are made up by profits on other classes of business. The situation at present is that the manufacturer is making a good profit on his lamps; the customer is saving on his bills, while the central station is forced to struggle harder to keep abreast of this progress. There is no sane reason, the author said, for penalizing new and profitable business with the loss on the old. He said the so-called three-rate scheme (that outlined in Mr. Doane's paper) is the one that is doubtless nearest correct, consisting as it does of a customer's charge, a demand charge and an output charge. He said, however there were commercial difficulties in the way of a three-rate scheme that cannot be overlooked. The demand and customer's charge can very well be combined, he believes, for the transition period at least, thus

making the demand charge based on candle-power and the output charge on kw-hours. He then outlined a rate scheme of this kind which has been adopted in a city of 90,000 people where competitive conditions prevail. The scheme is based on a charge of ¾ cent per month per candle-power of the demand, plus 3.5 cents per kw-hour for the energy consumed. For motor circuits the rate consists of a charge per kw-hour depending on the hours' use per month of the demand. This determines the gross rate, which as based upon the load factor, and the bill is subject to discounts depending on its amount.

DISCUSSION.

That the subject of rates is a very live one and uppermost in the minds of many central-station men is evident by the animated discussion which followed the reading of the paper and which continued long after the hour set for adjournment, and even then had to be cut short abruptly. Mr. Copper, of the National Electric Lamp Association, in discussing the paper followed closely the lines of Mr. Doane's paper at the St. Louis convention of the National Electric Light Association and showed by means of lantern slides the nature and the relative magnitude of the various items which go to make up the cost of producing electrical energy and service. He explained by means of diagrams the Hopkinson and Doherty methods of charging which have been used to cover these costs and pointed out the lines along which, in his estimation, an ideal system of charging would be constructed. His discussion was written and was in fact longer than the paper itself, but contained nothing that varied essentially from Mr. Doane's N. E. L. A. paper. He criticised Mr. Conklin's paper in that the statements made carried the impression that it would be necessary under a three-rate scheme periodically to increase the customer charge. The diagrams he showed were apportioned on the assumption that the charge per customer remains constant.

Mr. E. J. Kiefer, of the People's Consolidated Service Corporation, of Easton, Pa., also submitted a written discussion with blue prints of rates based upon the total cost of production plus fixed charges and a margin of profit. In this system the annual kilowatt charge is separated for every customer, or covered in a straight kilowatt charge, his schedule providing the required rates under both conditions. The final rate proposed is based entirely upon the percentage of the customers use of his maximum demand.

Messrs. J. H. Perkins, of Wilkes-Barre; E. F. McCabe, of Lewistown; R. L. Lloyd, of Philadelphia; G. E. Wendle, of Williamsport; F. S. Nicholson, of Sayre; E. H. Davis, of Williamsport, and others joined in the discussion at this point. Mr. McCabe brought out the fact that the scheme proposed by Mr. Doane was not applicable to small stations having residential loads because it necessitated a maximum demand meter in addition to the regular meter, whereas small stations are now overburdened with meters and seek some substitute which is cheaper to buy and maintain. An additional meter, he said, was out of the question. Mr. E. H. Davis maintained that differential rates are seldom honestly applied and in 90 per cent of the cases cannot be applied. In meeting isolated plant competition companies got as much as they could for the service. In residences the rate is almost a flat rate and although stations may claim that differential rates are applicable, in reality customers are paying the maximum rate. The speaker said that there were no scientific rates, and if the customer kicked hard enough, the average manager would find some redeeming feature in his load which would entitle him to an extra discount. The majority of rates are arbitrarily fixed, the station endeavoring to get all that the traffic will bear, regardless of rate schemes in force.

At the final session the following pertinent question was brought up for discussion: Would it be considered good business for a central station of 30,000 hp capacity, that has a heavy day load and evening peak of light and power, to take on large consumers who would use electric power between the hours of 10 p. m. and 7 a. m. at a rate equal to the cost of manufacturing current and delivering same to the consumer? It is assumed that the night load is comparatively light.

There were five other questions of moment prepared for discussion at the meeting, but the time of the association was so taken up with the reading and discussion of the regular papers that they were not put. In discussing the question Mr. E. F. McCabe said that if the load was large a company of the size specified could take it at present cost and earn money. In substantiation he cited the case of a company whose manufacturing cost for energy was 3 cents; but after taking on a fair-sized load the cost was cut in two. Mr. Orr was of the opinion that under certain conditions a company could justify taking on a large load between the hours specified. Mr. Hubbell, of Carbondale, said that a company of the size mentioned in the question could undoubtedly take on a large load at a price equal to the manufacturing cost plus the cost of delivering the energy, because it would not entail additional labor or machinery. It would be out of the question, however, for a smaller company to undertake to take on a load of any proportions, he claimed, because it would mean additional help during the time the extra load was carried.

ENTERTAINMENT FEATURES.

Socially the convention of the Pennsylvania Electric Association was the most cordial ever given and on all sides appreciation was expressed for the excellent entertainment features provided. The opening reception on Tuesday evening was well attended and on Wednesday the accommodations at the hotel, which is equipped for 350 guests, were taxed to the uttermost, the attendance being greater than anticipated. There was a card party provided for the ladies in the morning with expensive prizes for the winners. In the afternoon there was an impromptu musicale with amusements, and a baseball game between the central-station men and supply men, the former being the victors. Motion pictures followed by a cotillon were provided in the dining-room in the evening the hotel ballroom being too small. At this entertainment it was hoped to show a film of an electric kitchen in operation secured from Mr. Gilchrist, of the Commonwealth Edison Company, of Chicago, but owing to some mishap the pictures were not put on the screen. Drives were given for the ladies to numerous interesting localities in the vicinity on Thursday morning, and in the afternoon there was a porch party with prizes for the ladies and bowling and shuffleboard contests with prizes for the men. In addition there was a most excellent vaudeville performance given in the evening, together with motion pictures. Dancing followed until early morning. The men derived very much enjoyment during the week by initiating some members in an impromptu organization known as the "Buzzards." Baseball games and bowling engaged the attention of the stronger sex on Friday and the ladies were taken for a drive to Bear Creek and those who did not care to avail themselves of the privilege engaged in a bowling tournament, prizes being provided for the winners.

NOTES.

The General Electric Company and the Westinghouse Electric & Manufacturing Company made exhibits of meters, lamps, heating devices and other apparatus on the porch of the hotel, while the Simplex Electric Heating Company occupied space in the hotel parlors. Various other manufacturing companies were represented.

On Friday morning a local association of power salesmen was formed, with Mr. Lewis, of the Scranton Electric Company, as corresponding secretary. It was provided that each member send complete details of some motor installation to the secretary, who is to keep a file of these details and each month send a notice to members stating the contents of the file. Members may apply for specific cases on file when needed. Thus, if a prospective customer operates a silk mill, the salesman may consult his list and if information on similar installations is available in the files, he may request the secretary to forward it to him. Each report is to be submitted complete in every detail, since otherwise it would not be of much advantage, and it is hoped that by the interchange of these experiences and data of actual installations and performances great progress will be made in the installation of electric motors throughout the State.

Central Station
Management, Policies and Commercial Methods

CENTRAL-STATION ADVERTISING IN ST. LOUIS.

The Union Electric Light & Power Company, of St. Louis, is conducting its newspaper advertising campaign steadily and persistently. Space is taken regularly in the daily papers to show the advantages of electricity in the home to prospective residence customers and in shops and industrial establishments to users of power. Each day some one desirable feature of electric service, as in the dining-room, the kitchen or the laundry in residences, or the overload capacity of electric motors, for instance, is made the subject of illustration and comment.

EARNINGS OF THE NEW LONDON (WIS.) STATION.

The third annual statement of the Electric Light & Water Works Commission, of New London, Wis., has been issued for the year ended June 30, 1910, a copy of which has been furnished us by the courtesy of Mr. H. C. Sterling, superintendent.

In New London, the population of which is about 3000, the electric light and water plants are combined and operate together. The total bond interest is $1,900.50, of which $500.04 is charged to the electric light plant and $1,400 to the water plant. The electric plant shows gross earnings from operation of $11,589.36. The expenses, including interest, are $7,853.48. The profits of the electric plant, not including any allowances for depreciation or loss of taxes, are $3,735.88. A gross revenue of $4,195.06 was obtained from electric wiring and supplies. The profits of this business were $345.62. Permanent improvements in the electric plant during the year were made amounting to $1,811.74. The plant now has 353 electric consumers and 126 water consumers. Electric consumers to the number of 70 were added during the past year. There are 140 electric irons and 45 electric fans connected.

CLASSIFICATION OF ACCOUNTS FOR SMALL COMPANIES.

At the Michigan Electric Association convention, on Aug. 18, Mr. F. B. Spencer, of Cheboygan, read a paper on accounting for central stations in small cities. He recommended the classification adopted by the National Electric Light Association committee on uniform accounts, which he said agrees very generally with the systems required by the New York and Wisconsin State Commissions. This classification is so designed that the small plants may use the system by eliminating a considerable amount of the detail, and still have sufficient conformity to the general scheme to make comparison with larger plants rather easy. He then outlined the necessary accounts for a small property. This outline does not differ greatly from that laid down by the Wisconsin State Commission and the National Electric Light Association.

In discussion of the paper Mr. A. N. Richardson, of Ann Arbor, said that the Wisconsin Commission classification covers both large and small companies and is very completely worked out.

Mr. A. C. Marshall, of Port Huron, president, said that anyone desiring the Wisconsin classification can get it upon application to the Railroad Commission of Wisconsin at Madison, Wis.

Mr. John Cavanaugh, of Benton Harbor, said that his company being a combined railway and lighting company is obliged to make reports to the Michigan Railroad Commission. There are about 100 subdivisions in this classification. He thinks the Wisconsin classification is better. On the whole he considers commission reports good features, as they compel companies to find out what they are doing.

On motion of Mr. [illegible], of Mount Clemens, it was voted to appoint a committee of three on accounting to report at the next convention.

CHICAGO SANITARY DISTRICT COMMERCIAL METHODS.

The trustees of the Sanitary District of Chicago, which controls the Drainage Canal water-power at Lockport, maintain a contract department for the solicitation of electric power business which employs methods similar to those of up-to-date private corporations. This department, in charge of Mr. N. F. Obright, contract agent, gives occasional trips down the Drainage Canal from Chicago to present and prospective power users for the inspection of the substation, transmission line, controlling works and hydroelectric plant of the Sanitary District Such a trip was made Sept. 7, when a party of about fifty were taken on the boat *Robert R.* from the State Street bridge in Chicago to the step-down substation at the end of the transmission line at Western Avenue and Thirty-first Street, and then on down the canal to the controlling works north of Lockport concluding with a visit to the hydroelectric power house south of Lockport. Lunch was served on the boat, and the return was made about 5 o'clock. About two-thirds of the party were presidents and vice-presidents of present and prospective power-using concerns and the remainder consisted of engineers and superintendents of such concerns.

LARGE ELECTRICAL ENAMELING OVEN.

Mr. John A. Cavanaugh, superintendent of the lighting department of the Benton Harbor-St. Joe Railway & Light Company, of Benton Harbor, Mich., read a paper before the Michigan Electric Association at Port Huron, Aug. 18, describing some work done in Benton Harbor in developing a successful electric oven for baking enamel. The experiments were carried on by the metal sectional department of the Baker-Vawter Company and Mr. Cavanaugh's company for the purpose of determining the feasibility of baking enamel on metal sectional filing cases and office cabinets. The first ovens, five in number, were 5 ft. x 7 ft. x 9 ft. The walls were built of first a layer of No. 10 galvanized steel plate, then 1 in. of dead air space, then 1 in. of "vitrobestos" or air-cell asbestos, then another inch of air space and another No. 10 sheet metal plate. The walls and the top of the doors were all of the same arrangement. The doors were arranged to close with screw clamps, making them air tight. It was hoped that these ovens could be heated to proper temperature, and then part of the energy shut off, allowing the oven to finish baking at reduced energy consumption. This, it was found, could not be done with those ovens. As soon as the circuit was broken the temperature fell. Various arrangements of coils inside of the oven were tried. After long continued efforts an arrangement was secured with which with four coils in use the temperature could be raised in one hour to 250 deg. This would have to be maintained for practically four hours, the total energy required being 46.8 kw-hours.

Later an oven was built 6.5 ft. x 8 ft. x 8.5 ft. with but one door, this door being 6 ft. x 8 ft. x 8 ft. Starting on the outside was a 3/4-in. layer of hard wood, then a thin sheet of asbestos paper, another thickness of 3/4-in. lumber put on diagonally, another thickness of asbestos paper, another thickness of wood, then 1/2 in. of asbestos. This oven was covered outside and in with polished tin. With four coils it requires one hour to raise the temperature to 210 deg. Fahr. After that the same temperature can be maintained with but two coils. This requires to complete the baking 16.2 kw-hours, or but little more

than one-third the amount required in the former oven. The rate for this energy is 2.25 cents per kw-hour, measured on a primary meter. Three 10-kw transformers, connected delta, three-phase, have been installed, and two ovens are connected on each phase. Ordinarily there are at least three of the six ovens in operation, the two adjacent ovens being connected to the same phase, and one oven baking while the other is being emptied and refilled, making a fairly balanced load of the three-phase circuit.

In discussing this paper Mr. Cavanaugh said that the load is on twenty-four hours a day. He is expecting later to go after bread-baking business. The cost of baking by electricity in this way is less than by steam coils.

ELECTRICITY ALLOWANCES AT AN ARMY POST.

The quantity of electricity that may be used for various purposes about an army post is subject, like any other commodity which the Government purchases or supplies, to definite limitations which are conveyed in a general order issued by the War Department. These quantities are defined in watt-hours per diem for each lamp installed in the various buildings and quarters, and a table is given showing the consumption permitted for each class of service during each of the four seasons of the year

In general the quantities apportioned are liberal, since the total amount allowed to any building is figured on the entire number of lamps installed, all of which are not likely to be needed during the full number of hours permitted. The actual consumption in this way is usually less than the allowance, although the saving credited on one year cannot be applied on the following year. An officer in charge of each installation is detailed to enforce the department order limiting the consumption in his building, and when this amount is exceeded, he is expected to make good the cost of the surplus electricity used. The allowances per month are as follows: A captain, 48 kw-hours; a first lieutenant, 36 kw-hours; a second lieutenant, 24 kw-hours, and a non-commissioned officer, 12 kw-hours. Any unused energy is cumulative for the entire fiscal year, but if it is not used within that time the balance is wiped off. Should an officer use more than his allowance he is charged with the excess at the regular rate.

Following are the watt-hours per diem allowed for each carbon, graphitized-filament and tungsten lamp installed in the principal post buildings, as given in general order, No. 49:

Buildings	16-c.p. Carbon				[illegible] Graphitized				25-w Tungsten			
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A[illegible]	[illegible]	56	42	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66	132	82	47	35	70
[illegible]	112	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D[illegible]	168	112	112	168	132	88	88	[illegible]	[illegible]	[illegible]	47	[illegible]
Guardhouse...	224	[illegible]	[illegible]	224	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	70	70	[illegible]
Hospital......	280	140	112	224	220	110	88	[illegible]	[illegible]	59	[illegible]	[illegible]
[illegible] and mess..	[illegible]	112	112	168	132	88	88	[illegible]	[illegible]	47	47	[illegible]
Post exchange	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	41	[illegible]
Power house	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	56	44	44	44	[illegible]	[illegible]	24	24	[illegible]

For all posts in the Philippine Islands and in Porto Rico, where the low latitude results in more nearly equalizing the duration of daylight during the seasons, the allowance for the months from April to September is increased 10 per cent, and that for the remainder of the year diminished in the same proportion. Carbon-lamp renewals for officers' and non-commissioned staff officers' quarters are limited during any year to [illegible] per cent of the total number of lamps installed, and for public buildings 60 per cent, except when the voltage employed is over 200 volts, when the renewal allowances become, respectively, 60 and 90 per cent of the total lamps installed. For tungsten lamps the yearly renewal allowance is 25 per cent for

In many instances the Government prefers to purchase its electrical energy from the nearest central-station company rather than to undertake to generate it in its own local isolated plant. The post near Des Moines, Ia., obtains its service from the Des Moines Electric Company, and Fort Benjamin Harrison, near Indianapolis, purchases its supply at 5 cents per kw-hour from the Indianapolis Light & Heat Company.

CONSTRUCTION OF UNDERGROUND STEAM HEATING MAINS.

In a paper read before the Indiana Electric Light Association at its convention in Indianapolis, Aug. 18, Mr. MacWilliams, mechanical engineer of the Indianapolis Light & Heat Company, discussed the construction of underground steam-heating mains as installed by his company.

To insure successful operation, said Mr. Williams, the underground plant should be installed by skilled labor under the direction of an experienced engineer. For durability, genuine full-weight wrought-iron pipe should be used, and this should be tightly wrapped with asbestos paper held firmly by spiral windings of copper wire. Of the several insulating materials available, such as concrete, tile and white-pine casing, the last-named is recognized from experience as standard and one of the best. It is a good insulator, reasonable in price, and is durable.

The standard construction as built by the American District Steam Company is made up of air and kiln-dried white-pine staves, free from sap and moisture, and tongue-and-grooved throughout their length. The staves are from 4 in. to 5 in. thick and about 3.2 in. wide. They are bound together with a 3/16-in. galvanized steel wire under pressure sufficient to embed the wire deeply in the wood and so leave a practically smooth surface. The whole is covered with asphaltum to a thickness of about ¼ in. to protect it from deterioration, and then rolled in sawdust to facilitate handling. The ends are carefully mortised and tenoned so that when two pieces are put together a driving fit is obtained, making a water-tight joint. The joint is then sealed with hot pitch. When installed, the casing is covered over the top and down the sides to a point below the center with three-ply tar paper, to protect it from moisture in the ground.

The inside of the casing is tin-lined, the diameter being made from 2 in. to 3 in. larger than the wrought-iron pipe over which it is to go. Guides are placed every 7 ft. to hold the pipe in the center of the casing. By this means a dead-air space of from 1 in. to 1½ in. is obtained between the asbestos-covered pipe and the tin-lined casing. The tin is used to protect the wood from the heat, and it also acts as a reflector.

The casing is further protected from the water which might collect under or around it by placing two 4-in. drain tiles at each side of the trench and below the bottom of the casing. The tile should be put in to grade and have the proper outlet to a sewer or cesspool. To increase the efficiency of the tile, it should be covered with broken stone or coarse gravel.

An ingenious device called the "variator" is used to take care of temperature expansion and contraction, which is about ¾ in. for each 50 ft. of pipe. The variator is built to take the expansion of about 50 ft., and so a double variator is placed every 100 ft., with an anchor special, midway between, to anchor the other ends. The center part of the variator is anchored in a brick box, built about it, while the flanged ends are left free to move in or out as the case may be. To the anchored part is fastened the outside edge of a corrugated copper diaphragm, the inside edge being fastened to the free ends of the pipe. This gives a packingless expansion device which, when covered with oiled shavings, is bricked over and needs no further attention.

The anchor special is nothing more than an eccentric cross. Provision is made for anchoring it firmly in a brick box which is built about it. It is also packed in oiled shavings and after it is bricked in the street is repaved over it.

provided for service connection, one on each side of the fitting, so that services may be run to each side of the street. These openings are as near the top of the fitting as is possible in order to insure the delivery of dry steam to the customer. From this arrangement there are two service conections for each 50 ft.

AN ENGLISH VIEW OF CENTRAL-STATION RATES.

A paper read at the meeting of the British Association at Sheffield, England, on Sept. 1, upon the subject of the "Price of Electricity," by Mr. Edward W. Cowan, deals with the much-discussed question of methods of charging for electrical energy. The author contends that, in the case of any supply which is subject to a reduction in cost of production per unit as the quantity supplied is increased, it is impossible to attribute a separate cost to any part of that supply, and that it is only the cost of the whole output which can usefully be taken into account. If that view be admitted as being a valid one, he holds that the system of attempting to base the price of supply to each customer upon the separate cost of supplying him falls to the ground.

Assume, he says, that in a central station there is a normal demand for an output of 3,000,000 units for lighting use at 4 cents per unit, and that the conditions are such that if the output could be doubled the total cost of production per unit would be reduced by 25 per cent. Further, assume that the expenses of production are such that at 3,000,000-unit output the cost is 4 cents per unit, or in other words that at that output no profit is made. Now let us suppose that a prospective consumer presents himself and offers 2½ cents per unit for a 3,000,000-unit supply of the same character in respect of load factor, etc., as the existing supply. The engineer makes a rapid calculation thus: He notes that his output will be doubled and he is fully aware that his cost of production per unit will be reduced from 4 cents to 3 cents under such circumstances. Is he to refuse this customer because he is only paying 2½ cents per unit for electricity which "costs" 3 cents to produce? His undertaking with its present output makes no profit, but with this consumer's demand added to the existing demand an aggregate profit will be earned of $15,000. If a separate cost can be attributed to a part of a supply under such conditions one arrives at the paradox that a profit can be made of $15,000 by selling 3,000,000 units at a loss of ½ cent per unit. It is obvious that a profit cannot be made by selling at a loss, and the conclusion one is forced to accept is that the sale is not made at a loss. The assumption that this customer's supply can be considered as having a separate calculable cost is, the author asserts, faulty. It is only the aggregate supply which, under such circumstances, can have a calculable cost of production.

Mr. Cowan in his paper quotes many leading English engineers, including Arthur Wright, J. H. Rider, Robert Hammond, C. H. Wordingham, J. F. C. Snell, etc., and contends that the system of charging which these engineers advocate, which system is adopted generally by central stations all over the world, is based upon the supposition that the cost of supplying each customer can, in theory at any rate, be arrived at, whereas such a figure is really unattainable In referring to the attempt to arrive at the cost per ton-mile of freight moved by a railway, the late Prof. Taussig pointed out in 1891 that the figure when found represented "no real thing whatsoever."

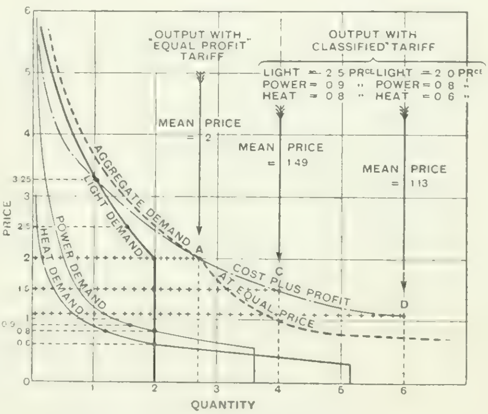
The author then proceeds to develop a system of charging which he recommends should take the place of the existing system. The system he advocates is based upon the railroad "classification" or "discriminative" rates. In this system attention is concentrated upon aggregate results and the question whether any individual consumer is being supplied at a profit or at a loss is disregarded, excepting that the encouragement of the most profitable consumer is recognized as contributing to the prosperity of the business interest as a whole. The fact that electricity is put to various uses is taken advantage of to differentiate between the charges to the different classes. It is claimed that the demand for electricity is in reality a demand for light, heat, power, etc., and the fact that electricity is common to the supply of these commodities is a fact of no essential economic bearing. Each use of electricity has its market price determined by the price of competing methods of attaining the same end and also by the specific utility of the electrical method. It is proposed that prices for each use shall be fixed as closely as possible to the market price of the particular service so that *in the aggregate* (1) the mean price shall bear as high a proportion to the mean cost as possible (consistent with a right use of the monopolistic power which is involved in electricity supply); (2) the mean price shall be as low as possible, and (3) the supply shall be as large as possible. The author states that if this system be faithfully and wisely carried out both producers and consumers gain in the aggregate, and that none are penalized for the sake of subsidizing others.

In the following diagram the author gives a graphic representation of this principle of "classification" which he says demonstrates the specific advantage which can be attained by its practical operation.

There are four characteristics indicated in this diagram, as follows:

(1) Cost of production in relation to the dimensions of the output with profit added.

(2), (3) and (4) The characteristics of the relation between



Classification of Charges.

demand and price of electricity for light, power and heat uses respectively. The aggregate of these three classes of demand (at equal price) is also plotted. (Dotted black.)

The point where the "cost plus profit" curve crosses the "aggregate demand" curve indicates the maximum output obtainable at "equal price" (or equal profit) from all three classes of consumer. Under the condition assumed in the diagram it is seen that the maximum demand obtainable at "equal price" is 2.7 at price 2.

If discrimination is made in the price charged as between the different classes of consumer, under the conditions assumed in the diagram, a very much larger output is obtainable, and further, it is supplied at a much lower mean price. If, for instance, the light consumers are charged 2 as before, the power consumers 0.8 and the heat consumers 0.6, the output is increased from 2.7 to 6 and the mean price reduced from 2 to 1.13 per unit.

It will be noted that both the power and heat consumers are charged prices appreciably below the "cost" of supplying them (that is according to the orthodox conception of the cost of supplying them) and yet a handsome profit is realized by doing so.

The characteristics of this diagram may be approximate to or widely differ from the actual conditions of demand in any given area, but the author considers that principle remains unassailable, as it is clearly a principle of essential economy under certain conditions. It is true that the license to "clas-

sify" may, in incompetent hands, or in grasping hands, be abused and no one will dispute that "personal" discrimination as compared with "class" discrimination should be strictly prohibited. But if the higher planes of successful undertaking are to be reached the fact that a system otherwise beneficial is open to abuse must not be allowed to stand in the way, but rather protective regulation and restriction should be employed to minimize the danger.

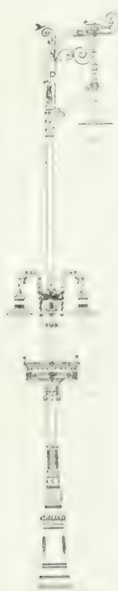
It is also true that there is a danger of miscalculation in "classifying" tariffs and the consequence of an error may be that mean price may fall below mean cost. This will happen if the course of demand of one use of electricity is wrongly estimated and a larger quantity of low-priced supply is demanded than is justified by the course of demand for relatively high-priced supply. Such danger should be met by providing a margin to meet the result of possible error and also possibly by setting aside a reserve which will be available to make good any deficiency, until alteration of price can be made and the error rectified.

In conclusion the author says that in view of the enormous field of potential demand for electricity for power and heat use, which cannot be reached at present because price bars the way, none will disagree with the conclusion that "we cannot afford to disregard any principle, however small its dimensions may be, which is a principle of essential economy."

Wiring and Illumination

EXTENSION OF STREET LIGHTING IN BUDAPEST.

In our issues dated Oct. 21, 1909, and April 28, 1910, Mr. Francis Jehl described a trial street-lighting system with Alba arc lamps in Budapest, which Mr. Etienne de Fodor, general manager of the Budapest General Electric Company, erected at his company's expense. The results of the test have proved so gratifying to the municipal corporation that it has not only decided to take over and pay for the cost, but has given the Budapest General Electric Company an order for the lighting of Andrássy Street (the Fifth Avenue of Budapast) and the second part of Rákoczi Street with 160 Alba lamps.


Ornamental Lamp Standard.

The city authorities have further decided to have all the main thoroughfares of the city lighted with arcs in the near future. This practical experiment that Mr. de Fodor made to convince the municipality of Budapest that the arc is the proper thing for street lighting may be taken as an object lesson by central-station managers, because it shows that taking a financial risk incurred in introducing a good thing is worth far more than any amount of talk or persuasion, for the laity are always better satisfied when they see the real thing and are not obliged to buy a "cat in the bag." The accompanying illustration shows one of the new ornamental standards, which are also fitted for gas, which is lighted after the arcs are extinguished at midnight. The combined type, however, is only used at the intersection of large avenues or squares, where the standards are erected on small islands in the roadway. Those placed on the curb of the street have no gas lamp, but are equipped with a flower basket.

DIMMERS IN CHURCH LIGHTING.

The lighting installation at St. [illegible] Military Church [illegible] the purpose of varying the intensity of illumination. Two large wire-resistance dimmers are installed at one end of the church and are operated by an attendant, who modifies the light according to circumstances. For instance, when the congregation is assembling a moderate illumination is provided and later the resistance is entirely cut out and the church becomes brilliantly lighted. Then during the sermon the illumination can be reduced to a dim glow, which is at once impressive and appropriate.

While, of course, there is little saving of energy, the system is particularly adapted to church lighting. The first cost of installation with dimmers is said to be less than that of the usual method, as the expense of the many long switch runs is avoided.

COMBINED SERIES ARC AND INCANDESCENT LIGHTING CIRCUITS IN CANADA.

For the lighting of the streets of Barrie, Ontario, Canada, use is made of fifty-two enclosed carbon-arc lamps of the 6.6-amp type and sixty 40-watt incandescent tungsten lamps of the 6.6-amp type. The tungsten lamps are at present operated on circuits distinct from the circuits of the arc lamps, each circuit being fed with energy through a separate constant-current regulator. The ampere ratings of the lamps were made equal in order that lamps could be used interchangeably upon the various circuits. Advantage will soon be taken of the arrangement in increasing the illumination in certain sections where tungsten lamps are now used and where arc lamps will be directly substituted therefor.

SPECIAL STREET LIGHTING ENHANCES PROPERTY VALUES.

That special street lighting enhances the value of outlying business property thus made attractive and conspicuous at night was recently demonstrated in St. Louis. Through the efforts of the Easton Avenue Improvement Association special ornamental street lamps were placed on Easton Avenue in the block bearing "4500" numbers. Lamps were placed every 25 feet on both sides of the street, electricity being furnished by the Union Electric Light & Power Company. The results were immediately beneficial. The business of the merchants was increased, vacant stores were rented, rents were increased, and various improvements were made. An offer of $1,000 a front foot was made for the lot on the northwest corner of Easton and Taylor avenues, which is a record for that section of the city. Real estate men and property owners attribute the advance entirely to the illumination of the street.

DECORATIVE LIGHTING FOR THE TORONTO EXHIBITION.

The lighting circuits of the buildings of the Toronto Exhibition have been rearranged for the purpose of supplying better illumination and reducing the fire risk. Many of the exposed conductors have been replaced by underground conduits; larger conductors are used and the switching arrangements have been improved. Ornamental cement lamp-posts have been placed along the main plaza road, around the horticultural building and along the driveway to the main gateway. Each post will be equipped with three 110-volt, 60-watt tungsten lamps.

Each of the buildings has been outlined with rows of 8-cp carbon lamps. These lamps receive energy through Norbit sockets, which have been employed in order that the wires may be removed subsequently and used for other purposes; the sockets are provided with contacts which simply puncture the insulating coverings of the wires. It is said that about 6000 additional small lamps are being used this year. The total expenditure for the improvements and extensions to the light

SPECIFICATION FOR INSULATING TAPE.

At the convention of the Pennsylvania Electric Association, held at Glen Summit Springs, on Sept. 14, 15 and 16, the committee on overhead-line construction, of which Mr. Thomas Sproule was chairman, submitted a report containing many valuable data relating to aerial circuits. One of the special features of the report was a list of specifications for insulating tape prepared from data furnished by various tape manufacturing companies and also from the specifications which were prepared by the American Telephone & Telegraph Company. These specifications are given in full herewith.

General.—The article desired under these specifications consists of a thin, flat braid, or tape, impregnated with an adhesive and insulating compound.

Braid.—The braid shall consist of a tough woven fabric not more than 0.015 in. nor less than 0.010 in. in thickness.

Compound.—The braid shall be thoroughly impregnated and covered with an adhesive and insulating compound, which shall amount to not less than 70 per cent nor more than 75 per cent, by weight, of the finished tape. The compound shall contain no active sulphur nor any other substance which will act injuriously on copper, iron or other metals, or on the braid. The compound shall adhere firmly to the braid.

Length.—The total length of 0.75-in. tape, after the insulating compound is applied, shall not be less than 160 ft. per lb.

Solubility and Absorption.—The compound shall be insoluble in water. The finished tape, when exposed to a moist atmosphere of approximately 90 per cent humidity for forty-eight hours, shall not absorb more than 2 per cent by weight of moisture.

Insulation.—When submerged in water, and after having been submerged in water continuously for 48 hours, a standard taped joint shall have an insulation resistance of not less than 1000 megohms. The joint to be tested shall be a standard Western Union joint in No. 14 B. & S. outside distributing wire. The distance between the ends of the insulation or length of the bare wire exposed in the completed joint shall not exceed 1.5 in. The joint shall be wound with two wrappings of tape, put on in reverse layers, with 0.5-in. overlap. The length of the taped joint shall be 2.5 in. In testing the tape the joint and 2 ft. of the wire shall be immersed in the water.

Mechanical Strength.—The tape shall be of sufficient strength to permit of its being tightly wound or applied without tearing or other injury.

Durability.—The tape, if kept in the roll, shall be guaranteed to show no marked deterioration in adhesiveness or insulation at the end of one year.

LETTERS TO THE EDITOR.

Converter Substation Design.

To the Editor of Electrical World:

SIR:—In the article in your issue of Aug. 4 entitled "American Switchboard Practice," under the subheading "Converter Stations" there is illustrated and described a certain type of substation without, however, any reference to the source of the schematic layout and arrangement of the apparatus shown. In order to supply this latter information I may say the cross-section as illustrated appears to be a direct copy, even to many small details, of a converter substation developed and built by the Brooklyn Rapid Transit Company and adopted as more or less standard by that company for its 2000-kw unit, 10,000-kw rotary substations.

This type of substation has so proved its superiority from an operating standpoint for railway work that it has been accepted by the Boston Elevated Railway Company. A description of the substation of this type built by the latter company is given in an article printed in the *Electric Railway Journal* of March 5, 1910.

Brooklyn, N. Y. A. K. MILLER.

A Correction.

To the Editor of Electrical World:

SIR:—It has recently been brought to my attention that a typographical error appears in several of the equations in my paper "On the Radiation from Metals" as printed in your columns in the issue dated June 23, 1910, page 1654. In the two equations for "σ" found on page 1656, the letter T is erroneously substituted for the Greek character Γ (gamma), which is not multiplied by $(\alpha - 1)$, but refers to the gamma function of $(\alpha - 1)$. The two equations to which reference is made should, therefore, read as follows:

$$\sigma \; [illegible] \; \Gamma(\alpha \; [illegible] \; \frac{1}{c_2 \; [illegible]}$$

and, three lines below—

$$\sigma \; [illegible] \; C_1\Gamma(\alpha \; [illegible] \; \frac{1}{c_2 \; [illegible]} \sum_{n=1}^{n=\infty} \frac{1}{n^{\alpha \; [illegible]}}$$

Cleveland, Ohio. EDW. P. HYDE.

Conflict of Water-Power Rights in Different States but Located on the Same Stream.

To the Editor of Electrical World:

SIR:—The recent Conservation Congress at St. Paul has brought to the front the question as to whether our nation's undeveloped water-powers, or at least such of them as are now not the property of individuals, shall be disposed of under the direction of the National Government or of the states. There are a number of considerations that may be raised in favor of each of these plans, some of which have been prominently brought forward and some of which have not been clearly pointed out. The present would seem to be the proper time to discuss all pertinent conditions, and the writer wishes to call attention through your columns to a matter that seems vital in the handling of water-power privileges. The principle is this, that once rights in any water-power have been granted to a person or a corporation, no other user of the water, located in a different state, shall have the right to interfere with the normal contemplated utilization thereof. Since our streams furnishing water frequently traverse more than one state, if these states are held to have unlimited sovereign rights over all water within their own boundaries, it will be perfectly possible for one state to nullify rights previously granted by another.

The seriousness of this possibility can be made clear by a hypothetical example. Suppose a plant to be established on a stream near a state boundary, the stream coming from the next state and that this plant has built up a load to the full normal capacity of the water-power and has enjoyed this load for some time, when another plant is established on the same stream higher up, and in the next state. We may further assume the not unlikely contingency that the upper plant has a considerable pondage and that the lower plant has little or none. The natural tendency of the upper plant will be to store water, at least during dry times, during Sundays and holidays for the heavier loads of other days. But the lower and older plant will not get the benefit of such storage at the time when extra water is needed and will actually experience a shortage of water as a result of the accumulating of the Sunday flow at the upper plant, which shortage will occur as much later than the Sunday storing period at the upper plant as the time required for the water to flow from one plant to the other; and such a deficiency of water might very likely occur [illegible] or the adding of a steam relay station. Where the two plants are close together the daily load variations might easily cause the lower plant to have plentiful water in the early hours of the morning and comparatively little water during the peak load

This possibility of a later-built plant taking advantage of an older plant, while not likely to occur often, is by no means a negligible danger. The writer knows of at least one such case. Such an injustice is, of course, provided against within the jurisdiction of any one state, where the first user has the right to his water. The point to be made is that such a method of control for public water-powers should be established, whether primarily under the states or under the National Government, that the later comer is bound to respect the rights of earlier plants even when in other states.

This general principle of interstate interference in the use of water has been before the public many times, one instance being in connection with the Chicago drainage canal, and possibly there may be some sort of roundabout legal redress at the present time, but this is not sufficient. Protection for the development of a water-power free from such disturbance should be definite and clean-cut and easily and cheaply invoked.

It would seem that the particular feature of water-power development concerned with the effect of one station's method of use on another station's supply would properly come under the jurisdiction of the National Government when the stations were in different states. There would seem to be no reason, however, why such matters as period of franchise grants and terms of payment therefor and similar matters might not be provided for entirely separately from interstate interference nor any reason why there should not be simultaneously both state and national regulation.

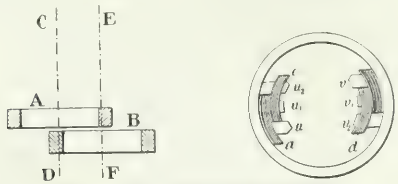
New York. PERCY H. THOMAS

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Variable-Speed Motor.—P. BARY.—An illustrated article on the B. V. D. system of variable-speed direct-current motors with stationary brushes. The motor belongs to the commutation-pole motors class, but does not have interpoles distinct from the main poles. The two kinds of poles encroach on each other. The principle is indicated in Fig. 1, where two



Figs. 1 and 2—Variable-Speed Motors.

coils *A* and *B* are shown. If *A* alone is excited the axis of the flux is *CD*. If *B* alone is excited the axis of the flux is *EF*. If both coils are excited the axis of the flux is parallel to *CD* and *EF* and between the two. When such overlapping windings are placed on each pole of a motor the axis of maximum magnetic flux can be displaced at will by adjusting the excitation of both windings and this effect is equivalent to a change of the position of the brushes with respect to the poles. Since wide speed variations of a motor are possible if the brushes can be displaced at will, the above arrangement serves equally well. Applied to a two-pole motor it is shown in Fig. 2. The author discusses at some length the use of such motors for traction purposes and the possibility of recuperating energy in traction.—*La Lumière Elec.*, Aug. 20.

Voltage Drop of Polyphase Synchronous Machines.—J. A. SCHOUTEN.—The voltage drop of a machine is caused by the apparent resistance of the armature and the reacting m.m.f. of the armature current. The principal problem is, therefore, to determine this reacting m.m.f. The author first discusses an approximate graphical method formerly used and an analytical method of Blondel. Only the analytical method permits one to determine correctly and quickly the m.m.f. In determining its value the author shows that former formulas on armature reactance, etc., were incorrect. The results of the author's theory are compared with success with the experimental results obtained on a single machine, and the author suggests testing the results of this theory on other machines. He finally shows that the calculation may be shortened by avoiding the graphical method.—*Elek. Zeit.*, Sept. 1.

Currents in Bearings.—L. BERGER.—A French translation in abstract of a recent German paper of Adler on the origin of the currents which pass through the bearings and frame of dynamo-electric machines and means of avoiding them.—*La Lumière Elec.*, Aug.

Short-Circuit Test.—L. BERGER.—A French translation in abstract, with illustrations, of the recent German paper of Doczekal on short-circuit tests of direct-current machines.—*La Lumière Elec.*, Aug. 27.

Lamps and Lighting.

Mercury-Vapor Lamps for Sterilization of Water.—M. VON RECKLINGHAUSEN.—An illustrated article on the sterilization of water by ultraviolet rays produced from the mercury-vapor quartz-globe lamp. The quartz globe is used in order to permit the passage of the ultraviolet rays which would be absorbed by a glass tube. A small water sterilizer has been constructed for hospital use, where 132 gal. of sterilized water are produced per hour from ordinary city water by means of one Cooper Hewitt "silica" lamp, absorbing 3 amp at 110 volts. (Fig. 3). The mercury-vapor lamp is placed in the dome top of the apparatus. The water enters the chamber formed by the outer cone with a swirling motion. At the top of this cone it overflows and finds an outlet at the discharge pipe at *B*. The swirling motion is maintained during the complete passage of the water through the apparatus in order that it may be thoroughly stirred up and all microbes presented to the action of the light, the water coming under its influence on two distinct occasions. Drain cocks *P* are provided on the apparatus to enable it to be thoroughly drained should circumstances arise whereby it is not to be used for a considerable time.—Lond. *Elec. Rev.*, Sept. 2.

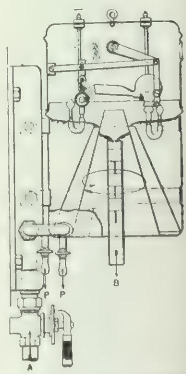


Fig. 3—Mercury-Vapor Lamp for Sterilizing Water.

Flame-Arc Carbons.—A note on two recent British patents (18,469, 1909; and 15,977, 1910; Aug. 25, 1910) of F. M. Lewis. The first patent covers a process of manufacturing flame-arc lamp carbons consisting of a tubular or solid core of hard carbon with an outer sheath of flaming material compressed over the core. The second patent covers a flaming mixture of equal parts of calcium fluoride and silicon carbide with a "binder of gold size." A sheath of this material 1.4 mm thick is applied to a core 11 mm in diameter with a 6-mm central hole. After baking, the electrode is given a protective coating of water-glass.—Lond. *Elec. Eng'ing*, Sept. 1.

New Flame-Arc Lamp.—A note stating that the Allg. Elek. Ges. of Berlin purposes to place on the market a new flame arc lamp for currents of from 8 amp to 12 amp, characterized by long lighting hours, which amount to from 80 to 100, as compared with 16 hours in the case of flaming arcs of the ordinary type. It is said that the advantages of the lamp consist prin-

cipally in the reduction of the [illegible] and attendance the lamp being suitable for external lighting and the illumination of high factory rooms. No details of the construction are yet given.—Lond. *Elec. Rev.*, Sept. 2.

Advertising Signs.—W. A. G. Müller.—A paper read before the annual convention of the Verband of German Electrical Engineers. The author describes various new automatic switches for the intermittent illumination of advertising signs. These switches are operated either automatically by a hot wire or by small electric motors.—*Elek. Zeit.*, Sept. 1.

Lighting Bowling Greens.—W. G. Rhodes.—An illustrated description of a method of lighting bowling greens by means of 50-cp and 100-cp osram lamps.—Lond. *Elec. Rev.*, Sept. 2.

Generation, Transmission and Distribution.

Circulating Water.—W. N. Y. King.—An article describing some experiments on the regulation of circulating water in connection with a condenser plant.—Lond. *Elec. Rev.*, Sept. 2.

Traction.

Railless Traction.—P. A. Mossay.—Illustrated notes on the Koehler Namag system of railless traction in use in several places in Germany. The principal novel feature seems to be the overhead equipment. It consists of two hard-drawn copper wires suspended one above the other in a vertical plane, while the current-collecting device is a combination of the trolley wheel and the bow. The trolley wheels, two in number, run on the upper negative wire and the two bows are pressed against the lower part of the underlying positive wire by means

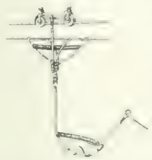


Fig. 4—Trolley for Railless Traction System.

of a spiral spring (Fig. 4). The current is led to the vehicle by means of a flexible line which winds itself automatically on a drum mounted on the car, enabling this latter to behave on the road with the ease and freedom of a self-propelled vehicle. The current-collecting device is further fitted with an elastic articulation which guards the overhead system from the shocks which are caused by the sudden starting or stopping of the car. The motor is either an 8-hp or 14-hp moderate-speed continuous-current series machine, fitted with commutating poles. The main field is wound in two sections, thus permitting series-parallel speed control.—Lond. *Electrician*, Sept. 2.

British Railways.—W. E. Dalby.—His presidential address before Section G of the British Association for the Advancement of Science. The author gives figures and curves on the development of British railways, with special reference to the cost of working per train-mile, etc. He then takes up locomotive problems, gives characteristic curves of steam locomotives, and finally discusses the development of electric railways which began in England at the end of 1890.—Lond. *Electrician*, Sept. 2.

Brooklyn.—In a continuation of the long series of articles on the line department of the Brooklyn Rapid Transit system a detailed description of the third-rail maintenance, high-tension work, feeders and miscellaneous features is given.—*Elec. Rail. Jour.*, Sept. 10.

Installations, Systems and Appliances.

Restricted Hour Supply.—[illegible] his long article on the restricted-hour system of power supply. The author emphasizes that the restricted-hour system should not be confounded with the two-rate system. The latter has a considerable element of risk as there is no sound provision for ensuring a proper return for the capital charges incurred by the maximum demand of supply. It is a system far less sound than the maximum [illegible] kilowatt of demand with a low price per kw-hour. Entire restriction should be aimed at, otherwise a consumer must be made to pay his fair proportion of the capital charges incurred by his demand. After briefly summing up the general arrangements of the restricted-hour system the author gives figures and diagrams showing the effect of this system on the central

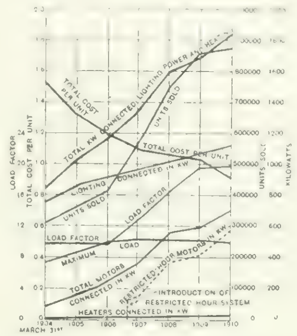


Fig. 5—Curves of Loads, Costs, Etc.

station of Burton-on-Trent. Fig. 5 gives the curves for the connections, load factor, etc., during three years each before and after the introduction of the restricted-hour system. They deal with the alternating-current supply only and do not include the direct-current supply, which is used for tramway purposes only. Curve I shows the lowness and the constancy of the load factor previous to the introduction of the restricted-hour system, and how, after its introduction, it immediately took a strong upward movement and maintained it. Total kilowatt connections have increased year by year at a greater rate since its introduction than before. After its introduction the load factor, which was 9.67 per cent for the year ended March 31, 1906, was raised to 19.63 per cent for the year ended March 31, 1909, or an increase of 100 per cent in three years. The curve shows in an interesting manner the yearly rise in maximum demand previous to its introduction and its constancy afterward, notwithstanding that the kilowatt connections increased at a more rapid rate. Further, the curve for the restricted-hour motors connected gradually gets closer to the curve for the total motors connected. This is due to motors which were running unrestricted being transferred to the restricted class. Other curves giving the operation of the system week by week for four years are also given.—Lond. *Elec. Rev.*, Sept. 2.

British Central Station.—An abstract of last year's financial report of the municipal central station of Bolton. In the preceding year the output of electrical energy had decreased on account of trade depression and the increased use of metallic-filament lamps. During the past year, however, the output of electrical energy has increased for all purposes. Private lighting shows an increase of 3.6 per cent power 22 per cent and traction 4.1 per cent. Since the average price received from power users was only 1.624 cents per kw-hour (1.70 cents a year ago), while lighting consumers obtained their energy at an average price of 5.5 cents per kw-hour (5.62 cents a year ago), it is evident that cheap power supply by no means implies penalizing lighting and other consumers. The total costs (excluding capital charges) were 1.12 cents per kw-hour, while capital charges amounted to 0.92 cent per kw-hour, the inclusive cost, therefore, being 2.04 cents, as against 2.14 cents last year. The plant capacity remains unchanged, viz., 7600 kw, the maximum load recorded during 1909-10 being 5941 kw, compared with 4925 kw in the year 1908-9. The load factor continues to decrease, being now only 23.1 per cent, as against [illegible] per cent in 190[illegible].—Lond. *Electrician*, Sept. 2.

Electric Cooking.—F. R. CRIPPS.—An illustrated description of a simple domestic electric cooking outfit used by the author in his own household of three persons. The outfit is partly home-made. Besides the other advantages of electric cooking it is claimed that at 2 cents per kw-hour it saves money.—Lond. *Elec. Rev.*, Sept. 2.

Wires, Wiring and Conduits.

[illegible] Tension [illegible].—M. H[illegible].—A translation of his recent German paper in which the author describes experiments made on paper cables at high pressures with a view to determining the dielectric losses in the insulation. The pressures were gradually increased until the insulation broke down; and from the oscillographic records the author describes a method which he has devised for drawing the so-called hysteresis curve, corresponding to that for the magnetization of iron. He also shows that there is apparently no "viscosity" traceable in paper cables, and that the breakdown takes place suddenly. He concludes with some remarks on the design of insulated transmission cables and effect of frequency. The same issue contains a long editorial on dielectric losses in cables.—Lond. *Electrician*, Sept. 2.

Electrophysics and Magnetism.

Corpuscular Hypothesis.—W. H. BRAGG.—A paper in which the author first relates the case for the corpuscular hypothesis of the Röntgen and gamma rays, according to which these radiations consist of streams of discrete entities. He then discusses at considerable length the consequences of this hypothesis. One of these consequences is the general principle that if one radiant entity (α, β, γ, X or cathode ray) enters an atom, one and only one entity emerges, carrying with it nearly all the energy of the entering entity. We are to think of each entity as possessing initially a certain store of energy which it spends gradually as it goes along, the result being ionization of the material through which it passes; there are no sudden accessions or withdrawals of energy; the path is not necessarily straight, but made up of a number of small pieces more or less straight, the deflections or turnings being the result of intra-atomic collisions; the β rays are very liable to such deflections, and the cathode rays even more so. Certain conversions of form may take place, γ into β, X into cathode rays, and so on, but in such cases the energy is handed on, and in some cases at least the momentum. The essence of it all is the recognition of the individuality of each entity, which is to be followed by itself from its origin, through all its changes of direction and sometimes its changes of form, until its gradually diminishing energy becomes too small to render it distinguishable.—*Phil. Mag.*, September.

Splashing of Mercury.—J. J. LONSDALE.—An account of an experimental investigation of the ionization produced by the splashing of mercury. The results are summed up as follows: Splashing mercury on an iron plate produces a large excess of positive ions over negative ions. A considerable proportion of these ions have a very small velocity. The amount of ionization depends on the nature of the surface on which the splashing is produced. The current-voltage curves for the positive ions show peculiarities which may be most readily explained by supposing the presence of neutral doublets, which are broken up by the field or other means. Below certain heights these doublets are not produced. Similar peculiarities in the saturation curve for the positive ions of aluminum phosphate and lime are also noticed. The negative ions from these three sources show no such peculiarities.—*Phil. Mag.*, September.

Hysteresis Loops.—S. P. THOMPSON.—A paper read before the British Physical Society on hysteresis loops and Lissajous' figures and on the energy wasted in a hysteresis loop. He shows that any hysteresis loop can be analyzed into a harmonic series of closed curves corresponding to the various terms in the analysis of the current wave. These constituents of the hysteresis loop are examined at considerable length in the paper.—*Phil. Mag.*, September.

[illegible].—[illegible].—A review of Rutherford's work on the alpha particle, giving a sketch of his extended researches on the electric charge and the mass of the alpha particles emitted from radioactive substances and the identification of the alpha particle as a positively charged atom of helium. Finally a summary is given of the different determinations of the "natural unit" of electricity.—Lond. *Electrician*, Sept. 2.

Hysteresis.—C. F. GUILBERT.—A discussion, with special reference to a recent German article of C. Breitfeld, of the phase displacement and the phenomena of hysteresis in alternating-current circuits containing iron. The discussion is chiefly mathematical and a suitable graphical representation of the phenomena is given.—*La Lumière Elec.*, Aug. 20.

Electrochemistry and Batteries.

Ozonization of Water in Russia.—It is reported that it is proposed to erect a water sterilization plant by means of ozone in St. Petersburg at a cost of $3,000,000. This scheme is on the point of being submitted to the Ministerial Council. The Siemens & Halske Company built a similar but smaller plant a year ago in St. Petersburg, and the approaching presentation of the new scheme is said apparently to show that good results have been obtained from the ozonization of water.—Lond. *Elec. Rev.*, Sept. 2.

Units, Measurements and Instruments.

Electric Resistance Thermometers.—H. L. CALLENDAR.—His presidential address to the British Physical Society on electrical recording thermometers for clinical work. The author first discusses the objections which have formerly been raised against electric resistance thermometers, namely, (1) that they are more difficult to construct and to insulate satisfactorily than thermocouples, and (2) that their indications are liable to be disturbed by the heating effect of the current employed. He shows that objection (1) is readily surmounted by proper methods of construction and objection (2) by a proper consideration of the conditions of sensitiveness. As to the latter point he shows that the limiting condition is imposed by the heating of the current on the resistance to be measured and the resistances, etc., should be so chosen and arranged as to give the greatest sensitiveness for a given limiting value of the current through the resistance to be measured. In an arrangement of the Wheatstone bridge, as indicated in Fig. 6, the

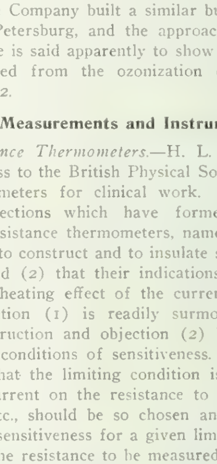


FIG. 6—Diagram of Wheatstone Bridge Arrangement.

ratio of the current c through the galvanometer G to the current C through the resistance R to be measured is a measure of the sensitiveness. This ratio is quite independent of the resistance or e.m.f. in the battery circuit. In order not to reduce the sensitiveness considerably it is of first importance not to make n small or m large. In the practical use of platinum thermometers n must be equal to unity, because it is necessary to compensate the changes of resistance of the leads by the equal changes of resistance of a pair of compensating leads on the opposite side of the galvanometer contact on the bridge-wire; and m is made $= 1$ or less. The author discusses the resistance of the galvanometer and the resistance of the thermometer, and then takes up the construction of clinical thermometers. Quicker action and a smaller heating effect of the current are readily effected by winding the wire on a flat plate of mica in place of a cross, and melting the lower part of the containing tube (which is preferably of lead-glass) down onto the wire so as to form a flat bulb, as illustrated in Fig. 7. If the glass is thin, the sensitiveness may be increased nearly five times, as

compared with a thermometer of the ordinary type, and the heating effect of the current reduced in nearly the same proportion. When inserted in a water bath at 37 deg. C. this thermometer takes less than a minute in arriving within a hundredth degree of the final temperature, but when inserted cold in the mouth it may take four or five minutes to get within a tenth of a degree, because the tissues of the mouth take time to recover from the cooling effect of inserting the thermometer. It is essential that thermometers of this type

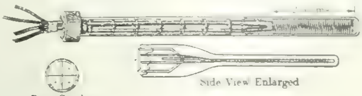


Fig. 7—Form of Flat-Bulb Thermometer.

should be provided with compensated leads, otherwise there will be a variable immersion error, and an apparent lag due to slow conduction of heat along the leads. It is also important for accurate work to avoid screw terminals in the head of the thermometer, and to provide each instrument with flexible leads 2 m or 3 m long, permanently soldered to the thermometer and compensator leads and securely attached to the head of the thermometer, as indicated in Fig. 7. Finally recorders, and especially the thread recorder, are discussed.—Lond. *Electrician,* Sept. 2.

Measurement of Magnetic Susceptibility.—P. Pascal.—A paper presented before the French Academy of Sciences. The solid or liquid body, the magnetic susceptibility of which is to be measured, fills one-half of a glass tube *T* (Fig. 8), which

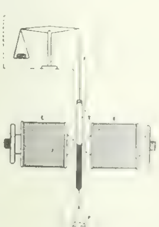


Fig. 8—Measurement of Magnetic Susceptibility.

has a length of 10 cm to 30 cm (4 in. to 12 in.) and an inside diameter of 8 mm (315 mils). By means of a thread *F* of 60 cm or 70 cm (24 in. to 28 in.) length this tube is suspended from one arm of a balance. The tube is in the air-gap of a strong electromagnet. The upper surface of the material to be tested is in the center of the magnetic field, which is practically constant in a volume of 2 cu. cm (0.12 cu. in.) for an air-gap of 1 cm (394 mils). A non-magnetic tray *P* is suspended from the lower end of the glass tube and the whole is protected by means of a glass cage, indicated in the illustration by dotted lines. A horizontal microscope permits the observation of the upper surface of the material to be tested. The apparatus is brought into equilibrium by putting weights upon the tray *P*. The weights on this tray are then changed and equilibrium is re-established by exciting the electromagnet. From the excitation of the electromagnet and the change of weights on *P* the magnetic susceptibility is determined.—*La Lumière Elec.*, Aug. 27.

Telegraphy, Telephony and Signals.

Telephone Exchange.—An illustrated description of a new telephone exchange in London which is the first London exchange to adopt a 40-volt common battery in place of the customary 11-cell battery, and it will employ the new circuit introduced by the Peel-Conner Telephone Works at the new Glasgow telephone exchange modified to suit London requirements. The exchange is in Willesden, and is equipped for 2700 subscribers' lines with an ultimate capacity of 8100. There are 208 incoming junctions, 240 outgoing junctions and 40 incoming order wires. Fig. 9 is a drawing of the relay employed throughout the circuits. The armature *A* is hinged in simple manner at *B* and is controlled by the flat brass spring *C*, which is an extension of the connection tab, and also carries one of the contacts. It presses the armature outward through the small ebonite piece *D*, which is fixed to the stirrup *F*. *G* is merely an ebonite distance-piece to keep the lower contact spring *H* in position, and the spring *C* has a hole in it just sufficiently large to allow it to clear *G* as it moves backward and forward. The end of the armature is brought inward and curved to embrace the extension of the core of the coil, and this end of the armature is shod with thin sheet brass to prevent sticking. All the iron parts are galvanized. A conical nut *K* with a lock nut is placed on a set-screw in the brass bracket which supports the coil and core. The stirrup *F* rests

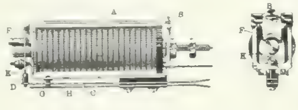


Fig. 9—Diagram of Telephone Relay.

on this nut in its normal position and by turning the nut in one direction or the other a very delicate adjustment is obtained of the distance between the core and the curved projection of the armature. Diagrams are given of the construction of the switchboard and connections.—Lond. *Elec. Eng'ing,* Sept. 1.

Wireless Telegraph Station.—A. Tosi.—An abstract of a paper read before the International Society of Electricians in Paris. The author describes the new wireless telegraph station at Boulogne, where the Bellini-Tosi directive system is employed. The results obtained as regards communication are stated to be excellent, messages having been regularly exchanged at night between Boulogne and Algiers, a distance of 1500 km (900 miles), using only ½ kw of primary energy at Boulogne. It has been found that in all cases the signals received on the directive system—which is not earthed—are considerably stronger than those of the ordinary system. Some quantitative experiments made with a Duddell thermogalvanometer at a distance of 3 km (1¾ miles) from the station showed that, using the directive aerial, the deflection obtained is practically six times (113:19) as great as with the ordinary vertical antenna (earthed). The concluding portion of the paper makes mention of the use of the radiogoniometer ("wireless azimuthal compass") on board ship for position finding. In the course of a voyage to New York and back on the *Louisiane,* of the Compagnie Générale Transatlantique, which was fitted with a temporary compass installation, it was proved that the useful range of the wireless compass was at least equal to that of the standard compass—namely, about 40 km (24 miles). The bearings of several wireless telegraph stations as determined with the wireless and the standard compass were always identical. The important point was also established that the elevated metal parts of the vessel have no influence whatever on the bearing as determined with the wireless compass. The use of such a compass in time of fog is obvious, and is still further increased if a land station fitted with the directive method is available within range.—Lond. *Electrician,* Sept. 2.

Telephone Transformer.—H. Pleijel.—An article in which the author gives formulas for the self-induction and the most favorable number of turns in the windings of a transformer for telephone currents. A simple graphical solution of the problem is given.—*La Lumière Elec.*, Aug. 27.

Wireless Telephony.—The first part of a review of the various papers and notes presented by Majorana to the Reale Accademia dei Lincei in Rome on wireless telegraphy and telephony. In the present instalment the different methods of the production of sparks and the regulation of sparks are [illegible]

stalment hydraulic microphones are especially dealt with and the principal arrangements used by Majorana in practice in the transmitting and receiving stations are described.—*La Lumière Elec.*, Aug. 27.

Wireless Telegraphy.—W. H. Eccles.—The first part of an article illustrated by diagrams on recent patents in wireless telegraphy. The author first deals with methods of generating oscillations and then discusses methods of producing signals. The article is to be concluded.—Lond. *Electrician*, Sept. 2.

Miscellaneous.

Electro-Vaccination.—The fact that a variety of skin diseases, such as psoriasis, lupus and eczema, show material improvement under exceedingly small doses of X-ray radiation has led to the view, put forward recently by Dr. W. Deane Butcher, and reported in the *Archives of the Röntgen Ray*, that the action of irradiation is of the same nature as that of vaccination—that is, it furnishes a stimulus under the influence of which the patient's own organism develops the equivalent of a vaccine. For example, the irradiation of a leg for lupus has been followed by improvement in a remote part of the body, such as the face; acne of the face has been cured by X-rays and high-frequency treatment applied to the back and shoulders; and numerous cases are on record in which remarkable results have been obtained from comparatively trifling applications of the treatment. Dr. Butcher remarks that "in the whole purview of medicine there is nothing more impressive or more certain than the cure of a small rodent ulcer by electrical methods"; but it may be effected in many ways—Röntgen rays, radium, ultra-violet light, high-frequency effluves, or zinc ions. The common factor in all these cures is, he thinks, "a biological recoil—the resentment of the cells of the organism to the insult of the ethereal vibration," resulting in the production of antitoxins or other antibodies. "It is a true vaccination."—Lond. *Elec. Rev.*, Aug. 26.

Mathematics.—E. W. Hobson.—His presidential address to the mathematical and physical section of the British Association for the Advancement of Science. He dealt with the scope and tendencies of modern mathematics. He emphasized that pure mathematics should not be suppressed for the sake of applied mathematics. The belief is very general among instructed persons that the truths of mathematics have absolute certainty, or at least that there appertains to them the highest degree of certainty of which the human mind is capable. Nevertheless there are two facts which are of considerable importance as regards an estimation of the precise character of mathematical knowledge. In the first place, it is a fact that frequently and at various times, differences of opinion have existed among mathematicians, giving rise to controversies as to the validity of whole lines of reasoning and affecting the results of such reasoning. In the second place, the accepted standard of rigor, that is, the standard of what is deemed necessary to constitute a valid demonstration, has undergone change in the course of time. That oldest text-book of science in the world, Euclid's elements of geometry, has been popularly held for centuries to be the very model of deductive logical demonstration. Criticism has, however, largely invalidated this view. The author questioned the success of the new school of teaching mathematics in English technical schools. "It is quite true that a great mass of detail which has gradually come to form part—often much too large a part—of the material of the student of mathematics may with great advantage be ignored by those whose main study is to be engineering science or physics. Yet it cannot be too strongly insisted on that a firm grasp of the principles, as distinct from the mere processes, of calculation is essential if mathematics is to be a tool really useful to the engineer and the physicist." In a separate editorial article the deplorable lack of mathematical training among engineering students, especially in evening schools, is discussed. The most serious is the inability to manipulate simple equations, and it is recommended "to keep the class working at the manipulation of simple equations for no less a period than three months." The second weakness is the inability to calculate the arithmetical part when the question has been brought to suitable form, and to use logarithms and the slide rule efficiently.—Lond. *Elec. Rev.*, Sept. 2.

Book Reviews

Freight Transportation on Trolley Lines. By Charles S. Pease. New York: McGraw-Hill Book Company. 62 pages, illus. Price $1.

Freight is the principal source of income for steam roads and yet the electric lines have been very slow to take up this branch of the transportation business. Of course, electric roads usually operate only short lines and have no facilities for handling regular freight business, yet a local freight and express business can often be profitably developed if taken up in a thorough-going manner. Mr. Pease has outlined the essentials of local freight business, and laid down simple rules to guide those who desire to establish such a business. It is a book which all electric interurban railway managers can read with profit.

Manual of Wireless Telegraphy. For the Use of Naval Electricians. By Lieut-Comdr. S. S. Robison. Annapolis: U. S. Naval Institute. 129 pages, 60 illus.

This is one of a series of books on various subjects compiled to serve as manuals for those engaged in carrying on the routine work of the various naval technical branches to which they relate. The present book contains five chapters and a number of appendices, as follows: Chapter I consists of a general review of facts relating to high-frequency currents, prefaced by a statement of the fundamental principles of electrical action. Chapter II relates specifically to high-frequency phenomena, with sections on condensers, skin effect, and electric waves. Chapter III is on damped and undamped oscillations. Chapters IV and V are devoted respectively to sending and receiving circuits. The three final chapters have in this edition (1909) been revised and extended by Dr. L. W. Austin. The appendices include several sets of official instructions for the installation and operation of wireless plants, regulations, keeping of log-books, etc. The book is of general interest as an epitome of the principles of wireless telegraphy and as a guide for the practical operation of plants. It cannot, however, be considered a systematic treatise on either the science or the art.

Medical Electricity and Röntgen Rays. With Chapters on Phototherapy and Radium. By Sinclair Tousey, A.M., M.D. Philadelphia: W. B. Saunders Company. 1116 pages, 734 illus. Price, $7.

In this substantial volume the author has brought together a vast amount of information not only on medical electricity and the X-ray, but also on the treatment of disease by electric light and radium. Considerable space is given to the physics of electricity in its bearings on medicine and to a description of the great variety of apparatus in use. There are full discussions of the physiologic effects of electricity; of electropathology; electrodiagnosis; ionic medication by electrolysis; the physiologic effects of electromagnets; electricity in diseases of the nervous system; and of high-frequency currents. Equally exhaustive are the chapters that deal with phototherapy, the Röntgen rays, radium and radium therapy. The work is so encyclopedic in scope that there is scarcely a topic relating to medical electricity for which the reader will look in vain among its pages. On this account it should prove a useful book of reference. As a text-book for the student and practitioner wishing to acquire a systematic and serviceable knowledge of medical electricity and light therapy it appears to be open to two objections, namely, the lack of perspective evinced in the author's treatment of some of the sections, and the tendency—natural, perhaps, in a work of this kind—to overrate the curative power of the agents with which it deals.

Machine Shop Drawings. Reading Drawings, Making Shop Sketches, Laying Out Work. By Fred. H. Colvin. New York: McGraw-Hill Book Company. 146 pages, 91 illus. Price, $1.

This little book may be considered as an exposition of the language of mechanical drawing which will enable any ordinary mechanic to interpret shop drawings, to lay out simple work involving geometrical relations and to make intelligible perspective sketches to assist him in conveying his ideas. Mr. Colvin has drawn all his examples from practice and his explanations are clear and to the point. For those who wish merely an elementary knowledge, this book is suitable.

Practical Testing of Electrical Machines. By Leonard Oulton and Norman J. Wilson. New York: The Macmillan Company. 210 pages, 90 illus. Price, $1.40.

The commercial testing of alternating-current and direct-current machines is here stated in the form of directions for making tests, working up the data and tabulating the results. The theory of the machines and of the tests is presupposed and is therefore not given. On account of the absence of all theory and reasoning, the book is not adapted to use alone, but should be studied in conjunction with other books. For those who have testing to do the book furnishes plain directions for making all the ordinary tests. The authors evidently do not consider the various loading-back tests as sufficiently common for presentation in this book, and it is probable that in England this may be true. American readers will consider this as a serious omission. Transformer testing is not treated.

The Gas Turbine. By H. H. Supplee. Philadelphia: J. P. Lippincott Company. 262 pages, 93 illus. Price, $3.

The present work collects and arranges for study and reference the principal contributions that have been made to the subject of the gas turbine. After a brief historical sketch, Neilson's paper entitled "A Scientific Investigation Into the Possibilities of the Gas Turbine," read before the British Institution of Mechanical Engineers in 1904, is given in full, together with its subsequent discussion by members. This paper occupies a fourth of the book, and is of considerable value from a theoretical standpoint, as a great variety of cycles for the use of the heat in a cubic foot of gas mixture are worked out theoretically for maximum ideal efficiencies. One of the conclusions is that the best results in gas turbines will come, not necessarily from high temperatures, but with moderate temperatures and careful dispositions to obtain the least possible negative work.

The next section of the book consists of a paper by M. Sekutowicz, read before the French Society of Civil Engineers. The entire range of theoretical and practical possibilities in connection with the gas turbine is here discussed in the clear, logical French style, so pleasing to those surfeited with "engineering English." It is interesting to note that one of the very cycles pronounced by Sekutowicz to be singularly capable theoretically of efficient service—namely, the use of waste explosion and exhaust heat gases to generate steam to be also directed upon the turbine blades for the double purpose of increasing the potential volume available from the total heat and also cooling the turbine blades themselves—should have been the actual practical scheme adopted by later experimenters.

The next two chapters of the book are devoted to theoretical considerations of expansion nozzles and turbine blades, and the final chapters give the experimental researches of Armengaud, Stelzer, Lemale, Rateau and Barbezat up to the death of Armengaud in 1908. It appears that up to the death of Armengaud considerable progress had been made, including the construction of a 300-hp gas turbine, which developed that amount of power over and above the negative work required by the air compressor, which was about half the load.

At present effort to produce a practical gas turbine is centered on two types. One is the constant-combustion type in which compressed air and gas are brought together in a suitable chamber and the resulting expansion from ignition directed upon the blades of a turbine wheel through a divergent nozzle. A steam nozzle also acts upon the same wheel, keeping down the temperature and getting its steam from a flash boiler in the path of the exhaust gases from the turbine wheel.

The second type is the explosion turbine, in which air is admitted at atmospheric pressure into the explosion chamber, meets a charge of gas, is ignited and directed upon a turbine wheel by a nozzle. The force of the explosion not only empties the chamber, but produces a suction that draws in another charge of air, which ignites after mixture with the gas, about three explosions to the second occurring. Even in its present crude state the small explosion turbines, such as Kravodine's, are stated to give about the same economy as a gas engine. For those interested in the development of the gas turbine this book will be of great value.

New Apparatus and Appliances

TUNGSTEN LAMP IMPROVEMENT.

The member companies of the National Electric Lamp Association have begun to supply, in limited quantities, a new form of "Mazda" lamp, developed in the laboratories of the Association, which, it is claimed, is one of the most important advances yet made in the development of the incandescent lamp. It is stated that the principal point which distinguishes the newcomer from its predecessors is the method of making and mounting the filament, which is produced in the form of a long ductile wire, by means of processes said to be unlike any of those hitherto employed in the manufacture of tungsten filaments. Lamps made from this wire have continuous as distinguished from non-continuous, or "hairpin," filaments.

The connection between the wire filament and the leading-in wires is made by means of a "clamped joint' similar to that used in tantalum lamps. Such a joint is more or less flexible, and it is therefore evident that all rigid points of filament attachment have been eliminated. It is stated that the lamps made from the newly developed wire will stand without damage a blow from two to four times as severe as will an ordinary tungsten-filament lamp. The wire as manufactured at present is ductile and flexible but becomes less ductile after the lamp is first lighted. The increased strength is mainly due to the improved method of support, as explained above. The present lamp is stated to be made by a radically different process from that employed for other "wire type" tungstens and not to possess the objections which have been noted against the latter. In fact, the new lamp is said to be practically equal to the present "Mazda" as regards life and candle-power performance, to which is added its freedom from fragility.

The following manufacturers are selling the new lamps: The Banner Electric Company, the Brilliant Electric Company, Bryan-Marsh Company, the Buckeye Electric Company, the Colonial Electric Company, the Columbia Incandescent Lamp Company, the Fostoria Incandescent Lamp Company, the General Incandescent Lamp Company, the Monarch Incandescent Lamp Company, New York & Ohio Company, the Shelby Electric Company, the Standard Electrical Manufacturing Company, the Sterling Electrical Manufacturing Company, the Sunbeam Incandescent Lamp Company and the Warren Electric & Specialty Company.

THEATER DIMMER.

The accompanying illustrations show side and front views of a bank of dimmers furnished the Hollis Street Theater, Boston, by the Ward Leonard Company, Bronxville, N. Y. One of the main features of the dimmer is that the absolute

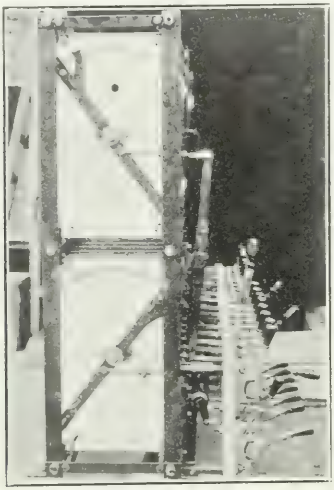


Fig. 1—Side View of Dimmer.

direct drive given between the operating handle and the controlling lever is maintained upon a straight line even though the plates are of a considerable height above the board. This obviates the cutting of a large slot in the switchboard and assures a perfectly smooth dimming of the lights. The operation

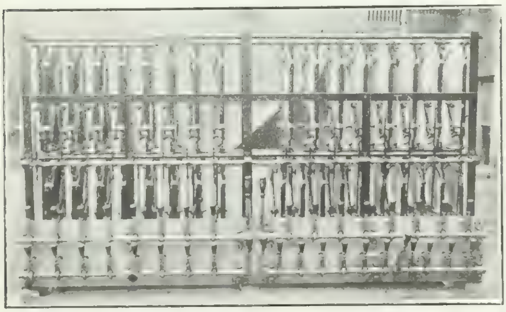
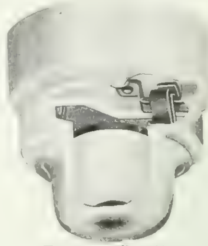


Fig. 2—Front View of Dimmer.

is self-explanatory from the cuts. It may be added that these dimmers are so nicely balanced in operation that any dimmer handle can be used to control the entire dimmer bank, it not being necessary to use a large handle as a master lever. The plates are of the standard enamel type.

TUNGSTEN ROSETTES.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has put on the market a rosette for use with tungsten lamps and shown in the accompanying illustration. As will be seen, the laminated cotton felt cushion takes the support off the lamp and eliminates vibration of the tungsten filament. This device will thus allow tungsten lamps to be used in factories and lofts where otherwise they could not safely be installed. As is well known, the life of a tungsten lamp will be greatly prolonged when a suitable shock absorber is used, especially in installations where lamps are subjected to more or less severe vibration. The manufacturers state that in spite of the fact that mechanically the construction of tungsten lamps has been considerably improved, their filaments are still fragile,



Tungsten Rosette.

but that the new rosette will enable their use in all places where the lamps are subject to vibration.

BENJAMIN REFLECTOR SOCKETS.

A line of reflector sockets is being placed upon the market by the Benjamin Electric Manufacturing Company, of Chicago. They consist of a deeply-hooded, one-piece, enameled-steel reflector with a threaded brass bushing tightly clamping the reflector between two leather washers and an especially designed

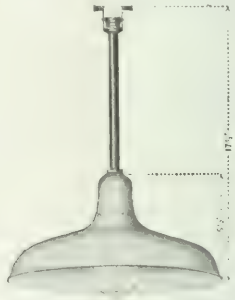


Fig. 1—Bowl-Shaped Reflector with 100-Watt Tungsten Lamp.

receptacle or socket. The reflectors are of two general types—flat-cone (distributing), for wide distribution, and bowl-shaped (diffusing), for medium distribution. The hooded portion varies in diameter to accommodate three kinds of lamps, namely, carbon and short base, skirted base and large base. Each

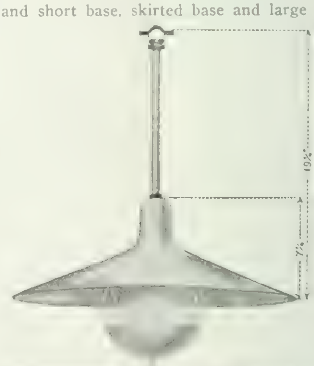


Fig. 2—Flat-Cone Reflector with 500-Watt Tungsten Lamp.

type of reflector is designed for use with a definite range of lamps and with particular regard for the correct relation of lamp filament and reflecting surface. The present device meets the demand for fixtures permitting the use of large base, i. e., 400-watt and 500-watt metallic-filament lamps.

Industrial and Commercial News

THE WEEK IN TRADE.

REPORTS from commercial trade and the industries were rather more irregular last week than for the past month, and there seems to be some falling off in actual trade. The first rush of fall buying is over in many sections, and the wholesalers and jobbers are therefore taking fewer orders than during the first two weeks of the month. Throughout the country state and county fairs and other festivals are stimulating retail trade to some extent. Reports from the West are still more optimistic than those from manufacturing centers. The early marketing of the cereal crops and the unusually high prices received are furnishing an abundance of ready money to purchasers. The cotton-crop movement is expanding, especially in the Southwest, and this is having a beneficial effect upon retail trade and upon collections. Reports from leading industries show that there has been rather less expansion than was anticipated. Curtailment is still in evidence in all of the leading textile industries, although the mills are operating more fully than in midsummer. Pig iron is somewhat quieter, but producers report that there are a number of inquiries received from abroad and prices show no inclination to decline. In finished lines in the iron and steel trade specifications on previous contracts are good, and the plants as a rule are operating from 65 to 80 per cent of capacity. New business, however, is not coming in at a rate of better than 50 per cent of capacity. At the end of August the United States Steel Corporation had on its books orders for 3,537,128 tons, a decrease of almost half a million tons from the end of July, and a decrease of 2,389,903 tons, or more than 40 per cent, from the beginning of the year. On some heavy lines prices are being cut, in many instances amounting to $1 per ton. The most active demand for finished goods is for steel wire. Collections are somewhat better, owing to the free supply of money throughout the Western country. Failures for the week which ended Sept. 15, as reported by *Bradstreet's*, were 210, as against 173 the previous week, 198 in the same week of 1909, 266 in 1908, 197 in 1907 and 171 in 1906.

THE COPPER MARKET

THERE was so little doing in the copper market last week that review is hardly worth while. Although there was a weaker tone developed and prices were somewhat lower, there was so little actual business that quotations must be regarded as nominal. Through agreements between domestic and foreign selling agencies it is not a difficult matter to fix a basis beyond which concessions will not be made. As long as a controlling amount of copper is included in these agreements the price of copper will fail to represent any condition of supply and demand. The real, cold-blooded situation is that the producers, according to the latest reports, are bringing forward an unprecedentedly large amount of copper and the actual consumers, both in this country and Europe, are using less than they did a few months ago. The continuance of such a condition must mean the accumulation of a surplus in spite of the fact that the figures of the last report of the Copper Producers' Association showed a decrease in stocks. Reports from all electrical manufacturers and brass founders since the first of the current month are to the effect that business is not as active as had been expected and that in consequence less copper was being melted. In foreign countries the consumption is a trifle better, but is not up to that of the flush times a few years ago. Imports have been somewhat less since the first of the month and exports have been at about the same ratio. The total exports for September, up to and including Sept. 19, were 17,699 tons. The daily call on the Metal Exchange Sept. 19 was as per accompanying table.

Standard Copper.	[illegible]	[illegible]	Settling [illegible]
Spot	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]

The London market Sept. 19 was as follows:

	Noon.	Close.
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for this year:

	[illegible]	[illegible]
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]

INDUSTRIAL AND COMMERCIAL NOTES.

Hugo Reisinger Says Germany Is Busy.—Hugo Reisinger, the importer of lighting carbons and other electrical specialties, returned from Europe last week, where he has been spending several months. He says that he found conditions abroad somewhat better than they are in this country, and this was especially true in Germany. In France and England unusually inclement weather has done much to retard the crops, and especially in France there is some feeling of discouragement. While the season in Germany has been colder, with more rain than usual, it has not seriously interfered with business. The big electrical concerns, he said, were all fairly busy, and the export trade was very satisfactory. The Bergmann factory, he said, was running full time and was now the third largest electrical manufacturing concern in the empire. Mr. Reisinger said he noted that since his trip the year previous there had been a great increase in the use of flaming-arc lamps for street lighting. In almost every city and town this kind of lamp was supplanting the old enclosed arc. He also said that Germany had practically abandoned the use of carbon-filament lamps; that the tungstens were used exclusively in house lighting, and that on every train in Germany all of the lighting is done by tungstens. Mr. Reisinger spent most of his time motoring over the Continent and through England and Scotland.

Allis-Chalmers Activities in Chicago.—Since the removal of the general offices of the Allis-Chalmers Company from Chicago to Milwaukee several years ago, President Whiteside has maintained offices in both cities, making his Milwaukee office, however, his main headquarters. Several months ago David Van Alstyne, formerly vice-president of the American Locomotive Company, was elected vice-president of the Allis-Chalmers Company, in charge of the manufacturing department, with headquarters at Milwaukee. This accession to the company will permit President Whiteside to devote more of his time to the larger interests of the company, which will require him to spend a greater portion of his time than heretofore in Chicago and New York. While continuing his Milwaukee office, it is probable that Mr. Whiteside will make his headquarters largely at the Chicago office of the company, which is in the First National Bank Building.

Southern Power Company.—After three years of investigation and experimentation, the Southern Power Company has let a contract for the installation of a 4000-hp plant for the production of nitrates by an electrochemical process. This plant will be used largely for experimental purposes, and will be located near the Great Falls power station of the company in South Carolina. It is said that a second plant of 24,000 hp is in contemplation, but the site has not yet been chosen. The Southern Power Company has purchased the "Geneva" process of converting the nitrogen of the air into nitrates suitable for soil fertilization, and has also developed a newer and, it is claimed, better process. It is said that as soon as these plants are completed the company will turn its attention toward inducing the large farmers of the Piedmont section to install private plants for the manufacture of their own fertilizers.

Berlin (Ont.) Lighted by Water Power.—The town of Berlin, Ont. is now illuminated with electric energy generated at Niagara Falls. The new system began operation last week. The formal test at the new municipal transformer station was [illegible]. The entire plant, including the transmission lines, is municipally owned. The power is transmitted at from 110,000 volts to 130,000 volts to the transformer station, where it is stepped down to 13,200 volts to the town's plant, where it is again transformed to suit local conditions—550 volts for street railway purposes, [illegible]

Insulated Wire Trade Depressed.—One of the principal manufacturers of insulated wire says that since the first of August the demand for this material has been very spasmodic and business has been very slow. A few orders have been received, but there has been no steadiness to the business and few specifications have been filed for future orders. This authority says that while there has been a great deal of building in cities during the past season, it has been to a large degree the construction of loft buildings instead of the construction of hotels and office buildings. He pointed out that loft buildings require very much less wiring than the other classes. "Our business," said he, "has been badly complicated for several reasons. In the first place, the three commodities which are used, copper, rubber and cotton yarn, have all been uncertain in price, which has made it extremely difficult for the manufacturer of rubber-covered wire to figure his factory cost. Rubber has been at the highest point in its history and has fluctuated violently. Just at the present moment Para rubber is selling at about $1.80, as compared with $3 a month or so ago. Copper, while the price has not been high, has been in a state of uncertainty, owing to over-production and manipulation, that has kept us always uneasy, while cotton yarns have been unsettled to an absolutely unheard-of degree. The result of these markets has made it almost impossible for the manufacturer to figure in advance upon a job of work. Another point that has seriously interfered with us is the entrance into the field of half a dozen manufacturers of cheap and, we think, unsatisfactory goods. By using substitutes and compounds these manufacturers have made a class of material that can be sold at far less than our cost of production. No concern with any reputation can afford to put on the market this class of insulated wire, although, of course, we could make it if we wanted to. The competition of these manufacturers has seriously disorganized our business. It is said that the building authorities of the city of New York, in conjunction with the underwriters, are now considering a new set of specifications which we hope will eventually bar out all inferior materials."

Western Electric Company's Business.—The report of the business of the Western Electric Company for the first nine months of its fiscal year which ended Aug. 31 shows a continuation of the heavy gains which had been previously recorded and shows no occasion to revise the former estimate of a total business for the year of something like $61,000,000. The gain in August was about 50 per cent over the same month last year. The main business of the company has been in the line of telephone apparatus and it is given out by the company that at the present time more than 7000 telephone companies are purchasing its supplies. The present year's business will be divided among approximately 800,000 orders as compared with 475,000 in 1906, with an average value per order of $71 for 1910, as compared with average value of $145 in 1906. The business is coming from all sections of the country, indeed from all parts of the world. Export business is showing gratifying increases. On the Western Electric's payroll there are at present 23,000 persons. In line with its policy of concentrating the manufacturing in its new Hawthorne works, and in order to provide adequate manufacturing facilities for the future, it is now planned to erect further extensions to the buildings at Hawthorne. In this connection it is announced that two properties belonging to the company have been placed upon the market for sale. One of these is located on the Chicago River, in the heart of Chicago, and is now covered by ten buildings used as warehouses, and the other practically covers two blocks in the downtown district of Chicago. This plot was formerly occupied by manufacturing plants which have now been transferred to Hawthorne. The company will retain at this point ample space for distributing purposes. The balance sheet of the company, as of March 1, 1910, recently submitted to the Stock Exchange, shows total assets of $60,306,000, which include $2,113,000 cash and $21,331,000 bills receivable.

Victor Electric Company.—The Victor Electric Company of Chicago has certified an increase in its capital stock from $16,100 to $330,000. A part of the proceeds is to be used for the purchase of ground and the erection of a four-story factory building in the neighborhood of Jackson Boulevard and Robey Street to have about 50,000 sq. ft. of floor space. This factory will give the company a little more than double the floor space now available in its quarters at 55-61 Market Street. The greater part of the increase was issued in common stock because of the fact that the company has accumulated a surplus out of proportion to its original capitalization. None of the stock, either preferred or common, is for sale, all of it having been subscribed by stockholders of record at the time the increase was made. The Victor Electric Company manufactures electrical machinery and electrically driven air compressors. C. F. Samms is president and manager and J. B. Wantz is secretary and superintendent.

August Business of the Electrical Companies.—Practically every one of the large electrical manufacturing companies reports a falling off of business during the month of August compared with previous months. This is the first decrease that has been reported for some time past, as the tendency of new orders has been upward since the beginning of the year. One of the reasons advanced for the shrinkage of business in August is the falling off in new construction work by railroads and traction companies. A notable exception to the decline in business is the demand for household appliances. Just at the present time this is greater than ever before, and from every part of the country, especially the Far West, there are inquiries for all kinds of domestic apparatus. A large part of this business is to supply the Christmas trade, which is heavy in this class of goods.

Hoosac Tunnel Electrification.—Officers of the Boston & Maine Railroad have confirmed the report that a plan has been matured for the electrification of the Hoosac tunnel. Since Charles S. Mellen has taken active charge of the railroad this is one of the first improvements that will be looked after. Mr. Mellen has given considerable attention to this matter and has had reports from engineers upon the subject. He has decided that the abolition of the smoke nuisance is imperative and, according to estimates made, electricity can be substituted for steam in this section at a cost not exceeding $1,000,000, including the cost of electric locomotives. When the changes are completed it is said that both passenger and freight trains will be taken through the tunnel from Tunnel Station, on the east, to North Adams and possibly to Williamstown, on the west, by electrical energy.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Herington, Kan.; Covington, Ga.; Victoria, B. C., Can.; Covington, Va.; Swift Current, Sask., Can.; Fairmont, Minn.; Edenton, N. C.; Cochrane, Ont., Can.; Skowhegan, Maine; Placerville, Cal.; Portland, Ore.; Red Hook, N. Y.; Washington, D. C.; Worcester, Mass.; Eldora, Ia.; Superior, Wis.; Chicago, Ill.; Pasadena, Cal.; Batesville, Ind.; Atlanta, Ga.; Hazen, Ark.; Centerville, Mich., and Marcus, Wash.

Chicago Telephone Company.—The Chicago Telephone Company installed 4709 new telephones in August and removed 2339, making a net gain of 2370. For the eight months which ended with August 45,960 new instruments were installed, as compared with 39,884 in the same period last year. The total number of telephones in service in Chicago and its suburban districts at present is 285,691, an increase of 14.9 per cent. The earnings of the company are at the present time increasing rapidly, and are larger than at any period in its history.

Garwood Electric Company.—The Garwood Electric Company reports that there has been an unusually large business during the past few months in welding equipments. Orders for this line of business have been heavier than at any time in the history of the company. Other lines of business are also fairly active, although during August orders were not as plentiful as earlier in the season. The shops at the present time, however, are as busy as at any period since the company was formed and as many workmen are employed.

Westinghouse Air Brake Company.—An official of the Westinghouse Air Brake Company is authority for the statement that this fiscal year will be one of the best since the company was formed. Equipment purchases by the railroads for passenger service broke all records on account of the replacement of wooden cars by steel cars on many Eastern lines. At the present time, according to this authority, orders for complete equipments are not so plentiful, but repair work is very active.

Financial.

THE WEEK IN WALL STREET

CONSIDERABLE surprise was expressed in Wall Street last week that the stock market showed increased activity and advanced prices immediately upon receiving the returns from the Maine election. The presumption was that a Democratic victory would have a depressing effect. The reverse was the case. As a matter of fact there was no politics at all in the market. There is at the present time in Wall Street nothing political that is giving rise to any serious emotions. The trouble with the Street is "general apathy" or general lack of business. The spasmodic trading, accompanied by increased prices which occurred in the early part of last week, meant nothing except that a few gamblers were willing to take a chance that the days of stagnation were over. The total course of the market during the entire week showed no improvement in price. While the total sales were almost twice the previous week they were almost all traceable to professionals. Traders whose only living depends upon transactions in the market must necessarily keep on trading. The result of the entire week's transactions was that the market ended not very different from the way it began and that the active issues showed only fractional changes. The principal practical feature of the week was the announcement that Phelps, Dodge & Company had taken over the heavy line of Rock Island stock being carried by the Pearson-Farquhar syndicate. This stock had been a menace to the market for many weeks, as it was well known that the syndicate could not care for it and there was the constant danger that it might be used as a club to further a bear raid. There is now no danger of a long line being forced upon a sensitive and weak market. There was no improvement worthy of note in the bond market during the week. Bond prices are not depressed, as might be expected under the circumstances, but they show no inclination to go higher. Transactions are very light and only the best known issues seem to have any call. Money remains distinctly easy for call loans, although time loans are not phenomenally cheap. Quotations Sept. 19 were as follows: Call, 1½@2 per cent; 90 days, 4¼ per cent. The quotations in the table are those of Sept. 19, 1910.

NEW YORK.

	Sept. 12.	Sept. 19	Shares sold.		Sept. 12.	Sept. 19.	Shares sold.
All-Ch.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All Ch., pfd	31*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Amal. Cop.	[illegible]	[illegible]	67,120	Mackay, C., pf.	75*	[illegible]	[illegible]
Am. D. T.	20½*	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]
Am. Loc.	[illegible]	[illegible]	900	Met. St. Ry.	15*	[illegible]	—
Am. Loc., pfd.	105	[illegible]	210	N.Y.&N.J.Tel.	139¼	[illegible]	—
Am. Tel & C.	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T.	[illegible]	135	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B. R. T.	73¾	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gen. Elec.	[illegible]	[illegible]	1,400	West'h, com.	59*	[illegible]	[illegible]
Int-Met.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—

PHILADELPHIA.

	Sept. 12.	Sept. 19.		Sept. 12.	Sept. 19.
Am. Rys.	[illegible]	43	[illegible]	[illegible]	[illegible]
Elec. Co. of A.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elec. St. B'ty.	[illegible]	48⅜	Phila. [illegible]	[illegible]	[illegible]
E. S. B'ty. pfd.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CHICAGO

	Sept. 12.	Sept. 19.		Sept. 12.	Sept. 19.
Chi. City Ry.	[illegible]	[illegible]	Chi. [illegible]	[illegible]	[illegible]
Chi. Rys., Ser. 1	[illegible]	[illegible]	Met. El. Co.	19*	19*
Chi. Rys., Ser. 2	[illegible]	13¾*	Met. El., pfd.	61½*	62*
Com. Edison	[illegible]	111	[illegible]	[illegible]	[illegible]
Chi. Subways	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BOSTON.

	Sept. 12.	Sept. 19.		Sept. 12.	Sept. 19.
Am. T. & T.	135⅛	[illegible]	Mex. Tel.	[illegible]	[illegible]
Cum. Tel.	[illegible]	[illegible]	Mex. Tel., pfd.	[illegible]	[illegible]
Edison E., Ill.	257⅛	[illegible]	N. E. Tel.	[illegible]	[illegible]
Gen. Elec.	[illegible]	[illegible]	W. T. & T.	[illegible]	[illegible]
Mass. E. Ry.	17¾*	[illegible]	W. T. & T., pfd.	[illegible]	83*
Mass. E. Ry., pfd.	81¾*	[illegible]			

*Last price quoted.
Shares sold for week Sept. 12 to [illegible]

FINANCIAL NOTES.

Montreal Street Railway & Power Merger.—A new phase in the power and street railway situation at Montreal has been given by the announcement at Montreal on Sept. 15 that an arrangement had been entered into between the directors of the Montreal Street Railway and the Montreal Light, Heat & Power companies to join forces [illegible] Canadian Light & Power Company [illegible] the Montreal Street Railway Company at the coming annual meeting of shareholders of the railway company in November. Following the announcement came large buying orders on the Montreal stock exchange for shares of the Montreal Light, Heat & Power Company, which caused a rise in the price of ten points to the record price of 145. It is claimed that an amalgamation of the Montreal Street Railway and the Montreal Power companies can be effected. Those who are back of the latest proposal claim that they can offer the shareholders of the Street Railway a much better proposition than can the Canadian Power interests. So far as can be learned, it is proposed by the interests concerned in the projected amalgamation of the Street Railway and Montreal Power companies to take in the Street Railway stock at $250 per share and the Power stock at $180 to $190 per share. The present market price of the railway stock is 244, paying a dividend of 10 per cent, while the price of Power stock is 144, on which a dividend of 7 per cent is being paid.

American Power & Light Company.—The American Power & Light Company, of New York, has purchased stock control of the Hanford Irrigation & Power Company, which owns a plant and valuable water rights at Priest Rapids, on the Columbia River, in Grant and Yakima Counties, Washington. There are vast power possibilities at this point, of which the Hanford company owns only a small portion. The main business of the Hanford company is pumping water for irrigation of large tracts of arid lands which belong to the company. Two large irrigating ditches have been constructed for the distribution of the water, and lands are being sold to settlers with water rights. The American Power & Light Company already possesses considerable holdings in Washington and Oregon. Last summer it incorporated a subsidiary company, the Pacific Power & Light Company, with a capital of $7,500,000, to take over and operate properties in Eastern Washington and Northeastern Oregon.

Austin (Tex.) Dam.—The Hydraulic Properties Company of New York is considering a proposition to take over the contract made by J. C. Dumont with Austin for the erection of a dam across the Colorado River. An electrical engineer has made an examination of the proposed site and other conditions and C. Frank Doebler, secretary of the company, has also made an investigation of the proposition. If the Hydraulic Properties Company takes over the contract it is probable that several changes will be made in the plans of the dam. The structure will have fewer gates than the one planned by J. C. Dumont and will have the power house at one end instead of in the center of the dam. The proposed dam, which will replace the one destroyed ten years ago, will cost $1,000,000, will be 65 ft. high and will render available 5000 hp.

Red Hook (N. Y.) Light & Power Company.—The Public Service Commission, of the Second District of New York, has authorized the Red Hook Light & Power Company to issue a mortgage for $150,000 to guarantee bonds of like amount and to take over the franchises held by John H. Sharpe in the towns of Germantown, Livingston and Clermont, in Clermont County. Of the new issue $10,000 are to be used to take up the same amount of bonds outstanding and $60,000 to pay for equipment and the construction of new transmission lines.

Southern New York Power Company.—The Public Service Commission of the Second District of New York has authorized the Southern New York Power Company, a newly-organized corporation, to issue $24,000 of new stock at par to pay for the property assets and franchises of the Walton Electric Light Company, of Walton, N. Y., and also $2,100 new stock to pay for the property of the Mulkins Electric Light Company, of Walton. The company asked for authority to issue $40,000 new stock.

Western Union Telegraph Company.—The preliminary report of the Western Union Telegraph Company for the quarter which ends Sept. 30 estimates the net earnings at $2,000,000, an increase of more than $70,000 over the same quarter last year. The surplus, after the payment of dividends, will be upward of $800,000. The directors have declared the regular [illegible] The annual meeting of the stockholders will be held Oct. 12.

Century Electric Company.—The Century Electric Company, of St. Louis, [illegible] and ceiling fans, announces an increase in its capital stock from $75,000 to $250,000. The increase is made necessary by the growth of the company's business. The officers of the company are: President, James F. Coyle; vice-president, E. S. Pillsbury; secretary, R. J. Russell; treasurer, John Harget.

Metropolitan Foreclosure Sale.—The United States [illegible] the sale of the property of the Metropolitan Street Railway Company, of New York City. [illegible]

United Railways of St. Louis.—Following the announcement last week by the directors of the United Railways Company of St. Louis that the quarterly dividend of 1¼ per cent on the preferred stock would be passed, the price of the stock in the St. Louis market declined 18¾ points. Shares dropped from 57¾ to 39. It was said that the action of the directors in passing the dividend was based on the necessity of taking care of the floating indebtedness of about $1,300,000, which under the depressed market conditions now prevailing it was impossible to fund upon terms favorable to the company. The passing of the dividend will also enable the company to carry out its program of improvements on the property. This large floating indebtedness was mainly incurred by heavy expenditures for construction and new equipment. The reports of the company show that its gross earnings are greater than ever before. The report of the company for the first seven months of 1910 shows a surplus of about $20,000 over fixed charges and the regular dividend requirements. The company is controlled by the North American Company, of New York.

Mexican Utility Companies.—Very favorable statements of the earnings of the Mexican Light & Power Company and of the Mexican Tramways Company for July, and for the seven months ending with July, have been given out. In both instances it is shown that the operating expenses for the seven months were lower than for the same period in the year previous, so that the improvement in net exceeds the improvement in gross. In the case of the Mexican Light & Power Company there has been a phenomenal reduction in operating expenses. The operating ratio to gross revenues in July this year was but 24.30, as compared with 80.47 per cent for July last year. It is stated that the new management of the company has put into effect a large number of economies which have resulted in this exceptional reduction. By the consolidation of the operating departments of a number of interconnected companies, the management has been able to save large sums in wages. The increase in the net earnings for the first seven months of the current year is equal to about 6 per cent on the outstanding common stock.

Chicago Traction Ordinance.—All hope of obtaining the passage of the Chicago Consolidated-Chicago Railways ordinance before the Council convenes in regular session, Oct. 3, has been abandoned by those who are back of the merger project. It has been announced by the city administration that no special meeting for this purpose will be called by the Mayor. In the meantime the Chicago Railways certificates showed considerable weakness in the market. This weakness, it is said, is due to selling by small holders, who fear that the Consolidated Traction litigation may be long drawn out, and that when it ends there will be a mass of new securities ahead of theirs. It is assumed that the Consolidated Traction lines will pay their way when they are rehabilitated, but the work of putting them in shape will probably extend over many months.

Kansas City Railway & Light Company.—The earnings of the Kansas City Railway & Light Company for the year which ended May 31 were the most favorable in the history of that organization. The gross amounted to $7,178,441, and after paying all fixed charges and dividends on preferred there was left a surplus of $637,551. The operating expenses for the year were considerably increased, but this is explained by the management as being due to the liberal expenditures which we made for renewals and repairs. During the year the company has been putting its physical property into the best possible shape.

Lincoln (Neb.) Telephone Earnings.—The annual report of the Lincoln Telephone & Telegraph Company, which has been filed with the Nebraska State Railway Commission and covers the year ending June 30, 1910, shows that the company received from operation a total of $234,906 and expended $135,824. At the end of the year a surplus was shown of $3,820. During the year quite a considerable amount of extension of lines was made and paid for out of the earnings.

Toronto Railway Company.—The Board of Control of the city of Toronto has reported in favor of the purchase of the Toronto Railway Company, in order to convert it into a municipal system. The price mentioned for the possible purchase of the stock is $150 per share. In this connection it is said that the Toronto Railway Company is considering plans for constructing 16 miles of additional track, to be financed by a further issue of common stock.

Shawinigan Water & Power Company.—President J. E. Aldred, of the Shawinigan Water & Power Company, announces that an offer will be made to the shareholders of $500,000 new stock at par. The business of the company is rapidly growing and Mr. Aldred states that the dividend on the common stock will probably be increased in the near future to 5 per cent per annum.

DIVIDENDS.

American Pneumatic Service Company, semi-annual, preferred, 3½ per cent, payable Sept. 30.

Butte Electric & Power Company, quarterly, preferred, 1¼ per cent, payable Nov. 1; common, 1¾ per cent, payable Oct. 1.

Canadian Westinghouse Company, quarterly, 1¼ per cent, payable Oct. 1.

Columbus (Ohio) Light, Heat & Power Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

Cumberland Telephone & Telegraph Company, quarterly, 2 per cent, payable Oct. 1.

Duluth Edison Electric Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

Electrical Securities Corporation, preferred, semi-annual, 2½ per cent, payable Nov. 1; common, quarterly, 2 per cent, payable Sept. 30.

Germantown Passenger Railway Company, Philadelphia, quarterly, $1.31½ per share, payable Oct. 4.

Halifax Electric Tramway Company, quarterly, 1¾ per cent, payable Oct. 1.

Manila Electric Railroad & Light Company, quarterly, 1 per cent, payable Oct. 1.

Massachusetts Gas Companies, quarterly, $1 per share, payable Nov. 1.

Massachusetts Lighting Companies, quarterly, 1¾ per cent, payable Oct. 15.

Narragansett Electric Lighting Company, quarterly, $1 per share, payable Oct. 1.

Northwestern Elevated Railroad Company, Chicago, preferred, quarterly, 1 per cent, payable Oct. 18.

Otis Elevator Company, preferred, quarterly, 1½ per cent, payable Oct. 15.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, preferred, quarterly, 1¼ per cent, payable Oct. 1.

Toronto Electric Light Company, quarterly, 2 per cent, payable Oct. 1.

United Gas Improvement Company, Philadelphia, quarterly, 2 per cent, payable Oct. 15.

United Traction & Electric Company, Providence, R. I., quarterly, 1¼ per cent, payable Oct. 1.

West End Street Railway Company, Boston, semi-annual, 3½ per cent, payable Oct. 1.

Western Union Telegraph Company, quarterly, ¾ per cent, payable Oct. 15.

REPORT OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Railways Company:					
Year ending June 30, 1910	[illegible]	$340,385	[illegible]	$342,072	$11,221
Year ending June 30, 1909	[illegible]	216,385	310,728	305,706	5,022
Aurora, Elgin & Chicago Railroad Company:					
July, 1910	182,387	87,612	94,775	32,568	62,207
July, 1909	167,614	77,894	89,720	28,895	60,825
Edison Electric Illuminating Company of Boston:					
Year ending June 30, 1910	[illegible]	[illegible]	[illegible]	166,778	1,934,160
Year ending June 30, 1909	4,111,342	2,766,029	1,345,313	88,846	1,303,827
Fonda, Johnstown & Gloversville Railroad Company:					
Year ending June 30, 1910	[illegible]	[illegible]	470,824	353,650	117,174
Year ending June 30, 1909	[illegible]	[illegible]	410,811	369,607	[illegible]
Railways Company General:					
Year ending June 30, 1910	[illegible]	[illegible]	68,087	.....	51,287
Year ending June 30, 1909	[illegible]	[illegible]	[illegible]	.....	76,397
Western Union Telegraph Company:					
Quarter ending Sept. 30, 1910 (estimated)	...		2,000,000	[illegible]	1,566,938
Quarter ended Sept. 30, 1909		..	[illegible]	433,062	[illegible]

General News

Construction News.

ANNISTON, ALA.—It is [illegible] with the Anniston Gas & E[illegible] ate the large gin plant in this city, recently purchased by a new company headed by J. H. Privett and D. C. Cooper.

MONTGOMERY, ALA.—The Montgomery Traction Company is contemplating the construction of a power plant to furnish electricity for operating its system. The company now purchases power from the Montgomery Light & Power Company. W. J. Ginnavan is general manager.

MONTGOMERY, ALA.—Bids will be received until Sept. 26 by the City of Montgomery for the installation of two 4-000-000-gal., electrically driven, direct-connected centrifugal pumps with motors and electrically driven, direct-connected air compressor with motor in the water-works pumping station. Gaston Gunter is Mayor.

TROY, ALA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 24, for the construction, including plumbing, gas piping, heating apparatus and electric conduits and wiring, of the U. S. post office at Troy, Ala., in accordance with drawings and specifications, copies of which may be secured from the custodian of site at Troy, Ala., or at the above office. James Knox Taylor is supervising architect.

JUNEAU, ALASKA.—Preparations are being made by the Alaska-Treadwell Company, of Juneau, to construct a large hydroelectric plant in the vicinity of its mines.

ATKINS, ARK.—W. F. Turner and J. W. Barker, of Atkins, Ark., have been granted a 50-year franchise by the Town Council to install an electric light plant in Atkins.

HAMBURG, ARK.—The Board of Commissioners of the Hamburg Improvement District has awarded the contract for the installation of an electric light plant and water-works system to W. J. Kennedy, of St. Louis, Mo. The cost of the work is estimated at about $30,000. Willis E. Ayres, 370 Randolph Building, Memphis, Tenn., is engineer.

HAZEN, ARK.—The Hazen Power Company is reported to be making preparations for the erection of an electric light and power plant. The equipment of the proposed plant will include a 250-hp engine, boilers with a rating of 300 hp and electric generators. A 10-ton ice plant will be operated in connection with system.

MAMMOTH SPRINGS, ARK.—It is reported that the Moore Manufacturing Company, which is now located at Springfield, Mo., is contemplating moving its machinery to Mammoth Springs, where it purposes to locate. It is understood that the plant will be equipped for electric motor drive. The company manufactures furniture.

BAKERSFIELD, CAL.—Negotiations have been closed whereby the plant and holdings of the Moran Electric Company are to be taken over by J. Q. Anderson and associates. It is proposed to extend and enlarge the system and furnish a twenty-four-hour service. The local distributing system will be rebuilt and will be tied in with the line from Maricopa. The new system will include three generating plants, two located at Maricopa and one in Bakersfield. Natural gas will be used for fuel.

BANNING, CAL.—Work is progressing on the White Water River project of the Consolidated Reservoir & Power Company. It is proposed to divert the water of the river to land owned by the company north of the town. Two or three power plants will be erected along the stream.

COALINGA, CAL.—Preparations are being made by the Coalinga Water & Electric Company to supply electricity for operating the pumps and other machinery in the Coalinga oil fields. The company has installed variable speed motors on the Goodluck property and is planning to demonstrate that not only pumping can be done by electricity, but that all of the mechanical work about the wells can be operated by electrical power. Demonstrating equipment will be placed on the J. T. O property and on the National 30 lease of the Associated Oil Company. William Stranahan is manager.

FRESNO, CAL.—The first 5000-hp unit in the new Crane Valley power plant of the San Joaquin Light & Power Company, of Fresno, Cal., was put in operation Sept. 4. The second unit of 5000 hp will soon be started. Contracts have been placed with the General Electric Company for the remaining two units of 5000 hp and orders will soon be placed for the water wheels. These units will be of the same type as those already installed, and probably will be completed in the spring. Excellent progress is being made on the auxiliary pla[illegible] Cal. J. G. White & Company, of New [illegible] Y., have charge of construction of the plant.

MODESTO, CAL.—Plans are being considered by the Sierra & San Francisco Power Company, [illegible] Stanislaus Electric Power Com[illegible] Tuolumne Water Power Company, for the erection of a feeder line from its Stanislaus power line to this city. The proposed line will be at least 15 miles in length. It is expected that electricity will be supplied in Ripon and Salida and to farmers along the route for pumping and other purposes. It is understood that a new substation in the western part of the town will be completed by the first of the year. H. F. Jackson is general manager.

PASADENA, CAL.—The City Council has granted the request of C. W. Koiner, manager of the municipal electric light plant, for a loan of $15,000 from the general fund for improvements to the municipal electric light system. The installation of an additional boiler is contemplated.

PASADENA, CAL.—The directors of the Pasadena Rapid Transit Company will vote on Oct. 18 on the proposition to issue $3,000,000 in bonds, the proceeds to be used for the construction of an electric railway between Pasadena and Los Angeles. It is proposed to build a direct line without grade crossings. Horace M. Dobbins, of Pasadena, Cal., is president.

PLACERVILLE, CAL.—Preliminary steps have been taken which indicate the formation of a company to develop the water power from Rock Bound Lake and Buck Island above this city. The company owns water rights amounting to 25,000 cu. ft. from each and proposes to build dams to increase the capacity. Arthur Bloch, of Oakland, Cal., is interested in the enterprise. The Mercantile Trust Company, of San Francisco, Cal., holds the deed of trust and agrees to finance the proposition.

REDLANDS, CAL.—The City Trustees are considering plans for the erection of street lamps from Stuart Avenue on Orange Street to Olive Avenue on Cajon Street; also from Third to Sixth Streets on State Street and from Fourth to Fifth Street on Citrus Avenue. It is proposed to charge the cost of installing the system to the property owners. It is expected that concrete posts will be erected.

RICHMOND, CAL.—The Board of County Supervisors has granted the Richmond Light & Power Company a franchise to erect transmission lines along the public highways of the county.

STOCKTON, CAL.—Plans are being made by the Sierra & San Francisco Power Company, a subsidiary of the United Railways Investment Company of San Francisco and which owns the large power system which was built in Tuolumne County a few years ago by the Union Construction Company, financed by the Knickerbocker Trust Company, of New York, N. Y., to supply the southern section of San Joaquin County with electricity for all purposes. The company will install two transformers at either Manteca or Escalon to reduce the voltage from 100,000 to 15,000 volts for commercial purposes. A second transmission line is now being erected by the company from the headwaters in Tuolumne County to San Francisco.

VALLEJO, CAL.—Announcement has been made by the Vallejo & Northern Railways Company that it proposes to construct a branch line from Sacramento to Woodland. The company is building a railway to connect Vallejo, Cordelia, Suisun, Vacaville and Sacramento.

DENVER, COL.—The Denver Gas & Electric Light Company, which recently acquired the property and franchise of the Denver Steam Heating Company, is preparing plans for the installation of a steam heating system in Denver.

GOLDEN, COL.—It is reported that surveys are being made for the construction of an electric railway to connect the Golden smelter with the mines of Clear Creek and Gilpin counties. It is understood that the parties interested in the North American Smelter & Mines Company are interested in the project.

WASHINGTON, D. C.—Sealed bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 5, for furnishing and installing lighting fixtures in the U. S. buildings at Belvidere, Ill.; Elizabeth, N. J.; Elgin, Ill.; Manhattan, Kan.; North Adams, Mass.; Platteville, Wis.; Rawlins, Wyo.; Saratoga Springs, N. Y.; Albany, Ga., and Roanoke, Va., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until Sept. 26, for furnishing the signal corps with one switchboard, common-battery, two-position, in accordance with specifications Nos. 544, 321-A, 430-A; drawings 688-D, 688-G.-L., 688J, 688K and 688L; also one distributing and protecting frame, sectional angle iron, mounting 300 pairs of central energy heat coils and lightning arrester protector equipment and 500 pairs of line terminals; protectors in groups of twenty, detachable from the frame and to be of the Western Electric Company's type 84-B or equal; no self-soldering heat coils will be considered. The line terminals shall also be mounted in groups of twenty on the opposite side of the frame from the arrester equipment. The frame shall be fully equippped as stated above and in addition the following extra material [illegible]

GAINESVILLE, [illegible] Public Works to investigate the cost of installing an electric light plant in Gainesville has reported to the Board of Public Works that it would [illegible] Gainesville Gas & Electric Company before it could operate a municipal plant. The city voted to issue bonds for the construction of an electric [illegible] are members of the committee.

ATLANTA, GA.—The Board of Commissioners of Fulton County is considering the question of establishing an electric light and water plant and sewerage system on the county almshouse property, at a cost of from $17,000 to $20,000. Preliminary plans have been prepared by P. H. Norcross, engineer.

COVINGTON, GA.—The Board of Water and Light Commissioners is reported to be considering the question of increasing the output of the municipal electric plant. It is proposed to install a 125-kw generator and switchboard and to establish a day service.

CULDESAC, IDAHO.—The City Council has authorized an election to be held here in October to vote on the proposition to issue bonds for the installation of an electric light plant and water-works system.

NEZPERCE, IDAHO.—The Nezperce & Idaho Electric Railroad Company is reported to be contemplating the construction of an extension from Vollmer to Forest, a distance of fourteen miles.

WALLACE, IDAHO.—Preparations are being made by the Cœur d'Alene Iron Works to rebuild its plant which was recently damaged by fire. It is proposed to increase the capacity of the plant and equip it for electrical operation.

CHICAGO, ILL.—Sargent & Lundy, of Chicago, Ill., have been engaged by the Commonwealth Edison Company, of Chicago, Ill., to take charge of the mechanical work of its proposed new plant.

CHICAGO, ILL.—Contracts have been awarded by the Board of Trustees of the Sanitary District of Chicago as follows: For installing electrical equipment to W. H. Jackson, of Chicago, Ill., and for construction of tunnel and machine foundations to George H. Jackson, of Chicago, Ill.

CHICAGO, ILL.—It is reported that plans are being prepared by Bernard Barthel, engineer, 79 Dearborn Street, Chicago, Ill., for the installation of a steam heating and power plant in the Del Prado Hotel, located at Fifty-ninth Street and Madison Avenue. The equipment will include two 200-hp internally fired Scotch marine boilers, one 250-kw generator, a 12-ton refrigerating machine, feed water heater, pumps, electrical work and steam heating.

DECATUR, ILL.—The capital stock of the Decatur Southern Traction Company has been increased from $25,000 to $1,200,000. Plans have also been made to begin work at once on construction of the proposed railway from Decatur to Pana. H. C. Simmons, of Virden, Ill., is secretary.

GIBSON, ILL.—The Gibson Electric Light & Power Company is reported to have refused to renew its contract for street lighting with the city unless it is granted several concessions, among which is an extension of its franchise for twenty years, payment for lighting the public buildings and the right to charge private customers a minimum of $1 per month, which, it is said, the city will not grant. Unless the city can build a municipal plant the streets will not be lighted.

KANE, ILL.—Plans are being considered for the installation of an electric light system in Kane. A proposition has been submitted to the town officials by F. M. Sinsabaugh, manager of the Carrollton Heat, Light [illegible]

KANKAKEE, ILL.—The capital stock of the Kankakee Gas & Electric Company is reported to have been increased from $5,000 to $850,000.

MOUNT STERLING, ILL.—The People's Electric Light, Power & Telephone Company has applied to the City Council for a franchise to construct an electric light plant and telephone system in Mount Sterling. The company proposes to furnish a twenty-four-hour service and will pay the city 2 per cent of its gross earnings and give free telephone service to city officials and also gives the city the right to purchase the plant at cost any time within ten years. If granted a franchise the proposed plant will be in operation within forty days. C. B. Dearborn and George D. Givens are interested in the project.

QUINCY, ILL.—A committee has been appointed by the Civic Improvement League for the purpose of preparing plans to install an ornamental [illegible]

ROCK ISLAND, ILL.—The Galesburg & Rock Island Traction Company is reported to have awarded a contract to the London Construction [illegible] McWhinney is president.

[illegible]

[illegible]

[illegible]

[illegible] chises and contracts from farmers and residents in the towns and villages at a maximum rate of 10 cents per kw-hour for domestic purposes in some districts and in others 7½ cents per kw-hour.

MICHIGAN CITY, IND.—A large dairy farm of 2000 acres is being established by C. W. Hotchkiss and John Fields west of this city. The farm will be equipped with the latest appliances, including a complete set of electric milkers.

MICHIGAN CITY, IND.—The South Shore Traction Company has completed extensive improvements to its plant and is now in a position to supply 60-cycle alternating current along its lines from South Bend to Kensington. The company is erecting a line from Chesterton to Porter, where it has contracts to supply electrical power for operating factories. This line will be completed within thirty days. The construction of a transmission line from Michigan City to Chesterton is also under consideration.

MUNCIE, IND.—The Muncie Electric Company is erecting a transmission line from its power house in Muncie to Dunkirk and Redkey.

NOBLESVILLE, IND.—The Circuit Court of Hamilton County has authorized Ralph H. Beaton, of Columbus, receiver of the White River Light & Power Company, of Noblesville, Ind., to issue $100,000 in receiver's certificates to complete the dam in connection with the company's proposed hydroelectric power plant.

SOUTHPORT, IND.—Applications have been filed with the Town Board of Southport by the Merchants Heat & Light Company and the Indianapolis Light & Heat Company, both of Indianapolis, Ind., for a franchise to furnish electricity in Southport for lamps and motors. The Indianapolis company is extending its transmission lines to the Bertermann Brothers' flower farm, seven miles distant, and is contemplating extending its lines to Cumberland with a view of lighting that village and the farmhouses along the route. The Town Board is considering the propositions submitted by both companies.

BRITT, IA.—The Western Electric Telephone Company has acquired the controlling interest in the Hancock County Telephone Company, which maintains exchanges in Garner, Britt and Kanawha.

CEDAR RAPIDS, IA.—Preparations are being made by the Cedar Rapids & Marion Telephone Company for improvements to its system in Cedar Rapids, which will involve an expenditure of about $22,000.

DAVENPORT, IA.—The Union Electric Telephone & Telegraph Company has applied for an amendment to its franchise ordinance to permit it to sell its system to the Iowa Telephone Company.

ELDORA, IA.—At an election held Sept. 12 the citizens voted in favor of the proposition allowing the Park Dam Company to construct a dam across the Iowa River at this place. The company proposes to install an electric power plant at a cost of about $25,000 and furnish a twenty-four-hour service. A. H. Latimer, of Eldora, Ia., is engineer in charge and George W. Wood is secretary.

FORT DODGE, IA.—The Corn Belt Packing Company is reported to be contemplating the construction of a new plant, which will be equipped for electrical operation.

FORT DODGE, IA.—The Fort Dodge, Des Moines & Southern Railroad Company is contemplating the erection of a substation this fall, which will be equipped with transformers and two rotary converters with a rating of 400 kw each. It is understood that Westinghouse machinery will be specified.

PELLA, IA.—Contracts have been awarded for the construction of a combined water and light plant in Pella as follows: To the Des Moines Bridge & Iron Company, of Des Moines, Ia., for laying 18,500 ft. 10-in. pipe, $9,269; furnishing valves, hydrants and specials, $1,150; constructing filter gallery, well and pump house, $6,600; to Joseph E. Bortenlanger, of Omaha, Neb., for furnishing engines, boilers, generators, motors and all electrical apparatus, $21,652; two triplex pumps, $3,590; 3½ miles of transmission line, $3,750; for city distributing system, complete, $10,152, and secondary wiring, $3,500; for constructing power house, to K. A. Verhey, for $6,390. Murray Corliss engine, Ideal high-speed engine, Murray boilers and Westinghouse generators and motors will be used. The Iowa Engneering Company, of Clinton, Ia., has charge of the engineering work. A. C. Kuyper is city clerk.

PERRY, IA.—The Commercial Club is interested in a project to install an ornamental street lighting system in the business portion of the city. The cost of maintaining the system is estimated at $160 per month.

SANBORN, IA.—The citizens have voted to grant W. D. Bowen, of Charles City, a franchise to install an electric light plant in Sanborn.

BELLEVILLE, KAN.—It is reported that the plant of the Belleville Light & Power Company, which was recently destroyed by fire, will be rebuilt.

HERINGTON, KAN.—Negotiations have been closed whereby the City of Herington will supply electricity in the City of Hope for street lighting and for commercial purposes for a term of ten years. A transmission line, eight miles in length, will be erected from the municipal electric plant in Herington to Hope. Current will be transmitted for the present at 2300 volts, three-phase over No. 6 bare copper wire. [illegible] for the line and for the system in Hope, including transformers, switchboard and instruments, will be asked for in the near future. H. L. Stromquist is superintendent of the Herington water and light department.

HUTCHINSON, KAN.—Prep[illegible] Missouri & Kansas Telephone Company for ex[illegible] system, which will involve an expenditure of about $200,000.

TOPEKA, KAN.—Extensive improvements are being made to the plant of the Topeka Edison Company, which includes the installation of two 500-hp boilers and 16,000 ft. of cable in the business district of the city.

WICHITA, KAN.—A transmission line is being erected by the Kansas City Gas & Electric Company from its plant in this city to Valley Center, Kan., for the purpose of supplying electricity to operate the proposed electric railway of the Arkansas Valley Interurban Railway Company. The power house now being erected at the junction of the Big and Arkansas rivers by the Kansas Gas & Electric Company is expected to be completed by Nov. 1. The cost of the transmission line and equipment is estimated at about $50,000.

LIBERTY, KY.—The construction of an electric railway to connect Liberty and Moreland is under cons[illegible] Liberty and Moreland business men.

LOUISVILLE, KY.—The Turner, Day & Woolworth Company, of Louisville, Ky., has recently equipped its plant for electric motor drive.

MAYSVILLE, KY.—The City Council is reported to have passed an ordinance authorizing a special election to vote on the proposition to issue $50,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

AUBURN, MAINE.—The City Council has awarded the Lewiston & Auburn Electric Light Company the contract for lighting the streets of the city for a period of five years, at $55 per lamp per year, the same price as paid under the present contract.

BONNY EAGLE, MAINE.—The contract for construction of a 60-ft. dam and power house for an 8000-hp hydroelectric development on the Saco River, at Bonny Eagle, Maine, has been awarded to the F. W. Abbott Company, 90 West Street, N. Y., by the Cumberland Construction Company. J. Y. White & Company have charge of construction of the plant.

SKOWHEGAN, MAINE.—Bid[illegible] Skowhegan Water Power Company for the construction of a concrete dam across the north channel of the Kennebec River, at Skowhegan. Plans and specifications may be seen at the office of C. S. Humphreys, hydraulic engineer, Madison, Maine, or at the office of F. A. Nolan, secretary of the Skowhegan Water Power Company, Skowhegan, Maine.

BOSTON, MASS.—The report that the Hoosac Tunnel would be equipped for electrical operation is reported to have been confirmed by the officials of the Boston & Maine Railroad Company. The cost of the work, including electric locomotives, is estimated at about $1,000,000. When the changes are completed, both passenger and freight trains will be taken through Hoosac Mountain from Tunnel Station on the east to North Adams, and possibly to Williamstown, on the west side.

BOSTON, MASS.—Superintendent of Streets Louis K. Rourke has withdrawn his call for bids for a two-year contract for lighting the streets and has decided to ask for bids for a five or ten-year contract for lighting the streets, parks and alleys by either gas or electricity. The contract affected is the one now held by the Rising Sun Street Lighting Company, which supplies 12,000 gas lamps. The contract expires Feb. 1, 1911. The company supplies 60-cp gas lamps at $23.60 each per year, which is $1.29 per lamp more than the city pays for electric lamps of the same illuminating power. Consent of the Mayor and City Council will have to be secured before a contract for more than two years can be awarded.

FALL RIVER, MASS.—Contracts have been awarded for power plant equipment for the Charlton Mills as follows: To the Providence Engineering Works, Providence, R. I., for one 10,000-hp Rice & Sargent, cross-compound steam engine, and to the Westinghouse Electric & Manufacturing Company, for an 850-hp, low-pressure steam turbine to generate electricity to operate the weaving mill, elevators and some of the spinning machines. The turbine will be operated by exhaust steam from the main engine.

LUDLOW, MASS.—The Ludlow Manufacturing Association has recently installed a 300-kw alternating-current generator in its plant to supply electricity for lamps and motors in mill No. 5. The company has also placed an order for a 2500-kw turbo-generator set to be installed, which will be used as an auxiliary in case of a breakdown or low water.

WALTHAM, MASS.—The Edison Electric Illuminating Company recently submitted a proposition to the W[illegible] Board of Trade offering to erect and maintain three large [illegible] advertising Waltham as a desirable place for manufacturers to locate in, if the Board of Trade would provide the locations for the signs.

WORCESTER, MASS.—The Worcester Electric Company has applied to the Massachusetts Gas & Electric Light Commission for permission to issue 2000 additional shares of capital stock at $100 par value, the price being fixed by the directors of the company at $180 per share. The proceeds to be used in connection with the construction of a new steam turbine plant [illegible] tion of the city. The cost of the new plant is estimated at about $500,000.

WORCESTER, MASS.—Plans have been completed for enlarging the Millbury plant of the Worcester Consolidated Street Railway Company to supply electricity for operating the entire system. The plans also call for the erection of a substation in Worcester [illegible] streets. Power from the Millbury plant will be transmitted to Worcester over lines carrying three-phase current at 13,000 volts, which will be erected on private right of way. Orders have been placed for equipment of power plant at Millbury and substation in Worcester, which, it is said, will call for an expenditure of about $500,000 and will include a General Electric 5500-kw, 13,000-volt, 3-phase, 25-cycle turbo-generator set; two rotary converters, switchboards, transformers, etc.; also four water tube boilers with a total rating of 11,360 hp. The power station of the company at Fremont Street will be used as an auxiliary station when the Millbury plant is completed.

CENTREVILLE, MICH.—Plans are being prepared by Vance I. Gray, 226 Huron Street, Toledo, Ohio, for a new electric light plant and waterworks system for the Centreville Water & Light Company. F. W. Thomas, 1919 Monroe Street, Toledo, Ohio, is secretary of the company.

DETROIT, MICH.—Smith, Hinchman & Grylls, of Detroit, Mich., are reported to be preparing plans for an addition to the municipal power plant.

GRAND RAPIDS, MICH.—It is reported that the Crawford Chair Company, of Grand Ledge, Mich., is contemplating the erection of a factory in Detroit, Mich. The plant, it is said, will be equipped for electrical operation.

KALAMAZOO, MICH.—C. K. Goff, of Battle Creek, Mich., owner of the so-called Armstrong franchise, has submitted a proposition to the City Council proposing that the Council return the $5,000 deposited with the city treasurer or extend the time for completing the work on the proposed electric light, heat and power plant until Jan. 1, 1911. Under the terms of the franchise the money was to revert to the city in case work to the amount of $10,000 was not completed on the system by Sept. 1, 1910. The money was advanced by Mr. Goff to Frank W. Armstrong to secure the extension to the franchise. Owing to the failure to promote the project to build the power plant, the franchise was transferred to Mr. Goff in June. The franchise has twenty-eight years to run. Mr. Goff is willing to turn it over to the city for the return of the forfeit money.

LANSING, MICH.—The new system of tungsten streets lamps, recently installed, is giving satisfaction, and the business men are anxious to have the lamps installed on the side streets, which will probably be done next year. About $20,000 has been expended on the street lighting system this year.

OXFORD, MICH.—It is understood that the City of Oxford, Mich., is contemplating the installation of a motor-driven centrifugal pump of about 500,000 gal. per day capacity in the municipal electric light and water plant in the near future.

AURORA, MINN.—The City Council is reported to have awarded the contract for lamp standards to be used in connection with the installation of an ornamental street lighting system to the Thompson & Stewart Company, of Duluth, Minn.

BUFFALO, MINN.—The Village of Buffalo is planning to install a 100-hp electric plant. The equipment will include a producer-gas outfit.

DULUTH, MINN.—The Great Northern Power Company is reported to have commenced condemnation proceedings for a site at Beaver Creek for a large storage reservoir.

EVELETH, MINN.—The Commercial Club is reported to have petitioned the Council for an appropriation of $6,000 to install an ornamental illuminating system on Grant Avenue.

FAIRMONT, MINN.—At an election held recently the citizens voted in favor of the proposition to issue $30,000 for improvements and extensions to the municipal electric light plant.

ROCHESTER, MINN.—The Board of Public Utilities has petitioned the City Council for an appropriation of $5,000 to be used for improvements to the municipal electric light plant.

STARBUCK, MINN.—Arrangements are being made by the White Bear Lake Telephone Company for the erection of about fifteen miles of rural lines this fall. A. H. Dreyes is manager.

STARBUCK, MINN.—We are informed that the Village of Starbuck would like to receive prices on a 50-hp or 55-hp Corliss engine and boiler, complete, for the municipal light and water plant. A. H. Dreyes is superintendent.

ST. LOUIS, MO.—It is reported that a meeting of the stockholders of the Suburban Light & Power Company will be held Sept. 22 to vote on the proposition to increase the capital stock of the company from $200,000 to $750,000.

ST. LOUIS, MO.—It is reported that prices are being received by the general purchasing agent of the Missouri Pacific Railway Company, St. Louis, Mo., on a large list of tools, a large part of which will be motor-driven. The list calls for boring machines, planers, radial drills, lathes, slotting machines, grinders, bolt cutters, pipe machines, punchers, boring and turning mills, etc., two 15-hp, 725-r.p.m., 220-volt, constant speed, direct-current, shunt-wound electric motors, complete with low voltage release starting rheostat; one 5-hp, 975-r.p.m., 220-volt, constant speed, shunt-wound electric motor, complete with low voltage release starting rheostat; one 30-hp, 1025-r.p.m., 220-volt, direct-current, constant-speed, shunt-wound electric motor, complete with release starting rheostat; one 7½-hp, 975-r.p.m., 220-volt, direct-current, constant-speed, shunt-wound electric motor, complete with minimum speed release start-[illegible]

[illegible] 25-cycle, three-phase, 705-r.p.m. induction motor, complete with sliding base, pulley and auto starter; one 50-hp, 220-volt, direct-current, constant-speed, shunt-wound, with low voltage release starting box.

VICTOR, MONT.—Announcement has been made that the Missoula Light & Water Company has purchased the electric plant at Victor, owned by J. S. Hodges, and proposes to make it part of the extensive system which is being developed between Missoula and Hamilton. The purchase of this plant gives the Missoula Light & Water Company control of all the light and power franchises throughout the valley. The principal branch office will be located in Hamilton.

BLADEN, NEB.—It is reported that the citizens have voted to issue bonds for the installation of a lighting system.

WALLHILL, NEB.—Bonds to the amount of $22,500 are reported to have been sold by the Village of Wallhill, the proceeds of which will be used for the construction of an electric light plant and water-works system.

MADISON, N. J.—A report has been submitted to the Council by the lighting committee recommending an expenditure of from $5,000 to $10,000 for improvements and new equipment to the municipal electric light plant. The Council has decided to establish a meter service throughout the borough, beginning April 1, 1911.

WOODBURY, N. J.—Sealed proposals will be received by the City Council until Sept. 27 for the construction of about 7700 ft. of 8-in. vitrified pipe sewers, with manholes and flush tanks and a pumping station equipped with duplicate rotary pumps and electric motors, automatically controlled, and about 1100 ft. of 6-in. cast iron force main, in accordance with plans and specifications on file at the office of the city clerk, Woodbury, N. J., and at the office of the City Wastes Disposal Company, 156 Fifth Avenue, New York, N. Y. Plans and specifications may be obtained from the city clerk, for which a deposit of $5 will be required to insure return of same. Arthur Starr is city clerk.

ALBUQUERQUE, N. M.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 4, for an electric elevator in the U. S. post office building at Albuquerque, N. M., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

ALBANY, N. Y.—The Municipal Gas Company, of Albany, N. Y., has been authorized by the Public Service Commission, Second District, to exercise franchises granted by the Town of Bethlehem to furnish electricity along the Albany and Greene Turnpike and all the public roads and highways intersecting the Albany and Greene Turnpike in the Town of Bethlehem.

BUFFALO, N. Y.—The contract for installing a power plant at the Erie County Penitentiary has been awarded to Timothy McEvoy & Sons, [illegible]

LONG BEACH, N. Y.—The Long Beach Power Company has filed a $500,000 mortgage in the office of the county clerk in favor of the Lincoln Trust Company to secure funds for improvements to its property in Long Beach.

NEW YORK, N. Y.—A proposition has been submitted by William G. McAdoo, president of the Hudson & Manhattan Railroad Company, to the Public Service Commission, First District, for the construction and operation of a subway railway connecting the Thirty-third Street station of his system with the Hudson Terminal station at Cortlandt Street. It is proposed that the line be constructed on the city's credit and leased upon terms similar to those of the present subway.

RED HOOK, N. Y.—The Red Hook Light & Power Company has been granted permission by the Public Service Commission, Second District, to take over the franchises held by John H. Sharpe in the towns of Germantown, Livingston and Clermont, in Clermont County, and to exercise privileges granted under the franchise. The company is also authorized to execute a mortgage upon its property to secure an issue of $150,000 in bonds. At the present time the company is authorized to issue $10,000 of the bonds at not less than par in exchange for $10,000 bonds now outstanding on the property; also $60,000 in bonds to be sold at not less than $80 to settle indebtedness incurred in construction of new lines and equipment.

RENSSELAER, N. Y.—The committee of the Common Council is negotiating with the Albany Southern Railroad Company for substituting the present street lighting system with tungsten lamps of 32 cp. The company has submitted a proposition to the committee offering to replace the 25-cp incandescent lamps with tungsten lamps of 32 cp, or to furnish 40-cp tungsten lamps at an additional cost of $1.75 per lamp per year, providing the city would enter into a contract with the company for a term of five years, which the city is not willing to do.

SODUS, N. Y.—Announcement has been made that the Sodus Gas & Electric Company has decided to extend its transmission lines from Williamson to Pultneyville, a distance of about four miles. The owners of the large flour mill have agreed to utilize electricity to operate the mill and the residents of the Village of Pultneyville have petitioned for street lamps. The property owners between Williamson and Pultneyville have also contracted for street lamps. Work on the extension will begin in the near future.

TONAWANDA, N. Y.—The Frontier Electric Railroad Company, which proposes to construct an electric railway from Buffalo to Niagara [illegible] and North Tonawanda by which the company will be granted a franchise in those cities. The company has acquired all the right of way of the Buffalo, Thousand Islands & Portland Railroad, between Buffalo and Niagara Falls. James Simmons is interested in the project.

WALTON, N. Y.—The Public Service Commission, Second District, has authorized the Southern New York Power Company to issue $24,000 in capital stock at par in payment of all the property, franchises and holdings of the Walton Electric Light Company, of Walton, N. Y., and $2,100 in payment of property and franchises of the Mulkins electric light plant, located in Walton. The company applied to the commission for permission to issue $40,000 to purchase the plant and holdings of the Walton Electric Light Company.

CHARLOTTE, N. C.—The Southern Power Company is reported to have awarded a contract for the installation of a 4000-hp plant for the production of nitrate by an electrochemical process. The first plant, which will be used largely for experimental purposes, will be located near the Great Falls power plant of the company in South Carolina. The company is said to be contemplating the installation of a 24,000-hp plant, the site for which has not yet been decided upon.

EDONTON, N. C.—The Board of Public Works will receive proposals for one 75-kw, alternating-current, single-phase, 60-cycle generator, direct connected to a simple automatic engine. For further information adress J. C. Martin, superintendent of the municipal electric light and water department.

GREENSBORO, N. C.—The Board of Aldermen and the Water and Light Commission are considering the question of establishing a municipal electric light plant in Greensboro.

SALISBURY, N. C.—Contracts have been placed by the Hambley Manufacturing Company for 50 broad looms and auxiliary machinery for the production of mercerized damask. The plant will be operated by electricity. C. C. Adams is president of the company.

CLEVELAND, OHIO.—The Lake Shore Railroad Company is reported to have placed orders for generators for its Elkhart shops, and, it is said, will purchase in the near future motors with a total rating of 5000 hp.

CLEVELAND, OHIO.—The Electric Controller & Manufacturing Company is reported to have engaged George S. Rider & Company, engineers, to prepare plans for the construction of its new plant, for which the company recently purchased a site at Eightieth Street and Bessemer Avenue, in Cleveland.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company is reported to have contracted with the General Electric Company, of Schenectady, N. Y., for two 1500-kw steam turbines, to be installed in its plant at the foot of Seventieth Street. It is understood that other equipment, including exciters, will be purchased later.

CLEVELAND, OHIO.—The Commissioners of Cuyahoga County have entered into a contract with the Cleveland Electric Illuminating Company to furnish electricity and heat for the new court house, now under construction. The contract is for a period of ten years, without a terminating clause, and under its terms all the equipment under the county ground becomes the property of the county at the expiration of the contract. The company agrees to supply electricity at the rate of 3.23 cents per kw-hour and 27 cents a unit for steam. It is estimated that the county will save $150,000 in the ten years, above the expense of establishing and maintaining a plant of its own.

COLDWATER, OHIO.—The New Idea Spreader Company is reported to have awarded contracts for the erection of a new plant, 60 ft. x 100 ft., as follows: For construction of power house, to A. De Curtins, of Lima, Ohio; Anton Burchard, engineer, of Cleveland, Ohio, for electrical installation, and Ammerman, McCall & Anderson, of Detroit, Mich., for heating and ventilating. A 200-hp power plant will be installed.

COLLEGE CORNER, OHIO.—A franchise has been granted to Robert S. Ashe, of Richmond, Ind., to install an electric light system in College Corner. Electricity for operating the system will be transmitted from Richmond.

COLUMBUS, OHIO.—The committee appointed by the City Council to make investigations regarding the cost of equipping the municipal electric light plant to furnish electricity for lamps and motors for commercial purposes has decided to recommend the City Council to submit to a vote at the November election the proposition to issue $150,000 in bonds to pay for same. If bonds are authorized it is proposed to expend $75,000 next year for equipment to equalize the power so that a day and night load can be carried. The remainder will be held for new generators when needed. It is estimated that with an expenditure of $75,000 the income from day contracts would be sufficient to pay the operating expenses of the plant. The City Council is considering the question of providing for a bond issue of $200,000 instead of $150,000, the proceeds of $50,000 to be used to extend the lighting system to the recently acquired territory.

NILES, OHIO.—Plans are being prepared by the Mahoning & Shenango Valley Railway & Light Company for improvements to its system in Niles, which will involve an expenditure of about $100,000. A new substation, car barn and freight station will be built.

HENRYETTA, OKLA.—At an election held recently the citizens voted to grant an electric light franchise to B. T. Lilly and associates.

SHAWNEE, OKLA.—It is reported that the Chicago, Rock Island &

Pacific Railway Company is contemplating the installation of an electric plant to supply electricity for lamps and motors for its Shawnee shops. J. B. Berry, Chicago, Ill., is chief engineer.

WOODWARD, OKLA.—The Woodward Cotton Company has applied to the Federal Court for a writ to restrain the municipality from erecting and operating an electric light plant. The company claims that it has an exclusive franchise for twenty years and that a municipal plant will put the company out of business. The city on Aug. 20 voted to issue $20,000 in bonds to construct a new plant.

DUFUR, ORE.—We are informed [illegible] system will be installed in Dufur. W. Brigham, [illegible] engineer.

PORTLAND, ORE.—The directors of the Pacific Power & Light Company are reported to have decided to erect about 200 miles of transmission lines at once in Eastern Oregon and Washington, which will involve an expenditure of from $500,000 to $600,000.

PORTLAND, ORE.—The Pacific Power & Light Company is reported to be considering the purchase of several large tracts of land in the Middle Columbia River basin in connection with its purpose of making a specialty of furnishing electricity for operating irrigation pumps.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 14, for condenser, motor-driven engine lathe, valve reseating machine, rivet sets, machine bits, cold-shuts for steam shovels, manganese steel plates, etc. Blanks and general information relating to this circular (No. 606) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 55 National Realty Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officer.

AVONDALE, PA.—The plant and holdings of the Chester County Electric Company have been sold, under an order of the Court of Chancery, to the Central Trust & Savings Company, of Philadelphia, Pa., for $10,000. The property includes a mill and water rights and electric plant in New Castle County, which supplies electricity in several towns in Chester County. The trust company held a mortgage on the plant.

LEECHBURG, PA.—The Pittsburgh & Allegheny Valley Railway Company is reported to have purchased a site in North Vandergrift, on which it will erect a power station.

SHICKSHINNY, PA.—Plans are being considered for increasing the output of the municipal electric light plant, which will probably be submitted to the voters at the next election. The installation of an engine and generator, a mercury rectifier and transformer for arc lamps is contemplated. William T. Davis is superintendent.

SUNBURY, PA.—The Edison Electric Illuminating Company has ordered from the General Electric Company, of Schenectady, N. Y., a complete luminous arc outfit for street lighting purposes. R. V. West, manager.

REDFIELD, S. D.—Bids will be received by the City Council until Oct. 3, for a 150-hp boiler for the municipal electric light plant. H. T. Patch is city auditor.

BRYAN, TEX.—Plans are being considered by the Bryan-College Interurban Company to extend its railway into the Brazos River bottoms, connecting several small towns. Preparations are now being made by the company to extend its system over the streets of Bryan and to run a loop around the outskirts of the town. O. E. Gammill is manager of the company.

CENTER, TEX.—The capital stock of the Center Light & Ice Company is reported to have been increased to $20,000 and the output of the ice plant increased to 20 tons. The company proposes to install additional machinery to supply electricity to operate fans and motors on its system.

GEORGETOWN, TEX.—The City Council is considering a proposition to issue $50,000 in bonds, the proceeds to be used for the purchase of the water and electric plant of the Georgetown Water, Light & Power Company, to be operated by the municipality. If the plant is taken over by the city, improvements will be made to it.

PALESTINE, TEX.—The City Commissioners have granted George W. Burkett and associates a franchise to build a street railway in Palestine.

ROSEBUD, TEX.—Negotiations have been closed whereby I. J. Nathan, owner of the electric light and ice plant at Marlin, has purchased the electric plant at Rosebud. It is understood that the new owner will make improvements to the system and install an ice plant.

WELLSVILLE, UTAH.—Application has been filed with the state engineer by H. C. Baker and H. J. Craven, of Ogden, Utah, for 10 cu. ft. per second of the water of Spring Branch, near Wellsville, Cache County. The water is to be utilized to operate an electric plant in Cache County and will be diverted by means of a channel 10,500 ft. in length. The plant will be operated under a head of 500 ft. and will develop about [illegible] hp.

COVINGTON, VA.—E. M. Nettleton is contemplating the installation of an electric generator at his planing mill for supplying energy for lighting the mill and electric service at his residence.

FALLS CHURCH, VA.—The stockholders of the Washington-Virginia Railway Company have voted to increase the capital stock of the company from [illegible] to [illegible] struct and operate an electric railway from Bluemont to Vienna, a distance of about fifty miles. M. E. Church, of Church Falls, is president.

BELLINGHAM, WASH.—Application has been made to the City Council by J. D. Crary, representing the Gray's Harbor Electric Company, of Aberdeen, Wash., for a franchise to build an electric railway in Bellingham. The company has also applied for franchises in South Bend and Raymond, Wash.

FREEWATER, WASH.—The City Council has granted the Walla Walla Valley Traction Company a franchise to construct and operate an electric railway in Freewater.

IRONDALE, WASH.—The Western Steel Corporation has entered into a contract with the Olympic Power & Development Company whereby the power company will furnish 2500 hp, within eighteen months, for use in connection with its steel plant in Irondale, with an option of 2500 hp additional after the 2500 hp shall have been delivered. The Olympic Power & Development Company is now constructing a power plant on the Elwah River, six miles from Port Angeles, at a cost of about $500,-

MARCUS, WASH.—It is reported that arrangements are being made by the Kettle River Power & Light Company for the construction of its proposed power plant, work on which will begin in the near future. The cost of the plant is estimated at $191,000. The company will supply electricity for the mine and for lamps and motors in Marcus. H. Allenburg, of Spokane, Wash., F. L. Tate and other capitalists, of Philadelphia, Pa., are interested in the project.

SEATTLE, WASH.—The control of the water power of the Priest Rapids, in the Columbia River, in Grant and Yakima Counties, Washington, has been purchased by the American Power & Light Company, of New York, N. Y., from the Hanford Irrigation & Power Company. The property of the Hanford company is estimated to be worth $4,000,000.

SEATTLE, WASH.—It is reported that negotiations are under way for the consolidation of the Hanford and Strathorn irrigation canals and power plants on Priest Rapids. The project, it is said, will involve an expenditure of about $90,000,000 in Northwestern power development. S. Z. Mitchell, of New York, N. Y., president of the Electric Bond & Share Company and chairman of the board of supervisors of the Pacific Light & Power Company, has charge of financing the project.

SEATTLE, WASH.—Plans are being made by the International Lead & Iron Company to develop its lead and hematite iron ore properties in British Columbia. The company proposes to establish furnaces and build a pipe foundry and car-wheel plant. Power for operating the proposed works will be secured from a hydroelectric plant which is now being installed near the company's holdings. The local office of the company is located in the Columbia Block. H. H. Shallenberger, of Spokane, Wash., is secretary of the company.

WILSON CREEK, WASH.—Work has commenced on the construction of the power house for the proposed electric light and power plant in Wilson Creek. The plant is being erected by C. J. Weller, who was recently granted a franchise by the City Council. It is expected to have the plant in operation by the middle of November.

MORGANTOWN, W. VA.—The Soutth Morgantown Traction Company is contemplating extending its railway in Morgantown, and franchise will soon be applied for. It is proposed to extend the railway from Morgantown to Fairmont.

SHEPHERDSTOWN, W. VA.—The Town of Shepherdstown is reported to be considering the question of installing a municipal power and pumping station.

THOMAS, W. VA.—The Davis Coal & Coke Company is constructing a central power plant to generate electricity for all mines located in this district. The boiler plant will be equipped with water-tube boilers and underfeed stokers; waste fuel will be used for the boilers. The electrical apparatus will include three turbo-generator sets with a rating of 2500 kw. Substations will be erected at each mine and both direct and alternating-current supplied at all stations. The main transmission lines will form two complete circuits, 11 miles in length. It is understood that contracts have been placed for machinery. B. F. Bush, 702 Continental Building, Baltimore, Md., is president.

MILWAUKEE, WIS.—The State Railroad Commission has issued a certificate of necessity to the Milwaukee Western Electric Railway Company for the construction of an electric railway from Beaver Dam to Fox Lake.

NORTH MILWAUKEE, WIS.—The North Milwaukee Light & Power Company has been authorized by the Railroad Commission to issue 500 shares of common stock at par value of $500 each, the proceeds to be used to pay outstanding indebtedness incurred by additions to the property and to provide for future extensions.

REEDSVILLE, WIS.—The Wisconsin Pea Canners Company is reported to be contemplating the construction of a new factory at Reedsville, for which power and operating machinery will be required.

SHEBOYGAN, WIS.—The Sheboygan Railway & Electric Company has been granted [illegible] 000 in bonds, of which the proceeds of $440,000 will be used for retiring or refunding an outstanding issue to the amount of $400,000 and $160,000 for paying outstanding floating indebtedness. The balance is [illegible] ditional rolling stock, machinery, etc.

SUPERIOR, WIS.—One of the docks which have been [illegible]

[illegible] Company is to be remodeled and new electrically operated equipment for handling freight installed.

SUPERIOR, WIS.—Preparations are being made by the Superior Water, Light & Power Company for improvements in its three departments during the next year which will involve an expenditure of about $150,000. Half of this amount will be expended on the water plant this year. The plans call for a larger pipe line and one or two new pumps. Allen Hazen, 103 Park Avenue, New York, N. Y., is consulting engineer. W. H. Winslow is manager.

LORAINE, WYO.—The Southern Wyoming Telephone Company, recently incorporated, is planning to erect a telephone line from Loraine to Bosler, thence to Medicine Hat, where it will connect with 100 miles of wire having no outlet. The company is capitalized at $25,000. The company has taken over the telephone line to the Rambler mine. R. D. Stewart is secretary and treasurer.

SHERIDAN, WYO.—The Sheridan Electric Light & Power Company has commenced work on the erection of a new transmission line from its local plant to the Acme and Monarch mines, where the company has contracts to supply 600 hp. The contracts provide for day service only, until the new 4000-hp plant on the Big Goose and Toungue River is completed, which, it is expected, will be ready for operation this fall.

MEDICINE HAT, ALTA., CAN.—The Alberta Southeastern Telephone Company, operating telephone lines from Medicine Hat to Cypress Hills in the Province of Alberta, has received an offer from the Provincial Government for the purchase of its system. It will probably be accepted.

NELSON, B. C., CAN.—The Pacific Exploration Company is reported to have been granted permission to erect an electric power plant on Pend d'Oreille River, near Waneta. The company proposes to install a 25,000-hp plant and furnish electricity to the Pend d'Oreille Valley, the Sheep Creek and Ymir districts, and to the Orient, Cheweha and Metaline districts. H. C. Hall, of Nelson, B. C., Can., is president.

VICTORIA, B. C., CAN.—It is reported that the Portland Canal, Light, Water & Power Company, which is now supplying the Stewart with electricity, has abandoned the proposed power house site on the Marmot River and will build on the American Creek, where, it is stated, some more power can be developed. Arrangements have been made with the Stewart Land Company for the change of power sites. The company proposes to install a large power plant and distribute electricity throughout the entire district. At present the company is operating a temporary plant.

WINNIPEG, MAN., CAN.—The contract for furnishing and installing 46,000 ft. of 13,000-volt, three-core cable has been awarded by the Board of Contract to the Canadian British Insulated Company, of Montreal, Que., Can., for $51,520.

BOTHWELL, ONT., CAN.—The Urban & Rural Telephone Company, recently incorporated with a capital stock of $4,000, is planning to erect a telephone system, which will serve the town of Bothwell, the townships of Zone, Oxford, Euphemia and Mosa. The main office will be located in Bothwell.

COCHRANE, ONT., CAN.—Preparations are being made by Beach Brothers to install an electric plant in Cochrane to supply electricity for lamps and motors in the town.

GUELPH, ONT., CAN.—At an election to be held Sept. 26 a proposition to appropriate $85,000 for extensions and improvements to the Guelph railway system will be submitted to a vote.

LONDON, ONT., CAN.—Contracts amounting to $16,000 have been awarded by the Water Commissioners for electrical equipment for the Springbank pumping plant to the Canadian Westinghouse Company, the Allis-Chalmers Company, Seamans Brothers and John McDougall & Company.

OTTAWA, ONT., CAN.—Arrangements have been made by the Hydro-Electric Power Commission and the Electric Commission of Ottawa with the Ottawa & Hull Power Company to supply the City of Ottawa with 1500 hp additional at $15 per horse-power delivered in Hull. The contract just completed will make the city's supply 4000 hp.

TORONTO, ONT., CAN.—The Board of Control has reported in favor of the purchase of the Toronto Railway Company to be operated as a municipal enterprise, also that the city engineer be instructed to prepare plans for new lines to the suburbs.

SWIFT CURRENT, SASK., CAN.—Sealed tenders will be received by G. W. Bilbrough, secretary and treasurer, until Sept. 27 for construction of power house and equipment as follows: Contract "C"—Power house. Contract "D"—Settling tank and intake. Contract "E"—Pumping machinery (compressed air system). Contract "F"—Electrical machinery. Contract "G"—Producer gas plant. Plans and specifications may be seen at the town hall, Swift Current, or at the office of J. Darlington Whitmore, engineer, 104 Willoughby and Duncan Block, Regina. Copies of plans and specifications for contracts "C" and "D" will be forwarded by the engineer upon receipt of check for $10, which [illegible]

New Industrial Companies.

[illegible] Batte, W. T. Overton and others. The company proposes to manu- [illegible]

THE CHICAGO ACME CLEANER COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $100,000 by C. H. Wolf, G. F. Nicklaus and M. Fulkerson, of Chicago, Ill. The company proposes to manufacture vacuum cleaners and operate the same.

THE DAYTON ELECTROMOBILE COMPANY, of Dayton, Ohio, has been chartered with a capital stock of $250,000 by John L. Baker, William Pflum, H. B. Brentlinger, George L. Baker and C. W. Dale, all of Dayton, Ohio.

THE DIFFERENTIAL POWER CLOCK COMPANY, of Chicago, Ill., has been incorporated by H. A. McLindon, E. D. Bacci and C. S. Hamilton, of Chicago, Ill. The company is capitalized at $100,000 and proposes to manufacture mechanical devices.

THE IMPROVED BLOCK RAILWAY SIGNAL SYSTEM, of Hammond, Ind., has been chartered by Charles D. Anderson, Howard Ross and Cornelia S. Benepe. The company is capitalized at $50,000 and proposes to manufacture block signal systems.

THE McCARTHY ENGINEERING CORPORATION has filed articles of incorporation with the Secretary of State at Dover, Del., with a capital stock of $100,000. The incorporators are: P. A. McCarthy, F. McCarthy, both of Houston, Tex., and H. W. Davis, of Wilmington, Del.

THE MERIT MOTOR CAR MANUFACTURING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 to manufacture motors, engines, etc., and also automobiles. The incorporators are: E. H. Knight, J. H. Riviere and E. C. Billings, all of New York, N. Y.

THE MONOBRAKE COMPANY, of Babylon, N. Y., has been incorporated by P. Krause, W. G. Nicoll and D. Sandman, of Babylon, N. Y. The company is capitalized at $125,000 and proposes to manufacture and deal in brakes, equipment and supplies for autos, etc.

THE NATIONAL HYDRAULIC CONSTRUCTION COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $500,000 to do a general contracting and building business, etc. The incorporators are William D. Johnson, 26 State Street, Hartford, Conn.; Edward del Castillo, 154 East Ninety-first Street, New York, N. Y., and H. L. Zeigler, 5 White Street, New York, N. Y.

New Incorporations.

SOUTH SHORE, S. D.—Articles of incorporation have been filed for the Dexter-Germantown Telephone Company by E. O. Ellingson, T. N. Bergdon, J. C. Johnson and Anton Klix. The company is capitalized at $20,000.

MADISON, VA.—The Madison Telephone Company, of Madison, Va., has been incorporated with a capital stock of $5,000. The following officers have been elected: J. B. Graves, president; M. L. Hoffman, vice-president; G. L. Gibbs, secretary, all of Glory, Va.

SPENCER, VA.—The Southeastern Telephone Company has been incorporated with a capital stock of $5,000. The officers of the company are: D. S. Bill, president; D. E. Moore, vice-president; W. C. Clanton, secretary, and G. W. Clark, treasurer.

FLAT ROCK, W. VA.—The Flat Rock Independent Telephone Company has been chartered with a capital stock of $5,000 for the purpose of constructing and operating a telephone system in Mason and other counties. The incorporators are: C. D. Dent, of Flat Rock, W. Va.; J. E. Carson, of Greer, W. Va.; G. W. Board, of Letart, W. Va.; C. W. White, of Leon, W. Va., and others.

Personal.

MR. JOHN B. MILLIKEN, controller of the Crocker-Wheeler Company, has accepted the position of treasurer of the Yale & Towne Manufacturing Company, of Stamford, Conn. Mr. Milliken's headquarters will be in New York.

MR. JOHN P. MOORE, formerly instructor in electrical engineering at the Pennsylvania State College, is again with Mr. Robert P. Woods, consulting and constructing engineer, of Indianapolis, and is now located at Roswell, N. M., as electrical engineer on extensive irrigation projects in the Southwest.

Trade Publications.

A BEAUTIFUL FIXTURE CATALOG.—A specimen of book-making that would adorn the collection of a bibliophile has been issued by the Pettingell-Andrews Company, of Boston, with the title "Lighting Fixtures for the Home, the Church and Public Buildings." The large size of page—12 in. x 15 in.—enables the excellent illustrations to be displayed with artistic effect, which is enhanced by good printing on a superior quality of plate paper. The binding is equally successful, the velvety leather of the back being excellently matched by the board covering and end papers. The work is further ornamented by four full-page views of large and handsome interiors, showing fixtures in place, the engravings having the effect of eau-forte etchings. As a specimen of good taste in book design and skill in execution the work could safely be exhibited alongside of the best productions of the Ameri- [illegible] congratulations to those concerned in the

achievement, namely, Mr. Levor, manager of the company's fixture studio, who is credited with the original plan of the book; Folsom & Sunergreen, who made the fixture engravings; G. Fred Crosby, who designed the decorations of the introductory pages and drew the four interior views above noted, which were engraved by the Hub Engraving Company; and last, but not least, the Barta Press, of Boston. The catalog is divided into five sections, namely, Colonial, English, French, Commercial and Glassware. About 250 fixtures are illustrated in the artistic sections, and about half that number of stock types in the commercial section.

CONDENSERS FOR SMALL CENTRAL STATIONS.—With this title the Wheeler Condenser & Engineering Company, of Carteret, N. J., has reprinted in pamphlet form a lecture delivered before the Missouri Gas, Electric & Street Railway Association. It contains a number of useful tables, charts and curves relating to the operation and economy of condensing machinery. The effect of vacuum on the steam consumption of simple slide valve, compound, high speed and low speed engines and steam turbines is first discussed, and then the other economies to be obtained by using condensing machinery, and, for instance, the reduction in boiler capacity, are taken up. With respect to jet condensers, a report of two tests is given, showing the advantages of the counter-current construction of the Wheeler rectangular jet condenser as affecting economy of operation and the attainment of high vacuum. The subject of air pumps is also considered, a typical indicator card from a dry air pump being reproduced. Under the heading "Surface Condensers" several pages are devoted to the various factors which influence the transmission of heat through condenser tubes and their bearing on the economy of a surface condenser.

BUSINESS NOTES.

THE GARWOOD ELECTRIC COMPANY has appointed Hugh A. Brown manager of its Chicago office, with offices at 555 Old Colony Building. Mr. Brown has during the past eight years been actively engaged in the sale of electrical machinery in Chicago and Cincinnati, and brings a technical training to the work of the company in forwarding the special application of motors and generators to industrial purposes of all kinds.

H. W. JOHNS-MANVILLE COMPANY OPENS NEW OFFICES.—Owing to the vicinity of Atlanta, Ga., and Rochester, N. Y., the H. W. Johns-Manville Company has recently opened a new office in each of these cities. The Atlanta office is located in the Empire Building, in charge of Mr. W. F. Johns, who has been traveling this territory for the company for a number of years. The Rochester office is located at 725 Chamber of Commerce, in charge of Mr. H. P. Domine, formerly with the Buffalo branch of the company.

MATHIAS KLEIN & SONS, manufacturers of linemen's and electricians' tools, Chicago, report that they are busy in both their old factory on Van Buren Street and the new factory on Clybourn Avenue. The Van Buren factory is now almost exclusively employed in the production of "Klein pliers" of various styles and sizes, side-cutting, long-nose, oblique-cutting, flat-nose, weaver-nose, burner pliers and gas pliers, for which there is an ever-increasing demand. The Clybourn factory is employed in the production of the various items comprised in the general line of the firm's products.

THE CONNECTICUT TELEPHONE & ELECTRIC COMPANY announces that the sales arrangements that have existed between the United Manufacturers and the Connecticut Telephone & Electric Company and the Connecticut Shock Absorber Company will be discontinued on Oct. 1. After that date inquiries should be addressed direct to the Connecticut Telephone & Electric Company and the Connecticut Shock Absorber Company at Meriden, unless such information refers to settlement of accounts for purchases up to Oct. 1, in which case such inquiries should be addressed to the United Manufacturers at New York.

THE LAGONDA MANUFACTURING COMPANY, of Springfield, Ohio, announces that it has bought out the Enterprise Machine Manufacturing Company, acquiring the rights and patents for the full line of water strainers and tube cleaners manufactured by the latter. Special attention is being paid to the development of the water strainer. Although this strainer has been on the market for several years and is well beyond the experimental stage, the Lagonda Manufacturing Company has made several important improvements and the apparatus is now known as the Lagonda-Enterprise strainer. This strainer is suitable for removing impurities from boiler feed water, circulating water, etc.

McGILL MANUFACTURING COMPANY.—The Crescent Company, manufacturer of electrical specialties, announces that on Oct. 1 it will change its name to the McGill Manufacturing Company. The main office will be at the factory at Valparaiso, Ind., where the company has just completed a new two-story brick factory building containing 15,000 sq. ft. of floor space. There will be no change in the policy or ownership of the business as conducted by the Crescent Company. Mr. J. H. McGill will continue as president and general manager and Mr. H. W. Harrold as treasurer of the company. The Chicago office at 516 West Monroe Street will be continued for the convenience of Chicago trade. This office will be under the management of Mr. F. R. Bryant.

THONER & MARTENS.—Mr. Peder C. Thoner, who for about twenty-one years has been associated with the Albert & J. M. Anderson Manufacturing Company, for the last fifteen years as foreman and superintendent, and Mr. Rudolph Martens, who has been with the same concern for seventeen years, the past ten years as foreman in charge of special and experimental electrical work, have formed a co-partnership under the firm name of Thoner & Martens for the purpose of establishing a machine shop for the manufacture of switches, switchboards, electrical machinery, specialties, experimental work and for general machine work. The shop will be located at 37 Hartford Street, Boston, Mass., near Fort Hill Square, and will be equipped with the best up-to-date machine tools.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 13, 1910.

[Conducted by W. H. Blasing, Patent Law, 2 Rector St., N. Y. City.]

969,773. PROCESS OF PRODUCING ALLOYS AND THE SEPARATION OF METALS; P. F. Cowing, New York, N. Y. App. filed Nov. 11, 1909. Metallurgical process for the electrolytic treatment of copper and nickel alloys by bringing the original alloy into solution electrolytically, substituting nickel and iron for the copper in the solution by selective deposition and cementation and then electrolytically depositing the nickel and iron.

969,774. INTERCOMMUNICATING TELEPHONE SYSTEM; H. D. Currier, Chicago, Ill. App. filed Nov. 23, 1907. A transmitter and receiver are in series with each other and a retardation coil of low resistance and high impedance is in shunt with the receiver permitting an increased flow of direct current through the transmitter and a ringing circuit supplied with current through a resistance in shunt with the receiver, the retardation coil being cut into and out of circuit when the receiver is connected with the local line and the trunk line respectively.

969,781. AUTOMATIC ELECTRIC HEAT CONTROL; H. G. Geissinger, New York, N. Y. App. filed Dec. 22, 1909. For electric heater circuits, including a circuit closer with an armature and energizing coils including lifting and retaining coils which raise the armature, the lifting coil being short-circuited by the armature when raised.

969,787. PLUG SWITCH; H. E. Leppert, New Britain, Conn. App. filed May 5, 1909. A plug with contact surfaces extending in the direction of the axis, one member cup-shaped and the other fitting therein and a support for the contact located in proximity to the outlet edges of the surfaces, said contact being connected to said support by a sliding connection so as to be transversely movable with relation to the support.

969,790. DYNAMO-ELECTRIC MACHINE; E. Mattman, Norwood, Ohio. App. filed Aug. 1, 1907. A field yoke of magnetic material with a detachable flange having ventilating opening between the poles.

969,796. BRUSH FOR DYNAMO-ELECTRIC MACHINES; E. T. Mug, Norwood, Ohio. App. filed Sept. 19, 1904. A carbon brush, the strands at one end being separated and embedded in the brush.

969,7[illegible]. PRIVATE BRANCH [illegible] PHONE SYSTEM; J. L. McQuarrie, Oak Park, Ill. App. filed Nov. 28, 1907. Secret system, the trunk line terminating into an intercommunicating system connectible at each station with the trunk line with a circuit-closing device also located at each station for completing the trunk line irrespective of the telephone set.

969,805. OUTLET BOX; C. T. Pratt, Frankfort, N. Y. App. filed June 7, 1909. A plug for closing the conduit openings consisting of a disk of slightly larger diameter than the aperture to be closed, the edge of the disk being upset to provide a flange on each side of the disk and formed on a plane oblique to that of the disk, one face being of less diameter than the aperture to be closed so that the flange can be set up after the disk is inserted in the aperture to retain the disk in place.

969,809. ALTERNATING-CURRENT MAGNET; A. Simon, Milwaukee, Wis. App. filed Oct. 8, 1906. A plurality of coils in axial alignment with a magnetic frame forming magnetic circuits for said coils in the same plane.

969,813. CIRCUIT BREAKER; H. L. Van Valkenburg, Norwood, Ohio. App. filed June 16, 1906. An oil switch or circuit breaker with automatic tripping mechanism to open the switch.

969,814. SEARCHLIGHT PROJECTOR AND THE LIKE; H. Viertel, Berlin, Germany. App. filed Mar. 10, 1909. An arc light with mirror with the positive electrode near the focus and a thinner negative electrode curved between the focus and the mirror.

969,816. TERMINAL CASING; H. L. Wallau and E. E. Noble, Cleveland, Ohio. App. filed Aug. 23, 1909. For junction boxes in which an insulating body has an upward socket with openings and a terminal block is secured to the body above each opening and a wing extends from the body between each pair of openings acting as insulating barriers for the prevention of arcs.

969,818. TELEPHONE DROP; A. H. Weiss, Chicago, Ill. App. filed [illegible] flexible members supported by the pivot, one of the flexible members [illegible]

969,824. ELECTRIC SWITCH; G. S. Williamson, New York, N. Y. App. filed March 10, 1910. For linotype machines with knee shift for the switch. Details.

969,832. TELEPHONE APPARATUS; G. Babcock, Rochester, N. Y. App. filed July 11, 1907. A magnet and coil with diaphragm, having their convex sides in engagement consisting of plates compressed to [illegible]

969,833. PRODUCTION OF FERRIC SALTS; A. G. Betts, Troy, N. Y. [illegible] lyzing the solution with an insoluble anode while maintaining it at a temperature between 50 and 100 deg. C.

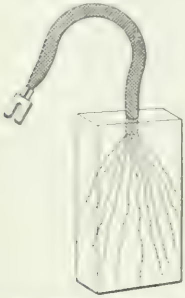
969,849. PORTABLE ELECTRIC HEATER; F. L. Dyer, Montclair, N. J. App. filed May 25, 1909. A heating coil within the heater and plug and connections and a chamber for enclosing the plug, and connections when not in use so that it may be carried about in the pocket until used.

969,866. MOTOR STARTER; C. T. Henderson, Pittsburgh, Pa. App. filed Jan. 13, 1906. A plurality of electromagnetic windings energized successively with a plurality of relay switches, one for each winding, arresting the successive operation thereof, and an electromagnet for actuating all of the switches.

969,876. SECONDARY BATTERY; G. J. Johnson, Chicago, Ill. App. filed March 28, 1910. "Hatch" battery consisting of a pair of compound elements each composed of pairs of porous plates with insulating edges and electrodes with their edges exposed to the action of the electrolyte, the plates having channels for the electrolyte.

969,892. COMMUTATOR BAR AND LEAD; C. E. Lord, Milwaukee, Wis. App. filed Dec. 21, 1908. A commutator bar with grooves and an aperture connected therewith with a connector passing through the aperture and setting in the grooves to form a loop and means for clamping the connector together beyond the loop.

969,894. METHOD OF AND MEANS FOR CONTROLLING REGENERATIVE ELECTRIC MOTORS; R. Lundell, New York, N. Y. App. filed Dec. 21, 1909. For operating a plurality of series motors



[illegible] Machines 969,849.—Portable Electric Heate[r]

drive a common load by connecting the motors to the line with [eac]h field coil in series with its armature and impressing independent [vol]tages upon the field circuits and regulating the latter by varying [illegible]

969,921. ELECTROLYTIC APPARATUS; W. Thum, Hammond, Ind. App. filed Nov. 22, 1909. A tank with an inclined floor and an anode cell in the tank above the higher part of the floor with a perforated bottom and sides and an anode basket within the cell with a filtering bottom.

969,985. SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed June 26, 1908. Railway system with a central station and telephone system for signaling and substations along the line with a signal at each substation, a selecting device therefor, and an electro magnetic means for operating the selecting device in each line at each signal receiving station and a shunt circuit transparent to the telephone currents bridged around the electromagnetic means.

969,993. ELECTRIC IGNITING DEVICE FOR GAS STOVES; C. Stamm, Milwaukee, Wis. App. filed March 16, 1908. A valve for the gas pipe carrying a swinging arm, and operated by a sliding bar and an electric igniter for the burner.

969,994. TROLLEY RETRIEVER; W. C. Starkey, North East, Pa. App. filed Nov. 23, 1908. A case with a stop and retrieving disk actuated by a spring tensioned by a rope to retrieve the trolley.

970,015. COVERING FOR MOUTHPIECES OF TELEPHONE TRANSMITTERS; A. K. Cann, Watkins, Col. App. filed Oct. 18, 1909. A thin disk of two portions that can be folded together, one portion embracing the neck of the transmitter and the other covering the mouth.

970,066. TELEPHONE TRANSMITTER; O. M. Leich and N. Pedersen, Genoa, Ill. App. filed June 19, 1908. A body with a diaphragm and bridge, leaf springs pressing against the diaphragm so arranged as to produce a long spring action.

970,078. INSULATOR; J. A. Meurling, Chicago, Ill. App. filed March 19, 1910. A cylindrical body with an opening for the pin, a wire groove on the outer surface and posts separated from the circuit to kink the wire in contact with the insulator.

970,087. BINDING DEVICE FOR CIRCUIT CONDUCTORS; T. E. Murray, New York, N. Y. App. filed March 10, 1910. Two plates with hook-shaped edges seated one within the other and overlapping flanges with a clamping screw passing through the flanges to engage a conductor seated in the hook.

970,088. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed June 16, 1910. A base with sockets and terminals and auxiliary fuse and removable fuse plug entering the sockets and closing the circuit between the terminals through the fuse.

970,089. BINDING POST; T. E. Murray, New York, N. Y. App. filed June 22, 1910. A bifurcated shank with sleeve thereon and a plurality of pairs of opposite recesses in its edge, each pair differing in size from the recesses of the other pairs and the wire to be held being arranged in a pair of recesses between the sleeve and the bottom of the shank.

[illegible] the button and one rod, an armature sliding on the rods [illegible] springs on the rods actuating the armature to close the [illegible]

[illegible] lytic vat, a driving shaft operating an endless carrier, carrying rings [illegible]

970,169. ELECTRICAL PROTECTIVE APPARATUS; J. A. Birsfield, Rochester, N. Y. App. filed July 18, 1907. For telegraph lines to protect from sneak currents by means of a lightning arrester and ground springs and a thermal device or fuse operating between the apparatus spring and the second ground spring.

970,180. ELECTROMAGNETIC DEVICE; W. S. Burnett, Milwaukee, [illegible] with a plurality of magnetizable core pieces separated from each other, each core controlling a separate device.

970,194. SLEEVE CABLE TERMINAL; R. S. Donaldson and V. E. Furnas, Louisville, Ky. App. filed Aug. 3, 1908. A distributing terminal with a common lead sleeve with wiped joints and an integral receptacle containing a fusible insulated compound.

970,200. INDICATOR; C. Emsheimer, New York, N. Y. App. filed Sept. 24, 1909. A casing with horizontal and aligned portions and a vertical central portion, hinged back and transparent front with an electric lamp bracket on the back.

970,204. GAS TURBINE; E. A. Forsberg and B. Jaungstrom, Stockholm, Sweden. App. filed April 13, 1907. Two oppositely rotating vane systems with a direct-current generator connected to each and counteracting speed regulators connected to the systems which change when the speed varies and a circuit regulator operated thereby to regulate the exciting circuit of the fields in proportion to the speeds.

970,211. TROLLEY BASE; C. E. Gierding, Newark, N. J. App. filed June 7, 1909. A push and stop for a trolley base including a turret with a pivot socket, a strut socket, tensile springs and buffer springs.

970,215. PREPARATION IMPERMEABLE FOR ROENTGEN RAYS; O. Gros, Leipzig, Germany. App. filed June 29, 1910. For medical use, consisting of a mixture of white bolus coated with bismuth oxid, to be applied to the body in X-ray work.

970,233. COMMUTATOR CONSTRUCTION; F. Jeffrey, Milwaukee, Wis. App. filed Oct. 25, 1909. Composed of segments with an undercut slot on the interior, the segments being clamped between their ends by clamping rings and wedges.

970,255. PULL SOCKET FOR ELECTRIC INCANDESCENT LAMPS; J. L. Moore, New York, N. Y. App. filed Nov. 17, 1909. An insulating block carrying a post which carries a rotatable sleeve having teeth actuated by a pull cord and actuating a sliding socket which moves the switch.

970,264. DOOR SWITCH; J. G. Peterson, Hartford, Conn. App. filed Nov. 3, 1909. A spring with a push-button having an inner section connected with the actuating mechanism and a movable outer section, a spring being arranged between the two sections.

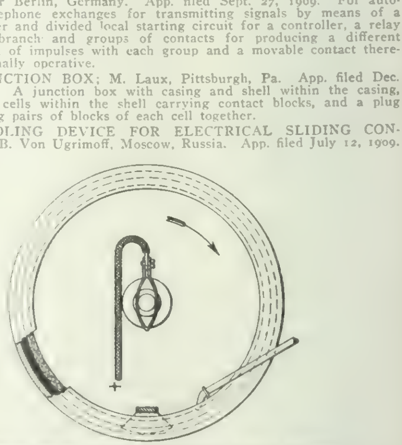
970,288. TELEPHONE REPEATER; C. Adams-Randall, New York, N. Y. App. filed April 15, 1905. Two independent normally closed main line circuits, each having means for opening and closing the other.

970,296. PROTECTED OR ARMOR-CLAD ELECTRIC SWITCH FUSE; H. H. Berry and W. J. Markham, London, Eng. App. filed June 9, 1910. A hand lever which pushes on and pulls off the switch blades, said lever being provided on either side of the case containing the switch, and a cover for the metal case, said cover carrying switch blades.

970,367. TRANSMITTER FOR TELESELECTERS; E. Blos, Schoneberg, near Berlin, Germany. App. filed Sept. 27, 1909. For automatic telephone exchanges for transmitting signals by means of a transmitter and divided local starting circuit for a controller, a relay in each branch and groups of contacts for producing a different succession of impulses with each group and a movable contact therefor, manually operative.

970,377. JUNCTION BOX; M. Laux, Pittsburgh, Pa. App. filed Dec. 20, 1909. A junction box with casing and shell within the casing, insulated cells within the shell carrying contact blocks, and a plug connecting pairs of blocks of each cell together.

970,407. COOLING DEVICE FOR ELECTRICAL SLIDING CONTACTS; B. Von Ugrimoff, Moscow, Russia. App. filed July 12, 1909.



[illegible] Cooling Device for Electrical Sliding Contacts.

An inwardly opening, revolving container with a revolving liquid conductor therein, and a stationary conductor in the liquid with a nozzle for spraying a second liquid into the container, particularly for unipolar dynamos.

970,410. CIRCUIT SWITCH; L. Wilson, Detroit, Mich. App. filed Feb. 3, 1910. For automobiles, including a key with wings to prevent the unauthorized insertion of a strange key.

970,412. ELECTRIC MOTOR; E. Arnold, Karlsruhe, Germany, and J. L. La Cour, Vesteras, Sweden. App. filed Oct. 5, 1908. A rotor with a commutator with brushes in two sets, the second set of brushes short circuiting the rotor winding on a line displaced from the first set and forming the compensating circuit, together with an auxiliary stator winding for producing magnetization along the line of the first set of brushes and means for varying the voltage per turn of the main winding.

970,420. STORAGE BATTERY; R. N. Chamberlain, Depew, N. Y. App. filed Dec. 8, 1906. Tray battery of sheet lead plates separated by insulators.

970,449. TELEPHONE ATTACHMENT; A. C. Hewitt and W. C. Thomas, Philadelphia, Pa. App. filed April 14, 1910. For supporting the receiver by means of an adjustable bracket arm, which also contains the receiver hook.

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A STUDY OF STATE REGULATION.

Elsewhere in our columns is given a summary of the work of the Massachusetts Gas and Electric Light Commission on the adjudication of street-lighting matters during the past decade. Massachusetts is to a very large extent in the curious situation of having delegated many important matters of government to commissions. Not the least important of these is the Gas and Electric Light Commission, which has, in theory at least, large authority in regulating rates as well as in standing guard over the capitalization of corporations engaged in gas and electric business. Its decisions constitute a body of precedent comparable in importance to decisions of the courts. Such a body has large potential powers for good or harm and it is only fair to the Massachusetts commissioners to say that they have a highly conservative record, unmarked by anything sensational and free from any imputation of socialistic tendencies. They err, if at all, on the side of caution and conservatism. The cases cited in this issue were not in their results of any considerable importance either to those concerned or to the municipalities or persons who started the proceedings. The changes in price ordered by the commission have rarely been large enough to be burdensome to the one party or satisfactory to the other. The decisions, however, touch on some extremely interesting and important points of policy and are worth more than a casual glance.

Perhaps the most interesting on the list of the decisions is the Fitchburg case ten years ago, and while the ultimate result was merely a reduction in the price of the street arc lighting of $10 per lamp per year, some vital points in the relations between capitalization and permissible prices were touched upon. In this instance the public service company operated both the gas and the electric business. In the case of the former under a conservative administration considerable sums from the income had been devoted to the improvement and development of the plant and its thorough up-keep. The board therefore held that under these circumstances the gas plant had attained a high value in respect to the capital issued upon it, and that upon such issue of capital a higher return than would be otherwise permissible might be allowed without prejudice to the public interest. With respect to the electric plant it appeared that the company, prior to going into the electric business, having earned and declared dividends of 10 per cent per year, these dividends were continued without interruption upon the entire capital invested in the electric plant, which had naturally come into a condition to demand thorough reconstruction in order to furnish satisfactory public service. On behalf of this electric plant, therefore, the board found that only a moderate dividend was justifiable. It is hard to overestimate the beneficial effect of this decision were it rigorously carried into effect. Obviously capital invested in a public service corporation has a right to a fair and reasonable return upon the investment, whatever that may be, under current and local conditions. It is not entitled to the same rate upon fictitious capitalization; on the other hand, it should certainly not suffer by having its rate reduced below the point that will take

care of maintenance and depreciation in addition to the reasonable net return. It has been the too frequent habit of such corporations to let up-keep and depreciation slide comfortably along until there arrives a day of reckoning in which something has to be done. Then there is usually an issue of securities to cover the funds which have been diverted from up-keep and depreciation to dividends for the prior term of years. The Fitchburg decision indicates in unmistakable terms that, while a relatively high rate of dividends may be allowed on a conservative investment that is kept up to its full value by conservative treatment, overcapitalization will not be encouraged in any form. Overcapitalization is an extremely hard thing to prevent since there are many ways of accomplishing the end, but if the commissioners hold rigorously to the principles laid down in this decision the way of the transgressor is likely to be hard in Massachusetts.

Another curious case came up in the Newton petition of the next year and in the Worcester petition of the same year. In the former case the street-lighting contract was found by the commission to have been taken at a figure which gave a small rate of return from the investment of the street-lighting part of the business upon the interest paid by the company upon its loans. In other words, the business was being taken at a little less than conservatively reckoned cost, so that the private consumers had to bear more than their share of the burden of the investment charge. In the Worcester case the city attempted to secure street lighting at cost, which involved the same shifting of the burden upon the private consumer. To this attitude the commission emphatically objected, holding that the rates for municipal use should not be made so low as to impose undue burden upon the private consumers. This sets out a principle which has often been violated upon a small scale. There not infrequently appears a tendency on the part of the municipalities to get some of their lighting for little or nothing in order to decrease the apparent cost of this lighting, when the inevitable result must be to transfer this saving made by the city to the private consumers in the form of extra costs. In effect, the commission held that the municipality should have the rights of any large consumer, but no more.

Even more interesting was one of the other cases mentioned, that of a petition from the town of Winchester alleging discrimination on the ground that the operating company had offered a neighboring town a large discount for a long-term contract, while Winchester, being unwilling to make a contract at the time for more than one year, was charged a higher rate. The board, after considering the matter, ruled that inasmuch as Winchester could secure the same discount if it chose to execute the contract for a longer term, thereby rendering the investment of the supply company a more permanent one, there was no unlawful discrimination nor any justification for ordering a reduction in price on this ground. The cases here mentioned are only a few of those cited, but they are sufficient to show the importance of a well-organized commission in adjudicating the difficult questions that are constantly arising between municipalities and public service corporations. The proceedings of the commission are comparatively brief, involve no long-drawn-out litigation, and the decisions take effect promptly. The authority entrusted to the Massachusetts commission is very great, dangerously great perhaps under condi-

tem has worked well and the decisions have very commonly been followed by an equal amount of growling from both sides, which is in general fairly good evidence of substantial justice.

WAVE-METERS IN WIRELESS TELEGRAPHY.

In wireless telegraphy use is made of electromagnetic waves in the ether. These waves are not directly appreciated by any of our senses, although if they were short enough to fall between the limits of 0.4 and 0.8 micron we have reason to believe that we could see them. The waves used in wireless telegraphy, of lengths, say, from a dekameter to a myriameter, must have been produced in the ether occasionally owing to natural causes, but were never detected until about twenty years ago, and now we are sometimes all too conscious of an amateur excess. This recent remarkable ignorance of circumambient activities should make us reticent in formulating the opinion that we understand nearly all of the universe. We may still cheerfully expect to learn more. We can see, feel and hear ocean waves. Our primary concepts concerning waves are mainly derived from sense memories of water waves, either on the ocean or in rivers and canals. We can hear sound waves and experiment with them in the laboratory. We can, in a certain sense, see short electromagnetic waves, but our notions are still crude as to the nature and true inwardness of a long electromagnetic wave.

It is known that when the ether is disturbed in a certain unknown way that we call electric there necessarily occurs at the same time a corresponding cross-disturbance which we call magnetic. A wireless telegraph semi-wave we can conceive of best as running over the land or sea, like a gigantic fence, with electric forces up and down, like the perpendiculars of the fence, and with magnetic forces in level courses, like the horizontal bars of the fence. If the wave would only stand still instead of rushing away at the speed of light we should expect to find a delicately suspended charged pith ball pulled in the up-and-down direction, and a delicately suspended horizontal compass needle aligned along the wave front, when subjected to the forces in the stationary wave. In the succeeding semi-wave the directions of these electric and magnetic forces would be reversed. The most important structural feature of the wave would naturally be its distance from crest to crest of like sign; or, as we call it, the wave-length. If the frequency of oscillation at the wireless sending station is doubled, the lengths of the emitted waves will be halved, so that if we know either the frequency or the wave-length of a simple sinusoidal wave-train we may infer the other immediately. In tuning stations one to another a knowledge of the length of the waves and of the natural frequency of the apparatus is obviously of great assistance. According to government regulations, all regular wireless stations have been directed to emit and conform to a wave-length of 300 meters, but to direct is easier than to comply.

The article by Mr. George Seibt in this issue discusses the history of wave-meter development. He intimates that, whereas the development in that art has been largely due to German engineers and physicists, attention in the United States has been more or less confined to purely commercial affairs. While we gladly admit that a large contribution to this work of wave-metering has come from Germany, nevertheless a very consid-

Switzerland and the United States, not to mention other countries, so that a careful enquiry will reveal no need for apology among us on this score. It is true that there has been much exploitation and promotion of wireless telegraph systems on this side of the Atlantic for stock-market purposes, but the progress of a science and its art are not to be judged adequately from a sole consideration of stock-market journalism. There can be little doubt that technical progress in wireless-telegraph engineering will demand and involve refinements in wave measurements and wave-meters. The history of this art when it comes to be written, in full and in detail, will also make very interesting technical literature.

PRESENT POSSIBILITIES OF EMPLOYING UNDERGROUND CABLES FOR TENSIONS ABOVE 25 KILOVOLTS.

In this country practically all of our high-tension systems working at pressures of 25 kilovolts and over are overhead systems. It is true that there are high-tension distributing networks in a few cities, but, as a rule, the e.m.fs. do not exceed the tension of 10 kilovolts. Again, most high-tension transmission lines are carried overhead through open country or sparsely settled districts. The problem of carrying an overhead 100-kilovolt transmission line through a city of large size is manifestly very difficult. In practice it would be desirable either to go around and avoid the city, or to carry the line underground at a reduced pressure. The progress of long-distance energy transmission is thus clearly more hampered in thickly settled districts than in open, unsettled country. It is harder to introduce into more crowded Europe than into the less crowded eastern United States, and harder in the Eastern than in the Western States. If, however, underground cables were just as cheap and reliable as overhead wires the difficulties in approaching and traversing large cities would be removed.

An article on this subject by M. J. Grosselin has recently appeared in *La Revue Electrique*, in which the impossibility of using cables for very high tensions is called in question. The principal difficulties are the high first cost, the large charging current, and the delay and expense of repairs. It is contended that it is perfectly possible at present, from the technical standpoint, to establish long-distance underground transmission e.m.fs. up to 50 kilovolts, using armored, twisted cables, and up to 67 kilovolts in single-conductor lead-covered cables. Much difference of opinion is likely to arise over some of the expedients offered in the article. There can be no question, however, of the desirability of utilizing underground cables at high tensions whenever it is economical to do so. The progress of high-tension cable manufacture should be aided and accelerated. At the same time, the future of long-distance energy transmission is likely to reside in overhead conductors carrying alternating currents. No greater incentive could be given to the development of high-tension direct-current transmission systems than the urgent necessity of placing the conductors underground.

With a pair of underground direct-current conductors operated at, say, 100 kilovolts between them, it would not be necessary to raise the normal pressure in each main above 50 kilovolts with respect to the ground whereas with the alternating-current system that pressure must be raised to over 70 kilovolts on the crest of each wave. Again, with direct-current transmission the charging current would normally be nil and the dielectric loss insignificant; whereas with alternating-current transmission the charging current might be very expensive to supply and the dielectric hysteretic loss might easily exceed the copper loss. It is quite conceivable that when it becomes necessary to place a very high pressure transmission system underground we shall develop alternating-current generators supplying energy to step-up transformers to operate rectifiers that shall deliver a large block of power, by underground mains, in direct-current form, with de-rectifiers at the distant end feeding energy to step-down transformers and a distribution network.

STREET-LIGHTING ECONOMY.

While we appreciate to the full the progress in Continental Europe with respect to the material and methods of street lighting, it is curious to note some of the strenuous efforts there made to secure economy. Here all-night and every-night lighting is the rule, while on the Continent a very large part of the illumination is shut off at midnight. Only recently the Paris chief of police has thrown all his influence toward increasing the amount of street lighting, and particularly continuing it through the night instead of extinguishing a large part of it at midnight. The police value of street lighting increases after midnight, since after that hour in the nearly deserted streets there is a freer opportunity for crime. Certainly the large European cities are on the whole no more orderly than our own. It is to be hoped, therefore, that American practice can return the benefits it has received from European practice by throwing its influence in the direction of all-night lighting.

The queerest economy, however, that has ever fallen under our notice is a scheme of nickel-in-the-slot public lighting recently described in a Berlin paper. In the half mile between two small European towns nine incandescent lamps are installed, and the thrifty local authorities, concluding that nocturnal wayfarers should be penalized, extinguish the lights at 10 p. m. They thoughtfully provide, however, on the lamp-post at each end of the lighting a prepayment meter which will respond to a 10-pfennig piece by turning on the lights for twelve minutes, a time that seems all too short for the gentleman who is pursuing a vacillating and circuitous path between the termini, however adequate it may be for those hurrying home sober. It would strike one as a wise piece of paternalism to provide at least one intermediate meter for continuing the good work. The scheme is certainly uniquely whimsical and reminds one of the terms in which Berlioz once stigmatized the assignment of both bass drum and cymbals to the same performer as "a poor and pitiful economy, fit only for those who travel about the country with bears." Joking aside, the Continent has much to learn of us regarding the value of continuity of lighting service. Municipal economy is a virtue which can be practised too much. We too frequently err here in insufficient lighting, but we do not in most cities extinguish the street lights at just about the time that the burglar starts out on his daily work. Improved lighting, whenever installed in American cities, has been followed by improved conditions from the police standpoint, and it will be very interesting to watch the effect if the street lighting of Paris, as is now urged, should be extended through the night in accordance with American practice. It is somewhat inconsistent that turning off lights at midnight should be the practice in a city where a [illegible] and laughed out of existence.

Chicago Meeting of the American Electrochemical Society.

At the eighteenth general meeting of the American Electrochemical Society, to be held in Chicago, on Oct. 13, 14 and 15, the following papers will be read and discussed: *Method for Determining Thermal Conductivity,* by Mr. Carl Hering; *The Electric Furnace and Its Application,* by Mr. Marcus Ruthenburg; *Electrolytic Method of Producing Metals,* by Mr. John W. Beckman; *Reduction of Tin Dross in the Electric Furnace,* by Mr. R. S. Wile; *Notes on Tribo-Luminescence,* by Mr. W. S. Andrews; *The Proximate Constituents of the Chemical Elements with Reference to Radioactivity and Electrons,* by Dr. Gustavus D. Hinrichs; *Electrochemical Preparation of Calcium,* by Prof. A. R. Johnson; *Efficiency in the Electrolytic Preparation of Calcium,* by Messrs Francis C. Frary, Henry R. Bicknell and Carl A. Tronson; *Electrochemistry of Polonium and other Radioactive Elements,* by Prof. A. R. Johnson; *The Present Status of Ozone,* by Mr. R. D. Small: *The Evolution of the Lead Storage Battery,* by Mr. Pedro G. Salom; *A New Secondary Cell,* by Mr. W. S. Block; *The Self-Discharge of Plante and Faure Storage Batteries,* by Messrs. O. W. Brown and W. G. Bowers; *Corrosion of Metallic Food Containers—Causes and Prevention,* by Dr. Edward Gudeman; *Electrolytic Corrosion of Various Metallic Anodes in a Liquid Ammonia Solution, Ammonium Trinitride,* by Messrs. A. W. Brown, M. E. Holmes and J. S. King, Jr.; *Electrolysis of Solutions of Ammonium Trinitride and of Potassium Amide in Liquid Ammonia,* by Messrs. A. W. Brown and M. E. Holmes; *The Electrolysis of Some Cyanides,* by Messrs. H. E. Patten and W. R. Mott; *Application of Electrostatic Separation to Ore Dressing,* by Mr. F. S. MacGregor; *The Isolation of an Ion and a Precision Measurement of Its Charge,* by Prof. Robert A. Milliken; *Phenomenon of Crystallization Through Membranes,* by Dr. J. H. Walton, Jr.; *The Relative Basicity of the Metals as Shown by Their Power to Replace One Another in Chemical Compounds,* by Dr. L. Kahlenberg; *The Effect of Water in Causing Chemical Reactions,* by Dr. David Klein; *The Physical and Magnetic Hardness of Some Electrolytic Iron Alloys,* by Mr. James Aston. The meetings will be held in the Congress Hotel, where the society will maintain headquarters, and at the University of Chicago.

Visits will be made to the Fisk Street generating station and the Market Street transformer and storage-battery station of the Commonwealth Edison Company; the Hawthorne plant of the Western Electric Company; the factory of the Automatic Electric Company; the stock yards and packing plants of Swift & Company, Armour & Company and Morris & Company; the South Chicago works of the Illinois Steel Company; the Gary plant of the Indiana Steel Company; the stores of Sears, Roebuck & Company; the Washington and Franklin streets exchange of the Chicago Telephone Company; the Lockport generating station and the drainage canal; the Field Columbian Museum.

Special entertainment for the ladies, including a visit to Hull House, Marshall Field's store, the Art Institute, etc., will be provided. On Friday evening there will be a subscription dinner at the Congress Hotel to which the ladies are particularly invited. On Saturday noon there will be a luncheon at the University of Chicago Commons, which ladies as well as gentlemen are expected to attend.

Convention of the Electric Vehicle Association of America.

It has been decided to hold the first annual convention of the Electric Vehicle Association of America in the Concert Hall at Madison Square Garden, New York City, on Oct. 18.

The convention committee, under the direction of Mr. Arthur Williams, chairman, is actively engaged in preparing a very interesting and practical program, and it is intended to have ten able writers on the subject of electric vehicles present papers. An electric luncheon will be served at the end of the morning session, and there will be a subscription dinner in the evening, after which guests and delegates will be invited to attend the Edison smoker. Invitations are being extended to everybody connected with or interested in the electric vehicle industry, especially central station men. A large number of electric vehicle manufacturers have arranged for exhibits at the New York Electrical Show, Oct. 10 to 20, and the convention, coming as it does on one of the days of the show, it is hoped, will offer an opportunity for the electric vehicle men and their friends to mingle to advantage

N. E. L. A. Uniform System of Accounts.

The National Electric Light Association is sending to class A member companies bound volumes of the standard classification of construction and operating accounts. Accompanying each volume is a letter from Mr. John L. Bailey, Baltimore, chairman of the Committee on a Uniform System of Accounting, which urges the adoption of the classification by all companies at an early date. Mr. Bailey says:

"The present tendency is toward commission supervision for public utilities, and it is thought that the general adoption of this system will influence future commissions to accept it in place of the burdensome systems that may be adopted if no general uniformity exists."

The committee has under consideration the creation of a statistical department, to which a synopsis of monthly or annual reports could be forwarded for tabulation and distribution to member companies adopting the system. Names of companies need not be disclosed in the distribution of the statistics, but it is essential that the kind and cost of fuel be given together with other information as to the cost of production.

The entire list of member companies would be divided into three or four divisions ,depending on the number of sub-accounts used by each company. Tabulations could then be made to show for each division the comparative receipts per capita and costs per kw-hour of fuel, labor and other items. Later the scope of the statistical department might be extended so as to keep member companies advised as to franchise matters, city contracts, rates, etc.

The committee asks for information as to the extent of the adoption of its classification and the support of the statistical department.

Additions to Electrical Faculty at Purdue University.

The instructional staff of the school of electrical engineering of Purdue University, Lafayette, Ind., has been increased by several important additions, made with the opening of the present school year, the new members coming directly from the commercial fields of the engineering subjects with which their university work will deal. Prof. Phillip S. Biegler, assistant electrical engineer of the Washington Power Company, Spokane, Wash., has been secured to fill the place of Prof. H. T. Plumb, who will be away on a year's leave of absence. Professor Biegler is a graduate of the University of Wisconsin and, aside from valuable experience in power-station construction work, has been engaged three years with the Commonwealth Edison Company of Chicago. He also served as assistant professor of electrical engineering at the University of Iowa. Mr. John C. Potter comes from the American Telephone & Telegraph Company to take charge of the work in telephone engineering. Mr. Potter is also a graduate of the University of Wisconsin, where he has obtained the E.E. degree. He has been engaged for three years as instructor at the above university, as well as for three years with the long-distance telephone company in different parts of the country. He has also done considerable work as expert for the Wisconsin State commission.

The position of assistant in the electrical laboratory will be

filled by Mr. C. W. Piper, who is a graduate of Rose Polytechnical Institute. He has had practical experience in the apprentice course of the Westinghouse Electric & Manufacturing Company and as assistant electrical engineer for Adams & Westlake, of Chicago, where he has been doing special research and design work on potential regulators for train lighting. Professor C. R. Moore and Mr. R. L. Witham, who have in the past assisted Professor Esterline in the design department, will have the responsibility of this portion of the work during the coming year, Professor Esterline having resigned to devote his entire time to his commercial interests. Professor Moore has been associated with the design department of the General Electric Company, and Mr. Witham with a similar department of the Fort Wayne Electric Works during the past summer.

Conference on Proposed System of Accounts in New Jersey.

A conference on the subject of a proposed uniform system of accounts for electric lighting and power companies was called by the New Jersey Board of Public Utility Commissioners at Trenton on Sept. 22. Commissioner Thomas J. Hillery presided.

In calling the meeting to order Commissioner Hillery said that under authority of the law relating to uniform accounts the commission thought it advisable to have a preliminary meeting with representatives of the companies and receive their advice and suggestions on the subject.

To furnish a basis for discussion Mr. Philander Betts, chief inspector of the utilities division of the commission, was asked to state his views on the subject. Mr. Betts said that a uniform system of accounts for electric companies had been given considerable attention in the country for some years and that as a final culmination a classification had been recommended by the National Electric Light Association. This classification was incomplete, but to furnish a basis for discussion he would recommend its adoption.

Mr. E. J. Allegaert, auditor Public Service Corporation of New Jersey, said that he was a member of the committee which recommended the National Association classification. He thought that this classification should be adopted ultimately, but that a little more work was needed on the system., He would suggest that the system might be prepared for adoption by, say, Jan. 1, 1912.

Mr. Frank J. Pryor, Jr., comptroller American Railways Company, which controls the Bridgeton Electric Company, said that he represented a holding company. New Jersey was the first state in which this company owned properties where a uniform system of accounts for electric lighting companies had been suggested. The accounting committee of the National Association intended to continue its work. Its system would be the recognized one and would be established as the standard in other states. A uniform system in all the states would be desirable. He therefore recommended the adoption of the National Association classification.

Mr. Thomas W. Haldeman, vice-president Washington Electric Company, was not familiar with the National Association classification. The system adopted by his company was simple and furnished sufficient information regarding the business. He thought the National Association classification might be too elaborate for a company operating in a town of 4000 population. If it could be changed so as to be adaptable to the requirements of companies with large or small earnings it might be entirely satisfactory.

Commissioner Hillery said that there was no disposition on the part of the commission to burden the smaller companies with a system of accounts intended for large companies.

Mr. Allegaert said that the National Association committee had not gone far enough in its work to make a division for companies with operations of different amounts. Very small companies could use the eight general operating expense accounts. Either the National Association committee or a joint committee representing the New Jersey commission and companies should prepare a classification that would be satisfactory for the small companies.

Mr. Mitchell B. Perkins, Cinnaminson Electric Company and Bordentown Electric Light & Motor Company, used a simple system which had been prepared especially for those companies.

Mr. Betts thought it would be desirable to have the commission analyze the different schemes and make recommendations. He thought that the system would have to provide, like that of the American Street & Interurban Railway Accountants' Association, for different grades of companies. Accounts dealing with the operation of power plant ought to be kept under one heading in a property transacting both electric lighting and railway business. If kept by the lighting company the amount paid by the railway company should be carried as a credit by the lighting company, or in some manner as an offset to the cost of operation.

Commissioner Hillery said that complete sets of accounting forms would be valuable to the commission. The commission would take under consideration the suggestion of the appointment of a joint committee. The system of accounts must be worked up gradually.

Mr. Betts spoke of the recommendation of the Public Policy committee of the National Association that, in view of the decisions of the United States Supreme Court in the Knoxville and Consolidated Gas cases, each company make a full and fair appraisal of its property. Such a valuation would be of interest to each company. Many companies did not know what their properties were worth. A valuation ought to show both the cost to reproduce and the present value.

Mr. Allegaert said the question of cost was very serious and difficult to determine.

Mr. P. S. Young, comptroller Public Service Corporation, thought valuation would be very costly for the companies. An inventory would be desirable, but values fluctuate from day to day. Separate valuations made by different engineers might be 50 per cent apart.

Mr. H. C. Case, Lambertville Heat, Light & Power Company, said that that company required about thirty operating expense accounts.

Commissioner Hillery, in conclusion, said that the commission desired to help the companies solve their problems.

Boston Edison Company's Annual Report.

The Edison Electric Illuminating Company of Boston has filed its return for the year ended June 30, 1910, with the Massachusetts Gas & Electric Light Commission. The return covers the districts of Boston, Milton, Dedham, Natick, Framingham, Somerville, Woburn, Medfield, Brookline, Newton and Chelsea and includes thirty-four cities and towns, in which are 33,834 customers. In Boston the company now has 19,557 customers, showing a gain during the year of 2708, or 16 per cent. The gain in customers in the whole territory for the year was 10,196, or nearly 45 per cent, the increase outside of Boston being in considerable part due to the acquisition of the suburban companies supplying the Newton, Brookline and Chelsea districts.

[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total	$4,709,156.03

[illegible] distribution, office expenses and management, taxes and miscellaneous expenses, were $2,688,720.23. The balance to profit [illegible] compared with [illegible] a year ago. The ratio of total expenses to total income for 1910 was

[illegible]

These results show that the company gained in revenue in every item except sales to other companies, the increases being as follows: Commercial lighting, $386,903.24; public arc lights, $60,084.91; public incandescents, $50,539.97; power for railways, $50,699.78; power for other uses, $127,376.27.

The subdivision of operating expenses for the year was as follows:

[illegible]	[illegible]
Distribution	555,690.22
[illegible]	[illegible]
Bad debts	14,000.00
Incidentals	173,025.32
[illegible]	[illegible]

The total cost of all plant on June 30, 1910, was $27,526,964.20, the larger items being underground lines, $6,367,277.39; buildings, $4,151,663.20; electric plant, $4,417,768.20; steam plant, $3,989,401.22; overhead lines, $3,514,709.42, and land, $1,390,899.45. The total cost of the plant was $9,623,864.20 more than capital and loans. The value of purchased properties during the year was $1,947,653.09. The total capital outstanding is $15,543,600. The total plant additions during the year amounted to $3,860,596.69. Plant depreciation was charged off at $439,539.80. The total dividends declared were $1,555,596. The total liabilities were $28,769,904.09 on June 30, 1910.

The company owns 36,024 boiler hp and 104,400 hp in steam engines and turbines. The capacity of its direct-current generators is 10,400 kw and of alternators 63,450 kw. The company's distribution system consists of 2,935,806 ft. of municipal arc wire; 6,968,513 ft. of municipal incandescent circuits; 59,176 ft. of direct-current lighting service wires (commercial); 9,575,977 ft. of alternating-current primary wire, and 5,667,384 ft. of secondary wire. There are now installed 883,446 ft. of conduit containing 7,056,407 ft. of cable not in Edison conduit service. There are 3350 line transformers in service. The connected load is as follows:

Municipal arcs	2,910
[illegible]	[illegible]

The company has 1512 customers using motors only. The total energy delivered at the switchboard for the year was 112,997,835 kw-hours and the total output sold or accounted for was 81,368,354 kw-hours, of which about 20,000,000 kw-hours were for motor service. The maximum load on the station during the year was 41,693 kw, the date being Dec. 1, 1909. The company burned 111,136 tons of coal during the year, the average cost per ton used being $3.47. There are now 1160 employees, the largest number, 403, being in the distribution department. The average net cost of production per kw-hour delivered at the station busbar was 0.68 cent.

Colorado Electric Convention.

The eighth annual convention of the Colorado Electric Light, Power and Railway Association was held at Glenwood Springs, on Sept. 21, 22 and 23. Special trains from Denver, passing through Colorado Springs and Pueblo, were run by both the Colorado Midland and the Denver & Rio Grande railroads for those attending the convention. Owing to the late arrival of special trains no regular session was held on the morning of the 21st. But about seventy members enjoyed a good swim [illegible] springs. The afternoon session was called early, and the roll call showed sixty members present. The reading of the minutes being dispensed with, President Wm. T. Wallace gave a short address, especially emphasizing the growth of membership and influence of the organization, its duties and opportunities. He spoke of the unprecedented extension in electrical applications, especially in mining and agriculture. In view of the probability of passage of a public service commission law, which is being urged by many parties, Mr. Wallace stated that the association should openly interest itself to bring about the enactment of a measure which would be fair to the public and the service company alike. A special committee was recommended to represent the association in conferences with other bodies, including state conventions and legislatures, the president stating that such a law should operate beneficially in every way.

ENTERTAINMENT FEATURES.

At the opening of the 10 o'clock session on Sept. 22 a baseball game between the association and the Colorado Electric Club was announced for 3:30.

The afternoon meeting adjourned to the baseball field across the Grand River. The batteries of the Colorado Light, Power & Railway Association and of the Colorado Electric Club were respectively Rundel and Deesz, and Glaze and Rickard. The score in the six-inning game stood 6 to 14. Errors were in so much dispute that record was impossible. The extremely thorough policing of the premises by the Sons of Jove brought order among the more obstreperous rooters, while other Jovians sold peanuts, cigars, pop and chewing gum on the grandstand, netting enough to maintain the Jovian booth at the coming Denver Electrical Show. It was remarked that after the first round most of the purchased cigars were surreptitiously replaced in the box and the profits increased accordingly. Manager Lucas, of the Hotel Colorado, umpired, and the hitting of Carter, electrical engineer of the Denver Gas & Electric Company, was the feature of the game, accounting for five of the Colorado Electric Club's runs.

During the evening an executive session was held, and reports of treasurer, auditor, etc., were received.

TUNGSTEN STREET LIGHTING.

The advantageous features of tungsten street lighting over other systems were described in a paper by Mr. Howard L. Aller, Denver. The author gave data to show that, although the tungsten lamp is not so efficient an illuminant as the arc lamp, yet better illumination results can be obtained by placing small tungsten lamps at short intervals than by using the more powerful arc lamps at large intervals. Moreover, the glare effect will be less with tungsten than with arc lamps.

The paper by Mr. Aller brought out considerable discussion on the absorption of light by enclosing globes, and the relative results of arch, post and suspension use. Some figures showing good life, the effectiveness of the film cut-out and the successful operation of series wiring in posts with underground feed were presented.

A special committee appointed last year to present recommendations to the association on meter practice then made its report. Mr. F. P. Cummings, of the Denver Gas & Electric Company, the chairman, was obliged to make abstracts from this report, which represents a distinct addition to literature on meter operation in its collected data and in its practical treatment by Mr. Cummings of experimental results following exhaustive tests by Mr. Buel, of the Northern Colorado Power Company, and himself. This report is to be printed and issued to members in pamphlet form. Discussion was omitted awaiting the publication of the report.

FRIENDLY RELATIONS WITH THE PUBLIC.

Mr. J. M. Connelly, Denver, presented a paper discussing in a convincing manner the advantages to a public-service company of cultivating friendly relations with the public. The author showed in what way wrong impressions are frequently conveyed, especially to representatives of newspapers, by reason of indifference or rudeness. He remarked that the old régime of the corporation, bound and blinded by a foolish independence, erroneously considered one of the excellent advantages of a monopoly, has passed to a deserved oblivion and

the principles that obtain in the transaction of private business under the discipline of competition are being largely employed by the utility companies in dealing with their customers. The author entered a special plea for publicity concerning the affairs of a company in order to keep the public informed as to its needs and intentions.

DISTRIBUTING [illegible]

A convenient system for keeping record of the locations of distributing circuits and transformers was described in a paper by Mr. J. C. Lawler, Colorado Springs. Use is made of maps drawn on tracing cloth, each circuit being drawn separately and showing the location of lines and the position of the conductor on the pole; certain signs are used showing the location of lightning arresters, size of wire, location and number of transformer, etc. The map also indicates the ownership of the poles and shows whether the line is a primary or a secondary circuit. These maps are cut in sections about 10 in. x 12 in., and kept in book form. The tracing permits blue prints to be made. The transformer numbers are written in lead pencil to facilitate erasures. The small sections make the map easy to handle, and obsolete sections can be replaced without redrawing the whole map. A transformer record is maintained in the office by a card system. Each transformer is indicated by a card showing all the name-plate data, when purchased, number, location, date installed and removed. Back of this transformer card is an address card giving the address of the consumer, dates connected and disconnected, meter number, its installation and approximate demand, each installation having an individual card. The approximate demands are added to determine the load on the transformer. This arrangement prevents overloading of transformers and gives the engineer a comprehensive idea of what is going on over his circuits. Mr. Lawler very thoroughly outlined practical operating features, and urged especial attention to the rapidity of Western town growth and the development of a broad enough plan for construction to obviate necessity for the usual makeshift extensions to accommodate customers and their changes of location.

The discussion on Mr. Lawler's paper centered largely upon the question of sectionalizing secondaries or of interconnecting them. Mr. Carter, electrical engineer of the Denver Gas & Electric Company, expressed the belief that separate blocks are more convenient and ideally more systematic, but require more copper for equal loss and equally satisfactory service, and fail to supply an equally reliable ground where secondaries are grounded. Other discussion, principally by Mr. G. B. Tripp, manager of the Colorado Springs Light, Heat & Power Company, developed that in the smaller towns separate secondaries if mechanically strong would give no difficulty from excessive voltage drop.

Mr. J. F. Dostal, electrical superintendent of the Denver Gas & Electric Company, as member of the N. E. L. A. committee on line construction, recommended that a local committee be appointed to investigate local conditions and confer with the national committee with the object of standardizing materials and methods. The Dostal drop-out connector for high-tension crossings was discussed and was said to afford effectual protection. Its general endorsement was noted as an advance over the various net and short-span arrangements in both installation and maintenance costs with equal assurance of safety.

CREOSOTE TREATMENT OF P[illegible]

Much information relating to the creosote treatment of pine poles was given in a paper by Mr. George R. Ogier, Denver. It was claimed that, by creosoting, the useful life of pine poles would be increased from five to twenty years. The author stated that creosoting not only prolongs the life of the durable species of wood in use, but it prolongs the life of the inferior and cheaper woods, and enables the utilization of inferior woods, which without the preservative treatment would have little or no value.

The discussion on Mr. Ogier's paper indicated that in the dryer climates the part of the pole above ground receives very little benefit from treatment. Carbolineum and creosote painting have been tried by some members and seem to be a palliative only, usually leaving a hard shell, but allowing decay to proceed under the shell. Concreting was advocated by Mr. W. G. Matthews, superintendent of line for the Denver City Tramways Company, who is using a great deal of concrete setting, and to some extent concrete collars for poles partially destroyed at the ground line. No exact information on increased life of poles with concrete butt protection was available.

INDUCTION GENERATORS AND ROTARY CONDENSERS

At the morning session on Sept. 23 Mr. A. L. Jones, engineer of the General Electric Company, Denver office, presented a paper discussing in an instructive manner the performance characteristic of rotary condensers and induction generators. Having discussed the use of an over-excited synchronous motor as a condenser for absorbing leading wattless current and thereby neutralizing an equal amount of lagging wattless current taken by other machines, the author outlined the advantages of employing this arrangement in preference to installing extra generators when the equipment is fully loaded. He claimed that the extra load that can be carried by a generator operating at a high power-factor in comparison with the load carried when the power-factor is low more than offsets the cost of the synchronous condenser for raising the power-factor.

The author described the use of an induction motor driven above synchronism as an alternating-current generator. He called attention to the fact that the induction generator cannot supply current to a short-circuit. He said that on large cable systems, and where a short-circuit involves a tremendous amount of power, this characteristic might be of great value. On a cable system also the charging current of the cables would partly supply the magnetizing current required by the induction generator and remove to some extent an objectionable feature of this type of machine. High-speed steam-turbine work seems to be the most promising field for induction generators, since the simple mechanical construction of the squirrel-cage rotor permits a high speed and high operating temperature without injury to the machine. It has also been proposed for gas-engine work where parallel operation of synchronous machines is usually secured at the expense of heavy flywheels and elaborate damping devices on the pole faces, and where, even with these, successful operation is not always possible. If instead of synchronous units, induction generators were installed having high-speed synchronous motors running light to supply the excitation for the outside load and for the generators there would be no necessity of limiting the angular variation of the gas engines to the present very exacting figures.

The author mentioned some of the objections to the induction generator. He remarked that it is distinctly a secondary and dependent piece of equipment, unable to function unless in connection with synchronous generators. It is unable to produce any wattless current, of which most modern systems require considerable. It requires such a large magnetizing current that the induction generator can bear only a small proportion to the rating of the synchronous machines, and its good effects are consequently reduced. While the simple mechanical construction should make the cost of such a machine less than that of the more complicated synchronous generator, heavy engineering and development charges will have to be borne by the first machines produced, which will probably make them cost more than the synchronous generators. There has been practically no demand for this type of generator, which shows that as yet the American power-station practice does not consider that the advantages of the induction generator can offset its many disadvantages.

In the discussion Mr. Jones explained the limitations of rotary converters for supplying leading current for excitation of the system. Unless a good direct-current load is utilized the armature conductors soon overheat, as they are designed for the small current difference between the input and output

ends. The interesting point was further developed that in the experience of most member companies the installation of oversizes in motors was responsible for much of the low power-factor prevailing on most mountain distributions. Salesmen of electrical companies came in for some criticism, but lack of data by machine manufacturers, and the consumer's desire to "add 50 per cent for safety," were considered the chief causes of this condition. Some distributions report a power-factor of from 40 per cent to 60 per cent. The remedy, outside of rotary condenser installations, seems to lie in a change in the connected load. Hoists form undesirable loads, and one company, the Colorado Light & Power Company, declines to connect to hoists rated at more than 75 hp, claiming that a profitable rate is prohibitive to the consumer. The load factor on single hoists is from 3 per cent to 8 per cent, and on double hoists it is 7 per cent to 16 per cent.

[illegible]

The committee on the grounding of secondaries, of which Mr. J. A. Clay was chairman, submitted a report based on the replies received from seventeen companies to thirteen questions relative to the grounding of secondary circuits. Attention was called to the rule of the National Electrical Code that motors operating at a potential of 550 volts or less be thoroughly insulated from the ground where feasible. The committee expressed the belief that the operating conditions existing with a large number of companies of the association are a menace to the life of employees operating motors under these conditions, particularly where such motors receive energy from transformers stepping down from a relatively high potential, that is, potentials above 5000 volts, and suggested that this matter be brought to the attention of the National Board of Fire Underwriters, because in a case of this kind the grounding of the secondaries supplying energy to an insulated motor would not give absolute protection.

The committee recommended that the question of grounding be brought more forcibly before the member companies in order that more definite information and a closer study and results may be obtained.

The discussion of the report was animated. Mr. Carter, electrical engineer of the Denver Gas & Electric Company, gave a very complete outline of the reasons for grounding, noting personal injuries and fires where high voltage on secondaries was undoubtedly involved. He explained his company's method of grounding and of handling the change in meter loops to outside wires. He frankly stated that in grounding neutrals it was usual to find a heavy ground already existing on one wire, more frequently an outside, and that the 220-volt life and fire hazard could be usually found where secondaries were not definitely grounded at the neutral. He recommended grounding to secure the lowest normal potential in any secondary system, and suggested that most of the desire for limitation of grounding to 150 volts was the result of aversion to change in previous convictions. This same cause was assigned for the neutral attitude assumed by many underwriting bodies. The discussion was continued by Mr. Clay, Mr. Farr and others. Actual reductions from lighting troubles were claimed by several grounding companies. The special difficulties of securing adequate grounds in some localities were brought up.

Finally, following a résumé of the situation by Mr. W. D. Wallace, a resolution was introduced and carried endorsing grounding secondary circuits carrying electromotive forces up to 150 volts, leaving the question of motor circuits open, though practice is strongly for grounding up to 440 volts, and many companies have definite rules to such effect.

A further resolution endorsed the grounding of motors, switch and transformer cases on secondaries operating at 220 volts and above. One company reported serious injury from a motor case at high potential. For the present it was deemed advisable to let the member companies decide each for itself whether it would be good practice to ground a motor case and

STEAM TURBINES.

A paper by Mr. E. M. Gilbert, Denver, entitled "Steam Turbines," dealt with many of the general details and operating features of steam turbines. In comparing steam turbines with reciprocating engines the author claimed for the former the following advantages: Reduction in space occupied; smaller foundations; saving in oil; absence of oil in condensed steam; less vibration; better regulation; greater simplicity; maintenance of efficiency throughout life, and "economy," especially with loads fluctuating heavily. The author called attention to the fact that a low-pressure turbine can be applied advantageously to any plant where reciprocating engines are used, being connected between the exhaust of the engines and the steam condensers. He cited a certain case where three 1000-hp reciprocating engines operating alone consumed 31 lb. of steam per kw-hour, while when used with a 1500-kw exhaust-steam turbine the specific steam consumption was reduced to 17.7 lb. per kw-hour, the turbine carrying about 70 per cent of the total load. The cost per kw-hour was reduced from 0.67 cent to 0.47 cent by installing the turbine.

OFFICERS.

Following the presentation of the report of the nominating committee the following officers were elected: President, Mr H. L. Corbett, manager of the United Hydroelectric Power Company; vice-president, Mr. J. A. Clay, San Juan Water & Power Company. An amendment to the constitution of the association makes the secretary an appointee of the president. The name of the secretary has not as yet been announced.

Hydroelectric Power Development in Central Massachusetts.

Through the expansion of the facilities of the Easthampton Gas Company in the past few weeks hydroelectric power developments are being actively pushed in the Connecticut Valley district of Massachusetts. About Aug. 1 of the present year a new transmission line was placed in service between Amherst and Mount Tom, and hydroelectric power from the generating plant of the Turners Falls Power Company delivered to Easthampton for general industrial and local service. The energy supplied from Turners Falls is transmitted over the line of the Amherst Power Company to Amherst, a distance of about 18 miles, and thence to a substation at Mount Tom, 10 miles from Amherst. The line potential is 23,000 volts at present, with the prospect of an increase at a later period. The line between Turners Falls and Amherst is of the wooden-pole type, and has been in service for some time. The new construction between Amherst and Mount Tom is of the steel-tower design. A single three-phase circuit is carried throughout the entire length of the line.

In order to maintain continuous service of adequate capacity the Easthampton Gas Company is now building a modern steam-turbine plant at Mount Tom, on the property adjoining the substation. The initial capacity of the steam plant will be 1000 kw, and the present substation capacity is 1500 kw. From the substation at Mount Tom as a distributing center the service is carried to Easthampton over a 4600-volt line, and at the West Boylston Mills the potential is reduced by step-down transformers for motor applications at about 440 volts. At the old steam plant of the Easthampton company electricity is transformed for local lighting and small motor service at 2300 volts. The Easthampton company expects to have the turbine station ready for operation by Oct. 15, using the steam plant as an auxiliary to the hydroelectric supply. The Mount Tom station is about three miles from the center of Easthampton. The construction work has been handled by the local companies under the direction of Mr. Howard M. Turner, supervising engineer, and the consulting engineers for the entire work are Messrs. Thomas & Neall, New York and Boston.

New York Commission News.

It was announced last week at the office of the Public Service Commission of the First District of New York that an agreement had practically been concluded with the Interborough Rapid Transit Company whereby title to the Steinway tunnel, running from 42d Street and Park Avenue under East River to Long Island City, would be taken over by the city free of cost, and a contract made with the Interborough Company for its operation; permission being granted for third-tracking the Second, Third and Ninth Avenue lines, the extension of the elevated lines across the Queensboro Bridge and the extension of the elevated system in several directions in the Borough of the Bronx. It is proposed to transport passengers from Long Island City to any station on the subway system for one fare. Chairman Willcox states that as soon as this agreement is ratified by the proper authorities work can be commenced upon the extensions. A public hearing has been called by the commission upon the project for Oct. 1.

The New York Public Service Commission, Second District, has granted its permission and approval for the exercise of a franchise granted to the Avon Electric Company by the town board and town superintendent of highways of the Town of Geneseo for the purpose of furnishing electric light service in that town.

The commission has made an order requiring all telephone corporations to file on or before Oct. 1, 1910, schedules showing all rates and charges of all kinds between points in New York and between each point upon its line and all points upon every line leased or operated by it and all points upon the line of any other telephone corporation whenever a through service or joint rate shall have been established between any two points The company is also required to furnish the commission with each issue of directory of subscribers of the various companies. The commission has also made an order requiring all telephone and telegraph corporations to report all accidents happening in connection with the work of these corporations.

Canadian Hydroelectric Commission News.

The difficulty between the Toronto City Council and the Hydroelectric Commission over the selection of the route through the exhibition grounds of the transmission line from Niagara Falls to Toronto has been satisfactorily arranged. At a meeting of the Council on Sept. 20 Mr. P. W. Sothman, chief engineer of the commission, stated that energy would be delivered in Toronto within a month if this gap through Exhibition Park was closed up.

The commission held an important meeting at Toronto on Sept. 20, with all the members present. It was decided to enlarge the territory served with cheap energy. The commission has secured an option on 15,000 hp from the Ontario Power Company to supply energy to the municipalities in the extreme eastern portion of the Province of Ontario.

The municipalities of Morrisburg and Prescott have made application for service, and the commission has instructed its engineer to furnish them with an estimate of the cost, based upon the price received from the Ontario Power Company. It is understood that the price to Morrrisburg, where 2000 hp was asked for, will be $16.33 per horse-power per annum, while to Prescott, which desires 1000 hp, the rate will be $22.13 per horse-power per annum.

Contracts have been let for the substation at Port Credit as follows: Building, Stewart Brothers, Port Credit; transformers, Allis-Chalmers-Bullock, Limited, Montreal; switching apparatus, Canadian Westinghouse Company, Montreal.

The commission finally decided that the ceremonies for the opening of the transmission lines for service shall take place in Berlin early in October. The ceremonies will consist of an electrical display of an extensive character and the municipality will give a banquet to commemorate the occasion.

Massachusetts Commission News.

Protests against the recent action of a majority of the Railroad Commission in the Boston & Eastern Electric Railroad project continue to be voiced in the press and elsewhere in the North Shore district near Boston. Mass meetings have been held on behalf of the new road, which desires to obtain a certificate of public convenience and necessity from the commission in order to start detailed engineering in connection with the actual construction of the railroad. The company plans to build a high-speed double-track line on a private right-of-way between Boston, Lynn, Salem and Beverly, and if its plans are carried out the time of transit between Boston and the North Shore will be cut far below anything ever before known. As outlined in these columns, there has been strenuous opposition from all existing transportation agencies, and the commission recently voted to lay the matter on the table until the Legislature of 1911 has had a chance to investigate the problems at issue. On Sept. 19 a large delegation of prominent municipal officials and residents of Essex County called upon Governor Draper and lodged a protest against the action of the board. President Bauer, of the Lynn Board of Trade, charged the commission with evasion of duty, and urged the Governor to use his influence as chief executive of the State to obtain an immediate decision of the board either for or against the road. The delegation stated that it desired the road to be built as soon as possible, but that in any case it wanted an immediate decision. Governor Draper said in reply that the commissions in the State act independently of him, although they are appointed by the executive. He assured the delegation that it had his sympathy, and that he would use his influence with the commission to see that a decision is rendered at once, one way or the other.

The Railroad Commission has declined to recommend that the Old Colony Street Railway Company be obliged to establish transfer stations in the City of Brockton during the Brockton fair.

One of the later rate cases to be heard by the Massachusetts Gas & Electric Light Commission is the petition of the Mayor of the City of Newburyport for a reduction in the price of both gas and electricity furnished by the Newburyport Gas & Electric Light Company. In accordance with its usual practice in appeals of this kind the full board gave a public hearing to the parties in Newburyport. The petitioners contended that the price of gas, $1.40 per 1000 cu. ft., was too high for the best interests of the community, and, in connection with the electrical prices, charges of discrimination were made. Mayor Robert E. Burke contended that a dividend of 8 per cent was unduly high, and also argued that the street-lighting prices were excessive.

The principal argument for the company was made by its manager, Mr. A. W. Rogers, who stated that in the past eight years every effort had been made to bring the local plant up to modern standards of construction and operation including a progressive distribution policy. He pointed out that the original plant was located in a three-story wooden building which covered all the land that the company owned, so that the stack had to occupy leased land. The machinery was pretty well out of date, with no chance to redesign the station. A new station was, therefore, built, with modern equipment. The policy of the company has been to supply the best grade of service and reach out for new customers in a liberal manner. Mr. Rogers said that the only business way of running a manufacturing concern like a central station is, first, to give the customers the best quality of service; second, to keep the plant in first-class condition and repair; third, to be liberal in making extensions; fourth, to give the stockholders a fair return on the money; and fifth, to lay aside a reasonable amount for depreciation and then, as fast as the growth warrants it, reduce the price. It was shown that the population of Newburyport remains practically at a standstill, and yet since 1902 the price of gas and electricity has

[illegible] a new station built, a gas holder [illegible] and other improvements have been made. In the past seven years the mileage of street mains increased from 14 to 24; the number of gas stoves from 340 to 1107, and the number of gas meters from 894 to 1810. The wire mileage had increased from 38 to 57; the number of transformers from 10 to 128, and the number of electric meters from 96 to 371. The number of arc and incandescent lamps had also increased, and the assessed valuation of the plant had increased from $154,500 to $307,800. Mr. Rogers asked what other enterprise had come into Newburyport, a city of about 15,000 people, and increased its valuation to such an extent? The taxes have increased in seven years from $2,569 to $7,617, an increase of $5,048. The gross income has increased from $52,767 to $93,485, and the earnings are now 2.75 per cent less on the capital stock than in 1902. Mr. Rogers said that there have been very few improvements or changes in the manufacture of coal gas that can be used by companies making less than 100,000,000 ft. per year that will materially reduce the cost of manufacture, and the cost of labor and most of the material entering the cost of manufacturing and distributing gas are very much higher. The cost of gas coal at tidewater point of shipment was 5 per cent higher in 1909 than in 1902, and labor is 20 per cent higher.

It was argued that the company in making liberal extensions had reduced the average amount of its product sold per mile of main, and the average per customer has also decreased, since, in extending into the outer districts, a good many miles of main have been added, with an accession of many small consumers. The price at which electricity can be sold depends largely upon the quantity which the market can absorb. Fixed charges are reduced as the sales increase. As the company does not have a large day consumption of gas, it cannot do as much business on the same investment as otherwise would be the case. Mr. Rogers said that it costs 97.2 cts. now per 1000 cu. ft. to deliver gas to the consumer under present conditions, exclusive of depreciation and fixed charges. Mr. Rogers further stated that he considered the net price for electricity, 15 cents per kw-hour, reasonable for the size of the city, and pointed out that the volume of the business greatly affects the possible price. The board has the case under advisement.

Objections continue to be raised against the new schedule of rates which the Massachusetts Highway Commission has recommended for adoption by the New England Telephone & Telegraph Company in the Boston and Suburban district. In spite of the fact that Prof. D. C. Jackson's exhaustive investigations of the traffic distribution showed that the larger part of intersuburban communication is between neighboring exchanges mass meetings continue to be held in various Boston suburbs with the object of securing modifications in the rates proposed. There has as yet been no opportunity to try out the new rates, for they have not been put into effect by the company. A so-called "Greater Boston mass meeting" was held at the American House, Boston, on Sept. 23, at the instance of the selectmen of Wakefield. A committee was appointed, with Representative Dean as chairman, to discuss the rate question with the New England Telephone & Telegraph Company. Failing to make an adjustment with the company an appeal will be made to the Massachusetts Highway Commission, and thence, if necessary, to Governor Eben S. Draper, with the request that the new rates be prohibited until action can be taken in the Legislature of 1911. It is considered unlikely that this agitation will be productive of any changes in the rates, for the reason that they were determined by the commission after one of the most profound analyses of costs and traffic ever made, the work being done by Messrs. D. C. and W. B. Jackson, of Boston and Chicago. It is recognized that in a metropolitan center like Boston, which virtually contains 1,500,000 people, scattered throughout nearly half a hundred municipalities surrounding the business nucleus, the needs of the [illegible] must be given precedence to those of [illegible] to a small degree more interested in [illegible] than in local suburban and inter-urban communication.

AMERICAN ELECTRICAL ENGINEERS—XV.

Edwin F. Northrup.

Edwin Fitch Northrup was born at Syracuse, N. Y., Feb. 23, 1866, where he attended the primary schools and after preparing for college at Cortland Normal School, Cortland, N. Y., entered Amherst College, Amherst, Mass., from which he was graduated with the degree of A.B. in 1891. While in Amherst he took an active interest in chemistry and philosophy and was one of the contributing editors of the *Amherst Literary Monthly*. Immediately upon graduation he entered the department of physics in Cornell University as a special student, and worked in the university shops through the summer of 1891. Special courses in physics and mathematics were pursued and part taken, as an assistant to E. L. Nichols, in a research on "The Time Infinitesimal."

In the beginning of 1892 Dr. Northrup entered the employ of Queen & Company, instrument makers of Philadelphia, Pa. The company had established an electrical laboratory at Ardmore, Pa., and was actively engaged in developing American

E. F. Northrup.

designs of electrical measuring instruments. In connection with his work in this laboratory Dr. Northrup took out two patents and contributed frequently to the technical press, which led to his appointment as a fellow in physics under Prof. Henry A. Rowland at Johns Hopkins University. He entered upon his fellowship in 1893, and his thesis, an original investigation in electricity, was completed in his first year and appeared later in the *Philosophical Magazine*. He was reappointed fellow the following year and received the degree of Ph.D. in physics in 1895.

Upon final graduation Dr. Northrup took charge for a short time of a six-mile electrical transmission plant of the "Monocyclic System," one of the first of its kind installed, which supplied electric power for the Ontario & Daly Mining Company, of Park City, Utah. He remained in Utah and Montana in miscellaneous practical electrical work until the fall of 1896, when appointment was accepted as head of the department of physics in the University of Texas, Austin, Tex. While occupying this chair he carried on an investigation of the etheric transmission of inductive action, the results of which appeared in these columns in the issue dated Dec. 18, 1897, and invented the "Northrup Oscillating Current Galvanometer." He was reappointed to the chair of physics, but left the university

shortly after to enter the detail laboratory of the Westinghouse Electric & Manufacturing Company, where he was chiefly engaged upon the standardization and design of alternating-current instruments.

In 1898 Dr. Northrup was called from the Westinghouse Company to assist Prof. Henry A. Rowland in the development of his alternating-current multiplex printing-telegraph system, in which work he was engaged four years. After Professor Rowland's death, April 16, 1901, he was placed in full charge as chief constructing engineer of the Rowland Printing Telegraph Company. Under his direction there was constructed a set of machines for operation between Berlin and Hamburg, Germany, the mechanical design of which was almost wholly his own. His work in connection with this telegraph system was recognized by the grant of a medal by the Paris Exposition of 1900. In 1902 he engaged with the Morris E. Leeds Electrical Instrument Company which in June, 1903, was incorporated as the Leeds & Northrup Company, with Mr. M. E. Leeds as president and Dr. Northrup as secretary. This company developed rapidly and placed upon the market many electrical measuring instruments of novel design, including inventions covered by sixteen patents granted to Dr. Northrup.

In September, 1910, Dr. Northrup concluded to lead a more scholarly life in an environment where he would have better opportunities for study and research in the higher and more refined branches of electrical measurement, and accordingly accepted the proffered chair of assistant professor of physics in Princeton University, the Palmer Physical Laboratory offering exceptional attractions to one of his tastes. He intends to continue to devote himself exclusively to that side of engineering and science which pertains to temperature and electrical measurements, and in addition to his university duties will act as a consultant on these subjects.

Dr. Northrup's contributions to engineering science have been confined principally to methods and instruments for precise electrical measurement. The chief of these are an original form of ballistic galvanometer (1892), which received an award at the Chicago Fair; a portable dry cell (1893); oscillating current galvanometer (1897); inventions connected with the Rowland Printing Telegraph, especially means for maintaining synchronism, page printers, keyboards and long-pull magnets (1898-1901). In the period from 1902 to 1908 his inventions include a four-coil decade system for resistance boxes; an alternating-direct-current comparator for alternating-current measurements; new designs of galvanometers; contributions to a new type of potentiometer; a line of resistance pyrometers; an electrical temperature recorder operating on a new principle; the working out of the law of pressure distribution in the interior of a conductor carrying current, and its application to an ammeter for the accurate measurement of currents above 1000 amp, direct or alternating; designs of indicating standardization wattmeters; a synchronizing tuning fork for the very precise speed control of small alternators.

Dr. Northrup has made numerous contributions to electrical literature, among which may be mentioned the following: A paper on "Dry Cells," *Journal* of Franklin Institute, March and April, 1893; "Specific Inductive Capacity" *Philosophical Magazine*, January, 1895; "A New Instrument for the Measurement of Alternating Currents," *Transactions* American Institute of Electrical Engineers, 1905; "Measurement of Temperature by Electrical Means," *Transactions* American Institute of Electrical Engineers, 1906; "Some Newly Observed Manifestations of Forces in the Interior of an Electrical Conductor," presented before the Physical Society and printed in *Physical Review*, June, 1907; "Conductivity and the Valuation of Electric Conductors," *Electrochemical Industries*, May, 1909; "A New Type of Ammeter for the Accurate Measurement of Alternating Currents Above 1000 Amperes," *Transactions* American Electrochemical Society, 1909; "Cooling Curves and a New Type of Apparatus for their Autographic Registration," *Transactions* Electrochemical Society, 1909; "The Comparison of Galvanometers and a New Type of Flat Coil Galvanometer," *Journal* of Franklin Institute, 1910.

Dr. Northrup is a member of the American Institute of Electrical Engineers, fellow of the American Association for the Advancement of Science, member of the American Physical Society, member of the American Electrochemical Society and member of the Inventors' Guild.

CURRENT NEWS AND NOTES.

Electrotherapeutic Association.—The American Electrotherapeutic Association has elected the following officers: President, Dr. Frederick De Kraft, New York; secretary, Dr. J. Willard Travell, New York.

N. E. L. A. Growth.—The National Electric Light Association continues its growth, and during the summer has gained about 100 members per month, the number being now about 5820 as compared with 5500 at the St. Louis meeting at the end of May. The report of the St. Louis convention is now in the printers' hands and will make two volumes of over 2000 pages, embracing some seventy papers and committee reports.

Electrical Engineering at Armour Institute.—Of a class of 214 freshmen students entering Armour Institute of Technology in Chicago this year, about fifty are enrolled in the electrical engineering course. This is by far the largest incoming class in this course in the history of the school. The total number of students in the electrical engineering department is 141, and the total number in the college is 563. The professors in the electrical department are much pleased with the appearance of the students in the incoming class, and remark that they seem to be more mature men than in former years.

Peat for Fuel.—The peat plant installed by the Canadian Department of Mines at Alfred has turned out several hundred tons of peat, which is to be sold in Ottawa at the rate of $3.25 per ton delivered. This is being done as a demonstration of the commercial success of government experiments in preparing the peat for fuel purposes. The department claims that at this rate peat is equal to the best anthracite coal at $6 per ton. The department also announces that peat can be sold for fuel at the works at a profit for $2.25 per ton; this price is equal to hard coal at $4 a ton. It is expected that within a short time private enterprise will be putting peat fuel on the market in the vicinity of population centers. The Dorchester Peat Company, with a capital of $75,000 and head office at London, Ontario, has been incorporated to develop the peat fields about London.

Outing of Commonwealth Edison Women Employees.—The annual outing of the women employed by the Commonwealth Edison Company, of Chicago, was held at Ravinia Park on the afternoon of Saturday, Sept. 24. Included in the party by invitation were a number of the department heads of the company, many of them accompanied by their wives. Outdoor games were the feature of the afternoon, and in the evening there was a supper, followed by music and dancing. The company was the host of the occasion. The annual outing for the women of the company is an outgrowth of a visit to the model farm of Mr. Samuel Insull, the president of the company, at Libertyville, Ill., three years ago. So enjoyable was this occasion that the practice has been continued as an annual event since that time, the company taking pleasure in giving this little treat to its faithful employees of the gentler sex, with the addition of enough men to keep the affair from being too one-sided.

Tungsten Fields in Washington.—It is claimed that the largest and most promising tungsten field in the world is located in Stevens County, Washington, from 40 miles to 75 miles north of Spokane.

Wireless in Army Maneuvers.—During the recent French army maneuvers, in which 80,000 troops engaged, a number of dirigible balloons participated, each of which was supplied [illegible]

Photo-telegraphy at Denver Show.—On the opening night of the Denver Electrical Show, Oct. 8, an attempt will be made to send photographs by telegraphy from Chicago to Denver, a distance of over 1000 miles. It is estimated that $1,500 will be expended in conducting this experiment in photo-telegraphy.

Illinois State Electric Association Convention Dates.—The dates for the 1910 convention of the Illinois State Electric Association have been fixed as Oct. 25, 26 and 27, 1910. It will be held at Rock Island, Ill. Further information about this convention can be obtained from Mr. C. A. Willoughby, assistant secretary, Mayer Building, Peoria, Ill.

English-American Cable.—Work is now being completed on a transatlantic cable from Penzance, Cornwall, England, to Coney Island, by way of Roberts Bay, Newfoundland. The cable, which now lacks only 120 miles of completion, will be the property of the Western Union Telegraph Company, which will then own twenty-eight deep-sea cables having a total length of 18,759 miles.

Alleged Damage by Elevated Railway Structure.—Owners of property at 47 and 49 Fifth Avenue, Chicago, have brought suit against the elevated railway companies using the Union Loop, alleging that their property has been damaged by noise, obstruction to light and dripping of water, to the extent of $50,000. It is asserted that the elevated trains have made the corner of Randolph Street and Fifth Avenue the noisiest in Chicago.

Control of Gasoline Lighting in Pueblo, Col.—An ordinance recently passed by the City Council of Pueblo, Col., places all gasoline vapor-lighting outfits under the supervision of the city electrician. The ordinance also stipulates that all tanks, carburetors, generators etc., must be placed outside the building and tanks holding over 5 gal. must be buried 3 ft. underground. A penalty of not less than $5 nor more than $100 will be inflicted upon anyone disregarding the law.

New York Electrical Show.—A special feature of the fourth annual New York Electrical Show, which will open on Oct. 10 at Madison Square Garden and continue for ten days, will be displays of the numerous new electrical inventions and appliances that have been developed within the past year. A complete exhibit will be shown of the inventions of Mr. Thomas A. Edison. Several foreign firms have engaged space and all of the prominent American electrical companies will make exhibits of general interest.

Telegraph Typewriter for Battleships.—The United [illegible] *Nebraska* with a complete telegraph-typewriter system. The department intends to give the system a thorough test to determine its efficacy as a method of communicating range and target observations and fire-control orders in time of battle to [illegible] the danger to such an instrument from gun fire might not overbalance its advantages and whether it can be operated speedily enough to compete with the telephone system.

Electric Protection for Treasury.—The United States Treasury at Washington has been equipped with electrically operated gongs so arranged that it will be impossible for an intruder to lift the latch on a door or touch the knobs on a vault without setting the gongs ringing all over the building. When the doors of the vaults swing shut after each day's business the system will become operative automatically, and when the doors close on the clerks another set of alarms will be set. The electric wires center in the watchroom, where guards are on duty every hour of the day and night.

Hydroelectric Development in Sweden.—Plans are being made to utilize the waterfalls near Aelfkarleo, Sweden, for industrial purposes. It is proposed to establish a plant for the supply of 5000 hp to the town of Gefle, sixteen miles distant, at a rate lower than is now charged by the existing plant at Gefle. It is hoped to secure customers for the new enterprise in Upsala, which is fifty-five miles from Aelfkarleo, and in other industrial places in the provinces of Upland and Gestrikland. The project will come before the next session of Parliament, and it is expected that construction work will begin next summer.

Increased Membership in I. E. S.—As a result of the membership campaign conducted for the Illuminating Engineering Society by Mr. Robert Crouse, assisted by Messrs. Philip Dodd and Napoleon Boynton, W. H. Gartley and H. B. Dates, 500 names have been added to the roll of the society. The increase represents about 50 per cent of the former membership. The new members were selected from well-chosen lists of persons specially interested in the subject of lighting, and since they will both give and receive value from their connection with the society, it is considered that the growth in membership is a healthy one.

Electrical Manual Training in Brooklyn.—The Department of Education of New York City offers free of charge in the Brooklyn Evening Technical and Trade School several electrical courses in manual training. One short and practical course covers electric wiring and installation. A four-year course in practical electrical engineering is also offered, beginning with the necessary mathematics and theory and followed by practical instruction in making, running and testing dynamos and other forms of electrical apparatus such as are used industrially. Steam engineering is also taught similarly, as well as industrial chemistry and elementary civil engineering.

Roentgen-Ray Insulator.—In a United States patent issued to Mr. Oscar Gros, of Leipzig, Germany, on Sept. 13, a description is given of a preparation impermeable to Röntgen rays. The preparation, which consists of white bolus coated with bismuth oxides, when used for filling the cavities of the body during examination, is said to yield an intense and uniform shading on the Röntgen plate. In manufacturing the preparation the inventor dissolves 10 grams of subnitrate of bismuth in diluted nitric acid and then adds to the solution 100 grams of white bolus. The mixture is then evaporated to dryness and subjected to calcination until nitrogen oxides cease to escape.

Electric Motors for Export.—According to an American consul a certain electric factory in a European country intends reducing the price of energy used during the daytime, thus make it pay even in small workshops to employ electricity as motive power. The consul states that in consequence of this there will shortly be a demand for electric motors from 0.5 hp to 20 hp. It is, therefore, advisable that American manufacturers of electric motors should send their descriptive catalogs with prices quoted in certain cities to the consulate in question for distribution among the intending users of electricity as motive power. Inquiries should be addressed to the Bureau of Manufacturers, Washington, stating the file number, 5556.

HYDROELECTRIC DEVELOPMENT ON THE ILLINOIS RIVER.

Details of the Proposed Low-Head Station of the Northern Illinois Light & Traction Company at Marseilles, Ill.

FOR more than forty years commercial use has been made of the water-power of the Illinois River at Marseilles, Ill. The Marseilles Land & Water-Power Company, a corporation headed by Mr. W. D. Boyce, a Chicago publisher and capitalist, owns the dam, headgates and races, leasing water rights to various hydraulic power users. The existing development under normal river conditions is capable of producing considerably more power than the present demand, which amounts to about 6525 hp, and this available surplus has recently been contracted for by the Northern Illinois Light & Traction Company, which has also secured the transfer to itself of some of the other older water leases. In this way the Northern Illinois Company, which is a subsidiary of the Western Railway & Light Company, of which Mr. W. B. McKinley is president and Mr. H. E. Chubbuck general manager, has obtained sufficient water-power to operate continuously a 2700-kw electrical generating station which it is now building at the site.

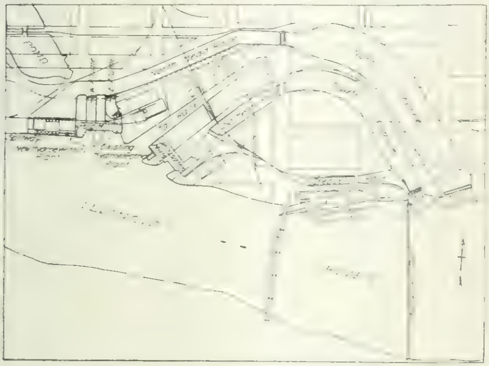


Fig. 1—Map of Marseilles Water-Power District.

The Consolidated Water & Light Company, of Marseilles, was also recently acquired by the McKinley interests from Mr. Boyce, together with the existing hydroelectric development, transmission lines and substations for distributing energy for lamps and motors in Marseilles, and for wholesaling to the local distribution companies at Morris and Seneca.

Fig. 2—Site of New Hydroelectric Development on Illinois River at Marseilles, Ill.

In the new plan, the Northern Illinois Light & Traction Company will be made the operating company, selling electrical energy at wholesale from the Marseilles generating station to Morris, Seneca, Ottawa, La Salle and Utica, and to the Chicago, Ottawa & Peoria Railway, which is also one of the McKinley properties. Eventually the new station will be tied in with other lines belonging to the Western Railways & Light Company. A steam plant at Ottawa will be floated on the system, supplying the peak-load demand, besides providing relay service. This arrangement will enable the new hydroelectric plant to operate at a load factor very nearly approaching unity.

Fig. 1 is a map of the Marseilles water-power district, showing the Marseilles concrete dam, of ogee section, 920 ft. long and 9 ft. high. Water is diverted through separate headgates into the north and south head-races The new power development will be located, as shown on the map, at the extreme westerly end of the north head-race and on the bank of the Illinois River, where an average head of 11 ft. is available. The flow of the Illinois River at Marseilles is fairly uniform throughout the year, resulting from the diversion through it of a large amount of Lake Michigan water by way of the Chicago River, the Drainage Canal and the Desplaines River. The north head-race, through which the new power development will receive its supply of water, is 2400 ft. long and has a minimum cross-section 80 ft. wide and 20 ft. deep.

Fig. 2 is a photographic view of the power site as it was before starting construction work and Fig. 3 is a reproduction of a photograph taken of the dam during the low-water period. Nearly all of the water shown flowing over the dam will be utilized in the new hydroelectric development.

Fig. 4 is a plan of the new generating station and Fig. 5 shows its construction in cross-section. The building will be erected on concrete foundations resting on a bed of shale. The superstructure will be built of brick with steel roof trusses and a tile roof. Across the forebay to the north of the power house a concrete bridge will be constructed, superseding a wooden bridge now existing at this point. This bridge is for the accommodation of the Manufacturers Terminal Railway Company, another property recently acquired by the McKinley interests. This bridge, as shown in Fig. 4, will also be utilized to support the racks in the flume leading to the turbine wheels. The arrangement of these racks is shown in Fig. 5 and they have been designed so that no steel projects above the water level, thus preventing in winter time the ready transmission of heat from the water through the steel to the colder air, which in freezing weather would cause anchor ice to form on the racks

Fig. 3—Dam on Illinois River at Marseilles, Ill.

There will be twelve vertical turbine waterwheels installed in individual flumes and supported on suspension roller bearings. Six of these wheels are now in operation in the old power house and will be used to drive two 450-kw, 60-cycle, 2300-volt horizontal-shaft generators. Each alternator will be geared to its group of three water-wheels through shafting. The six new wheels are each to be direct-connected to 300-kw umbrella-type alternators operating at 72 r.p.m. These generators will all be three-phase, 2300-volt machines. Four of them will produce 25-cycle and two 60-cycle energy. Space will be left at one end of the power house for the installation of an extra unit, leaving room also for assembly and repair work.

A spur will run from the Manufacturers Terminal Railway track into this end of the power house, from which point a

25-ton electric overhead traveling crane will be employed for unloading and erecting machinery. This crane will also be utilized in handling the gates of the individual waterwheel flumes. These large steel gates will be available for shutting off any individual flume during an emergency, while in case a flume is desired to be closed for some length of time, wooden stop-logs may be inserted ahead of the gate, after which the

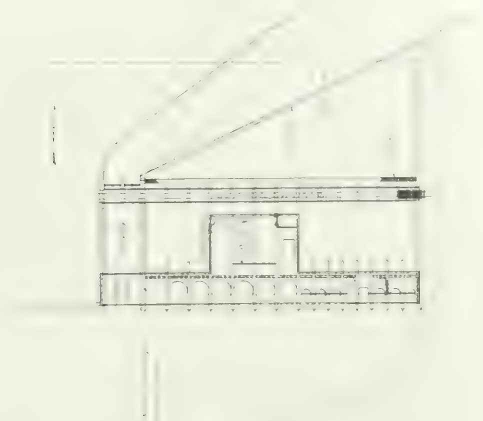


Fig. 4—Plan of Hydroelectric Station To Be Built at Marseilles, Ill.

latter may be drawn up and transferred by means of the crane to any other flume.

Excitation will be obtained from two direct-driven waterwheel generators, either of which will be of sufficient size for the demands of the entire plant. As electrical energy will be generated at both 25 cycles and 60 cycles, a frequency-changer will be installed in the station of sufficient size so that the entire capacity of the plant may be utilized for either the 60-cycle load or the 25-cycle load. This provision is necessitated by the fact that 25-cycle current must be furnished to the Chicago, Ottawa & Peoria Railway, now operating between Morris and Princeton, with a branch to Streator. For this railway five rotary-converter substations are now in operation. Since all the other demands on the station will be 60-cycle, and since the peaks of the two systems do not coincide, the power house has

Operating costs have been carefully weighed against investment charges wherever there is a possibility of reducing the cost of production.

The high-tension transformers will be arranged in two banks. One bank will step up the potential of the 2300-volt, three-phase, 60-cycle circuit up to 33,000 volts, and the other bank will step up the potential of the 2300-volt, three-phase, 25-cycle circuit up to 15,000 volts. Either bank of transformers will be sufficient to handle the entire station output. The operation of the plant will be controlled from a centrally located remote-control switchboard designed to facilitate the rapid and efficient control of all apparatus.

A new substation is now in course of construction at Ottawa and others will soon be started at La Salle and Utica. In the Ottawa substation there will be installed three 200-kw, 60-cycle,

Fig. 6—Reinforced Concrete Poles on Transmission Line.

2300-33,000-volt Westinghouse transformers protected by electrolytic lightning arresters. Space is left in this substation building for another set of transformers of equivalent rating. This substation is located about 2500 ft. from the main plant

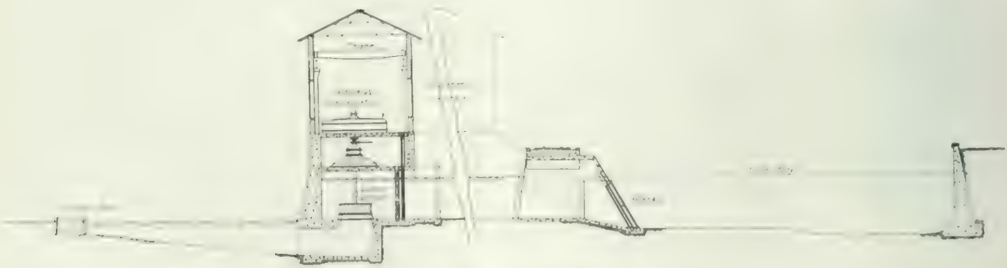


Fig. 5—Cross-Section of Proposed Hydroelectric Station at Marseilles.

been designed to adapt itself to existing conditions. The unusually favorable load conditions under which this plant will operate permit the expenditure of a large sum of money to obtain the highest possible operating efficiency, and the owners look forward to obtaining the best that the art will afford.

at Ottawa and is designed for use either as a step-up or a step-down station, depending on whether energy is being received at Ottawa from the hydroelectric plant at Marseilles, or whether energy is being supplied to the system by the Ottawa plant, as will be the case during peak-load demands.

Running east from Marseilles to Seneca and Morris and West to Ottawa, Utica and La Salle there is an unusually interesting 33,000-volt, three-phase, 60-cycle transmission line. The poles for this line were made of reinforced concrete and set along the bank of the old Illinois and Michigan Canal, which runs parallel to the Illinois River, and passes through the Illinois River towns which will receive electrical energy from this new hydroelectric plant. This transmission line is about thirty-six miles long a part of it having been in use for the last three years. The concrete poles are from 30 ft. to 60 ft. long, with 6-in. square tops, and in the case of the 30-ft. poles, 9-in. square at the base. The 30-ft. poles are reinforced throughout their entire length by six 0.5-in. square steel rods. The poles are designed to carry two 10-ft. wooden cross-arms and are spaced 125 ft. to 132 ft. apart. At present they carry three No. 4 hard-drawn copper wires. The cross-arms and braces are attached to the pole by galvanized iron through-bolts inserted in holes cast in the concrete. Fig. 6 shows a portion of this concrete-pole line at Ottawa.

It is expected that the entire development here described will be completed and ready for service by Aug. 1, 1911. Mr. C. W. Humphrey, of Chicago consulting and designing engineer, has been retained to execute the engineering work.

ILLUMINATION OF A NEW YORK DEPARTMENT STORE.

Extensive Use of Tungsten and Tantalum Incandescent Lamps in the Gimbel Brothers' Establishment.

Early this morning the large department store of Gimbel Brothers, situated at the corner of Broadway and Sixth Avenue, New York City, was opened for the transaction of business. The building, which is an eleven-story fireproof structure, occupies the half of the block running from Thirty-third to Thirty-second Street on Sixth Avenue immediately in front of the new Pennsylvania Railroad Terminal and is in close proximity to other immense department stores on and within a radius of a few hundred feet of Herald Square. Over twenty-six acres of floor space are provided for the 30[illegible] departments

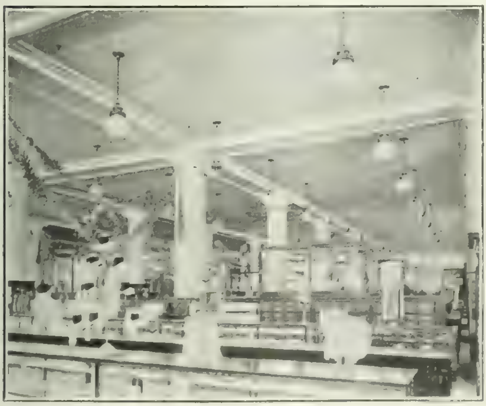


Fig. 1—Corner of Main Floor.

in the store, and in addition to 908 showcases there are forty-five show windows of very large proportions in which to display goods. Advantage is taken of every labor-saving device known in department store work. Thirty-six passenger elevators and ten freight elevators are available for use, and for small parcels two double-blade spiral conveyancers, running from the roof to the sub-basement, and eight electric conveyances reach all parts of the building. Eight telephone operators are employed to attend 1020 stations, and seventeen miles of pneumatic tubes, with 370 stations, are employed in the cash transfer system. In wiring the building over 540 000 ft. of wire in conduit was utilized, requiring the services of forty men for thirty weeks.

Fig. 2—Tungstens with Opalescent Shades on Seventh Floor.

For supplying the large connected lamp and motor load in the building, which aggregates approximately 10,000 hp, the New York Edison Company has erected a substation in the sub-basement. The equipment being installed consists of seven 1000-kw rotary converters with the necessary step-down transformers and high-tension switches. Three-phase, 25-cycle alternating current at a tension of 6600 volts is brought underground from the Waterside Stations, and this is converted to direct current at a potential of 240 volts for the three-wire system in the building. A direct-current switchboard is located in the sub-basement and tied with the building distribution board by heavy tie connections. Ultimately there will be several 1,000,000 circ. mil concentric cables feeding out into the Edison distribution mains so that in case of trouble with the substation apparatus these feeders will supply energy from the street service to the building, ensuring continuity of service under all conditions.

With the exception of the showcases the entire structure is illuminated by tantalum and tungsten incandescent lamps. The showcases are fitted with 8-cp and 16-cp tubular carbon-filament lamps, because the newer types of lamps are not made in

Fig. 3 Individual Reflectors with Tungstens in Art Gallery.

that form. Altogether there are [illegible] tungsten [illegible] and 900 tantalum lamps in the installation, ranging in rating from 25 watts to [illegible] watts.

The Gimbel installation is the first of its kind; that is, the first where a distributive system of lighting has been designed and carried out. The floors of the building are laid out in bays, there being 152 bays having an area of 21 ft. by 23 ft.

2 in. The wiring is designed so that one switch controls on the main floor two outlets in each bay, there being four outlets allowed to each bay throughout the structure. On the floors above the first one switch controls four outlets.

On the first floor there are four 250-watt clear-bulb tungsten lamps to each bay, and these are equipped with a 12-in. sand-

Fig. 4—Arrangement of Lamps on Third Floor.

blasted ball attached to the ceiling by a chain fixture hanging approximately 4 ft. from the ceiling, bringing the bottom of the lamp about 13 ft. 6 in. from the floor. Each of the ceiling outlets on the second and third floors is equipped with 150-watt clear-bulb tungsten lamps used with sand-blasted balls of smaller size than those used on the first floor.

The fourth, fifth, sixth and seventh floors are equipped with 100-watt frosted-tip tungsten lamps with reflectors of the opal and prismatic glass type having open bottoms, and the latter reflectors are satin-finished. The eighth floor is equipped with 60-watt clear-bulb tungsten lamps in sand-blasted balls, not much light being needed, as the concert hall and dining-room

Fig. 5—View of Sixth Floor.

are located on this floor. The ninth and tenth floors are equipped similarly to the fourth, fifth, sixth and seventh floors with the exception that 60-watt tungsten lamps are used.

The staircases are lighted by 25-watt and 40-watt tantalum lamps with open bottom reflectors. In the toilets, locker- [illegible] -watt plain-bulb tungsten lamps

with open bottom reflectors are employed. In these cases, however, 40-watt tantalum lamps will undoubtedly be used hereafter, as not much illumination is required.

The average intensity of illumination throughout the building is approximately from four to six foot-candles, the highest intensity being on the fifth and sixth floors, where the light

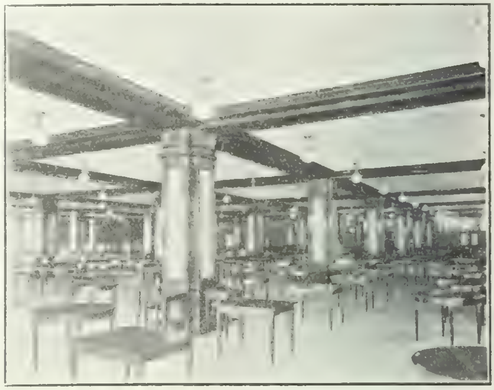


Fig. 6—Corner of Restaurant.

flux density is approximately six to eight lumens per square foot, while on floors where sand-blasted globes are used the intensity drops from two to four foot-candles. This loss is caused by absorption through the form of glassware used, illumination being subordinated to artistic effect.

The show-window lighting of the Gimbel store is most effective and economical. The outlets are placed on the ceiling where window glass and ceiling form an angle and are spaced approximately 1 ft. apart. Each outlet is equipped with either a 60-watt or a 100-watt tungsten lamp, depending on the goods displayed the larger unit being used when dark articles are shown. Each lamp is equipped with a specially-designed in-

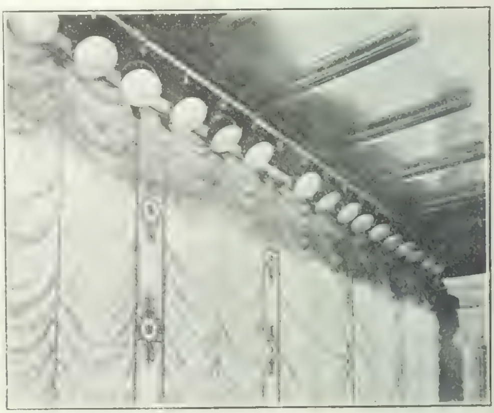


Fig. 7—Arrangement of Lamps in Show Windows.

dividual steel reflector of the Holophane-d'Olier type with holder that can be adjusted to accommodate either size of lamp, so that the reflector is brought in proper relative position to the filament of the lamp. The reflector directs the light flux in the most useful direction, the lamps being individually treated and the reflection being specific rather than general.

THE DEVELOPMENT OF THE WAVE-METER IN WIRELESS TELEGRAPHY.

By Geor[illegible]

During the last six years wireless telegraph experts and physicists have been very active in the development of high-frequency apparatus and the perfection of methods for measuring and investigating electric waves. At present there are many methods and instruments suitable for studying electric waves, and the art of measuring has approached a degree of perfection equal to that usual in the measurement of low-frequency currents. The work which led to the present

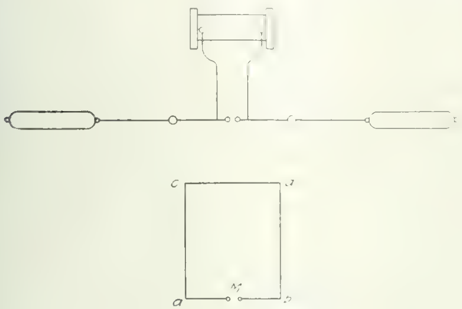


Fig. 1—Hertz's Oscillating System.

success is largely due to German engineers and physicists, among whom may be mentioned Zenneck, Wien, Drude and many of their pupils, while in certain circles in the United States much attention has been given to the purely commercial development of wireless telegraphy.

The beginning of electric wave measurement dates from the first experiments with electric waves. Hertz in his experiments employed devices which enabled him to measure in a rough way the wave length. In his writings on the velocity of propagation of electric waves[1] he describes, among other things, the method shown in Fig. 1. An oscillating system connected with an induction coil produces electric waves of a definite

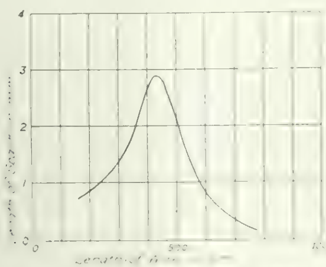


Fig. 2—Relation of Spark to Length

period, and transmits them inductively to a receiver made up in the form of a wire quadrangle, *a c d b*, which, by means of a spark micrometer, is used to detect the maximum amplitude of the potential. By changing the length of the different wires Hertz obtained the curve shown in Fig. 2. The marked maximum he explained as a resonance phenomenon. If in his time it had been known that the transmission of waves on good conducting wires takes place at the same velocity as in the air, Hertz would have been able to determine directly the frequency of his oscillator. Since his wire quadrangle oscillated in a half wave length with the potential node in the middle and the maximum amplitude at the spark micrometer, the wave length determined in this way is $\lambda = 8.8$ m, and the frequency, assuming a propagation velocity of $V = 3 \times 10^{10}$ cm per second, is $f = 3.41 \times 10^7$. Although Hertz worked with frequencies which are much higher than those now used in wireless telegraphy, his experiments deserve especial praise, as the resonance phenomena noted by him are the basis upon which all wave meters now used in practice are founded.

A notable step in the progress toward a practicable wave meter was made by Lodge in his studies of electric resonance, or "syntonics" as he called it. Instead of the open oscillating circuit which was used by Hertz, Lodge utilized the closed circuit, and in this way larger amounts of energy were present and resonance effects were more marked. From his apparatus a sort of standard form of demonstration apparatus for lec-

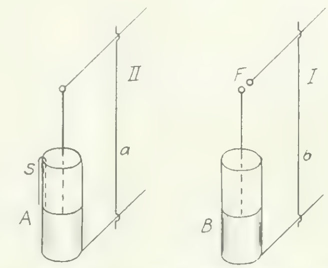
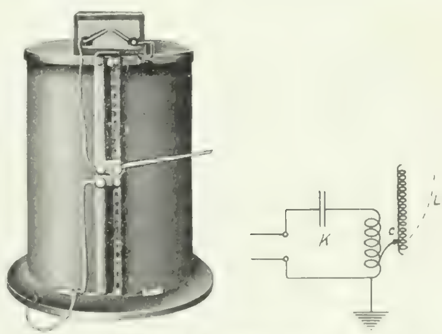


Fig. 3—Diagram of Lodge's Demonstration Apparatus.

tures has been developed.[2] Fig. 3 shows a schematic diagram of Lodge's apparatus. Two equal Leyden jars, *A* and *B*, are connected in circuit by heavy wires, the parts *a* and *b* forming bridges which may be moved to or from the jar. The system in which the oscillations are generated contains the spark-gap *F*, and the resonator is provided with a tinfoil strip *S*, which is connected to the inner layer of the Leyden jar, carried over the top of the jar and brought in close proximity to the outer layer. When oscillations are produced in system I, by induc-



Figs. 4 and 5—Frequency Meter.

tion the wire quadrangle in the second system is traversed by a pulsating magnetic field, which produces oscillations in system II, the magnitude of these oscillations depending on whether or not the natural period of the receiving system coincides with that of the oscillations. In case of resonance, system II will be set into violent oscillation and the gap between the tinfoil and the outer layer of the Leyden jar will be broken down. By adjusting one of the bridges *a* or *b* the conditions of resonance may be attained.

Thompson and Kirchhoff have developed the mathematical theory which applies to the frequency and wave length of [illegible] with Lodge's apparatus. According to

[1] H. Hertz, Ann. d. Phys. [illegible]

[2] [illegible]

them, the frequency is $f = \frac{1}{2\pi\sqrt{CL}}$, and the wave length in air and good conducting wires is $\lambda = 2\pi\sqrt{CL}$, in centimeters, where L and C are both measured in centimeters.

A very rigorous mathematical theory of the phenomena occurring in secondary circuits was later developed by Bjerkness[3], in which formulas are given for the maximum potential across the condenser, thermal effect and the effect of the potential across the condenser and its dependency on the frequency and the damping coefficient. This work was made the basis for the determination of damping and frequency, and Bjerkness, in addition to the mathematical treatment, published a number of measurements made on damped oscillations produced in his experimental apparatus.

Along with the closed circuit oscillator there is another form of resonator which is identified with the names of Tesla,[4] Slaby[5] and Seibt,[6] and which for the measurement of waves was of passing importance. The form referred to is the coil type shown in Fig. 4. If a coil wound on a glass core is connected to a generating circuit and a contact arranged so that the length of wire in the coil can be varied, there is a definite position of this contact for each wave-length, which is recognized by a lively discharge at the top of the coil. In this position the length of wire represents a quarter wave or a multiple thereof.

Scheller and Count Arco[7] were the first to build a frequency meter on this principle and make measurements with it in a practical sending station. Fig. 4 shows their apparatus. The turns of wire were covered by a hard rubber sleeve, except along the path of the adjustable contact. The spark discharge was observed on the needle gap at the top of the coil, and the length of wire connected in circuit was read directly from a scale over which the contact played.

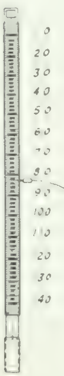


Fig. 6—Coil Details.

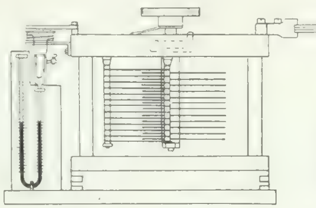


Fig. 7—Franke-Doenitz Apparatus.

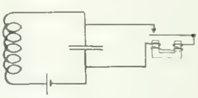


Fig. 8—Eichborn Apparatus.

The results obtained with this tuning coil could be considered as giving only an approximate indication of the wave-length. Owing to the difficulty of accurate observation, the secondary effect of the resonator upon the sender and the indefinite capacity of the coil, this type of wave meter was not successful.

The author demonstrated some eight years ago the marked effect of the surroundings on indications obtained with this coil form of meter.[8] Experimenting with an arrangement such as shown in Fig. 5 the point of resonance with a given train of waves could be varied over a wide range by simply approaching the hand or a sheet of tinfoil to the coil.

These experiments demonstrated that an oscillating system which could be used for measurement purposes must possess a sufficiently large capacity to render the influence of neighboring objects negligible. This requirement was met even to a lesser degree by Slaby's so-called multiplication coils[9] than was the case with Scheller and Count Arco's coils. The Slaby coils had the advantage of being more easily transported, cheaper to build and of greater sensitiveness than the Scheller and Arco apparatus. In Fig. 6 the construction of one of the coils is shown. The principal parts are a glass tube, around which many turns of very fine wire are placed; a contact point, which can be moved up and down over the turns, and a thin sheet of chemically-prepared (barium-platinocyanide) paper which is rubbed with goldfoil and fastened to the point of the contact. When the excitation reaches a sufficiently large value, a green light appears on the paper screen, which indicates the maximum resonance.

Resonance coils can be considered as inapplicable to wave measurements. They have never come into extended use, not only on account of the lack of accuracy of the measurements, but also on account of the amount of time required to make the adjustments, which in practice is a very serious objection. Engineer Doenitz[10] produced an excellent scheme which pointed the way to a successful solution of the problem. Fig. 7 shows a sketch of the Franke-Doenitz apparatus, which consists principally of an adjustable plate condenser of the Koepsel type, three coils of different inductance, and a Riess air thermometer in which the position of a column of colored alcohol indicates the heat effect produced. The plate condenser is made up of two systems of semi-circular plates, one system being fastened rigidly and the other arranged to rotate between the first ones. The air thermometer is in a special circuit, which is loosely coupled to the measuring circuit. Adjustment of the wave-length is attained by means of the inductance coils and the condenser in combination. The inductance coils are used for large steps, and the condenser for gradual and fine adjustment.

The great advantage of the Franke-Doenitz wave-meter as compared with the resonance coil lies in the use of quantitative apparatus and a large condenser, which latter guards the apparatus from the influence of the surroundings. By means of this instrument not only could the resonance maximum be determined, but the resonance curves could be plotted and the damping of oscillating circuits determined.

Between the years 1903 and 1906 the Doenitz wave-meter ruled the market, but in time the large, heavy plate condenser immersed in oil gave trouble, and the sensitiveness of the air thermometer was no longer satisfactory. At about this time Dr. Eichborn in Zurich developed a method[11] of producing slightly damped oscillations which possessed great possibilities as a method of wave measurement.

The principle of this apparatus is shown in Fig. 8. The oscillation circuit includes a source of energy and an interrupter connected in parallel with a condenser. When the circuit is opened a train of slightly damped oscillations is produced. What takes place in this system of circuits is similar to the surges that occur in an ordinary electric system when the current is suddenly interrupted. If at the time of interruption the current in the circuit is I_0 and the potential across the condenser is E_0, the wave is represented by the equation

$$I = e^{-at}\sqrt{E_0^2 + \left(\frac{I_0}{\omega C} - \frac{aE_0}{\omega}\right)^2}\cos(\omega t - x)$$

It is of great importance to smooth operation that the interruption of the current take place quickly and without spark at the contacts. This latter condition can easily be attained by using large condensers in parallel with the windings of the interrupter magnets.

With the principle of the Eichborn apparatus in mind, the Franke-Doenitz wave-meter, under pressure of the requirements of practice, was thoroughly overhauled and the construction greatly modified.

The Gesellschaft für Drathlose Telegraphie in Berlin brought out its so-called station tester, in which, among other novelties, use was made of the Hartmann & Braun hot-wire instrument instead of the air thermometer.

The C. Lorenz Company, of Berlin, and Mr. Hahnemann

[illegible]

[illegible] Martin

[9] Slaby: E.T.Z., p. 38, 1901.

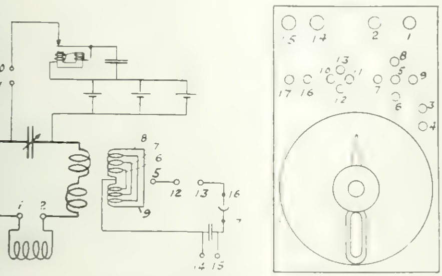
[illegible]

[illegible] p. 20, 1903.

[illegible]

built a testing outfit provided with auxiliary apparatus and devices for making various connections, which was especially well adapted to measurement of undamped oscillations. The Marconi Company, it is rumored, has lately given up the Flemming cymometer, and has adopted a wave-meter involving a closed oscillating circuit, which includes a plate condenser of adjustable capacity.

It is not the purpose of this article to go into details of all these constructions. The modern views on the construction of



Figs. 9 and 10—Seibt Apparatus.

wave-meters may be sufficiently well set forth in the description of an instrument which the author designed for the Radio-Telephone Company, of New York, and which is now in extensive use in the United States. In the opinion of the author this apparatus has the following advantages over the above-mentioned constructions: In spite of its wide adaptability, its manipulation is exceedingly simple and the possibility of errors of any kind is remote. When constructed as a calibrated resonator it has a sensitiveness such as was heretofore unknown, and can therefore be used for observing the powerful waves of the sending station as well as the incoming waves. The calibration is given directly in wave-lengths, and is the same whether operating as a sender or a receiver, so that no corrections need be made.

The uses to which it can be put are as follows: (1) In the erection of a station it may be used to tune the antennæ and the primary oscillation circuit to the desired wave-length. (2) When operating as a calibrated sender it serves the purpose of tuning the receiving apparatus to the determined wave-length.

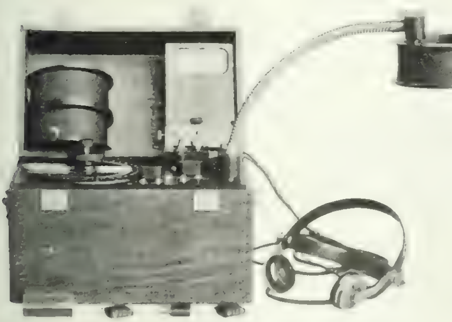


Fig. 11—Seibt Apparatus.

When a number of oscillations of different wave-lengths are to be received it may be used to calibrate the apparatus in wave-lengths. (3) Upon completion of the station it serves as a control of the sender and receiver. (4) In scientific laboratories it is suited to the investigation of electrical properties of oscillation systems, for the taking of resonance curves, for the determination of the degree of coupling and the damping coefficient of circuits.

The instrument consists primarily of a closed oscillating circuit with a continuously adjustable capacity and a step-by-step adjustable inductance. The additions which must be made to this oscillating circuit depend upon the use to which the instrument is to be put; for instance, whether or not it is to be used as a wave-meter for the reception or production of oscillations, what length of waves it is to measure and what degree of sensitiveness it is to have. Fig. 9 shows the complete circuit diagram. Fig. 10 gives a top view and Fig. 11 shows the actual appearance of the apparatus in its commercial form.

When in use the flexible arm is inserted in the holes 1 and 2, and to the plug on the end of the arm is fastened one of the three-wire inductance coils which are wound upon hard-rubber cores. The three inductance coils give three overlapping ranges of measurement corresponding to the following wave-lengths: $\lambda = 200$ to 600, $\lambda = 450$ to 1300, and $\lambda = 1000$ to 3000 respectively. The contacts 3 and 4 are short-circuited with plugs whenever wave-length measurements are being made.

When the wave-meter is to be used as a generator of oscillations, 10 and 11 are connected through a short-circuit plug, whereby an automatic interrupter contained within the case is set into operation, and with each interruption of the current slightly damped oscillations are produced.

When the wave-meter is to be used as a resonator the following operations must be performed: (1) Contacts 12 and 13 are connected by a short circuit plug. (2) To 16 and 17 a detector is connected. (3) Contact 5 is connected by a plug with either 6, 7, 8 or 9, according to the degree of sensitiveness desired. (4) 14 and 15 are connected to a telephone receiver or a pocket galvanometer, according as it is desired to adjust the instrument by means of hearing or sight. However, both the telephone and galvanometer may be connected either in series or parallel. One of the two detectors is a standard Radion detector, consisting of a thin, adjustable brass contact point and a lead sulphate crystal as a second electrode. The other form of detector is much more sensitive, and is made up of a thin platinum wire, which is fastened on one side to two lead-sulphate crystals, and on the other side between two brass plates. As a precaution against the gradual action of the oxygen in the air, the crystals are covered with a coating of paraffine.

The indications of the pocket galvanometer when used with the lead sulphate detector are not exactly proportional to the square of the current. In damping coefficient measurement, therefore, it is necessary either to use a curve which gives the relation between the square of the current and the deflection of the galvanometer, or to substitute for the latter an instrument which gives indications that are truly proportional to the heat-

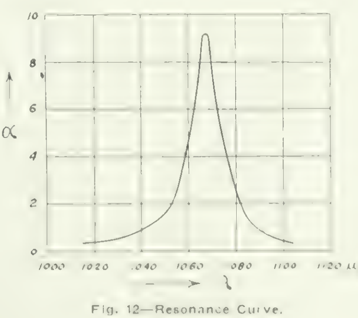


Fig. 12—Resonance Curve.

ing effect of the current, such, for instance, as a thermocouple, bolometer or hot-wire instrument. According to Zenneck's simplified expression of Bjerkness's formula, and with the resonance curve, the sum of the decrements of the sender and receiver is given in the following formula:

[illegible]

The separation of the two decrements is accomplished by introducing into the resonant circuit a known resistance, which increases the decrement by a calculable amount, δ_2; and if the deflection of the instrument is now a_r the decrement of the circuit is expressed by the formula

$$\delta_1 = \delta_2 \frac{a_r\left(1 + \frac{\delta_2}{\delta_1 + \delta_2}\right)}{a - a_r\left(1 + \frac{\delta_2}{\delta_1 + \delta_2}\right)}$$

The simplest formula for expressing the increase in decrement is the following:

$$\delta_2 = 0.58 \cdot 10^{-3} \frac{CR}{\lambda}$$

wherein C is in centimeters, R in ohms and λ in meters. In order to provide for these determinations, the wave-meter is accompanied by a calibration curve for the capacity in centimeters, and three resistors having a resistance of 3 ohms, 6 ohms and 12 ohms respectively. When making measurements the resistances are inserted in the holes 3 and 4, as shown in Figs. 9 and 10. The material of the wire for the resistor is so chosen that no noticeable skin effect occurs. The inductance and capacity of these resistors can likewise be neglected. Fig. 12 shows as an example a resonance curve made with this wave-meter. Employing the method outlined above, the damping coefficients of this wave are found to be $\delta_1 = 0.0149$, and $\delta_2 = 0.0287$.

NATURAL AND FORCED AIR CIRCULATION ACROSS SPARK-GAPS.

A matter that is receiving a great deal of attention in the wireless field is spark-gap ventilation. The advantages a spark-gap across which an air blast is caused to circulate has over one that depends only on natural ventilation may not be generally known, but if properly tried it will be found to increase greatly the efficiency of a wireless transmitter. There are various means of accomplishing this, and one that has been found to work to good advantage is shown in the diagram and may be described as follows:

The gap proper consists of two zinc disks, each 1 in. in diameter and 5/8 in. in thickness. The top disk is drilled neat to take a 3/16-in. machine screw and counter-sunk, as shown by the dotted lines in the diagram, so that the screwhead will be flush with the sparking surface. The disk is screwed to the regulating stud which passes through a sleeve in the top of the casing. The lower disk has a shoulder turned with a slight taper so that it will fit snugly into a piece of 5/8-in. brass pipe about 6 in. in length. From the top of the disk six holes are drilled, the ones near the circumference being drilled at an angle so that all will converge within the shoulder.

At the other end of the brass pipe, which is threaded, an elbow is attached and to this a piece of rubber hose, which is connected to a blower, the one used in the case described being a 1/4-hp, 2300-r.p.m. Sturtevant machine. A resistance was put in series so as to reduce the speed to 1800 r.p.m., as this produced the best pitch of spark.

The blower was so connected that it started automatically with the starting of the transmitting motor-generator set and was placed outside the operating room so that the noise of its running would not interfere with the receiving of signals.

One of the advantages of an air blast across a spark-gap is that it keeps the spark-gap cool and at a practically uniform resistance which will allow the transmitter to be used indefinitely without the spark varying in pitch or the necessity of having either to shorten the gap or increase the power in the primary circuit due to the I^2R loss in the heated oscillating circuit. Gases formed by the oxidation of the air and metal and which allow brush discharges of lower potential to pass and give varying and rough notes in the spark are dispersed, and by causing a clearer note and giving the spark a higher pitch the signal may be read more readily, especially through interference and atmospheric disturbances.

The writer has had occasion to install a blower across two different spark-gaps and in each case the efficiency of the transmitter was greatly increased. This was especially noticeable with one set on a ship where it was necessary to transmit daily with the utmost power available (in the case cited, 3½ kw) as

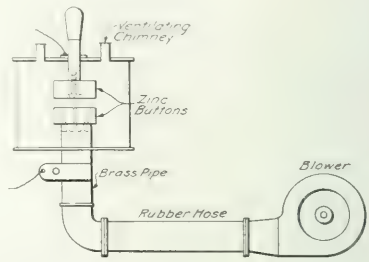


Fig. 1—Diagram of Spark-Gap Ventilating System.

many as 20 to 30 messages of considerable length to distances varying from 200 miles to 1100 miles. The spark did not heat or break or give the least particle of trouble. When used up the disks are readily removed and can be replaced by new ones.

An air blast is particularly applicable to spark-gaps which are enclosed on account of the noise made when transmitting. In open or non-enclosed gaps a scheme which has worked extremely well is shown by the photograph and can be readily understood.

The main spark-gap is composed of two identical gaps con-

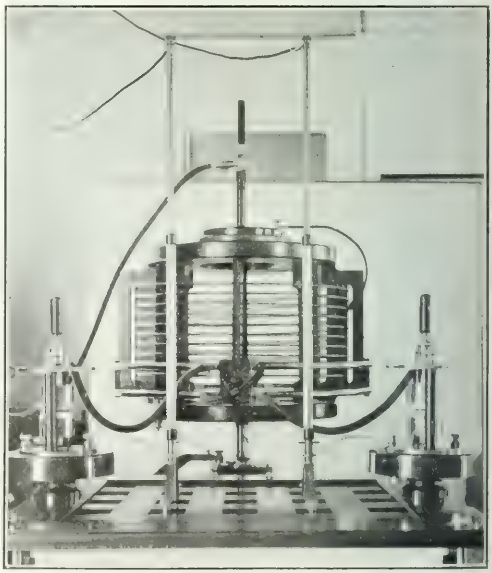


Fig. 2—Two Spark-Gaps in Series.

nected in series with the condenser and the primary of the inductive coupling. These are of much larger diameter than usually found on a wireless transmitter. Each gap is made up of zinc rings 2¼ in. in diameter and rounded on the sparking surface. The inside of the rings in the upper gaps is cup-shaped and solid, while the lower gaps have holes drilled inside the

rings so that when the sparks are oscillating the heated air rising causes cool air to come up through the holes and circulate across the gap. The great amount of sparking surface also helps greatly to limit the heat. Owing to the capacity of the disk or ring the gap cannot, of course, be separated nearly as far for the same potential as would be the case if the discharge were across points.

Another form of self-ventilating gap is the revolving synchronous gap used in the high-frequency Fessenden transmitter. This type of gap consists of a large revolving, insulated disk directly connected to the shaft of the alternator. On the periphery of the disk, set in a brass band, are spokes the same in number as the field coils of the alternator and the discharge takes place between these spokes and two adjustable stationary members set on either side of the revolving disk to which the condenser terminals are attached. As these alternators revolve at a rate of speed of about 1500 r.p.m. the windage set up, and consequently the circulation of air across the spark-gap, is considerable.

RECENT STREET-LIGHTING CASES IN MASSACHUSETTS.

One of the most important duties of the Massachusetts Gas & Electric Light Commission is the adjudication of petitions in connection with central-station rates and service. Chapter 121 of the Revised Laws of the commonwealth provides in Sec. 34 that upon the complaint in writing of the Mayor of a city or the selectmen of a town in which a company engaged in the manufacture or sale of gas or electricity for light or heat is located, or of 20 customers thereof, either of the quality or price of the gas or electric light sold and delivered, the board shall notify the company and after a public hearing may order any reduction in the price of gas or electric light or improvement in quality, and that the maximum price fixed by such an order shall not be exceeded except as provided in Sec. 35. The latter provides that a gas or electric light company may apply to the board to fix and determine the price of gas or electricity to be thereafter sold by the company, and the order of the board, reached after public hearing of all parties in interest, is binding until superseded by a further order.

Among the matters which have been brought before the board under the foregoing chapter, street-lighting rates frequently appear. During the past decade the board has had occasion to discuss street-lighting questions at more or less length, sometimes in connection with petitions concerned directly with rates and service for the illumination of the public thoroughfares, and at other times in connection with petitions asking for a general reduction in rates. A résumé of the more important utterances of the commission in relation to electric street lighting is useful. The board has had jurisdiction in this field for upward of twenty years, but at the present writing only the cases of the past ten years will be reviewed, and as reflected in the decisions of the commission.

FITCHBURG PETITION, 1900.

This was a complaint of customers of the Fitchburg Gas & Electric Light Company relative to the price of gas and electric light. The case concerned commercial arc lighting, gas supply and street illumination. At the time the company supplied arc lights of 1200 nominal candle-power for both street lighting and commercial purposes. There were 265 street lights, operated on an all-night and every-night schedule, at a price of $110 per lamp per year. The population of the territory was about 31,000. In considering the petition the board made a careful study of the operating expenses, capital and depreciation charges. The important question in the case was the relation of plant value to capitalization. Economy in management and a conservative administration had enabled the company to apply to the development of its gas plant considerable portions of its income which under a different policy might have been paid in dividends. The board points out in its decision that "in this way the gas plant has attained a high value relative to the actual capital issued upon it, and upon such capital a higher return than would be otherwise permissible may be allowed without prejudice to the public interest." Regarding the electric plant, the board found that the great advances in the art of electric lighting and the peculiar conditions surrounding the business in Fitchburg had combined to cause a large reduction in the plant value. It was evident that a thorough reconstruction of the electric plant was necessary to furnish a satisfactory public service. Prior to the assumption of the electric business the company had been earning and declaring dividends of 10 per cent per year. It continued this rate without interruption upon the entire capital invested in the electric plant. The board found that the company had not realized the effect of this dividend and the maintenance charges upon the prices, and that "the more nearly even relation between the electric plant and its capital seems to justify only a moderate dividend upon the latter," and that a reduction of the general dividend upon the entire capital and the charges for maintenance would open the way for the further reductions in price recommended. In this case the price of street lights was reduced to $100 per year.

WALTHAM PETITION, 1901.

As in the Fitchburg case of 1900, the Waltham case was not primarily of interest on account of street lighting, but in the course of a petition of the Mayor of Waltham against the Waltham Gas Light Company for lower prices of gas and electricity the resulting inquiry by the board disclosed the fact that a very large difference existed in the price per unit of energy to the city and to private customers for electric arc lights. These charges were about 10 cents per kw-hour to the city and approximately 16 cents to private consumers. The board referred to this matter in the following significant language:

"It seems to have been assumed by the company and the city that the latter was entitled to a concession in rates, perhaps even to the full amount that has been made. Whether the city is justified in claiming and the company in allowing so large a differential is perhaps difficult to determine. This board, however, has no authority to require the rate to be increased, even if it be clear that it be unfairly low. Any such adjustment can only be reached by agreement between the parties. Since, however, the entire income, even with a fair price for power, promised to return the company little if any more than a fair profit, the board did not see its way clear under the existing conditions to require a reduction in the price of street lights, and was able to recommend only moderate reductions in the prices for commercial lighting."

NEWTON PETITION, 1901.

This was a petition by the Mayor and consumers of the City of Newton complaining of the price and quality of gas and electric lights supplied by the Newton & Watertown Gas Light Company. The municipality served had a combined population of about 50,000 and covered an area of about 60 square miles. The territory was largely a residential district. About 75 per cent of the total electrical output was for street lighting only. There were in service 222 arc lamps of 1200 nominal candle-power on all-night and every-night service at a price of $100 per lamp per year. There was also incandescent service running until 12:30 a. m. The investigation showed that the service could be improved by more frequent renewals of street lamps, quicker attention to temporary troubles, and increased generating and distributing plant capacity. The company took the service in hand at once. The interesting feature of the case was the influence of the street-lighting business. This returned to the company only about 40 per cent of the entire electric income; and the rate per unit received for the electrical supply to street lights was less than one-half that received for commercial lights. In its decision the commission stated that it was unnecessary in this instance "to determine the

vexed problem of how large a differential, if any, should be allowed in the price to the municipality for its use, as compared with the price to private consumers (the italics are writer's), *but the board cannot approve a policy by which the rates for municipal use are made so low as to impose upon private consumers the entire burden of the investment charges.* The prices secured by the city are by agreement with the company, and this board has no authority to increase them, even were it thought desirable to do so. Any adjustment of such a condition seems to be left by statute to mutual agreement between the parties. It appears to be a fact, however, that so large a portion of the gross profit comes from commercial lighting that the return realized by the company upon its investment for the street lighting business is at a less rate than the interest paid upon its loans. While the present conditions continue the board cannot see its way clear to require a reduction in the electric lighting rates either for street or commercial purposes."

WORCESTER PETITION, 1901.

In this case the Mayor of Worcester complained of the prices charged for electric street lights by the Worcester Electric Light Company. At the time there were about 700 arcs of 2000 nominal candle-power in service on the all-night and every-night basis, at a price of 32 cents per lamp per night. The company offered to supply these under a five-year contract upon a sliding scale from 31 cents the first year to 30 cents for the last year. The city contended that the company should make a lower price, that it could well afford to do so, and that such lights ought to be supplied to the municipality at net cost, and without profit. The company was one of the most prosperous in the State, and had acquired exceptional ability for performing its duty to the public. Its accumulated surplus enabled its business to be carried on with greater economy and its product sold at the same rates as in other cases, or lower, with a more liberal return upon the investment. The board's discussion of this case was most interesting, and its final paragraphs are quoted as follows:

"Perhaps the most important question involved in this case is how far the public may properly share in the benefits which this prosperity makes possible. What the corporation has already earned and saved it has a right to retain. It is its own property, and there is no law, nor any principle receiving general public approval, by which its surplus can be directly diminished for the purpose of selling at less than a fair profit.

"But it must not be forgotten that, however wise and skilful may have been the management, the company has been able to acquire its present accumulations only by the exercise of a monopoly which it has enjoyed by the favor of the State, and which is, in a measure, assured to it by law. This is certainly a most important contribution by the public to the company's prosperity, for which the public is entitled to special consideration. When both parties have so contributed to these results neither ought to claim the exclusive right to the benefits they confer. These conditions impose upon the company a duty to share these advantages with the public, if not as a matter of legal right, yet as a sound public policy. Such a division of them will be to the company the surest guarantee of the continuance of its monopoly, just as the public interest will be most surely promoted by a ready recognition that a portion of them belongs to the corporation. The reasonable price to be charged is therefore not to be determined by prices which may be paid elsewhere to other less fortunate companies, but is to be one which this company, with all its facilities and advantages, may reasonably be required to make.

"We cannot, however, require such a division of profits to be carried so far that any portion of the company's product should be sold at mere cost, without profit, even to the municipality. . . . (Newton & Watertown italicized decision cited.) . . . In the present case, the investment necessary to do the distinctive work of the municipality, the lighting of its streets, constitutes a large proportion of the entire construction expenses of the company. This investment expects a return; it is made for that purpose; it is clearly entitled to it. If this be not paid for by the municipality, it must be paid by the private consumers. The lighting of the streets is a general public benefit, or it ought not to be done from the public purse. The municipality is no less able to pay a fair price for what it receives than are private consumers. The 1000 customers of this company have as much right to demand that the entire burden of public lighting shall be borne by the 13,000 property taxpayers of the city as the latter have that any portion of it shall be borne by the customers of the company as such. Nor is the opposite contention sustained by the mere fact that the company in a peculiar way occupies the streets by permission of the municipality. Authority for this is granted by the State not for the purpose of revenue to the city, but because it seems to be the only practical way of securing to the city and its citizens one of the great conveniences, a necessity, it may be, of modern life in the most economical and satisfactory way. The corporation is bound, in common with all other citizens, to pay its proportional share for the support of the government, to perform its work in a way that shall interfere in the least possible degree with the public convenience, to directly reimburse the municipality to the last dollar for any expense imposed upon it, and to render the public service for which it is created to the city and all the citizens who may desire it in the best manner and at the lowest reasonable cost. These duties fully performed, it is doubtful if the company has any other. This position, however, does not necessarily conflict with the claim that the municipality may be entitled to some differential advantage, as compared with private consumers generally. The city is the largest customer of the company, and like other large customers has the right to supply its own electric lights if it shall think it advisable to do so; and just as a large private consumer may be entitled to a price as low as he himself could make the light, so the municipality may be entitled to a price as low as it could render equal service with its own plant." The board, therefore, made little reduction, but required the company to put into effect its lowest offer two weeks from the date of the finding.

WAYLAND APPEAL, 1902.

In this case the commission refused the Natick Gas & Electric Company the right to supply street lighting and other service in the town of Wayland, on the ground that the existing service supplied by the company elsewhere was unsatisfactory, and that the Weston Electric Light Company had ample capacity in its plant to supply more than the demands of the territory. The franchise granted the Weston Company in Wayland was sustained.

BRIDGEWATER PETITIONS, 1902.

These petitions were addressed to the board on account of the inability of the town of Bridgewater and the Bridgewater Electric Company to form a street-lighting agreement. As a result of the facts brought out at the public hearing the board was convinced that there was an opportunity for the problem to be solved by a new arrangement by the town as to the number and kind of lamps used. The company's petition requested the board to fix an increased price for lighting, while that of the town complained of the price and quality of the service. The board did not recommend a price, or attempt to tell the town what its lighting should be, but assisted in the negotiations so far as possible, with the result that an agreement was reached between the company and the town. The board stated in its finding that the arrangements had its full approval, and that the conditions were as rigorous and the price as low as the board could impose upon the company. The agreement was accepted by the town and a contract made.

WELLESLEY AND WAYLAND PETITIONS, 1902.

In these cases consumers in Wellesley and Wayland petitioned for an improvement in the quality of electric lighting service supplied in both municipalities by the Natick Gas &

Electric Company. The service was found to be inferior, and the company made plans for its improvement.

QUINCY PETITION, 1906.

This was a petition by customers of the Quincy Electric Light & Power Company for a reduction in the price of electricity and for improvement in the quality of service. In this case the street lighting was not in contention, but it exercised a profound influence upon the company's business. Notwithstanding a relatively high price for commercial lighting, the average price received for the entire output, a factor of great importance in the eyes of the board, was less than 11 cents, which the commission considered "a low price for a company of this size and character," and also pointed out in its decision that the cause is to be found in the arrangement between the city and the company for lighting its streets. The board said:

"More than two-thirds of the company's output and probably an equal proportion of its investment is for street lighting alone. The company's prices for this service have gradually tended downward, until they have reached the point which barely meets the operating cost, with no provision for depreciation, interest, or dividends, and the entire burden of such charges is thus thrown upon the supply for private customers. While the board is unwilling to approve the policy which has brought about these conditions, it has no authority to increase these prices. We are not familiar with the reasons which have led to them, nor are we prepared to say that, having been now reached, they ought to be increased. It is very plain, however, that the facts are of such importance that they control the situation, and that if the price for street lighting were increased a corresponding decrease might be made in the commercial lighting price."

BLACKSTONE PETITION, 1907

This petition was a complaint by the selectmen of Blackstone seeking an improvement in quality and a reduction in the price of street lights supplied by the Blackstone Electric Light Company. The company supplied energy to 38 arc lamps of 2000 nominal candle-power on an all-night and every-night schedule, and 19 street-incandescents. The price of the arc lamps was advanced in 1901 from 38 to 40 cents per lamp per night. The incandescent price was 10 cents per lamp per night. In 1903 the company entered into a contract with the Woonsocket Electric Machine & Power Company for the purchase of all the energy required by the Blackstone company until 1913. The prices to be paid the Woonsocket company were 20 cents per arc per night; for the incandescents, 5 cents, and for energy for commercial incandescent lighting, 6 cents per kw-hour, measured at the town line. There was constant difficulty in earning a dividend out of this business. The only issue was the price of the public lamps. The board found that some such contract as was made with the Woonsocket company was desirable from the viewpoint of the company and the public, but that in this instance the Woonsocket company appeared to be the only party receiving substantial benefits. In the opinion of the board the prices agreed upon were unreasonably high—higher in fact than it would cost the Blackstone Company to produce its own energy in a proper plant. It was apparent that as long as the company is bound by the contract any reduction in the prices of light in force at the time of the hearing would prevent the payment of any dividend. The responsibility for the contract was, however, the Blackstone Company's. At the hearing evidence was offered in behalf of the selectmen for the purpose of establishing the fair cost of supplying the public lamps, and of fixing the price upon the basis of this cost, plus an allowance for depreciation and a return upon only that portion of the company's plant used in supplying the public lamps. The board found that this basis ignored the investment actually made in the entire plant and the income to be derived therefrom in relation to the expense of conducting the entire business. The case called for the fixing of a price which seemed reasonable, taking into account not only what the company was doing or could do as conditions stood, but also what it might fairly be expected to do under proper management. The board ordered the price of arc lamps to be reduced to $130 per year for all-night service, and incandescents to $30 for all-night service. Arc lamps burning until 1 a. m. were fixed at $117, and incandescents on the same schedule at $26. The rates determined applied to arcs of 2000 nominal candle-power and incandescents of 32 cp.

WINCHESTER PETITION, 1908.

The most interesting question in this case was one of alleged discrimination. The selectmen of Winchester petitioned the board for an improvement in the quality and reduction in the price of arc and incandescent lamps used in street lighting, the supply being by the Edison Electric Illuminating Company of Boston. The point at issue was the fact that the company offered the neighboring town of Arlington a 20 per cent discount from the regular rates on condition that a twenty-year street-lighting contract be made. The authorities of Winchester were unwilling to make a contract for more than one year at the time of the petition, and contended that the company was discriminating in favor of Arlington. The board took the ground that before ordering a reduction in rates on this basis it must be convinced that the facts present a clear case of unlawful discrimination. The board said:

"The company's position is distinguishable from an attempt to impose, as a condition precedent to obtaining a supply at all, or except at a price in excess of the regular rate, that a customer must agree not to obtain his supply from any other source for a given period. The latter is plainly an unlawful discrimination, and has been so held by the courts. The ground commonly relied upon against discriminations is that they tend to give undue advantage to those to whom they are made, as against those to whom the same concessions are not offered. But in this case it must be confessed that the discrimination complained of is not offered to one municipality and withheld from another, nor is it conditional upon the number of lamps operated or the quantity of electricity supplied, but is offered upon the same terms to all municipalities willing to make contracts for extended periods. There is no clear weight of authority that a discrimination of this character is unlawful, and for this reason the board is of the opinion that it is not justified in ordering a reduction in price on this ground alone."

The company made the point in this case that inasmuch as the wires and apparatus supplying the street-lighting service were devoted to that exclusive purpose, the possibility that the town might light its streets in some other way and abandon the company's supply introduced an element of risk due to abnormal depreciation which should be provided for in the price charged, but might be minimized by making a long-term contract with the municipality served, in which the reductions in price would be in proportion to the contract life.

CHESTER PETITION, 1908.

Street-lighting rates were incidentally concerned in this petition, which was a prayer of the selectmen of Chester for a reduction in the price of electric lighting and a change in the method of fixing the price. There was no well-sustained complaint respecting the quality of the street lighting. Chester is a small town of about 1300 inhabitants. The business has never been a success, and the board dismissed the petition, with some extended comment upon the disadvantages of employing complex rate-making systems in small communities.

LEOMINSTER PETITION, 1909.

This was a petition by the selectmen for a reduction in the price and quality of electric light and power supplied for both public and private use by the Leominster Electric Light & Power Company. The quality of street-lighting service was somewhat criticised, but as it appeared to the board, no properly accredited effort was made to determine the quality of the street lights, and the board issued no order regarding it. In connection with a general rate reduction ordered, the street-lighting prices were slightly reduced, arc lamps of 1200 nominal candle-power being cut from $110 to $105 per lamp per year for all-night service.

Central Station

Management, Policies and Commercial Methods

MERCHANTS' STREET LIGHTING IN CHEYENNE.

Cheyenne, Wyo., has just witnessed a great advancement in decorative street illumination. One or two merchants secured the co-operation of the electric company in lighting ornamental column lights in front of their stores, and within a few months, following an active campaign by the lighting company, fully 50 per cent of the business district, comprising at present some six blocks, has been lighted in a similar manner. The columns are heavy and substantial and are surmounted by five globes containing 100-watt tungsten lamps. The spacing is about uniform, but laid out more in reference to the buildings than to equal spacing. The effect is excellent and the increase in business on these streets is very observable.

CENTRAL-STATION RESULTS AT CAMBRIDGE, MASS.

The annual report of the Cambridge (Mass.) Electric Light Company has been filed with the State for the year ending June 30, 1910, and the records of the year show an increase in total revenue and a slight reduction in the net cost of manufacture at the generating station. The company's total revenue for the year was $335,111, compared with $310,209 in the preceding twelve months. The 1910 income consists of commercial arc and incandescent lighting, $169,918; street lighting, $68,071; electric motor service, $87,602, and energy sold to other companies, $9,520. There was a gain of about $9,200 in commercial incandescent lighting, and an increase in sales for motor service of about $15,100, or practically 21 per cent.

The total expenses of the company for 1910 were $174,783, the principal items being: Manufacture, $69,141; distribution, $44,911; office expenses and management, $17,885; taxes, $33,-089. The total expenses increased about $13,500 over those of 1909. The net cost of manufacture at the switchboard of the generating plant was 0.94 cent per kw-hour, compared with 1.02 cent in the preceding year. The company burned 9642 tons of New River coal during the year at an average cost of $3.57. The 1909 coal cost was $3.72 per ton.

The company delivered 7,344,392 kw-hours at the switchboard during the year and sold 4,854 664 kw-hours. In its own lighting and auxiliary service the company consumed 422,334 kw-hours. The sale of energy for motors totaled 3,027,476 kw-hours, compared with 2,514,122 units for motor uses in 1909, and the sales to metered customers for lighting aggregated 1,590,801 kw-hours. Street lighting consumed 1,289,422 kw-hours. Energy is supplied by the company to the municipal lighting system of Belmont, Mass., the delivery and measurement being at the town line. For this service the company supplied 236,387 kw-hours at a price of 4 cents per kw-hour.

The total connected load of the company on June 30 was about 8839 kw, consisting of municipal arcs, 297 kw; commercial arcs, 26 kw; municipal incandescents, 31 kw; carbon lamps 4414 kw; tungsten lamps, 40-watt units, 225 kw; Nernst lamps, 109 kw, making the total connected lighting load 5103 kw; motors, commercial, 3215 kw, and municipal, 22 kw. The company reports 1811 customers using incandescent lamps only, 89 using electric motors only, and 150 using both lamps and motors. The total number of customers is 2056.

The total cost of the plant on June 30 was $1,082,460, the larger items being: Steam plant, $295,008; underground lines, $221,292; land $212,240; overhead lines, $140,489; electric plant, $114,555; transformers, $44,384; meters, $39,412. The total valuation of the plant by the assessor in May, 1910, was $1,125,-000, so that there was an excess of tax value over the cost or book value of $42,540. The company had 259 transformers in use last June, and 3161 meters. Additions made to the plant during the year cost $32,858, the largest item being meters, $10,168. The outstanding capitalization of the company on June 30, 1910, consisted of 8000 shares of stock of the par value of $800,000. The total dividends declared in the year amounted t[illegible]

COOKING A DINNER FOR EIGHTEEN ON AN ELECTRIC RANGE.

Electric cooking utensils are in widespread use for preparing breakfasts, luncheons or parts of meals, but the preparation of an entire dinner for a large party on an electric range is not so frequent. Therefore a dinner of this sort which was cooked and served to eighteen persons at the Electric Shop in Chicago on the evening of Sept. 15 was an event of especial interest.

The dinner was given partly as a working demonstration of the electric range No. 30, made by the Hughes Electric Heating Company of Chicago. The Electric Shop, as is generally known, is the handsomely appointed display room and retail sales department of the Commonwealth Edison Company. Mr. J. J. Schayer, its manager, with his sales force; Mr. T. M. Caven, of the Hughes Company, and a guest or two composed the party that sat down to the dinner, which was a good one.

As mentioned, there were eighteen present, and a full dinner was served, consisting of consommé, roast beef, mashed potatoes, lima beans, a salad, peach shortcake, and coffee. The meal was cooked in two hours' time, with a consumption of electrical energy of 2310 watt-hours, or 128 watt-hours per person. Figuring this on a basis of 10 cents a kw-hour, the cost for the electricity for cooking the food for each person was 1.28 cents. Divided among the different elements of the dinner, the consumption of energy was as follows:

Consommé	176 watt-hours
Roast beef	1318 " "
Lima beans	196 " "
Potatoes	219 " "
Shortcake	146 " "
Coffee	255 " "
Total	2310 watt-hours

The consommé, of which there were two quarts, was made on the 880-watt burner, which was run at full heat for five minutes, after which the energy was turned off and the storage heat in the burner finished the cooking. The roast, which weighed about 16 lb., was cooked in the oven, which has a total capacity of 1760 watts. The heat in the oven was turned on for ten minutes before the roast was put in; after the meat had been in the oven ten minutes, the electricity was turned down to the next low heat, or medium heat, which consumes 440 watts. This was left on for an hour and forty minutes, at the end of which time the roast was taken out.

Immediately upon removing the meat, the pastry for the shortcake was put in the oven, being subjected to the high heat for five minutes, after which the electricity was turned off and the cake left in for three minutes longer, when it was baked perfectly. The potatoes, of which there were half a peck, were put on the 880-watt burner and boiled for fifteen minutes at full heat, after which the electricity was turned down to 220 watts and this heat was applied for thirty minutes, giving a consumption of 219 watt-hours. The coffee was made in individual percolators taking 500 watts each, and these were operated for ten minutes, the total consumption of electricity being 255 watt-hours.

The range used is designed for the ordinary requirements of

a family not to exceed eight people, but the Electric Shop dinner shows what can be done with it when it is necessary to use it in serving a large dinner. To use the electric range economically, it is necessary to manipulate the heating with intelligence and good judgment, something after the manner indicated in the foregoing description of how this particular dinner was cooked. The cooking in this case was done by a lady who is not a professional demonstrator, but who prides herself on her ability to operate her kitchen at the minimum cost.

EXPERIENCE WITH SEWING-MACHINE MOTORS IN CHICAGO.

Estimates of the number of electric sewing-machine motors of the household type in service in Chicago and its immediate suburbs vary, but it is thought that from 800 to 1000 of these motors are in service. The central-station companies encourage the use of these attachments, although their consumption of electrical energy is individually slight. It is found that the use of one electrical device in the household serves as a precedent for the introduction of others. Thus, an electrically operated sewing-machine will help in the introduction of a motor-driven washing-machine, and vice versa. The introduction of sewing-machine motors is, therefore, considered of wider importance than merely in relation to the additional load secured, although, as every little helps in the matter of day load, this is not despised.

The Commonwealth Edison Company is alert to push the sewing-machine motor at all times. This labor-saving device is advertised and various leads are followed up by the salesmen. The North Shore Electric Company likewise finds it worth while to pay considerable attention to this device. Both companies have the motors permanently displayed in their showrooms, and the North Shore Company makes a specialty of selling the motors on instalments, giving the customers a year's time in which to pay for them. When a sewing-machine motor is sold by the central-station companies they send out a man to install it and connect it and see that everything is in running order. The installation of these small motors is a comparatively simple matter, but the electric-service companies, nevertheless, take the precaution of seeing that the work is done by a competent man. Sewing-machine motors are also sold by dealers in electrical supplies, and the manufacturers of the apparatus are also naturally interested in pushing the sales. An arrangement is often made to rent the motor at a small sum to be paid weekly, this rent to apply on the price of the machine.

The arguments used in urging the introduction of these motors for domestic purposes are that they relieve women of part of the drudgery of household life and are distinctly conducive to health, while the cost of operation is very small. It is said that many women who are strong enough to do the washing for a household are forbidden by their doctors to operate sewing-machines by the ordinary treadle method. Of course, where there is a great deal of sewing done at home the motor drive of the sewing-machine becomes a more important factor. Nevertheless, there are many ladies who are in no sense required to do so who like to do the finer classes of sewing themselves on their own machines at home, and to this class, too, an appeal is made.

Manufacturers of various articles of wearing apparel who give work out to be done at home are often interested in the introduction of sewing-machine motors among their work-people, for the reason that they find that by the use of the electric motor attachment a woman can do at least twice as much work at home as by foot-power. A manufacturer of this class in Chicago has a sewing-machine equipped with electric motor on exhibition in the room of his factory where the women come in when they apply for work to be taken out and executed in their homes. This manufacturer neglects no favorable opportunity to tell the women taking out the work that the motors will make their task easier and also increase their income greatly, for this class of work is paid for by the piece. Dressmakers also constitute a class who are urged to use the electric motor drive for their sewing-machines.

There are many different styles of sewing-machines designed for household use, perhaps 150 of them. There are also several types of electric motors designed to drive sewing-machines. The motors are adapted to be started, stopped and regulated in speed by the motion of the foot treadle, leaving the hands of the operator free to guide the work. Very excellent speed regulation is obtained, ranging from the slowest stitching—that is, with a pause after every stitch—to the highest practicable speed desired for long, straight seams. Motors are provided for both direct-current and alternating-current circuits, and for all commercial voltages and frequencies.

As there are so many different kinds of household sewing machines, some variation is necessary in the matter of connecting the motor to the machine. However, electric motors are now available to fit any type of household machine, including the drophead design. Of course, there is a large demand for motors to drive sewing-machines in factories, but this is a different class of work.

Almost always the customers are satisfied with their experience with electrically driven sewing-machines. If troubles arise, they are usually sewing-machine troubles and not electric-motor troubles, although the electric motor is sometimes blamed unjustly when there is some fault in the sewing-machine itself.

An electric sewing-machine motor forms an acceptable present for a lady who does her own sewing. Husbands often buy them to give them to their wives as a little surprise, and it is found that the sale of these devices is considerably augmented just before the holiday season. The motors are not only used to drive the machine itself, but are supplied with bobbin-winding attachments, so that by a simple adjustment the various types of bobbins may be wound by the power of the motor.

LIABILITY FOR INJURY FROM ELECTRIC SHOCK.

The question has been presented to a court of last resort, probably for the first time in this country, as to whether a power company can be held liable to a person injured by contact with a live wire belonging to a street-lighting company, at a point beyond where the current has been delivered by the power company to the street-lighting company. The question came up in the case of Fickeisen vs. Wheeling Electrical Company, 67 S. E. Rep. 788, and it was decided by the Supreme Court of Appeals of West Virginia in favor of the power company. The facts involved were these: A person walking along a public street in the city of Bridgeport, Ohio, came in contact with a wire used in connection with the street-lighting system, which had fallen from the cross-arm of an electric light pole, the contact resulting in his death. His administrator brought suit against the Wheeling Electrical Company, which company was located in Wheeling, West Va., and manufactured the electricity which caused the death. The wire which carried the current belonged to the Bridgeport Electrical Company, which was engaged in supplying electric light for the streets and houses of Bridgeport, Ohio. The Bridgeport Company purchased the electricity which it used from the Wheeling Company and the current was delivered on the Ohio side of the Ohio River, where the wires of the two companies connected.

The lower court held that the Wheeling Company was liable on the theory that, the current being continuous from the wires of the Wheeling Company to the wires of the Bridgeport Company, there was no specific point of delivery where one might say that the right to the electricity of one company ended and that of the other began. This was reversed by the Appellate Court on the ground that electricity is personal property and capable of sale as other commodities of trade. Under the law of sales, when the Wheeling Company delivered the electric current to the wires of the Bridgeport Company on the Ohio side of the river, the title and possession of the Wheeling Com-

pany ceased, and the Bridgeport Company took title and possession and was thereafter responsible for negligence in connection with its use.

"Suppose," said the court, "that at the end of the bridge the Bridgeport Company had a storage battery for the storage of electricity, and that the Wheeling Company had delivered the electricity into the storage battery, and the Bridgeport Company had taken it therefrom for lighting the streets, and that someone should be killed from the grounding of a defective wire of the Bridgeport Company? Would you say that the Wheeling Company in that case would be liable? We think not. Though this mysterious agent, friendly, yet sometimes deadly to man, be unseen and unseeable, still it had substance so far as to be measured. A certain quantity measured by volts performs, under the law of some of the States, the deadly function of electrocution of the murderer. It is capable of measurement by the volt. In this case it was delivered in quantity known by one company to the other. When it reached the point where the unfortunate Whitney met his death whose property was the electricity? So far as the human mind can realize, it was the property of the Bridgeport Company. It was there as an active, deadly agent, producing the death of Whitney, and that agent was the property and in the possession of the Bridgeport Company, because it was on its wires. So far as we can use the word 'possession' as applied to electricity (and we can so use the word), it was in the possession of that company."

It was further said by the court: "The strongest view that can be presented to the contrary is that the Wheeling Company had sold this dangerous agent, knowing that it was to be conveyed over wires, and that unless such wires should be good and safe this agent might work harm, and that it must inspect such wires; that it was using those wires in performing its contract with the Bridgeport Company; and that it must see to the safeness of the instrument of delivery. But the fault of this argument is that it disregards the fact that delivery of the electricity has been already made, at the bridge end. It did not use the wires of the Bridgeport Company. The wires of the Bridgeport Company were not the vehicle of the conveyance of electricity as still the property of the Wheeling Company. As well might we say that when the seller of an article conveys it in his wagon to the place of delivery, and there transfers it to the wagon of the purchaser, and when harm is done by the latter's wagon or by the article later on, the seller would still be liable for damages therefrom. Surely a seller of an article, dangerous or not, after delivery to the purchaser, is not liable to a third party for damages therefrom. If a manufacturer of electricity sell it to an owner of an automobile to be used in running it, the seller would not be liable to a third person damaged by the badness of the storing receptacle or the automobile. There is no privity of contract between them, of course, and liability cannot be predicated on contract in such case."

The court admitted its inability to find any direct authority exactly fitting the case and referred to the question as an "important case of first impression in this State." Many decisions bearing somewhat upon the question, and in both ways, were cited. Amid the conflict of authority the court followed those which it felt were more sound. A Tennessee case was cited in which a horse was killed by a defective electric wire, while hitched in front of a house; the wire being owned by the owner of the house and used in connection with an electric sign in front of it, and the electrical company having no interest in or control over it. It was here decided that the company could not be held liable, the court saying: "We understand that liability for an injury depends upon the interest in or control over the appliance, and if there is neither interest nor control, there would be no liability." So, where a depot which was wired by the company owning it was destroyed by fire and the insurance companies which paid the loss brought suit against the electric light company which supplied the current for lighting purposes, it was held that judgment should be in favor of the electric company on the ground that it had nothing to do with wiring the building. And where a guest at a hotel was injured by an electric light falling upon him, which burned his back, it was held that, as it was not shown that the wiring was done by the electric light company, it could not be held responsible for the injury. In another case it was held that a person who was injured while turning off the electricity on his premises could not recover of the company supplying the current for the reason that he himself owned the electrical apparatus in his house. Upon these principles it was held in the present case that the Wheeling Company was not liable.

Wiring and Illumination

DECORATIVE LIGHTING IN MEXICO CITY.

The electrical illumination of Mexico City during September was one of the most attractive features of the celebration of the centennial anniversary of Mexico's independence. The Mexico Light & Power Company reports that approximately 300,000 additional lamps were in use upon the streets and to decorate the exteriors of the different public and business buildings and private residences. The grounds of Chapultepec Castle, the summer home of President Diaz, were a blaze of light. The National Palace, where the offices of the President and his cabinet are situated, was decorated with 30,000 incandescent lamps. In addition to these 100 arc lamps shed their bright rays from different parts of the exterior of the ancient building. The historic cathedral edifice, situated diagonally opposite the National Palace, was a beautiful picture by night with its thousands of incandescent lights that mark the outlines of its towers and the various openings. Many of the decorative designs upon the private buildings were unique and beautiful.

DIRECT COMPARISON, ACUITY AND FLICKER PHOTOMETRIC METHODS COMPARED.

By Sydney W. Ashe.

In previous articles[1] the author has referred to some investigations carried on employing photometric measurements. The flicker photometer used in making these measurements was described in the *Electrical World* by the writer's associate.[2] The articles referred to have been commented upon in an interesting way by Mr. J. S. Dow,[3] who has carried on instructive experiments along lines somewhat similar to those suggested by the writer. It is the purpose of the present article, without going into specific details, to comment upon some of the results obtained. An attempt was made to compare two 16-cp carbon lamps on the some photometer with the direct-comparison method, the acuity method and the flicker method to see whether the mediums of each set of readings would coincide. With the lines of the flicker photometer not rotating and set so that both sides of the comparison wedge were visible, a series of readings was taken by the direct-comparison method. Starting the lens rotating another series of readings was taken using the flicker method. The wedge was then removed and type was inserted on both sides of the wedge and a series of acuity values was obtained.

In order to obtain the most accurate value the median of each set of readings was taken. Ten settings were punched in the strip of paper on the photometer bar, and counting from either right or left an arrow was marked between the fifth and sixth readings. This value was then read off from the

[1] [illegible] Modern Illumination Upon Physiological Optics," [illegible] 1909. "The Flicker Photometer," Nov. [illegible], 1909.
[2] [illegible] *Elec. World*, Feb. [illegible], 1910, "Heterochromatic Photometry." [illegible]
[3] [illegible] "The Flicker Photometer."

scale of the photometer bar. A few interesting things were noted in making these measurements.

1. Although every precaution was taken to eliminate all possible errors, physical and physiological, the medians of the three sets of values did not coincide.

2. Between the direct-comparison method and the flicker method there was always a definite difference of from 1 per cent to 3 per cent.

3. The readings by the flicker method clustered most closely about the median, those of the direct-comparison method were about twice as scattered and those of the acuity method were about five times as scattered.

4. When the flicker photometer alone was used it was much easier to compare lights differing in color than those of the same color, the flicker being more decided where the difference of color was marked. This fact did not harmonize with numerous other statements previously printed to support the belief that the flicker is solely a function of brightness.

5. Where so-called green and blue incandescent lamps were used the values for the flicker photometer clustered even more closely together, those of the direct-comparison method diverged about twice as much as before and those of the acuity method were about the same.

6. In taking the direct-comparison readings if the observer occasionally removed his eye while making settings the values clustered more closely together. This fact was marked particularly with the colored lights.

7. The medians of different sets of values where colored lights were used with the direct-comparison method seemed to disagree slightly, the observer's concept of the intensity value of different colors seeming to change.

ANIMATED ELECTRIC ADVERTISING SIGN.

By S. D. Levings.

The present perfection of the animated electric sign may logically be said to be based on a step-by-step action, the steps consisting of the energization of stationary electric lamps in such a manner and with such changes of location as to produce the effect of motion. But the imagination must needs be brought into play before the result is fully accomplished. This step-by-step idea, fully evolved, is the fundamental basis of the motion picture as observed from its projection on the screen. It was found by experiment that twelve projections per second could be cast upon the screen, at which rate of speed the eye could not distinguish between the individual projections, hence positions of the objects. It was also found that at about ten projections per second the eye could differentiate between them.

Many electrical engineers have been from time to time engaged in a solution of the sign problem, which would have as a result the effect produced by the motion picture as cast upon the screen. In such a solution many obstacles present themselves. In the first place, a flasher to produce a rapidity of change as great as twelve per second would be impracticable of maintenance if not of design. Secondly, and far more important, the time factor of illumination of the incandescent lamps used enters. The time required for an ordinary carbon-filament lamp to reach maximum brilliancy and return to darkness again is such that a rapidity of twelve illuminations is not possible. In other words, one line of lamps could not reach maximum brilliancy and be extinguished again in time for a series of lines to be illuminated at the rate of twelve per second. These points and many others effectually condemn the step-by-step system of conveying to the observer the effect of continuous motion. The solution proposed by Mr. E. J. Prindle, of New York City, is to move the lamps themselves, and on such a basis Mr. Prindle has designed an animated electric sign.

The first sign of this type was exhibited in a hall in Newark, N. J., and occupied a space approximately 20 ft. x 80 ft. First the outline of a man's head appears. The face has a distinct expression of surliness, and to add to the ugly mood represented the figure's eyes are cast down. The corners of the mouth droop. Fig. 1 shows the initial illumination. A sign in true perspective, bearing the legend "Uneeda Biscuit," then appears in such a position as to be in front and distant from the figure. After the sign appears, the figure raises its eyes, still maintaining, however, its expression of bad humor. Fig. 2 shows the expression of the figure at this juncture. No change in the illumination occurred whatever. After gazing at the sign for a moment the figure's hand, clasping a biscuit, comes into relief, held in the position shown by Fig. 3. Immediately the hand is outlined the eyes again drop. The hand is next raised, the mouth opens and the biscuit is inserted. The jaws then close upon the biscuit, and the hand following this movement recedes from the mouth carrying the remainder of the biscuit

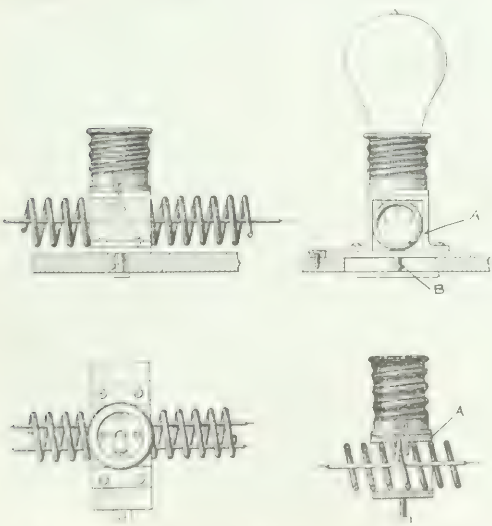
Figs. 1 to 6.—Changing Facial Expressions in Animated Electric Sign.

The biscuit is shortened by the bite taken from it. Fig. 4 shows the figure at this point; the drooping corners have disappeared, thus changing the whole expression of the face.

Fig. 5 shows the shortened biscuit and the jaws closed upon the bite. The figure then proceeds to masticate the bite, and Fig. 6 shows the final expression. A few lamps were lighted or extinguished during the expression changes, as may be noted by the droop line in comparing Figs. 1 and 6, and also by the two small creases, one below the eye (see Fig. 13) and one to the left of the mouth. Other facial expressions, however, were obtained by actual movement of the lamps, and an instance may be cited of the position of the eyebrow lines in comparing Figs. 1 and 6.

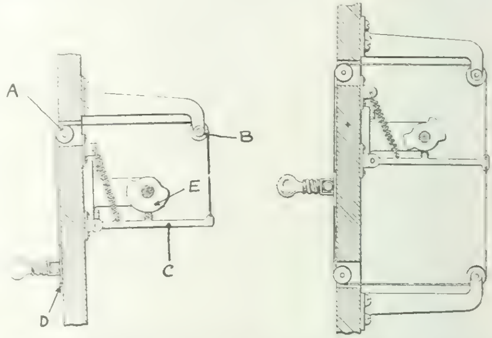
The body of the sign is similar to the present type, and is capable of the same mounting and flexibility of design. The apparatus for producing the movement of the lamps is applied to the rear of the board at the various points necessary, such parts being provided with a housing for protection from the weather. There are two principal divisions of the electrical effects; first, that of stationary lamps such as form the outline of the head and shoulders, the bridge of the nose, etc., and, second, that of movable lamps such as form the eyebrows, jaw, wrinkle lines, etc. The stationary lamps may be of any type, and may be mounted on the face of the board, or recessed in it, according to the effect desired and the angle from which the sign may be viewed. The movable lamps are mounted on a coiled spring, as shown in Fig. 7. A special lamp socket adapted from the standard incandescent socket is mounted on a bridge piece, as shown at *A*, Fig. 8, which in turn is mounted on a plate secured to the face of the board. This plate is held to another plate at the rear of the board by the pin shown at *B*, which passes through a slot provided in the board. This slot is designed in length to conform to the maximum locations necessary for the lamp or lamps during the complete cycle of the sign's action. Owing to this construction, the springs holding the lamps may be shifted laterally over the limits of the slot to form any desired shape, and may be stopped at any position desired, to be again shifted at the proper time.

Connections to the lamp are made from a circuit which passes through the coiled spring. This arrangement is shown in Fig. 9.



Figs. 7, 8, 9 and 10—Details of Movable Lamps and Sockets.

In order to prevent the lamp sockets shifting positions on the [illegible] to them. This plate fits over the wire of the spring and holds the lamp socket in position. The lamps may be required to move, all at the same time, direction and distance, in any given portion of the sign, or they may be required to advance or recede independently of their neighbors on the same spring. There are two ways in which this movement has been provided for; one, by a cord attached to the lamp socket or point of contact with the spring, which passes through the board over a pulley as shown in Fig. 11 at *A*, and thence over another pulley attached to a bracket as shown at *B*, and thence down to a



Figs. 11 and 12—Section Views of Apparatus for Moving Lamps.

permanent fastening on the movable lever shown at *C*, Fig. 11. In this case a stop shown at *D* is placed on the face of the board against which the spring rests when in normal position. The movement of the spring is accomplished in the following manner:

A shaft is mounted vertically or horizontally on the rear of

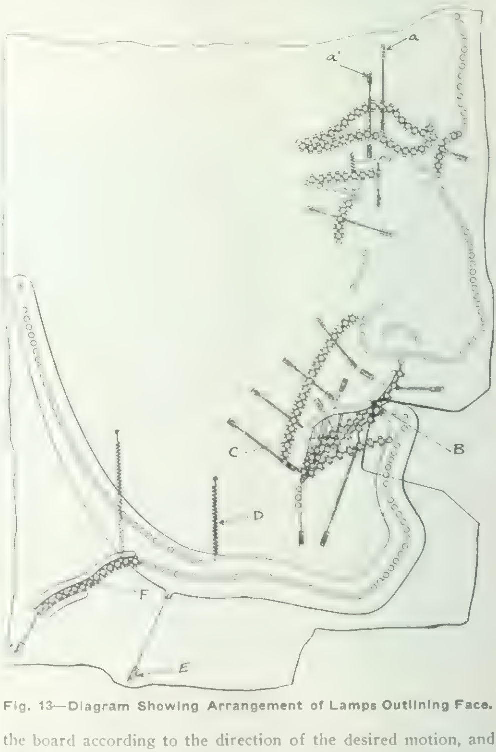


Fig. 13—Diagram Showing Arrangement of Lamps Outlining Face.

the board according to the direction of the desired motion, and upon this shaft are mounted cams so situated as to engage the movable lever shown at *C*. A roller is provided on this movable lever to reduce friction and wear. The depressions in the cam shown at *E* are so designed that the movable lever will be

depressed the proper distance to pull the spring to the required height by means of the connecting cords. The action is apparent. It has been found since working out this portion of the sign that hinged or pivoted levers will give superior results

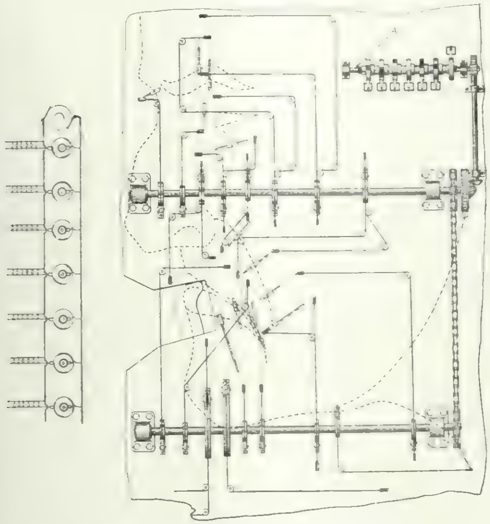


Fig. 14—Diagram of Apparatus for Effecting Combinations of Lamps.

over the cords, and will have a much longer life. Where the stop method as just described will not result in the desired motion, the scheme shown in Fig. 12, based upon the same principles as illustrated in Fig. 11, is used.

A broader application of the moving principles may be seen in Fig. 13, which is a portion of the face shown in Figs. 1 to 6 inclusive. In order to gain the expression of a frown or smile the eyebrows play an important part. At *a* and *a'* in Fig. 13 may be seen the slots provided for the levers that pass through to the back of the board and the cam mechanism. By comparing the eyebrow lines in Figs. 1 and 6 it will be noticed that the divergence is markedly different in the two, and the continuous movement from one position to the other is obtained in the manner just described. Again, the crease starting at the nose to form part of the expression is considerably different in form in Figs. 1 and 6. In Fig. 13 will be seen the varying lengths of levers, or cords, as shown by the drawing, which govern the curve of the springs of lamps forming the crease. The stationary lamps forming the bridge of the nose, forehead and lower portion of the face are indicated in Fig. 13.

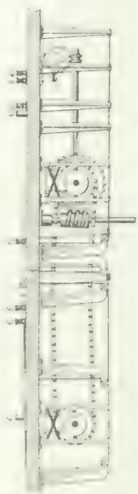


Fig. 15—End View of Apparatus Shown in Fig. 14.

Additional changes in the direction of the springs may be produced by placing stops of the correct dimensions and shape at given locations. For instance, at *B*, Fig. 13, may be seen the curved stop which governs the shape of the upper [illegible] line. The position of the spring *C* is that of the face wearing the expression shown in Fig. 1, while the expression shown in Fig. 6 is produced when the spring *C* is pulled up against the curved stop *B*.

Illustrative of the various forms of movement that may be obtained in this design attention is called to the jaw as seen in Fig. 13. When the figure bites the biscuit and chews upon it the effect is produced by the jaw being hinged at the natural point for such action to appear. A spring shown at *D* is provided to hold the jaw in place, while the actuating lever works in the opening *E*. The "Adam's apple" line *F* is actuated shortly after the biscuit has been bitten and chewed, and gives the appearance of swallowing.

In obtaining different combinations of action it is necessary to provide for the addition and subtraction of lamps as the movement progresses. This action is taken care of as shown by Fig. 14. This is a view of the rear portion of the board of which Fig. 13 is the front. At the left are shown diagrammatically several circuits, each of which is provided with a commutator. These may all be mounted on a single shaft as shown at *A*, and may be driven by a series of gears from the same shaft and by the same power that drives the movement levers. The practical use of this scheme is best illustrated by the biscuit, which, when bitten, is foreshortened the proper amount. The commutator serving that portion of the sign is so timed that it cuts the energy off at the proper instant, while another commutator throws on another set of lamps which connect the two sides of the biscuit and again form the end of it. Fig. 14 shows the general scheme for the driving gears by which means the movement levers are actuated. The number of shafts is a matter of design, the minimum being used that will serve all portions of the sign to good advantage, electrically and mechanically. Fig. 15 is the end view of Fig. 14.

NEW TELEPHONE PATENTS.

PARTY LINE SYSTEM.

A party-line system has been patented by Mr. R. C. Livingston, of Spring Valley, Minn. The line is broken up into sections, which are controlled by means of switches at the various stations. Any two stations in communication occupy the line between them, but both ends, beyond them, are available for other uses.

EXCHANGE RELAY.

A combined line and cutoff relay comprises the special feature of a telephone system for which a patent has been granted to Mr. O. C. Dennis, of Chicago. This relay is ironclad and the contact springs are carried upon the coil heads. A loose core is provided, each end of which is surmounted by an insulating cap. The relay has two windings, each confined to one end. As the core slips back and forth under the influence of the coils it drives the contact springs into proper positions.

CIRCUIT FOR SEMI AUTOMATIC SYSTEM.

A semi-automatic system is described in a patent granted to Mr. J. L. Wright, of Washington, D. C. This system is of the "auto-manual" type, the operator setting up the desired number on a keyboard. Impulses are forwarded from a continuously moving impulse shaft and wheels. It is, of course, therefore essential that no call be started except at what may be termed the beginning of a rotation of the impulse wheels. The feature of the system under consideration is the circuit and mechanical management for assuring this. The sending circuit is controlled by two locking relays which will operate only in proper sequence. These are both energized at will by the operator, but one undoes the effect of the other. Therefore, nothing is affected at the sending circuit by locking the two relays. The beginning of a rotation of this impulse system is marked by an insulated spot on one of the wheels, which releases one of the relays, and at the completion of a rotation it releases the second or cut-off relay. The latter can in no way be released first, as its release circuit is of no effect unless its companion relay be released first.

REINFORCED RECEIVER SHELL.

To strengthen the standard hard rubber or similar receiver shell to overcome excessive breakage has been found quite a problem. The solution of Mr. E. Schwartz, of Belgium, is described in a recent patent. He forms a thin sheet-metal shell,

over which he lays a coating of the insulating compound. This latter is of similar composition and thickness to the usual shell. A further improvement lies in the use of a heavy metal rim at the cap end of the shell, which ring carries the threads. The corresponding cap threads are upon the metal cap lining.

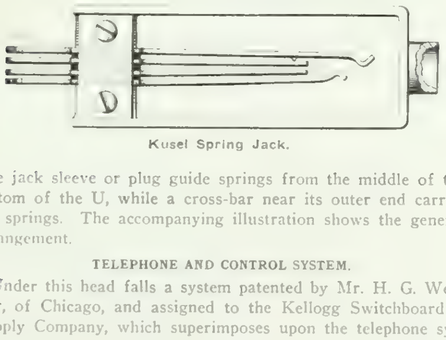
NEW APPARATUS

Of all devices required in the operation of a telephone plant, the receiver has probably been subject to the least change. Universally, the receiver has been an electromagnetic device. However, it has long been recognized that other principles of operation can be resorted to as exemplified by the condenser telephone, where the operation is due to the mutual attractions of the two oppositely charged plates of a condenser. Moreover, it has been found that the microphone is, in a rather weak way, reversible, being capable of originating very weak sounds in response to received currents. More recently, the speaking arc was devised.

Different from all of these is the receiver recently patented by Messrs. N. J. Wohl, of New York City, and Harry Hertzberg, of Brooklyn. This receiver is based upon the expansion due to thermal effects of the received currents. A leakage is arranged, one end being anchored and one end attached to the diaphragm at its center. One or more members of the linkage are fine conducting wires through which the telephone currents are led, and the expansions and contractions of these cause a corresponding pull upon the diaphragm.

Mr. G. S. McComb, of San Francisco, has invented and patented a wire receiver support of great simplicity. The wire is specially formed. One end clamps beneath the nut of the transmitter-adjusting clamp at the right of the transmitter. The wire then leads forward, thence to the left over the mouthpiece, which acts as a support. It then again turns forward, where it is formed up into shape for retaining the receiver.

A spring-jack construction forms the subject of the patent granted to Mr. H. J. Kusel, of Chicago, and assigned to the Century Telephone Construction Company. Use is made of a U-shaped frame, the jack springs being mounted within the U.



Kusel Spring Jack.

The jack sleeve or plug guide springs from the middle of the bottom of the U, while a cross-bar near its outer end carries the springs. The accompanying illustration shows the general arrangement.

TELEPHONE AND CONTROL SYSTEM.

Under this head falls a system patented by Mr. H. G. Webster, of Chicago, and assigned to the Kellogg Switchboard & Supply Company, which superimposes upon the telephone system a time-clock system. A triple-wound coil is inserted in each subscriber's line having the clock service. The primary leads are joined to the clock-control circuit, while the two secondaries are respectively connected in the two line limbs. These secondaries are mutually non-inductive, but are inductive to the primary. Bridged at the substation is a relay between condensers. This relay is highly inductive and therefore of little effect in shunting telephone currents. At the clock-setting period the master clock closes a circuit and thereby introduces a low-frequency alternating current upon the triple-coil primaries. The secondaries respond with equal and balanced power. Therefore, the opposing currents generated in the two sides of the line do not affect the telephone apparatus. However, the middle of the bridged relay at the substation is grounded, and both sides of the telephone line are also grounded at all times at the central office. Therefore, a circuit is completed for the alternating clock current, which causes the actuation of the clock-control relay at the substation.

LETTERS TO THE EDITOR.

Esperanto.

To the Editor of Electrical World:

SIR:—Doubtless you have long ago formed your opinion as to the merits of Esperanto, the international language. I hope that it is favorable; but as there is much irresponsible criticism of Esperanto, especially on occasion of the recent international convention in Washington, I want to offer an opportunity for every thinker to judge for himself. I have had prepared 100,000 brief grammars of the language in pamphlet form, and will send one free to any person who is sufficiently interested to ask for it, enclosing stamp for reply. I think it really due to this great movement for an international auxiliary language, which now embraces *fifty nations* in its scope, that you publish this letter so that your readers may have the opportunity of judging for themselves.

Chicago, ARTHUR BAKER,
700 E. Fortieth Street. Editor *Amerika Esperantisto.*

Central Station Rates.

To the Editor of Electrical World:

SIR:—I have read with much interest the article in your Sept. 15 issue by Harry G. D. Nutting on "Central Station Rates." I believe that Mr. Nutting's ideas meet more nearly the ideas and experiences of managers of small plants than anything which has come to my notice in recent publications.

There is, however, one statement which Mr. Nutting makes which it seems to me should be qualified somewhat. He says, "Anything proportioned on the connected load cannot possibly be correct" and that "it is probable that the most satisfactory way of determining the demand at present is by special investigation as to the requirements of individual consumers."

Unless the demand is actually measured by a meter, on just what factors are we to estimate the demand when we make the special investigation referred to? Will not the connected load be the main factor? Of course, the nature of the load and the nature of the purpose for which it is to be used may be admitted as factors, but these factors tend rather to establish the class in which a customer should be placed than his demand.

Just what constitutes "connected load" is somewhat of a problem in itself. As the term is used in rate-making, I believe it generally refers to the normal connected load when the installation has got beyond its experimental stage and settled down to normal running. To determine this connected load requires a special investigation of each installation, and such details as the nature and location of the lamps, the number of outlets in a room, etc., must be considered; but they should be considered with respect to fixed rules and two installations of the same kind and size should be rated alike.

When a customer wants to know why his fixed charge is larger than his neighbor's, we should be in a position to show him without bringing any personal element whatever into play. If you tell him that his neighbor uses more 8-cp lamps than he does, he will perhaps agree to install the same number of eights that his neighbor has; perhaps he may do so and then be dissatisfied, when the matter will again come before the manager.

It is perfectly true that it is an easy matter to change from 16 cp to 8 cp, and it is just as easy to change from 16 cp to 32 cp; and as to borrowing an electric iron, this too is very true, and I am sure that we are all very glad indeed that the time has come when the housewife thinks more of the electric iron than of the old kind, even if she has to borrow one. If a customer wishes to use one or two 32-cp lamps in a place normally laid out and intended for sixteens, he is simply using his installation and that of the company in a more efficient manner than his neighbor who keeps the sixteen or an eight in use; consequently I do not see that it is very far out of the way

if his fixed charge is not increased thereby. In fact, the sum total of all these small changes which may be made from the normal connected load will, in actual operation, make no difference in the peak demand on the station and very little, if any, on any fixed expenses whatever.

It is, in fact, not absolutely certain that a measured maximum demand is entirely correct for the purpose. Does not a station sometimes have to figure on the possible load which a certain installation may put on the peak even though that installation never does put it on as shown by the meter? When all is said and done the writer believes that at the present time the best way to fix the demand charge is to divide the customers into as many distinct classes as possible and then determine the normal connected load by certain fixed rules. A certain percentage of this connected load should then be taken as the basis for the demand charge. The exact percentage must be obtained from observations of the *average* demands of the different classes and would remain practically constant when once determined.

The metallic-filament lamp is an important factor in determining connected load, but if the central station has the proper control of the lamp situation, it is in a position to know whether or not a customer who is rated on a metallic-filament basis is using this type of lamp or not.

In closing I wish to say with Mr. Nutting, "It becomes necessary to distribute these expenses among the various customers in a reasonable and equitable way. Here is the most difficult part of scientific rate-making," and I believe that the question cannot be too fully discussed at the present time.

Tarrytown, N. Y. S. W. BORDEN.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Shunt Commutator Motor.—R. VAN CAUWENBERGHE.—The shunt commutator motor for single-phase or polyphase currents is started as a series or repulsion motor and is operated as a shunt motor only after it has run up to speed. On the basis of practical formulas the author gives the mathematical theory of the machine operated as a generator or a motor. He thinks the only great disadvantage of this machine is its commutator. Its advantages are the absence of an exciter, the simplicity and exactness of compounding, and the simplicity of parallel operation without surging. If the air-gap is made small enough, the excitations can be considerably reduced so that there are only a few more amp-turns on the rotor than on the stator. There is no possibility of such enormous short-circuiting current as occurs with ordinary turbo-generators where they may assume a value of from twenty to thirty times the normal current. The voltage curve is a perfect sine curve at all loads; this is a great advantage for single-phase generators. The rotor core does not need to be highly saturated, which is an advantage for turbo-generators.—*Elek. Zeit.*, Sept. 8.

Magnetizing Current of Induction Motors.—T. HOOCK AND R. E. HELLMUND.—A critical discussion of the different methods, and their difficulties, of calculating the magnetizing current of single-phase or polyphase induction motors. The authors deal successively with the determinations of the amp-turns for the air-gap, the amp-turns for the stator and rotor cores, the amp-turns of the stator and rotor teeth, and the effect of stray fluxes.—*Elek. u. Masch.* (Vienna), Sept. 4.

Lamps and Lighting.

Quartz Tube Lamp.—An illustrated description of two new mercury-vapor quartz-tube lamps of British make fitted in a globe so as to give the appearance of an arc lamp. One is called the silica lamp and consists of a clear or opal globe, which fits on the totally enclosed metal case, and can be lowered at will, leaving the inside open for inspection, etc. A quartz tube *A* (Fig. 1) of somewhat irregular shape, exhausted to a high degree of vacuum, and containing a quantity of mercury, is the source of light, the luminous portion in the smaller capacity lamps (1200 hefner cp, 4 amp, 100 volts to 130 volts) being about 1.75 in., and in the larger (3000 cp, 3.5 amp, 200 volts to 240 volts) about 4 in. The tube is mounted within the globe on the outside of the base, and is arranged so that it can be tilted and the mercury may be free to run to and from each end. A solenoid *B*, the plunger of which is connected to one end of the quartz tube, and an automatic cut-out *I* are both mounted in the case. An external resistor *R* is mounted in any convenient place. On putting the lamp in circuit by switch 1 the current first passes from the positive main through the resistor *R*, the cut-out *i* and the solenoid *B*, back to the negative main, the solenoid causing the positive end of the tube to be tilted and the mercury to flow along the tube to the opposite end, thereby completing the tube circuit and lighting the lamp. As the cut-out coil is in series with the tube, this now comes into operation and immediately breaks the solenoid current. The quartz tube then falls back to its original position and remains illuminated until the lamp is switched off. As soon as the mercury in the quartz tube meets and the current in the tube is thereby started, a small portion of the mercury is vaporized. This solely constitutes the conducting medium in the tube and is the only source of light, there being a continual process of vaporization and condensation whenever the lamp is burning. The advantages over arc lamps are an absolutely steady light (bluish-white in color) and absence of any deposit within the globe. The comparative running costs per hour, with energy at 2 cents per kw-hour, for the open, enclosed and flame-type arcs, respectively, are given as 5.52 cents, 2.24 cents and 3.64 cents, as against 1.14 cents for the silica lamp, with the same candle-power conditions in each case. Another quartz-tube lamp brought out by another company is called the "quartzlite" lamp and is made to give from 1800 cp to 2500 cp on direct-current circuits. The lamp is made for 100-volt to 150-volt circuits and gives an average of 4 cp per watt.—Lond. *Elec. Review.*, Sept. 8.

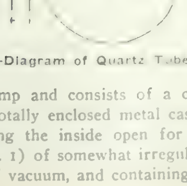


Fig. 1—Diagram of Quartz Tube Lamp

Arc Lamps.—O. ARENDT.—An illustrated paper read before the Berlin Electrical Society on arc lamps without regulating mechanism, dealing especially with the development of the Beck lamp. In the original lamp the positive carbon electrode was provided with a lateral rib which rested on a metallic support, and, by gradually burning off, regulated the sliding down of the electrode by gravity. Since 1906 the negative electrode is made to rest on the metallic support and the latter is connected to the supply circuit; silver is used for this metallic support. Ventilation is so provided for the hot vapors that there is no deposit on the globe. Recently a four-arc Beck lamp has been constructed for which, on account of the great heat produced, a special ventilation system had to be designed. According to tests of Goerges a 220-volt, 12.2-amp direct-current lamp has a mean spherical candle-power of 14,300 hefner candles without globe and 8860 candles with globe; oper-

ated with alternating current the mean spherical candle-power is 6340 without globe and 3940 with globe. Goerges calculates therefrom the mean hemispherical candle-power of the direct-current lamp as 25,700 hefners without globe, while some months before this had been determined experimentally as 25,500 cp. "These surprisingly large candle-powers can be explained only by reflection and interference phenomena, since the simple addition of the candle-powers of the four single arcs would not give one-half of the measured and calculated candle-powers." The author finally describes the Thauma lamp, which is a differential shunt-excited enclosed-arc lamp, provided with "Beck regulators," that is, thin iron wire resistors in a glass tube which is evacuated or filled with inert gases. These are in parallel with one-half of the differential shunt excitation.—*Elek. Zeit.*, Sept. 1.

Metallic-Filament Patent.—The British Solicitor-General has affirmed the decision of the Patent Office of July, 1907, to grant a patent to the Consortium f. Elektrochem. Ind. in spite of strenuous opposition. The patent was applied for on July 6, 1906, and covers the process of heating the formed tungsten filament to a temperature close upon its melting point before it is employed in a lamp in order to drive off any impurities and to render it denser. This may be accomplished by external heating or by passing a current through the mounted filament before sealing the bulb. Opposition had come from Drs. A. Just and F. Hanaman and from the German Welsbach Company.—Lond. *Elec. Eng'ing*, Sept. 8.

Metallic-Filament Lamp.—A note on a recent British patent (2432, 1910; Sept. 1, 1910) of the Felten & Guilleaume-Lahmeyerwerke A.-G. In order to ascertain whether the complaints of consumers that lamps have broken down after a short period of burning are justified, a substance that is chemically affected by the light, heat or current is placed in the bulb. The lighting of the lamp will then produce discoloration or some other indication of its proper working. The insertion of checking devices of different degrees of sensitiveness for recording the duration of the passage of current through a lamp is also covered by this patent.—Lond. *Elec. Eng'ing*, Sept. 8.

Lighting and Globe Design.—C. Toone.—An article giving some general considerations concerning the principles of modern lighting. Values are given of the luminous efficiency of various lamps and of their intrinsic brilliancy. Incandescent lamps are frequently, and arc lamps practically always, used in conjunction with a diffusing globe. This globe should be of such a nature and size as to result in a mean intrinsic brilliancy of its surface of from 0.0005 cp to 0.0020 cp per square millimeter, or as nearly within this range as is practicable. Globe diameters of more than 40 cm are not convenient, hence the suggested globe surface brilliancy is frequently exceeded in the case of flame arcs. The diagram of Fig. 2 is useful in globe design. By its aid the required globe diameter for a given surface brilliancy can be estimated, the mean spherical candle-power of the source and the nature of the globe material being known. Conversely, with the same known factors, the probable brilliancy of the globe of a certain diameter can be determined; again, a suitable globe material can be decided on if the remaining conditions are specified. The first suggested application is carried out as follows: The problem is to find the diameter of an opal globe required to give a surface brilliancy of about 0.10 cp per square centimeter with a lamp having a mean spherical candle-power of 975. Through the point, on the left-hand scale of the diagram, representing 975 cp, draw a straight line through the point representing 0.10 cp per square centimeter on the second scale (from the left). Produce this line to cut the center axis in a point *A* (this center axis is purely constructional). Referring to the table at the head of the diagram it will be seen that the constant $k = 0.50$ for opal globes; hence, through *A* and the point representing $k = 0.50$ draw a straight line which, produced, cuts the right-hand scale in a point representing $D = 39.5$ cm (15.5 in.); that is, the required globe diameter is about 40 cm. From the following values it appears that from 40 per cent to 50 per cent absorption may be expected with such a globe (large globes absorb a higher percentage than do small globes of the same material): Clear glass, from 5 per cent to 15 per cent; rippled glass, from 20 per cent to 25 per cent; Holophane glass, from 20 per cent to 30 per cent; ground glass, from 30 per cent to 40 per cent; heavily ground glass,

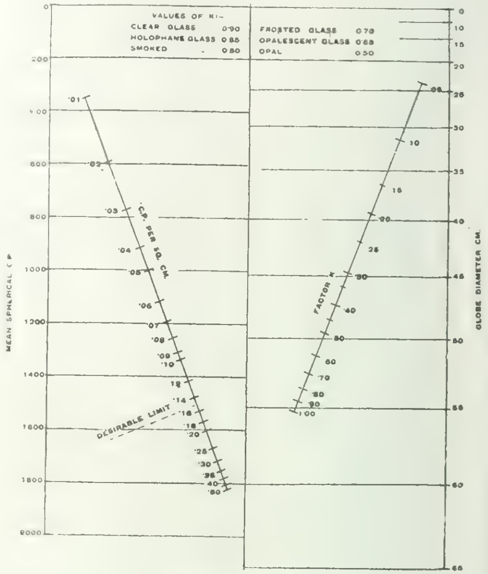


Fig. 2—Lighting and Globe Design.

from 40 per cent to 50 per cent; opal glass, from 50 per cent to 60 per cent. The desirable illumination in most interiors is between 0.7 ft.-candle and 2 ft.-candles. The author considers indirect lighting to be the best for interiors.—Lond. *Elec. Review*, Sept. 9.

Sealing Iron Wire Hermetically into Glass.—H. J. S. Sand.—An abstract of a British Association paper. The glass is fused round the iron wire, and while it is still hot a small piece of heated steel tube surrounding the wire is pushed a few millimeters into the glass. After cooling, the steel tube is soldered to the wire. A vacuum tight seal is produced between the glass and the inner surface of the steel tube, which on cooling becomes slightly stretched and at the same time compresses the glass. The author pointed to the possibilities of this method in connection with electric lamp manufacture and the saving which would be effected by obviating the use of platinum.—Lond. *Elec. Eng'ing*, Sept. 8.

Generation, Transmission and Distribution.

Electric and Steam Hoists.—A preliminary report, signed by Frölich, Dobbelstein and Bütow, on extended tests carried out on eight different hoisting plants under the auspices of the Association of German Engineers and several mining societies in the Dortmund district. The object was especially to get exact comparative figures for electric and steam operation. The four electric plants where tests were made were equipped with the Ilgner system. The power consumed for one hoisting horse-power varied between 1.39 kw and 2.47 kw for the main hoisting period (seven and one-half hours) and between 1.56 kw and 2.70 kw for the whole day (twenty-four hours). In the four steam-operated plants the steam consumption for one hoisting hp-hour varied between 16.5 kg and 26.82 kg (36.3 lb. and 59 lb.) of steam for the main hoisting period and between 24.1 kg and 30.96 kg (53 lb. and 68.1 lb) for the whole day.—*Elek. Zeit.*, Sept. 1.

Electricity for Organ Blowing.—An illustrated description of an organ-blowing equipment in which a motor of small

horse-power running at a slow speed on a direct-current system operates by means of worm gear enclosed in an oil bath a second motion shaft which transmits power by means of cranks suitably joined to the reciprocating motion of the feed bellows. Control is effected by means of a flexible rope worked from the main reservoir, which passes round a drum attached to a specially designed type of controller. The contact-making arm of this controller is free from the shaft and normally hangs in a vertical position by reason of its own weight. When the current is switched on a definite quantity of resistance is in series with the armature, giving a safe starting position for the rheostat. As the reservoir cover rises the radial arm keyed to the shaft and carrying a pivoted armature comes into contact with a solenoid magnet fixed on the contact-making arm of the controller. After this contact is made the two controller arms remain magnetically locked together until the current is interrupted, and the controller thus works as an ordinary series controller. The inconvenient starting switch is thus entirely done away with, an ordinary switch at the console being sufficient to start and stop the motor. The regulating resistance, which is placed in series with the motor, is of special arrangement.—Lond. *Elec. Review*, Sept. 9.

High-Tension Transmission Line in Italy.—A note stating that part of the water-power of the Pescara River, developed by an Italian electrochemical company, is soon to be utilized for supplying electricity to Naples. About 27,000 hp will be transmitted. The transmission line will have a length of at least 200 km (120 miles). The transmission e.m.f. will be [illegible] volts.—*La Revue [illegible]* [illegible]

[illegible] illustrated description of the different systems of electric driving of rolling mills, with reference to typical European installations. In the first instalment non-reversing rolling mills are dealt with; in the second instalment reversing rolling mills are discussed.—*La Revue Elec.*, Aug. 15, 30.

Pumps and Compressors.—L. WEIL.—A description, illustrated by numerous diagrams, of the various types of automatic starting and regulating devices for motors driving pumps and compressors.—*Elek. u. Masch.* (Vienna), Aug. 21 and 28.

Traction.

Single-Phase Traction in London.—P. DAWSON.—A paper read before the British Association on the electrification of the London, Brighton & South Coast Railway between Victoria and London Bridge, where the single-phase system is used. He said that experience has shown that the acceleration obtained is quite as good as anything obtained by continuous-current working in spite of claims put forward to the effect that the continuous-current motor would give superior results in this respect. Moreover, the extra weight involved by the transformers, etc., is only 10 per cent. Coming to the question of energy consumption, this was found to be from 70 watt-hours to 80 watt-hours per ton-mile for the single-phase system and from 90 to 100 for continuous current. These figures referred to energy consumption at the generating station; on the trains themselves the figures are practically identical for the two systems. The difference at the station is due to the different transmission efficiencies. The power-factor for the whole system is about 80 per cent. Up to the present the motors have been a complete success. The commutators present a black, shiny appearance, very similar to that of a continuous-current machine, and although the sparking is more obvious than with direct-current machines, yet it does not appear to do as much harm. This result was demonstrated by the fact that the commutators were used for 50,000 miles before it was necessary to turn them down. From the commencement not the slightest trouble has been experienced with the overhead work, and after eight months no appreciable wear of the conductor can be detected. Each bow strip required renewal after running for 15,000 miles. One of the most serious problems was the lowering of the bow from 21 ft. in the yards to 13 ft. under bridges. This was a very difficult matter, but it has been overcome successfully, although in some instances the bow is only 1.5 in. from the under surface of the bridge. Owing to the fact that porcelain is a strong, reliable substance under compression, but weak and unreliable under tension or flexion, the compression method has been adopted throughout. He believes that the system described is the only one where the catenary suspensions are doubly insulated. A feature of interest is the oft-recurring St. Andrew's cross painted on the ironwork at intervals along the permanent way. These crosses mark positions where it is most economical for the motormen to switch off the current, and their adoption has resulted in a saving of from 5 per cent to 10 per cent in the cost of energy. From diagrams it appears that the acceleration obtained is equal to over 1 mile per hour per second. He gave a brief description of an interesting gasoline-electric inspection vehicle for use on the line. This little coach is equipped with a gasoline engine and a small generator, and can be run to any part of the system with great rapidity. It is entirely independent of the overhead wires, and can, therefore, be employed when the current is switched off. The generator provides illumination and enables inspections and work to be carried out with great ease.—Lond. *Electrician*, Sept. 9.

Single-Phase Traction in Sweden.—Some supplementary notes on the trials which have been made on the Swedish State railways with single-phase traction. Data are given on the power-house construction and the automatic voltage-regulation method employed. Use is made of a voltage regulator of Oefoerholm, which is based on the principle of the Tirrill regulator, but differs from it in details. Line construction and the different types of porcelain insulators used are then dealt with, and the test values are given for the impedance and insulation resistance of the rails when used as carriers of the return current.—*Elek. Zeit.*, Sept. 8.

Accelerometer.—H. E. WIMPERIS.—An abstract of a British Association paper on an accelerometer for the measurement of road resistance. The instrument consists of a brass box about 4 in. across, containing a copper disk mounted on a vertical pivot and "damped" in its motions by a permanent magnet. The center of gravity of the disk is purposely removed from the axis so that when the box moves forward one side of the disk tends to lag behind, thus partially winding up a coiled spring and actuating a pointer which moves over a scale. To render the reading unaffected by any accelerations at right angles to the direction of motion use is made of a second parallel axis which is geared to the first one and has attached to it masses having the same mass movement as the disk itself. Couples about these two axes add up in the direction of motion, but neutralize one another in any direction at right angles. The accelerometer, therefore, reads in one of the three directions of space only, and is not affected by even violent movements in the other two directions. With this instrument the author has measured the road resistance of various classes of road and has obtained figures varying from 50 lb. to 210 lb. per ton. On main-line railways the resistance is usually from 12 lb. to 30 lb. per ton, depending on the speed. He has also measured the acceleration of practically all the London electric railways with this instrument. The acceleration of the London, Brighton & South Coast single-phase line was 1.9 ft. per second per second, which was identical with the figure given by Dawson. The breaking retardation was found to be 5.8 ft. per second per second, which was about twice that of the Great Northern, Piccadilly & Brompton Railway, which had about the same acceleration. The main use to which the instrument has been put hitherto, however, is in connection with motor-cars.—Lond. *Elec. Eng'ing*, Sept. 8.

Installations, Systems and Appliances.

The Price of Electricity.—E. W. COWAN.—The first part of a paper read before the Economic Science Section of the British Association. The author criticises the principles on which the charges for electrical energy are usually based, this basis being an equal rate of profit from every class of consumer. Although this principle is safe, the author argues that best economic results cannot be obtained because the factor of demand is entirely ignored. The demand for electricity is of

a "composite" kind, energy being required for lamps, motors and heaters. Classified tariffs should be adopted so as to secure the greatest economic advantage. The author supports his views by reference to the adjustment of prices in railway freight charges and other lines of business.—Lond. *Electrician*, Sept. 9.

British Central Station.—An account of last year's financial record of the Glasgow municipal central station. Of the total of 36,479,243 kw-hours sold, 15,087,680 kw-hours were used for private lighting, 19 655,173 kw-hours for motors and heaters, and 1,556,661 kw-hours for public lighting, while the remaining 179,729 kw-hours were sold by contract. The energy was sold at the following rates:

Lighting:		
Shops, warehouses, offices, etc.	915	kw-hours at 16 c[illegible]
Shops, warehouses, offices, etc.	7,885,833	" " " 7
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Special lighting	1,711,764	" " " 3
[illegible]	[illegible]	[illegible]
	15,087,680	
Industrial service:		
[illegible]	[illegible]	
Motors and heaters	9,011,794	" " " 7½
Motors	1,172,238	" " " 2
[illegible]	[illegible]	
	19,655,173	

A table is then given of the number of hours during which different consumers used electrical energy. This table shows a remarkable decrease in consumption by "short-hour" and what may be called "medium-hour" consumers, in spite of a considerable increase in the number of consumers. Perhaps the most gratifying feature is the increase in the sales of energy for heating, the increase of 75,674 kw-hours representing 54 per cent of the previous year's output. The total generating and distributing cost per kw-hour sold, without capital charges, was 1.460 cents; including interest and sinking fund, 2.728 cents, and including depreciation, 3.47 cents.—Lond. *Electrician*, Sept. 9.

Central Station in Brazil.—A. McPherson.—An illustrated description of the central station of Maceio, a city of 35,000 inhabitants, in Brazil. Only 1.5 per cent of the population are consumers of the station. The rating of the plant is 300 kw, the single-phase system being used.—Lond. *Elec, Review*. Sept. 9.

Wires, Wiring and Conduits.

Underground Cables for High Tensions.—M. J. Grosselin.—The author first quotes several opinions which have been expressed on the impossibility of using underground cables for long-distance transmission at very high tensions, and then refers to the fact that 40,000-volt cables are in successful use at two places in France. At the Girod plant at Ugine there are 2.6 km (1.6 miles) of $3 \times 40{,}000$-volt cable, while the Grenoble Lighting & Power Company has 4.5 km (2.7 miles) of the same cable. The author discusses the limitations of the construction of three-conductor and single-conductor cables and finds that the former can be built up to 50,000 volts, the latter up to 67,000 volts. The capacity effects and the possibilities of a dangerous rise of voltage are then discussed, and the author concludes that long-distance transmission by underground cables at from 50,000 volts to 67,000 volts is possible if transformers with a one-to-one ratio of transformation are inserted to take care of the charging current and to dampen excessive voltages. Some estimates of cost are added.—*La Revue Elec.*, Aug. 15.

Tests of High-Tension Insulators.—W. Weicker.—The conclusion of his paper on the conditions of weather, etc., which are of especial importance for the discharge of high-tension insulators. The amount of humidity in the air is a factor of prime importance, but is often neglected in laboratory experiments. The following losses of a 6500-volt insulator were observed under different weather conditions: In dry air, 0.05 [illegible] rain with high humidity in the air, 1.1 watts; in a blizzard-like thunderstorm rain 1.5 watts; in heavy snowfall, mixed with rain above 0 deg. C., with simultaneous strong wind, 2.2 watts. Wet snow, therefore, represents the most unfavorable condition for a high-tension insulator. The suitable arrangement of insulator tests so as to approach the conditions of practice is discussed.—*Elek. Zeit.*, Sept. 1.

Hermetically Sealing Iron Wire into Glass.—(See the abstract of the paper by Sand above, under Lamps and Lighting.)

Electrophysics and Magnetism.

Electrotonic Theory.—A note on a recent paper by J. A. Crowther on the scattering of homogeneous beta rays and the number of electrons in the atom. In this investigation the scattering of a homogeneous pencil of beta rays was measured for various substances and for rays of different velocity. It was shown to obey the following laws: For rays of given velocity the intensity I of the radiation contained within a given cone may be expressed by the equation $I/I_0 = 1 - e^{-kt}$ where t is the thickness of the material and k a constant depending upon the angle of the cone. For rays of given velocity the most probable angle of emergence was proportional to the square root of the thickness of material traversed by the rays. For rays of different velocities the probable angle of emergence divided by the square root of the thickness traversed was inversely proportional to the product of the mass of the incident beta particle into the square of its velocity. From equations given by Sir J. J. Thomson the number of electrons contained in atoms of different elements was deduced. It was thus found that the ratio of the number of electrons per atom to the atomic weight was constant, the ratio being very nearly 3.0 for all the elements examined; that the positive electricity within the atom was not in an electronic condition, but was distributed fairly uniformly over the space occupied by the atom. Experiments were also described on the absorption of homogeneous beta rays. It was shown that the first stage in the absorption of a pencil of homogeneous beta rays consisted in the scattering of the rays according to the laws already considered. The absorption of the completely scattered radiation was then shown to take place according to an exponential law. —Lond. *Electrician*, Sept. 2.

Electrochemistry and Batteries.

Bleaching Liquor as a By Product of an English Central Station.—An article on the production of calcium hypochlorite (bleaching liquor) by electrolysis in connection with the Poplar municipal central station. This plant reported on consists of forty cells through which salt water is circulated, the cells being run in series on a 220-volt circuit and taking from 16 amp to 25 amp. The plant is in duplicate. These two plants can deliver in eight hours 400 gal. of hypochlorite solution at a strength of from 4.5 grams to 6.1 grams of chlorine per liter. The output per month during 1909 varied from 658 gal. in December to 4326 gal. in August, or 173 gal. per working day. The cost of material on a yearly output of 27,216 gal. was $265.55, electricity costing $149.40. The bottles used for distribution are charged for extra. A fresh use for the disinfectant has also been found in the public baths of the district, where it is used to eliminate any danger of infection being spread in the bath, as well as to oxidize the various impurities given off into the water before it is changed; 70 gal. of 2.5-grams solution is added to a 70,000-gal. bath. This, which in any case is a commendable precaution, may easily come to be regarded in the case of populous districts as a necessity. From the central-station engineer's point of view a fair-sized motor would doubtless provide a more satisfactory load. But if a municipality has to buy disinfectants it is better to make them in its own central station. The hypochloride solution is chiefly used in Poplar for sterilizing the water in swimming baths, street watering (of course, in a highly diluted form) and for distribution by the public health department in cases of outbreaks of infectious diseases.—Lond. *Electrician*, Sept. 9.

Electric Steel Furnace Plant.—H. Thieme.—After a short discussion of the principal features of the electric induction furnace for steel making, a detailed illustrated description is

given of the electric steel plant [illegible] Le Gallais Met. & Company, in [illegible]. In the present instalment the electric power plant and the construction of the electric furnace are described. There are two single-phase furnaces, each from 3 tons to 4 tons rating, and a

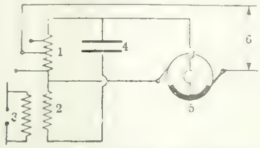


Fig. 3—Diagram of Arrangement for High-Tension Discharges.

three-phase furnace of 1½ tons rating. The article is to be concluded.—*Elek. Zeit.*, Sept. 8.

Units, Measurements and Instruments.

High-Tension Discharge.—[illegible]—A paper read before the British Association on a new apparatus for using high-tension discharges suitable for direct connection with an alternating-current supply circuit. The principle is shown in Fig. 3. Energy is stored in a magnetic field by an inductance 1. It is then permitted to surge into a condenser 4, which forms with the inductance 1 a low-frequency oscillatory circuit. When the energy is accumulated in the condenser 4 the latter is mechanically bridged across the primary winding 2 of an induction coil with which it forms a high-frequency oscillatory circuit. The energy is then transmitted by the secondary winding 3 of the induction coil to the work circuit and can be of an oscillatory or unidirectional character, according to the purpose in view. The above cycle of events is controlled by a contact maker 5, which is driven by a small motor arranged with commutator and slip-rings so that the apparatus can be worked when the mains 6 supply either direct or alternating current. Tapping points on the inductance 1 allow of a suitable range of voltages being used. At "make" the system is switched onto the supply mains, the current rises in the winding of the inductance 1 and builds up the magnetic field. When sufficient energy has been stored the system is severed from the mains and this may be referred to as the epoch of "break." As only the current in the condenser 4 passes through the primary winding 2 the inverse e.m.f. induced in the secondary winding 3 is so small as to be negligible, but if desired it can be entirely eliminated by a modificaton in the connections. At the epoch of "break" the energy stored in the condenser 4 is added to that in the inductance 1, and then the total energy in the inductance 1 begins to surge into the condenser. At the precise epoch when the condenser has received the whole of the energy in virtue of its reverse charge the contact maker 5 short-circuits the inductance 1. The condenser then discharges with great rapidity through the primary winding 2, and the energy then oscillates between the condenser and primary winding in the well-known manner.—Lond. *Electrician*, Sept. 9.

Weston Cell.—In a report to the British Association results are given of an investigation made at the National Physical Laboratory concerning the limits of temperature between which

[illegible]	Lower Limit, Deg. C.	Upper Limit, Deg. C.
6	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]
12	[illegible]	[illegible]
12	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

various cadmium amalgams may be most usefully employed in the Weston standard cell. [illegible] The [illegible] the Weston cell far surpasses that of five years ago. At the National Physical Laboratory 67 cells were tested in 1909, and of these 60 agreed with the laboratory standards within 1 part in 10,000. What is not understood at present is the occurrence of strange hysteresis effects in a few cells (see below).—Lond. *Electrician*, Sept. 9.

Weston Standard Cell.—An editorial note on hysteresis effects in some Weston cells, to which reference is made in the report of the electrical standards committee of the British Association. Cells which exhibit marked hysteresis effects invariably change with time at a comparatively rapid rate. The cause of the hysteresis seems to be different from that observed, many years ago, in the case of the tube form of Clark cell, for in the latter case the irregularities appeared to be chiefly due to a difference of concentrations of the zinc sulphate solution at the anode and cathode. But, as the Rayleigh H form of vessel is used for the Weston cell, a difference of concentration in the cadmium sulphate solution at anode and cathode is very improbable. If a Weston cell in which the hysteresis effect occurs is raised in temperature, the decrease in e.m.f. is, in general, very nearly normal; but when afterward the temperature is lowered the increase in e.m.f. is abnormal. All cells sent for test at the National Physical Laboratory are examined for this hysteresis effect, and no certificate is granted if the effect exceeds a certain limit. For the purpose of the test the cells are kept at a constant temperature for a few days and their e.m.f. measured; afterward, the temperature is increased 10 deg. C. and the cells maintained at this temperature for twenty-four hours. The cells then cool in a normal manner to the initial temperature and after two days the e.m.f. is again measured. If this disagrees with the e.m.f. first observed by 0.0001 volt or more the cell is regarded as abnormal and no certificate is granted. Comparatively few cells fail in this test; in many cases there is absolute agreement between the initial and final values of the e.m.f.—Lond. *Electrician*, Sept. 9.

Alternating-Current Galvanometer.—W. E. Sumpner and W. C. S. Phillips.—A paper read before the Physical Society of London. The authors describe a galvanometer for alternating-current circuits and resembling a moving-coil galvanometer in almost every respect except that its field is due to a laminated electromagnet excited by an alternating voltage. A specially shaped stamping is placed between the poles. The use of the instrument as a voltmeter and for comparing inductances and capacities is explained.—Lond. *Electrician*, Sept. 9.

Miscellaneous.

British Association.—This year's meeting has been held at Sheffield, beginning on Aug. 31. The president is Dr. T. G. Bonney. Abstracts of papers presented will be given, or are being given, elsewhere in the Digest.—Lond. *Electrician*, Sept. 9.

Neglect of Science by Commerce and Industry.—An account of a discussion held at a joint meeting of the Chemical and Educational Science Sections of the British Association. Mr. R. Blair in opening the discussion said that one of the main defects of college training is neglect of the question of cost in design and the commercial side generally. All engineering firms exist for the purpose of making a profit, and modern conditions render it essential that all technical students should fully realize the importance of economical design and cheap maintenance. Employers want men who can in their designs give the most for the money. It is quite insufficient to teach design on physical principles alone. Methods of production, ease of repair, depreciation, and even conditions of transit in large machines, should all be taught in connection with effective design. On the other hand, in order that heads of firms should more fully appreciate the need for science in business, he recommends special courses in technical training for them. He deplores the lack of application of scientific principles to canvassing the various markets of the world, a matter to which attention is being called repeatedly by British consuls abroad.

Another suggestion is that consultative committees should be attached to all faculties or departments, such committees to be advisory, and to be composed of commercial leaders and business experts of the highest reputation. Probably this is the best way of enlisting the sympathy of industrial and commercial men. Subsequent speakers included Sir W. Tilden, Dr. H. T. Bovey, Dr. E. H. Griffiths, Sir William White, Mr. J. E. Stead and Prof. E. H. Armstrong. Sir W. Tilden thought the greatest ignorance on the part of employers in relation to science was to be found in the electrical and chemical industries. He supported this statement by a reference to the exceedingly low salaries frequently offered to fully qualified men. He also criticised the government in this connection and said it was impossible to find an official, from a cabinet minister downward, holding a superior administrative position who had received an education in which physical science had formed any substantial part. The measure of parliamentary sentiment in favor of science is to be found in the moderate grants made for this purpose. The Imperial College of Science is quite inadequately endowed. Dr. H. T. Bovey said the only means of securing the universal application of science to industry is by the organization and centralization of technical education. In America it is essential for a young engineer to have received a diploma in some technical institution of repute before he can obtain employment. Sir William White and other speakers differed from the view that England is behind other countries in the application of science to industry. Principal Griffiths depreciated abuse of the industrial leaders. There are faults on both sides, and the cause of the present unsatisfactory state of affairs is the lack of means of communication between those working in the universities and the commercial men. If the universities cannot provide the type of men required in business they must put their house in order. The need for co-operation was supported by other speakers. Sir William White suggested that a laboratory should be attached to all commercial undertakings, a policy which has led to some remarkable results in the steel industry.—Lond. *Elec. Eng'ing*, Sept. 8.

Book Review.

Children's Diet in Home and School. By Mrs. Louise E. Hogan. Revised edition. New York: Doubleday, Page & Company. 194 pages. Price, 75 cents.

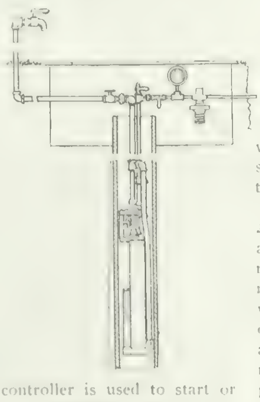
As indicating the growing recognition of electric heating it is interesting to note that the revised edition of this well-known little book on children's diet contains a section devoted to electric cooking and several other applications of electric heat, such as to milk warming, pasteurizing, etc. A considerable number of recipes are included for the preparation of nursery foods in the electric chafing dish, and indications are given to recipes in other sections of the book to which electric utensils may be applied. We are told that a number of central-station companies have purchased editions for special complimentary distribution among their residential customers with families.

New Apparatus and Appliances

ELECTRO-PNEUMATIC WATER-SUPPLY SYSTEM.

As one feature of a water-suppply system for furnishing water from a well or other source of supply, without storage, by air pressure, Mr. Thomas O. Perry, of Chicago, has invented an automatic electric controller which is of considerable interest. In general terms the Perry automatic water system comprises an electric motor or other source of power, driving an air compressor which stores air in a tank from which a pneumatic pump submerged in the well is driven. By means of this pump water is supplied to lines of piping with faucets, and the water is, therefore, available "fresh from the well," without storage, whenever needed.

The motor, compressor and tank may be located at any convenient place. Having connected these properly and started the compressor, the air is stored in the tank to any pressure desired and then the compressor is stopped. The compressed air operates the pump and is used only when water is drawn from the faucets. It is not necessary to start the compressor again until the air reservoir requires re-charging. A pressure reducer on the air line maintains an even pressure of water at the faucets, regardless of the amount of air pressure in the tank, down to a predetermined minimum pressure. It is, therefore, necessary to operate the motor only intermittently when the pressure in the tank, as shown by a gage, falls to a certain point. The Perry electric controller is used to start or stop the motor connected to the air compressor when the air pressure [illegible] a certain minimum or maximum.



Where electric service is available the use of an electric motor for driving the compressor is always recommended. By the use of the electric drive a comparatively small air reservoir may be used, as the automatic controller regulates the system closely within any desired limit. Fig. 1 is an illustration showing the entire system arranged for electric drive.

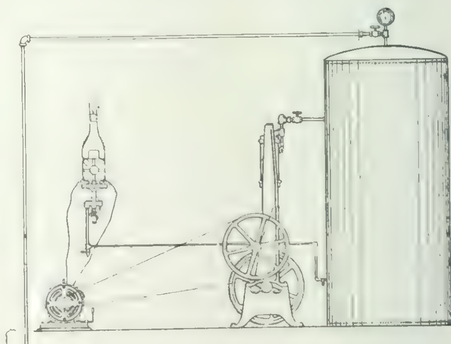


Fig. 1—Electro-Pneumatic Water Supply System.

The Perry electric controller, which is shown clearly in Fig. 2 and also in Fig. 3, where it is arranged to operate the arm of a rheostat, is designed to start and stop an electric motor automatically by the variation of pressure between predetermined maximum and minimum values. It may be operated on a wide variation between starting and stopping, or on a difference of only 2 lb. or 3 lb., if desired. As usually employed, it is operated by air pressure, but the pressure of water or other liquids may be used instead. As patented, it is spoken of as a "fluid pressure controller." It is provided with two diaphragms, and the air is admitted to the upper diaphragm through a valve controlled by the pressure on the lower one. This action

allows the full pressure to act directly upon the mechanism controlling the switch.

While the pressure is increasing it gradually compresses a spring the force of which is conserved by means of a latch until a predetermined value is reached, when it is automatically released. This action allows the full force of the spring to

Fig. 2—Electric Controller for Small Motor.

operate the blades of the switch, instantaneously breaking the circuit. When the pressure is again lowered to a given point the action is reversed, the same instantaneous action closing the circuit. That is in principle the operation of the controller as shown in Fig. 2, which may be installed as illustrated for small series-wound direct-current motors of ½ hp or less, for which no starting box is required. For larger motors, or where a starting box is necessary, the controller is connected

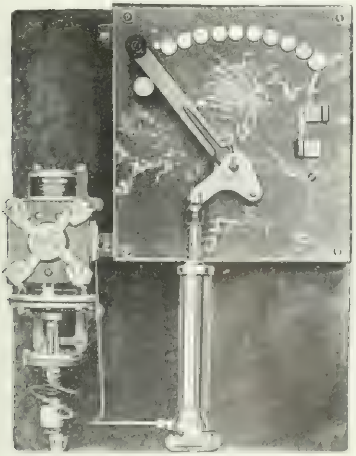


Fig. 3—Electric Controller Attached to Rheostat Arm of Larger Motor.

to a small pneumatic cylinder, [illegible] of which the arm of the rheostat is moved to start or stop the motor as before. The Underwriters' Laboratories have approved the operation of the controller, which is supplied with a metal enclosing case, not shown in the illustrations.

The operation of the electro-pneumatic controller with its two diaphragms is very similar to the operation of the Perry pneumatic pump, which consists of two cylinders, connected by a head, adapted to be alternately filled with water and emptied by the use of automatic valves closely resembling those used in the controller and designed in the same way to be operated by the pressure of the air itself. It is asserted by the United Pump & Power Company, Old Colony Building, Chicago, which manufactures the Perry pneumatic water system, that the cost of supplying water with the compressor driven by an electric motor is less than 2 cents per 1000 gal. where the lift is 50 ft. and the rate for electrical energy is 12 cents per kw-hour. The system is designed, of course, to be used where water from public water works is not available. In many country homes and similar locations however, electricity may be had where water from street mains is not obtainable. The system is of interest to central-station managers, therefore, as a possible source of new business.

While the size of the motor will depend on the conditions, such as the lift and amount of water required, it is said that a ½-hp motor will be sufficient to operate a water system for supplying 500 gal. an hour, which is usually sufficiently large for the ordinary rural home or farmstead. For larger plants the power required is proportionately small, a 10-hp motor being sufficient to supply 300,000 gal. per day.

PORTABLE RAILWAY SUBSTATION.

The Westinghouse Electric & Manufacturing Company recently completed for the Fort Wayne & Wabash Valley Traction Company a portable substation which is now in operation on the latter company's electric lines in the vicinity of Fort Wayne, Ind.

The general arrangement of the electrical apparatus in the car includes no great departure from previous practice. The lightning arresters are located at one end of the car; close to this end are the oil circuit-breaker and the transformers; the switchboard is near the center, and the rotary converter is near the other end. A liberal space is allowed near the switchboard in the middle of the car, and there are no high-voltage wires in the neighborhood of the board; hence safety is secured for the operator.

The dimensions of the all-steel car are: Length over end sills, 40 ft.; width over all, 9 ft. 5 in.; truck centers, 27 ft., and height, from floor to underside of roof at center, 8 ft. 9 in.

The 500-kw, 500 r.p.m., 550-volt, six-phase, 25-cycle rotary

Fig. 1—Exterior of Car.

converter is of standard construction. The [illegible] comprises two panels of [illegible] slate. The [illegible] three-pole, 35,000-volt, oil circuit-breaker is operated by hand from the switchboard; thus, distant control of the high-tension, incoming line is provided. The three-phase transmission circuit of 33,000 volts and 25 cycles is brought into the car

[illegible] switches.

There are two 33,000-volt, primary, lowering transformers

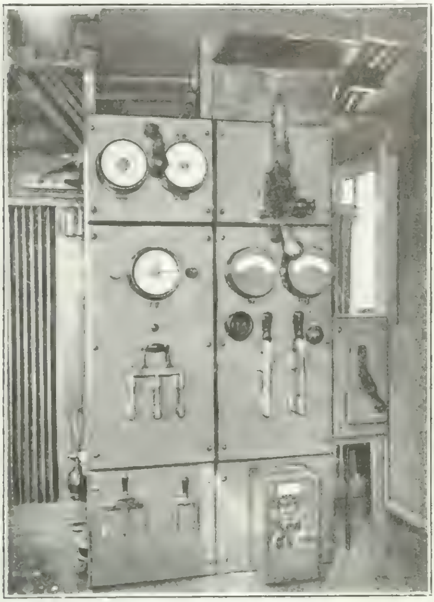


Fig. 2—Switchboard.

of the oil-insulated, self-cooled type; they are double-V connected. Three low equivalent lightning arresters are provided.

ELECTRIC VEHICLE FOR TRANSPORTATION OF GUNPOWDER.

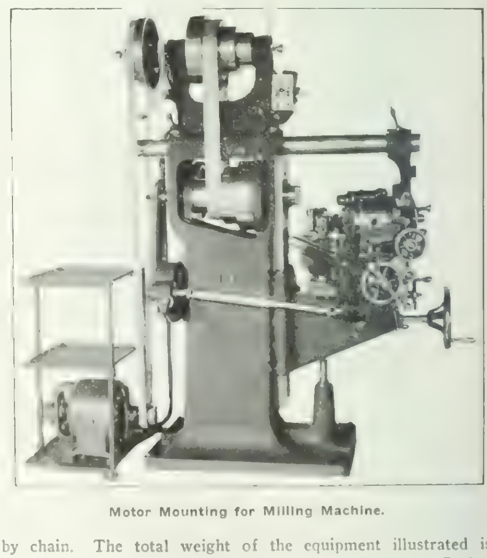
The Studebaker Brothers Company, of New York, is making delivery to the Union Metallic Cartridge Company, of Bridgeport, Conn., of one of its electric vehicles, which has some fea-

Electric Vehicle for Transportation of Gunpowder

tures in its equipment adopted because of the dangerous nature of the load to be carried. The matter of a suitable vehicle for the transportation of powder from the outlying powder houses to the manufacturing establishment of the Union Metallic Cartridge Company has been under consideration for about a year and a half, and as the result of consultation with the Studebaker engineers it was proved that an electric wagon could be so equipped as to insure absolute protection against any danger from ignition of the powder. The compartment of the vehicle in which the powder will be carried is practically hermetically sealed and is so constructed that there is no metal exposed in a way to cause danger of friction and consequent ignition. The controller and the other portions of the apparatus at which sparking is likely to take place under ordinary circumstances have been immersed in oil, and all the wiring of the vehicle has been placed in metallic conduit with the greatest care possible to ensure safety. This machine is equipped with sixty-four cells of Edison battery and the vehicle will be run over the road from New York to Bridgeport in making delivery to prove its practical utility in every particular. Conditional upon the satisfactory performance of this machine the Studebaker Company has orders for additional equipment. This case is another illustration of the adaptability of the automobile to new fields and the characteristics of the electric machine render it alone serviceable in this instance.

MOTOR MOUNTING FOR UNIVERSAL MILLING MACHINE.

In the accompanying illustration is shown a method for belting a motor to a milling machine in such a way that the mount can be attached to a machine in stock, thus avoiding the expense and delay which might otherwise arise in covering the motor-drive requirements. The motor drives by a narrow, high-speed belt a two-speed cone which is back-geared to the main upper four-speed cone through a double-gear system, thereby providing a total of sixteen speeds. Both of the overhead cone pulleys run on a stationary shaft stud that is made hollow to allow of supplying the lubricant from grease cups at the two ends. This shaft is keyed to the eccentrics, one of which has a segment worm-gear under control of a crank. This scheme is used to give the proper tension to the belt so that it may be eased off for shifting purposes. The connection from the spindle to the rotary feed change box is



Motor Mounting for Milling Machine.

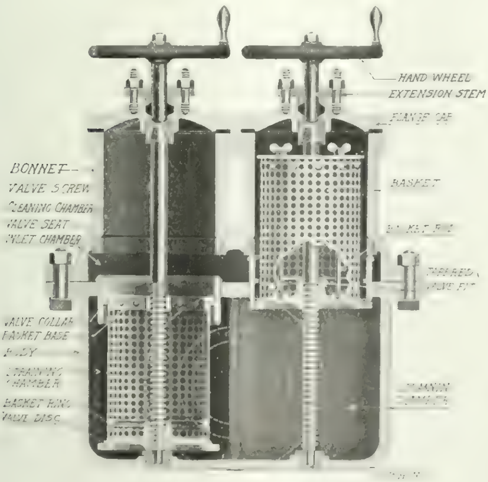
by chain. The total weight of the equipment illustrated is 2450 lb. It is built by the Garvin Machine Company, Spring and Varick Streets, New York.

MULTIPLE STRAINERS.

Nearly all sources of water supply, especially for circulating water, contain a certain amount of suspended matter, and attempts are often made to remove this by placing a strainer around the suction pipe foot valve. The strainer soon becomes clogged and it is necessary to shut off the pumps while it is being cleaned.

In order to get around these difficulties the Lagonda Manufacturing Company, of Springfield, Ohio, has recently placed on the market a multiple strainer for removing impurities in feed water, circulating water, etc. These strainers can be installed either outside or inside the buildings and in any position, horizontal, vertical or inclined. They are made up of different sections which can be cleaned, one at a time, without interrupting the flow of water. The strainer consists of a cast-iron body having a number of removable strainer baskets, the number depending upon the size of the line.

Referring to the accompanying illustration it will be seen that the water enters through the inlet pipe and passes up to the top of the valve chamber, where it divides, going down through all of the baskets in multiple. When it is desired to clean the strainer, one of the baskets is drawn to the upper part of the chamber by turning the hand-wheel; at the same time the valve collar is forced tightly against the valve seat and the valve disk on the bottom of the basket seats on the valve collar. This action entirely shuts off the water supply from the section containing the basket to be cleaned. By means of a small by-pass the pressure in this chamber is now relieved and the bolts at the top loosened and the flange cap tilted over, thereby exposing the basket. The basket can now be taken out and cleaned. In replacing the basket the operations are exactly the



Multiple Strainer.

reverse. The next basket can now be removed in the same way and the whole strainer cleaned without shutting off the water.

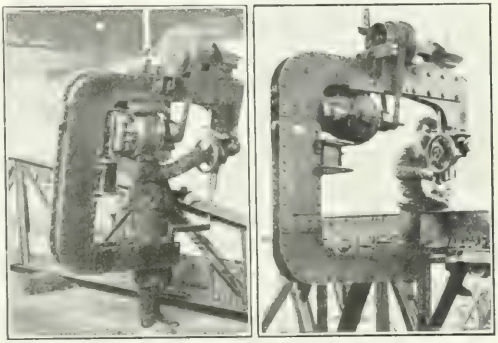
The effective straining area of a Lagonda strainer is from 2.2 to 4.0 times the area of the pipe line, and in removing one basket for cleaning the straining area is not reduced more than 30 per cent, and therefore the pipe line is never throttled in the process of cleaning.

The strainers are built in sizes from 2 in. to 48 in., having from two to six baskets, the number depending upon the size of the strainer. They are also suitable for use in either suction or pressure lines and are built to withstand working pressures up to 200 lb. per square inch. In practice one of the baskets is left out of service so that in case the baskets in use should become clogged the clean basket can be quickly lowered into service.

AN ELECTRIC PENDULUM DRILL.

While portable electric drills are finding a rapidly growing variety of applications in shops of various kinds, their use in this country has been confined chiefly to light work for which the operator can carry the device from place to place, using breast pressure to feed the drill. Of course such a limitation in capacity could not last long for so convenient a device as the portable drill, and already several manufacturers are planning to supply the need for similar devices of far greater power.

Among the first of these is the electric crane builder of Berlin, Carl Flohr, who is offering what he calls a "pendulum



Electric Pendulum Drill.

drilling machine" for use wherever it is more feasible to move the drill than the pieces that are to be bored. To make it generally adaptable, the frame of the drill is hung from a traveling crane by a stirrup on which the loop can be shifted so as to tilt the frame to an angle. This tilting adapts it admirably for drilling structural steel trusses. Interchangeable extensions on the lower end of the frame brace the work against the drill so that a power feed can be used to save time, while the pressure is ample to prevent superposed plates from slipping on each other during the drilling.

Comparisons in shops under actual manufacturing conditions are said to have shown that such a suspended drill bored from 1000 to 1200 ⅞-in. holes a day, as compared with from 700 to 800 holes in the same class of structural work when the latter had to be moved along a stationary drill press. The moving of the structure would undoubtedly be slower and more costly than that of shifting the suspended drill, hence the total difference in the cost of drilling would not be in the number of holes per day. For ordinary drills the machine is fitted with a 2.4-hp motor belted through cone pulleys to give speeds of 75 r.p.m., 180 r.p.m. and 300 r.p.m., with corresponding power feeds of about ½ in., 1¼ in. and 2 in. per minute (12.5 mm, 30 mm and 50 mm). For high-speed drills a 5-hp motor is used with two-speed cones giving either 300 r.p.m. or 400 r.p.m. with power feeds of about 2.75 in. and 3.50 in. respectively (67.5 mm and 90 mm). In either case the machine has an effective 12-in. opening and takes drills having diameters up to 1.25 in. The total weight with the lighter motor is about 1650 lb. (750 kg), or fitted with larger motor for high-speed drilling about 1870 lb. (850 kg).

For work which cannot be reached from the ground the [illegible] drilling holes for most of the rivets in trusses with such a suspended drill after the parts are assembled, much of the time otherwise required for laying out the rivet holes is saved and the chance of having holes out of line is reduced to a negligible factor, thus saving time in the riveting and permitting the use of cheaper labor on this class of work.

GENERAL UTILITY MOTOR.

The general utility motor now being placed upon the market by the Westinghouse Electric & Manufacturing Company marks another advance of the application of electricity to household convenience. By means of its special attachments the motor can be adapted to a variety of uses about the house,

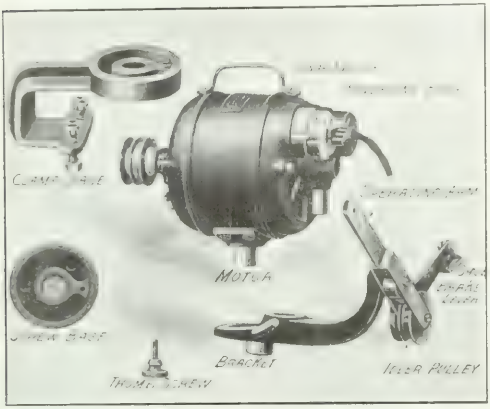


Fig. 1—Motor and Attachments.

and thus commends itself heartily to the favor of central-station companies as providing another wedge for the introduction of electricity into the home. Furthermore, it is essentially a day load. The motor takes from 40 watts to 120 watts for its operation.

The general utility motor can be readily arranged to operate the following devices: Family sewing machine, buffing, polishing and grinding wheels, ventilating blower, jewelers' lathe, light machinery, small lathes, sign flasher, moving win-

Fig. 2—Motor Operating Sewing Machine.

dow display, mechanical toys, etc. The motor is sold complete with one or more attachments, and further attachments can be obtained by the purchaser as desired. A different attachment is not necessary for every one of the uses mentioned above, as some of the attachments make the motor available for several purposes without change. The general utility ventilating outfit is one of the features of the new apparatus. The small blower will supply fresh air to the kitchen, increase the draft of a furnace, remove foul air from sick rooms, and readily adapt itself to any small ventilating work. By fitting the blower openings with suitable pipe, air currents can be directed wherever desired.

The general utility motors are made for operation on 115-

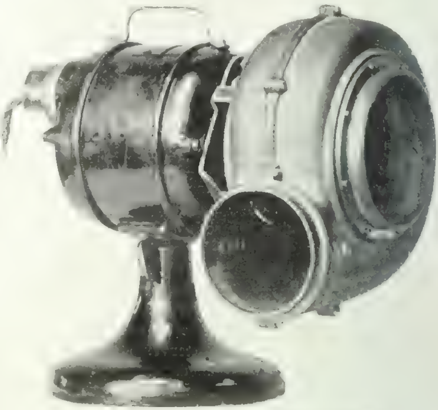


Fig. 3—Motor-Operated Ventilating Blower.

volt and 230-volt direct-current circuits, and on 110-volt and 220-volt alternating circuits of 60 cycles and 133 cycles. The direct-current motors are shunt-wound, while the alternating current motors are of the induction type, single-phase. The motors run at a speed of 1700 r.p.m. The motor is light and

Fig. 4—Polishing Tableware.

can be easily carried from place to place by means of a handle in the top of the frame. It is artistically finished in black enamel to harmonize with the other house decorations. The applications of the attachments are positive, and it is impossible to put them on wrong.

PACIFIC COAST ELECTRICAL EXPOSITION.

The first electrical exposition held on the Pacific Coast and probably the largest held west of Chicago successfully opened at the Coliseum in San Francisco on the evening of Sept. 17. With nearly a hundred exhibit booths and approximately 30,000 sq. ft. of floor space actually occupied by exhibits, and a line of apparatus, supplies and features shown that could hardly be surpassed in the East, the exposition may be said to have been a success and a credit to its promoters.

The exposition had its inception over a year ago when a number of representatives of the different electrical trades in San Francisco organized and laid plans to hold a show in the old Coliseum during December, 1909. Previous exhibitions of a portable nature, showing electric lighting, heating and cooking appliances, had been held by the local lighting companies in San Francisco, but the time was deemed ripe for an exposition along the lines of the shows that had been held in New York, Chicago and other Eastern cities. The plans progressed favorably, but unfortunately the old Coliseum was destroyed by fire before the date of opening, and as no other building in the city was large enough the project had to be postponed until the new Coliseum was completed.

Fig. 1—San Francisco Electrical Exposition.

The new building, only just completed and dedicated by this exposition, is located on Page, Baker and Oak Streets, opposite the Pan Handle of Golden Gate Park. It has 60,500 sq. ft. of floor space 37,620 sq. ft. of which is under the dome and entirely free from columns or other obstructions. Special attention was given by the management to the apportionment of space, arrangement of booths and aisles and the general decorative scheme of the booths. Each booth was marked off by square white columns ornamented by simple but effective capitals, and judicious restrictions as to projecting displays, signs and decorations helped to make the general appearance of the hall very pleasing.

The general lighting of the hall was furnished by means of 500-watt tungsten lamps, this being the first time that such a large area has been lighted by lamps of this size. The lamps were also the first to be shown on the Pacific Coast. There were fifty-four lamps installed, they being contributed by the General Electric and Westinghouse companies and National Electric Lamp Association. They were supported in twelve rows across the hall and fed in multiple on a 118-volt alternating circuit, the energy being contributed by the San Francisco Gas & Electric Company. For exterior illumination at the entrance there were installed arcs of the flaming, intensified, luminous and metallic-flame types, the lamps being furnished by the exhibitors.

For the exhibitors' use there was installed a complete system of distribution under the floor with distributing cabinets at convenient locations. To each exhibitor was furnished all the energy he needed of either direct or alternating current, meters being installed for the individual booths at distributing centers. The direct current was supplied on a 110-volt, two-wire system from a Westinghouse motor-generator set.

The energy was received from the San Francisco Gas & Electric Company's 11,000-volt, three-phase distribution system, being transformed to 118 volts by means of four transformers located just outside the building. Electricity was carried to the 110-volt and 220-volt, two-phase system inside the building by means of six 500,000 circ. mil rubber-covered cables. The total load on the building was 200 kw.

The exposition management was vested in an executive committee consisting of Messrs. W. W. Briggs, of the Westinghouse Electric & Manufacturing Company, chairman; John R. Cole, John R. Cole Company, vice-chairman; J. A. Vandegrift, Oakland Warehouse Company; Albert H. Elliot, secretary and treasurer; W. W. Hanscom, consulting electrical engineer and director of exhibits, and D. M. Moses, general manager. It was almost entirely to the indefatigable work of these gentlemen that the success of the exposition was due.

The method of financing and conducting the exposition was a co-operative one, each exhibitor taking space becoming a stockholder in the enterprise. Space was rented at 50 cents a square foot and the total of nearly 30,000 sq. ft. rented provided sufficient income to finance the exposition, paying all expenses, including the commission for the general manager. An admission fee of 50 cents was charged to the public and the receipts from this source will be distributed pro rata among the exhibitors, so that with an anticipated attendance of 30,000 the exposition will entirely pay for itself. On the opening night there was an attendance of about 7000, and the indications were that the 30,000 mark would be reached before the week was over, the closing day being Sept. 24.

Practically every electrical manufacturing firm or dealer in San Francisco was represented at the exposition, and the exhibits included the newest and latest in lamps, motors, generators, switchboards, wire, batteries, vehicles, telephones, musical instruments, insulating materials, novelties, specialties, etc.

Fig. 2—San Francisco Electrical Exposition.

Prominent among the exhibits were those of the City of San Francisco, Southern Pacific Company, San Francisco Gas & Electric Company, City Electric Company, National Electric Lamp Association, General Electric Company, Westinghouse Electric & Manufacturing Company.

The complete list of exhibitors is as follows:

Allen Co., L. B., Chicago.
Amer. Conduit Mfg. Co., Pittsburgh.
American Elec. Fuse Co.
American Ever Ready Co.
American Faucet Co.
American Ironing Mch. Co.
Amer. Steel & Wire Co.
Apple Elec. Co., Dayton.
Auto Maintenance & Mfg. Co.
Aylsworth Agencies Co.
Babcock Elec. Carriage Co.
Baker & Hamilton.
Baker Motor Vehicle Co.
Barker, James, Co., Inc.
Bay Cities Electric Co.
Benjamin Electric Co.
Bossert Elec. Con. Co.

Brooks, Follis Elec. Corp.
Brumfield Electric Sign Co.
Burrell, D. H., & Co.
Burroughs Adding Mch. Co.
Cal. State Ass'n Elec. Contractors.
Cal. State Ass'n Elec. Cont.
Century Elec. Co.
City Electric Co.
Clark, Jas., Jr., Louisville.
Cole, John R., Co.
Collins Wireless Tel. Co.
Columbia Incandescent Lamp Co.
Columbus Vehicle Co.
Crocker-Wheeler Co.
Cutler Heater Co.
Cutler-Hammer Mfg. Co.
Cyphers Incubator Co.
Daggett, R. B., & Co.
Dean Electric Co.
Decker Elec. Co.
De Lux Electric Sign Co.
De Veau Tel. Mfg. Co., Brooklyn.
Direct Line Tel. Co.
Dossert & Co.
Drendell Electric Co.
Duntley Vacuum Cleaner Co.
Electric Cleaner Co.
Electric Launch Co., Bayonne N. J.
Electric Mfg. Co.
Electric Mfg. Co., New Orleans.
Elec. Ry. & Mfrs'. Sup. Co.
[illegible] *Electrician.*
Elec. Storage Battery Co.
Electrical World.
Elec. Contractors' Association of California.
Engineering & Maintenance Co.
Ericsson, L. M., Tel. Mfg. Co.
Excello Arc Lamp Co.
Federal Sign Co.
Fred Fisher Co.
Ft. Wayne Electric Works.
H. F. Frosche Co
General Acoustic Co.
General Electric Co.
General Elec. Const. Co.
German-Amer. Elec. Co., New York.
[illegible]
Gray Telautograph, New York.
[illegible]
Harvey Hubbell Co., Bridgeport.
Holabird-Reynolds Elec. Co.
Holophane Co.
Home Tel. Co.
Ideal Electric Co.
Johns-Manville Co.
Journal of Electricity, Power and Gas.
Jupiter Switchboard Co.
Keller Mfg. Co.
Kellogg Sw. Bd. & Sup. Co.
Kiewert, C. L., Co., Milwaukee.
Kimball Elec. Co., Chicago.
Klein, Mathias, & Sons.
[illegible] Co., So. Bend.
Kohler & Chase.
Krantz, H., Mfg. Co.
Laugenour Sales Co.
Levy Elec. Co.
Machado & Roller.
McDougald Mfg. Co.
Monarch Tel. & Mfg. Co., Chicago.
Moore, C. C., & Co.
National Dictograph Co.
National Elec. Lamp Ass'n.
National Indian Rubber Co.
N. Y. Insulated Wire Co.
Otis & Squires.
Pacific Electric Co.
Pacific Elec. Heating Co.
Pacific States Electric Co.
Pacific Tel. & Tel. Co.
Paraffine Paint Co.
Parrott & Co.
Pierson Roeding Co.
Pioneer Automobile Co.
Poss, P. H.
Rauch & Lang Carriage Co
Reed Electric Works.
Reliance Automobile Co.
S. F. Compressed Air Cleaning Co.
S. F. Gas & Electric Co.
[illegible] field, Ill.
Santa Clara College.
Schwartz Elec. Co., Adrian, Mich.
Shawmut, Chase, Newburyport, Mass.
Simplex Electric Heating Co., Boston.
Smith, F. E.
Southern Pacific Co.
Sprague Electric Co.
Standard Underground Cable Co.
Stave Electric Co., N. Y.
Studebaker Bros.
Tel. Electric Equip. Co.
Thieben, Joseph, & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
United Railways.
University of California.
Vacuum Specialty Mfg. Co.
Van Nort Carbon Brush Co., St. Louis.
Wagner Electric Co.
Walters Surgical Co.
Western Union Tel. Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instrument Co.

A brief account of the various exhibits follows:

PARROTT & COMPANY displayed the Grant flaming arc and the "Sunray" arc. They also had as an overhead illumination a [illegible] watt, 550-watt and 750-watt lamps.

[illegible] Monarch time system with a secondary clock over the main entrance. Its exhibit also comprised Monarch telephones, Cooper Hewitt mercury-vapor lamps, Apple ignition and lighting system, Schwarze bells, "Nokorode" soldering paste and "All-in-One" ground clamps.

The WESTERN UNION TELEGRAPH COMPANY had a Barclay printing telegraph machine in operation and a Wheatstone apparatus, both of which attracted a great deal of attention. Its booth also contained quadruplex and duplex instruments, old and new instruments and a historical display showing the evolution of the battery. The merits of the night letter system were also demonstrated.

The SOUTHERN PACIFIC COMPANY had a large space fitted up in its usual attractive manner. Two large semaphore stations were in operation, as well as a model of a complete block showing the operation of the block signaling system used on its lines. Automatic lantern machines and advertising signs showed various attractive views of scenery on the Southern Pacific route, while the company's advertising department was

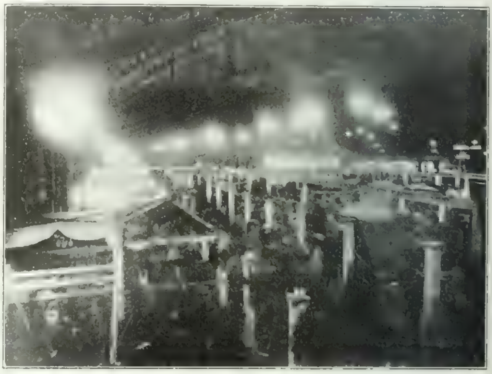


Fig. 3—San Francisco Electrical Exposition.

well represented with its splendid line of publications. Drawings and photographs of its new electrical work on the east side of San Francisco Bay were also on display.

The SAN FRANCISCO GAS & ELECTRIC COMPANY, while having one of the largest booths in the hall, contented itself with a very attractive and home-like lounging and reception space, suitably decorated. Albums of views taken on its system were on exhibition.

H. W. JOHNS-MANVILLE COMPANY had an interesting exhibit of underground conduit, subway and aerial fuse and service boxes, asbestos wood which is becoming very popular on the Coast, pole-line insulating materials, porcelain, railway material, etc.

The CITY ELECTRIC COMPANY had a model underground vault completely equipped with transformers, switches, junction boxes, etc. Of the company's own design and manufacture there was shown a 11,000-volt underground combined switch and fuse and a 500-volt, three-wire, large-capacity, six-way junction box.

The BURROUGHS ADDING MACHINE COMPANY showed eighteen of its seventy-one different types of adding machines, most of which were electrically driven.

The BENJAMIN ELECTRIC MANUFACTURING COMPANY and the HOLOPHANE COMPANY jointly occupied a booth and displayed the new "Stiletto" type of high-efficiency reflectors, enameled steel reflectors for tungsten lamps of 16 cp to 500 watts for factory and interior lighting, the series cluster body, the new street series type, as well as the well-known Benjamin fixtures.

The AMERICAN STEEL & WIRE COMPANY showed a large and well-arranged display of bare copper, weatherproof wire and cable; galvanized iron and copper telephone and telegraph wire, bare and insulated; rubber-covered wire and cable; magnet wire; lamp cord; annunciator and office wire; galvanized

guy and messenger strand, pole [illegible] submarine cable; rail bonds and rail bond tools; all the goods displayed being taken out of San Francisco stock.

The American Electric Fuse Company, through its local agents, Stewart-Fuller Company, showed Allan-Bradley rheostats, American enameled wire, telephone protection, spark and wireless coils, while the Stewart-Fuller Company exhibited Vulcan electric soldering and branding appliances.

The Brooks, Follis Electric Corporation included in its attractive booth a complete line of electrical supplies and novelties, lighting fixtures, Golden vibrators, a San Francisco product, etc.

The Vacuum Specialty Manufacturing Company, of San Francisco, demonstrated its Monarch renovator, a cleaning apparatus which weighs but 25 lb. and operates on the turbine principle.

R. B. Daggett & Company exhibited a Walker electric truck, two Baker electric coupés and a Baker electric runabout. The Reid headlight and reflector and Sangamo amp-hour meter were also shown.

Holabird-Reynolds Company and Pacific Electric Heating Company showed a full line of electric irons and high-tension insulators.

The Cutler Heater Company, of California, had on exhibition its Cutler electric hot-water heater.

The Ideal Electric Company showed an electric brougham that will seat four persons with ease.

Columbus Electric Auto Company showed an electric roadster.

The Reliance Automobile Company showed the Detroit electric coupé, the Pioneer Automobile Company the Babcock, and the McDougald Manufacturing Company the Rauch & Lang electric vehicle. Edison storage batteries were also exhibited in several of the booths.

The Telephone Electric Equipment Company showed Simplex electric heating goods, intercommunicating apparatus for commercial and home work and a line of motors.

Joseph Thieben & Company, electric lamp dealers, displayed everything in the lamp line from searchlights to parlor chandeliers, including automobile lamps and batteries, tungsten and carbon lamps, etc.

The Home Telephone Company had an interesting display of its automatic telephone system with apparatus in working operation. Two types of private branch exchanges were shown in service. The company had sixty telephones in operation in the various booths. Automatic switching devices were shown in glass display cases.

John R. Cole Company had a display of Hubbell specialities, American circular loom, Stanley & Patterson batteries, Matthews Brothers' specialties and oil circuit breakers.

Gray National Telautograph Company showed its line of instruments for the reproduction of handwriting, pictures, etc.

The Drendell Electric Company made a strictly "home industry" display of goods manufactured in San Francisco, including high-tension switches, panel boards, automatic switch and stage apparatus, remote control switches, etc. A three-panel, high-tension board for the Central Electric Company, of Fort Whipple, Ariz., and a three-panel low-tension board for the Cuayaga Rubber Company, of Mexico, were installed in the booth.

The Dean Electric Company showed a complete line of telephone supplies, switchboards, flash-light police and fire systems, harmonic converters, etc.

The Electric Railway & Manufacturers' Supply Company, "The Specialty House," Coast agents for the Ericsson and De-Veau telephone apparatus, showed a full line of these goods, as well as Trumbull switchboards—one of seven panels, 21 ft. long being installed.

The American Ever Ready Company made a feature of its Ever Ready batteries, the only battery made on the Coast. The capacity of the company's plant is a carload of batteries a day. The company also had a very attractive display of Christmas lighting, and also showed its automatic engine starters and other automobile specialties.

The Electric Storage Battery Company, through its agents, the Pierson-Roeding Company, had a generating set such as is installed for country-house lighting in connection with a large line of "Chloride" and "Exide" batteries.

The Direct Line Telephone Company had on exhibit a model system with seven instruments in operation, showing the small desk pigeonhole telephones and demonstrating the convenience and advantages of the system.

D. H. Burrell & Company showed a Burrell-Lawrence-Kennedy electric milking machine and their exhibit proved most popular to the layman. Two Holstein cows were on duty and although they had never been milked by this device before they did not "kick," but gave milk to the edification and enjoyment of the public.

The Electrical Contractors' Association, of California, which includes in its membership practically all the electrical construction companies in the State, including forty in San Francisco, District No. 1, had a spacious booth which was maintained as headquarters for the members. Several of the members contributed exhibits which included an ingenious display of metal molding, condulet and knob and tube work arranged to form an electric sign.

The Jupiter Switchboard Company had installed in the above space three types of panel boards, one of which, built of a large sheet of plate glass, with extremely simple and also practical switch and bsbar connections, all in bright copper, made a very striking exhibit.

The American Faucet Company, of San Francisco, showed in operation several of its "Little Giant" vacuum cleaners.

The Pacific Electric Company had a very interesting exhibit of oil switches, including an electric control switch (oil) for 80,000 volts. The company also had set up complete on short poles a pole-top switch of the Baum type for high-tension work up to 100,000 volts.

The Levy Electric Company, of San Francisco, had a display of wireless telegraph goods, motors and washing-machines, vibrators, moving pictures showing the workings of the company's store, also photographs of the large jobs done by the firm. This company also had the contract for wiring the Coliseum.

The National Dictograph Company had one of the most popular exhibits. It showed its dictograph, affording communication without picking up the telephone. An instrument was also connected up with a downtown theater and the public was given an opportunity to hear the music and the actors.

Charles L. Kiewert and the Crocker-Wheeler Company jointly occupied a space under the direction of the Engineering & Maintenance Company, San Francisco agents. A very interesting exhibit was shown of a variety of flaming and luminous arcs for a number of purposes, the types including the Siemens, Aurola, Alba, Triplex, Economy and Lilliput, while the well-known Crocker-Wheeler motors and generators were well represented.

The Kellogg Switchboard & Supply Company exhibited a complete line of telephone apparatus, including a train dispatching telephone system, harmonic four-party line system, etc.

The Standard Underground Cable Company showed its largest telephone cables and power transmission cables, Davis terminals, submarine cables and a lead press illustrating the method of placing lead on the cables.

Otis & Squires, manufacturers' agents, displayed a line of specialties as follows: Switchboard panel by Krantz Manufacturing Company, lineman's tools by Mathias Klein, conduit by American Conduit Company, instruments by Roller Smith Company, gas-engine coils and magnetos by Knoblock-Heideman Company, L. B. Allen soldering compound, Dossert & Company's solderless connectors, Van Nort carbon brushes, Paragon Seller telephones, drop "Ironite" wire, and Columbia incandescent lamps.

The Century Electric Company, of St. Louis, exhibited its line of motors and the California Incandescent Lamp Company made a display of Bryan-Marsh lamps.

The [illegible] had an interesting exhibit of its

electric welding machines, showing one machine in operation welding wire and other material.

[illegible] wire and cables.

Kohler & Chase, of San Francisco, had a full line of electrical pianos, pianolas and electrical stringed instruments in operation for the enjoyment of the public. A large Wurlitzer auto band instrument was also exhibited by the firm and was used to supply the band music for the exposition.

The Brumfield Electric Sign Company, represented by Mr. W. C. Brumfield, the "original electric sign man" on the Pacific Coast, had a complete exhibit showing the automatic operation of electric signs.

The Pacific Telephone & Telegraph Company had a complete Bell telephone exhibit with eleven telephones for public use and two switchboards, one of which was in operation as a private branch exchange. During the evenings the company dispensed free music over its public instruments, which were provided with double receivers, the music being transmitted from Los Angeles, Seattle, Portland, Reno, Spokane and other Pacific Coast cities.

The Walters Surgical Company had a most complete line of X-ray and electro-medical apparatus, with static machines Crookes tubes of different sizes and colors, 10-in. spark machines, therapeutic lamps, etc.

The Studebaker Automobile Company showed four electric vehicles, a line of "Exide" batteries and a Westinghouse mercury rectifier.

The American Ironing Machine Company displayed household laundry machinery, including washers, ironers, collar machines, etc.

The Paraffine Paint Company had on exhibition its complete line of insulating pitch, tape, electrical compounds, paints, etc.

The San Francisco Municipal exhibit of the department of electricity, which was in charge of Mr. William H. Uring, chief of the department, was large and well planned. There was displayed the fire-alarm and police telegraph apparatus manufactured in the department's shops. An exact reproduction was installed of the fire-alarm system as well as the police telegraph, so arranged that the public could operate them and see the workings of the central-station instruments. The department has 348 miles of line in operation in the city.

The National Electric Lamp Association occupied four booths facing the two main aisles in the center of the Coliseum. Decorative arches, surmounting massive columns, surrounded the entire exhibit. Mazda lamps, fitted with the new "Stiletto" type Holophane reflectors, hung pendent from the arches. The supporting columns were surmounted by gold capitals and eagles of staffwork. A Spanish arbor was built in the center of the space for use as a reception room. The arbor was artistically decorated with autumn leaves and Oriental portières and lighted with Mazda lamps, giving a most attractive effect. The general decorative scheme was in white and gold. In addition to the regular line of Mazda lamps shown, there were displayed 110-volt and 220-volt tantalum and Mazda lamps, regular and round, the Mazda street series and sign lamps, the tantalum street-railway lamps and various sizes of Mazda miniature and automobile lamps. A complete outfit of automobile fixtures was exhibited, it being equipped with Mazda lamps lighted from a storage battery. An interesting historical feature of the exhibit was a number of Goebel lamps, which were used by Henry Goebel in New York in the early sixties. A Bunsen photometer illustrated the methods used in photometering incandescent lamps. A small rotating mirror photometer illustrated the distribution of light about a lighting unit and also emphasized the importance of using proper reflectors. Among those in attendance at the booth were Messrs. J. A. Vandegrift, L. S. Twomey and G. E. Norris, the exhibit being in charge of Mr. A. J. Hitzker, of the engineering department.

Mr. James Barker showed a line of electric vibrators, hair driers, etc.

[illegible] Works had a joint exhibit, the principal feature of which was a Fort Wayne electric drill in operation on a large block of sandstone. With a 1½-hp motor this machine, it is claimed, can drill anything that a 2½-in. air drill will bore and with one-eighth the power. They also showed a large line of power motors, wattmeters, etc.

The Duntley Pneumatic Cleaners, shown by the Compressed Air Cleaning Company, were centers of much interest, as were the electric water heaters, also exhibited in the same booth.

The Keller Manufacturing Company likewise showed its Keller-Santo vacuum cleaner, an exhibit machine being provided with a glass case in order to show the complete operation.

The Directograph, a device for electrically transmitting writing to a large display board, was the center of much interest to the public.

The General Acoustic Company showed its Acousticon, an electrical instrument for aid in hearing.

The Westinghouse Electric & Manufacturing Company, occupying 1000 ft. of space in the center of the hall, had a booth that was always the center of much interest. The industrial and power departments made features of motor-driven appliances, including vacuum cleaners, grinders, polishers, household and kitchen utensils, there being shown a complete line of every type of motor manufactured by the company. A miniature oil-well derrick with motors pumping, pulling and drilling oil wells was a feature. The details and supply department exhibited transformers, oil circuit-breakers, switches, heating appliances, toasters, etc. The lamp department showed on two revolving disks a great variety of lamps of all types and sizes. The publicity department was also well represented with its line of literature. As a novelty feature Mr. G. F. Haller operated electric signs with high-voltage and high-frequency current. He pereformed several novel electrical feats with a Tesla coil, Crookes tubes, Geisler tubes, etc. The exhibit was in charge of Mr. W. W. Briggs, manager of the San Francisco office, and was supervised by Mr. T. E. Collins. Others in attendance included Messrs. J. G. de Remer, C. E. Heise, L. A. Somers, J. J. Pottinger and W R. Dunbar.

The General Electric Company also occupied 1000 sq. ft. of floor space, the booth being divided into two sections. One was devoted to a complete line of energy-consuming devices of general interest and the other comprised a model electrical dining-room and kitchen completely equipped with cooking and heating devices. This exhibit was a very practical one and was in charge of competent demonstrators. In the general section were shown alternating-current and direct-current rectifiers and controlling apparatus, arc and incandescent lamps, instruments, switches, etc. A color booth was of special interest to merchants, the lamps including a full line of the Mazda and tantalum type. The exhibit was in charge of Mr. A. M. Hyler

The *Electrical World* was represented by Mr. C. W. Whitney and Mr. George B. Burnham.

Mr. F. E. Smith had a full and very large line of Weston instruments, including those of the later types, such as power-factor meters, indicating and recording wattmeters, voltmeters, ammeters, etc. During the exposition a board was arranged with various instruments to measure the voltage, current and power consumption of the Coliseum and exhibits.

TELEPHONE TRAIN DISPATCHING EQUIPMENT FOR LOUISVILLE & NASHVILLE RAILROAD.

The Louisville & Nashville Railroad has placed an order for a complete equipment of Western Electric telephone train-dispatching apparatus including selectors and telephones. This equipment will cover the Cumberland Valley and Kentucky Divisions from Cincinnati to Norton, a distance of 304 miles, and will consist of six circuits in all, four train wires and two message crcuits, with a total of 162 stations.

The Louisville & Nashville already has installed a Western Electric train-dispatching telephone equipment, consisting of dispatcher's equipment and twenty-six way-station selectors, between New Orleans and Mobile, a distance of 139.7 miles.

Industrial and Commercial News

The Week in Trade.

THERE were practically no changes in the condition of trade last week that were worthy of special mention. Continued good weather throughout the crop-producing sections has added somewhat to the general feeling of optimism, but has added little to the actual buying of retailers, or, in fact, to the buying of consumers. While it is universally admitted that all outside conditions are favorable and point to liberal business, there is still a widespread conservatism among all classes. While a few more mills may be employed than during the summer, all lines of both woolen and cotton manufactories are running at less than capacity. In the iron and steel industry it is estimated that the mills are not working at more than 50 per cent. of capacity. Some finished lines report a slightly larger volume of business being booked ahead, but the improvement is hardly important enough to boast about. Just at the present moment the railroads seem to be buying little and orders for structural material always fall off with the approach of winter. Among the electrical companies there has been a distinct slackening of business since the first of August. This is especially true with regard to the demand for heavy machinery. There is still considerable demand for telephone apparatus, and small motors are also selling in fair amount. Traction companies are also buying equipment in moderate volume and are keeping fairly busy the repair shops of some of the larger concerns. Considering the general state of demand in the iron and steel industry there has been a remarkably small amount of price cutting. It is reported that in a few lines of heavier materials a little price shading has been resorted to to stimulate orders, but in most important lines quotations have held firm. The early movement of the crops throughout the West and the high prices obtained have had the effect of making ready money rather plentiful, and have of course done a great deal to improve collections. Business failures for the week which ended Sept. 22, as reported by *Bradstreet's*, were 190, as compared with 210 the previous week, 171 in the same week of 1909, 267 in 1908, 166 in 1907 and 165 in 1906.

The Copper Market.

DEVELOPMENTS in the copper market last week were rather unfavorable to the holders of metal. There was more indication of pressure to sell and slight price concessions were made in many directions. Transactions, however, were very small, and inquiries for large lots of metal were so few that there is very little encouragement to expect much

[illegible]	Bid.	Asked.	[illegible] price.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

The London market Sept. 26 was as follows:

	Noon.	Close.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Extreme fluctuations for this year:

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

business in the immediate future. Domestic consumers are accepting shipments on former contracts without asking for postponement, but are placing very few new orders. It is expected that the report of the Copper Producers' Association for September will show large domestic deliveries, but this will not mean new business; they will represent the heavy orders taken in July and the early part of August. It is given out by many of the more optimistic selling agencies that the actual production of pig copper during the month of August shows considerable curtailment, and that the figures of the Copper Producers' Association represent refinery returns for the previous two months. If this is the system of preparing statistics, the August curtailment will not show in the copper tables until the October report is made public Nov. 8. Imports during the month of September have been relatively small when compared with earlier months of the year, but are still heavy enough to augment considerably the production figures. Exports for the month up to and including Sept. 26 have been 27,850 tons. Daily call on the metal exchange Sept. 26 quoted standard copper as per the accompanying table:

Industrial and Commercial Notes.

Central Colorado Power Company and Denver Gas & Electric.—It is now fairly well understood in Denver that the Central Colorado Power Company and the Denver Gas & Electric Company have come to terms and that a contract will soon be signed by which the Denver company will become the purchaser of practically all of the energy which the Central Colorado Power Company has for sale. In June there was a motion put on foot by the Central Colorado company looking toward securing a franchise from the city for distributing energy for lighting and power purposes. If such a program was ever seriously contemplated it has apparently been abandoned and wholesaling energy will be the entire business of the company. The Denver Gas & Electric Company, which is now entirely dependent upon steam plants, has agreed to purchase from the Central company about 10,000 hp per year, which practically is all that the company has for sale in Denver. In Denver there are many rumors that the Central Colorado Power Company intends to develop a number of new plants and increase its capacity to 50,000 hp, but these stories lack confirmation. For the past six weeks G. B. Walbridge, president, and O. B. Willcox, vice-president of the Central Power company, have been in New York negotiating the deal with the operating authorities of the Denver Gas & Electric Company. No official statement, however, is obtainable.

Telephone Improvement Company.—It is announced that Frederick C. Stevens, now chairman of the New York State Department of Public Works, will retire from this position at the end of the year to become president of the Telephone Improvement Company, a corporation soon to be incorporated under the laws of New York. This company will be formed through the consolidation of the Telechronometer Company, of Rochester, and the North Electric Company, of Cleveland. These companies control a patent meter for measuring the time-use of telephones, an automatic telephone message-meter and a new switchboard patent. The manufacturing plant of the new company will probably be in Rochester.

J. G. White & Company Contract.—J. G. White & Company, Inc., engineers and contractors, 43 Exchange Place, New York, have been awarded a contract by the New York, Ontario & Western Railway Company for the erection of railroad shops at their Mayfield yards, Mayfield, Pa., near Carbondale. The work to be carried out consists of the erection of a 10-stall roundhouse, with a 75-ft. turntable, machine shop, carpenter shop, with complete power plant, storehouse, office building, oil building, sand storage, drier and loading house, and a complete coaling station with a storage capacity of approximately 1,000 tons. The buildings will be of the usual type of brick and steel construction. The estimated cost is approximately $150,000.

Washington 300,000-hp Hydroelectric Development and 1200-mile Railway.—[illegible] Railway Company, a $25,000,000 corporation, with headquarters in London, New York and Tacoma, have secured the services of the W. K. Palmer Company, engineers, of Kansas City, in connection with the development of about 30 hydroelectric properties in the State of Washington aggregating 300,000 hp and the construction of 1,200 miles of railway to be operated from these plants. The Palmer Company will serve as consulting engineers, take charge of all engineering work and supervise construction.

Waverley Electric for Manchuria.—The Waverley Company, of Indianapolis, has recently sold through Fearon, Daniel & Company, of Shanghai, one of its electric runabouts to Taotai Key, managing director of the Mukden (Manchuria) Electric Light Works.

Sales of Ice-Making Machinery.—Within the last month the York Manufacturing Company, of York, Pa., has sold the following ice-making and refrigerating machinery: William Esser, Spokane, Wash., 11-ton refrigerating plant; Reading (Pa.) Abattoir Company, 65-ton compression side, brine coolers and piping; Consolidated Ice & Power Company, Valdosta, Ga., 11-ton refrigerating plant; Delaware Ice & Light Company, Selbyville, Del. 20-ton ice-making plant; George A. Fuller & Company, general contractors, 30-ton refrigerating plant for the Whitehall Annex Building, New York City; the Schumacher Company, Houston, Tex., eight-ton refrigerating plant; Great Falls (Mont.) Meat Company, 20-ton compression side and expansion piping; Charles F. Scheffer, Dewart, Pa., 10-ton refrigerating plant; Wilson Creamery Company, Huntington, W. Va., 40-ton compression side, brine coolers and piping; Percy Fur House, Oshkosh, Wis., six-ton refrigerating plant; Jacob A. Day, Kingston, N. Y., four-ton refrigerating plant; Henry Meyer, Brooklyn, N. Y., 240-ton complete ice-making plan; John Treber, Deadwood, S. D., eight-ton ice-making plant; McSweeney Packing Company, Sweetwater, Tex., 65-ton compression side, 10-ton freezing system and expansion piping; Althoff Manufacturing Company, Denver, Col., 30-ton compression side to be installed at the Western Packing Company's plant; Eastman Kodak Company, Rochester, N. Y., 400-ton high pressure side; Riverton (N. J.) Ice & Cold Storage Company, 20-ton compression side, 12-ton freezing system and brine piping, and Crystal Springs Ice Company, Cincinnati, 150-ton high pressure side.

Power, Transit & Light Company.—The Power, Transit & Light Company, of Bakersfield, Cal., has awarded a contract for the construction of a new steam power plant to J. G. White & Company, Inc., engineers and contractors, New York City. The building will be 82 ft. x 140 ft., with substructure of concrete, self-supporting steel frame, and walls of metal lath and plaster, which is the usual form of construction throughout lower California, and will be designed to accomodate two 2000-kw horizontal turbines, with boilers, condensers and necessary auxiliaries. A 750-kw turbine will be temporarily installed at the earliest possible date. Water for condensing purposes will be obtained from an irrigation ditch near the plant, and the water for boiler purposes will be supplied from wells to be driven near the power house. As the boilers will be installed with oil burners, there will be no basement under the boiler room. The station will be designed electrically to deliver practically full load at either 60,000 volts, 10,000 volts or 2300 volts, and will operate at all the above pressures simultaneously. The estimated cost is approximateyl $400,000.

Hickory (N. C.) Hydroelectric Plant.—Colonel Marcellus E. Thornton, of Hickory, N. C., has commenced construction of the hydroelectric plant on the Catawba River, three and one-half miles out from Hickory, of 9000 primary horse-power, with from 2000 to 8000 secondary horse-power, after over five years of indefatigable effort. The proposition is one believed to be of extraordinary merit. The dam is to be 42 feet high and the unpounded water extends back up to the Catawba River six miles, thus producing an area of impounded water the first two feet of which will alone operate the plant ten hours without other supply of water. Several large and strong concerns have bespoken current for power and will locate plants out on the river, where land is cheap and can be had, and in Hickory. An electric Edison storage-battery car line will be operated from the railroad at Hickory out to the dam at once. This will haul railroad cars and freight in bulk. The name of this corporation, which is under the laws of North Carolina, is the Water Power Electric Company. It will be completed and in operation within a year or fourteen months.

Power Plant for Comox (B. C.) Coal Fields.—Engineers are now at work making surveys in connection with the project of the Canadian Collieries (Dunsmuir) Limited, for the development of 50,000 hp on the Puntledge River in the center of the Comox coal field in British Columbia. The Canadian Colliers Company is controlled by Messrs. William McKenzie and D. D. Mann, who organized the company when they purchased the large coal interests of Hon. James Dunsmuir, ex-Premier and Governor of the Province of British Columbia, some months ago. It is expected that within the next month several hundred men will be employed on the construction of the dam and power house and that the whole work will be completed within a year. The electrical energy to be developed [illegible] in the mines and in running the various plants, as well as a 14-mile railway line connecting the different collieries with the ore bunkers at Union Bay.

Allis-Chalmers Company.—The Allis-Chalmers Company reports that, while business continues to be good, orders during August were not as large as those in either July or June. A representative of the company says that domestic business showed a distinct falling off, except in the line of mining machinery. A few good orders for electrical apparatus were taken, among which might be mentioned a 6500-kw generator for the Cliff Electric Distributing Company, of Niagara; two steam turbines for the city of Grand Rapids; one 550-kva hydroelectric unit with transformers for Sturgis, Mich., and two 2000-kw steam turbine units for the New Jersey Zinc Company's plant at Hazard, Pa. There were also quite a number of large export orders for Russia, Japan and Mexico, principally devoted to mining machinery.

Electricity Helping the South.—B. Frank Mebane, a large cotton manufacturer of Spray, N. C., who has recently been in New York, is quoted as saying: "The situation of the cotton manufacturers in the South is growing better all the time. A large part of this improvement is due to the development of electric power for operating cotton mills. The extensive operations of the Southern Power Company mean the supply of power in small units to small plants and to individual consumers. This is a progressive step in the way of giving to the makers of cotton goods electricity to compete with the cheap manual labor of Japan and China. The use of electricity is the means by which our manufacturers can meet the competition of cheap foreign labor."

Amateur Wireless Operators Organizing.—An effort is being made under the direction of George Hiram Mann, an attorney of Washington, to form a national organization of amateur wireless operators. It is given out that the object of this organization is: first, to defeat the Depew bill; second, to secure the passage of the Roberts joint resolution, which provides a commission to take testimony before any legislative action is adopted, and, third, to secure an expression on behalf of all the amateurs favoring some positive legislation which will give them protection. This organization expects to be heard by any congressional committee that considers wireless legislation at the next session.

Mexican Interurban Lines.—The Mexico Tramways Company, the Canadian concern which owns the hydroelectric plant at Necaxa and the extensive system of electric railways in Mexico City, has received concessions from the Mexican government for the construction of two electric interurban lines. One is to run between Mexico City and Puebla, a distance of 129 miles, and the other between Mexico City and Toluca, 32 miles. The construction of these lines will involve some heavy and costly work. The concessions are for a period ninety-nine years, and construction work will be begun at once. It is expected to have both lines completed within three years.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Comox, B. C., Can.; North Adams, Mass.; Bakersfield, Cal.; Georgetown, Cal.; San Marcos, Tex.; Sykesville, Md.; Yorkton, Sask., Can.; Alexandria Bay, N. Y.; Allentown; N. J.; Anaconda, Mont.; Rochester, N. Y.; Duluth, Minn.; Centreville, Mich., and Buffalo, N. Y.

Trent River Energy at $25 a Hp-year.—A Campbellford (Ont.) company which has acquired interests for the development of electricity at Healey's Falls on the Trent River, has made a proposition to supply the Kingston (Ont.) city corporation with electrical energy at $25 per hp per annum. If negotiations are concluded it is intended that construction of the power plant will commence and that energy may be delivered within a year.

General Electric Company Sales.—Among the recent sales of the General Electric Company are: two 1500-kw steam turbine units to the Cleveland Electric Illuminating Company, to be installed in the Seventieth Street power station, and one 1000-kw rotary converter to the Yonkers Railroad Company.

Charleston Consolidated Railway & Lighting Company. The Charleston Consolidated Railway & Lighting Company has let a contract for the construction of its new power plant. The plant when completed, it is estimated, will cost about $200,000.

Financial.

The Week in Wall Street.

There were a number of interesting happenings in the Wall Street market last week which tended to promote more than usual interest and to a limited degree some activity. While the total transactions for the week were not large, they were an improvement over the few weeks previous. The trend of prices was upward, but at the end of the week there had been some reactions and net gains were small. The first encouraging development was the decision of the master in the Minnesota Circuit Court of Appeals on the Northwestern rate case. This decision, which was in favor of the railroad, furnished much encouragement to Wall Street traders and produced some interest in railroad shares. It was immediately followed by a fair advance, which, however, only lasted two days, owing to sales by profit-takers and to the statement made by Commissioner Lane, of the Interstate Commerce Commission, to the effect that the railroads could not solve their financial difficulties by higher traffic charges. It was the general opinion that such a statement would not have been made by Mr. Lane had it not reflected the prevailing sentiment of the commission. Another feature which helped along Wall Street sentiment was the practical announcement of the entrance into the Interborough Rapid Transit Company of a powerful syndicate of bankers. One bright feature of the week was a somewhat better enquiry for bonds. Actual transactions in bonds were considerably increased and prices for all good issues were notably stronger. Although such a thing is unusual at this period of the year, there were substantial reductions made last week in the rates for time money. This indicates that the banks are still well supplied, and also that they are losing some of that conservatism which has been so marked within the past two months. Quotations Sept 26 were: Call, 1¾ @ 2 per cent; 90 days, 4½ @ 4¾ per cent. The quotations in the table are those of the close Sept. 26.

NEW YORK.

	Sept. 19.	Sept. 26.	Shares sold		Sept. 19.	Sept. 26.	Shares sold.
[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	83,390
[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	1,850
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am. D. T....	20½*	[illegible]	—	Ma[illegible] Ele[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
Am. Tel. & C.	71¼*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T..	135	[illegible]	8,270	Steel, pfd....	115½	[illegible]	[illegible]
B. R. T. ...	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gen. Elec	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	62½	3,600
Int. Met.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	400

PHILADELPHIA.

	Sept. 19	Sept. 26.		Sept. 19.	Sept. 26.
Am. Rys..........	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elec. Co. of A..	[illegible]	11½*	Phila. R. T........	[illegible]	[illegible]
Elec. St. B'ty	[illegible]	47	[illegible]	[illegible]	[illegible]
E. S. B'ty, pfd......	30*	[illegible]	[illegible]	[illegible]	[illegible]

CHICAGO.

	Sept. 19.	Sep. 26.		Sept. 19.	Sep. 26.
Chi. City Ry.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chi. Rys., Ser. 1	[illegible]	[illegible]	Met. El. Co.........	19*	[illegible]
Chi. Rys., Ser. 2	[illegible]	[illegible]	Met. El., pfd.......	62*	[illegible]
Com. Edison........	111	[illegible]	Nat'l Car..........	[illegible]	[illegible]
Chi. Subways	[illegible]	[illegible]	Nat'l Car., pfd......	120*	[illegible]

BOSTON.

	Sept. 19.	Sep. 26.		Sept. 19.	Sep. 26.
Am. T. & T..........	[illegible]	[illegible]	Mex. Tel..........	[illegible]	[illegible]
Cum. Tel...........	144½*	143	Mex. Tel., pfd..	[illegible]	6½*
Edison E. Il.	[illegible]	[illegible]	N. E. T.	[illegible]	[illegible]
Gen. Elec.	[illegible]	145	W. T. & T......	[illegible]	[illegible]
Mass. E. Ry.	[illegible]	18	W. T. & T., pfd.	[illegible]	[illegible]
Mass. E. Ry., pfd...	81½*	[illegible]			

*Last price quoted.
Shares sold for week Sept. 19 to Sept. 24.

Financial Notes.

Montreal Power-Railway Merger.—The past week has [illegible] Montreal Light, Heat & Power Company, the stock going to over 161 during a week of considerable excitement, consequent upon the meeting on the same day of the boards of directors of the Montreal Street Railway and the Montreal Light, Heat & Power companies. It is understood that as a result of these meetings a circular will shortly be forwarded to the shareholders of the two companies suggesting a possible basis of amalgamation, current rumors being to the effect that Montreal Street Railway stock will be taken into the amalgamation at 250, while 190 will be the figure allowed to the shareholders of the power company. The proposed consolidation has aroused the citizens of Montreal, and it is proposed to have the board of control or City Council request the recently formed Public Utilities Commission to investigate the proposed merger. Colonel Hibbard, chairman of the commission, stated that according to the act constituting the commission, where the rates are not a matter of contract, the commission has the power to revise rates, and it may fix them at what it considers a reasonable figure.

Traction Opposition In Montgomery, Ala.—On Sept. 19 a street railway franchise was granted by the City Council of Montgomery, Ala., to Colonel Charles F. Woodward and associates of Boston, Mass. Colonel Woodward has put up cash forfeit to guarantee the building of a trolley road. It is expected that an extensive system will be developed, and that many of Montgomery's suburbs will be reached. It is claimed that since the lines of the Montgomery Traction Company were built the center of population of the city has considerably expanded. The new street railway with a few miles of track will reach the majority of the population. It is reported that this new street railway project has the backing of Henry L. Doherty and other New York financiers. The Doherty interests are already heavily involved in Montgomery, controlling the Montgomery Light & Water Power Company. Recently the interests back of this company attempted to take over the Citizens' Light, Heat & Power Company—the controlling interest of which is in the hands of R. Tillis, who owns the existing traction company.

Commonwealth Power, Railway & Light Company.—The make-up of the Commonwealth Power, Railway & Light Company, the holding concern of the Hodenpyl, Walbridge & Company and the E. W. Clark & Company properties in Michigan, is officially given out as follows: Constituent companies, Grand Rapids Railway Company, Saginaw-Bay City Railway Company, Michigan Light Company, Consumers' Power Company, and Cadillac Water & Light Company. The company owns and operates the street railway properties in Saginaw, Grand Rapids and Bay City and the interurban line connecting the two last-named cities; gas properties in Jackson, Kalamazoo, Pontiac, Flint, Saginaw and Bay City; electric light and power companies in Grand Rapids, Kalamazoo, Jackson, Flint, Saginaw, Bay City, Cadillac, Pontiac, Battle Creek, Lansing, and a number of intermediate cities and towns. The capital stock of the company is $6,000,000 cumulative 6 per cent preferred, $12,000,000 common stock. There have been no bonds issued.

Northwestern Elevated Railroad Company.—The annual report of the Northwestern Elevated Railroad Company of Chicago, for the year ended June 30, 1910, shows total earnings of $2,632,038, an increase of $91,155 compared with the preceding year. Operating expenses for the year amounted to $1,055,685, including $737,670 for conducting transportation, $149,593 for maintenance of equipment, $56,435 for maintenance of way and structure, and $111,987 for general expenses. The other charges against earnings amounted to $1,200,254, including bond interest of $944,100. The net earnings were $376,029, of which $150,000 was paid in dividends. The report shows that the ratio of operating expenses to earnings in the fiscal year 1910, exclusive of the earnings of the Union Loop, was 51.25 per cent, compared with 49.82 per cent for the preceding year.

Metropolitan West Side Elevated Railway Company.—For the year ended June 30, 1910, the Metropolitan West Side Elevated Railway Company of Chicago reports total earnings of $2,991,368, of which $2,862,932 was passenger earnings. The increase in gross revenue was 9.4 per cent over the preceding year. Total operating expenses amounted to $1,503,525, including $902,769 for conducting transportation, $214,902 for maintenance of equipment and $135,560 for maintenance of way. The total net income of the year was $1,500,091, a gain of over 13 per cent, compared with the preceding year. Bond interest, taxes and various charges consumed $1,075,868 and dividends on preferred stock $130,618, leaving $293,604 for surplus, which now stands at $1,676,581. The ratio of operating expenses to receipts was 40.26 per cent.

South Side Elevated Report.—The South Side Elevated Railroad Company, of Chicago, reports total gross earnings for the year ending June 30, 1910, of $2,348,000, an increase of about $130,000. After the payment of all fixed charges and deducting $50,000 for depreciation there remained available for [illegible]

Westinghouse Back Dividends.—At a meeting of the directors of the Westinghouse Electric & Manufacturing Company last week the back dividends, amounting to 8¾ per cent on the preferred stock, were ordered paid. This will wipe out all of the arrears due on this stock which accumulated while the company was in the hands of the receiver. The first payment of these back dividends will be 3½ per cent, which will be paid Oct. 15; the next, 3½ per cent, will be paid Jan. 15, 1911, and the remainder, 1¾ per cent, paid April 15, 1911. The directors also declared the regular dividend of 1¾ per cent on the preferred stock, which is payable Oct. 15. These payments aggregate about $350,000, and the total dividend payments for the last six months will aggregate $420,000.

Pennsylvania Light and Power Merger.—There was recorded at Harrisburg last week a merger of the Philadelphia & Suburban Gas & Electric Company with the Pottstown Light, Heat & Power Company, North Penn Gas Light Company and the Lansdale & North Wales Gas Company. The combined capital of these companies is given as $4,457,500. The stocks of the four companies are owned by the American Gas Company, of Philadelphia, and the merger is in line with the plan to unite all of its subsidiary concerns. The officers of the new corporation, which will be called the Philadelphia & Suburban Gas & Electric Company, are: M. W. Stroud, of Villanova, president; S. P. Curtis, of Ardmore, vice-president; W. T. Robinson, of Haverford, secretary and treasurer.

Sedalia (Mo.) Light & Traction Company.—The bondholders' protective committee of the Sedalia Light & Traction Company, of which Otto T. Bannard, of New York, is chairman, announces that $320,000 par value of bonds have been deposited with the New York Trust Company, and $152,000 have been deposited in Chester, Pa., under an agreement to act in concert with the committee. The total issue of bonds [illegible]

DIVIDENDS.

American Cities Railway & Light Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

American Gas & Electric Company, quarterly, 1½ per cent, payable Oct. 1.

American Telephone & Telegraph Company, quarterly, 2 per cent, payable Oct. 15.

Bell Telephone Company of Canada, quarterly, 2 per cent, payable Oct. 15.

Capital Traction Company, Washington, quarterly, 1½ per [illegible]

Carolina Power & Light Company, Raleigh, N. C., quarterly, preferred, 1½ per cent, payable Oct. 1.

Central & South American Telegraph Company, quarterly, 1½ per cent, payable Oct. 8.

Chattanooga Railway & Light Company, preferred, quarterly, 1¼ per cent, payable Oct. 1.

Chicago City Railway Company, quarterly, 2½ per cent, payable Sept. 30.

Cleveland Railway Company, quarterly, 1¼ per cent, payable Oct. 1.

Consolidated Gas, Electric Light & Power Company, Baltimore, preferred semi-annual, 3 per cent, payable Oct. 1; common semi-annual, 2 per cent, payable Nov. 1.

Detroit Edison Company, quarterly, 1½ per cent, payable Oct. 15.

Electric Storage Battery Company, quarterly, both preferred and common, 1 per cent, payable Oct. 1.

Gamewell Fire Alarm Company, quarterly, 1¾ per cent, payable Oct. 1.

Gary (Ind.) & Interurban Railway Company, quarterly, 1 per cent, payable Oct. 10.

Illinois Traction System, preferred, quarterly, 1½ per cent, payable Oct. 1.

Kansas Gas & Electric Company, Wichita, preferred, quarterly, 1¾ per cent, payable Oct. 1

Manchester Traction Light & Power Company, quarterly, 2 per cent, payable Oct. 15.

Mexican Telegraph Company, quarterly, 2½ per cent, payable Oct. 15.

Mexican Telephone & Telegraph Company, preferred, semi-annual, 2½ per cent, payable Nov. 1.

New England Telephone & Telegraph Company, quarterly, 1½ per cent, payable Sept. 30.

Pennsylvania Lighting Company, preferred, quarterly, 1¼ per cent, payable Oct. 15.

Terre Haute, Indianapolis & Eastern Traction Company, preferred, quarterly, 1¼ per cent, payable Oct. 1.

Tri-City Railway & Light Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

Union Switch & Signal Company, preferred, quarterly, 3 per cent, common 3 per cent, both payable Oct. 10.

West India Electric Company, quarterly, 1¼ per cent, payable Oct. 1.

Westinghouse Air Brake Company, quarterly, 2½ per cent, extra 1½ per cent, special 1 per cent, all payable Oct. 10.

Westinghouse Electric & Manufacturing Company, quarterly, preferred, 1¾ per cent, payable Oct. 15.

REPORTS OF EARNINGS

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Light & Traction Company:					
[illegible]	[illegible]	[illegible]	$255,786	[illegible]	[illegible]
[illegible]	[illegible]	8,215	228,195	[illegible]	[illegible]
Boston Suburban Electric Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Central & South American Telegraph Company:					
[illegible]	[illegible]	[illegible]	238,2[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chicago South Side Elevated Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	302,965
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	69,405
Kansas City Railway & Light Company:					
August, 1910	621,929	[illegible]	254,169	188,460	[illegible]
[illegible]	[illegible]	[illegible]	260,306	174,033	86,273
[illegible]					
[illegible]	[illegible]	[illegible]	439,811	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	197,403	[illegible]	[illegible]
Mexican Telegraph Company:					
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
Mexican Tramways Company:					
August, 1910	526,001	[illegible]	266,731		
[illegible]	[illegible]	[illegible]	237,463		
Montreal Street Railway Company:					
August, 1910	396,828	216,314	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nashville Railway & Light Company:					
[illegible]	[illegible]	87,748	58,290	[illegible]	20,531
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17,507
Northern Ohio Traction & Light Company:					
August, 1910	263,149	135,832	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Northwestern Elevated Railroad Company, Chicago:					
[illegible]	[illegible]	1,055,686	1,576,353	[illegible]	[illegible]
Year ended June 30, 1909	2,540,883	995,818	[illegible]	[illegible]	[illegible]
Ontario Power Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August, 1909	48,899	[illegible]	37,149	27,146	[illegible]
Philadelphia Rapid Transit Company:					
[illegible]	[illegible]	9,886,759	8,104,342	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	8,952,792	8,192,572	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,768,804
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,411,501
[illegible]					
[illegible]			[illegible]	[illegible]	[illegible]

General News

Construction News.

BIRMINGHAM, ALA.—The City Council is contemplating enlarging the electric light plant in North Birmingham, recently taken over by the city.

BIRMINGHAM, ALA.—At an election held Sept. 19 the citizens voted against the proposition to sell the municipal electric light and water plants in North Birmingham.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has ordered special tungsten lamps which will be placed in one of the principal alleys of the city as an experiment. If satisfactory it is expected that all downtown alleys will soon be lighted by tungsten lamps.

MONTGOMERY, ALA.—The City Council has granted the Montgomery Traction Company a franchise to extend its road from the end of the present Cloversdale line to the new college for women, in Montgomery.

NORMAL, ALA.—Walter S. Buchanan, it is reported, would like to receive prices on electrical equipment for lighting hospital and trades school.

BENSON, ARIZ.—The installation of an electric light plant in Benson is under consideration. The equipment of the plant will include a 60-kw generator and two engines. J. E. Collins, of Tucson, Ariz., is interested in the project.

JEROME, ARIZ.—The Haynes Copper Company is reported to be installing electrical euipment for operating machinery at its mines, including a large motor-driven pump. The company contemplates extensive development work, which, it is said, will require additional equipment in the spring.

PHOENIX, ARIZ.—Extensive improvements and extensions are contemplated by the Phoenix Railway Company to its local and interurban lines, which will involve an expenditure of about $125,000. The work will include the construction of a ten-mile extension to the Indian School and to Glendale, laying new tracks on other lines and the purchase of new rolling stock. Samuel L. Mitchell is general manager.

FORREST CITY, ARK.—The Caldwell Telephone Company is reported to be constructing rural lines in St. Francis County, from Forrest City to Good Hope.

GRAVETTE, ARK.—The local electric light plant, owned by the Electrical Promoting Company, is reported to have been purchased by the City of Gravette, and will be operated as a municipal plant. It is proposed to enlarge and improve the entire system. A new generator has already been purchased. E. F. Craven has been engaged as superintendent.

LITTLE ROCK, ARK.—Contracts will soon be awarded by the Little Rock & Hot Springs Electric Railway Company for the construction of its proposed railway from Little Rock to Hot Springs. L. Garrett, 219½ Main Street, Little Rock, Ark., is general manager.

ALHAMBRA, CAL.—At a meeting of the taxpayers, held recently, the proposition to install a municipal electric light plant was carried. Bonds will be voted to provide funds to establish a plant.

BAKERSFIELD, CAL.—The Power, Transit & Light Company, of Bakersfield, Cal., has awarded the contract for the construction of a steam and electric power plant in Bakersfield, to J. G. White & Company, engineers, 43 Exchange Place, New York, N. Y. The building will be 82 ft. x 140 ft. and will be designed to accommodate two 2000-kw. horizontal turbines, with boilers, condensers and auxiliary apparatus. A 750-kw turbine will be installed as soon as possible. The boilers will be installed w[illegible] oil burners. The station will be designed to deliver electricity at either 60,000, 10,000 or 2300 volts, and will operate at all the above pressures simultaneously. The cost of the plant is estimated at $400,000.

BARSTOW, CAL.—Sealed bids will be received by the Board of County Supervisors until Oct. 10 for a franchise applied for by the Pacific Light & Power Company to erect and maintain lines for the transmission and distribution of electricity upon highways of this county.

BARSTOW, CAL.—The Atchison, Topeka & Santa Fe system is reported to have added $75,000 for the installation of an electric light plant to its appropriation of $500,000 for expenditures in the Town of Barstow, where extensive improvements are being made in connection with its system. The equipment of plant includes two 100-kw General Electric turbo-generator sets.

FRESNO, CAL.—The San J[illegible] sev-eral contracts to supply electricity from its new Crane Valley power plant to the gold mines in that vicinity. The company is erecting new transmission lines to Merced, which will soon be completed. A new line is also being erected up Merced River to Jaspar to the large rock crushing plant in that place, it [illegible] Yosemite Stone Company's plant, located on the Merced River, eight miles above Merced Falls. Transmission lines are also being extended to Snelling to supply energy for lamps and motors in that town and also to a gold dredging plant located near there. It is also proposed to extend the system to the Mount Gains Mine. A. G. Wishon is general manager.

GEORGETOWN, CAL.—Preliminary work is now being done by the Rubicorn Water & Power Company for the construction of a large hydro electric power plant on the American River, above Georgetown. The company maintains an office in Georgetown, Cal.

GEORGETOWN, CAL.—Preparations are being made by the Loon Lake Water & Power Company, successor to the California Water & Mining Company, for the construction of large storage reservoirs and erection of large hydroelectric power plants on the Georgetown Divide. It will require several years to complete the work. A large part of the work is located about 25 miles from Georgetown. H. D. Jerrett is local manager.

LOS ANGELES, CAL.—The Pacific Electric Railroad Company has applied to the City Council for a franchise to lay tracks in Pedro Street.

LOS ANGELES, CAL.—The Southern California Edison Company, of Los Angeles, has secured, through a subsidiary company, the Chuckawalla Power Company's rights on the Colorado River, thus furnishing it with the key to a situation which means the beginning of a large irrigation project in the Southwest. The country to be reclaimed is tributary to Parker, Ariz. It is estimated that 500,000 acres can be ultimately reclaimed, of which 250,000 acres are on the California side of the Colorado River, in the great Chuckawalla Valley. The company proposes to construct a dam of solid masonry 60 ft. high and 900 ft. long across the Colorado River, six miles above Parker.

PLACERVILLE, CAL.—The American River Electric Company has recently installed three 1500-kw oil-insulated water-cooled transformers in its plant on the American River, located about seven miles from this city. Automatic high-tension circuit breakers will be instituted.

TRINITY CENTER, CAL.—Work has commenced on the construction of a new power plant to replace the one destroyed by fire nearly two years ago. It is expected to have the plant completed so that work in the mines can be resumed before winter.

UPLAND, CAL.—The City Council has passed an ordinance granting a franchise to the Pacific Light & Power Company to erect transmission lines on Orange Avenue in Upland and to connect with the Tenth Street line. The company, it is said, will probably erect a power house on Orange Avenue.

WHITTIER, CAL.—The Southern California Edison Company is contemplating the extension of its transmission lines to East Whittier to supply electricity for lamps and motors to the various oil fields in that vicinity.

DENVER, COL.—It is reported that negotiations are under way between the Central Colorado Power Company and the Denver Gas & Electric Company, whereby the latter company will retail all of the energy supplied by the Central Company in Denver. It is also stated that the Central Colorado Power Company is contemplating the construction of another power plant to be located at Grizzley Creek, six miles east of Glenwood Springs, in the cañon of the Grand River. The plans include driving a two-mile tunnel below the present bore and increasing the output of the company from 26,000 to 50,000 hp.

MONTROSE, COL.—A company has been organized to construct an electric railway through sections of the Uncompahgre Valley in Delta County. The proposed railway will connect Montrose, Olathe, Delta, Hotchkiss and Paonia. Electricity for operating the road will be secured from a plant at one of the drops in the Gunnison tunnel irrigating project, providing satisfactory arrangements can be made with the federal government. T. P. Townsend, of Denver, Col., is president of the company. E. L. Osborn, cashier of the First National Bank, of Montrose, is also interested in the project.

NEW HAVEN, CONN.—It is reported that plans have been prepared by Westinghouse, Church, Kerr & Company, of New York, N. Y., for the construction of a new power house, 70 ft. x 135 ft., for the Winchester Repeating Arms Company.

SEAFORD, DEL.—It is reported that the construction of an electric light plant in Seaford for the purpose of supplying electricity in Seaford and other Sussex County towns is under consideration. It is not expected that active work will begin until after the expiration of the contract with the Sussex Light & Power Company, which now furnishes electricity in this place.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Oct. 3, for furnishing, under proposal No. 479, bluestone terminal boxes, battery renewals, conduit, safety straps, tool belts, sounders, tubes, voltmeters, clamps, insulators, relays, zincs, etc. Captain A. S. Cowan is disbursing officer.

for furnishing at the U. S. naval stations the following supplies: Brooklyn, N. Y., schedule 2911, 37,000 ft. of duplex rubber-covered wire; schedule 2918, mild steel plates, seamless drawn copper tubing. Bids will also be received until Oct. 11 as follows: Mare Island, Cal.—Schedule 2886, one motor-driven blower; schedule 2902, 3165 lb. weatherproof copper wire, 8500 ft. rubber-covered and braided copper wire and electrical supplies. Charleston, S. C.—Schedule 2930, one motor-driven engine lathe. Application for proposals should designate the schedule desired by number.

ELBERTON, GA.—Plans have been perfected for the installation of an ornamental illuminating system in the business section of the town.

LEWISTON, IDAHO.—The Interstate Telephone Company has submitted a proposition to the Commercial Club to extend its telephone line to Lewiston from a point near Spokane, Wash., to connect with the Nez Perce Co-operative Company, thereby securing connection to all sections in Nez Perce and Idaho counties. The cost of the proposed extensions is estimated at about $100,000.

BELLEVILLE, ILL.—The contract for lighting the streets, public grounds and buildings has been awarded to the St. Clair County Gas & Electric Company for a period of ten years. Under the terms of the contract the company is to supply 351 arc lamps at $24,570 per year. The municipal buildings are to be lighted free of charge.

CHICAGO, ILL.—The Victor Electric Company, of Chicago, Ill., it is stated, has increased its capital stock from $16,100 to $300,000. The company is planning to erect a large factory building, which will more than double the space now occupied by the company.

CHICAGO, ILL.—It is reported that plans are being prepared by F. E. Davidson, architect, 98 Jackson Boulevard, and Paterson & Davidson, engineers, 9 Jackson Boulevard, Chicago, Ill., for a power house for the Progress Company, to be erected at East Ravensford Park and Berteau Avenue.

ELGIN, ILL.—The International Voting Machine Company, of Elgin, Ill., is reported to be preparing plans for the construction of a factory building, 55 ft. x 145 ft., which will be equipped for electrical operation. It is understood that equipment for the plant has been purchased.

GENOA, ILL.—Application has been made to the Board of Trustees by the Woodstock & Sycamore Traction Company, of Woodstock, Ill., for a franchise to construct an electric railway in Genoa.

ROCKFORD, ILL.—The Paris Traction Company, of Paris, Ill., has petitioned the City Council for a fifty-year franchise to extend its railway as far as Chrisman.

ROCKFORD, ILL.—The Rockford Tool Company expects to have its new factory completed and ready for operation in a short time. The plant will be operated by electric motors. The equipment has already been purchased.

ANGOLA, IND.—The Angola Railway & Power Company has just completed the installation of a new Fort Wayne arc machine and forty-four Fort Wayne 4-amp. magnetite arc lamps. C. W. Morse is manager.

BRISTOL, IND.—The construction of an electric railway to connect Bristol, Mottville, Constantine, Battle Creek and Kalamazoo is under consideration. The proposed railway will connect with the Northern Indiana Railway at Bristol. Herbert E. Bucklin is interested in the project.

CONNERSVILLE, IND.—Contracts have been awarded for electrical equipment in connection with the new pumping station as follows: For furnishing vertical electric motors and turbo-generator condenser, to the General Electric Company, of Schenectady, N. Y., at $7,090; for furnishing electrical centrifugal unit for booster station, to the Cooper-Hewitt Company, of Louisville, Ky., for $572; for tubular boilers, etc., to the Browne Company, of Dayton, Ohio, for $838, and for deep well pumps to the Roth Manufacturing Company, of Indianapolis, Ind., for

CRAWFORDSVILLE, IND.—Contracts have been awarded by the building committee of the municipal electric light plant as follows: For construction of chimney to M. W. Kellogg Stack Company, of Chicago, Ill., at $3,600; for heater and purifier, to the Hoppes Manufacturing Company, of Springfield, Ohio, $935. W. C. Carr & Son, of Crawfordsville, Ind., submitted the lowest bid for construction of the building. The contract for the building has not yet been awarded.

HARTFORD CITY, IND.—The Hartford City Lighting Company has applied to the Commissioners of Blackford and Jay counties for a twenty-five-year franchise to erect transmission lines and construct conduits for the transmission of electricity on the county roads. The company proposes to extend its system to Dunkirk and Redkey.

MACEY, IND.—The plant and holdings of the Macey Telephone Company have been purchased by Claude Warner and A. O. Yeareck, of Argus. The new owners are planning to remodel and extend the system.

LOGAN, IA.—It is reported that the Bullock Public Service Company has an offer of $6,000 for the local electric light plant.

GLASGOW, KY.—It is reported that the Louisville, Lincoln Farm &

Work will commence on the project within ninety days. J. M. Richardson

LEXINGTON, KY.—It is reported that the Lexington & Eastern Railway Company is contemplating the construction of a telephone line from Lexington to Jackson.

LOUISVILLE, KY.—The J. M. Robinson-Norton Company, of Louisville, Ky., is reported to be considering the construction of a new power

AMESVILLE, LA.—We are informed that Penick & Ford, Ltd., are in the market for a second-hand directly connected direct-current generating unit, 60 or 75 kw, 250 volt.

OWENSBORO, KY.—The City Council has granted the Owensboro & Rockport Bridge & Terminal Company a franchise to construct and operate a railway along the entire river front of Owensboro. The company is planning to build an electric railway from Rockport, Ind., to Owensboro, Ky., work on which will begin in the near future.

NEW ORLEANS, LA.—It is reported that the American Chicle Company is preparing to construct a new three-story factory building, 100 x 100 ft., and power plant, 25 ft. x 80 ft., in New Orleans, La., during the late fall or early winter.

BRUNSWICK, MAINE.—The selectmen have entered into a new contract with the Brunswick Electric Light & Power Company for street lighting, which provides for the removal of all but thirty-six of the arc lamps now in use and the installation of 105 tungsten lamps.

BALTIMORE, MD.—The Public Service Commission has approved the franchise of the Susquehanna Transmission Company to erect poles, wires and conduits in Baltimore County for the purpose of transmitting electricity from the Susquehanna River to Baltimore.

BALTIMORE, MD.—The Pennsylvania Railroad Company is reported to have awarded the contract for the construction of a new power plant, locomotive and car repair shop at Orangeville, Md., in connection with its improvements at Baltimore to Irwin & Leighton, of Baltimore.

BALTIMORE, MD.—The Susquehanna Transmission Company has applied to the Highways Commission to cross seventeen county roads with its transmission line, which the company proposes to erect from the Hartford County line through Baltimore County to the City of Baltimore.

BALTIMORE, MD.—It is reported that the Pennsylvania Water & Power Company has notified Superintendent of Lamps and Lighting McCuen that the company will not be able to supply the city with electricity. Mr. McCuen has been considering a plan under which it might be possible for the city to reduce the cost of street lighting. The plan contemplated the city owning the equipment and purchasing energy to operate the same.

BALTIMORE, MD.—Sealed proposals will be received until Oct. 5 by the Board of Awards, Baltimore, Md., for furnishing electric cable, transformers and switchboards to the various parks in the city of Baltimore, in accordance with specifications of the Board of Park Commissioners, which can be obtained at the office of the board, Madison Avenue entrance to Druid Hill Park, Baltimore, Md. William S. Manning is general superintendent of Board of Park Commissioners and J. Barry Mahool is president of Board of Awards.

SYKESVILLE, MD.—The board of directors of the Springfield State Hospital for the Insane has engaged Henry Adams to prepare plans for a new central power house and heating plant to be erected at the institution at Sykesville at a cost of about $75,000.

FALL RIVER, MASS.—The Aldermanic committee on street lamps has voted to recommend the substitution of gas and electric lamps for the 400 oil lamps now in use in the suburbs of the city; also to recommend the Mayor to execute a contract with the Fall River Electric Light Company for a term of five years to furnish not less than 100 incandescent electric lamps of 60 cp, the cost not to exceed $25 each per year, and to contract with the Fall River Gas Company for a term of three years to furnish and maintain 415 gas lamps of not less than 60 cp, the price not to exceed $22 each per year.

FOXBORO, MASS.—The Norfolk & Bristol Electric Light Company has applied to the Board of Gas and Electric Light Commissioners for permission to issue $300,000 in capital stock, the proceeds to be used for the purchase of a gas-generating plant in the Town of Foxboro. The company proposes to supply electricity and gas in this town.

NORTH ADAMS, MASS.—Plans are being considered for equipping the Hoosac Tunnel for electrical operation as soon as possible. It is understood that work will commence very soon on the construction of a power plant in Zylonite, to supply electricity for the tunnel. The equipment of the plant will include two 3500-kw generators.

NORTHBORO, MASS.—The Woodside Woolen Mills, of Northboro, Mass., have discarded steam power and are operating the mill by electricity supplied by the Marlboro Electric Light Company.

ORANGE, MASS.—Plans are being considered by the New Home Sewing Machine Company to remodel one of its buildings, which will be used in connection with the box making department. The machinery will be equipped for electric motor drive.

PITTSFIELD, MASS.—The Berkshire Street Railway Company is reported to have awarded the contract for the construction of a twenty-mile extension to the Woronoco Contracting Company. Surveys are now being made between Huntington and Lee.

SPRINGFIELD, MASS.—The [illegible] Company has petitioned the State Board of Gas and Electric Light Commissioners for permission to issue additional capital stock to the amount of $250,000. the proceeds to be used for paying the cost of permanent additions and improvements to its plant.

ANN ARBOR, MICH.—The Eastern Michigan Edison Company has recently purchased the Hudson and Dover mill dams near the source of the Huron River, just below Portage Lake, including flowage rights. from the Birkett Manufacturing Company. The deed gives the Edison company the right to create a reservoir over two miles in length, extending to and connecting with Portage Lake.

BAY CITY, MICH.—The Tittabawassee Power Company, recently organized to supply electricity in Bay City, Saginaw and other towns has awarded a contract for the construction of a dam near Sanford, where 1800 kw will be developed.

CENTREVILLE, MICH.—The Centreville Water & Electric Company is making preparations to remodel its plant and install new equipment at a cost of about $15,000. F. W. Thomson is manager of the company and Vance I. Gray, 226 Huron Street. Toledo, Ohio, is engineer.

CHEBOYGAN, MICH.—W. H. Blake is reported to have disposed of the controlling interest in the Cheboygan Telephone Company. The new owners, it is said, contemplate making improvements to the system, including the installation of new equipment.

DETROIT, MICH.—Plans are being prepared by the Detroit Sulphite Fiber & Paper Company, of Detroit, Mich., for a large addition to its plant, which will be equipped for electrical operation throughout. Albert Danielson, of Kalamazoo, Mich., is engineer in charge of the work.

ESCANABA, MICH.—The Escanaba Traction Company, it is reported, is planning to commence preliminary work in connection with the construction of its proposed hydroelectric power plant. The company, it is said, will purchase some equipment and materials for the plant this fall.

GRAND RAPIDS, MICH.—Preparations are being made by the Imperial Furniture Company for the erection of a new plant in Grand Rapids, Mich. The plant will be equipped for electric-motor drive.

GRAND RAPIDS, MICH.—Two petitions have been presented to the City Council, signed by business men and property owners, asking that the question of granting a franchise to the Grand Rapids Power Company be submitted to the voters in November. The reason given for requesting the resubmission is the desire to secure flood protection by the elimination of the water-power canals and the establishment of a central power station at the dam.

ALEXANDRIA, MINN.—The City Council is reported to have awarded a contract to A. L. Ide & Sons, of Chicago, Ill., for the installation of an 85-hp engine and 50-kw generator, direct-connected, in the municipal electric plant, for $4,300.

CANBY, MINN.—Proposals will be received at the office of the City Recorder, Canby, Minn., until Nov. 3, for one 15-kw alternating-current generator, switchboard, one 7½-hp motor, wire, etc., for use in connection with operating a sewage pump. John S. Dodds is city engineer.

DULUTH, MINN.—Preparations are being made by the National Power & Development Company, Torrey Building, Duluth, Minn., for the development of a 1000-hp hydroelectric power project on Poplar River, about ninety miles from Duluth. The cost of the work is estimated at $170,000 and will include the construction of a 35-ft. reinforced concrete dam, 1200 ft. of conduit and a 30-ton paper mill. The power plant will supply electricity to operate the paper mill and also to operate a railway. D. A. Reed is consulting engineer and J. P. Rossman manager.

MINNEAPOLIS, MINN.—The Minneapolis Furniture Frame Company is reported to be contemplating the erection of a new three-story building, to be equipped for electric-motor drive.

OSYKA, MISS.—We are informed that bids will be asked about Nov. 1 by the city of Osyka, Miss., for the construction of an electric light plant and water works system, for which bonds to the amount of $20,000 were recently voted. Clinton Thompson is Mayor and Xavier A. Kramer, of Magnolia, Miss., is consulting engineer.

KANSAS CITY, MO.—The lighting committee of the City Council is negotiating with the officials of the Kansas City Electric Light Company to secure a reduction in the price of tungsten lamps now used in the business district furnished by the company. If satisfactory terms can be made it is proposed to install a uniform lighting system in the entire business district. The company now charges $32.50 per lamp per year and the committee has asked for a reduction to $20 each per year. Louis H. Egan is general manager of the company.

ST. JOSEPH, MO.—It is reported that the Home Telephone Company and the Postal Telegraph Company will build a joint telephone and telegraph line from St. Joseph to Hannibal, Mo. The proposed line will be about 200 miles in length and will cost about $140,000.

ST. LOUIS, MO.—Sealed proposals will be received by Maxime Reber, president of the Board of Public Works, until Oct. 7, for furnishing and erecting at the high-service station No. 2 one 30-ton electric traveling crane, complete with all appurtenances, as per letting No. 9991, and for furnishing and erecting complete at the high-service station No. 2 a steel crane runway and columns with all necessary connections, as per letting No. 10,147. Plans, specifications and forms of contract may be obtained upon application at the office of the Water Commissioner, room 312, new City Hall, St. Louis, Mo.

ANACONDA, MONT.—The Anaconda Copper Mining Company, it is understood, will require a large line of electric-motor driven machinery for its various properties in the vicinity of Anaconda.

HASTINGS, NEB.—The Hastings Telephone Company is reported to have received permission from the Railroad Commission to issue $110,600 in capital stock, making a total issue of $150,000.

KEARNEY, NEB.—The Railroad Commission is reported to have granted the Kearney Telephone Company permission to increase its capital stock by [illegible]

ALLENTOWN, N. J.—Bids will be received by Charles S. Joiner, borough clerk, until Oct. 19, for construction of a municipal electric light plant, furnishing and installing one 25-kw, direct-current, 3-wire, 250-volt generator; one 30-hp, internal combustion engine, one 15-ampere, 8-hour storage battery; 2½ miles transmission lines, street lamps, switchboard, etc. Plans and specifications and form of contract may be seen at the office of the borough clerk, Allentown, and at the office of W. W. Young, consulting engineer, 220 Broadway, New York, N. Y.; 46 Park Street, Bordentown, N. J., and 1002 Drexel Building, Philadelphia, Pa. A. Robinson is Mayor.

BLOOMFIELD, N. J.—It is reported that alterations are being made to the plant of the Scott & Bowne Company in Bloomfield, N. J., which will include the erection of a new boiler and engine house.

JERSEY CITY, N. J.—Plans have been prepared by L. O. Koven & Brothers for the construction of a power plant to be erected adjoining their plant on the Paterson Plank Road. The building will be 50 ft. x 75 ft., of brick and steel construction and will cost about $25,000.

MADISON, N. J.—The Borough Council is considering the question of making improvements to the municipal electric light plant, including the installation of three 2-phase, 60-cycle alternators, 250-kw, 120-kw and 70-kw, respectively, and new switchboard to control same. H. S. Torrey is chief engineer.

MOGOLLON, N. M.—The new hydroelectric power plant of the Helen Mining Company is reported to be nearly completed. Electricity generated at the plant will be utilized to operate the machinery, etc., in its mines.

ALEXANDRIA BAY, N. Y.—The St. Lawrence International Electric Railroad & Land Company expects to purchase during the next two months one 400-hp Corliss engine and one 200-kw General Electric generator to increase the output of the plant to meet the demands for electricity for lighting purposes. B. M. Martin, of Alexandria Bay, N. Y., is superintendent.

AVON, N. Y.—The Avon Electric Company has petitioned the Public Service Commission, Second District, for permission to extend its transmission lines from Lakeville to Geneseo, or from Long Point on Lake Conesus to Geneseo. The cost of the proposed extension is estimated at $1,350 per mile.

BUFFALO, N. Y.—The Cataract Power & Conduit Company has applied to the Public Service Commission, Second District, for permission to issue $178,000 in bonds, the proceeds to be used as follows: For overhead construction, $7,223; for cables, etc., $48,548; for conduits, $6,277; for transformers, $3,000; for meters, $5,500; for station equipment, $50,000.

DOLGEVILLE, N. Y.—The contract for lighting the streets of the village has been awarded to the Utica Gas & Electric Company, of Utica, for a period of five years, beginning Jan. 1, 1911. Under the terms of the contract the company is to supply incandescent electric lamps at $22.50 each per year and arc lamps at $75 per lamp per year, which is a reduction of $10 per year on price of arc lamps paid under the present contract.

MAYVILLE, N. Y.—The Mayville Telephone Company is reported to have increased its capital stock from $15,000 to $25,000.

PERRYSBURG, N. Y.—Sealed proposals will be received at the office of the Department of Public Works, room 1, City Hall, Buffalo, N. Y., until Oct. 8, for the construction of the J. N. Adam Memorial Hospital for Incipient Tuberculosis at Perrysburg, N. Y., including power house for same. Plans and specifications can be seen and printed forms of proposals secured on application at the Bureau of Buildings, the office of the architect, room 298, Ellicott Square, Buffalo, N. Y., and at the office of the trustees of the hospitals, room 411 White Building, Buffalo, N. Y. Francis G. Ward is commissioner of public works.

ROCHESTER, N. Y.—Extensive improvements and additions are being made to the plant of the Eastman Kodak Company, at Kodak Park, Rochester, N. Y., including the installation of a 1000-kw power plant, for which, it is understood, the company is now receiving bids for equipment.

SCHENECTADY, N. Y.—The Schenectady Railway Company is contemplating extending its system in Schenectady. A franchise will soon be applied for.

ASHEBORO, N. [illegible] route of the transmission lines of the Southern Power Company from High Point to Asheboro, via Randleman, where the company has contracts to supply electricity for textile and woodworking plants.

CHARLOTTE, N. C.—Plans are being considered by the Southern Bell Telephone Company for extensive additions to its local system, for which an appropriation of $40,000 has been made. The work will include [illegible]

[illegible], N. C.—The Piedmont Traction Company, [illegible] constructing an interurban electric railway between Mt. Holly and Charlotte, is reported to have awarded contracts for the equipment of the entire system. The company has secured a franchise to enter the city. It is expected to have the proposed railway in operation between Gastonia and Charlotte, and probably Salisbury, in about six months.

GREENSBORO; N. C.—It is reported that the Southern Power Company has decided to locate one of its three large auxiliary plants in Greensboro.

GREENSBORO, N. C.—Preparations are being made by the Southern Bell Telephone Company for extensive improvements to its local system [illegible] installation of six miles of underground and aerial cables to replace the present overhead wires, and also the erection of several hundred miles of rural telephone lines. E. A. Woodruff is local manager.

RALEIGH, N. C.—The directors of the state prison are reported to be contemplating the installation of an electric light plant at the convict farm.

CAMBRIDGE, OHIO.—The capital stock of the Cambridge Home Telephone Company has been increased from $25,000 to $50,000. J. M. McKitterick is president of the company.

CLEVELAND, OHIO.—Preparations are being made by the city to place all wires in connection with the municipal electric plant under ground during the coming winter. It is said that the change will be made when the lighting system is extended to the new territory recently acquired by the city. The new street lighting system will include about 400 magnetite lamps, which will be installed at a cost of from $50,000 to $75,000. The present plans call for the installation of two new substations, a new switchboard, new poles and wire.

COLUMBUS, OHIO.—Sealed proposals will be received by H. S. Holton, director of public service, Columbus, Ohio, until Oct. 3, for furnishing ornamental lamp standards for the Mound Street viaduct. The plans call for eight standards with provision for five lamps each and fifteen standards with provision for one lamp each.

HUDSON, OHIO.—The contract for construction of the power house for the municipal electric light plant has been awarded to Philip Schmid, of Youngstown, Ohio, and for garbage disposal plant to A. A. Dittrick, of Cleveland, Ohio. D. M. Hosford is engineer.

IRONTON, OHIO.—Prenarations are being made by the Norfolk & Western Railway Company for the erection of a large signal tower in Ironton, at a cost of about $36,000.

JACKSON, OHIO.—Owing to a misunderstanding regarding the legal requirements the date for receiving bids for machinery, lamps, etc., in connection with extensions and improvements to the municipal electric light plant at Jackson, Ohio, has been extended from Sept. 29 to Oct. 20. W. A. Dallas is clerk.

DURANT, OKLA.—The City Council has awarded a contract to the Westinghouse Electric & Manufacturing Company for the installation of an electric plant in Durant. The cost of the plant is estimated at about $20,000.

STILLWATER, OKLA.—The Oklahoma Public Service & Interurban Railway is reported to be contemplating the construction of a power house at Stillwater. R. A. Sturgeon is chief engineer.

TALIHINA, OKLA.—Plans are being considered to increase the output of the municipal electric plant. It is proposed to install a 35-kw, single-phase, alternating-current generator and an automatic high-speed engine.

TECUMSEH, OKLA.—The City Council has granted the Rapid Transit Interurban Company a franchise to construct an electric railway in Tecumseh. The company has received authority from the Commissioners of Pottawatomie County to cross all highways. It is expected that work will commence soon on construction of the railway.

TULSA, OKLA.—The Tulsa Corporation is reported to be contemplating the installation of additional machinery in its electric light plant, including a 500-kw turbo-generator set, two boilers with a total rating of 1000 hp, and condensers.

BAKER CITY, ORE.—Plans are being considered by the Commercial Club for the installation of an ornamental street lighting system in Baker City.

EUGENE, ORE.—The Tri-State Railway & Power Company has been granted a franchise for the erection of an electric transmission line from Eugene to Albany.

NYSSA, ORE.—The City Council has granted the Idaho-Oregon Light & Power Company a twenty-five-year franchise to install an elec- [illegible]

PORTLAND, ORE.—Plans are being made by the United States engineers to install an electric light plant at Big Eddy so that work on The Dalles-Celilo Canal can be continued both day and night. Lieut. H. H. Robert is local officer in charge of the work.

PORTLAND, ORE.—The Portland Railway, Light & Power Company is reported to be contemplating increasing the output of its steam plant located near the Eastern & Western Lumber Company's mill. A generator and battery of boilers will be installed. O. B. Coldwell is elec- [illegible]

PORTLAND, ORE.—Extensive improvements and additions are being made to the East Side power plant of the Portland Railway, Light & Power Company, including the installation of eight 450-hp Babcock & Wilcox boilers, ten Copes feed water-heater regulators, a Weber chimney, a Hamilton-Corliss engine direct connected to a 2000-kw General Electric generator. Charles C. Moore & Company, of San Francisco, Cal., have charge of the work.

ALLEGHENY, PA.—The American Locomotive Company is reported to be contemplating the construction of a power house, 50 ft. x 65 ft., at Allegheny, Pa., plans for which have been prepared.

ALLENTOWN, PA.—The Lehigh Valley Transit Company is reported to have secured franchises which will permit it to build an electric railway from Quakertown to Perkasie.

DILLSBURG, PA.—The construction of an electric railway from Dillsburg to Dover, a distance of about fifteen miles, is under consideration. It is proposed to organize a company capitalized at $180,000 to build the proposed road. Local capitalists are interested in the project.

DUQUESNE, PA.—It is reported that the installation of a power and heating plant in the new municipal building in Duquesne, Pa., is under consideration.

ECONOMY, PA.—The Inter-Borough Electric Company has secured permission from the War Department to lay a cable, 1375 ft. in length, across the Ohio River, near Economy, work on which will start very soon. The cable will supply electricity in Woodlawn and other towns.

PHILADELPHIA, PA.—It is reported that the Pennsylvania Railroad is planning to equip its main line for electrical operation as far as Waverly, and is also preparing plans to extend its electrical zone about thirty miles further into New Jersey. It is expected to have the railroad ready for electrical operation as far as Newark by April 1, 1911. It is understood that the Hudson & Manhattan Railroad Company, which operates the Hudson River tubes, is contemplating putting in operation during 1911 a rapid-transit system from Newark to connect with the tubes at Jersey City.

PHILADELPHIA, PA.—The new lighting system installed by the Philadelphia Electric Company was put in operation Sept. 15. Nearly 1000 twin arc lamps of 2000 cp erected throughout the city, including the 350 in the central business section, were lighted for the first time. The new lamps were installed by the company at a cost of $200,000. The street lighting system has been increased by the installation of 1129 arc lamps this year, making a total of 13,600. The cost for maintaining each lamp is $100.06 per year, making an increase in the cost of street lighting $112,967. The entire cost for next year is estimated at $1,306,783. Mayor Reyburn has given his approval to a design for the memorial electric lamp standards to be erected around Independence Hall and in Independence Square. It is proposed to erect fifty-six lamp standards, one for each signer of the Declaration of Independence, and each bearing three 2000-cp arc lamps. The standard was designed by the Philadelphia Chapter of the American Institute of Architects. It is expected to have the lamps installed by Jan. 1, 1911.

WOODVILLE, PA.—The contract for installing a feeder system for electric lighting for buildings at the Allegheny County Home, at Woodville, Pa., has been awarded to the Morganstown Electric Company, 355 Second Avenue, Pittsburgh, Pa. R. J. Cunningham is county controller.

TIVERTON, R. I.—The Town Council has entered into a contract with the Tiverton Electric Light Company for lighting the town for a period of fifteen years. Under the terms of the contract the company is to furnish not less than 100 60-cp incandescent electric lamps at $25 each per year. The company also agrees to pay the town a special tax of 1 per cent of its gross earnings.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company has awarded the contract for construction of its power plant at foot of Charlotte Street to the Gadsden Contracting Company, of Savannah, Ga. The power house will be 120 ft. square, two stories high. Orders have been placed for the equipment, consisting of one 1000-kw turbo-generator set, two 2000-kw turbo-generator sets, three 500-kw motor generators, two 100-kw turbine exciters, one 35-kw motor generator exciter, with switchboards, wiring, piping and connections; intake and discharge condensers, artesian well and boilers with a total rating of 3000 hp. One 1000-kw turbo-generator set, with switchboard, exciter and accessories, will be installed in the present power house. The cost of the work is estimated at $200,000. George H. Waring is general manager.

GREENVILLE, S. C.—The River Falls Company, recently organized to develop a town site, is reported to be contemplating the installation of an electric light plant, water and sewage systems. For further information address W. H. Patterson, 231 Candler Building, Atlanta, Ga.

GREENVILLE, S. C.—The State Railroad Commission has granted the local Southern Bell Telephone Company permission to increase its telephone rates, on condition that the company would make improvements to the local system at a cost of $100,000, the increased rates not to become effective until the improvements have been made. The work will include the erection of a new exchange building, the installation of underground conduits and modern equipment.

SPARTANBURG, S. C.—The Georgia & Carolina Railway Company will soon apply for a charter in South Carolina to construct an electric railway from Hamburg to Spartanburg, a distance of 120 miles. The capital stock of the company is placed at $100,000, to be increased later to $2,500,000. The incorporators are: Allen W. Jones, Charles C. Howard and G. R. Coffin, of Augusta, Ga.; A. E. Pafgett, of Edgeville, and Daniel Crosland, of Aiken, S. C.

DEADWOOD, S. D. The Con[illegible] P[illegible] & Light Company is reported to have awarded the cont[illegible] [illegible]struction of an addition to its power house to Mullen & Rourke, of Deadwood, S. D. The cost of the work is estimated at about $40,000.

ONIDA, S. D.—The Onida Electric Light & Power Company has been granted a twenty-year franchise to construct and operate an electric light plant in Onida.

KNOXVILLE, TENN.—It is reported that Eastern capitalists have purchased from the Knoxville Power Company its riparian rights, seven and one-half miles of river frontage property, several thousand acres of land and all other holdings for a hydroelectric power plant on the Little Tennessee River. The new owners, it is said, will commence work at once on the development of the water power on the Little Tennessee River with a view of supplying electricity in Knoxville and other towns and cities in Eastern Tennessee. The cost of the plant is estimated at $3,000,000. R. W. Austin was one of the promoters of the Knoxville Power Company.

SPARTA, TENN.—The Home Telephone Company, recently incorporated, is planning to construct a telephone line to connect Cookeville and Smithville, a distance of fifteen miles. C. W. Roberts is manager.

AUSTIN, TEX.—The City Council is considering an ordinance requiring the Southwestern Telegraph & Telephone Company to place its wires underground on certain streets in the city.

HOUSTON, TEX.—The contract for construction of power plant and engineering laboratory of the William M. Rice Institution is reported to have been awarded to William Miller & Sons, of Pittsburgh, Pa., and Houston, Tex., for $182,430.

SAN MARCOS, TEX.—The City Council has granted the San Marcos Utilities Company an extension of its franchise for a period of twenty years, in return for which the company is to pay a franchise tax of 3 per cent on its gross earnings and to supply electricity to private consumers for lamps as follows: For the first 20 kw-hours at 15 cents per kw-hour; 12½ cents per kw-hour for the next 20 kw-hours and 10 cents for all above. The company is contemplating making extensive improvements to its plant.

VERNON, TEX.—We are informed that the Vernon Light & Power Company is contemplating making extensive improvements to its system which will double the output of the plant in the near future. L. H. Sullins is superintendent.

WACO, TEX.—The civic improvement committee of the Business Men's Club is reported to be ready to receive bids for the installation of an ornamental lighting system for the business section of the city. C. W. Coons is secretary of the club.

PARK CITY, UTAH.—The auxiliary steam plant of the Park City Electric Light Company was recently destroyed by fire.

EMPORIA, VA.—The hydroelectric power plant of the Emporia Hydro-Electric Corporation has been completed and will soon be put into operation. The plant will develop about 1000 kw and cost about $200,000.

PETERSBURG, VA.—The Southern Timber & Land Company is reported to be in the market for electrical equipment for operating a band mill, and would like to correspond with parties interested. J. W. Seward is president of the company.

BRATTLEBORO, VT.—Negotiations are under way between the Board of Trade and M. Z. Chase, of Providence, R. I., and H. L. Harriman, of Hyde Park, Mass., for the establishment of cotton mills in Brattleboro, costing about $500,000. The promoters ask for a free site, subscription for $120,000 of the capital stock and exemption from taxes for a period of years. It is proposed to operate the mill by electricity obtained from the plant of the Connecticut River Power Company, at Vernon, Vt.

PASCO, WASH.—The appropriation for the Water and Light Department has been increased by $3,000 for the purpose of extending the lighting system to the residence portions of the city.

SEATTLE, WASH.—At an election to be held Nov. 8 a proposition to issue $1,400,000 in bonds, the proceeds to be used for extending and enlarging the municipal electric light plant, will be submitted to a vote.

SEATTLE, WASH.—The City Council has passed an ordinance providing for enlarging and extending the municipal electric light plant, which will call for an expenditure of about $1,400,000. A special election will be held in November to vote on the proposition to issue bonds to pay for the improvement.

SPOKANE, WASH.—Announcement has been made by H. H. Shallenberger, secretary of the International Lead & Iron Company, that a town is being laid out at Salmon Rapids, and preliminary surveys have been made for the installation of a 65,000-hp electric power plant on the Salmon River.

TACOMA, WASH.—The Puget Sound, Chelan & Spokane Railway Company, recently incorporated with a capital stock of $25,000,000, has engaged the W. K. Palmer Company, engineers, 717-720 Dwight Building, Kansas City, Mo., as consulting engineers to take charge of all its engineering work and supervise construction. The railway company proposes to develop about thirty hydroelectric properties in the State of Washington, aggregating more than 300,000 hp, and the construction of about 1200 miles of electric railway.

JARROLDS VALLEY,, W. VA.—It is reported that the Seng Creek Coal Company is in the market [illegible] operated machinery for its mines, bids for which will be opened in October.

WELCH, W. VA.—The contract for the construction of the power house at the Miners' Hospital has been awarded to the J. D. Shott Paving Company, of Bluefield, W. Va.

WHEELING, W. VA.—The Wheeling Traction Company is reported to have awarded the contract for additional equipment for its power station to the Westinghouse Electric & Manufacturing Company, consisting of an 1800-kw low-pressure steam turbine, operating on exhaust steam, and two 500-kw motor generator sets.

GREEN BAY, WIS.—It is reported that the Green Bay Barker Company, recently organized, is contemplating establishing a factory at Green Bay, Wis., for manufacturing a machine designed for stripping bark from pulp wood in large mills. It is understood that the plant will be equipped for electric motor drive. Electricity for operating the plant will be purchased from the Northern Hydroelectric Power Company.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has been granted a franchise by the City Council to extend its tracks on Seventh Street and Eleventh Street.

NEENAH, WIS.—The Hardwood Products Company, it is reported, will erect a three-story factory, 40 ft. x 60 ft., with the co-operation of the Neenah Industrial Association in Neenah. A separate power plant will be erected. It is understood that the plant will be equipped for electrical operation.

OSHKOSH, WIS.—The Waite Grass Carpet Company is reported to be contemplating the purchase of a number of electric motors during the fall.

RACINE, WIS.—The Racine Manufacturing Company, it is reported, will soon be in the market for equipment, including motors, for the addition to be made to its plant.

COMOX, B. C., CAN.—Surveys are being made in connection with the project of the Canadian Collieries (Dunsmuir), Ltd., for the development of a large hydroelectric plant on the Puntledge River in the center of the Comox coal field in British Columbia, where it is estimated that 50,000 hp. can be developed. Electricity generated at the plant will be utilized in operating a system of compressed air haulage in the mines and machinery in various plants and also to operate a 14-mile railway connecting the different collieries with the ore bunkers at Union Bay.

WINNIPEG, MAN., CAN.—Bids will be received by the Board of Control until Oct. 7 for a motor car for use on standard-gage railway track. M. Peterson is secretary of board.

LONDON, ONT., CAN.—Contracts have been awarded by the Water Commissioners for electrical equipment for the Springbank pumping station as follows: For two 3,000,000-gal. turbine pumps to the John McDougall Iron Works Company; to the Canadian Westinghouse Company for two 250-hp self-starting, synchronous motors with direct-connected exciters; for two 350 kva, 3 phase, 13,200 to 2300-volt, self-cooled transformers, to the Allis-Chalmers-Bullock Company, and for switchboard equipment to Siemens Brothers. H. J. Glaubitz, Continental Life Building, Toronto, Ont., Can., is consulting engineer.

TORONTO, ONT., CAN.—Application has been made to the Hydro-Electric Power Commission by the municipalities of Morrisburg and Prescott for service, and the commission has instructed the engineer to furnish them with an estimate of the cost upon the price received from the Ontario Power Company. It is understood that the price to Morrisburg, where 2000 hp was asked for, will be $16.33 per hp per year, and to Prescott, which desires 1000 hp, the rate will be $22.12 per hp per annum.

WINDSOR, ONT., CAN.—At a meeting of the representatives of the municipalities using electricity supplied by the Hydroelectric Power Commission, held recently, it was decided that the city of Windsor should be allowed to export part of power taken from the commission to Detroit, Mich. Under the agreement made with the commission energy will be supplied to Windsor at the following rates: For 5000 hp, $48 per horse-power per year; $33 per horse-power per year for 10,000 hp; $28 per horse-power for 15,000 hp, and $25 per horse-power for 20,000 hp.

MONTREAL, QUE., CAN.—The Board of Control is reported to have decided to recommend to the City Council to accept the bids of the Montreal Light, Heat & Power Company for lighting the streets for a period of ten years. The company submitted a proposition offering to supply 1650 lamps or over at $72.70 each, on schedule "A," and $63.15 on schedule "B."

YORKTON, SASK., CAN.—Bids will be received until Oct. 11 by T. F. Acheson, secretary and treasurer, for equipment for an electric light plant as follows: Section 1, boilers; section 2, engines, piping, etc.; section 3, generators, switchboard and arc lamps; section 4, transformers; section 5, meters. Specifications may be obtained from W. E. Skinner, Ltd., consulting engineers, Winnipeg, Man., Can., or from T. F. Acheson, secretary and treasurer.

New Industrial Companies.

THE AEROCRAFT COMPANY, [illegible] of incorporation with a capital stock of $10,000 for the purpose of manufacturing motors. The incorporators are: Benjamin L. Gates, Hugh H. Abernathy and Joseph J. Zini.

THE AMERICAN STORAGE BATTERY COMPANY, of Cambridge, Mass., has been incorporated with a capital stock of $50,000 for the [illegible] van, of Auburndale, Mass., is president, and C. M. Ludden, of Waltham, Mass., treasurer.

THE CABLE CARRIER & TELEPHONE COMPANY, of Aurora Ill., has filed articles of incorporation with the Secretary of State at Dover, Del., with a capital stock of $200,000 for the purpose of manufacturing a motor car running on a wire and used for delivering parcels.

THE CHICAGO ACME CLEANER COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing vacuum cleaners and to operate same. The incorporators are: Charles H. Wolfe, George F. Nicklaus and Monroe Fulkerson.

THE ELECTRIC DISINFECTING & PERFUMING COMPANY, of New York, N. Y., has been chartered by E. J. Forhan, G. F. Martin and H. P. Jones, all of 154 Nassau Street, New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture machines for disinfecting and perfuming.

THE ELECTRIC LIGHTING COMPANY, of Indianapolis, Ind., has filed articles of incorporation with the Secretary of State with a capital stock of $100,000 for the purpose of manufacturing a device for lighting vehicles with electricity; also to manufacture automobile parts and accessories, electric supplies, etc. The directors are: C. C. Wedding, S. C. Renick and H. H. Harbinger.

THE ELECTRICAL SIGNALING COMPANY, of St. Louis, Mo., has been incorporated by Charles H. Parshall, Herbert A. Vrooman and Arthur G. Mosely. The company is capitalized at $50,000 and proposes to manufacture and deal in signal devices.

THE FLEXUME SIGN COMPANY, of Buffalo, N. Y., has been chartered with a capital stock of $125,000 by R. R. Wiley, W. K. Wiley, of St. Catharines, Ont., and W. C. Wallace, of Niagara Falls. The company proposes to manufacture advertising devices, illuminated signs, etc.

HOLMAN BROTHERS, of New York, N. Y., have filed articles of incorporation with a capital stock of $25,000 by P. Angwin, H. S. Brussell, of New York, N. Y., and E. W. Beebe, of East Orange, N. J. The company proposes to manufacture and deal in all kinds of machinery.

THE INTERSTATE CONSTRUCTION COMPANY, of Hammond, Ind., has been incorporated by Frank O'Shea, John C. Lavernie and Inace Schia. The company is capitalized at $30,000 and proposes to make a specialty of constructing electric railways.

THE METALLIC WELDING & MANUFACTURING COMPANY, of Louisville, Ky., has filed articles of incorporation with a capital stock of $5,000 for the purpose of engaging in the electrical, steel and repair business. The incorporators are: E. L. Hughes, of Louisville, Ky.; George M. Bailey, of Kansas City, Mo., and I. Bailey, of Madisonville, Mo.

THE NATIONAL BOAT & ENGINE COMPANY, of Augusta, Maine, has filed articles of incorporation with a capital stock of $1,000,000 for the purpose of manufacturing power and small boats and vehicles of all kinds propelled by mechanical power, etc. R. S. Buzzell is president and M. M. Farrar, of Augusta, Maine, treasurer.

THE OVERLAND SALES COMPANY OF NEW YORK, of Setauket, N. Y., has been incorporated by C. T. Silver, of New York, N. Y.; E. A. Widham and J. A. S. Schaefer, of Brooklyn, N. Y. The company is capitalized at $100,000 and proposes to deal in motors, engines, etc.; also in wagons, boats and vehicles of all kinds.

THE PATENT ELECTRIC FUSE SPITTER COMPANY, of Mokelumne Hill, Cal., has been incorporated with a capital stock of $200,000 by J. B. Sayve, T. C. Peters and F. M. Sorasco, of Sutter Creek, Cal.

THE PELLER MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation for the purpose of manufacturing metal lamps, gas and electric fixtures, etc. The incorporators are: Emanual Feller, 29 Riverdale Avenue, Yonkers, N. Y.; Osias Buchalter, 293 East Third Street; Max Garfinkel, 249 South Second Street, New York, N. Y. The company is capitalized at $2,500.

THE FRANK P. PERKINS COMPANY, of Belford, N. J., has been chartered by E. H. Lane, L. Harang, of Brooklyn, N. Y., and F. P. Perkins, of Belford, N. J. The company is capitalized at $50,000 and proposes to do a general electrical engineering business.

THE SAGAMORE ENGINE COMPANY, of Portland, Maine, has been chartered with a capital stock of $40,000 for the purpose of manufacturing and selling engines and other machinery. H. M. Patten, of Stoneham, Mass., is president, and L. C. Wade, of Lynn, Mass., treasurer.

THE SAURER MOTOR TRUCKS has filed articles of incorporation with a capital stock of $1,000,000 for the purpose of manufacturing automobiles and accessories. W. M. Thompson, of Chicago, Ill., is incorporator.

THE SHAFFER MOTOR COMPANY, of New York, N. Y., has been incorporated by C. W. Shaffer, 1851 Broadway, New York, N. Y.; Earle W. Webb, 141 Broadway, New York, N. Y., and John L. Little, 45 Cedar Street, New York, N. Y. The company is capitalized at $100,000 to manufacture and deal in motors, engines, machinery, etc.

THE SHEET METAL SPECIALTY COMPANY, of Evansville, Ind., has been incorporated by Jesse, Frederick and Edna Helser. The company is capitalized at $10,000 and proposes to manufacture car fenders.

THE SHIELD ELECTRIC COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000 for the purpose of dealing in electric and other kinds of machinery. The incorporators are: Ernest E. Schmid, 557 West 124th Street; Robert M. Schmid, 23 Beekman Place; Charles P. Schmid, 2400 Seventh Avenue, all of New York, N. Y.

THE DAN SMITH ROTARY ENGINE COMPANY has filed articles of incorporation with the Secretary of State with a capital stock of $2,000,000. The incorporators are: J. H. Adams, P. A. Hatting, of New York, N. Y., and C. K. Kelly, of Philadelphia, Pa.

THE SOUTHERN ELECTRIC COMPANY, of St. Louis, Mo., has been chartered with a capital stock of $6,000 by Wilfred Hearn, W. H. Close and C. Schnyder.

THE SOUTHERN ENGINEERING COMPANY, of Jacksonville, Fla., has been organized by Alfred Oldfield and Horace P. Ramey, 411-412 Clark Building, Chicago, Ill., for the purpose of doing a general engineering business in the Southern States, making a specialty of water-power development, municipal work and colonization projects.

THE VARIABLE POWER GAS ENGINE COMPANY, of New York, N. Y., has been chartered with a capital stock of $50,000 by A. Bolognesi, Aldo Bolognesi and Alfredo Bolognesi, of New York, N. Y. The company proposes to manufacture machinery, etc.

THE WALRATH MAXIM GAS ENGINE COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing gas engines. The incorporators are: H. O. Coughlan, L. H. Guenther and A. H. Jarvis, of Jersey City, N. J.

New Incorporations.

AUBURN, CAL.—The Sunset Power Company has been incorporated with a capital stock of $500,000 by C. B. Greeley, Theodore Tremer, of Alameda, Cal., and William L. Boos, of San Francisco. The company is interested in mining and power propositions in Placer County.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Midway Light & Power Company with a capital stock of $250,000 for the purpose of generating and distributing electricity for lamps, heaters and motors. Plants will be located at Maricopa and Moran and the head office will be in Los Angeles. The directors are: H. L. Dearing, of Los Angeles, Cal.; E. F. Hughes, of Sierra Madre, Cal.; Herbert Williams, of Los Angeles, Cal.; H. J. Goudge, of Alhambra, Cal., and C. L. Chandler, of South Pasadena, Cal.

DENVER, COL.—Articles of incorporation have been filed by the Denver Tramway Terminals Company, whose purpose is to build a terminal for the Denver City Tramway Company, the incorporation papers having been filed in the interests of the latter company. It is also the intention of the Denver Tramway Terminals Company, which is capitalized at $1,400,000, to construct two loop lines.

DOVER, DEL.—Articles of incorporation have been filed for the Cities Service Company with the Secretary of State with a capital stock of $50,000,000. The company is a holding company for the consolidation of the Denver Gas & Electric Company, the Empire District Electric Company and the Spokane Gas & Fuel Company. Henry L. Doherty will be president of the new company and associated with him will be James M. Beck, of New York, N. Y.; Leslie M. Shaw, of Philadelphia, Pa.; Denis Sullivan, of Denver, Col.; Frank W. Frueauff, of Denver, Col.; C. T. Brown and H. H. Scott, of New York, N. Y.

OKAWVILLE, ILL.—The Okawville Electric Light & Ice Company, capitalized at $10,000, has been incorporated to install, maintain and operate an electric light plant at this city. Among the incorporators are: John Fietsam, John J. Frank and William F. Hagebush.

BATESVILLE, IND.—Articles of incorporation have been filed for the Batesville Electric Light & Power Company by John A. Hildebrand, A. W. Bomweber and Harry Blank. The company is capitalized at $10,000 and proposes to establish an electric plant to supply electricity for lamps, heaters and motors in Batesville and other cities and adjacent towns.

MAXWELL, IND.—Articles of incorporation have been filed for the Maxwell Telephone Company by John H. Mugg, T. A. Seamans, R. A. Albea, George B. McClaren and John R. Shipley, directors of the company. It is the purpose of the organizers to construct and operate a telephone system to Maxwell and throughout Hancock county.

HAGERSTOWN, MD.—Articles of incorporation have been filed by the Mount Aetna Rural Telephone Company, with its principal office at Hagerstown, for the purpose of constructing and operating a telephone system in Washington County. Among those interested in the proposition are: C. H. Keller, William O. Funk, Henry C. Wolfe and others.

SANDSTONE, MINN.—The Clover Belt Telephone Company has been incorporated with a capital stock of $50,000 by J. H. Ingraham, Hugo Wickber, M. Bullis and others.

CHARLOTTE, N. C.—The Charlotte Rapid Transit Company, with an authorized capital stock of $150,000, has been incorporated for the purpose of constructing a street railway in Charlotte and the suburban districts. Among those interested in the proposition are: Cameron Morrison and Paul Chatham, Charlotte; Hugh Chatham, Elkin, and J. E. Kavanaugh, Winston-Salem.

CARSON, VA.—Articles of incorporation have been filed by the Tri-County Telephone Company, which contemplates the construction and operation of a telephone system in this city. The capital stock is given at $5,000, and the following officers have been elected: W. B. Daniel, Disputanta, president; Timothy Rives, Petersburg, Va., vice-president; E. T. Birdsong, Disputanta, secretary and treasurer.

GRUNDY, VA.—The Grundy Home Telephone Company has been formed by G. T. Hawkins, L. W. Farley and others. The company is capitalized at $2,000 and proposes to install a telephone system in Grundy and erect lines in Buchanan County.

Personal.

MR. GUGLIELMO MARCONI has [illegible] on the *Princess Mafalda* from Buenos Ayres for Italy to be at [illegible] while recovering from sickness.

MR. J. F. MEISTER, a graduate of Cornell University, has been appointed instructor in electrical engineering at the Oregon Agricultural College, Corvallis, Ore.

MR. IRVING W. PHILLIPS, formerly of San Francisco, has accepted a position with the Stone & Webster Engineering Corporation and is now connected with its Minneapolis office.

MR. C. J. ERICKSON has joined the staff of the Texarkana Gas & Electric Company, Texarkana, Ark. Mr. Erickson succeeds Mr. R. G. Stewart as superintendent of the railway department.

MR. DANIEL W. BOWIE, who has been assistant city electrician of Atlanta, Ga., for the past two years, has been appointed city electrician to fill the position left vacant by the resignation of Mr. Fred Miles.

MR. WALTER I. SWEET, of Port Richmond, has been appointed by the New York Public Service Commission to be assistant chief of the Division of Telephones and Telegraphs. Mr. Sweet will have charge of the New York office.

DR. BERTRAM B. BOLTWOOD, formerly assistant professor of physics at Yale, has been made head of the newly created department of radio-chemistry at the university. Dr. Boltwood spent one year in Europe making a special study of radio-chemistry.

MR. W. L. ABBOTT, chief operating engineer of the Commonwealth Edison Company, Chicago, has been renominated by the Republican State Convention as a trustee of the University of Illinois. Mr. Abbott, who is a graduate of the university, is now serving as president of the board of trustees.

MR. HENRY B. SEAMAN has tendered his resignation as chief engineer of the New York Public Service Commission, to take effect Oct. 1. Mr. Alfred Craven, formerly assistant to Engineer G. S. Rice under the old Rapid Transit Commission, and more recently assistant to Mr. Seaman, will be appointed acting chief engineer.

Mr. H. A. SINCLAIR, for many years the treasurer of the New York Electrical Society, has resigned, much to the regret of the officers and members, who appreciate his loyal and devoted service. He has been succeeded by Mr. Kingsley Gould Martin, of the New York Edison Company, and son of Mr. T. C. Martin, secretary of the National Electric Light Association. The coming season marks the fortieth year in the history of the society, the oldest body of the kind in this country.

MR. H. T. EDGAR, manager of the Northern Texas Traction Company, Fort Worth, Tex., has been appointed general manager of the Seattle (Wash.) Electric Company. Mr. Edgar has been connected with public service corporations for a number of years. Early in 1898 he was appointed manager of the Lowell (Mass.) Electric Light Corporation, and in September, 1901, was transferred by Stone & Webster to El Paso, Tex., becoming vice-president and manager of the El Paso Electric Railway. Five years ago he was appointed manager of the Northern Texas Traction Company.

MESSRS. R. B. ROBERTS, JR., AND P. N. GOLDEN, engineers representing Henry Floy, consulting engineer in charge of the design and installation of the new central station of the Middletown Electric Light Company, Middletown, Conn., started the new plant in successful operation the early part of September and it is now regularly carrying the larger portion of the municipal and commercial lighting load. The work on the new plant did not begin until early in May, making only a little over three months from time of beginning work until the plant was delivering electrical energy. Considering the fact that the building had to be erected on piles, and that the entire superstructure to an elevation approximately ten feet above ground level is built of concrete and made waterproof, this is an unusual record.

MR. MATHIAS KLEIN, the senior member and founder of the firm of Mathias Klein & Sons, Chicago, was agreeably surprised on Sunday, Sept. 18, on his return from an afternoon outing, by the assembly of his descendants who had gathered at the old homestead to bring their congratulations for his eighty-fourth birthday. Mr. Klein has lived at the old homestead for fifty-four years. It is now practically in the heart of the North Side, but in the early days it was decidedly on the outskirts of the city. Mr. Klein still enjoys bodily and mental vigor. Born in the City of Worms, Hessendarmstadt [illegible] time as apprentice and journeyman [illegible] mined to turn to the new land of promise. Until 1855 he resided in the City of Philadelphia, working [illegible] wage of $6 per week. He [illegible] to Chicago. He was employed until 1857 in the repair and mechanical department of Edwin Hunt, a prominent hardware merchant of that time. In 1857 Mr. Hunt decided to abandon this part of his business, which Mr. Klein took up with the best wishes of Mr. Hunt, opening up on his own account in a small shop in Couch Place, between Lake and Randolph and Clark and Dearborn Streets. This was the beginning of the present firm of Mathias Klein & Sons.

Obituary.

MR. GEORGE POOLE, who, in conjunction with the late Mr. Henry L. Carter, established the hydroelectric plant of the York Haven Water & Power Company, died at New Hartford, Conn., on Sept. 24, at the age of fifty-six years. Mr. Poole was formerly vice-president of the York Haven Paper Company, and at the time of his death was president of the Poole Engineering and Machine Company, Baltimore.

MR. J. D. VOLTZ, of Elgin, Ill., a man with an electrical name and for fifty-five years a telegraph operator, died recently. During the civil war Mr. Voltz was a military telegrapher in the federal service and he is credited with sending from Rome, Ga., to President Lincoln the message outlining General Sherman's famous march through Georgia to the sea. A year ago Mr. Voltz was retired on a pension by the Chicago & Northwestern Railway Company, by which he had been long employed as a station agent.

MR. GABRIEL L. FELDMAN, for many years a leading expert in the electroplating industry, died at Spring Lake, N. J., on Sept. 16, following an operation for appendicitis. Mr. Feldman was born in Philadelphia fifty-four years ago and was a resident of Newark for forty years. For the past thirty-five years he was connected with the Hanson & Van Winkle Company, advancing through various positions to that of secretary, which office he held at the time of his death. He leaves a widow, four daughters and three sons.

Trade Publications.

ALTERNATING-CURRENT MOTORS.—The Gregory Electric Company, Chicago, Ill., has issued a booklet showing a complete assortment of Wagner single-phase and polyphase motors applied to various classes of machinery.

MOTORISTS' HANDBOOK.—The National Carbon Company, Cleveland, Ohio, has just issued the seventh revised edition of its handbook on the operation of motor cars and motor boats. Much that is of interest and benefit to the owners of automobiles or motor boats is included within the thirty-two pages of the publication.

ELECTRICAL LABORATORY APPARATUS.—The Thordarson Electric Manufacturing Company, Chicago, Ill., has issued an illustrated catalog describing its laboratory apparatus, coils and special electric devices. The apparatus is designed to cover all electric dynamic experiments and is quickly dismantled and assembled for any condition required.

LAUNDRY MACHINERY.—The American Laundry Machinery Company, Chicago, New York, etc., has issued a very complete catalog in which machines covering the whole range of laundry work are illustrated and described. Each of the six companies absorbed by the American Laundry Machinery Company stood in the foremost ranks of the laundry machinery industry and since the amalgamation of these companies further developments have added much to the efficiency of the apparatus. The growing tendency in favor of motor-driven machinery rather than the separate purchase of motors and machines has caused the company to establish an electrical department whose entire effort is devoted to the development of electrical equipment solely for laundry machinery. Much of the apparatus designed by this department is included in the catalog.

BUSINESS NOTES.

THE PITTSBURGH TESTING LABORATORY, inspecting and consulting engineer and chemist, Pittsburgh, Pa., has moved its New York office from 1 Liberty Street to 50 Church Street. The company's interests in New York and New England have been placed in the hands of Mr. Wm. F. Zimmerman, the second vice-president of the company.

PITTSBURGH OFFICE OF THE BUCKEYE ELECTRIC COMPANY.—The Buckeye Electric Company, of Cleveland, has located in the Fulton Building, Pittsburgh, a branch office to assist in the more rapid and efficient service of the lamp trade in that territory. Mr. Foster, who will be in charge of the office, is well known to the incandescent lamp fraternity and is no stranger to Pittsburgh, although for two years much of his time was spent in Indiana.

THE W. K. PALMER COMPANY, engineer, Kansas City, Mo., has been retained by the Puget Sound, Chelan & Spokane Railway Company, a [illegible] with headquarters in London, New York and Tacoma, as consulting engineers for, and to supervise the construction of, about thirty hydroelectric properties in the State of Washington, [illegible] than [illegible] hp, and also [illegible] miles of railway to be operated by [illegible] power from these plants.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 20, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

970,473. MANUFACTURE OF LUBRICATING OILS; Alexandre de Hemptinne, Ghent, Belgium. App. filed May 11, 1909. Changes oils into a viscous product by means of a silent electric discharge.

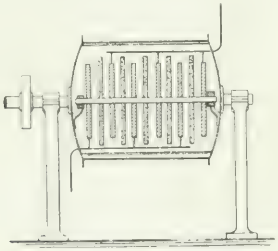
970,478. CIRCUIT CONTROLLING DEVICE; F. Dunning, Schenectady, N. Y. App. filed June 10, 1910. For electric motors of the squirrel-cage type, including a starting switch and a running switch biased to open position, and an operating handle therefor with electrical means for locking the running switch in closed position.

970,488. MEANS FOR HEATING METALS; E. F. Gehrkens, Schenectady, N. Y. App. filed July 6, 1908. A magnetic core with a winding and a gap with a piece of metal partly in the gap and partly in inductive relation to the winding.

970,498. ELECTRIC METER; J. Harris, Lafayette, Ind. App. filed May 3, 1909. Mercury meter, the mercury conveying the current to the armature and means for varying portions of the liquid included in the pressure circuit.

[illegible] CIRCUIT CONTROLLING DEVICE; [illegible] D. C. App. filed Feb. 12, 1907. A rotary snap switch with a plurality of electrical contacts, a movable contact connecting the electrical contact, means for operating the movable contact, a detent therefor and a carrier with lugs for stopping the detent.

970,533. CIGAR CUTTER AND LIGHTER; W. A. McAneny, Denver, Col. App. filed May 4, 1910. Cigar cutter and lighter avoiding waste



970,473.—Manufacture of Lubricating Oils.

of the battery charge by shifting the electrode out of the path of the lighter prior to the return stroke.

970,556. LIGHTNING PROTECTOR; A. F. Rosenberger, Chicago, Ill. App. filed Jan. 2, 1908. A pair of electrodes with parallel contacting portions and divergent gap surfaces with insulating material between and with its edge coincident with the angle of the gap.

970, 581. ELECTRIC LIGHT SOCKET; W. H. Walters, Salt Lake City, Utah. App. filed Nov. 13, 1909. A three-point socket including a threaded shell, opposite contact bars on the shell, each bar having a bearing and a stem of insulating material slidable in the bearing wit' a contact maker on the stem for connecting either of the bars to the shell.

970,587. LAMINATED TRANSFORMER CORE; O. Wiemer, St. Louis, Mo. App. filed May 17, 1909. A laminated transformer core consisting of separately formed crosspieces with their end edges in broken line and yoke segments registering therewith, thus avoiding waste in punching.

970,592. WIRELESS TRANSMISSION APPARATUS FOR CONTROLLING THE MOVEMENTS OF VESSELS; V. C. De Ybarrondo, Los Angeles, Cal. App. filed Jan. 31, 1910. Electromagnetic means combined with the rudder and energized by impulses transmitted thereto from the generating apparatus under control of the operator.

970,600. CIRCUIT CONTROLLING MECHANISM; W. A. Atwood, Schenectady, N. Y. App. filed Dec. 8, 1909. A gang of circuit breakers which may be tripped open and mounted side by side and interlocked. The movable member of the first circuit breaker actuates the latches so that the overload coil of each breaker need only be large enough to operate the latch of one breaker.

970,642. LIGHTNING CONDUCTOR; E. Redmond, Rochester, N. Y. App. filed Feb. 7, 1910. Consists of a metallic chain and a wire or strip passing at intervals through the links of the chain.

970,678. CLUSTER LAMP HOLDING DEVICE; R. B. Benjamin, Chicago, Ill. App. filed Aug. 5, 1907. Combines a supporting cap with a base and casing independently co-operating with the cap, the casing being detachably secured to the trap and the base aligned in the casing by the cap.

970,684. CONTROLLER HANDLE; F. E. Case, Schenectady, N. Y. [illegible] throwing off at the first "on position" during normal operation which may be made inoperative at the will of the operator.

970,693. GROUND CONNECTOR; J. L. Donald, Mooresville, N. C. [illegible] the inside and tapering to make electrical connection between the collar and the pipe and having a lug to receive the wire.

[illegible] ILLUMINATING DEVICE [illegible] door knob with the battery and illuminating device in the knob con- [illegible]

[illegible] FOR TRANSFORMING [illegible] INTO STEEL; G. Gin, Paris, France. App. filed Jan. 25, 1906. A [illegible] elongated portions of the hearth and one or more electromagnets with cores near the elongated portions with oppositely wound coils on adjacent cores.

[illegible] AND DISTRIBUTING [illegible]

[illegible] with a switch base of insulating material, having a cavity for receiving the switch and a series of recesses at the corners for receiving the conductors.

970,755. ELECTROPLATING; A. Rosenberg, London, England. App. filed March 16, 1909. Electroplates by making a dry mixture comprising a salt of the metal to be deposited and a second metal in powdered form, moistens the mixture and rubs it on the surface.

970,786. DYNAMO-ELECTRIC MACHINE; A. J. Brown, Norwood, Ohio. App. filed July 30, 1906. Collector rings having supports for centering them, including centering members with beveled surfaces carried by radial arms.

970,800. SIGNAL BOX; F. W. Cole, Newton, Mass. App. filed July 10, 1906. A sliding bar actuator mounted on the box door connected with [illegible] lever for engaging the winding arm and a breakable locking device for the sliding member.

970,820. APPARATUS FOR REPRODUCING PICTURES OR CHARACTERS; G. E. Hoglund, Chicago, Ill. App. filed Sept. 10, 1909. Improvements in the feeding mechanism for the instruments in the synchronizing mechanism and other parts of the machine.

970,821. AUTOMATIC EXCHANGE SELECTOR; H. B. Holmes, Park Ridge, and E. B. Craft, Wilmetter, Ill. App. filed June 4, 1906. A selector carrying the terminals of the line and having an arm sweeping over the terminals in long and short steps, respectively. A continuously rotating shaft controlled by an electromagnetic clutch controls the movement of the brush in long steps over the terminals and electromagnetic mechanism steps the brush in short steps over the terminals.

970,827. DYNAMO-ELECTRIC MACHINE; A. S. Hubbard, Belleville, N. J. App. filed July 3, 1908. A field for dynamos, including a plurality of radially arranged laminations having their inner ends in close proximity to each other so as to form a unipolar field.

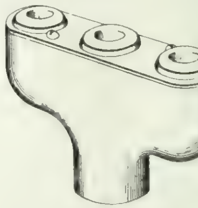
970,850. WIRELESS TELEPHONY; A. Plisnier, Jr., Stuttgart, Germany. App. filed Feb. 12, 1908. The Duddell oscillating circuit is fed by a mercury vapor spark gap or an electric arc and the tension on the microphone may be varied by means of a self-induction coil, a shunt circuit including a microphone and capacity.

970,852. PROCESS OF AND MEANS FOR DEPOSITING METALS; A Rosenberg, London, England. App. filed March 16, 1909. A method of electroplating which consists in the application to an electrically conductive surface in the presence of an electrolyte of the metal to be deposited together with a polishing agent.

970,865. TROLLEY; G. Weber, Mount Oliver, Pa. App. filed June 17, 1909. Trolleys with a harp and a plurality of wheels, one or two of which always engage the wire.

970,869. INSULATED RAIL JOINT; E. C. Zimmermann, New York, N. Y. App. filed March 10, 1910. A rail member supporting a plate of conducting material insulated therefrom and a bolt connected with the plate and having a contact, but insulated from the rail.

970,886. FIRE AND POLICE TELEGRAPH SYSTEM; F. W. Cole, Newton, Mass. App. filed Sept. 27, 1907. A signal transmitter with a winding member, a pivoted lever therefor, and a lever secured to the pivot shaft thereof, and two independent actuators for engaging the lever to turn the pivot shaft and operate the actuating lever.



971,002.—Cover for Electrical Outlet Boxes.

970,887. FIRE-ALARM TELEGRAPH SYSTEM; F. W. Cole, Newton, Mass. App. filed April 25, 1908. A signal transmitter with a ground circuit connected with the main circuit by the operating device and rewinding mechanism to restore the operating device and disconnect the ground.

970,963. ELECTRIC SWITCH; F. W. Smith, New York, N. Y. App. filed April 19, 1910. A switch lever with terminal blocks on the panel, so that when the lever is locked it may be automatically released at the desired strength of current. Details.

970,975. PRIVATE BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM; J. N. Wallace, La Crosse, Wis., and Edward B. Craft, Chicago, Ill. App. filed Nov. 23, 1907. Private branch exchange telephone system, including an intercommunicating system and also providing for outside connections with Central. Dispenses with the transfer key and makes use of contacts operated by the movement of the locking plates associated with a group of operating keys.

970,981. TROLLEY HARP; R. D. Blackstone, Muskogee Okla. App. filed Oct. 5, 1909. A pivoted arm carrying the wheel, pivoted to the end of the pole so as to follow the curve in the wire.

971,002. COVER FOR ELECTRICAL OUTLET BOXES; E. H. Freeman, Trenton, N. J. App. filed June 24, 1910. An outlet box with a cover plate, insulating bushings and a metallic cap plate.

971,006. ELECTRIC RAILROAD; G. P. Horton, Washington, D. C. App. filed Sept. 30, 1909. For transferring from an underground to an overhead system, the plow being hinged to throw it up out of the way when necessary.

971,010. ELECTRIC GAS-LIGHTING DEVICE; R. A. Jewett, Worcester, Mass. App. filed July 2, 1907. When the valve controlling the gas supply is turned it also ignites the gas passing from the burner. Details.

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ILLUMINATING ENGINEERING CONVENTION AND LECTURES.

More than ordinary interest centers around the forthcoming convention of the Illuminating Engineering Society in Baltimore, an outline of which is given elsewhere in this issue. Not only are the papers to be presented of thoroughly solid character, but the convention itself represents to a large extent the introductory exercises connected with the beginning of a course of lectures on illuminating engineering under conditions of much more than temporary importance. Following the regular sessions of the convention, an admirable feature of which will be the abundance of time available for discussion, a course of thirty-six lectures will be offered under the joint auspices of the Illuminating Engineering Society and Johns Hopkins University. It is probable that at no time during the history of engineering education have lectures and subjects been selected for a course of instruction with more care than was bestowed upon the Johns Hopkins course in illuminating engineering. The subjects were arranged according to the well-defined needs of those seeking instruction, and each lecturer was chosen solely with reference to his knowledge of the subject and ability to treat a certain branch of illuminating engineering in the most instructive manner.

The inauguration of the Johns Hopkins course of lectures means much to the Illuminating Engineering Society, the good work of which during the past five years has rendered this result possible by first creating an appreciation of the laws of illumination, then generating a demand for greater knowledge of the subject, and finally supplying the means for the acquisition by anyone of the knowledge which has been accumulated by the recognized leaders of the newly created profession of illuminating engineers. Although it is too soon to define the knowledge which an illuminating engineer must possess in order to be considered as such, and doubtless many years will elapse before engineering colleges will confer the degree of I.E. upon their graduates—if perchance such a specialized profession will ever justify the use of a special degree—yet no one can question the importance of the establishment of the Johns Hopkins lecture courses in illuminating engineering, which will serve as a guide for other colleges that do now, or that will hereafter, offer courses in the same subject.

AN UNUSUAL FIELD FOR THE CENTRAL STATION.

Elsewhere in our columns will be found a rather complete account of what strikes us as a most novel and interesting field of activity for the central station—the furnishing of energy to a large ship-repairing and dry-docking plant. Electric motors have been used for a long time in ship-building yards to a minor extent. The present case, however, involves the supply of central-station energy to a very large repair plant with a multiplicity of dry docks, so that energy is demanded both by general machine-shop work and for pumping on a gigantic scale at short notice and at any time of the day or

night. The plant itself is an old and famous one, which grew like many other works in an irregular fashion until the problem of motor service came to be a very grave one Most of the service at first required was obtained by non-condensing engines supplied with steam from somewhat inefficient and inadequate boiler plants. To change over the entire system for the application of electric motors was no small task, and to so arrange it that it could be economically handled by purchased central-station energy was really a notable feat. Results have proved the entire reliability and usefulness of the change, for in more than one and a half years of operation there has been only one brief interruption to service caused by a short-circuit in the cable. Energy was supplied from the 6600-volt, three-phase, 25-cycle system of the Edison Electric Illuminating Company of Brooklyn, and reduced to suitable motor voltage at scattered substations around the works. The motors are of the induction type, some of them constant-speed and some worked for variable-speed service by the use of resistance in the secondary circuits. Perhaps the most remarkable single application of motors was to the 6000-ton floating dry dock. The use of this equipment at full-capacity service requires the pumping of approximately 10,000 tons of water, which is accomplished by ten 12-in. centrifugal pumps on each side of the dock, each group being operated by a 300-hp electric motor through the medium of line shaft and bevel gears. The pumping machinery on both sides of the dock, which is under complete control by a single man, has proved to be extremely efficient and convenient. The conditions with respect to the amount of energy at times needed and the unusual hours that it might be required in case of rush work were such as to make the installation of an isolated plant for this service inconvenient and expensive, while with central-station connection it is possible to obtain an almost unlimited supply of energy whenever it is really needed. On the other hand, the load is such that it can be kept off the peak at the station under most service conditions. Altogether the installation is a most interesting demonstration both of the enormously useful field of motor-driven apparatus and of the opportunity for central stations not only to enter the ordinary field of motor working, but to meet great and extraordinary requirements on an economical basis.

A STUDY IN MOTOR LOADS.

Mr. W. S. Kelley contributes to the current number an interesting statistical study of motor loads and their peculiarities as derived from examination of data from a number of Massachusetts stations. We can only touch upon some of the points brought out, but the tables will repay careful reading since Mr. Kelley has for a good many years made a study of motor conditions, and the data from Massachusetts, while far from perfect, are on the whole more satisfactory and conclusive than the official data from stations in other States, owing to the long labors of the Massachusetts Gas and Electric Light Commission. Mr. Kelley's investigations cover a large number of cities, omitting the very largest and the smallest, and hence they are typical of ordinary urban conditions rather than of those found in large centers of population or in the country stations. One important table deals with the cost of service as derived from six typical stations. The point of this [illegible] Such a comparison can, of course, deal only with averages, but in so far as averages are justifiable the results are important. The main point is that it is shown that, including all items of cost, general expense and depreciation, a kw-hour of energy for lamps delivered at the meter costs nearly double the kw-hour at the meter for motors. This result is a little surprising, although it is well known that distribution costs of lighting load are high. The discrepancy shown is rather larger than would ordinarily be considered likely. The distribution expense is the point of greatest difference between the two classes of service. The result is a rough justification of the very common situation found in central-station practice of making normal motor rates per kw-hour about one-half those charged for energy used in lighting. We are inclined to think, however, that with a properly-developed motor load, and particularly with a large and scattered motor load, the difference would be less than that found from the stations investigated.

A special point of interest is the examination of the motor load-factor in various industries. While the highest load-factors are found in motors used in textile mills, the textile industry, as a whole, shows a slightly lower load-factor than is, for example, found in shoe factories while the diversified small industries, generally supposed to tend toward large load-factor, make a somewhat unsatisfactory showing. This result is perhaps due to the general conditions surrounding the small industries rather than to any failure of the usual law of averages. The difference is probably largely or completely made up by the variation of the diversity-factor, so that it remains yet to be proved that a large and varied load of industrial motors is any less advantageous from the standpoint of the man at the station than the load of motors employed in textile works, and it is certain that the diversified load would bring a much larger return than Mr. Kelley's figures actually show. These statistical studies of station conditions are extremely useful in bringing out broad facts which otherwise would either escape notice or be wrongly interpreted. They require, on the other hand, great caution to secure sound conclusions with respect to any particular case, since local factors enter into the final adjudication of such matters to an extent often overwhelming

THE APPLICATION OF STATIC ELECTRICITY TO THE SEPARATION OF MINERAL PARTICLES

The use of the magnetic field for the continuous separation of magnetic oxides of iron from accompanying non-magnetic mineral materials is well and widely known, but the use of the electric field for the continuous separation of conducting from non-conducting substances is not widely known. A description of an electrostatic separating mill is given in this number by Mr. Henry A. Wentworth. The magnetic field in ore milling is necessarily limited in application to ores of the magnetic metals, iron, nickel, cobalt and manganese, while in practice it is confined to iron, the most powerfully magnetic metal of all. The electric field is capable of much wider range in application because not only do mineral substances differ markedly in their electric conductivities, but these conductivities are also capable of being altered artificially, in the test ore, by various methods of treatment. On the other hand, magnetic fields can readily be applied in an ore-milling machine or process to a very considerable intensity, and without much difficulty, whereas electrostatic fields are difficult to apply, especially with any

considerable intensity. Damp weather is a great enemy to electrical action, whereas it causes no particular detriment to magnetic action.

Considerable ingenuity is required in arranging ore-milling apparatus for the application of an intense electric field. The generating apparatus must be of a very special kind and the insulation of the high-tension electrodes must be carefully maintained. Some of the difficulties that have to be overcome are described in the article. Another advantage possessed by the electric over the magnetic separator lies in the greater possibilities of extension which lie before its application. New ways of treating the ore and new ways of applying or of producing the electric field may confidently be expected, whereas the prospects of introducing marked improvement into the magnetic separator are by no means dazzling. An essential element in all separators, whether electric or magnetic, is the preliminary crushing process, which includes the principal share in the expense of the treatment. In bulk the mineral substance obeys gravitation wholly, but neither electric nor magnetic forces in appreciable degree. As the ore is crushed to smaller and smaller particles, the sway of the electric forces increases, while that of the gravitational force remains theoretically the same. Practically speaking, when the particles are very fine the sway of gravitational force upon them is virtually reduced, because of the frictional resistance of the air to their descent. Whatever extra air resistance exists is a gain to the electric force by giving a longer time for its application. Another advantage of the electric process is that, if it can be applied to any extent, it can probably be applied with increasing effectiveness and economy on a very large scale with comparatively little attendance and supervision.

PHOTOGRAPHIC PHOTOMETRY.

A very interesting paper on some peculiarities of photographic photometry by Mr. Brush is abstracted in the Digest. The research, while far removed as yet from the realm of ordinary photometry, deals with matters which are of considerable theoretical importance and which may not be lacking in practical application. Photometry is at present passing through a somewhat critical phase. In particular, heterochromic photometry, which is likely steadily to assume greater importance, is in an extremely unsatisfactory state and the possibilities of applying photographic methods to this particular class of work have been several times considered. It is perfectly true that the sensitiveness of ordinary photographic plates does not approximate to the luminous values determined by the eye. On the other hand, the eye is so notoriously ineffective in heterochromic photometry, owing to various little-understood physiological and psychological factors, that it is not without the range of possibility that relief may be found in photography. It should not be an impracticable thing to find a combination of sensitizer and screen which will come very near to duplicating the luminosity curve of the normal eye. In such case it would be easy to compare lights of different colors by a method which would not only give their relative luminosity values but would secure a permanent record of them. Mr. Brush's investigation throws much light on the conditions necessary to be fulfilled in the application of such a method. In the first place he finds it practicable by a suitable length of exposure so timed as to give the maximum contrast for minimum difference in illumination to secure prints showing variations of less than 1 per cent in the light to which they were exposed. It seems altogether probable that by suitable means of comparing densities one could obtain photographic determinations comparable in precision to the readings of an ordinary photometer, and certainly much better in precision than heterochromic comparisons have generally proved to be. Moreover, with suitable exposures the operation practically would call for little time or trouble other than that taken in treating the plates after exposure. In the relation between size and density of images the effective luminosity has been pretty carefully worked out in stellar photography so that sufficient data are available. Great caution evidently must be exercised regarding uniform development, and one of the points brought out in the course of Mr. Brush's investigation was the desirability of carrying on the developing process in a tray considerably larger than the plate, the plate being fixed in the middle of the tray with its face flush with the bottom. Moreover, the strength and temperature of the developer must be very carefully adjusted to a normal condition.

Two curious limitations found in the photographic process are worth mentioning. One of them concerns the inertia of the chemical change that produces the exposed plate. Apparently in starting the photographic action there is a certain inertia requiring a definite amount of energy. A certain amount of lack of sensitiveness has to be overcome before any image is formed, and if exposure is stopped near this critical point the plate decreases in sensitiveness instead of increasing as it would if exposure had been continued, so that the inertia must be overcome again on a second exposure. This means, of course, that one must work above certain critical values of illumination and exposure in order to have proportionality of results. A second interesting fact strongly brought out in the research is the continuance of the inertia effect after exposure ceases. It was evident from Mr. Brush's experiments that for some minutes at least the chemical action continues, so that development before the termination of this inertia period does not show the full effect of the exposure. These, however, are not things which need seriously interfere with the usefulness of photography in many photometric problems. They are merely indications of precautions to be taken. The paper is extremely well worth the reading in full by anyone interested in scientific photography as well as by the photometrist.

TEMPERATURE-COEFFICIENTS OF ELECTRICAL RESISTIVITY

The last number of the *Physical Review* contains a paper by Mr. A. A. Somerville on temperature-coefficients of electric resistivity, especially at relatively high temperatures, all with reference to the resistivity at 0 deg. C. as standard. In electric measurements and applications the temperature-coefficient of copper is an important physical constant. Hardly any dynamo-electric machine can be tested without having the temperature-coefficient for the resistivity of its copper windings involved in the process. The earliest systematic measurements of the coefficient for copper were made by Dr. Matthiessen in England about half a century ago. They did not indicate a straight-line law of increase in resistivity with temperature. On the contrary, they indicated an upwardly curving [illegible] per cent per degree [illegible]

[illegible] all sides that the quality of copper obtainable at that time was inferior to that commercially supplied at the present day. In recent years the resistivity of copper has generally been observed to follow substantially a straight-line law with respect to temperature, at least between the limits of 0 deg. C and 100 deg. C. In Mr. Somerville's observations there appears, however, to be a slight downward bend in the curve near room temperature, [illegible] deg. C., 0.4 per cent at and near 200 deg. C. and 0.6 per cent near 1000 deg. C. In a general way, the results may be described by saying that between 0 deg. C. and 700 deg. C. the coefficient was near to 0.4 per cent per degree, while between 700 deg. C. and 1000 deg. C. it was near to 0.6 per cent per degree. Even so, the curve of resistivity in copper, with respect to temperature, may be described as not far from a straight line between 0 deg. C. and 1000 deg. C. The measurements of Dewar and Fleming have indicated that between 0 deg. C. and —200 deg. C. the curve is also nearly the same straight line prolonged.

It is reported that when copper wire is hard-drawn not only is the conductivity reduced, but the temperature-coefficient of resistivity is also reduced. That is, there appears to be some connection between the resistivity and its temperature-coefficient. The resistivity behavior of alloys is certainly in the same direction, for their resistivity is always much higher than that of their pure constituents, while their temperature-coefficient of resistivity is much lower. Both gold and silver appeared to approximate to straight-line resistivity-temperature graphs up to 1000 deg. C., while iron displayed the well-known remarkable discontinuity in the neighborhood of 775 deg. C., where its resistivity rises suddenly with a slight further rise of temperature. After this critical temperature has been exceeded the resistivity resumes a lower gradient. It is very remarkable that at this critical temperature of recoalescence there should be so profound a change in the electric, magnetic, mechanical and metallurgical states of pure iron. Aluminum and magnesium show good straight-line relations up to 550 deg. C., and then increase very rapidly in their resistivity. At the temperature just noted these metals approach the molten state. Carbon, on the other hand, makes a good descending straight line as far as [illegible] deg. C., the temperature-coefficient [illegible] per cent per degree.

Leaving aside iron and nickel, the graphs of pure copper, silver, gold, platinum, aluminum and magnesium may be described as essentially of the straight-line type, with an average temperature-resistivity coefficient of about 0.37 per cent per degree C., reckoned on the value of 0 deg. C. This means that if the average graph be extended by extrapolation back to very low temperatures it would reach zero-resistivity at —270 deg. C., or very close to the thermo-dynamically inferred zero of temperature. On the other hand, if 0.42 per cent be taken as the ordinarily observed value for pure copper, the inferred absolute zero of copper resistivity would be —238.1 deg. C. The meaning of the term temperature-resistivity-coefficient, as used in this article, differs from that ordinarily used in electrical literature. It may be described as meaning the slope of the resistivity-temperature curve at any assigned temperature, whereas it is ordinarily taken to mean the percentage increase of resistivity per degree C. from and at the assigned temperature. The former definition has certain theoretical advantages in representation or in description while the latter definition has certain practical advantages in computation under industrial conditions. It is not of great importance which definition is adopted at first hand, but it is of great importance to avoid misunderstanding through the ambiguity. The two definitions should give rise to two distinct and separate terms.

A MATTER OF NOMENCLATURE.

Sciences, however remotely they may apparently be allied, often help each other in unexpected ways. An interesting example of this is presented in a recent paper by Dr. Hartmann, the distinguished astro-physicist, dealing with the luminosity of Halley's comet. He desired to express the surface brilliancy of the object in absolute measure instead of following the too frequent custom of indulging in vague generalities and comparisons. Having devised apparatus for reasonably precise comparisons even of the very low intrinsic brilliancies of nebulæ, Dr. Hartmann was discrete enough to turn to the recognized data of technical illumination for the basis of his comparisons, and took as his unit the regular measure of intrinsic brilliancy which would normally be used in German practice—that is, 1 hefner per square centimeter. Now, there is no systematic name for the unit of intrinsic brilliancy, because in lighting techniques intrinsic brilliancy is not measured frequently enough to have created the demand for a unit, and when measured it is expressible in comparatively simple numbers. The intensities with which Dr. Hartmann was dealing, however, were at times only a few thousandths or even millionths of this standard intensity, which condition would naturally lead the investigator to the use of a sub-multiple. Dr. Hartmann, therefore, finding his unit unnamed, appropriated the term *phos* to its use with the systematic set of prefixes, kilo and mega for the multiples, milli and micro for the sub-multiples, all being used in their usual significance.

In terms of these freshly coined units, Dr. Hartmann has given to the world an important investigation of the intrinsic brilliancies of various celestial objects finding, for example, for the nucleus of Halley's comet a surface brightness of the order of 620 mkph, on May 23, while a little later he found that the surface brightness of the ring nebula in Lyra was down to 1.2 mkph. This nomenclature for intrinsic brilliancy having thus made a dignified entrance into astronomical literature, it remains to be seen what reception awaits it in illuminating engineering circles. The term *phos* is one of those which have been advocated for the unit of intensity originally called *pyr* by Professor Blondel, but it is only one of several names thus proposed. There is certainly no valid objection to *pyr*. In fact, it is rather difficult to improve on the systematic units of Blondel's system, the only question being how many of them are needed at the present time for practical purposes. Considering the fact that *phos* has shown its adaptability to astronomical research and has appeared with so distinguished a sponsor as Dr. Hartmann, there seems to be no good reason why it should not take its place in lighting technique as the name of the systematic unit of intrinsic brilliancy, unnamed in Blondel's great paper of 1893. It will be subject, at least for the present, in astronomical and other literature to the same qualification as the lux and the lumen. In Germany the unit of intensity which is preferred is the hefner, while elsewhere

it is generally the internati[illegible] as the former is [illegible]st nine-tenths of the intern[illegible] [illegible] of one value to the other need cause no more confusion in case of the *phos* than in the case of the other units. Until there is final settlement of a scientific unit of intensity we shall have to contend with this difference between German and non-German usage, but this need not in practice discourage the use of systematic units.

MAGNETIC STORMS.

As the effects of disturbance in the earth's magnetic fields are more and more studied they become increasingly puzzling. The old, comfortable generalization that the earth is a colossal magnet was well enough so far as it went, but the cause of the magnetization and the laws which it obeys have escaped detection, while the casual variations in the magnetic elements are exceedingly puzzling on account of their singular time relations. Some of these have been studied with particular care from the standpoint of electromagnetic theory and with particular reference to the possible explanation of some of the magnetic anomalies by the assumption of cathode ray streams on a gigantic scale. We not long ago called attention to the curious delayed action between solar outbursts and magnetic storms, and a recent paper by Dr. Bauer emphasizes the necessity of paying closer attention to the time relations in order to get some clue to the cause of the actions. The particular class of phenomena studied by Dr. Bauer are those apparently having a terrestrial origin, especially the magnetic disturbance coincident with the Mont Pelée eruption of 1902. This eruption brought to light the fact that there is definite progressive development of the magnetic disturbances, which were shown to develop in an eastward course, being felt progressively at various stations to the east and completing the circuit of the earth in about 3½ minutes. A similar disturbance the next year showed a like sequence of manifestation with a period of about four minutes for the complete circuit of the globe.

Analysis of these two cases showed that if the disturbances are produced by electric currents they would have to circulate from east to west if positive and from west to east if negative or such as would be produced by moving negative charges, and that in either case they would have to circulate chiefly in regions far above the earth. Following out this line of investigation, Dr. Bauer has looked into the application of the cathode-ray theory, developed by Birkeland and others, to account for terrestrial magnetic disturbances. The possibility of cathode rays from the sun being the source of electromagnetic anomalies is certainly a very attractive one, although perhaps not in the least necessary to an explanation of the facts. In other words, it is only one of several hypotheses, the validity of which must be tested by physical facts. Dr. Bauer following up the study of the two cases investigated, found in examining the possible effect of cathode rays coming from the sun that if they entered the earth's magnetic field from without they would be deflected to the wrong direction to account for the observed phenomena. If the corpuscular explanation applies to this particular case, one would have to assume corpuscles shot out from the earth instead of from the sun, not upon its face an impossibility even considering the volcanic disturbance coincident with [illegible] of the cases investigated. Unfortunately, if the stream of charged corpuscles is such as would agree with the time taken by the disturbance to go clear around the earth, the orbit of the corpuscle stream would have to be something over 2,000,000 miles from the earth, which pretty effectively eliminates this particular hypothesis.

Dr. Bauer states very conservatively that it is not possible to state definitely whether the initial cause of the disturbance coincident with the Mont Pelée eruption was terrestrial or solar, but the natural inference would be that the coincidence was of a character to determine with a very high degree of probability the terrestrial origin of the effects observed. The results found for these particular cases are emphatically against the solar-cathode-ray theory of Professor Birkeland. They do not, however, invalidate his hypothesis for the explanation of other phenomena, which must be taken up upon their merits. It is not in the least necessary, in fact, to suppose that all the electromagnetic effects observed in and about the globe are due definitely to a single cause. Any great disturbance of the earth's crust, considered as part of an irregularly magnetized body, may be expected to disturb the magnetic conditions, however produced, and to initiate a sequence of magnetic phenomena lasting until the mechanical disturbance has been quieted. On the other hand, as regards external disturbing causes, it is quite certain that a sufficiently violent electromagnetic change at the sun is competent to produce measurable terrestrial effects quite irrespective of the existence or non-existence of cathode-ray effects, however important these latter may prove to be. A study of the time relations involved may give a reasonable clue to the separation of the phenomena into groups dependent on one or another active cause, but so far as the investigations upon the subject have gone, there is not the slightest reason to suppose that all variations in the earth's magnetic field and the electrical conditions surrounding the earth are due to any one particular exclusive cause. All the facts point to an intricate series of perhaps interrelated causes rather than to the sole action of any one. A more complete co-ordination of magnetic observations with respect to time is needed before the data for conclusive examination of the current theories are at hand.

The attractive feature of Professor Birkeland's cathode ray hypothesis is that it accounts simply and consistently for many cases of delayed action between solar and terrestrial phenomena; and, the earth being only a little over a hundred solar diameters distant, the existence of cathode streams reaching even to the earth's vicinity seems plausible enough. On the other hand, even in this case there is no certainty yet that the tremendous electromagnetic effects known to exist at the sun's surface are really coincident with their conspicuous appearance on the surface of the photosphere. That is, there is a possibility that the apparent lack of coincidence in the time relations between solar and terrestrial magnetic upheavals may be only apparent, so that the phenomena could be accounted for without invoking the relatively slow motion of cathode rays. The whole matter is as yet undetermined and perhaps the final criterion as regards cathode action will have to be looked for, not in the elements of terrestrial magnetism, but in the auroral phenomena, which Professor Birkeland is already investigating, and in astronomical investigations relating to the distribution of material particles in extraterrestrial space.

Convention of American Street and Interurban Railway Association.

The annual convention of the American Street & Interurban Railway Association will take place at Atlantic City, N. J., Oct. 10 to 14. Three halls located on Young's Million Dollar Pier have been provided for the meetings, and in addition suitable rooms are available for meetings in the Marlborough-Blenheim and Traymore hotels. All of the meetings of the American Association and of the Transportation and Traffic Association will take place in the Greek Temple near the outer end of the pier. The accountants will hold all their meetings in the Annex Court Hall, midway between Aquarium Court Hall and the Greek Temple. The sessions of the Engineering Association on Tuesday and Wednesday will be held in Aquarium Court Hall, near the Boardwalk end of the pier, and the Friday sessions will be held in the Greek Temple. No session of the Engineering Association is scheduled for Thursday, that day being set apart for the inspection of exhibits. The claim agents will hold all their sessions at the Traymore Hotel. The Manufacturers' Association has arranged for exhibits on the Million Dollar Pier, and adjacent to the pier and along the Boardwalk considerable space will be used for an extensive display of electric railway cars. The entertainment features include the annual reception in the ballroom on Young's Million Dollar Pier on Monday evening; a smoker, entertainment and indoor baseball game for the railway and supply men on Tuesday evening, and a progressive euchre party for the ladies on Tuesday. The annual amateur vaudeville and theatrical performance will be given on Wednesday evening, and a promenade concert and ball on Thursday evening. In addition the ladies will be guests at several afternoon entertainments during the week. A golf tournament will take place at the Country Club of Atlantic City on Thursday. This will be open to all delegates and guests, and a clock golf contest has been arranged for the ladies on Wednesday afternoon.

Annual Convention of the Illuminating Engineering Society.

The fourth annual convention of the Illuminating Engineering Society will be held at Johns Hopkins University, Baltimore, Md., Oct. 24-25. The convention will open in McCoy Hall at the university at 10 o'clock on Monday, Oct. 24, and there will also be an afternoon sesssion at 2:30 o'clock. There will be two sessions on Oct. 25 at 10 o'clock in the morning and 2 o'clock in the afternoon respectively. The following is the list of papers to be read and the authors: *The Value of Illuminating Engineering to the Manufacturer*, by Mr. V. R. Lansingh, of New York; *Practical Value of Illuminating Engineering to the Central Station*, by Mr. John F. Gilchrist, of Chicago, Ill.; *The Value of Illuminating Engineering to the Commercial Man*, by Mr. W. J. Serrill, Philadelphia, Pa.; *Illuminating Sheets for the Calculation and Recording of Data*, by Mr. J. S. Codman, Boston, Mass.; *Central-Station Illuminating Engineering Department Work and Methods Applied by the Denver Gas & Electric Company*, by Mr. C. F. Oehlmann, Denver, Col.; *The Relations Between Pressure and Light Output with Various Gas Lamps and Burners*, by Mr. Norman Macbeth, Gloucester, N. J.; *The Temperature Rise Due to the Energy Radiated in the Lower Hemisphere from Different Light Sources*, by Messrs. J. G. Felton and E. J. Brady, Philadelphia, Pa.; *Some Spectral Luminosity Curves Obtained by Flicker and Equality-of-Brightness Photometers*, by Dr. Herbert E. Ives, Cleveland, Ohio; *An Unrecognized Aspect of Street Illumination*, by Mr. Preston S. Millar, New York; *The Effect of Light on the Movement of Lower Organisms*, by Prof. S. O. Mast, Baltimore, Md.

Following the convention a course of thirty-six lectures on illuminating engineering will be given at Johns Hopkins University. The subject and scope of the lectures have been proposed by the society and approved by the university. The lecturers have been invited by the university upon the advice of the society. An outline of the lecture course was given in the first issue for June 1910.

Among the entertainment features will be an automobile ride for the ladies through the suburbs of Baltimore during the afternoon session on Monday. At 8 p. m. there will be a public lecture in McCoy Hall, to be followed by a reception and view of the apparatus used in the lecture course. The reception will be held in the physical laboratory of the university. A trolley trip has been planned for Tuesday for the ladies, starting at 10 a. m. After a trip to points of interest the cars will carry the party to the Baltimore Country Club, where luncheon will be served at 12.30. A subscription banquet will be given on Tuesday at 7:30 p. m. to both gentlemen and ladies in attendance at the convention in the large banquet hall of the Hotel Belvedere.

Meetings of the A. I. E. E.

The two hundred and fifty-second meeting of the American Institute of Electrical Engineers, marking the opening of the season of 1910-1911, will be held in the Engineering Societies Building, 33 West Thirty-ninth Street, New York City, on Friday evening, Oct. 14, 1910. A paper entitled "Potential Strength in Dielectrics" will be presented by Messrs. Harold S. Osborne, of the American Telephone & Telegraph Company, and Harold Pender, professor of theoretical and applied electricity, Massachusetts Institute of Technology, Boston, Mass.

A public engineering meeting will be held in the Engineering Societies Building on Monday evening, Oct. 17, 1910, at 8 p. m. for the discussion of the subject, "Rapid Transit Requirements of Greater New York." An informal paper will be presented by Mr. Frank J. Sprague, past-president of the Institute and chairman of the railway committee of the A. I. E. E. A brief statement will be given of the general facts pertaining to routes and construction and equipment of the existing and proposed subways, illustrated by lantern slides. The meeting is to be an informal one, intended to afford opportunity for the expression of engineering views upon a subject of much importance.

Reports of the Board of Supervising Engineers, Chicago Traction.

For the fiscal year ended Jan. 31, 1909, the board of supervising engineers, Chicago Traction, has issued its second annual report, which makes an imposing volume of 522 pages, with many illustrations, maps and diagrams. With this book is issued an "Advance Report" of the same body, presenting financial and statistical information for the year ended Jan. 31, 1910, being a part of the third annual report, not yet issued in full. In a prefatory note to this "Advance Report" the board of supervising engineers explains, under date of Sept. 23, 1910, that the compilation of the annual reports published by the board, giving comprehensive descriptions of the construction and rehabilitation work performed by the street-railway companies of Chicago under its supervision, requires months of preparation, which has caused these reports to be somewhat delayed. Therefore, in advance of the appearance of the third annual report certain financial and statistical information relating to the fiscal year ended Feb. 1, 1910, which will be covered by that report, is issued and presented with the second annual report.

The board of supervising engineers consists of Mr. Bion J. Arnold, chairman; Mr. George Weston, representing the City of Chicago; Mr. Harvey B. Fleming, representing the Chicago City Railway Company; Mr. John Z. Murphy, representing the Chicago Railways Company, and Mr. A. L. Drum, representing the Calumet & South Chicago Railway Company. Mr. F. K. Parke is the secretary of the board and Mr. L. H. Davidson is the assistant secretary, Beside the companies mentioned the Southern Street Railway Company is also under the supervision of the board.

There are really two boards, Board No. 1. embracing the work of the Chicago City Railway Company and the Chicago Railways Company, and Board No. 2, having jurisdiction over the work of the Calumet & South Chicago Railway Company. Messrs. Arnold, Weston, Fleming and Murphy constitute Board No. 1, and Messrs. Arnold, Weston, Drum and Fleming constitute Board No. 2.

It is shown that on Jan. 31, 1910, the total value of the properties of the three companies named in the preceding paragraph, and also of the Southern Street Railway Company, was $98,529,977.96. Of this large amount the largest item was the value of track, amounting to $23,486,045.38, while cars, which come next, were valued at $11,519,526.67. The value of power plant equipment is comparatively a small item, being $4,894,178.64. This is undoubtedly due to the fact that the street-railway companies of Chicago are large purchasers of electrical energy from the Commonwealth Edison Company. Electric equipment of cars, however, is valued at $6,095,054.74.

The gross receipts of the four companies named for the year ended Jan. 31, 1910, were $22,832,882.64, and the total operating expenses $15,983,017.84. The largest item of expense was the operation of cars, which cost $6,701,433.31 for the year. The operation of generating plants cost $2,496,077.13, the item of purchased energy being $1,794,499.15. Under the provisions of the traction settlement ordinances the City of Chicago receives 55 per cent of the net receipts after 5 per cent interest on capital invested is deducted from the net receipts from operation. The city's proportion of these "net receipts" for the year mentioned was $1,276,252.65.

The total value of the properties of the Chicago City Railway Company on Jan. 31 last was $38,507,294.18; Chicago Railways Company, $51,851,308.97; Calumet & South Chicago Railway Company, $6,931,278.82; Southern Street Railway Company, $1,240,095.99.

The figures given above are obtained from the "Advance Report" for the year ended Jan. 31, 1910. The second annual report of the board, covering the year preceding that, is a veritable mine of useful information relating to the engineering, economic and financial features of the great work of rehabilitating the surface street railways of Chicago under the ordinances of Feb. 11, 1907; March 30, 1908, and June 29, 1908. There is not only a general account of the work done by the board, but also exhaustive treatment of the various departments of the work. These varied "exhibits" relate to such subjects as pay-as-you-enter cars; ventilation of street cars; chemical treatment of ties; installation of through routes; publicity of accounts; track and roadway; electric energy distribution; building and fixtures; generating plant equipment; cars, equipment and operation, and tunnels.

Pueblo Fire-Prevention Ordinances.

The City Council of Pueblo, Col., has passed four ordinances relating to the prevention of fire as follows: An electrical ordinance requiring conduit for permanency in the inner fire limits, embracing the main conflagration areas of the city; a gasoline lighting ordinance, providing for outside tanks and for outside generators except in dwellings; an ordinance restricting storage of gasoline, gunpowder and other explosives, and an ordinance regulating the disposition of rubbish, waste, etc. The latter ordinance also requires all new buildings exposed by other buildings to have fireproofed windows in order to prevent conflagration.

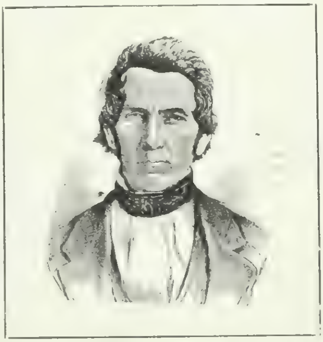
Upon the passage of these ordinances Mr. W. J. Canada, electrical engineer of the Rocky Mountain Fire Underwriters' Association, made the following statement to the Council:

"Besides the flat reduction on Pueblo's insurance rate already in force, each building owned and occupied where these ordinances are observed will receive a direct additional benefit of any charge in insurance rates for defective construction which these ordinances prohibit. Where charges in rates for hazardous wiring, gasoline lighting, rubbish, building exposures or other such conditions now exist, the improvement of these buildings to place them in accordance with the new ordinances will remove the charges. As these ordinances will reduce the causes and numbers of fires, they will prove at least the equal of additional fire-fighting equipment in reducing fire losses."

Removal of exposures in existing buildings and some additions to fire-fighting equipment are strongly recommended by the Council as set forth in the recent report on Pueblo by Mr. Canada.

Commemoration of the Invention of the Electric Motor by Davenport.

In the midst of the rapid advance of a great art and industry historic perspective is not seldom lacking. The pressure of daily applications tends to obscure the significance of pioneer discoveries and inventions, and the ready acceptance of hard-earned achievements as stepping stones toward a larger influence in the affairs of men often blinds an entire profession to the epoch-making work of its originators. Gradually, however, as an art assumes a world-wide scope and as the value of precedent begins to receive its due recognition those who look deeply into the causes of development recognize the significance of achievements which, while little appreciated by the world at large, constitute the foundations of modern triumphs and illustrate conceptions which were far ahead of their times. Appropriate commemoration logically follows, and if by some dignified and enduring mark a milestone is set up beside the highway of progress, the result must inevitably be the enrichment of the record of the art for those who practise it and the spread of an enlightening influence upon all who visit the community.



Thomas Davenport.

Considerations like these characterized the recent annual meeting of the Vermont Electrical Association, which was held at Brandon, Vt., on Sept. 28 and 29, 1910, close by the home of Thomas Davenport, inventor of the electric motor. The meeting was the association's ninth, and in conjunction with the New England Section of the National Electric Light Association and the Vermont Historical Society the occasion was made memorable by the dedication of a tablet in honor of the inventor, who in 1834 built the first electric motor which the world had ever seen. The tablet was unveiled in the village of Forestdale on the site of Davenport's remarkable labors, and the interest of the occasion was heightened by the presence of several direct descendants and near relatives of the inventor, and by a representative gathering of electrical men of distinction, including President W. W. Freeman, Executive Secretary T. Commerford Martin, and New England Section President Alex. J. Campbell, of the National Electric Light Association. Honored places were occupied by Rev. W. G. Davenport, of Washington, D. C., son of the inventor; Rev. W. R. Davenport, Bellows Falls, Vt.; Mr. William S. Davenport, New Bedford, Mass., inventor and manufacturer of a multiple automatic screw machine; Mr. Henry A. Davenport, Putnam, N. Y.; Hon. H. F. Field, Rutland, Vt., former State Treasurer of Vermont; Miss Frances Davenport, Washington, granddaughter of the inventor;

[illegible], Mrs. C. M[illegible] and Mrs. [illegible] Kingsley, Rutland, Vt., and Mrs. J. D. Kingsbury, Bradford, Mass., [illegible] ex-Governor Stickney, of Vermont, represented the Vermont Historical Society, and President C. E. Parker, of the Vermont Electrical Association, occupied the chair. Mr. E. D. Blackwell, of Brandon, was chairman of the committee on arrangements, the other members being Messrs. George S. Haley, of Rutland, and C. C. Wells, of Middlebury.

Headquarters were maintained by the association at the Brandon Inn. To enable the dedication to be generally celebrated Sept. 28 was named "Davenport Day," and business was largely suspended during the exercises at Forestdale. The local merchants exhibited tasteful electrically illuminated window decorations, and around the park in the center of Brandon were installed about 200 2-cp incandescent lamps with red, white and blue colored bulbs. The Vermont Electrical Association also had an electric sign of 135 lamps in operation at the main entrance of the hotel, energy being supplied by the Neshoba Electric Company. By the courtesy of the residents of Brandon and its vicinity, the party was transferred from the hotel to Forestdale, a distance of about three miles, by automobiles. The morning of the 28th was devoted mainly to social uses, a short executive committee meeting being held before lunch, at which the prospects of a closer relationship with the national organization were favorably considered.

The unveiling exercises were held on a small stand decorated with the national colors just outside the Davenport house in

Davenport Memorial Tablet.

Forestdale, the site of the house being nearly covered by an American flag. Music was furnished by the Brandon Cornet Band of twenty-four pieces, a feature being a march composed in honor of Thomas Davenport. About 500 persons were present when President Parker introduced the Rev. W. G. Davenport, of Washington, D. C., who invoked divine blessing, giving thanks for the mysterious powers of Nature and for the men who have been led to chain them for the benefit of the [illegible]

President Alex. J. Campbell, of the New England Section, N. E. L. A., then presented the tablet, pointing out that although history of the most stirring kind had been made in the Green Mountains, history no less important is being made today in the building of a great industrial democracy, bringing about the equality of man. He said that it was fitting that Thomas Davenport should have aided in the creation of this industrial democracy, and that such men are as true contributors to history as those who risk their lives in warfare. He presented the deed of the tablet to the Vermont Historical Society as a monument to an indomitable spirit and a mind that persevered. In accepting, ex-Governor Stickney emphasized the meed of honor due to men in all walks of life and the benefits of rescuing from oblivion the acts of the world's great workers. Pinched by poverty and with limited means for experiment, Davenport by singleness of purpose succeeded in making an invention of great benefit to the world.

The unveiling of the tablet was then performed by Miss Frances Davenport and Mrs. Alex. J. Campbell. The tablet is a handsome bronze plate with raised letters, carried upon a block of native Vermont marble about 5 ft. high and 3 ft. wide. It stands at the side of the Brandon-Rochester highway near the front of the old Davenport home and bears the following inscription:

IN MEMORY OF
THOMAS DAVENPORT
1802——   —1851

THE INVENTOR OF THE
ELECTRIC MOTOR

NEAR THIS SPOT STOOD THE
BUILDING WHERE HE DEVELOPED
HIS INVENTION

THIS TABLET IS PLACED HERE BY
ALLIED ELECTRICAL ASSOCIATIONS
IN AMERICA IN RECOGNITION OF THE
GREAT SERVICE RENDERED MANKIND
BY THE INVENTOR, TO THE DEVELOPMENT
OF WHICH HE DEVOTED HIS LIFE.

ERECTED SEPT. 28, 1910.

A masterly appreciation of the achievements of Thomas Davenport was then presented by Mr. T. Commerford Martin. Mr. Martin paid a high tribute to the influence of New England upon American invention, and in graphic phrases touched upon the work of Franklin, Morse, the two Fields, Sprague, the Wallace family, Farmer and Thomson, with brief reference to the accomplishments of Alexander Graham Bell and Edison on New England soil. A. B. Chandler and C. A. Tinker were also cited as natives of this section who have brought distinction to it, and the name of Thomas Davenport, the blacksmith of Brandon, was added with emphasis to the list of those who have wrought with great influence upon the electrical world. The speaker reviewed the career of the inventor with keen appreciation of his difficulties and enthusiasms as the first American patentee of the electrical motor, the first man in all time to apply electric power to the operation of railways, and the first man in the world to hitch together those tremendous forces, electricity and the printing press. Seen from the industrial standpoint it is significant that if the Davenport patent were enforced today it would embrace every one of the millions of electric motors in use in the United States, whose royalties would constitute an income equal to anything enjoyed by Carnegie or Rockefeller. It would have been a merciful dispensation if the bitter bread of struggle and disaster eaten all the years of his short life by this extraordinary genius, this prophetic village blacksmith, could have been sweetened with the merest modicum of the vast wealth that his glowing conceptions have helped to create for the benefit of us all.

Mr. Martin sketched the meager education available for the inventor, and passed rapidly through his early career, leading to an absorbing interest in the "galvanic magnet" of Henry, and his securing of an electromagnet and batteries of his own. The flash of insight which revealed the availability of power from an electromagnetic source, the material curse of experiment in its effect upon domestic prosperity, the pathetic cutting up of her silk wedding dress by his devoted young wife to sup-

ply insulating materials for the [illegible] the motor, the support given Davenport by Professor Turner, of Middlebury College; Mr. Ransom Cook, of Saratoga Springs; Mr. Orange A. Smalley, of Forestdale; President Eaton, of the Rensselaer Polytechnic Institute; General Van Rensselaer, of Troy, and Prof. Joseph Henry, and finally increasing financial disasters, were chronicled in sufficient detail to bring the personality of the inventor vividly into relief. Reference was made to Davenport's work in the production and sustaining of piano-string vibration of electromagnets, and his inventions improving primary batteries.

When Davenport came upon the scene Faraday and Henry had already done their great work and the principles of the electric generator and the electric motor had been clearly perceived and enunciated. Yet there were no real motors before Davenport's time, and had the dynamo been known his work would have been carried to instant fruition. Davenport and others much later failed because they had no ready source of cheap power, and because the reversibility of the motor was unknown. Energy produced by battery is at least twenty times as costly as that produced by coal through the medium of a steam engine and a dynamo. All the electrical arts except telegraphy were held back by the absence of cheap power. When Davenport told the great Joseph Henry that he proposed to build his motors up to 1 hp, the cautious philosopher warned him to "go slow," and hinted that electricity could not compete with steam. Brief reference was made to the contemporary work of Dr. Jacobi in motor construction and its limitation by the absence of abundant and inexpensive power. Mr. Martin said that it was astounding that at a time when his native State had not a single mile of steam railroad Davenport built his little model of an electric railway and asserted that that was the best way to do it. Mr. Martin then referred to the breadth of Davenport's patent claims and the far-reaching character of his fundamental definitions, which included the statement that the principle of his invention "was the production of rotary motion by repeated changes of magnetic poles." Writing of Davenport's work fifty years later, in 1891, Mr. Franklin L. Pope, the leading electrical patent expert and littérateur of his day, said: "If this patent, which expired in February, 1851, were in force to-day it is not too much to say that upon a fair judicial construction of its claim every successful electric motor now running would be embraced within its scope."

In conclusion Mr. Martin reviewed the application of the principle of the commutator by Davenport in the 1835 motor, the building of the model electric railway, embodying incidentally the idea of a central-station source of supply and the use of a track-return circuit, and touched upon the fate of representative Davenport equipment which had been destroyed by fire or carried to the bottom of the sea, and Davenport's heroic efforts to raise funds by means of exhibitions and lectures and his pioneer work in trying twice to establish a technical journal, not only devoted to electricity and magnetism, but actually printed by electricity. The *Electro-Magnet and Mechanical Intelligencer* and the *Magnet* of 1840 were little quarto sheets, but they were the first of their kind in America and probably the first in the world, and made Davenport the father of electrical journalism. His record is astounding and unimpeachable. Struggling against adversity, dying in poverty, and long obscured by forgetfulness, this modest, simple son of Vermont stands forth as conspicuous as one of her granite mountains among the immortals who for the benefit of their fellow men have tamed and utilized the lightnings of the Almighty.

On the evening of Davenport Day an informal gathering was held at the Brandon Inn, and reminiscences of the inventor were given by relatives, with remarks by others present. Among the speakers were: Rev. W. G. Davenport, President W. W. Freeman, N. E. L. A.; Mr. A. J. Campbell, Mr. H. T. Sands, ex-Governor Ormsby, of Vermont; Mr. Henry F. Field and Mr. E. D. Blackwell. On Sept. 29 a barbecue was held at Lake Dunmore. Baseball, rowing and running races with other sports filled the day.

Association of Railway Electrical Engineers.

The third annual convention of the Association of Railway Electrical Engineers was held in the Hotel La Salle, Chicago, Sept. 27 to 30. Mr. E. M. Cutting, of Oakland, Cal., president, was in the chair at the opening session. The total convention attendance was about 400, of whom perhaps 150 were active and associate members, including some of the best known men among the electrical engineers of the leading steam roads of the country.

In his opening address President Cutting referred to the proposal to hold the regular meetings at Atlantic City and put himself on record as opposed to it on account of the tendency of delegates to spend their time sight-seeing instead of at the meetings. He also stated his objections to merging with the Master Car Builders' Association on the ground that it would completely overshadow the electrical engineers 'association and make rapid and effective action almost impossible.

The report of the secretary-treasurer Mr. G. B. Colegrove, showed a membership of 486, with expenditures of over $2,900 during the year.

ILLUMINATION

The report of the committee on illumination, of which Mr. H. C. Meloy was chairman, was read by Mr. J. R. Sloan, electrical engineer of the Pennsylvania Railroad. The committee noted the improvements in incandescent electric lamps adopted for car lighting, and referred to the new drawn-wire filament of the tungsten lamp as perhaps the most interesting recent advance. This lamp gives a long, useful life and is sufficiently strong mechanically to fulfil the conditions demanded by train-lighting service. It is noted that one year ago only one railroad had standardized the tungsten lamp to the exclusion of all other types, while to-day practically all the railroads in the country are using the tungsten lamp with entire satisfaction.

The committee recommended that the two standard ranges of voltage for car-lighting lamps be continued; that is, from 28 volts to 34 volts, and from 57 volts to 65 volts, inclusive. It was also recommended that the use of lamps having other than round bulbs be abandoned as soon as possible.

Various standard carbon, tantalum and tungsten lamps were recommended as the result of conferences which have been held with the lamp manufacturers.

Some information and data were also given by the committee in relation to lamps made for general illumination as well as those designed for car lighting.

In relation to the variation of life with the impressed voltage, curves were given to show that the tungsten filament is the most stable in this respect. For example, when operated at a voltage 8 per cent above normal the tungsten filament has its life shortened to 35 per cent of its normal value, while for the same variation in voltage the life of the tantalum and carbon filaments is reduced to 29.5 per cent and 21 per cent of normal respectively.

The discussion of this report was opened by Mr. H. Schroeder, of the General Electric Company. He referred to the question of drawn-wire, ductile tungsten filaments for car-lighting lamps and stated that while the present development of this filament does not justify putting them on the market it does indicate that a satisfactory lamp will soon be developed. He also described the drawn-wire filament and showed the difference between the two types by describing the processes of manufacture in a general way. He said also that 1000 hours is considered a good life for lamps in general and showed how the life can be increased by using high-voltage lamps on low-voltage circuits.

In response to the request of Mr. D. J. Cartwright, electrical engineer of the Lehigh Valley Railroad, for information on series tungsten versus multiple tungsten for lighting railroad yards, Mr. Schroeder stated that the series tungsten lamp is longer lived, due to the larger cross-section of the filament used, and that the series system is a good one to install where all of the lamps are to be in use continuously when a constant current transformer is installed. He added that experience

showed the life of series lamps to be from 2000 hours to 3000 hours against from 1000 hours to 1500 hours for multiple lamps, so it is a question of lamp renewals against the cost of a transformer and whether there is a multiple circuit already in use.

Mr. R. S. Carrick, of the Tipless Lamp Company, New York, said that there are two objections to the ductile-filament lamp—high cost and short life—but that satisfactory ones will undoubtedly be developed in the near future.

Mr. A. J. Farrelly, of the Chicago & Northwestern Railroad, asked if any of the members present had had any experience with tungsten lamps of from 100 watts to 500 watts for station lighting. He said he would use them in the new terminal station of his company in Chicago.

The matter of etching the name of the owners on the lamps was brought up and the discussion brought out the fact that this practice prevents many losses. Some users stamp their own initials or other symbol on their lamps instead of paying the makers for doing so. While etching does not prevent all stealing of lamps it does deter many who do not like to run the risk of people seeing such lamps in their houses, although some are willing to take the chance.

Mr. C. R. Gilman, Chicago, Milwaukee & St. Paul Railroad, asked if any of the members could give any data on the life of tungsten lamps in actual service, but no one could do so. Mr. Gilman then stated that he had found lamps giving over 1000 hours' life in service on his road, although only a few are in use. Mr. Cartwright stated that he had observed some 100-watt lamps in stations which had been burning 1700 hours. He said also that by putting tungsten lamps on the cars they had been able to use old batteries that were so nearly worn out that they would have to be replaced if carbon-filament lamps were used. Mr. J. R. Sloan, of the Pennsylvania Railroad Company, stated that when the management of his company refused an appropriation for additional battery-charging equipment a year ago the difficulty was overcome by using the tungsten lamps in place of carbon ones.

At the Tuesday afternoon session, when the discussion was resumed Mr. Gilman stated that he had always found it more economical to protect the eye from the light by using a shade on the lamp than by using frosted globes. While there are certain conditions that call for frosting for decorative effects general car lighting does not require their use. He stated also that where 8-cp lamps were equipped with shades in place of 16-cp lamps without them, making no other changes, better light and more satisfactory illumination were obtained.

Mr. Farrelly mentioned another feature of car illumination which he called "an indiscriminating public." He told of several cases where complaints had been made by people regarding the lighting when the trouble was merely one of comparison, the properly lighted car being the one criticised because it was not so bright as some other which was really too brightly lighted.

Mr. Hancock, chief electrician of the Queensland Government Railways, Australia, stated that his road had experienced a great amount of trouble with some glass shades because of dirt settling in the grooves and reducing the efficiency of the shades. He stated also that he had found these shades very fatiguing when they were within the range of vision and asked if any of the other members had observed the same effect. The opinions of several of those present were that fluted or ribbed shapes diffuse the light so well that there is no cause for complaint when the proper type of shade is used in each instance.

The discussion then turned toward the proper place to locate lamps, some of the members advocating placing them along the center of the deck and on the deck rail, others stating a preference for the deck and just over the windows, while still others advocated the deck rail alone. It was generally agreed that dining-cars require different treatment from parlor-cars and day-coaches.

Mr. J. R. Sloan read that part of the report of the committee on specifications referring to incandescent lamps. The committee recommended methods of ordering lamps and various specifications as to bulbs, bases, filaments, leading-in wires, vacuum, etc. It was stated that the value of the unit of candle-power shall be that maintained by the Bureau of Standards on Jan. 1, 1909. Provisions are made in the specifications for photometric measurements, inspection and tests. All packages of accepted lamps shall be stenciled by the inspector with a serial number commencing at 1 at the beginning of the year, and continuing consecutively until the end of the year. Tables were given to show the initial rating and performance of carbon-filament, metalized-filament, tantalum-filament and tungsten-filament lamps.

In the discussion Mr. Schroeder stated that the clause in the report which reads "the inspector shall examine 10 per cent of each lot of lamps" is difficult to apply when a large lot of lamps is received. He suggested that some sort of sliding scale be used whereby a smaller percentage of lamps be tested as the size of the shipment increased, asserting that a fair average could be obtained.

Referring to the tables shown, Mr. Schroeder suggested that they be brought up to date with the new international standard ratings and that the lamps be rated in total watts instead of candle-power. He suggested also that the limits on tungsten filament lamps should be changed, substituting "watts per candle, maximum only," in place of "watts per candle, per cent above and below rating." This suggestion was based on the great improvements being made in lamps by the makers and was made because the roads would be apt to copy the tables from the proceedings for use in their instruction books.

Mr. Sloan suggested that the report be referred back to the committee without further reading and that it should have a general revision. After some discussion as to how the report was to be handled and approved it was referred back to the committee, which was advised to get some of the lampmakers to confer with it in order that the report might be as complete and up to date as possible.

CAR LIGHTING IN AUSTRALIA

The president then called upon Mr. S. H. Hancock to make some remarks about car lighting and electrical work in Australia. Mr. Hancock prefaced his remarks by stating that each state government there owns the roads and that no two of the roads are of the same gage, so there is no interstate traffic over one another's lines.

Gas-lighted trains have been most used in Queensland until recently, and now electrically lighted trains are being run on many of the lines. The adoption of electricity was retarded to a great extent by the belief in the necessity of having a gas auxiliary outfit on board to use in case of emergency, but this has been changed now. Owing to the running of mixed freight and passenger trains on branch lines it has been hard to get electrically lighted trains in very general use excepting on main lines. In New South Wales, the oldest state in the country and also the most densely populated, electric lamps have been used for about ten years on some of the lines. Use has been made of both straight storage-battery and axle-generator systems, but none of them has been very satisfactory, and hence only a few of the express trains have electric light regularly. In Victoria, the smallest state gas is used exclusively, and it will not touch electricity on account of the large amount of money invested in gas outfits. The states of South Australia and West Australia have both adopted electrically lighted trains.

Mr. Hancock had considerable to say regarding the use of gas auxiliaries, and showed very clearly that other countries are watching the United States for an example to follow. He urged the association to take a definite stand against gas.

In the discussion which followed these remarks it was brought out that on several lines where gas was available the men did not take such good care of the electrical outfits as they should, depending on the gas in case of trouble during the run, but that complaints almost disappeared after the gas outfits had been removed and the men were compelled to rely on the electrical equipment. The Pullman company now puts no gas on any of its electrically lighted cars, and other builders are following this example.

After extending a vote of thanks to Mr. Hancock for his kindness in addressing the association, the meeting adjourned for the day.

ACCOUNTS AND REPORTS.

At Wednesday morning's session the report of the committee on accounts and reports was read. This report, which was presented by Mr. F. R. Frost, chairman of the committee, showed the great need of a standard method for calculating and reporting the cost of car lighting. Many reports are submitted without explanation and are incomplete, so the committee endeavored to devise a standard and simple method to overcome this difficulty. When considering dissimilar methods of lighting all items of expense should be included, and to make such comparison complete the figures should be reduced to a standard, based on total effective illumination and hours of lighting. This would require more time and testing than circumstances usually permit.

It was recommended that comparative reports of cost of maintenance and operation for similar systems include no allowance for interest and depreciation, for power for operating head-end systems or axle generators, for haulage of electrical apparatus or for insurance and taxes, as it is difficult to settle upon a satisfactory basis for calculating these items. Sufficient data should be given, however, to enable the engineers to make their own allowances.

Depreciation on account of obsolescence is viewed with considerable difference of opinion, but the committee believes that an allowance sufficient to replace the equipment in ten years should be made. No depreciation should be allowed on articles replaced at intervals with material of latest design charged as renewals.

During the discussion on this paper Mr. Cartwright questioned the advisability of taking either interest or depreciation into account, because the only point of interest to the association in this matter is the cost of lighting passenger cars per car-month or per 1000 miles. He then presented some figures made as the result of records kept on twenty-one cars for a period of nearly two years. These covered the actual cost of material and labor necessary to make repairs and keep the cars in operating condition, in so far as the electrical lighting equipment was concerned, and included lamps, fuses, belts, generators, regulator parts, storage batteries and miscellaneous fittings. The average was $10.97 per car-month for material and $10.39 per car-month for labor, including one new equipment and damages by wrecks.

There was a great deal of discussion and much difference of opinion as to how the cost of energy for lighting should be determined, because of the many systems in use and the wide variations in operating conditions and cost of fuel. The consensus of opinion favored omitting the cost of energy generation when axle or head-end systems are used because there is no appreciable increase in steam consumption.

STANDARDS.

The report of the committee on standards was presented by Mr. C. R. Gilman, of the Chicago, Milwaukee & St. Paul Railroad, chairman of the committee. This showed in a general way what has been done toward adopting the recommendations of the committee of 1909. Investigation showed that most of the recommendations had been put into practice and many of the devices mentioned put into use.

The following recommendations, made last year but not yet adopted as standard, were proposed by the committee:

(1) That all cars assigned or interchanged with head-end lighted roads be provided with three-line train main wires and the G-3 connectors. (2) That storage-battery boxes be placed in the center of the car. That they be made of iron, bottoms lined with wood and inside of box be protected with a heavy coating of acid-resisting paint. (3) That all cars carrying storage batteries be provided with two charging receptacles of a carrying capacity of 65 amp. (4) That all wiring under cars be placed in iron conduits. (5) That a fuse block, enclosed in an iron moisture-proof box, be placed just outside of the battery box, same to contain two 150-amp knife-blade fuses. (6) That the rules of the Fire Underwriters shall cover all car wiring. (7) That knife-blade N. E. C. type fuses be used for all fuses of 31 amp and above, the ferrule type for 11 amp to 31 amp, and the screw type for 10 amp and less. (8) That all parts of suspension gear of axle equipment should clear any part of the car body 3.5 in. and that same gear clear the track 6 in. when the car stands level. (9) Suspension gear to be so designed that the armature can be easily removed. (10) When facing the end of the truck on which the generator is mounted, that the pulley be on the right-hand side. (11) That a straight pulley seat be provided on the axle. It is recommended that a bushing or sleeve secured to same be used. Dimensions for bushing to be 7.5 in. external diameter and 8.5 in. long, turned straight. That the pulley hub have an internal diameter of 7.5 in., bored straight, the length of the hub to be 6.5 in. and the face be straight—9 in. or wider if flangeless or 8 in. wide if flanged. (12) That the generator pulley be 8 in. face, flanged, and the face crowned and perforated. That a flanged pulley with a perforated crowned face 8 in. wide be used on the generator. (13) That each electrically lighted car be provided with a framed diagram of the wiring, placed in a conspicuous place.

The report referred also to the recommendation of the Master Car Builders' committee on car lighting, which is as follows: "Section 10. That where axle generators are used negative, positive and generator field leads shall be fused as close as possible to the generator, either at the joint at which these leads enter the conduit or where they are secured to the bottom of the car. The above fuses are to be for emergency service only and to be at least 100 per cent above the capacity of the fuses on the switchboard protecting the same leads." The committee disagreed with this recommendation and earnestly desired careful consideration and discussion of this point.

The discussion of the report was very pointed and resulted in the appointment of a committee to confer with the Master Car Builders on the general subject of train lighting. Mr. Cartwright was made chairman. The M. C. B. committee has expressed its desire to confer with the Association of Railway Electrical Engineers on all matters of mutual interest and to help in any way possible with the work being done. During the discussion it developed that practically every one present was in favor of adopting the recommendations of the committee on standard practice, and action was taken embodying this sentiment as the sense of the association.

THE ILLUMINOMETER.

Mr. J. C. Heninger gave an interesting talk regarding the use of the "illuminometer" in railway work. His talk was illustrated by sketches and a machine was demonstrated to show the principles and practice of its workings. Mr. Heninger prefaced his remarks by stating that from the beginning of the time when commercial lighting assumed any proportions there has always been a demand for a clean-cut method of comparing the results obtained from the various methods of illumination. This was started away back in the days of gas and oil lighting, but has increased in importance as the use of electricity has increased.

There has always been a demand for an instrument for use by the average man, and many kinds of instruments have been devised to meet this demand. One of the earliest methods of comparing the value of two lights was by means of a scale set up like an indicator. The common form of photometer was then described, together with some of the numerous variations, and several of the latest devices of different construction were sketched out. The main point emphasized was that the simplest and most accurate and easily understood system for the practical man is the one based upon the straight law of distances.

Mr. Heninger then stated that the Sharp-Millar portable photometer had been found best adapted to that kind of work. He stated that the Blondell and Weber instruments are more accurate, but that they are not so compact or easily operated and that there are many difficulties which might arise in their use.

He then described the Sharp-Millar instrument in detail.

making sketches on the blackboard and demonstrating its uses. He showed how to determine the candle-power of lamps of various intensities and how to determine the illumination of rooms and shops at different points.

During the discussion on this paper Mr. Heninger emphasized the importance of having the voltage on the standard lamp used inside the illuminometer at the correct value, because a slight error would be multiplied many times in the process followed in making measurements. He demonstrated this by an experiment, referring particularly to the effect of change of resistance in the rheostat as it heats in service. In response to a question regarding the effect of different colored finish in cars upon the working of the instrument, Mr. Heninger stated that it is well known that there is a difference. He then showed how it could be compensated for by the use of specially prepared screens, and stated that carbon standards should be used when testing carbon lamps, tungsten standards for tungsten lamps, etc.

DATA AND INFORMATION

The report of the committee on data and information was presented by the chairman, Mr. D. J. Cartwright, of the Lehigh Valley. The chairman stated that, owing to the confused conditions relating to car lighting, it was impossible to furnish much detailed data as to the number of electrically lighted cars in service or as to the kinds so fitted. Roughly speaking, however, there are about 5000 electrically lighted cars in service or contracted for at this date, and a list showing the numbers and equipment of those on twenty-six of the leading railroads was presented. This list covered a total of 3629 cars equipped as follows: 2316 with axle-lighting outfits (1800 of them being for 32 volts and 516 for 64 volts) and 1268 equipped with straight storage systems at 64 volts. The balance are presumably equipped with head-end systems.

The committee suggested that a printed data blank be sent to every road asking for information on electrically lighted cars, and the report includes a suggested form for such data sheet. Regarding methods for improving the service, the committee expressed the belief that if the officials of the railroads would listen to the suggestions of the electrical engineers and allow them to be tested a great amount of good would be accomplished by the association. The committee also referred to the great amount of good which should result from the exhibits being complete, and expressed the desire that more of the manufacturers might be represented next year.

CAR VENTILATION

A paper on "Car Ventilation" was read by Mr. B. A. Stowe, of the Jandus Electric Company, and was followed by considerable discussion. A committee consisting of Messrs. Cutting, Hutchinson, Frost, Collett, Stowe and Morrison was appointed to report further on the subject at next year's convention. After some routine business was discussed the association adjourned for the day.

ELECTRICAL OPERATION OF DRAWBRIDGES

During Thursday morning's session Mr. S. F. Nichols, of Chicago, presented a paper on the electrical operation of drawbridges. Prior to the introduction of the bascule spans in 1894, he said, the center-pier swing span was the commonly accepted type of drawbridge. These bridges were usually operated by steam. Maintaining steam day and night and getting coal and water to such plants make their operation unnecessarily expensive, especially where the traffic is light. Subsequently gasoline engines were extensively tried. Such engines are frequently difficult to start in cold weather and require considerable time for such starting, so that the engine must be kept running all the time in order to be prepared for the approach of a vessel. The series-wound reversible electric motor when developed placed at the bridge engineer's disposal an almost ideal equipment for this purpose. The first installations of electric motors for bridge operation were on highway-bridges, commencing about 1890. Such bridges were more accessible to electric energy supply than steam-railway bridges, as they frequently were bridged by electric railways.

An added incentive to the adoption of electric motors for bridge operation was furnished by the development of the bascule type of drawbridge, requiring motors on each leaf. Being very compact, the electric motor can be located very close to the point where the power must be used, obviating the necessity of having a large engine-room with a heavy floor system above the deck of either the swing or bascule span. This fact makes it possible to locate the bridge operator at the most convenient position from the standpoint of accessibility, or where the best view can be obtained of the river or railroad traffic. The motors can be located on a moving portion of the structure, while the operator's house is located on the fixed part. This is one reason why the electric motor has been so important a feature in the development of the bascule bridge. The modern bascule bridge requires the use of one or two motors for the operation of the moving leaf, a motor for the front lock and in some cases a motor for the rail lock. Frequently moving-rail locks are omitted and the end locks are operated by hand-power. Each of these motors is ordinarily provided with a solenoid brake and the motors operating the end lock and rail lock are automatically stopped by the current being cut off and the brake being applied when the lock reaches the end of its travel in either direction. The current is ordinarily cut off from the leaf motors and the brake applied when the leaf in opening reaches a point beyond which it is dangerous to allow it to travel. It is not usually feasible to install a mechanical brake, because all the motors are on the moving leaf. To provide against a failure of the motor brakes an emergency brake is usually installed which will be applied automatically in case the current fails, or it may be applied by the operator if desired. An electric solenoid has frequently been used for the purpose of releasing this brake in the past, but a better method has been found in the shape of a small electric motor operating a brake-releasing mechanism and holding it in release as long as the current is held on the motor. Rupturing the circuit by the operator or by interruption of service on the line automatically trips a release and insures instantaneous application of the brake without waiting for the mechanism to go through the reverse motion corresponding to that in releasing. This equipment is less likely to be deranged than a large solenoid, and is simpler to replace in case of trouble.

On a large swing bridge, in addition to the motors required at the center for swnging the span, a motor is necessary at each end for the rail-lock mechânism. To prevent disastrous mistakes by the usual low-price bridge operator an interlocking system has been worked out whereby it is impossible for the operator to start opening the bridge until all railroad signals have been set against the train, and no signals can be cleared until the bridge is restored and the rail locks and wedges are in place. The operations must be performed one at a time and one operation must be completed before another is begun.

The adoption of electric motors for drawbridges has usually been contingent upon being able to secure electric energy, either direct current or three-phase alternating current at 25 cycles or 60 cycles. Recent improvements in gasoline-engine design make it possible to operate to a good degree of economy comparatively small isolated electric generating plants for bridge operation. One plan is to have a generating plant large enough to supply energy directly to the motors on the bridge. This means a large generating plant. Another plan is to install a storage battery of high enough discharge rate to take care of the operation of the bridge under the severest conditions. The gasoline-generating unit in this case may be very small, simply being large enough to recharge the storage battery at the desired interval. A combination of the two plans is better yet. The paper then described the swing-bridge installation over the St. Louis River, near Duluth, Minn.

In discussion of this paper Mr. Edward Wray inquired whether any bridges are being operated from storage batteries receiving energy through mercury-vapor rectifier sets from alternating-current supply. Mr. Nichols replied that there is such an installation over the ship canal at Indiana Harbor.

CHANGES IN TRAIN [illegible]

The Thursday afternoon session was opened with the report of the committee on train-lighting practice. This committee consisted of Messrs. George Griswold, J. R. Sloan, A. W. Chambers, George W. Murray and A. J. Farrelly, chairman. The report was to cover changes in methods of train lighting during the year. One of the most important changes in lighting from the head-end noted is that made on the Chicago, Milwaukee & St. Paul Railway, where a 110-volt system with generator at the head end has been changed to operate at 64 volts in accordance with the recommendations of the association made a year ago. This change has not involved the purchase of any new generator equipment. The steam turbine speed is maintained at 3600 r.p.m., as formerly. Extra resistance in the field circuit of the generator cuts down the generator voltage. The generators are compound-wound and part of the series-field current is shunted through a German-silver bar about 12 in. in length. The wattage of the first train equipped in this way was 7700 as against 16,700 formerly with older types of lamps. Along with this change was that of reducing the number of cells required in each set of batteries from fifty-four to thirty-two. The train lamps receive energy from a return loop, which forms the third train wire and maintains equal potential at all parts of the train. The batteries are supplied with energy from the mains before the loop is reached and hence receive a slightly higher voltage than the lamps. Curves were given of the actual performance of batteries and generators on the pioneer limited train of this company.

Another change in head-end methods during the year has been the installation on the Burlington road of an 18-volt auxiliary lighting circuit for service when the generator is not operated. Energy for this auxiliary circuit is furnished by a 9-cell storage battery on each car. It is charged from the train line 110-volt circuit.

As to axle-lighting practice, the committee recommended that in the application of axle-lighting equipment the truck be run out from under the car. Some roads refuse to do this and as a result the cost of placing these equipments is higher than if the trucks were taken from under the cars. The cost of application was given at $6.25 in one case and $4.55 in the other case.

As the number of axle equipments increases it becomes necessary to have some method of keeping track of the details of the equipment on each car. A card used by the Canadian Pacific for keeping such record was shown. In connection with this an identification plate should be used on each car axle.

In battery practice the battery connector problem has been very troublesome because of difficulties with open connection from the failure of both bolt connections and soldered joints. The failures of soldered joints have been due mostly to the corrosion of the tin in the solder by the acid. A number of roads have adopted the practice of burning across the tops of their lead bolt connectors. The committee recommends the use of the amp-hour meter on all battery equipment to determine the amount of charge and discharge the batteries have received.

ILLUMINATION.

An informal talk on illumination was given by Mr. J. R. Cravath, of Chicago. He took up first the question of measured efficiency in interior lighting. Measured efficiency he defined as being the ratio between the lumens generated by the lamps and the lumens delivered on a certain working plane. He showed how to calculate the number of lumens delivered by the lamps and showed the derivation of the unit, lumen, from the units of candle-power, distance and area. A high measured efficiency, he said, would be obtained by keeping the absorption low. To keep the absorption low the [illegible] be directed so as to be reflected back and forth many times between dark walls or ceilings, but must be directed with as few reflections as possible from the sources of light to the working plane. He said that by actual test it had been found that the difference between efficient and inefficient utilization in a small room might mean a difference of 45 [illegible] course, involves the use of light-colored ceilings and walls.

There are, however, a number of things which modify the measured efficiency before giving the practical efficiency. Artificial lighting is for the purpose of enabling one to see clearly and easily. The effect of different combinations of light on the eye must, therefore, be considered. One of the main things which interferes with seeing clearly is glare. Glare may be from the lamps themselves or it may be by reflection from paper, polished steel, etc. Glare from lamps has two detrimental effects, namely, contraction of the pupil of the eye and an automatic distraction of the attention of the eye from the object looked at to the bright light. This results in more or less effort to see clearly when lamps are in the field of vision. The nearer the lamps are to the line of sight, the worse the effect. The remedy for glare is increased area of light sources, which may be obtained by the use of large globes or reflectors, by diffusing the light through artificial "skylights" or by diffusing it from a light-colored ceiling by reflection from concealed lamps, as in the indirect system. Contrast is an element in illumination which both helps and hinders. For example, in a dark room a dimly lighted page may appear fairly well lighted. On the other hand, in a room with dark walls with many bright lamps the contrast between the dark walls and the bright lamps will always be uncomfortable and there is no way to avoid this as long as the lamps are exposed within the field of vision.

The lighting of railway cars in the past has violated all of the principles set forth. Many of these cars are finished in rather dark woodwork. The lamps are bare, thus not only wasting a large amount of the light flux on dark walls high in the car, but also presenting an amount of glare to the eyes of the passengers which really reduces their ability to read comfortably even with the insufficient illumination which reaches the reading page after excessive absorption by dark walls. For the efficient lighting of cars and for the comfort of the passengers, he recommended the use of lighter colored wood and light ceilings. These add to the cheerfulness of the car, as well as the efficiency and comfort of the lighting. Even in the use of reflectors considerable judgment must be exercised because the use of a wide distributing reflector along the sides of a day coach on lamps over each row of seats would result in excessive loss by absorption on the sides of the cars.

In all systems the human element must be reckoned with and unless the system installed be maintained in good condition the fine designs are of no avail. Fifty per cent of the light generated may easily be absorbed by dirt on the lamps and glassware. Of the glassware commonly used in car lighting, prismatic glass shows dirt the least, but is most difficult to clean. Opal glass shows dirt the soonest, but is very easily cleaned. Whatever system of lighting is in use, a proper system of cleaning and maintenance must be adopted along with it if the results are to be good.

Mr. D. J. Cartwright asked whether an arrangement of lamps in a line along the center of a day coach would be as good as a row over each seat. The speaker replied that if the lamps were placed at the same interval in both cases and the proper reflectors were used one arrangement would be as good as the other, but the appearance of lamps at sufficiently frequent intervals along the middle of the car would probably be objectionable to some of the officials of the company. One member said that the traffic and advertising department usually wants a lot of brilliant lamps exposed in a car for advertising purposes to make a fine showing when the car is standing in the station. The speaker and Mr. C. R. Gilman both took the position that the car should be lighted first for the comfort of the passengers and after that to get as much advertising effect as possible. The standard arrangement of exposed berth lamps in Pullman coaches the speaker condemned as being uncomfortable and unsatisfactory. The bull's-eye berth lamps recently developed are much more satisfactory.

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On Friday morning Mr. W. R. Bliss, of the United States Light & Heating Company, of Milwaukee, Wis., who had been

absent at previous sessions, being in attendance, was called on for a few remarks in recognition of his important work in railway-car lighting and in the formation of the association. Mr. Bliss responded fittingly to the effect that he hoped soon to see the Association of Railway Electrical Engineers take rank with the other large associations of steam-railway men, like the Master Car Builders and Master Mechanics.

An amendment was proposed to the constitution permitting the secretary to be other than an active senior member of the association. After considerable discussion the proposed amendment was lost. An invitation was received from the Washington Terminal Company for the association to hold its next semi-annual convention in the rooms of the Washington Terminal Station. It was voted to hold the next annual meeting at Chicago, the date to be left to the executive committee, but to be as near to the second week in November as posssible. It was voted to hold the semi-annual meeting in Washington, if possible, just before the Master Car Builders' convention, thus accepting the invitation of the Washington Terminal Company. The auditing committee then presented its report. Secretary Colegrove called attention to the deficit in the association's affairs and there was some discussion on the question of increasing the dues. This was finally referred to the executive committee to act if it found it advisable and to submit an amendment at the next annual meeting.

THE NEW OFFICERS.

Officers were elected in accordance with the rules of the association, which provide for balloting for each office one by one without any nomination. The election resulted as follows: President, Mr. J. R. Sloan, electrical engineer of the Pennsylvania Railroad Company, situated at Altoona, Pa.; first vice-president, Mr. F. R. Frost, electrical engineer of the Santa Fé Railway; second vice-president, Mr. D. J. Cartwright, electrical engineer of the Lehigh Valley Railway; secretary and treasurer, Mr. J. Andrucetti assistant electrical engineer, Chicago & Northwestern Railway; new members executive committee, Messrs. F. E. Hutchinson, chief electrician, Rock Island lines; C. J. Causland, chief electrician, Pennsylvania Railroad; Alex McGary, chief electrician, New York Central & Hudson River Railroad.

LADIES' ENTERTAINMENT FEATURES.

A number of ladies attended the convention and various entertainment features were arranged for their benefit. There was an informal reception and dance at the Hotel La Salle on the night of Monday, Sept. 26. An automobile tour was given on Tuesday afternoon, and that evening was ladies' night for viewing exhibits, Edison moving pictures being a specially attractive feature. There was a theater matinee on Wednesday afternoon, and in the evening the Tel-Electric Company gave a musicale in the Red Room of the hotel. The annual banquet was held on Thursday evening at the Hotel La Salle. Mr. Charles E. Brown, of the Central Electric Company, Chicago, was toastmaster, and there were speeches by Mr. Warren J. Lynch, passenger traffic manager of the New York Central Lines; Mr. William H. Bennet superintendent of telegraph of the Chicago & Northwestern Railway, and Mr. H. J. Slifer, general manager of the Chicago & Great Western Railroad. The attendance was about 350. Dancing followed the banquet.

Indiana Commission News.

The report of the Indiana Railroad Commission on the recent Union City, the Kingsland and the Tipton wrecks will soon be completed, but will not be made public until after Governor Marshall has examined it carefully. It is believed that the Governor will ask the next Legislature to pass a law giving power to the commission to enforce an order requiring the installation of block signal systems on the railways.

Mr. D. E. Matthews has been appointed chief inspector for the commission, succeeding Mr. Alexander Shane, who resigned to become manager of the Indianapolis, Columbus & Southern Traction Company.

Canadian Hydroelectric Commission News.

It has been definitely announced that the official turning on of the Niagara energy will be performed by the Premier of Ontario, Sir James Whitney, at Berlin, on Tuesday, Oct. 11, at 3:30 p. m. Many invitations have been issued to the various mayors, engineers, officials, contractors and press representatives of the different municipalities connected with the transmission of Niagara energy to the Western Ontario municipalities. Mr. Thomas A. Edison has also been invited. It is planned to have a very elaborate ceremony, concluding with a banquet in the evening.

The commission at a meeting on Sept. 27 decided upon further development of the scope of the commission's undertakings. Application is being made to the interests which control the energy production in the Trent Valley for delivering energy to Cobourg, Whitby and other towns in the Midland district. With this extension the work of the commission will cover the whole Province of Ontario, namely, the Ottawa Valley, St. Lawrence frontier, Midland district, Niagara zone, Fort William and Port Arthur.

The following towns in the eastern part of the Province have requested the commission for estimates on electric service: Kingston desires 2500 hp; Belleville, 3200 hp; Deseronto, 300 hp; Brockville, between 500 hp and 1000 hp; Oshawa, 500 hp; Cobourg, 900 hp; Bowmanville, 600 hp; Picton, 500 hp, and Durham, 2000 hp.

The Toronto Electric Light Company has obtained an injunction restraining the Toronto city corporation from putting up any more poles for its hydroelectric system, or from stringing wires on those already erected. The corporation following the issuance of the injunction obtained an order for a speedy trial on Oct. 3. Mr. Kenneth L. Aitken, engineer in charge of the electrical department, has been granted a two months' leave of absence on account of illness. Mr. Alex. Dow, of Detroit, was in Toronto during the last week in September, and it was expected that he would be placed in charge of the city's work during Mr. Aitken's absence.

New York Commission News.

The Public Service Commission of the First District of New York held a public hearing last week upon the recent proposal of the Interborough Rapid Transit Company for third-tracking and extending its elevated lines. Various civic organizations of the Borough of the Bronx were in attendance, and very little objection was made to the Interborough's plans. In the offer now pending the Interborough expressed its willingness to accept a franchise on its elevated extensions running twenty-five years, with three extensions of twenty years each. For this franchise it will pay 2 per cent of the gross increase in receipts at the express stations and will submit to a readjustment of the payment at the end of each franchise period.

The commission last week issued an official booklet describing the proposed Tri-Borough Rapid Transit Railroad, bids for the construction of which will be opened Oct. 20 and Oct. 27. The system will have a total length of 44.2 miles, and under the plans the tunnel will be made large enough to accommodate a full-size railroad car. The line has been planned to carry 1,000,000 passengers a day, and the stations will accommodate ten-car express and eight-car local trains. Concrete partitions will be constructed between the tracks, so that each single track will be practically a tunnel by itself, and it is claimed that the piston action of the trains will create very much better ventilation than in the present subway.

In the inquiry into the rate charged for electricity by the Queens Borough Gas & Electric Company in the Far Rockaway section of Queens Borough, which was set for Sept. 27, a postponement was taken until Oct. 10. The company claims that by this time it will have collected all the data necessary to establish what would be a fair and reasonable rate.

The New York Public Service Commission, Second District

gave a hearing on Oct. 4, at Albany, on the application of the Oswego Power Transmission Company for permission to begin construction and exercise right and privileges granted it by the City of Fulton, and on the application of the Peekskill Lighting & Railroad Company for permission to begin construction and exercise franchises for furnishing electricity to the Town of Yorktown, Westchester County.

The commission has received an application from the Postal Telegraph-Cable Company for an order restraining the Western Union Telegraph Company from discriminating against competitors in the matter of rates. Complainant alleges that in places in the State of New York where there is no office of the Postal Telegraph Company it is obliged to hand its messages over to the Western Union Telegraph Company for delivery. The Postal Telegraph Company collects from the sender the same fee as is charged by the Western Union between the sending and receiving points, and delivers it to the Western Union at the office nearest to the receiving point. The Western Union Telegraph Company not only charges the local fee from the point it receives the message to destination, but also adds a charge for four or five words indicating that the message had been turned over to the Western Union for further transmission, the additional words giving the place where and the date when the message was actually turned over to the Western Union. The commission is asked to make an order permanently restraining the Western Union Telegraph Company from charging any sum or sums of money on account of the adding of the additional words referred to in the complaint.

The commission has received the first complaint under the amendment of the Public Service Commissions law made last year which provides that gas or electrical corporations can make complaints as well as municipal authorities or individuals, the Buffalo Gas Company having filed a complaint against the City of Buffalo, alleging that the city is indebted to it for gas supplied in a sum upward of $124,000, which amount the city has refused to pay.

New Jersey Commission News.

The New Jersey Board of Public Utility Commissoners has approved of the proposed issuance, sale and delivery by the New Jersey & Hudson River Railway & Ferry Company of $100,000 of 4 per cent mortgage bonds. The proceeds from the sale of these bonds are to be used for the extension and construction of tracks and additions to the generating plant. The board has also approved an ordinance adopted by the Newark Board of Street and Water Commissioners granting permission to the Public Service Railway Company to construct and operate street-railway connections between its tracks in Bridge Street, Front Street and Ogden Street, Newark, it being found that the permission sought is necessary and proper for the public convenience. The application of the Hoboken Manufacturers' Railroad Company for permission to cross some fifteen streets in the City of Hoboken at grade has been denied. The ruling of the board states: "Should the local authorities approve, in whole or in part, of the application before them, the application to this board may be revived on notice to the municipality and the present disposition will not act in prejudice thereof."

Massachusetts Commission News.

Hearings have begun by the joint board consisting of the Massachusetts Railroad and the Boston Transit Commissions upon proposed subway extensions in metropolitan Boston. Last week the joint board listened to arguments of various property owners and prominent real estate interests of the West End of Boston on behalf of a tunnel loop between Park Street, Scollay Square and the Charles River section of the West End. It was contended that the Boston terminus of the Cambridge subway should have been at Scollay Square instead of Park Street. The Boston Elevated Railway Company and the Boston Transit Commission [illegible] the Park Street location after a thorough study of the traffic distribution of the city. The proposed West End subway contemplates a line under the existing Tremont Street subway and a loop to the West Boston bridge. At this writing there appears little prospect that the proposition will be accepted.

The Selectmen of Abington have petitioned the Massachusetts Railroad Commission to change the fares on the Brockton and Abington line of the Old Colony Street Railway Company. A hearing will be given by the board.

Plans have been filed with the Railroad Commission by the Boston Elevated Railway Company under the signature of President William A. Bancroft for an elevated railway station on the company's Forest Hills extension. The station was recommended by the board last May as a result of a petition of residents of the Jamaica Plain district of Boston, and will be built at the intersection of Washington and Green Streets. It will accommodate trains of eight cars.

A petition has been received by the Railroad Commission for an investigation of the service on the surface lines of the Boston Elevated Railway Company between South Boston, Fields and Upham's Corners. A hearing has been assigned for Oct. 17.

The United Electric Light Company, of Springfield, has petitioned the Massachusetts Gas & Electric Light Commission for authority to issue new stock to the amount of $250,000 par value to cover the cost of plant extensions.

CURRENT NEWS AND NOTES.

Wireless for Mercantile Establishment.—Plans have been completed for the erection of two steel and wooden towers 125 ft. high on the roof of the Wanamaker store at Broadway and Ninth Street, New York. The towers are to be used for a wireless telegraph station, which will communicate with a similar station connected with the Wanamaker store in Philadelphia.

Chicago Electrical Show.—The sixth annual Chicago electrical show will be held at the Coliseum Jan. 7 to 21, 1911. The management has established the policy of sharing the profits derived from the show with the exhibitors. The basis of this is that after paying the expenses of conducting the show and the administration and setting aside a small reserve fund to the Exposition Company, the remaining profits, if any, are to be divided equally between the Exposition Company and the exhibitors, the share of the latter being prorated among them in accordance with the amount of floor space paid for by each exhibitor. The show will be held, as before, under the management of the Electrical Trades Exposition Company, and Mr. Homer E. Niesz will be manager with offices at 150 Michigan Boulevard, Chicago.

Brooklyn Edison Educational Work.—The educational work which the Edison Electric Illuminating Company of Brooklyn has been carrying on for a number of years among its employees will be continued during the 1910-1911 season along different and what is believed will be more effective and satisfactory lines. A scholarship committee has been appointed by Mr. Freeman, the general manager of the company, and this committee, in co-operation with the faculty of Pratt Institute, has fixed upon certain courses at that institution which may be attended by any Edison employee. An employee may select any one of these courses, starting with as advanced a class as his previous training will warrant, the subjects being so arranged that those entering will not have to spend time on unnecessary matter, but will be taught just what they need to know in the line of study they take up. The tuition fee is $15 a term, which may be paid in advance or in instalments. At the end of each term the company will return the cost of tuition to each employee who has completed the term with a fair average. It is the intention of the company in this way to give everyone in the service an opportunity to receive a technical education which will enable him to advance more rapidly and increase his value to himself and the company.

Increased Street Lighting in Chicago.—The Sanitary Dis- [illegible] contract with the City of Chicago for providing street lamps for the entire city and taking over the transmission lines owned and operated by the city. It is said that the number of street lamps will be practically doubled.

New York Celebration in 1913.—Plans [illegible] lated for a celebration in New York City during 1913 to commemorate the settlement of the city by the Dutch in 1613 under Adrian Block; the delivery of the speech of Abraham Lincoln on the battlefield of Gettysburg in 1863, and the signing of the treaty of Ghent in 1814. Mr. Henry Clews is chairman of the executive committee.

Electricity for Curing Seasickness.—According to reports from Boston, Dr. Antonio Maggiorani, of Rome, has devised an electrical treatment or "hydroelectric bath" for alleviating seasickness. The treatment is similar to that employed by Dr. Maggiorani in the hospital of the Santo Spirito, Rome, being described as "baths with electric fermentation." It is claimed that the treatment "increases the vital force of the organism so that the patient offers great resistance to nervous maladies."

International Railway Fuel Association.—The third annual convention of the International Railway Fuel Association will be held in Chattanooga, Tenn., on May 15 to 18, 1911, at the Hotel Patten. This association is made up of steam-railroad men, and it studies the production, transportation and utilization of fuels for railroad purposes. Mr. W. C. Hayes, of New York (Erie Railroad), is president, and Mr. D. B. Sebastian, of Chicago (Rock Island), is secretary.

Chicago Drainage Canal Excursion.—The contract department of the Sanitary District of Chicago, which operates the Chicago Drainage Canal, entertained a party of about forty gentlemen on an excursion down the Drainage Canal to the hydroelectric plant at Lockport, Ill., on Sept. 29. A large proportion of the members of the party were possible users of electrical energy for industrial operations, and they were much interested in the hydroelectric works, as well as the electrical generating plant, the transmission line and the terminal station. Mr. N. F. Obright, contract agent of the Sanitary District, was in charge of the party.

Electrochemical Manufacture of Fertilizers.—An important application of electricity will shortly be made by the Southern Power Company which is establishing at Great Falls, S. C., a 4000-hp plant for the manufacture of commercial fertilizers by the Guye electrochemical process. Air is forced through an electric furnace, after which nitric acid is produced by combination with water, the acid being applied to limestone to give nitrate of lime, which is the chief constituent of commercial fertilizers. Much of the machinery for the Great Falls installation, which will cost about $200,000, has been manufactured abroad and installation will begin soon.

New York Meeting of A. S. M. E.—At the meeting of the American Society of Mechanical Engineers to be held in New York on Oct. 11 Mr. Frank B. Gilbreth will present a paper entitled "Fires: Effect on Building Materials and Permanent Elimination." Among those to discuss the paper are Mr. Henry B. Keasbey, of the National Fire Proofing Company; Prof. Ira H. Woolson, of the National Board of Fire Underwriters; Mr. William D. Grier, chairman of the special committee on manufacturing risks and special hazards of the National Fire Protection Association; Mr. C. A. Turner and others concerned with various phases of fireproofing building construction.

Proposed Canadian Hydroelectric Development.—City Solicitor Hunt, of Winnipeg, has been advised by Mr. Robert Shaw Oliver, Acting Secretary of War of the United States, [illegible] Power & Company for permission to divert the water from the Birch Lake Basin and the Winnipeg municipal generating station at Point du Bois. Mr. Oliver pointed out that under the conditions by which the permit was issued to the company, the work of construction could not be started until a hearing had been granted every one affected. A meeting for this purpose will be held and notice sent to Winnipeg in order that the [illegible] party may be represented.

Officers of Kansas Public Utility Association.—At the annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association, Kansas City, Sept. 27 and 28, the following officers were elected: President, Mr. W. R. Murrow, Independence; first vice-president, Mr. J. H. Rathert, Junction City; second vice-president, Mr. B. F. Eyer, Manhattan; third vice-president, Mr. H. A. Walker, McPherson; secretary and treasurer, Mr. James D. Nicholson, Newton; executive committee, Messrs. A. M. Patten, L. O. Ripley and E. S. Leavenworth. It was decided by a unanimous vote that the next annual meeting be held in Independence, Kan., on Thursdoy and Friday, Sept. 21 and 22, 1911.

Railway Electric Supply Manufacturers' Association.—On Sept. 29, during the annual convention of the Association of Railway Electrical Engineers, in Chicago, the Railway Electric Supply Manufacturers' Association, an allied organization, held its annual meeting. Officers were elected as follows: President, Mr. A. C. Moore, Safety Car Heating & Lighting Company, Chicago; vice-president (West), Mr. George H Porter, Western Electric Company, Chicago; vice-president (East), Mr. H. G. Thompson Edison Storage Battery Company, New York; treasurer, Mr. Edward Wray, Chicago. The new officers of the executive committee are: Mr. Godfrey H Adkin, Electric Storage Battery Company, Chicago; Mr. R. M Newbold, Adams & Westlake Company, Chicago; and Mr O. B. Duncan, J. Lang Electric Company, Chicago.

Public Lectures on Engineering in New York.—The Department of Education of the City of New York has arranged for numerous courses of lectures for the year 1910-11. Among these are courses in general physics and electricity, the program for which has been announced for October, November and December, 1910. Dr. Charles E. Lucke, professor of mechanical engineering, Columbia University will deliver eight lectures on "Power." The subject of "Physics" will be treated in eleven lectures by Mr. J. Newton Gray, of the Manual Training High School, and nine lectures will be delivered by Professor William C. Peckham, of Adelphi College. Twenty-two lectures on the "Principles and Practice of Electrical Engineering" will be delivered by Mr. W. Wallace Ker, of the Hebrew Technical Institute. "Modern Applications of Electricity" will form the subject of nine lectures of Mr. T. I. Jones, of the Edison Electric Illuminating Company, Brooklyn. Mr. J. Newton Gray will lecture five times on "Electricity." "Electricity and Magnetism" will be treated in ten lectures by Mr. Frederick W. Huntington, and there will be eleven lectures by Mr. Charles L. Harrington.

New York Electrical Show.—At the fourth annual New York Electrical Show, which will be held in Madison Square Garden from Oct. 10 to 20, a prominent feature will be the lighting of the building as a whole. The tower will be equipped with a bank of flaming-arc lamps of the long-burning type. During the exposition the Electric Vehicle Association of America will hold its convention. Arrangements for the exposition are now being completed under the general direction of Mr. George F. Parker. The general decorative scheme will be green and gold, and the exhibitors' booths will be arranged according to entirely new models. The feature of the show, however, will be the interior lighting, which will be very brilliant. New lamps are to be put in for this occasion and 100,000 electrical lamps will flood the main hall with the brightness of daylight. There will be exhibited many novelties in electric signs, which will add to the interest of the lighting features.

APPLICATION OF ELECTRICITY TO MARINE WORK.

Equipment of the Works of the John N. Robins Company, Erie Basin Dry Docks, Brooklyn, N. Y.

As the works of the John N. Robins Company comprise the largest ship-repair and dry-docking plant in the United States, it would be well, before taking up the detailed description of the substitution of electricity for steam as a motive power, to describe generally the plant and the work to be accomplished.

The Erie Basin Dry Docks are located on Erie Basin, Beard Street, foot of Dwight Street, Brooklyn, N. Y., and comprise two basin dry docks, No. 1, 512 ft. in length and taking vessels of 20-ft. draft over keel blocks, and No. 2, 620 ft. in length and taking vessels of 25-ft. draft over keel blocks at high tide. These are timber-lined basin or graving docks, originally constructed about the time of the close of the Civil War; but they have since been extensively rebuilt and enlarged. There are besides these graving docks three floating dry docks, one balance dock of 4000 tons, one sectional dock of 6000 tons and one pontoon dock of 6000 tons lifting capacity.

By referring to Fig. 3 the general location of the docks and the buildings will be seen. The entire plant covers an area of twenty-three acres. The shops embrace a machine shop, with tools capable of handling the largest cylinders and crankshafts; a small machine shop with small tools for general repair work; a copper and sheet metal shop; a large boiler shop with heavy rolls, punch and shears, capable of handling the heaviest plate work; a blacksmith shop with steam hammers, furnaces and plane table for forming ship ribs and other large shapes, and a carpenter shop fitted with a complete set of wood-working machinery for joiner and other wood work. The plant, as a whole, has a capacity for dry docking, painting and repairing 500 vessels a year.

Previous to the introduction of the equipment to be described energy was furnished to the machinery in this plant by nine large steam boilers, having an aggregate rating of 1700 nominal horse-power and which were operating much of the time at an excessive overload. These boilers were supplying steam at 100 lb. pressure to not less than twenty steam engines scattered over the entire works, ranging in size from a compound engine of 600 hp. for pumping the [illegible] and three steam-driven air compressors of respectively 350 hp, 130 hp and 120 hp, to various small engines rated at from 10 hp to 25 hp. With the exception of the steam [illegible] pumping the dry docks, all engines worked non-condensing. The aggregate nominal horse-power of the engines was approximately 2000, and as the two floating dry docks and the new one under construction would require an additional 1400 hp it will be seen that the question of supplanting steam by electricity for such a diversified and widely scattered plant was a very involved one.

REASONS FOR CHANGE.

This plant, like many others, by additions had developed without a consistent plan through a long series of years and consequently had reached a point where something radical had to be done. The steam boilers were of the horizontal tubular type and on account of the local conditions of the buildings two firerooms were maintained at a considerable distance apart. There were, moreover, no adequate facilities for handling or storing fuel, and it was necessary to rehandle fuel separately for each fireroom. The burning of bituminous coal under the condition of excessive intermittent demand for power resulted in smoke production, which was strongly resented by local authorities. At the same time it was quite apparent that a considerable economy should result from the proper application of electricity as compared with steam.

Fig. 1—General View of the John N. Robins Dry Docks on Erie Basin, Brooklyn, N. Y.

The first and most important question to be decided was the advisability of purchasing electricity from a central station or installing electric generating equipment. The great diversity of work to be done made this question a difficult one. The plant often works at full capacity night and day and at other times there is little work on hand. Again, the aggregate amount of energy to be used when several dry docks are operating at one time, besides a large air-compressing plant, would mean a very large installation and an exceedingly bad load factor. The suddenness with which these loads would be thrown on and off, it being understood that a floating dry dock is usually pumped in less than one hour and a basin dry dock in about two hours, would demand quick firing of boilers and a large force of firemen always on hand.

Therefore, a most careful study was made to determine the distribution and use of energy and the yearly consumption of coal, from which an operating cost was worked out as a basis for determining the maximum unit price which it would be possible to pay for electricity and still show a reasonable economy over existing conditions. With this point determined the matter was taken up with the local central station for the distribution of electrical energy, and after an extended discussion a satisfactory contract was finally arranged so as to

favor the central station as much as possible as to peak loads and the dry dock company as to having a large amount of power available at any time of day or night. The details of the form of this contract are of little general value, as it was worked out to suit very unusual conditions.

GENERAL PLAN FOR THE INTRODUCTION OF ELECTRICITY.

It will be understood from the foregoing that no general plans could be formed until the main question of central station or independent generation of electricity had been settled. The advisability of a central-station source of energy having been reached, a general review of the application of electricity and the amounts was started, and it was decided to adopt the primary voltage of the central-station system for the larger units in the yard and for distribution about the works; the dry dock company to operate its own transformers for low-voltage energy adaptable to smaller motors.

Referring to Fig. 2, which is a general diagrammatic view of the entire installation, it will be seen that service was introduced from the Edison mains of 250,000 circ. mils at 6600 volts, three-phase and 25 cycles. A main substation, located as shown on the general plan, was provided for handling all high-voltage connections. This station is located in a special structure elevated one story above the ground, so as to avoid moisture conditions as much as possible. The switchboard, as will be seen by referring to the photographic view, is composed of 13 panels, two of which are used to handle the Edison service and the others, as indicated on the diagram, for controlling distributing circuits to high-tension motors for compressing air and pumping the graving docks. Other switches control circuits to local substations with transformers for various purposes.

All switches are of the standard oil type and each panel is provided with a time-limit-relay circuit-breaker and with a watt-hour meter to furnish an independent record of the consumption of electrical energy for the different purposes to which it is applied, thus making it possible to charge up the cost of electricity for the different docks, machine shops, compressed air and other purposes for which it is used.

DISTRIBUTION OF ELECTRICITY.

The general arrangement for the distribution of electricity and the location of minor substations will be seen by reference to Fig. 3. The distribution of energy to these stations is accomplished by underground conduit and lead-covered cables. The conduits are of fiber, encased in concrete. The cables are of the same high standard and specification as those used by the Edison Electric Illuminating Company of Brooklyn, from which the electricity is obtained. Manholes are provided at suitable intervals for hauling cables and every possible precaution is taken as to drainage of the ducts and protection of the circuits from injury.

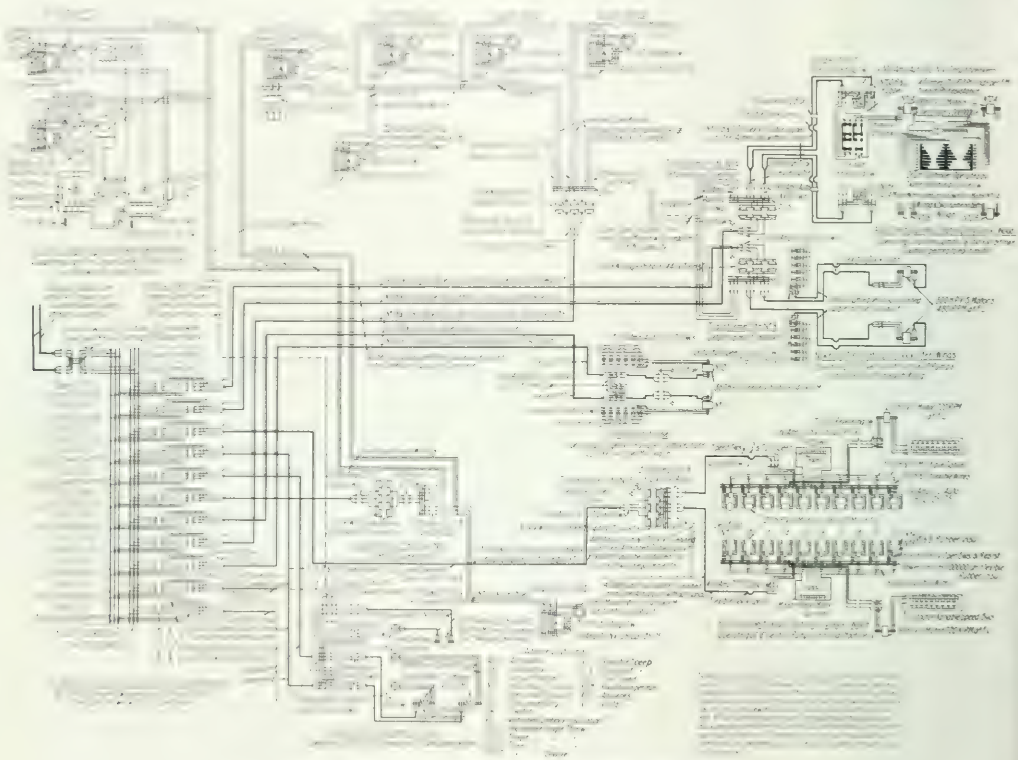


Fig. 2—Diagrammatic View of Entire Electrical Installation.

INTRODUCTION OF ELECTRICITY.

The actual introduction of electricity into this plant centers about, and was occasioned by, the building of the new 6000-ton pontoon floating dry dock with steel wings, and the description of its introduction will, therefore, more or less center about the putting into operation of this dock, it being understood that all changes were to be made without interrupting or in any way interfering with the operation of the works.

The plans were completed and work first commenced upon the main substation; then followed installation of the conduit and cables for distribution to and the construction of the minor substations. All of this work was practically completed by the time the floating dry dock referred to was delivered at the

yard, and the first application of electricity was to the pumps of this dock, about Feb. 1, 1906.

6000 TON PONTOON FLOATING DRY DOCK.

The pontoon floating dock has a length in the wings of 335 ft., a width over all of 100 ft. and a depth of pontoon of 11 ft. The maximum net lifting power is 6000 tons, raising a vessel of approximately 400 ft. in length. The lifting power

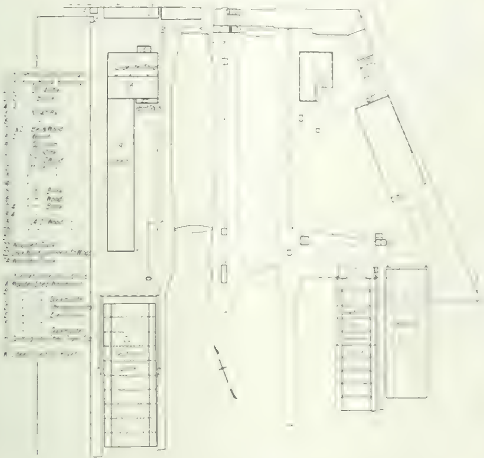


Fig. 3—Plan View of Erie Basin Dry Docks.

is the combined buoyancy of ten pontoons, all separate floating structures mechanically united together by the steel wings or side walls. The lifting power is obtained by pumping out the water which has previously been admitted to sink the dock. For removing this water there are ten 12-in. centrifugal pumps on each side of the dock. Each set of pumps is operated by a 300-hp electric motor through a horizontal line shaft, miter gearing and vertical shaft to the pumps located at the bottom

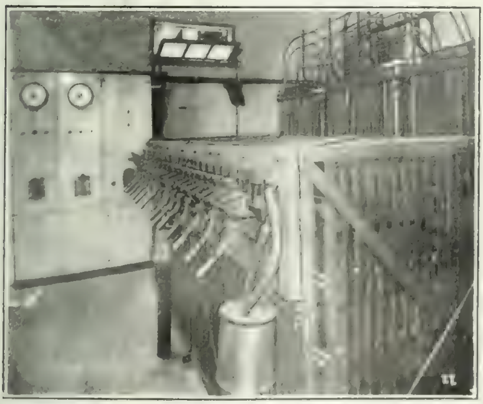


Fig. 4—Substation and Controller Room for Pontoon Dry Dock.

of each end of each pontoon. These pumps deliver the water against a maximum head of 15 ft. The electric motors operate at 485 r.p.m. and the line shaft and pumps at 250 r.p.m.

OPERATION OF 6000 TON DRY DOCK.

To sink this dock flood gates are opened to admit water directly through the pumps, and as the water continues to enter the dock settles until it has reached the necessary depth to allow the vessel to enter above the keel blocks. The flood gates are then closed until the vessel has been located and secured centrally in the dock. This is done under the direction of the dockmaster, who stands on the pier directly in front of the vessel. It will be understood that the operation of the pumping machinery by the motors is controlled from substation No. 3, located on the pier within about 20 ft. of the point where the dockmaster stands, and that as soon as the vessel is properly

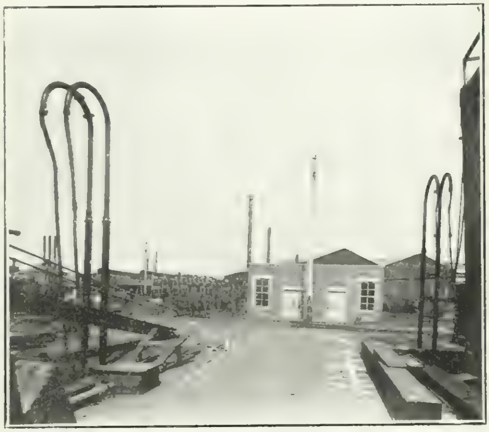


Fig. 5—Substation and Method of Carrying Conductors to Floating Dry Docks.

located the signal is given for starting the motors. The controllers for these motors are of such construction as to obtain a wide variation of speed ranging from 10 per cent up to full speed. Variation of speed is obtained by inserting resistance in the armature circuit in the usual manner by means of slip rings, it being understood that the secondary circuits from the armature are conducted from the floating dry dock through flexible connections to the pier and to the substation, a distance of approximately 200 ft. The contact levers for the controllers are of the laminated pressure type with carbon

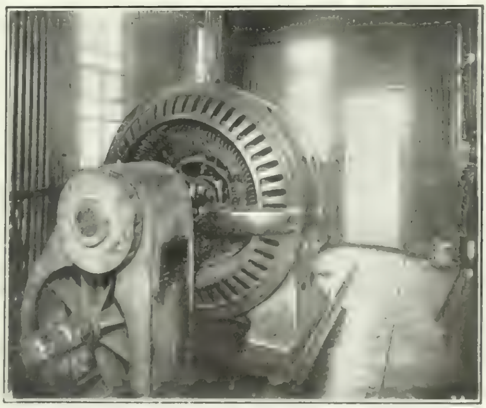


Fig. 6—300-hp Induction Motor on Pontoon Dry Dock.

break and the main circuit is supplied with oil switches and time relay circuit-breakers. The resistance used is of the standard, cast-iron grid type and of such an amount as to allow the motors to be operated continuously at any speed.

It will be seen by referring to the general plan that this substation is located in the same building as the one for the balance dock substation No. 4, and that while separate transformers are provided for each dock provision is made for the

cross connection of the transformers so that either bank may be used to operate either dock, as a provision against breakdown. The electric motors were manufactured and installed by the Western Electric Company, the controllers were manufactured by the Cutler-Hammer Manufacturing Company and [illegible]

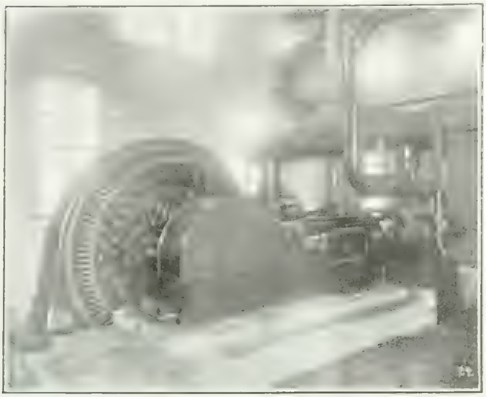


Fig. 7—Motor-Driven Air Compressor.

The full capacity of the dock can be pumped in from twenty-five to thirty-five minutes, requiring the handling of approximately 10,000 tons of water. This dock was put into commission about the first of February (midwinter), 1909, and from the first has continued to operate in a most satisfactory manner. The control of the pumping machinery on both sides of the dock by one man, located so as to be directed most readily by the dockmaster, has proven to be a very great advance over anything heretofore accomplished. When it is taken into consideration that this was the first introduction of electricity in this plant and that the operation was by workmen entirely unfamiliar with its application, the result is highly satisfactory. Those desiring a more complete description of the construction and operation of this floating dry dock are referred to the August, 1909, issue of *International Marine Engineering*.

BALANCED FLOATING DRY DOCK.

The second application of electricity was to the 4000-ton balanced floating dry dock located adjacent to the one previously described. This dock is one of the oldest floating structures in New York Harbor, having been built more than fifty years ago. The pumping of this dock was accomplished by steam engines operating through gearing six single-acting bucket pumps on each wing. These pumps were each 36 in. in diameter and 30-in. stroke, designed to operate at about twenty-two strokes per minute. As the pumps were of very ample capacity and simple construction it was not deemed necessary to change them.

The boilers and engines were removed and replaced by two 100-hp electric motors on each wing, each motor driving a group of three pumps, and as it had been customary for the dockmaster to control this dock from the deck of the vessel being raised, the controllers were placed upon the dock, the motors on each wing being under control of a separate operator who could readily be directed by the dockmaster on board the vessel. The motors operate at 450 volts, 470 r.p.m. full load and are controlled by drum controllers and resistances in the armature circuit to give variable speed.

As previously stated, the energy for these motors is supplied by transformers from transformer station No. 4. The operation of the dock with these motors has been entirely satisfactory from the beginning. Their application has resulted in the removal of a considerable fire risk and a very considerable weight of boilers, engines and fuel. The time required to pump the dock is about one and one-half hours. These motors were manufactured by the Wagner Electric Manufacturing Company and the controllers by the Westinghouse Electric & Manufacturing Company.

AIR-COMPRESSING PLANT.

The next application of electricity was to an entirely new air-compressing plant, replacing the steam-driven machines

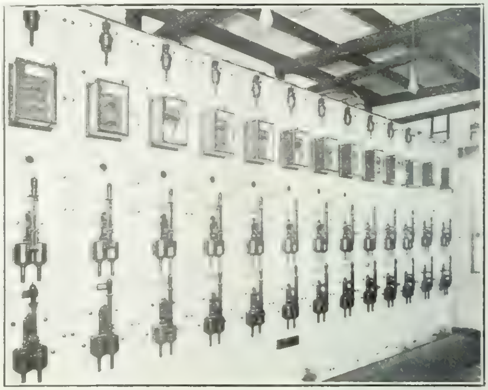


Fig. 8—High-Tension Switchboard.

previously used, which were of early design and low economy. By referring to the general plan it will be seen that the new air-compressing plant is located at a central point for the purpose of reducing air distribution losses to as small an amount as possible.

This plant, which is one of the first large compressed-air

Fig. 9—Induction Motors on Balanced Dry Dock.

plants to be driven by high-tension motors, deserves careful consideration. It is composed of two units each of 2000 cu. ft. capacity per minute. These machines operate at 145 r.p.m.,

the operation being by direct-connected 6600-volt electric motors. The high-tension current is brought from the underground conduit to the switchboard provided with oil switches and overload, time relay, circuit-breaker in the secondary or armature circuit. Each unit requires 360 hp at full load. These motors and controllers were designed and installed by the Western Electric Company. The air compressors are of the well-known piston-inlet, hurricane-valve type manufactured by the Ingersoll-Rand Company. The low-pressure cylinder is 27¼ in. in diameter and the high-pressure cylinder 15¼ in. with a stroke of 24 in. To insure clean, dry air the intake was carried up through the roof, the air entering through a hooded and screened ventilator cap. An 8-in., high-pressure discharge from each machine runs independently to a receiving and cooling tank on the outside of the building. The air leaves this tank near the bottom by two 8-in. mains for distribution underground to docks and shop.

Fig. 10—6000-Ton Pontoon Floating Dry Dock Partially Submerged.

A new and ingenious method of air unloading was used for the first time on these machines. A series of small air tanks or receivers proportioned relatively to the volume of the cylinder and so connected to the delivery valve of the cylinder as to be thrown into connection therewith by automatic action of the controller increases the clearance in the cylinder and thus reduces the amount of air delivered.

From the time of starting these machines not the slightest trouble or interruption has been experienced with the electrical operation and on many occasions the machines have run from week-end to week-end without shutting down. Provision was made in the design of the machines for the use of either salt or fresh water for air cooling, and for handling the salt-water circulation a 2-in. centrifugal pump was provided, driven by a belt from the main shaft of the machine.

GRAVING DOCK PUMPING PLANT.

In dry-docking a vessel in a graving dock the ship enters an open slip and when fully entered a floating gate or caisson is placed across the entrance, thus closing it from the sea. The ship is then centered over a line of keel blocks down the middle of the basin or dock. The water is then removed from this enclosure by allowing it to flow from the other end of the dock by an underground passage or conduit to a well of a depth somewhat greater than the dock itself. From this well the water is removed by large pumping machinery.

It will be readily understood that with proper conduits or underground connections more than one graving dock may be pumped by the same machinery. In the case under consideration two docks situated side by side are served by one set of pumps located at a point which may be readily determined by referring to Fig. 3 marked "Pump House."

Reference to Fig. 13, showing a section of the well, the pumping machinery and electric motors which are to be described, will aid in the general understanding. It will be understood that the new pumping plant was to be installed without interrupting the use of the docks, which were being worked to their full capacity, often being pumped three or four times a day.

Fig. 11—Smaller Graving Dock at J. N. Robins Works.

The steam-pumping plant consisted of a compound marine engine driving, through gearing, two 30-in. centrifugal pumps, and occupied all of the building indicated as "Pump House" in Fig. 3. The new plans provided for installing the pumps in the upper part of the well, handling the valves in what had been the former valve room and placing the motors one story above ground over the valve room. To accomplish this it was

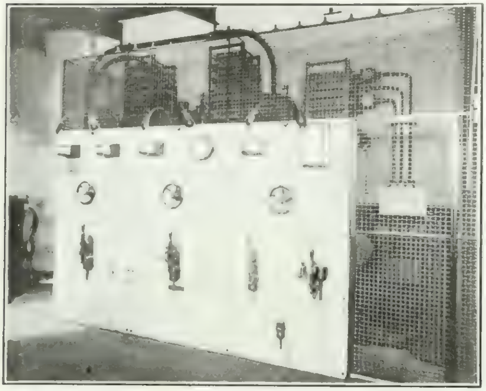


Fig. 12—Graving Dock Pumping Plant Switchboard.

necessary to make a connection to the 30-in. vertical suctions below the horizontal delivery to the old pumps. This was done in a little more than two days and was the only interruption during the entire progress of the work.

Horizontal check valves were inserted in the new connections

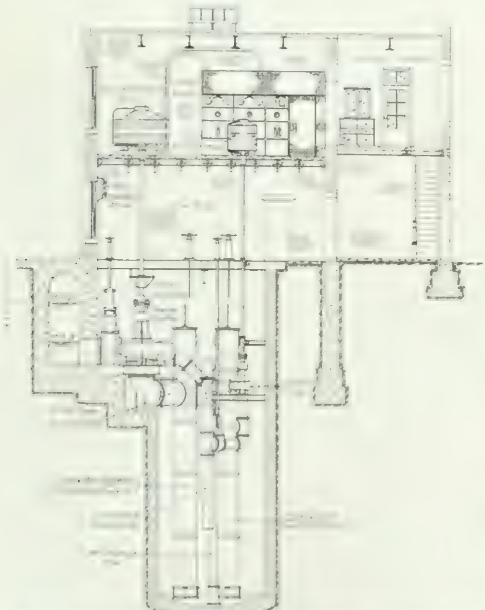


Fig. 13—Sectional Elevation of Graving Dock Pumping Plant.

and the vertical centrifugal pumps connected directly to these outlets through vertical L's, and the delivery of the pumps was carried through 30-in. gate valves and a concrete wall to the delivery conduit extending 300 ft. and delivering into the head of the slip at the northern corner of the works.

Besides the two 30-in. pumps referred to there was installed a 12-in. drainage pump with connection to both docks and also to the bottom of the well. It will be understood that basin dry docks are never entirely watertight and that a pair of these

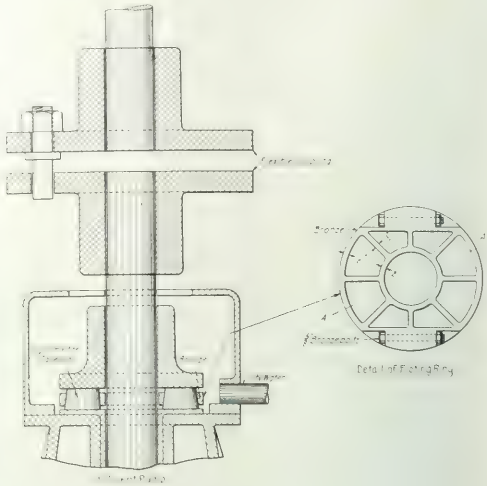


Fig. 14—Details of Floating Ring Thrust Bearing.

docks, such as are here shown, require a 12-in. centrifugal pump to be in almost constant operation.

By referring to Fig. 13 it will be seen that the pumps are installed below low water level and considerable difficulty was encountered in the installation of proper reinforced concrete foundations for such heavy machinery. The floor of the valve room is of steel I-beams overlaid with iron plates in such a manner that both plates and I-beams may be removed to a sufficient extent to handle all machinery and fittings placed in the well. This is facilitated by the heavy I-beam construction of the motor-room floor, the lower flanges of which provide a ready means for attaching hoisting tackle.

The motor-room floor is of steel and concrete construction, the two 350-hp motors being carried on two 24-in. I-beams and the rest of the floor supported by 18-in. I-beams. The walls

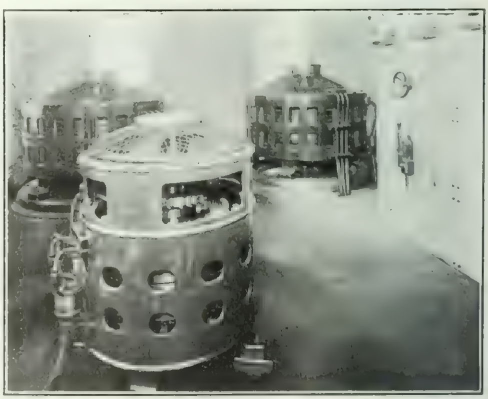


Fig. 15—Pump Room and Motors for Graving Docks.

are of hard brick 20-in. thick, laid in cement. This construction has resulted in a perfectly steady motor-room with two 350-hp motors operating at 375 r.p.m. The 50-hp drainage motor runs at 500 r.p.m. The armature and vertical shaft of these motors are carried on ball bearings at the upper end of the shaft.

Flexible couplings are introdu[illegible]e the pumps which are provided with independent water-cooled thrust bearings.

ELECTRICAL EQUIPMENT OF GRAVING DOCK PUMPS.

As previously stated, the two larger motors operate at 6600 volts and by reference to Fig. 13 the arrangement of the controllers and starting switches will be plainly seen. Oil switches are used and the multiple switch starters are provided with resistance for starting only, and so arranged, by interlocking, that the main switch cannot be closed for starting unless all the resistance is in the armature circuit; any desired control of the pump being obtained by closing the delivery gate valve from the pumps. In fact, positive instructions are given always to start up the pumps with the delivery valves closed, which has the effect of starting up with friction load only, the load then being gradually added as the delivery valve is opened.

Fig. 16—Transformer Cabin and Switch Box in Yard.

It might further be explained that while these centrifugal pumps must deliver against a maximum head of nearly 40 ft., the pumping commences against zero head or with the level of water inside and outside of the basin the same. It should also be understood that in handling water with centrifugal pumps operated by electric motors it will be found that the pump will not overload by increase of head, but that the paradoxical or opposite result will occur; that is, the motor will unload by the increase of head and will overload by a decrease of head.

By referring to Fig. 13 there will be seen directly over the delivery valves from the pumps a motor overload alarm. This is an electric bell arranged to have its circuit closed by an overload relay and will commence ringing as soon as overload takes place. This will occur if the delivery valve is opened too wide when the pumps are first started against a zero or very low head.

The drainage pump motor is operated at 440 volts and at 500 r.p.m. Continuous oiling for all these motors is obtained by centrifugal pump action which circulates oil from a receptacle above the lower bearing through a small pipe to the thrust and upper bearing. The operation of these motors has given perfect satisfaction from the first. Some difficulty was experienced with the thrust bearings of the pumps and the fact was finally apparent that no satisfactory thrust bearing for pumps operating under similar conditions had been developed. This difficulty was met by designing a floating ring thrust bearing with lignum vitæ pins, illustrated in detail in Fig. 14. These rings are made in halves and can readily be replaced when worn. They have now been in operation on the two larger pumps for several months, giving perfect satisfaction, and in the judgment of the mechanic in charge will not require renewal for a long time. Fresh water from the city mains is used for cooling while the pumps are in operation. Approximately two hours are required to pump out the water from the larger dock, during which time there is handled approximately 7,500,000 gal. of water.

The pumps were furnished by the Morris Machine Works, of Baldwinsville, N. Y., and the electric motors and controllers by the General Electric Company.

ELECTRIC LIGHTING AND SHOP MOTORS.

Direct current is used for lighting the plant, obtained from one 55-kw and one 25-kw generator, which were formerly belt-driven from separate steam engines. By referring to Fig. 2 it will be seen that the present installation provides for the driving of these generators by motors of 85 hp and 40 hp respectively, through belt connection.

The general arrangement of switchboard and connections for lighting are shown on the diagrammatic plan referred to. The energy for driving these motors is obtained from a bank of three 50-kw, single-phase transformers reducing the potential from 6600 volts to 440 volts. These transformers also supply energy at the same voltage for the shop motors.

There are two constant-speed motors for the machine shop, the larger one, a 50-hp motor, operating at 480 r.p.m., belted to the line shaft. The smaller machine-shop motor of 25-hp operates at 357 r.p.m. This motor is attached to the ceiling and belted to line shaft.

In connection with the blacksmith shop there is a 20-hp motor operating at 1440 r.p.m. directly connected to a blower. This blower and motor are installed on a concrete foundation protected by a small frame structure conveniently located to the forges. There is a 10-hp motor operating at 715 r.p.m. driving small machinery in the coppersmith shop; also a 60-hp motor operating at 288 r.p.m. driving a line shaft in the boiler shop. These motors receive energy from a bank of three 50-kw, single-phase transformers located in transformer station No. 2, a detached steel structure near the boiler shop. There is a carpenter shop motor of 35 hp operating at 475 r.p.m. belted to line shaft, operated from transformers in transformer station No. 1.

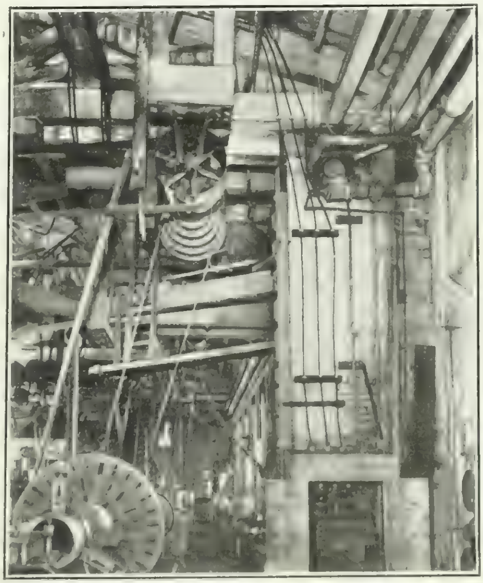


Fig. 17—Large Induction Motor in Machine Shop.

In the shop operation the policy of operating line shaft with motors was adopted rather than employing individual machines. The reasons for this practice were not only the great economy in cost of installation, but the fact that in a plant of this kind much of the machinery is operated only at infrequent intervals and that most of the machinery is of early design and not particularly adapted to the direct application of electricity.

The general practice will be adopted of installing new machinery with direct-connected motors. In every case the shop motors have either been installed on the ceiling or on a special platform erected so as to be entirely out of the way. Photographic illustrations shown herewith will convey a clear understanding of the method adopted. All shop motors are of the constant-speed type, manufactured by the General Electric Company, and are operated through General Electric compensators.

6000 TON SECTIONAL DRY DOCK.

This dock is of very unusual construction and operation, being the only remaining example of a dock much in use forty years ago and then known as the Dodge-Burgess sectional floating dry dock, and would require a much more extended illustration and description than is allowable at this time for its complete understanding. As the application of electricity to this structure is not completed, a more detailed description with illustrations will be given at some future date.

Generally speaking, the equipment is to consist of twenty 20-hp motors and two 50-hp motors. The 20-hp motors are each to be directly connected to a centrifugal pump and the 50-hp motors are to be connected to mechanism for controlling ballast tanks. The machinery will be operated in two sets of ten 20-hp motors and one 50-hp motor, the 50-hp motor being arranged to operate in either direction. In connection with the 20-hp motors there is a special controller system which permits of the ten motors in each group being started, stopped or operated from a master controller, and it will also be possible to operate the motors at three different speeds, it being understood that it is a requirement to operate all the motors at the same speed but to vary the speed of the whole group.

GENERAL OBSERVATIONS.

There is now installed and in operation 2774 hp of motors. The total energy consumption for the month of May, 1910, was 263,200 kw-hours and it is interesting in an installation of this kind to learn from the watt-hour meters on the main switchboard the distribution of this energy.

The list is headed by the air compressors, which have a combined consumption of 67.1 per cent of all the energy used. Transformer station No. 1 supplied energy for the lighting dynamos and machine-shop motors and shows a consumption of 9.48 per cent. The two large graving-dock motors come next with a consumption of 9.52 per cent, followed by the small graving-dock drainage motor with 7.36 per cent. Transformer station No. 2, supplying the boiler-shop, copper-shop and blacksmith-shop motors, takes 3.54 per cent of the energy. The new dock, with two 300-hp motors, consumes only 1.56 per cent and the balance dock, with four 100-hp motors, 1.44 per cent.

Attention is called to the fact that the 50-hp motor running nearly constant on the graving docks consumes almost as much energy as the two 350-hp motors used in pumping these docks. The new 6000-ton pontoon dock has a capacity almost as large as one of the graving docks and handles more vessels than either, but requires less than one-fifth of the energy to operate it.

Since the introduction of the high-tension electricity into the yard in February, 1909, the main switch supplying the high-tension service has been thrown out but once by a short-circuit caused by the closing, by mistake, of a switch on a dead-end cable which had been sealed over the end when pulled in and not protected when connected to the switchboard. This caused an interruption in the service for about one hour.

While there is a total installation of 2774 hp, it has been found practicable to work with a maximum demand of 1200 kw, a figure which was arrived at at the time the contract for service was arranged, it being understood, of course, that maximum demand influences the cost of energy. It is practically certain that if the works were operating from a private electric generating plant the installation would have to be very much greater, in all probability not less than 2500 kw, to allow for spare boilers and generators and the unwillingness of the different departments to handle the work so as to keep down the maximum load.

By the terms of the present contract any amount of power is available to meet a necessity, but it is distinctly understood that a study of the distribution of the work will mean a saving and directly affect the earnings of the company.

A daily record of the watt-hour meter readings is kept and checked with the monthly bills from the central-station meters. The positive knowledge of the cost of energy and its distribution is of very great value to the accounting department of the business.

The elimination of coal handling and of the maintenance of

Fig. 18—Motor in Boiler Shop.

steam boilers and furnaces has greatly simplified the operation of the plant. An unlimited amount of power available at any hour of day or night by simply closing a switch is an advantage which cannot be overestimated.

It should be understood that in ship-repair work the utmost dispatch and promptness in executing work is the first consideration. In the month of October, 1909, the steamer *Howard* was put into graving dry dock No. 1, cut in two, the bow drawn forward 40 ft., this space built in with ribs, plating and all interior work, made watertight and left the dry dock in fourteen days. This was accomplished only by working every man available day and night and during this time the air compressors and much other machinery in the shop never stopped.

The foregoing is an advance printing of a paper to be read before the Brooklyn Engineers' Club by Mr. William T. Donnelly, consulting engineer, 135 Broadway, New York, who planned the entire installation and designed the new pontoon dry dock.

USE OF STATIC ELECTRICITY IN THE SEPARATION OF MINERAL PARTICLES.

By Henry A. [illegible]

Several years ago it was observed that minerals differ very greatly in electrical conductivity. Some, such as quartz, are among the poorest conductors, while others, of which pyrite is an example, are good conductors, belonging almost in the class with pure metals. As a rule, the close association of minerals in ores is such that comparatively fine crushing is necessary to free the constituents from one another,

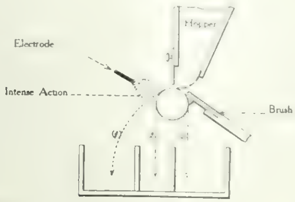


Fig. 1—Section of Electrostatic Separator, Showing Principle of Operation.

division to particles 0.05 in. in diameter or less being common. It has accordingly been found that the electrostatic forces which can be brought into play in a mineral mixture of conductors and non-conductors (or, more strictly speaking, of good and poor conductors, since all minerals seem to conduct electricity to some extent) may be relatively great as compared with the gravitational forces acting upon the constituents. Therefore, taking advantage of the well-known law that like charges repel while unlike charges attract, it was demonstrated that if a mixture of particles resulting from the crushed ore were dropped onto a charged metallic plate the particles of the better conducting material received their charges instantaneously and were repelled vigorously, whereas the poorer conductors received practically no charge. By properly catching the repelled portion separately from the unrepelled, a separation of the ingredients was effected.

In the mining world most of our supply of lead, zinc and copper, as well as a great deal of our gold and silver, is derived from the sulphide minerals, which sulphides are, as a rule, very definite in their relation to electrical conductivity; the sulphides of lead, iron and copper being excellent conductors, while the sulphide of zinc is, as a rule, a very poor conductor. Generally speaking, rock and various worthless vein-filling materials are also only slightly conductive.

Referring metallurgically to these minerals when occurring together, three separations are essential. First, the separation of the various sulphide minerals from the accompanying rock; second, the separation of the lead minerals from those of copper and zinc (but not necessarily of iron); third, the separation of zinc sulphide from all the other sulphides. Lead sulphide is much heavier than the other common sulphides, and all the sulphides are heavier than most of the rocks with which they occur, so that it is possible by means of gravity to concentrate the lead minerals by themselves (which is desirable) and to concentrate all the sulphides from the accompanying rock. There now remain together the zinc, iron, and copper minerals, and it is essential that the zinc be separated from the other two in order to obtain high efficiency and low cost of extraction in both the zinc furnace and the copper furnace. This separation, which cannot be done efficiently by gravity, has been one of the inducements for the development of electrostatic separation and one of its largest uses since commercial development. Another problem, of great importance from the metallurgical standpoint, is the concentration of many sulphide minerals from certain rocks of high specific gravity, such as barite, garnet, and epidote, in which rocks or gangue the sulphides often [illegible] rocks, as a rule, are of very low conductivity, so that electrostatic separation offers an efficient means for the concentration of the sulphides. Regarding the separation of the poor conductor, zinc sulphide, present in these rocks more will be noted later.

Having thus indicated very briefly a few important applications of this principle when developed, it will be shown how these results have been accomplished.

It was soon learned that not only could the good conductors be charged and repelled, leaving the poor conductors apparently inert, but also, if the particles were not too heavy, the differences in potential between the surface of the poor conductors and the surface against which they rested were sufficient to cause them to cling to the surface until brushed off. This effect was intensified by causing the mineral mixture to be sprayed with ionized air, whereby the poor conductors received a comparatively dense charge, different from that of the surface on which they rested. The better conductors, of course, conveyed this charge to the surface as fast as received.

To keep a metallic roll or surface insulated while charged at a potential of 50,000 volts or 60,000 volts, simultaneously supplying that surface with a stream of particles of which a large portion might be excellent conductors, proved a very difficult task. With the dust, dirt and moisture of the average mill, the problem was well-nigh impossible of solution. Therefore came the study of a combination of the grounded metallic surface onto which the ore might be fed, with an electrode placed opposite it, forming an electrostatic field which could be varied in intensity by changing the distance between the surfaces and

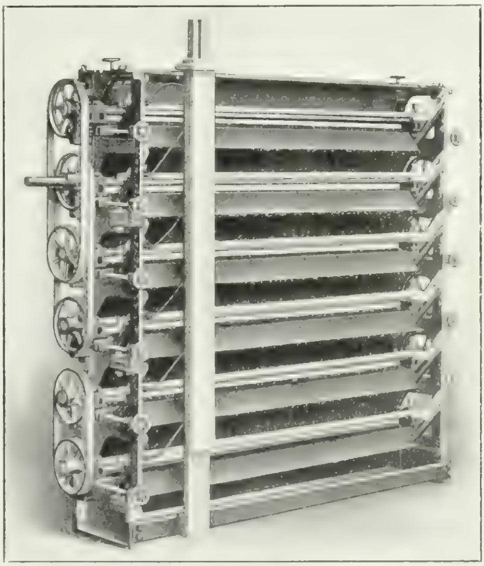


Fig. 2—Electrostatic Separator.

by altering the potential difference applied. This arrangement is illustrated in Fig. 1. By this solution of the problem, those parts of the mechanism which must necessarily come in contact with the ore and the persons of the workmen could be grounded, while a highly charged opposite electrode could be carefully insulated. Furthermore, this adaptation permitted the use of metal for all the wearing parts, resulting in longevity of the machine. In the accompanying illustration, Fig. 2, is shown a Huff electrostatic separator. This is almost entirely of metallic construction; and yet a potential of from 18,000 volts to 40,000 volts is maintained between the electrodes. By comparing the machine with the sketch illustrating the principle,

Fig. 1, the action is readily understood. The dotted paths numbered 1, 2, and 3 indicate the directions taken by the various particles, those of greatest conductivity following No. 1, under certain electrifications, and No. 2 under others, while the poorer conductors follow No. 3. Because of a certain amount of mechanical interference of the particles while passing through the electrostatic field, the best work is obtained by using several successive fields, as shown in the cut.

To obtain an electrification of the electrostatic separators by a means which should supply sufficient energy to take care of the line and machine losses in a large mill; which should not be dangerous to the operators at 30,000 volts or more in case of accidental contact; of which the potential should be capable of easy and convenient regulation, and of which the operation might easily be changed from a practically steady condition to a series of extremely sudden changes separated by inert intervals, was a problem which, though fairly simple when solved, offered a great deal of difficulty to the investigators. Naturally the static machine was first used, but the difficulties of obtaining a sufficient output and yet close regulation of potential, especially in moist climates, soon side-tracked this source of electricity. There has accordingly now been developed a system embracing a special alternator, transformer and interrupter which fulfils the conditions set forth. With one set of apparatus large mills are supplied with electricity at 20,000 volts to 35,000 volts, with as simple wiring and care as are required by the lighting system. This electrical apparatus is placed in the engine room of the mill. If steam drive is used, a separate engine is used to operate the generator, to insure steadiness of the potential in the static fields on the separating machines. By means of a rheostat in the field of the generator the voltage on the separators can be altered at will.

In the electrostatic mill of the American Zinc, Lead & Smelting Company, at Platteville, Wis., which has been in practically continuous operation since March, 1908, a supply of material of about 80 tons per day of blende and marcasite concentrates is obtained from the various jig mills of the district, and is separated by the electrostatic plant, producing a high-grade zinc product for the zinc smelters and a marcasite product valuable for its available sulphur for the sulphuric-acid and gunpowder manufacturers. The ore, entering on the higher side of the mill, passes through a rotary dryer, and is then delivered to an elevator which raises it to the top of the mill; thence it flows by gravity over screens separating it into four sizes from 0.16 in. down, the oversize from the largest mesh going to a set of crushing rolls and thence returning to the elevator. From the screens the ore material passes to the separators and into the finished-product bins on the lowest floor of the mill. This mill operates twenty-four hours a day (three shifts). In the operation of separators it is often found best to arrange them in units consisting of a roughing machine on one floor and a cleaner for each product on the floor below, the middlings resulting from the procedure passing into the elevator boot and thus back through the system. This general scheme is followed in the electrostatic mill of the United States Smelting, Refining & Mining Company at Midvale, Utah, and in other electrostatic mills.

Zinc sulphide, or blende, as above mentioned, is when pure a very poor conductor of electricity. Blende, however, seldom occurs pure, but usually has in chemical combination with it varying amounts of iron, manganese or other element, and this combination is more conductive than is the pure blende itself. As the impurity increases in amount the conductivity increases also, although it is not certain that there is any definite relation between the amount of impurity and the conductivity. With small amounts of impurity there is no appreciable effect from an electrostatic standpoint, and excellent separations of blende containing as much as 12 per cent of chemically combined iron have been made electrostatically from chalcopyrite and pyrite. One of the recent developments of the process has been its application to the so-called "black-jack" zinc problems.

It has been found that if resinous non-conducting blende be immersed in a very dilute solution of copper sulphate, its conductivity from an electrostatic standpoint (when it is again dry) suddenly becomes very different from what it was before, the blende now being readily separable from the poorly conducting rocks, which have been unaffected. By this treatment the blende is darkened, but the surface, even under a powerful microscope, does not show difference from its original condition. Other means have been found for altering the conductivity of minerals so that separation may be effected between two minerals which in their natural state act very similarly in electrostatic separation. Limonite, one of the ores of iron, is a very indifferent conductor. If it be roasted to drive off the chemically combined water, the ferric oxide remaining is a very good conductor and is readily separable from the gangue rock and clays with which it occurs.

An investigation covering practically all the known minerals has been made by Mr. G. W. Pickard, consulting electrical engineer for the Huff Electrostatic Separator Company, who has prepared a complete table embracing 221 minerals which were found to be good conductors in the sense that they can be successfully separated by electrostatic means.

THE DESIGN OF SHUNT FIELD WINDINGS.

By Frank W. Merrill.

It is the purpose of this article to consider the relation between different variables entering into the design of the shunt field windings of dynamo-electric machinery, and to describe and illustrate a method of design that several years of actual experience have shown to be accurate and direct. That part of the design pertaining to the calculation of the relative amounts of two sizes of wire to be wound on a given field coil, to obtain amp-turns intermediate between those corresponding to the two sizes, has recently been worked out by the author and is believed to be entirely new.

The magnetic circuit of any direct-current motor or generator is similar to a multiple-series battery circuit. The simplest form is the bi-polar machine, having one north and one south pole. The m.m.fs. of the two field coils are here connected in series, so to speak, since their combined efforts serve to drive the entire flux around the length of the magnetic circuit. In the case of a four-pole machine the poles are alternately north and south and there are, magnetically considered, two in series and two in parallel. One pair of poles—a north and a south—drives *half* of the total flux of the machine entirely around the length of the magnetic circuit. The other pair of poles drives the other half throughout the same length of circuit, but in a different part of the machine. Thus there are two pairs of poles magnetically connected in multiple. By way of further illustration there would be, in the case of a twelve-pole machine, two in series and six in parallel; and in the case of a machine with any number of poles there would always be two in series and as many in multiple as there are pairs of poles.

Considering the multiple-series battery circuit, the number of cells in series determines the voltage or pressure of the battery. When the method of connection is once established the voltage of the battery will depend entirely upon the voltage which one cell can generate. In the case of the system of field coils the method of connection is established by an absolute law —*there are always two in series.* This being the case, the magnetic pressure—or amp-turns—required to send the flux through the length of the magnetic circuit must be supplied *on each pair of poles.*

Electrically speaking, however, it is customary to connect all of the field coils in series, regardless of their magnetic relation to one another. This method of connecting the windings of the coils will be assumed throughout the remainder of the article.

Suppose that the magnetic circuit of a six-pole shunt motor

has been calculated, and that the number of amp-turns needed per pair of poles to send the required flux through the frame, magnet core, air-gap, teeth and armature core is known. The mechanical dimensions of the motor, such as the size of the poles or of the form on which the coils are to be wound, the limiting size of the coils themselves, and all other dimensions of the motor are also known. The unknown elements are the size of the wire and the number of turns per coil to be wound on the shunt coil. The first step in finding these unknown quantities is accomplished by the use of the following formula:

$$M_c = \frac{1.035 \; [illegible] \; 3}{E}$$

Let us now consider in detail the different terms of the above formula, and then illustrate its use by means of a practical example.

(1) E in the denominator stands for the line voltage for which the motor is to be wound.

(2) The expression L_m is the length in inches of the average turn of wire on one of the field coils. (L_m is an abbreviation for "length of mean turn.")

(3) IT is the number of amp-turns wanted per pair of poles.

(4) The constant 3 stands for the number of pairs of poles magnetically connected in parallel.

(5) The constant 1.035 represents the conductivity of the wire, and its value depends upon the material of which the wire is made, and upon the temperature of this material. The above constant is for pure copper at a temperature of 75 deg. C., which is estimated to be the actual temperature of the wire when the coils show a rise by thermometer of some 40 deg. C. above the surrounding air. This condition may for convenience be called "hot." If the coils now be allowed to cool to the temperature of the room, say, 20 deg. C., or 68 deg. Fahr., the value of the constant becomes 0.863, because the material has increased in conductivity. This will be more clearly explained a little later.

(6) The term M_c is the most important of all. It is the unknown cross-section of the wire in circular mils.

Analyzing the formula it will be seen that the value of amp-turns depends upon, first, three variables which are merely dimensional in nature. These are cross-section of wire, length of average turn and the number of pairs of poles. Another term which influences the value of the field strength is the line voltage, but this is always fixed by the kind of service available. The remaining factor—the constant 1.035—involves the material and temperature of the wire, which may be considered constant for the average operating condition. It is evident, therefore, that as soon as the voltage and general dimensions of the coils are fixed the amp-turns will vary directly as the cross-section of the wire.

Derivation of [illegible]

Resistance of one mil-foot of copper at 20 deg. C. (68 deg. Fahr.) = 10.35 ohms.

Resistance of one mil-inch = [illegible]

Resistance of copper will increase 1 per cent for each 2.5 deg. C. rise in temperature. Assume that the coils reach an average hot operating condition when the temperature rise has become 50 deg. C. This represents an increase in resistance of $50 \div 2.5 = 20$ per cent. The resistance of one mil-inch of copper under this condition $= 0.863 \times 1.2 = 1.035$.

The constant 0.863 would be used in the formula when it was desired to determine the amp-turns with the copper "*cold*."

The constant 0.863 increased by 10 per cent to 0.95 would be used when the average temperature of the coils might be described as "*warm*" (25 deg. C. rise).

When round wire is wound on a field coil former in even layers, one wire directly on top of another, it is evident that the space or cross-section occupied by each wire is equal to the square of the diameter of the wire measuring over the insulation. That is, considering no bedding of one wire into the spaces between two others, it may be said that each wire occupies the area of the square circumscribed about it. This kind of winding is numerically described by the space factor 0.7854—which is the ratio of the area of a circle to the area of the square of its diameter.

If the diameter of the insulated wire is D, and the number of turns per coil is N, then the cross-sectional area of the coil $= D^2N$.

In ordinary careful winding there will be some crossing over

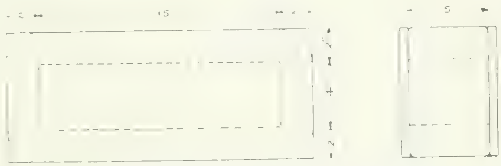


Fig. 1—Dimensions of Field Coils.

and piling up of wires, and there will also be much bedding of wires into the spaces.

It is believed that these two effects approximately offset each other, so that the space factor 0.7854 most nearly represents actual conditions.

Field coils are usually wound on forms, but some times directly on the poles. The shape of the pole or form is not always round. It may be oval, rectangular, or some other peculiar shape. *Whatever this shape may be, however, it can be reduced to an equivalent circular section.*

Suppose that the coil is to be wound on a form of the section

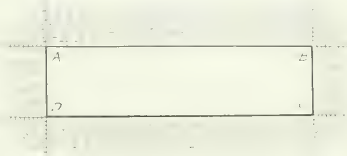


Fig. 2—Coil Windings.

shown in Fig. 1, and that the maximum sized coil that can be placed in the machine will be produced when the coil is wound 2 in. deep—that is, level with the top of the form. D^2N maximum is here equal to $2 \times 5 = 10$ sq. in. The equivalent circular section of the coil former may now be found. The perimeter measuring around the former $= 15 + 4 + 15 + 4 = 38$ in. $38 \div 3.1416 = 12.1 =$ the equivalent diameter of the coil former.

The accuracy of this method of procedure can be seen by referring to Fig. 2. Here the wire wound on the form is represented by dotted lines. It will also be noticed that the lines AB, BC, CD, and DA have been produced so that they extend outside of the coil. Those portions of all turns of wire

Fig. 3—Reduced Diagram of Field Coil.

in the coil lying opposite the straight sides of the form and parallel to them are of the same length. On each corner of the form will be noticed the wire bending through the quadrant of a circle. Combining the four corners and the four quadrants there is obtained a complete circle. Each turn of wire is, therefore, made up of two parts, a constant length, $ABCDA$, and a variable length, which is function of the depth of the layer and of 3.1416. The variation in length of turn with the

depth of the wire in the coil is, therefore, a function of 3.1416, and the field coil form whatever its shape may for convenience be at once reduced to an equivalent circular section in the manner described above.

Fig. 3 represents the conventional diagrammatic figure to which any field coil form may be reduced, to facilitate computation.

D = the equivalent diameter.

L = The length of one layer of wire.

T = The maximum allowable thickness to which the coil may be wound.

Then TL = the area of winding space $= D^2N$, where D^2 = the square of the diameter of the insulated wire and N = the number of turns in the coil.

Insulation adds approximately the following amounts to the diameter of any wire, expressed in inches:

Double cotton	0.0090
Single cotton	0.0045
Double silk	0.0040
Single silk	0.0020
Single silk and single cotton	0.0060

[illegible]

Given the field form shown in Fig. 4, required 7500 amp-turns per pair of poles when the motor is hot. The motor is

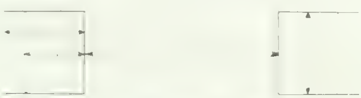


Fig. 4.—Dimensional Reduced Diagram of Field Coil.

a 450-volt, four-pole, shunt-wound machine. The heating is not to exceed 0.42 watt per square inch of total external surface of coil.

Assume that the form is wound three-quarters full—that is, to a depth of 1.5 in. The mean diameter of the coil = 5 + 1.5 = 6.5 in. Length of mean turn $L_m = 6.5 \times 3.1416 = 20.4$ in. [illegible]

Then [illegible]

substituting the known values,

$$1.035 \times 7500 \times 20.4 \times \text{[illegible]}$$

This calls for a size of wire intermediate between No. 22 and No. 21 B. & S. gage. No. 21 will give too many amp-turns, No. 22 too few. This detail, involving the relative amounts of the two sizes to be used, will be thoroughly worked out a little later.

Estimate now the coil for No. 22 wire in order to illustrate the method.

0.0253 = diameter of bare wire.

0.0045 = increase of diameter due to single cotton insulation.

0.0298 = diameter of insulated wire.

[illegible]

Allowable D^2N or sectional area = 1.5 × 3 for the first trial [illegible] can be got into this [illegible] $L_m = 20.4$. Total feet of wire in the four field coils of motor = [illegible] equals 34,000.

Referring to the B. & S. wire table it is found that this amount of No. 22 wire has a resistance of 550 ohms at 68 deg. Fahr. Its hot resistance will be 20 per cent higher, or 660 ohms. Field amperes = 450 ÷ 660 = 0.68. Amp-turns per pair of poles = 5000 × 2 × 0.68 = 6800. Since 7500 amp-turns are required, the prediction of the formula that No. 22 wire would give too few amp-turns, is borne out.

[illegible]

× 0.68 = 306 watts. Total external surface of coil = perimeter × number of coils [illegible] (1.5 + 3 + 1.5 + 3) × 20.4 × 4 = 740 sq. in. 306 ÷ 740 = 0.42 watt per square inch nearly —which experience has shown to be about the correct value for continuous-service open motors with an average amount of ventilation.

The coil is now correct from the standpoint of heating, but it does not yet produce the required number of amp-turns. The formula has shown that the correct size of wire lies somewhere between Nos. 21 and 22. The calculation for No. 22 has shown that this wire alone will give only 6800 amp-turns—the required number being 7500.

The B. & S. wire table is designed according to the law of geometrical progression, and the consecutive sizes of wire differ from one another by a *factor* of 1.26, which is equal to $\sqrt[3]{2}$. Hence a wire three sizes smaller in number than a given wire will contain 1.26 × 1.26 × 1.26 = 2 times as many circular mils, because the factor $\sqrt[3]{2}$, or 1.26, is used three times, which is the same as the factor 2 being used once. Another way of looking at this relation between consecutive sizes of wire is to note that the increase in cross-section and weight from any size to that next smaller in number is 26 per cent.

Hence, No. 21 wire has 26 per cent more cross-section than No. 22, and if used alone on the field coils would give 26 per cent more amp-turns. Therefore, the coil, if wound with No. 21 wire alone, would give 6800 × 1.26 = 8560 amp-turns. This value is too great.

In order then to obtain exactly 7500 amp-turns the coil must be wound partly with one size and partly with the other—connecting the two sizes in series so as to obtain the effect of a fractional size. After some experience one can estimate quite closely how many turns of each to wind, but this method is only guesswork and does not appeal to the careful designer.

What is needed is a formula that will supplement the general equation for obtaining the circular mils, and show at once the number of turns of each size of wire to wind on the form within a given depth to produce the required number of amp-turns. Such a formula is entirely possible, and the method of its derivation will now be discussed.

Suppose that the general formula has been applied and it has been found that the size of wire required lies between the sizes S_1 and S_2. Suppose that the coil has been wound entirely with S_1, thereby producing a result either too small or too large. It is necessary, therefore, to substitute a certain number of turns of S_2 for some of the turns of S_1. The cross-sectional area, D^2N, of the first size of wire tried = A_1. The area of the winding space of the second size substituted for part of the first = A_2. If addition is made of *larger* wire, the amp-turns of the first size become affected by a factor of *increase* greater than unity. If addition is made of *smaller* wire, the amp-turns of the first become affected by a factor of *decrease* greater than unity. By changing its name, the factor is thus kept always greater than unity, whether larger or smaller wire is to be added.

Let F be this factor.

Then [illegible]

$$\frac{\text{[illegible]}}{0.26} \qquad (1)$$

For A_1 there may be substituted the number of turns of the wire first tried as proportional to A_1. A_2 will then be obtained in terms of this unit. To determine the number of turns of the second size, if smaller, one should multiply by 1.26, and if larger divide by 1.26 for bare wire.

Then $$\text{[illegible]} = \frac{T_1 (F - 1)\, 1.26}{0.26} \qquad (2)$$

Where T_s = the number of turns of the second size used if this size be the smaller.

[illegible] $$T_1 \frac{\text{[illegible]}}{0.26 \times 1.26} \qquad (3)$$

Where T_L = the number [illegible] size used if this size be the larger.

The constant 1.26 used in the above is true for bare wire only, and represents the ratio between the values of D^2 for two consecutive sizes, D^2 being the square of the diameter of the wire.

With insulated wire, however, the ratio between sizes is not 1.26—but is somewhat less, due to the effect of the addition to each size of the same thickness of insulation, which in small wires tends very much to equalize the space occupied by the two wires being compared.

EXAMPLE NO. 1.

	No. 31 single cotton.	No. 30 single cotton.
Diameter of bare wire......	0.0089	0.0100
Single cotton insulation....	0.0045	0.0045
Diameter insulated wire....	0.0134	0.0145
	$D^2 = 0.000179$	$D^2 = 0.00021$

$$\text{Ratio } \frac{0.00021}{0.000179} = [illegible]$$

EXAMPLE NO. 2.

	No. 13 single cotton.	No. 12 single cotton
Diameter of bare wire......	0.0720	0.0810
Single cotton insulation....	0.0045	0.0045
Diameter insulated wire....	0.0765	0.0855
	$D^2 = 0.00585$	$D^2 = 0.00731$

$$\text{Ratio } \frac{0.00731}{0.00585} = 1.25$$

The above examples show that for large wires the insulation is of small moment and that the ratio of D^2 for two consecutive sizes approaches the bare wire value of 1.26.

In order to make formulas (2) and (3) as accurate as possible one should substitute the ratio of an average size of wire in place of the bare wire ratio 1.26. The ratio between No. 23 and No. 24 B. & S. single cotton covered is 1.20, which has been chosen as a fair average. This value having once been assumed, it will be found that the formula is quite accurate for all sizes, as the insulation ratio is really a variable of the second order, so to speak.

Substituting,

$$T_S = \frac{T_L (F - 1) 1.20}{0.26} \text{ or } [illegible] \quad (4)$$

$$T_L = \frac{T_S (F - 1)}{0.26 \times 1.20} \text{ or } [illegible] \quad (5)$$

Formulas (4) and (5) are now in their final form.

Referring again to the example based on the field form shown in Fig. 4, one may easily illustrate the method of use and the accuracy of the above formula.

GENERAL [illegible]

$$M_c = \frac{1.035 \times 7500 \times 2 [illegible]}{450}$$

= 705 intermediate between sizes Nos. 22 and 21.

	No. 22.	No. 21.
Bare	[illegible]	[illegible]
Insulation	0.0045	0.0045
Insulated	0.0298	0.0330
	$D^2 = 0.00089$	[illegible]

Allowable D^2N for each [illegible] $\frac{4.5}{0.00109}$ [illegible] turns of No 21 if wound entirely [illegible] area of 812 circ. mils. Then $F = 812 \div 705 = 1.15$.

Use can now be made [illegible] No. 22, thus $T_S = 4100 (0.15) \times 4.6 = 2820$ turns of No. 22.

Ratio D^2 [illegible]

will then replace $2800 \div 1.22 = 2300$ turns of No. 21 [illegible] $4100 - 2300 = 1800$ turns of No. 21 left.

The smaller size should be wound on the bottom.

2800 × 4	1800 × 4
No. 22 single cotton.	No. 21 single cotton.
$D^2 = 0.00089$	$D^2 = 0.00109$
$D^2N = 2.5$	$D^2N = 1.96$
$2.5 \div 3 = 0.83$ in. depth of No. 22. wire.	$1.96 \div 3 = 0.66$ in. depth of No. 21 wire.

5.00	mean diameter (see Fig. 4)	5.00
0.83		0.83
		0.83
5.83		0.66
$5.83 \times 3.1416 = 18.4 = L_m$		7.32

$7.32 \times 3.1416 = 23.0 \text{ in.} = L_m$.

$2800 \times 18.4 \times 4 \div 12 = 17{,}200$ ft.

$1800 \times 23 \times 4 \div 12 = 13{,}800$ ft.

Resistance hot No. 22 wire = 336 ohms; resistance hot No. 21 = 212 ohms; total resistance = 548 ohms. Shunt-field current = $450 \div 548 = 0.82$ amp.

Turns of wire per pair of poles = (1800 + 2800) 2 = 9200.

Ampere-turns per pair of poles = 9200 × 0.82 = 7550, which is accurate to within one-half of 1 per cent.

The above may seem a long process when it is studied through for the first time, but by making the computation on a slide rule, and using either formula (4) or (5), in connection with the general equation for obtaining circular mils, it will be found that shunt-field coils can be proportioned both rapidly and accurately.

It is not the purpose herein to discuss to any extent the subject of the heating of field coils, but a few general statements may safely be made.

The temperature to which a field coil will rise depends upon two things, namely, the rate at which energy (I^2R loss) is liberated and the rate at which this heat energy can be carried away. In order to reduce the number of watts liberated in the coils it is necessary to use a large amount of copper so as to obtain the required ampere-turns with the smallest possible current.

It may be noted in passing that on a constant-potential circuit the ampere-turns are independent of the actual number of turns and may be varied only by changing some of the variables given in the general formula for circular mils. The large number of turns is, therefore put on the field coils solely for the purpose of reducing the heating.

With the size of the motor frame fixed, the limiting size of the field coils becomes fixed, and the safe heating limit will then determine how many ampere-turns may be obtained.

Heat may be removed from the coils in three ways, namely, conduction, convection and radiation. Of these three, convection—the removal of heat by the circulation of air around the coils—is by far the most important. The author would estimate from his experience with this kind of work that 70 per cent of the heat is removed by convection. In an open, well-ventilated motor the permissible loss may run from 0.4 watt to 0.5 watt per square inch of total outside surface of coil for continuous service. In a fully enclosed machine, however, this value should be reduced to about 0.2 watt per square inch.

ELECTRICITY TO THE AID OF GAS.

A recent issue of a gas-lighting paper calls attention to the disadvantages attending the use of matches for illuminating [illegible] portable electric lamps for this purpose. It is stated that at the present time, when electric pocket torches of convenient size are available, there is no excuse for any gas company [illegible] holding a naked lamp [illegible]

AMERICAN SWITCHBOARD PRACTICE.—II.

Influence of Distant-Control Switchgear on Alternating-Current Station Design.

By [illegible] Q. Hayes

IN the previous article the writer traced the influence of switching apparatus on the design of rotary-converter substations and also on main generating stations; the subject being divided into and treated under three sections, the first two of which, converting stations and generating stations, were covered in the first article.

TRANSFORMING STATIONS

As explained in the first portion of this article, the term "transforming stations" is applied to any generating station where the main portion of the output has its voltage stepped up by means of transformers and the energy thence fed out to the transmission lines, or where high voltage is stepped down by means of transformers before the energy is distributed to the various feeder circuits.

All of the previous illustrations have indicated the use of circuit-breakers in fireproof masonry compartments, such as have been supplied in practically all of the large stations, and the switching equipment is arranged in these masonry compartments in such a manner that leads of opposite polarity are separated by soapstone, concrete, brick or similar material. These fireproof walls, barriers, etc., prevent an arc forming in one place and communicating to adjacent conductors. The amount of current available momentarily at the point of trouble in large stations of 13,200 volts or less where the generators are connected to a common bus is something enormous and every precaution must be taken to prevent trouble from arcs spreading. For such voltages the question of suitable insulation distances between the live metal parts and the masonry structure is comparatively simple.

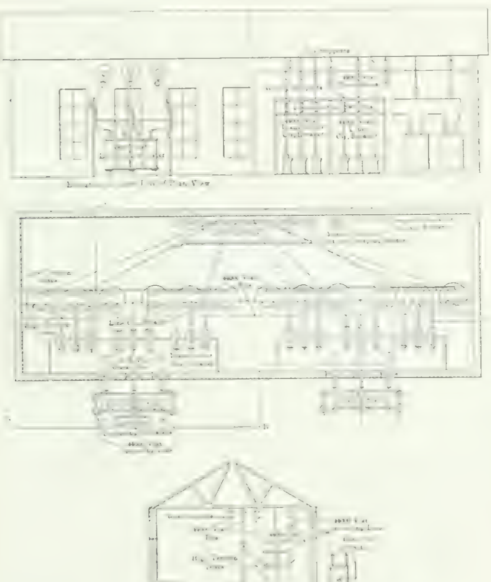


Fig. 1—Transforming Station, 44,000 Volts.

Where the generators connect through step-up transformers giving voltages from 22,000 to 135,000, or even higher, the question of enclosing the busbars and wiring for the high-tension circuits becomes an entirely different proposition. Some engineers are of the opinion that the cellular construction should be used for large circuits of any voltage and bottom-connected breakers have been designed that work in well with the enclosed busbar construction for high-voltage plants, as shown in Fig. 2. In the writer's opinion, however, the open system of wiring is preferable for any voltage higher than that for which generators can be conveniently wound.

The writer's opinion relative to the advisability of open busbars and wiring for high-voltage circuits is based on the following reasons: (1) The violence of an arc and the destructive effect of a short-circuit depend on the amount of current available at that point and are inversely proportional to the voltage for the same amount of power. While fireproof barriers and cellular constructions are required on large plants of comparatively low voltage, they are unnecessary for higher voltage plants of the same or even larger output. (2) The distance from wire to ground has to be greatly reduced over what could be obtained with open wiring in the same space, as the fireproof barriers offer a more or less perfect ground for high-voltage circuits, and the higher the voltage the more perfect the ground. (3) A more expensive building and costly construction are usually needed for enclosed busbars and wiring than are required for open wiring. (4) Inspection and repairs are more difficult for busbars, wiring disconnecting switches and similar appliances that are boxed in masonry compartments and are only visible and accessible by the removal of doors, than if everything was in plain sight. Inspection will be more frequent and thorough and incipient trouble will be noticed far sooner with open wiring than with enclosed, as the station attendant in a few minutes' walk can see everything and will not have to remove many doors and visit two or three floors to examine the condition of the apparatus.

Fig. 1 shows a transforming station intended for the control of two 44,000-volt, three-phase incoming lines, four banks each of three 625-kva step-down transformers and a number of 6600-volt, low-tension feeder circuits. As may be noted, the 44,000-volt incoming lines enter through a suitable wall bushing and then pass through the open helical choke coils and disconnecting switches into the oil circuit-breakers and from the oil circuit-breakers through a second set of disconnecting switches to the 44,000-volt busbars hung from suspension insulators. Passing back from the 44,000-volt busbars the connections go through disconnecting switches into the oil circuit-breaker and thence to the high-tension side of the step-down transformers. A panel-type switchboard with manually operated oil breakers located on the station wall takes care of the 6600-volt circuits.

In order to illustrate more clearly the difference in the design of the station made necessary by the use of enclosed busbars for the high-tension circuits, Fig. 2 has been prepared for the purpose of comparison. This station shows three different designs of switching equipment for the control of two 15,000-kva, 66,000-volt, three-phase incoming lines and four 7500-kva, three-phase step-down transformers supplying energy to two sets of 13,200-volt busbars, which in turn supply both underground and overhead feeders. Section "A" shows the general arrangement of the circuit-breakers, busbars, connections, etc., using bottom-connected breakers of standard design and arranging to locate the 66,000-volt busbars, with their disconnecting switches, on the lower floor. With this arrangement the control desk, the low-tension breakers and the high-tension breakers are all placed on the upper floor. In order to provide sufficient headroom for lifting the coils and iron out of the transformer case, it is necessary to slide the transformer into the passage way and then run it on a truck to the central portion of the building, where the floor has been raised under the control desk in such a manner as to provide the necessary head room. With this arrangement it may be noted that the total height of the building required from the floor line to the roof girders is 47 ft. 6 in. The high-tension

incoming line breaker and the breakers for the high-tension side of the step-down transformers are arranged in two rows in order to provide sufficient space for the breakers.

Section "B" shows the arrangement necessary to use top-connected breakers and still to enclose the busbars. With this arrangement the 66,000-volt busbars, as well as the 13,200-volt circuit-breakers with their busbars and the control desk, are placed on the upper floor, while the 66,000-volt breakers themselves, with their disconnecting switches, are located on the main floor near the transformers. With this arrangement a somewhat smaller amount of headroom is required, and any transformer can have its coils or iron removed as soon as it is slid out into the passage way. The building arranged in this manner requires a height of 37 ft. 6 in. from the floor line to the roof girders and requires a second floor, the same as shown in section "A." Section "C" shows the arrangement of this same station with top-connected breakers and open busbars and wiring for the 66,000-volt circuits. With this arrangement there is no necessity of any second floor, all of the apparatus is placed on the one level and the height of the building is greatly reduced, as the distance from the floor line to the bottom of the roof girders is only 30 ft.

Needless to say, the plan indicated in section "C" is by far the cheapest with respect to the cost of the building itself. In sections "B" and "C" the design of the circuit-breakers is such that there is ample space to place the line breakers and the breakers for the high-tension side of the step-down transformers in one continuous row. These three sections of Fig 2 clearly show how the design of the switchgear materially affects the design of the station.

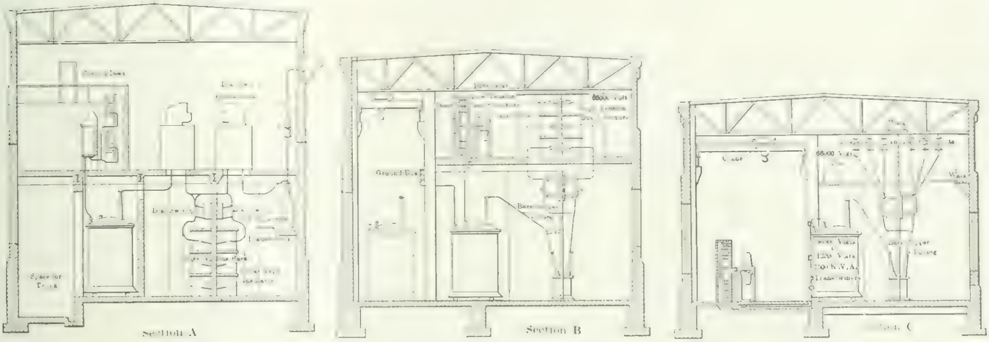


Fig. 2—Transforming Station, 66,000 Volts.

Fig. 3 shows the sectional view through the transformer and circuit-breaker house of a proposed 100,000-volt station. This station is designed to contain eight 7500-kva generators, with provision for eight future generators. At the time when the designs were being drawn up two different transformer propositions were considered, one being to furnish eight 7500-kva, three-phase transformers, one for each machine, and the other to supply three 5000-kva transformers arranged in groups of three each to take care of the output of two 7500-kva generators. These transformers, whether in three-phase units or in single-phase units, would be used for stepping up the voltage to 100,000 volts and a large number of 100,000-volt feeder circuits would leave the station.

Both the high-tension and the low-tension circuits were arranged to form complete ring systems, and as the station is practically symmetrical around the vertical center line, one-half of the drawing on the right-hand side shows the connections for the three-phase transformers, while the corresponding arrangement on the left-hand side takes care of the single-phase transformers. The 11,000-volt circuits are practically independent of whether three-phase or single-phase transformer units were to be supplied.

One particularly novel feature of this installation was the

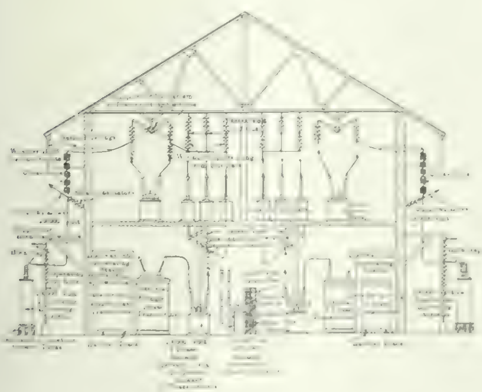


Fig. 3—Transforming Station, 100,000 Volts.

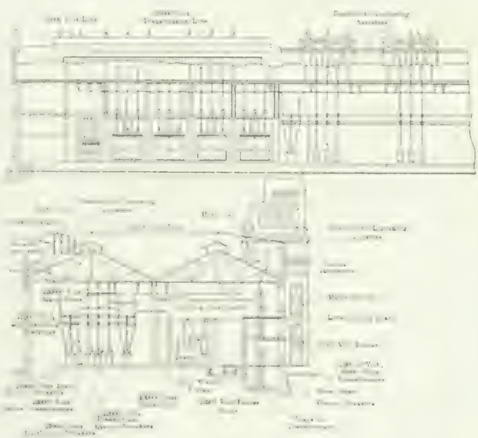


Fig. 4—Transforming Station, 120,000 Volts.

type of disconnecting switches to be used in the 100,000-volt circuits. As indicated on this drawing, the disconnecting switches consisted essentially of a contact hung from suspension insulators, which contact could be lowered until it made connection with a rod projecting up from a condenser bushing. Flexible leads attached to the moving contacts connected to the station wiring in such a manner that these switches were practically single-break switches, and the three poles of a three-pole switch were operated by a single mechanism with a suitable indicating device. This type of disconnecting switches—namely, a combination of suspension insulators and condenser bushings—can be applied to practically any voltage that is apt to be reached in high-tension service. The oil circuit-breakers in this installation were provided with condenser-type series transformers clamped around the condenser bushings, and these series transformers furnish current for the ammeter and relays.

Copper tubing was to be used throughout for the busbars and wiring, the tubing being entirely bare and the busbars being hung from suspension insulators. Where wiring supports were needed additional suspension insulators, ordinarily hung from the busbars or busbar supports, were used. The outgoing lines pass through condenser bushings set in the outside wall, and the helical choke coils for the transmission line were suspended from these condenser bushings. The outgoing lines are anchored to the building by means of a series of suspension insulators and the suspension type of switch was made into a horn-gap for use with the electrolytic lightning arresters, the lightning arresters, choke coils and horngaps all being located out of doors.

Fig. 4 shows the elevation, section and the general appearance of the outside of the building for a proposed terminal station designed to take care of an ultimate total of six 120,000-volt, three-phase transmission lines, each capable of carrying 20,000 kva, 25 cycles; twelve 10,000-kva, 120,000-volt, three-phase step-down transformers and a large number of 12,000-volt, three-phase distributing circuits. The 120,000-volt circuits in this plant are obtained from star-connected transformers whose neutral point is to be solidly grounded, thus greatly reducing the insulation strain on the various portions of the equipment, and actually permitting the use of slightly smaller switching apparatus than was required for the 100,000-volt installation indicated in Fig. 3. As shown in the sectional view, it was the intention to bring in the 120,000-volt circuits through condenser-type bushings located in the roof of the building, and the 120,000-volt lightning arresters will be installed on the roof.

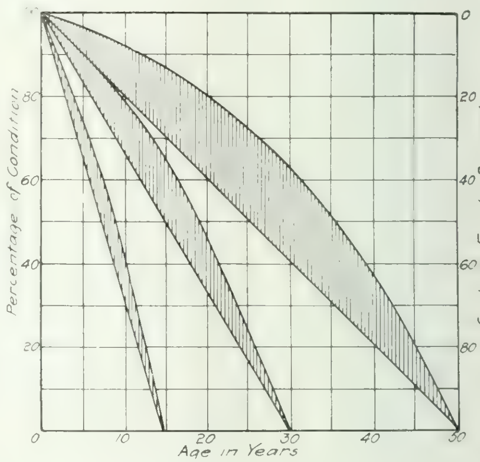
From the inlet bushing the circuit passes through disconnecting switches to the 120,000-volt circuit-breakers and series transformers and thence to other disconnecting switches to the high-tension bus, which is arranged to form a continuous ring. The connections are so made that under normal conditions each 20,000-kva incoming line will supply energy to two 10,000-kva step-down transformers. The 12,000-volt circuits from the step-down transformers pass through a circuit-breaker to a transformer bus. This transformer bus in turn connects through a second breaker to the main low-tension bus or through either of two other breakers to two group buses, each group bus being used for supplying energy for four 2500-kva, 12,000-volt feeder circuits. With this combination ring and group system on the high-tension and low-tension side, a great amount of flexibility is secured with a comparatively small number of switching appliances.

These various drawings of high-voltage plants indicate clearly the large amount of space required for the switching equipment and the great necessity of carefully considering the switching equipment before going deeply into the general design of the station. While it is felt that the illustrations and descriptions of these stations are comparatively meager, it is hoped that the information contained herein may be of some value in relation to the question of station design as influenced

DEPRECIATION IN ITS RELATION TO APPRAISALS.

Mr. Frank F. Fowle, a Chicago consulting engineer, was the principal speaker at the luncheon of the Electric Club of Chicago on Sept. 21. His subject was "Depreciation in Its Relation to Appraisals." Before treating of the specific aspect of depreciation indicated by the title of his talk, Mr. Fowle briefly discussed the subject of depreciation in general terms. It is universally admitted, he said, that all properties either appreciate or depreciate in value. Depreciation may be considered in relation to the cost of operation and also in relation to the value of the property. Considering the latter factor, the components to be considered are (1) wear and tear from use, (2) corrosion and decay, as in the case of poles for instance, (3) obsolescence, owing to advances in the art, and (4) inadequacy, owing to increasing business.

In any concrete case it is important to know the probable life of the property and also its rate of depreciation from year to year. In practice, the problem connected with depreciation is essentially how the depreciation shall be financed. In a going concern that which is to be provided for as depreciation is the cost of reconstruction minus the salvage value of the property. Depreciation must be provided for both in order to pro-



Calculating Depreciation.

tect the investors in the property and also to afford funds for reconstruction.

In taking up the subject of the appraisals of electrical properties, the speaker said that for this purpose there are three principal considerations to be borne in mind, and these may be classified as financial, economic and physical. Under the first named it is necessary to note the present cost of reproducing the property, and also its present depreciated value. There are differences of opinion as to the correct methods of arriving at these amounts. It may be observed that if the property is to be sold there should be a fair distribution of depreciation between the buyer and the seller.

Under economic considerations it is to be remembered that usefulness is the measure of value. The use or service may be uniform or periodic, and the value must be extinguished, therefore, in proportion to the use. The present value of the property is measured, under the economic consideration, by its remaining usefulness.

The physical considerations referred to have to do with the manner in which the wear and tear and corrosion and decay advance. Is the value measured by remaining unworn property? Is the wear uniform? If not, what should be taken as

the rate of wear? These are some of the questions to be answered.

Referring to the methods taken to provide for depreciation in actual practice, Mr. Fowle remarked first that there are some public-utility companies that make no such provision whatever. Some large concerns finance new construction out of earnings. Many companies make a partial provision in advance, and an increasing number of companies are endeavoring to make a full provision for depreciation in advance. The inquiries and investigations of the public-service commissions in various states have had something to do with the effort to provide fully for depreciation.

There are two principal methods for calculating depreciation in advance, namely, the sinking-fund method and what is known as the straight-line method. The first consists in setting aside a fund to provide a certain amount in a certain term of years, including interest compounded at, say, 4 per cent. The straight-line method assumes that the property depreciates regularly and gradually to a certain predetermined time, when it has no value.

The accompanying diagram was exhibited by Mr. Fowle to show the difference between the two systems. Taking three ages of the property, fifteen, thirty and fifty years, the straight lines indicate the percentage of condition for various intermediate periods, while the curved lines show the percentages of condition under the sinking-fund plan. The shading between the two lines in each case shows the difference between the two systems, the sinking-fund plan naturally revealing a higher percentage of condition. Opinions differ as to which of the two systems is the better. Personally, the speaker favored the straight-line method, and he remarked that the sinking-fund curve represents a condition that is wholly financial.

Mr. W. B. Jackson opened the discussion. He said that the subject of depreciation is a tremendously important one. The treatment of the problem goes right to the heart of the successful operation of public-service companies. It is to be remembered that a property depreciates as its individual parts depreciate. The individual unit of the whole property will depreciate from full value to salvage value during its life. When it comes to determining the amount of depreciation, the two methods mentioned by Mr. Fowle are to be considered. When analyzed there is not so much difference between these methods as might be thought. In the sinking-fund plan the interest on the fund is figured as a part of the earnings of the property. The payments into the sinking fund are in equal annual amounts, but the fund is increased by interest until the full wearing value of the plant is returned. Mr. Jackson rather favors the sinking-fund method. Probably the method of having the depreciation fund build itself up is the more logical of the two; but there is, after all, not a very great difference between the two plans. In one case a smaller amount is taken out of the earnings. In the other a larger amount is taken out, but the interest on the fund will be paid back into it to offset the larger amount taken out.

Mr. L. B. Marks, of New York, was invited to speak, but begged to be excused from discussing the subject in hand. He paid a compliment to the Electric Club of Chicago, however, for keeping together while the New York Electric Club has disbanded. This circumstance, he thought, might be due to the fact that the Chicago people are better "mixers."

President F. P. Vose who was in the chair, remarked that the little talks at the weekly luncheons of the club constitute a sort of post-graduate course for many of the members.

Mr. Harold Almert remarked that there is much confusion in terms in relation to depreciation. He spoke of a recent hearing in a federal court where the subject was under consideration. Of four or five experts who testified no two agreed in defining replacement value. He urged the engineers to make a study of the terminology of depreciation, so that exact and generally received definitions might be established. He agreed with the preceding speakers as to the great importance of the subject.

Mr. W. S. Taussig brought up the subject of bookkeeping methods, and Mr. Fowle explained briefly the method of "reducing balances," brought out in England. This, however, is more appropriate for certain kinds of manufacturing business where there are proportionately greater risks in the early years of the existence of the business. There is probably no method of figuring depreciation that will apply to all kinds of business.

LESSONS FROM ELECTRICAL ACCIDENTS.

Instructive lessons may almost always be drawn from the study of electrical accidents. The maintenance of continuous service and the prevention of injuries to both equipment and operators tax the skill of power-plant machinery designers and those in general charge of installations in commercial work. Whether the cause of a failure of apparatus be simple or complex, the recurrence of faults in the handling or service of machinery year by year warrants renewed reference to the subject. In the following notes the causes of a number of electrical breakdowns in the past year are reviewed, the experiences being those observed by a casualty company's engineers in close touch with failures of both steam and electrical apparatus.

The insurance company's records show that for the year 1909 40 per cent of the failures of generators resulted from defects in armatures or rotors. Twenty-nine per cent were due to faults in commutators and slip rings; 12 per cent to troubles with field coils and stators, and 3 per cent to brush rigging and terminals. Mechanical difficulties with shafts, spiders, cores, binders, pulleys and gearing accounted for 12 per cent of the failures, and 4 per cent of the troubles were due to defects in frames, pole pieces and bearings. In the case of motors the percentages of trouble were as follows: Armatures and rotors, 37; commutators and slip rings, 27; field coils and stators, 20; brush rigging and terminals, 4; rotating parts not carrying current, 7, and stationary parts not carrying current, 5. Among the troubles due to defects in starting switches and controllers, 52 per cent were in resistor coils, 9 per cent in contacts and switch arms, and 21 per cent in automatic apparatus, making 82 per cent in parts carrying current. Eighteen per cent of the defects occurred in frames, slabs, coil supports and springs.

Among the direct-current motors examined on account of troubles in operation 39 per cent of the defects occurred in armatures or rotors, 31 per cent in commutators, 15 per cent in magnet coils, 3 per cent in brush rigging and 7 per cent in rotating parts not carrying current. Five per cent of the troubles happened in stationary parts not carrying current. In the case of alternating-current motors examined, rotor troubles were 23 per cent of the whole; slip rings and commutators, 6 per cent; stator coils, 49 per cent; brush rigging, 8 per cent; rotating parts not carrying current, 6 per cent, and stationary parts not carrying current, 8 per cent.

The causes of the generator and motor breakdowns were chiefly dirt, neglect, bad design and poor construction.

Among the specific cases of failure was that of a 250-kw, 500-volt, direct-current generator running at 375 r.p.m. One evening when the load was about 200 amp the watch engineer saw flashing with solder thrown from the commutator lugs. He at once stopped the machine, but found nothing wrong, and it was restarted. A few hours later the sparking recommenced and a second shutdown was made. Careful examination disclosed some solder melted out of four commutator lugs and wedged in behind them a ferrule 7/8 in. in diameter and 1/2 in. deep, which might have come from the handle of a file or soldering iron. It was apparent that through carelessness the ferrule must have become wedged in place before the connections were all soldered.

The presence of mice in the space between the ends of the winding drum and the commutator lugs of a 500-volt motor

caused a short-circuit and fuse blowing in another case. It appeared that the mice had crawled into the armature during the night to enjoy its warmth and had been flung to the outside of the cavity behind the armature lugs when the motor was started in the morning. As a safeguard against a similar accident the openings in the end plates were covered with a fine wire netting.

The importance of fireproof installations of motors and controlling apparatus in localities where inflammable material surrounds the equipment was illustrated by the case of a 500-volt, three-phase motor driving a hoist in a coal mine. The speed was regulated by a controller of the barrel type immersed in oil, which cut in or out resistance in the rotor circuit. The motor and controller were installed below ground near the doors separating the intake from the discharge air shaft. The room had a wooden floor and was surrounded by fresh coal. On account of a short-circuit in the controller the oil in the box and the resistance cables leading from it were set on fire. The heat was sufficient to vaporize the oil, which set fire to the compartment doors and for a time short-circuited the ventilation of the mine. The sand supplied was useless in smothering a fire on vertical or suspended cables, but the fire was eventually extinguished by chemicals.

Defective bearings caused a long series of troubles with a 440-volt, three-phase motor of 120 hp. The motor was installed to drive drawing machinery by spur gearing, the pinion being 7 in. in diameter and the gear 29 in. The pinion was mounted on the overhanging end of the motor shaft and an auto-starter was provided to reduce the voltage when bringing the equipment into service. The motor refused one morning to speed up, and upon examination one of the auto transformer coils was found to be burned out. In the repair shop the insulation of one of the coils, particularly of the inner section, was found to be roasted and charred, but there were no signs of metallic short-circuits. The inspector concluded that the damage had been done by holding the starting switch on too long when trying to start the motor. In the meantime a starter was borrowed, and later the repaired equipment was put back in service. After some alteration of the taps it was found possible to start the motor with the repaired outfit, on account of the equalization of drop on each phase. Two days later it was found to be impossible to start the motor and the inspector therefore had the triple-pole oil switch taken to pieces and carefully examined, tested the stator and rotor coils and examined all connections. The protecting shields were taken off the sides of the stator and the air gap was gaged and found to be about 1/16 in. wide all around. On applying the current the rotor began to turn slowly and then seemed to be lifted and forced against the upper part on one side of the stator and there to stick. On taking the bushes out of the bearings the upper halves, and especially at the driving ends, were found to be worn sufficiently to allow the shaft and rotor to be forced into contact with the stator by the pressure exerted by the teeth of the driven wheel upon those of the pinion on the end of the rotor shaft. The bearings were adjusted and no further trouble in starting the motor was encountered.

In discussing the accident the insurance company's engineer stated that the reason why the motor started with the borrowed starter, but not with its own probably was that the former delivered a higher voltage than the latter. The reason why it started on some occasions and not on others was more difficult to determine. It appeared that there were some positions of the machinery beyond the driving pinion in which the resistance to motion and consequently the pressure on the pinion teeth was greater than in others. The rotor or stator cores may also have been not quite circular. Whether the rotor was brought to a standstill by friction against the stator core or by loss of torque owing to weakening of the revolving field by the unequal width of the air gap is uncertain, but the occurrence showed that the shields over the stator windings of alternating-current machines should be so arranged by piercing or otherwise that the width of the air gap may be visible. In the case referred to neither the clearances between the shaft and its bearings nor that between the rotor and the stator could be seen without partially dismantling the machine and thus much valuable time was lost in seeking the cause of the trouble.

Another accident occurred in the operation of a 350-hp three-phase motor supplied with 11,000-volt service. The frequency was 50 cycles. The stator winding consisted of double-cotton-covered and braided copper wires distributed in 144 tubes of insulating material carried in as many partly closed slots so that each slot held a tube containing 40 conductors. The winding was divided into 18 coils, six coils per phase, star-connected, so that the voltage between each terminal and the neutral point was 6360 and between each coil 1060 under normal conditions. The rotor was of the wound type with three slip rings and brush rigging for connection to a liquid rheostat for starting. There was no starting apparatus in the stator circuit beyond a three-pole oil-immersed switch without any impedance, inductive or otherwise, between the supply and the motor terminals. Repeated failures of the stator coils occurred, and upon examination of a damaged coil a hint of the trouble was finally found. The cotton covering was bleached, stained green and badly decayed. A test with litmus paper showed it to be acid and further analysis disclosed the fact that nitric acid was present. The conclusion was that the cause of the repeated breakdowns was the destruction of the insulation by nitric acid formed by decomposition of the air by brush discharge from the high-tension conductors.

The reasons why the coils nearest the terminal were most affected were that the difference in potential is highest at such parts of the windings and the brush discharge and formation of nitric acid greatest and also that the concentration of potential, which doubtless broke down the insulation, is bound to occur more or less across the terminal coils at starting. The report states: "Unless brush discharge can be sufficiently reduced, as has been claimed, by restricting the conductors in each slot of the stator to a single row, the only way of preventing damage seems to be to insulate the conductors completely from air and moisture. This may be done by using formed coils thoroughly impregnated and made up solid with waterproof materials before being placed in the slots. Unfortunately this method involves open slots in the stator core, which are detrimental to induction motors, especially small ones, both as regards efficiency and power-factor on the one hand and weight and cost on the other. It has not been found practicable to impregnate windings thoroughly after being placed in position. Adequate protection can, however, be obtained for conductors wound by the 'pin' method by placing them in waterproof tubes projecting beyond the ends of the slots in the stator core and binding the projecting portions and the end windings emerging from them with a thick covering of tape saturated in some adhesive and waterproof material to seal them completely from air and moisture." The owners had the machine rewound for 440-volt service and supplied a step-down transformer instead of following the above plan for protecting the windings.

The report of the year's casualties closes with a warning against touching high-tension machinery or circuits which may have considerable electrostatic capacity even for a time after current has been cut off. Plenty of time should be allowed for the charge to leak away. The stators of large high-tension alternators may remain charged for periods in excess of ten minutes in some cases, and hence the part to be handled should always be given a light preliminary touch with the finger. Long cables armored or buried underground or immersed in water may under certain conditions hold charges for hours and should never be handled by those who do not understand the conditions under which they become condensers and know the proper methods of discharging them.

CONSTRUCTION OF FOUNDATIONS FOR ELECTRICAL MACHINERY.

By Bruce H. Page.

Usually the location of a foundation is determined by the position of the member which is to drive or be driven by the machine that the foundation is to carry. The outline of the

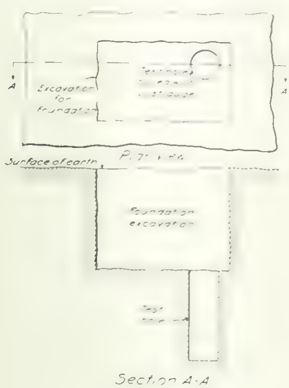


Fig. 1—Method of Digging Test Hole.

foundation plan is, approximately, laid out on the surface, in the designated place, and the hole in which the foundation is to rest is dug. The depth of the excavation is most often such that the base will, if out of doors, lie below frost line, or such that the base will rest on good bottom. Sometimes a

Fig. 2—Foundation Bolt Templet for 110-hp. Motor.

foundation must be made deeper than required by either of these considerations, so that it will have sufficient weight to hold it in position, but not frequently. If it extends below frost line or to good bottom it will, ordinarily, be heavy enough. In a building where frost can have no effect and where the soil is solid the weight may be the determining factor.

As a rule, excavations for adjacent buildings furnish information as to the probable nature of a soil. If there is any question, a test hole, as shown in Fig. 1, can be driven into the soil, from the bottom of the foundation hole, for from 4 ft. to 6 ft. If the soil continues firm for this distance, it is, doubtless, safe to erect a foundation thereon. A test hole can be conveniently made with a post-hole auger, or lacking this, an ordinary spade will do. It is common practice, instead of digging, to explore the earth from the bottom of an excavation with a test-bar. This is merely a steel bar or an iron pipe which is driven with a maul. If such a bar drives firmly and steadily for a distance of, say, 6 ft. into the soil at the bottom of the hole it is reasonably safe to set the foundation on it.

Foundations for machinery should always be entirely independent of other structures. They should in every case be a sufficient distance away from the foundations of the enclosing building that the settlement of one cannot affect the other. For satisfactory operation a driving or driven machine must align accurately with the driven or driving one. This alignment, where foundations are involved, must be secured through the correct location of the foundation bolts. The foundation bolts are held in position by templets during the construction of the foundation. so the templets must be nicely made and located if good operation is expected.

A typical foundation bolt templet of wood is shown in Fig. 2. This illustrates a templet for a 110-hp motor, provided with an outboard bearing, having a speed of 450 r.p.m. The same templet could be also used for a motor of greater rating because manufacturers so design their standard lines of motors that a given frame will accommodate the windings and mechanical parts for motors of two or more horse-power ratings.

Templets are usually constructed of wooden planks, although where its use is justified because of many applications they are built from structural steel. Almost any sort of plank can be used for making a templet, but, because it is cheapest in the long run, reasonably clear-grained pine is used. Yellow pine, although it is heavy, is good. Woods which tend to warp and distort should be avoided. As a rule, the sticks composing a templet are planed on all four sides, but for ordinary rough work this is not necessary. It always pays, unless the templet is a very simple one, to furnish a drawing of it to the erection man with the foundation. From this the carpenter can build the templet without having to search the foundation drawing for his dimensions. The length of each stick and the diameter of all of the holes should be shown so that the workman can obtain at once every dimension that he will require. It is cheaper to record such dimensions on the tracing in the drafting room than to make it necessary for the woodworker to ferret them out for himself. All necessary dimensions are shown in Fig. 2. In this templet the three transverse sticks are made long enough to extend out over the form and support the templet in a manner to be hereinafter described. Important center lines should be scratched on the templet and marked with a *V*, as shown in Fig. 2, because the templet is located with these center lines as index marks.

Templets can be of so many different forms, to accommodate different foundation-bolt arrangements, that it is scarcely feasible to suggest general methods for making them. Obviously they should be composed of the fewest possible number of sticks and weigh little; yet they should be substantial and rigid. The components are held together with wood screws, or, in rough work, with clinch nails. A four-bolt templet and the method of supporting it on the form is shown in Fig. 8.

After the hole is dug for the reception of the foundation and the templet made, the foundation can be built. Stone or brick set in mortar was used much more generally in the past than at present for machine foundations. Concrete has largely replaced both of these materials except for temporary work

For this and in certain other cases brick and mortar foundations find convenient applications. Lime mortar is most often used. There are certain small foundations which are to be permanent that can be built more cheaply of brick than of concrete. This is because of the cost of the forms necessary for the concrete foundations and of the fact that a brick mason and a laborer can build a brick foundation without having to secure aid from the carpenter shop.

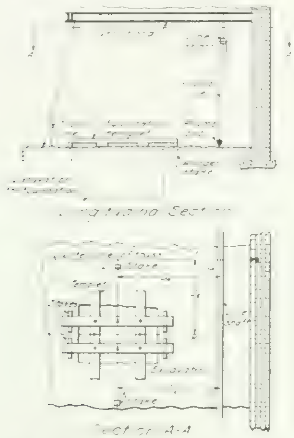


Fig. 3—Lining Templet to Line Shaft.

A mixture of one part cement, three parts sand and six parts gravel forms a concrete that is extensively used and that has given perfect satisfaction for machine foundations. This mixture will weigh, when set, from 140 lb. to 150 lb. per cubic foot. In general, concrete foundations only will be discussed in this paper. Much of the information given concerning them applies to masonry foundations.

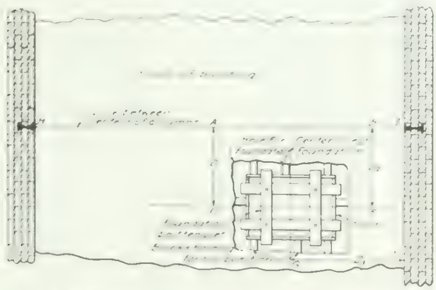


Fig. 4—Lining Foundation to Truss Centers

Ordinarily, a form is required for a concrete foundation. There is, in books and articles on concrete construction, an abundance of information regarding the building of forms. Although these do not specifically treat of machine foundation forms, their suggestions are, generally, applicable. All that practice sanctions in regard to timber for and the construction of and the bracing of forms for other structures can profitably be reviewed by the machine foundation constructor. Forms will not be treated of further with the exception that a few suggestions will be given in this article.

Two typical cases, illustrating how templets and forms are [illegible] carry a motor to drive a line shaft is being installed. The foundation center lines are located from the dimensions D_4 and D_6, given on the erection drawing. These are, respectively, the distances from the center line of the line shaft and from the center line of an adjacent truss to the foundation center lines. The soil is so firm that no form is required. The excavation constitutes the form. The templet, after having been accurately aligned, in a manner to be described, is held in position by being nailed to wooden stakes driven in the soil.

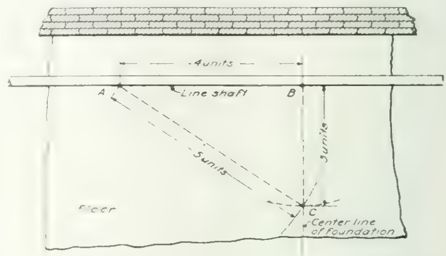


Fig. 5—Method of Aligning to Line Shaft.

The aligning is done thus: The plumb-bob dropped over the line shaft indicates the location of that member on the surface of the soil. The plumb-bob is first adjusted at the point M and the distance LM measured off and then at O and the distance ON measured off. The string LN, representing one center line of the foundation, is drawn between two stakes The templet is now adjusted until the two corresponding index lines on it coincide with the string line. Then the templet is shifted until the distance JK is correct and it is nailed to the

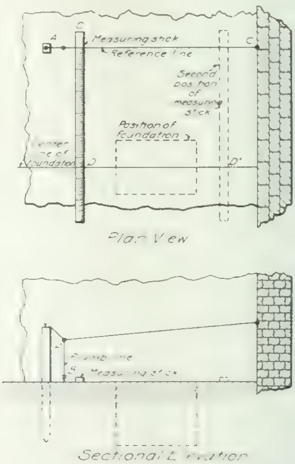


Fig. 6—Method of Aligning to Truss Centers.

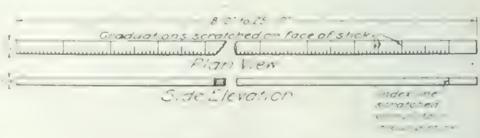


Fig. 7—Measuring Rod for Aligning.

stakes which have previously been driven at approximate locations. The elevation of the templet is determined from the floor line without difficulty, and it is adjusted until it (the templet) is level in all directions. The sticks composing the templet have been left long enough to extend beyond the excavation so that they may be nailed to the stakes.

In Fig. 4 is shown a templet which is being aligned from a truss center line. In this case a form is used and the templet is nailed to the top edge of the form. The longitudinal center

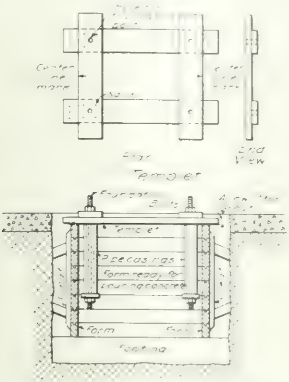


Fig. 8—Templet and Form in Position.

line of the foundation CE is made parallel with the truss center line HI through the measurements AC and BE. The distance GF is from the inner face of the wall to the transverse center line. All three of these center lines (HI, CE and GJ) are, in practice, taut cords. After the templet and form have been accurately located in their correct position, blocks are wedged between the outer face of the form and the face of the excavation to prevent the form from shifting while the concrete is being rammed in. Sometimes, if the form is not worth saving, the space between the form and the foundation is filled with earth before the concrete is placed and the form is left there.

It is essential that measurement lines, such as ML, Fig. 3, and AC, Fig. 4, be at right angles to the reference line from which the measurement is taken. If one is available these right angles are best determined with an engineer's transit, but if no instrument is at hand they can be accurately laid out by one of the methods suggested in Figs. 5 and 6. In Fig. 5 an application of the law of a right triangle is used. It is desired to lay off the line BC at right angles to the line shaft. A plumb-bob is dropped at B over the line shaft and the point marked. At A, which is located so as to be four units distant from B, the bob is again dropped. Then with radii of respectively five units and three units arcs are struck from A and B, which intersect at C. Then the line BC through C will be at right angles to the shaft. The radii are struck with a piece of string having nails tied on for points at each end.

A measuring rod, shown in Fig. 7, is used for laying out the lines accurately in Fig. 6. The measuring stick is merely a clear-grained piece of white pine, say, 2 in. wide and from 8 ft. to 25 ft. in length, of ⅞-in. stock. It should be nicely planed on all four faces and have an index line and graduation lines scratched on it. The index line is "squared" around all four faces, while the graduations appear on the upper face only and usually divide the stick into feet and inches. It is essential that the stick be not narrower than 2 in. When it is used for laying out one line parallel to another, the reference line (a string) lies over and when the stick is at right angles coincides with the index line on the stick. If the stick be too narrow, the reference line may seem to coincide accurately with the index line when it does not. The wider the stick is the greater will be the accuracy.

A reference line AC (Fig. 6) is strung. It may be between two column centers or between a stake and some other point. A plumb-bob B is hung at a convenient location from the reference line. The measuring stick is then laid on the ground in the position shown in Fig. 6 and its outer end is shifted around O as a center until, to a person sighting with one eye from a position at P, the index line (on the measuring stick) the plumb line and the reference line all coincide. The stick is then at right angles to the reference line. A mark is made on the floor at D the required distance from the reference line. This operation is repeated with the stick in the position shown in dotted lines and the point D' is obtained. Then a line through D and D' is parallel to the reference line and at the correct distance from it. The templet is located with reference to this line.

BOILER-ROOM PRACTICE DISCUSSION AT MICHIGAN CONVENTION.

A paper on the boiler-room and its contents was given by Mr. H. F. Rosenkrans at the recent Michigan Electric Association convention. He first pointed out that it is sometimes well to have boiler tests made by experts, so that changes can be recommended that will increase the efficiency of the plant. The engineer who says, "What is the use of going to so much trouble?" is usually a man who does not read the engineering papers or keep posted, and is of the kind who never get ahead. The boiler-room should be considered first in the operation of any steam plant. It is often considered last. The author described the bad effect of uneven firing with hot fires one interval and a general cooling off of the fire brick and tubes another interval by having the doors open too much and throwing on large quantities of coal at a time. The efficiency of a boiler is not all in the boiler. It is often in the way it is operated. Some firemen with the same fuel will increase the efficiency from 10 to 30 per cent.

As to specifications for new boilers, the boiler must be designed for a working pressure to suit the conditions, using a factor of safety of five on riveted joints. The material and workmanship must be the best quality throughout. All riveting, calking and expanding must be done carefully and thoroughly. The boiler must be tight under a water pressure 50 per cent over the designated steam pressure. The steel should be open-hearth and stamped with the maker's name and tensile strength. It should have an ultimate tensile strength of not more than 65,000 lb., or less than 58,000 lb. per square inch., and an elastic limit of not less than one-half of the ultimate tensile strength. The elongation must not be less than 25 per cent in 8 in., and the reduction in area not less than 50 per cent. The sample must bend back on itself cold, without sign of fracture under cold and quench tests. Usually these tests are made at the mills where the boiler steel is manufactured. The report of these tests should be accompanied by an affidavit that the report is that of tests of specimens from the mills from which the plates are rolled. The heating surface of tubes should be figured on the fire side only, and such heating surface should be 9.5 sq. ft. per horse-power. No other parts of the boiler should be allowed as heating surface. A boiler should carry continually, if necessary, 33 per cent more work than it is rated to carry without any undue strain to boiler or setting; the steam should not show more than 2 per cent moisture at the nozzle; and the boiler should evaporate 10 lb. or 11 lb. of water per pound of coal, from and at 212 deg. Fahr., with coal of 14,000 heat units per pound. The steam nozzles should be of cast steel and riveted on. The blow-off opening should be of cast steel or boiler plate riveted on, giving ample surface for screw-

ing in pipes. Any opening over 2 in. should have flanges riveted on.

The steam piping should be as short as possible. Many plants have the boiler-room at one end of a large building, and the main steam pipe running the whole length of the boiler-room and engine-room, when the boiler-room could have been directly back of the engine-room, thus saving about half of the pipe. Double-strength fittings should be employed where pressures are over 125 lb. Long-sweep bends should be used in pipes where possible, and especially from the main steam nozzle of the boilers to the main steam pipes. The steam pipes should be drained by inclining them toward the engines, and the drip connection should be just above the throttle of the engine. This prevents a possibility of water hammer or bursting of steam pipes. All steam pipes should be covered with a good air cell or 85 per cent magnesia covering, and after the pipes are covered flour paste, consisting of about 2 lb. of glue to 5 gal. of paste, should be applied. Two or three coats of this will keep out air, and the pipes will be better looking and more easily kept clean.

A poor feed-water pumping system is a constant worry to the boiler attendant, and endangers life and property. Should the water in the boiler become dangerously low, it is not always necessary to draw out the fire. If ashes are available they can be moistened with water and thrown over the fire. This deadens the heat at once. After the boiler furnace and parts of the boiler exposed to heat are properly cooled, the boiler can be filled with safety, and the ashes can be pulled off the hot coals and the fire started. The boiler feed pump should be as close to its work as possible, to avoid long runs of piping. The feed pipes to the boilers should always be double-strength pipes, and made perfectly tight with a good plug valve, like a blow-off plug valve for shutting water off. This should go next to the boiler. Outside of this should be a swinging check valve. A union next to the check valve and one next to the feed pumps allow easy and quick repairs. A union should never be placed between the boiler and shut-off valve on a feed line. If possible globe valves on a feed line should be avoided, but if they must be used they should be so connected that the water goes against the bottom of the valve and passes up through the valve and then to the boiler. Should the valve come off the stem, it does not shut off the boiler feed, as it would if put in the other way.

The open heater and purifier is perhaps the best source of hot water. With exhaust steam, especially if at from 1 lb. to 5 lb. back pressure, a feed temperature of 214 deg. to 220 deg. is obtained, but if a back pressure is carried on the heater, there should be from 3-ft. to 5-ft. head from the heater to the boiler feed pump. The open heater and purifier is also good for a compound condensing plant, by taking hot water from the hot well for the heater and heating it with live steam with about 5 lb. back pressure on the heater. When doing this all exhaust openings should be closed to prevent waste of steam. This will give a feed temperature of from 210 deg. to 220 deg. If there is no gain in heat by this method, there is a gain by feeding pure water to the boilers, keeping the boilers cleaner and in better condition than if water were fed in from the hot well at 100 deg. There should be a set time for cleaning boilers at regular intervals. A boiler should never be cooled by blowing it down and then filling it with cold water. This will cause leaking tubes sooner or later. It is good to blow off a boiler vigorously once or twice in twenty-four hours when steam is high and the load light. The blow-off valve should not be opened with a jerk, but opened and closed slowly to prevent water hammer. If a plug blow-off valve is used the plug should be removed occasionally and painted with graphite and cylinder oil, which will make it stay tight longer and make it open more freely.

In changing over from one boiler to another the pressure on each boiler must be alike, as there is danger when the pressure is unequal. The valve should be opened slowly and if a rush of steam is heard in the pipe line, the valve should be left cracked until the pressure becomes equal, when it may be opened wide. It is well not to cut out the other boiler until the one cut in has been under steam an hour or two and warmed up. The fire should burn out clean in the boiler which is being cut out, to keep it from popping and blowing steam after being cut out. It is well to have a steam vent pipe at the highest point in the steam dome to let the air out when filling, and after cleaning this should be left open until the steam rises to allow the air to escape so as not to interfere with the speed of the engine when changing over boilers. A man may be judged by the appearance of his boiler and boiler-room. A clean, neat boiler-room usually signifies a clean, wide-awake engineer and superintendent in charge.

Mr. H. A. Chase, of Hart, followed with a written discussion on this subject. He thought that the art of firing must be self-taught. The firemen learns by experience best what is the most economical way. At Hart it is his custom to weigh all the coal brought in and the ashes taken out, and to keep a record of the kw-hour output. He recently visited a plant where there were holes in the breeching of the boiler and around the fire doors and the arch had fallen in so as to let some of the gases go directly up the chimney. On questioning the engineer about it, he said that he could not see any difference in the fuel consumption since the arch had fallen in, so he did not think it worth while to repair it. Such men, Mr. Chase thought, should be carrying a hod instead of running a boiler-room.

Mr. A. N. Richardson, of Ann Arbor, in answer to a question as to the use of fuel oil by his plant, said that oil fuel is used only for peak load. Water-power supplies most of the output. For operating a peak-load plant this fuel oil is very satisfactory and takes much of the labor out of the boiler-room. For ordinary twenty-four hour runs, however, it has been established that fuel oil cannot compete in Michigan with coal at present prices. Mr. Chase remarked that forcing a boiler is likely to increase the cost of the output. Mr. J. R. Cravath, of Chicago, said that in many of the larger plants it is now the practice to overload boilers for short periods, rather than start up additional boilers, and that boilers have been found economical at much higher rates of working than were formerly considered proper. In small plants there is fequently a tendency to run more boilers than necessary during a light-load period. While this makes matters easy for the fireman, because he does not have to pay as much attention to keeping up steam as he would if the boilers were working hard, it is likely to be detrimental to economy. If a boiler is being worked fairly hard, the fireman has to use his fuel with some degree of economy in order to keep up steam.

Mr. A. C. Marshall, of Port Huron, thought this a good point for investigation by small plants, as the larger plants have been working boilers at higher capacities recently.

Mr. John Cavanaugh, of Benton Harbor, suggested that if the fireman gets lazy, so that he does not keep even fires, the remedy is to get a new fireman. Boilers, he said, are sometimes overrated.

Mr. A. N. Richardson claimed that before a boiler can be overloaded it must be provided with a furnace which can stand the heat. Frequently the furnace limits the load.

Mr. R. W. Hemphill, of Ann Arbor, called attention to the fact that the practice of the larger coal consumers at the present time in buying coal on a heat-unit basis has caused the coal which is high in heat units to be shipped to these larger users. The result of this is likely to be that the smaller companies get the poorer coal, which the coal companies cannot supply with profit to the large companies under test. Therefore, there is an increased necessity for small users to be more careful in purchasing coal. He thought it would be well for the executive committee to make an arrangement with some laboratory for members to procure coal analysis at intervals. Mr. F. B. Spencer, of Cheboygan, said that a large number of tests made by the University of Michigan laboratory might be available for the information of members on various fuels.

LETTERS ON PRACTICAL SUBJECTS

A PORTABLE STAND FOR GRAPHIC INSTRUMENTS.

Graphic, or, as they are sometimes called, curve-drawing, electrical meters are very useful to concerns that employ many motors in that with a graphic instrument a permanent accurate record of motor performance can be obtained. The curve, usually reading in either amperes or watts, indicates clearly what the average, maximum and minimum inputs to the motor are and it shows the time relations between them. It is impracticable to obtain significant records of these characteristics through the use of indicating instruments. In a reasonably large concern a graphic instrument will usually pay for itself the first year it is used by enabling its purchaser to select motors of the smallest capacity that will do the work.

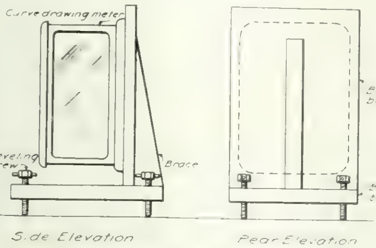


Fig. 1—Stand for Graphic Meter.

When a motor drive for a new machine or application having unknown input characteristics is being arranged a spare motor should be geared to it temporarily. The input to the motor should be measured and recorded with a graphic instrument. From the curve thus obtained it will be possible to determine to a certainty the size of motor that should be purchased. There need be no margin allowed so that the motor may be quite big enough. If necessary a curve-drawing instrument can be inserted in the motor circuit and be left there for a day or a week or a month, and it will, with little attention, accurately record what the input requirements to the motor have been for each interval of time during the period.

Fig. 2—Detail of Leveling Screw.

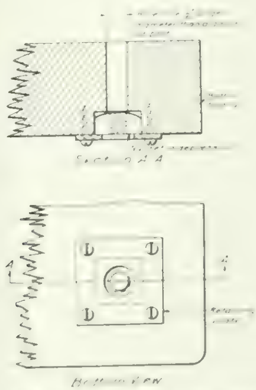


Fig. 3—Arrangement for Leveling Screw Nut.

Obviously, for such functions a graphic meter must be portable. It must be so arranged that it can be easily transported to and set up at any point in the plant. The better types of curve-drawing instruments have been designed for switchboard mounting, so that if they are to be made portable a special stand must be arranged for them. Fig. 1 shows a type of stand that is easy to make and cheap, and which will give good service.

Referring to Fig. 1: The stand is composed of three pieces of board about 1½ in. thick. The actual thickness of the back board is determined by the thickness of the switchboard panel for which the studs and supporting bolts on the instrument are designed. Thoroughly dried wood should be chosen for the support and a wood that will not warp readily is much to be preferred. The component pieces are held together with screws and they can be mortised one into the other if desired. After assembling, the whole should be well varnished to prevent any possibility of warping. The sizes of the component pieces of board and the locations of the stud and bolt holes depend on the make of meter that is to be mounted. The manufacturer of the instrument will furnish a drilling templet and an outline drawing of it, but it is probably better to take dimensions from the instrument after it has been received.

Four leveling screws, one in each corner, are arranged in the bottom board. A meter of this type must be quite accurately leveled if a true record is expected. The leveling screws are constructed as delineated in Figs. 2 and 3. The screw itself, Fig. 2, is made by inserting a slightly tapered pin through a hole drilled through the head of a hexagonal head tap-bolt of about ⅜ in. diameter. The pin, which serves as a handle, is formed from drill or brass rod. It is driven snugly into the hole and, because of its taper, will stay there.

The nuts through which the leveling screws turn are arranged as detailed in Fig. 3. A square iron nut is tightly fitted into a depression cut in the bottom of the bottom board, and a metal plate, fastened over it with wood screws, retains it. The round hole through the board for the leveling screw should be bored somewhat larger than the diameter of the screw so that there will be ample clearance.

Directions for the arrangement of electrical connections cannot be given because they are different for each make of instrument. For direct-current installations, where the voltage regulation is reasonably good, a graphic ammeter will draw curves which, by taking into account the voltage (which is assumed to be constant), can be calibrated in watts or horsepower. An ammeter is simpler than a watt-meter, is more easily connected and is, on the whole, preferable for direct-current work. But in alternating-current work, where low power factors are encountered and where the current taken by a motor may not be at all proportional to the actual power consumed, a wattmeter must be used.

One graphic instrument can be made to record inputs to motors of small, large or intermediate capacities and of different voltages by providing suitable shunts and multipliers for direct-current instruments and series and shunt transformers for alternating-current instruments. The electrical manufacturers do not regularly list these "wide range" outfits, but will furnish information concerning them on application.

[illegible], Pa. H. H. [illegible]

CHANGING OVER FROM 220 VOLT DIRECT CURRENT TO 110 VOLT ALTERNATING CURRENT.

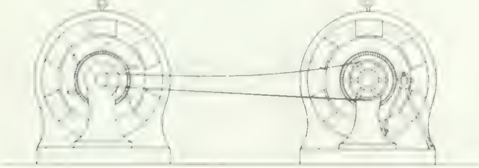
About fifteen years ago it was the practice to install 220-volt direct-current systems for commercial lighting in the smaller towns. Since that time most of the towns have outgrown the limitations of the system, and as a consequence regulation is inconceivably bad, line losses are exorbitant, and the plants are either on a losing basis or very near it. In many instances the managements would very gladly spend the necessary money to change to alternating current, but they are possessed with the idea that the change would involve so many difficulties, interruptions of service, and inconveniences to consumers that the advantage of the change would be more than overbalanced by disadvantages. Such managements, however, are crossing bridges before reaching them, judging from the experiences at Lawrenceville, Ill. This plant had a load of about 40 kw on 220-volt direct-current circuits. Street lamps were connected in multiple between one of the regular service wires and a third wire which ran back to a switch in the plant. The

first step toward making the change was to install the alternating-current plant with separate engine, switchboard, feeders to the central distributing point on the public square, and two transformers with a total capacity of 30 kw located near this central point. With the equipment installed all that was necessary to change to alternating current was to cut in the transformers and start the alternator, leaving the switches on the direct-current board open. Transformers were tapped across the 220-volt wires and the service on these was continued without interruption. To facilitate establishing 110-volt service the incandescent street lamps were connected permanently across the commercial 220-volt mains and the third wire was connected into the transformers and made to serve as a neutral. All new services were connected to the neutral and were supplied at 110 volts. The management was very anxious to get the old service over to 110 volts, but at the same time did not care to bear the entire expense of the new lamps required in the change. It was finally decided to give a credit of 12½ cents for all old 220-volt lamps, to apply on the purchase of new lamps, on which the company made a profit of 5 cents. To induce consumers to make the change the higher efficiency of 110-volt Gem and tungsten lamps and the fact that flatirons fans and other devices could be connected to 110-volt circuits and not on the 220-volt lines were widely advertised. Eighteen months after alternating-current service was established there was only one 220-volt lighting service. In this instance, at only a very nominal expense to the company for lamps, the change was made without causing a single interruption of service and without forcing any customer to any expense for lamps against his will. The company, of course, went to considerable expense in purchasing new meters. However, all the old meters were sold for $5 apiece, and the revenue from these was equal to almost half the cost of the new ones.

[illegible] [illegible]

TURNING DOWN A COMMUTATOR

There has been so much published about the care of commutators that it would seem difficult to write anything more on the subject. However, the following scheme may be new to some and has been used in a number of instances with very satisfactory results. The method usually used to turn down a commutator on a repair job where the armature is too large to remove is to leave one or two pairs of brush arms on and run the machine from these at as low a speed as the field regulation will permit, or possibly with a water rheostat in the armature circuit. This will, of course, do where nothing else is possible, but there is always bad sparking and burning at the point of the cutting tool due to its short-circuiting the bars when it crosses the mica. The tool has to be sharpened frequently and the job is seldom good even where the greatest care is exercised. For this reason it is always best to belt the



Belted Units.

machine to a separate motor and turn down the commutator with the fields unexcited. In the plant with which the writer is connected there are several machines set symmetrically with their shafts parallel. The shafts overhang the outside of the bearings sufficiently to enable one to put a pulley on the shaft of the machine to be repaired. The belt is then put directly on the shaft of the other machine and by using a suitable pulley the proper speed for turning down is obtained. A commutator [illegible] r.p.m. at about r.p.m. with good results, but it is better to keep below this speed than to exceed it. The accompanying sketch shows very plainly the scheme indicated above; it is unnecessary, of course, to shut down the machine used as the motor and the additional load would seldom, if ever, be of serious moment.

Niagara Falls, N. Y. J. Cloyd Downs.

DEALING WITH NATURAL GAS COMPANIES

Electricity usually gets the better of it in a fight with natural gas, but while the strife is going on a great deal of anxiety is caused by the management of the lighting company and much time is wasted because the electric light company does not impress upon the gas company some forcible reasons why it should not push the use of gas for lighting. The arguments are effective only in case the electric light company employs the gas company's product in the generation of electricity. In short, it may be argued that indirectly the gas company can get at least as much revenue from the electric light company as from customers using gas lamps. An 80-cp Welsbach burner will consume about 4 cu. ft. of gas per hour. At 20 cents per 1000 cu. ft. the revenue to the gas company is 0.08 cent per hour. The fuel cost at 10 cents per 1000 cu. ft. with gas under a boiler is 1.5 cents per kw-hour in the average small plant. This brings the gas company a revenue of 0.36 cent per 80 cp per hour with 3-watt lamps and 0.15 cent with tungsten lamps. According to these figures the gas company will come out far ahead if it stays out of the lighting business. But the figures are changed considerably if a gas engine is employed. Assuming gas at 20 cents per 1000 cu. ft. and an engine that will average 15 cu. ft. per hp-hour, or 20 cu. ft. per kw-hour, the revenue to the gas company is 0.4 cent per kw-hour, or 0.1 cent and 0.024 cent per 80 cp per hour with carbon and tungsten lamps respectively. The percentage of carbon and tungsten lamps usually found on an electric system would probably bring the average up to 0.08 cent, the revenue to the gas company when the gas is employed directly in lighting. The gas company may argue that the Welsbach mantle is not always in good condition (and usually it is not) and as a consequence consumption is so far beyond 4 cu. ft. per hour that the actual revenue is much greater than indicated by the figures given. This is doubtless true, but the increase is certainly offset by the fact that during the winter months gas is used for heat as well as light, and that the consumption in the stores is decreased by an amount equal to that of the gas used for lighting. In other words, the revenue to the gas company would be as great during almost half the year were no gas employed for lighting. Where a minimum bill is charged the revenue during the warmer months is likewise not increased as much as would at first be presumed. There are usually four months when at 20 cents per 1000 cu. ft. the gas consumption of the average family for both cooking and lighting is not up to the minimum charge, and in such instances the gas company gets no revenue from the gas used for lighting. Taking it all in all, if the electric light company will burn gas at its plant the gas company can safely discourage gas lighting. On the other hand, where gas competition cuts into the revenue seriously it would probably pay the electric company to go to some additional fuel expense if necessary and use gas as fuel if by so doing the gas company could be induced to get out of the lighting business.

[illegible] George Holmes

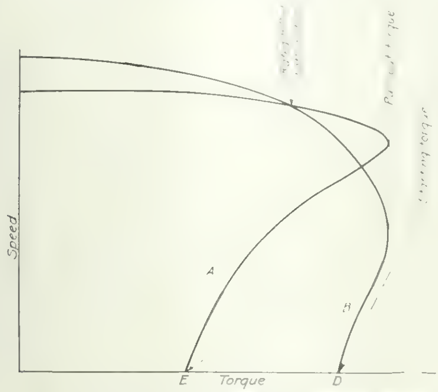
STARTING TORQUE OF INDUCTION MOTORS.

In your first issue of July appeared an article by Mr. Southworth on the starting torque of induction motors which contains a very practical way of determining the starting torque of any kind of a machine, line shafting, etc. However, in the application of the data difficulty is experienced in distinguishing between torque and horse-power.

For instance, in the example quoted, the author finds that a 60-lb. pull is necessary to start the line shafting. He then uses this starting torque for the calculation of the horse-power necessary at the rated speed of the shaft, apparently

forgetting that the 60-lb. pull was registered at practically zero speed. Aside from the confusion of mechanics involved, it is, of course, impossible to pick out the size of the motor necessary to start a given load without some consideration of the operating characteristics of the motor.

It cannot be assumed offhand that the starting torque of every induction motor bears a fixed relation to either the full-load running torque or the pull-out torque. For instance, the 5-hp motor which Mr. Southworth believes necessary to run the load might have a speed-torque characteristic represented by either of the curves A and B of the accompanying illustration. The shape of these curves, of course, depends upon the resistance in the motor. These two motors might have the same full-load running torque and also the same pull-out torque. However, the starting torque of B is twice as large as that of A, as shown by the two points *D* and *E*, of the torque curve at zero speed.



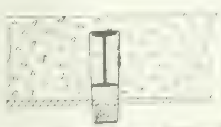
Speed Torque Characteristics of Induction Motor.

Any reliable motor manufacturer is willing to supply the speed-torque characteristic of a motor, so that in case it is necessary to calculate the size of motor to start a given load it would be necessary merely to use the suggestion which Mr. Southworth gives and obtain the pounds pull reduced to a 1-ft. radius; then if the motor selected shows the point *D* to be equal to, or greater than, the starting torque calculated the motor is of ample size to start the load.

New York. GEO. F. FENNO.

SUPPORTING CONCRETE FLOOR FORMS WITHOUT SCAFFOLDING.

In building the concrete floor of a large power station in Illinois on which I was recently employed we erected all the forms in position and placed the concrete without constructing any supporting scaffolding to carry the forms while the concrete was being poured or was setting. In this case the forms were supported by wire loops slung over the steel beams, the wire being cast into the concrete as the latter hardened and having its protruding ends snipped off flush with the lower surface of the finished floor slab. The accompanying sketch shows how this was accomplished, and illustrates the great saving of labor which resulted from avoiding the erection of supporting scaffolding. After the concrete had hardened the wire loops were cut off close to the finished surfaces, and as this floor formed the basement ceiling these few protruding ends did not prove objectionable in appearance.


Supporting Concrete Floor Forms Without Scaffolding.

Chicago, Ill. MORTIMER MEEKS.

110-VOLT SHUNT MOTOR ON A 220 VOLT, THREE WIRE CIRCUIT.

A friend of mine recently called me into his shop to ask my advice about the cost of having his 2-hp, 110-volt shunt motor rewound for 220 volts, as the central-station company refused to allow him to continue operating this machine across only one side of its Edison three-wire system, claiming that its operation tended to unbalance the lines. The cost of reconstruction as estimated by a local electrical company really exceeded the second-hand value of the motor, which was an old one; and as the service it rendered was only occasional and at low speeds, such a change did not seem worth while. After examining the case, the thought occurred to me that at the low speeds commonly employed (control being secured by manipulating the starting rheostat in the armature circuit) the current taken by the armature probably would not much exceed that taken by the field, and the two might be accordingly connected in series across the 110-220-volt, three-wire system with the neutral tapped in without much unbalancing. I tried this, first taking the precaution of reversing the armature brush leads to secure the same direction of motor rotation. The motor started up as usual, and at none of the loads it was called upon to pull did the armature circuit take current exceeding that of the field winding by more than the demand of a 32-cp carbon-filament lamp. When this fact was shown to the company's inspector he of course, was satisfied, as the unbalancing now produced by the motor did not exceed the effect of turning on a single lamp. That 110-volt motor is accordingly now running with its armature and field virtually in series across 220 volts, the neutral being connected in to carry the difference in demand of the two windings, and the expense of rebuilding it has been avoided by a few simple changes in connections.

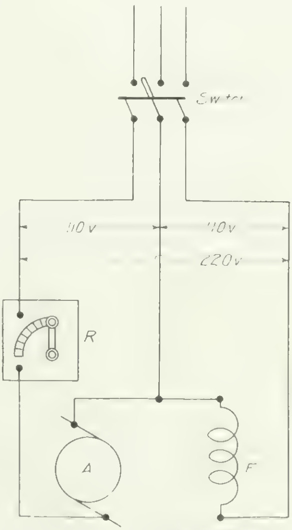


Diagram of Motor Connections.

[illegible] [illegible]

PARALLELING SMALL COMPENSATED COMPOUND WOUND ALTERNATORS.

In many plants where operation would be greatly facilitated by paralleling alternators with compensating windings the machines are kept independent because of the inability to hold them in parallel without undue hunting. Frequently the engineer gives up the job after a few attempts, and submits ever afterward to the inconveniences attendant upon running the machines separately. It sometimes happens that the designs of the machines make it almost impossible to run them together, particularly when the machines have compensating windings.

If the machines are of the compensated types efforts to parallel them should not be given up until trial has been made with these windings cut out. An instance within the writer's experience may be cited. Operation of two alternators together was given up after a few unsuccessful attempts and switches were arranged to give each machine a separate load. Later, increased output made parallel operation imperative. An attempt with the compensating windings of each machine cut out proved entirely successful from a paralleling standpoint, but voltage could not be maintained on the smaller dynamo without current in the compensating winding, and when operated

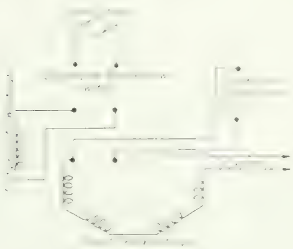


Diagram of Connections.

single the voltage fluctuated to a disagreeable extent on this machine. All difficulties were finally overcome in the following manner: On the larger machine, a 75-kw Wood alternator, driven by a steam engine, the rectifying bushes were lifted and the commutator short-circuited by binding No. 11 copper wire around it. The disconnected compensating coils were then permanently connected in series with the smaller field windings in the exciter circuit. The smaller machine, a 50-kw Westinghouse, driven by a three-cylinder gas engine, had its compensating winding excited through a commutator from transformer secondaries wound on the spokes of the armature. To obtain the additional excitation resulting from putting the compensating winding in the exciter circuit and to facilitate changing from compound to plain shunt excitation double-pole and single-pole, double-throw switches were connected, as indicated in the accompanying engraving. When both switches were thrown up the compensating winding was connected direct to the commutator bushes. With the double-pole switch down and the single-pole switch open the two fields were in series on the exciter circuit. It was, of course, necessary to keep the shunt field circuit closed, and this required that the single-pole switch be not opened until the double-pole switch had made contact with the lower posts, and that the single-pole switch be closed before throwing the double-pole switch upward. In practice it was found necessary to lift the compensating bushes in order to eliminate excessive sparking with circuit open. The machines were successfully operated in this manner for about twelve months.

[illegible] [illegible]

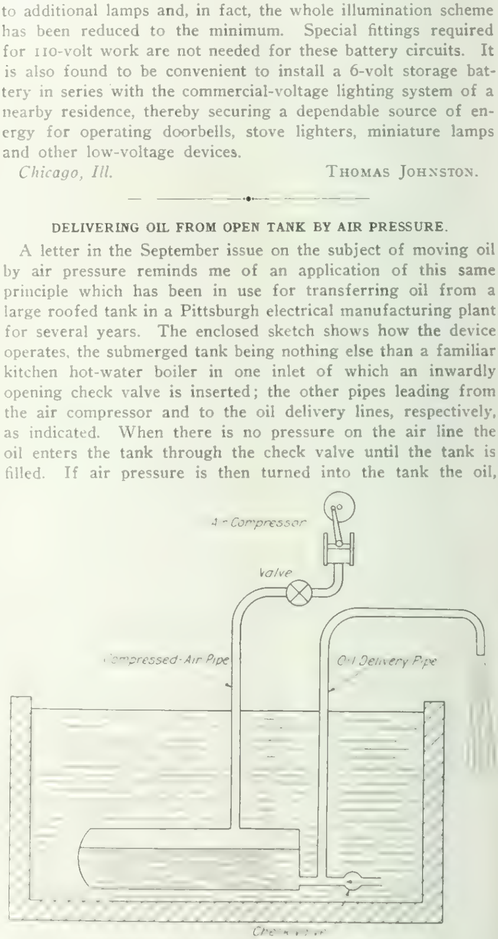
HOUSE LIGHTING FROM PORTABLE STORAGE BATTERIES.

The introduction of the portable storage battery and the miniature tungsten lamp for automobile lighting has directed attention to many other uses for which these small self-contained power plants are adapted. Low-voltage tungsten lamps are now found on 75 per cent of the automobiles in use, deriving their energy supply from a small portable battery, usually of the type known as "6-60," which signifies a 6-volt, 60-amp-hour battery. A unique electrically equipped home is that of Mr. J. A. Haschke, on the West Side, Chicago, in which all of the lighting is done from low-voltage tungsten lamps supplied from two portable Jewel storage batteries of the type mentioned above. One of these batteries, mounted on a shelf in the basement, is connected to fourteen 6-volt tungsten lamps of various sizes from 2 cp to 10 cp. Five of these lamps, enclosed in oval reflectors, are mounted in clothes closets, being [illegible] lighted when one enters. Lamps are also arranged about the various dressing mirrors in the rooms and 8-cp lamps are provided to furnish the general illumination of the bedrooms. A 6-cp lamp lights the music sheet on the piano, and in the basement is a 10-cp lamp over the coal pile, which is useful when the furnace is to be fired. The battery is also connected to a jump-spark coil which ignites the burners of the kitchen gas stove and supplies energy for operating a system of burglar alarms, call bells, electric door chimes, electric fans and cigar lighters. The other battery is used for operating a vacuum cleaner, a sewing-machine and a massage vibrator. There is now being constructed for this residence an electrically lighted and operated water-spray fountain for the parlor, which will also derive its energy from the battery. About every two weeks one of the batteries is taken downtown to be re-charged. The cost of re-charging a 6-60 battery is only 15 cents, therefore making the cost of up-keep but 30 cents per month. Considering the many conveniences obtained from these batteries this low cost seems very economical. As the installation is classed under low-voltage apparatus, the cost of running lines to additional lamps and, in fact, the whole illumination scheme has been reduced to the minimum. Special fittings required for 110-volt work are not needed for these battery circuits. It is also found to be convenient to install a 6-volt storage battery in series with the commercial-voltage lighting system of a nearby residence, thereby securing a dependable source of energy for operating doorbells, stove lighters, miniature lamps and other low-voltage devices.

Chicago, Ill. THOMAS JOHNSTON.

DELIVERING OIL FROM OPEN TANK BY AIR PRESSURE.

A letter in the September issue on the subject of moving oil by air pressure reminds me of an application of this same principle which has been in use for transferring oil from a large roofed tank in a Pittsburgh electrical manufacturing plant for several years. The enclosed sketch shows how the device operates, the submerged tank being nothing else than a familiar kitchen hot-water boiler in one inlet of which an inwardly opening check valve is inserted; the other pipes leading from the air compressor and to the oil delivery lines, respectively, as indicated. When there is no pressure on the air line the oil enters the tank through the check valve until the tank is filled. If air pressure is then turned into the tank the oil,



Forcing Oil from Open Tank by Compressed Air.

which cannot escape through the closed check valve, is forced out through the delivery pipe. After the oil contents have been forced from the tank, the air pressure is again released by opening the air line to the atmosphere and the tank quickly fills with oil again through the check valve.

[illegible], Pa. [illegible]

QUESTIONS AND ANSWERS

What relation does the horse-power required to drive a direct-connected exhaust fan bear to the speed of the fan? G. L. H.

The volume of air delivered by a centrifugal fan varies directly with the speed of rotation. The pressure exerted by the fan varies with the square of the rotative speed. The power necessary to drive the fan, therefore, varies with the cube of the speed. The above relations are theoretical, but correspond with a fair degree of accuracy to the results actually obtained in practice.

How can the speed of a [illegible] be increased from about 700 r.p.m. to about 1500 r.p.m.?

Although you have not stated the fact directly, we are led to believe that the single-phase motor mentioned in your query is of the induction type. In order for a four-pole motor to operate at 700 r.p.m. it would be necessary to supply the machine with 25-cycle current. When rewound to make a two-pole motor the speed would reach probably 1400 r.p.m. at full load.

What would be the effect of taking out and turning end for end the squirrel-cage rotor of a three-phase induction motor? S. R. N.

When the rotor of an induction motor is taken from the machine and replaced with its ends interchanged the operation should not be affected in any respect, provided only that all bearings of the machine are symmetrically placed with reference to the center of the rotor. That is to say, the rotor should align accurately with the stator core. Unless this condition obtains there will be a considerable magnetic pull on the rotor, the tendency being for one of the bearings to become overheated.

Kindly give a short, simple method of finding the number of amperes per terminal of a three-phase generator, the kva, e.m.f. and power factor being given. J. R. M.

The number of amperes per terminal of a three-phase generator can be determined directly from the rated kva and the e.m.f. of the machine. The "equivalent single-phase current" of the machine is found by dividing the rated kva by the e.m.f. In a three-phase machine the actual current per lead wire is equal to the equivalent single-phase current divided by a constant having the value 1.732. The power-factor affects the value of the kilowatt, but the value of the kva is not affected in any respect by the power-factor.

Why is it that the electricity in a 600-volt railway motor will oftentimes flash over a distance of several inches from brush holder to motor shell? Under ordinary conditions 600 volts will not flash over 1/32 in. unless an arc is started? [illegible]

Although the distance over which 600 volts under ordinary conditions will cause an arc to be produced is very short, observation shows that this e.m.f. is sufficient to maintain an arc of considerable length after it has once been formed. In an ordinary 600-volt, direct-current railway motor the normal e.m.f. between adjacent segments would obviously be very much less than 600 volts, in fact often less than ten volts. However, there may be produced between adjacent segments an e.m.f. having a value many times as great as normal under conditions which may be considered somewhat unusual. The abnormal e.m.fs. are produced by rapid rate of change of the flux surrounded by the conductors forming the armature coil. If under any condition whatsoever the flux which a coil surrounds is changed rapidly an enormous e.m.f. is produced between the terminals of the coil. Such a rapid rate of change occurs when the circuit is opened quickly by reason of some accident. It is this abnormal e.m.f. which produces the result frequently referred to as a flash-over, which starts as a miniature arc between two adjacent segments, which combines with a similar arc between neighboring segments, and subsequently spreads over the whole commutator, finally reaching the brush holder.

A 2200-volt, three-phase line feeds a bank of three single-phase transformers, and it is desired to deliver 220-volt, three-phase current to a motor circuit and 110 volts, single or polyphase, to lamp circuits from the secondaries of these transformers. Is it possible or practicable to delta-connect the primary and secondary circuits, supplying the 220-volt, three-phase current to the motor from this connection and also supplying 220-110 volts to the lamp circuits with the wire that corresponds to the neutral of a three-wire, direct-current grounded system? Y. H. C.

It is not possible to ground a three-phase system, such as you describe, at more than one point without causing destructive currents between the phases. However, it is entirely unnecessary to ground the system at more than one point. If your three-phase system is grounded by earthing the neutral point of one of your three-wire systems, then the two outer wires of these three-phase systems will be at a potential of 110 volts above ground and the two neutral points of the other two three-wire systems will be at the same potential above ground. The only wire of the whole system that will be at a higher potential will be the outer three-phase main lead, which will be at a potential of 190 volts above ground.

I have a 20-hp, 500-volt, direct-current, four-pole, four-brush motor which was recently changed to work on a 250-volt circuit, by paralleling the field coils and the armature coils. The armature has 97 bars and the connections were from 1 to 49. On changing the winding the armature leads next each other were looped so that instead of two circuits going through the armature there were four. The brushes were increased in size from 3/8 in. thick to 5/8 in. thick, the width and height remaining the same. The connections at the commutator melt, however, after the machine has been in operation about 10 or 12 hours, although the motor is not located in a warm place and receives good attention. The load on the machine is about 55 amp. at most; the brushes show no sign of pitting and cover about 2½ commutator bars. Any information on the cause of the trouble will be appreciated. C. F. K.

From the data given we are led to believe that your 20-hp, 500-volt motor which has 97 bars on the commutator has 49 slots on the armature. Motors of this type are ordinarily provided with armature windings having two coils per slot, and when used at 250 volts the coils in each individual slot are connected in parallel, thereby making a 49-coil machine. This machine is provided with a 49-segment commutator, and is connected with a throw of 1 to 25. When this same machine is to be used on 500 volts the commutator is changed to one having 97 bars, and the armature coils are connected in series, one coil in one of the slots being disconnected entirely from the circuits; the leads in this coil are cut off short and thoroughly insulated from contact with any metallic parts. We believe that your machine is of this type, and hence when connected for 250 volts should have a 49-segment commutator instead of a 97-segment commutator; in each case the armature would be connected according to the two-circuit arrangement. You have evidently reconnected the machine to give what may be called a parallel arrangement instead of a series arrangement, and if the connections are properly made and the machine is magnetically in good balance, the only effect to be noticed would be an extra amount of heating at the commutator. However, we should have predicted that by changing the brushes as you have done the heating would not have been excessive and the machine would give satisfactory performance. We suggest that you examine the machine carefully and ascertain whether or not, by accident, you have connected in parallel coils which at any chosen instant are surrounded by different amounts of flux, so that with the rotation of the armature there is generated in a closed circuit a certain alternating e.m.f. which would produce local heating at the point where these coils are joined together, namely at the commutator. It might be well for us to mention that even if the connections are properly made according to the method which you intended to use, the brush short-circuits a considerable number of segments, and by this means produces quite an amount of local heating at the point of connection between the armature leads and the commutator segments.

Central Station
Management, Policies and Commercial Methods

LICENSING ELECTRICIANS AT PUEBLO, COL.

The City Council of Pueblo, Col., has enacted an ordinance creating a city electrician and making specific stipulations regarding electric wiring and those engaged in performing wiring work. The city electrician has the usual powers allotted to him and is governed in his rules and decisions by the *National Electrical Code*. All persons, firms or corporations other than public telephone, telegraph and messenger call companies before installing, repairing or operating any wiring or apparatus within the corporate limits, excepting central power stations and substations belonging to electric light and railway companies, must first procure a license. Three grades are provided: Grade A grants the holder the right to install and repair electric wiring or apparatus, and a fee of $50 is charged for the license; grade B entitles the holder to attend to the maintenance and operation of electric wiring and apparatus in any single generating plant under one management, and the fee for the license is $15; grade C grants the owner the right to operate moving-picture machines and theater switchboards and costs $5. In addition bonds of $1,000, $500 and $500 are required of each licensee under the respective grades designated. Iron conduit is specified for all interior wiring within the inner fire district and for all wiring in public mercantile and factory buildings in the outer and urban districts. Except in the case of private residences all main-line switches and cut-outs must be installed on the outside of the building. The feed wires where practicable must enter the rear of the building and one main-line switch and cut-out must control all the wires of the same voltage in any one building for each 25 ft. of frontage. A failure to comply with the ordinance subjects the offender to a fine of not more than $100 or less than $5.

CENTRAL-STATION ADVERTISING.

The Metropolitan Electric Company, of Reading, Pa., believes in the efficacy of advertising, and during the year has brought out a number of cleverly devised advertisements. The

Window and Interior Display of Metropolitan Electric Company.

mediums employed are the backs of monthly bills, mountain railways and folders, in addition to the city directory and *Financial Bulletin*. In its flatiron campaign the poster in the cars leading up the mountain to pleasure resorts bore the catch line "A family is known by the flatiron it keeps." In letters to customers the same catch line was employed with the following addition: "Let us make you a known quantity by selling you an electric flatiron." In its flatiron campaign the Metropolitan Electric Company placed the irons out on a fifteen-day trial with the proviso that those who wished could purchase the iron for $4. A leaflet pointing out the merits of the electric flatiron was illustrated with an engraving showing a Chinese laundryman employing one, underneath which was the caption "Electric flatirons save soles. Note the Celestial smile."

The advertisement in the city directory is devoted to pointing out the merits of electricity in the home and is illustrated with a dining-room cartoon; while the advertisement in the *Financial Bulletin* calls attention to electric signs and is illustrated by an engraving of a national bank sign. A very neat calendar inviting the recipient to live the electric life because it is cheap, clean and convenient is issued by the company. On the back of the company's monthly bills is printed an illustrated story on some convenient electrical household device, such as a luminous radiator, a heating pad, a shaving cup, a cigar lighter, etc.

The company invites its patrons to visit its showroom, where a liberal education in things electrical may be obtained. The showroom is artistically arranged with electrical apparatus and a very attractive effect is given to the display by the white pergola which extends the length of the room. This was made of a wooden frame covered with white cloth and painted. Ferns and other decorations were used to add to the attractiveness of the setting.

INTERVALS FOR TESTING WATT-HOUR METERS.

By John Gilmartin.

When considering methods of maintaining the accuracy of residence meters the selection of the proper test interval is one of the most important problems the meter department has to solve. For the purpose of discussion it may be stated that the problem may be approached from two viewpoints which may be called the ethical and the economic, and reasoning from the same data the desirable interval may vary according to the point of view.

From the ethical viewpoint it would be held that it is the company's duty to know that its customers' meters are accurate within reasonable commercial limits and most especially that they do not run fast. On the other hand is the fact that the average electric meter in service to-day tends gradually to become slow in time, and, therefore, from the economic viewpoint, it is profitable for the company to calibrate its meters periodically. Further consideration shows that in certain respects the ethical and economic viewpoints are identical. For instance, if a company allows its meters to become slow it not only wrongs itself, economically speaking, but it fails in its duty to its consumers because, as has been pointed out elsewhere, if some consumers' meters are correct and others are slow, the consumers with the correct meters are in effect being discriminated against, as they are paying a higher rate per kw-hour than their neighbors who have nominally the same rate but whose meters are slow.

On the other hand, if the meters should be generally fast, the company would not only be failing in its duty, ethically speaking, but in the long run it would suffer financial loss because there would be a bad effect on the business if it became known that the company allowed its meters to become fast, and it might hinder the extension of its business even if not known. If it is granted that the average meter becomes slow as time goes on, from the economic viewpoint, then, the theoretically correct test interval would be that which would result in the lowest annual sum of the two items, value of lost energy and testing expense. That is, it is proper to shorten the test interval up to the point where any further increase in

revenue due to higher meter accuracy will be more than offset by the amount expended in making the tests and adjustments. To determine that point intelligently the meter department must know the following: (1) The cost to test and adjust each type of meter in the various classes of service. (2) How the meter accuracy falls off as time goes on. (3) How to apply the meter accuracy curve to the income from each class of consumers and estimate the amount of revenue lost.

Cost to Test.—This item may be definitely ascertained and is usually known offhand. For residence service 45 cents per test is here assumed as being a fair value. It covers labor and a few minor items of expense. The largest item for material is probably jewels, but it is not believed the omission of material from the calculations would have any effect worth noting on the comparisons. Induction meters can undoubtedly be tested and adjusted somewhat more cheaply than can the commutator type, but the difference is not great and for the present purpose the two are assumed equal. Tests are assumed to be made on the consumer's premises.

Meter Accuracy.—The rate at which the accuracy of a given type of meter falls off can only be known from results secured in actual service. In general the accuracy secured varies between different types, the induction type being superior to the commutator; sometimes results vary between different styles of the same type, or with local conditions, or with the type of bearing and several other items that are quite well known. It is therefore desirable, in giving results secured, to state the meter type, etc. The curves in Fig. 1 show average results of a large number of tests made in actual service. They apply to commutator meters of about the average type now in service, not the very old types nor the very latest, and are for meters having sapphire jewel bearings. The results in Fig. 2 for induction meters were secured similarly to the above and are for a good type of meter. They may be taken as representative of the better types of induction meters now in service, the jewels being sapphire and the shaft ends medium sharp.

When a meter is found to be slow there is a question as to how long it has been in this condition. If a meter is found

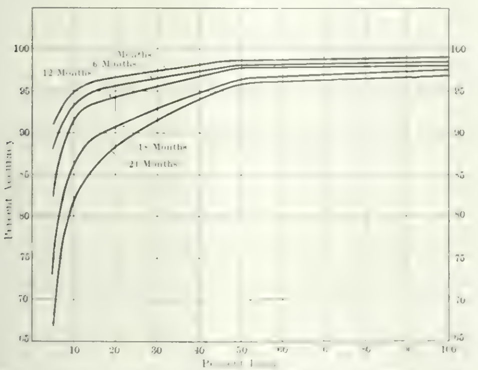


Fig. 1—Curves Showing Increase in Error with Time. Commutator Meters of Medium Old Type. Sapphire Jewels.

10 per cent slow after a year of service it would not be proper to divide the year's kw-hours by 0.90 to find the correct kw-hours because the meter may have gradually become slow. The curves of Figs. 1 and 2 indicate that the average meter slows up at a fairly even rate and in calculating the lost revenue for the various test intervals it is so assumed. For instance, for the twelve-month interval it is assumed that the six-month curve represents the average accuracy for the twelve months.

Lost Revenue.—The amount of revenue lost through slow meters is, as a rule, difficult to determine. In the case of an alternating-current system a meter may sometimes be installed in the primary circuit and its kw-hour reading compared with the sum of the kw-hours of the consumers' meters on that circuit. All of the meters on the circuit can then be tested and adjusted and a new comparison made. If the circuit has not been altered between comparisons the two comparisons should show the approximate loss due to slow meters. This method is complicated by the presence of line and other losses which may exceed and tend to mask the energy loss due to slow meters. As the primary circuits in large systems are frequently interconnected, and direct-current circuits almost invariably so, it is frequently impossible to make the comparisons. Because of the above and other practical difficulties this method is not frequently employed.

The usual method is to test the meters and by applying the necessary correction, as shown by the tests, to the registration of the meter the lost revenue can be calculated. The principal difficulty in using this plan is due to the well-known shape of the meter calibration curve when friction is present in the meter. (See Figs. 1 and 2.) As the meter error varies with

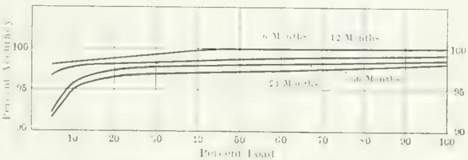


Fig. 2—Curves Showing Increase in Error with Time. Induction Meters of Good Type. Sapphire Jewels.

the load, it is necessary to know at what per cent of full load the meter is working before the percentage error can be stated and the lost revenue due to a slow meter be calculated. Usually the load on a meter varies considerably during each twenty-four hours, and it is therefore necessary to estimate the average error in order to calculate lost revenue. In order to do this it is necessary to know the shape of the consumer's load curve.

Residence Service.—A good approximation for the average accuracy of meters in residence service is the rule of the Public Service Commission of the First District, New York,

TABLE I.—PER CENT OF TOTAL REGISTRATION RECORDED AT VARIOUS PER CENT OF METER RATING.

Per cent meter rating	5	10	15	20	25	35	50	60 and above
Per cent total registration	9.4	8.5	9.2	10.5	12.2	15.7	14.3	20.2

which assumes that one-fourth of the connected load is the normal load and in calculating the average error the normal load error is multiplied by three and added to the one-tenth and the full-load error and the result divided by five. Table I gives the registration at various per cents of the meter rating as taken from a considerable number of tests on residence

TABLE II.—METHOD OF CALCULATING ERRORS.

Per Cent of Registration and Per Cent Error	Product
9.4x27	254
8.5x14	119
9.2x10.5	100
10.5x9.2	96.5
12.2x8	97.6
15.7x6	94
14.3x3.7	52.8
20.2x3	60.6
Totals .. 100	874.5

Average error 8.74

service. Table II shows the method of calculating the average accuracy when using the results of Table I and the meter performance curves in Figs. 1 and 2. Table II is based on the three-year interval, using the eighteen-month curve for showing the average percentage error over the total three-year interval.

The values in Table I and the curves of Figs. 1 and 2 are used in making up Table III. For a given per cent slow the lost revenue depends on the annual income from the meter, and therefore in considering residence service it is necessary to know the income from the average consumer

The average income from residence consumers is usually estimated at between $20 and $30 per year. After examining the accounts of a considerable number of residence consumers it seemed that for the purpose of this article they could be classified into small, medium and large consumers. The average annual income of a number of small consumers was found to be $16.66, and probably a considerable percentage of the residence consumers in every city fall in this class. The medium consumer is another fairly large class and a number of these were found to average $20.50. From $30 and up the number of consumers is smaller than the other two classes, but still quite numerous, and for the present purpose values of $35 and $50 have been assumed. The four values of income here mentioned cover a wide range in residence service and are used in Table III as the basis on which to determine the lost revenue. The form of rate may in some cases have an effect on the loss due to a slow meter. The usual rates for residence service are either a straight energy charge, usually between 8 cents and 12 cents per kw-hour, or some form of the primary and secondary rates, such as 16 cents per kw-hour for a certain number of units and 5 cents for the remainder. A minimum charge is used with each of the rate systems, but the writer believes the minimum is somewhat lower with the primary and secondary system. A form of rate seldom or never used in residence service is a fixed charge per month per kilowatt of demand plus a small energy charge, usually from 1 cent to 2 cents per kw-hour.

Under this form of contract the kw-hour charge is sometimes a small part of the total bill, and the effect of a slow meter extends only to the kw-hour part of the bill, and should not be applied on the whole bill. The minimum charge is another item to be considered, as there are several months in the year when the kw-hours used by the average residence are well below the minimum and the meter error has no effect on the revenue, and therefore the money received for such months should be deducted from the total annual revenue when considering the loss due to slow meters. The accounts showed that 28 per cent of the revenue from the small consumers was from the minimum charge and therefore could not be affected by the meter error, and hence this is deducted from the total revenue as shown in Table III. For the medium customers the value was 15 per cent, while for the $35 and $50 consumers an arbitrary deduction was made as shown in Table III.

[illegible] LOST REVENUE. RESIDENCE SERVICE.

COMMUTATOR METERS.

[illegible] Gross Revenue Received	[illegible] Revenue Above Min. Charge	[illegible]					Annual Lost Revenue Due to Slow Meters plus Annual Testing Expense for Test Intervals as Below					Proper Test Interval
		[illegible]	9 Months	[illegible]	2 Years	[illegible]	[illegible]	[illegible]	1 Year	2 Years	3 Years	
$16 66	$12 00	[illegible]	$0 39	$0 44	$0 67	$1.05	[illegible]	$0.99	$0.89	$0.90	$1.20	1 Year
20.50	17 50	.53	57	64	98	1.53	1 43	1.17	1.09	1.21	1.68	1 Year
35 00	32 00	.96	[illegible]	1 16	1 80	2 80	1.86	1 64	1.61	2 02	2.95	[illegible] Months
50.00	45 00	1.35	1 46	1 63	2 52	3 93	2 25	2.06	2 08	2.74	4.08	[illegible] Months
Average	[illegible]	[illegible]	3.25	3.63	5 62	[illegible]						

INDUCTION METERS.

			[illegible] Years				[illegible] Year					
16.66	12.00		.36	09	.23	.30	.47		.54	.46	.45	2 Years
20.50	17.50		.52	.13	.33	.44	.63		.58	.56	.59	2 Years
35.00	32 00		.95	.24	.60	.80	1.06		.69	.83	.95	1 Year
50 00	45.00		1.34	.34	85	1.12	1.45		.79	1.07	1.27	1 Year
[illegible]	[illegible]		2.98	.75	[illegible]	[illegible]						

The average percentage error being taken as one-fifth of the [illegible] of three times the one-fourth load error plus the one-tenth load error plus the full load error, for commutator meters the errors for six-month, [illegible]-month, one-year, two-year and three-year intervals are 3.0, 3.2, 3.42, 5.2 and 8.2 per cent. respectively; for induction meters the errors for one-[illegible] two-year, three-year and four-year intervals are 1.0, 1.92, 2.34 and 2.7 per cent. respectively.

SUMMARY.

Table III gives the desirable test intervals based on the methods and data discussed in this article. It is not pretended that the values given are rigidly applicable to any meter system, because local conditions may alter the conclusions. For instance, the latest and best types of meters will give better results than those shown in Figs. 1 and 2, or the use of diamond jewels would improve the results shown in Fig. 1, etc. It is believed, however, that, under the limitations given in connection with the data and figures, they will be found very closely correct.

The ratio of meter rating to connected load is assumed at from 0.9 to 1.0 and where this ratio is greater the results here given would be affected. There is not much choice between several desirable test-intervals in some of the cases in Table II, but other conditions being equal the shorter test-interval is the better. It must be borne in mind that the curves in Figs. 1 and 2 are averages of all meters, fast and slow, and therefore some meters are considerably faster and some considerably slower than the average shown by the curves.

The more frequent test-interval would lessen the variation from the average, and therefore, other things being at all equal, it is the most desirable from the ethical viewpoint. Considering inspection and energy theft the more frequent test-interval is also found to be the better.

MOTOR LOAD OF MASSACHUSETTS CENTRAL STATIONS.

By Walter Stuart Kelley.

The object of the statistics employed in this article is to discover tendencies from which laws of development may be deduced. The results in individual cases are interesting, but not conclusive, and only by massing data are the results of general value. Too much dependence should not be placed on individual results obtained by a process of averaging. Here, again, tendencies will be shown; the results will be correct relatively, but may not be exact for any individual case. For instance, the ihp values given in Tables III and IV are derived from the brake hp cost at the motor pulley times the combined efficiencies of the various processes from motor pulley to engine cylinders. The efficiencies taken are intended to average the conditions met with as to motor losses, transmission losses, generator and switchboard losses and engine losses. These may not be exactly reproduced in any individual case, yet applied to a large number of cases the tendency with respect to other factors involved will be accurately shown. They will vary somewhat for each individual motor drive, but a person in position to know the local values in any particular instance may arrive at accurate results, if such local values are utilized by the method outlined.

In what is shown here management is perhaps the chief factor. The endeavor has been to differentiate results so as to show what other factors have influence and to indicate the relative value of such influence. The results should afford a corrective in many cases, but here, as elsewhere, a little knowledge is a dangerous thing. The best experience and judgment along the line of power-service development should

be used. Central-station managers should not hesitate to go outside their own ranks to secure it temporarily if they wish to make the most of the situation.

Massachusetts central stations have not been taken because they are in any way different from others, but because they are representative. As a rule, they carry considerable motor load, and the data required are available. The presentation is mainly tabulated data under different groupings. It will be observed that most of the data used are not to be found

TABLE I.—MOTOR DATA ON MASSACHUSETTS STATIONS.

Cities	Motors H.P.	Motors No.	Kw-Hours Sold	Receipts
Newburyport..	[illegible]	[illegible]	427,500	$11,628 12
Marlboro......	[illegible]	[illegible]	516,667	14,259.44
Beverly.	[illegible]	41	121,241	6,854.40
Northampton.	[illegible]	246	134,987	6,330.33
North Adams.	1424	201	[illegible]	21,956.21
Waltham..	[illegible]	152	191,617	18,000.00
Pittsfield...	1405	[illegible]	591,651	22,965.70
Gloucester.	[illegible]	[illegible]	85,296	10,051 56
Quincy....	775	42	248,537	19,766.88
Fitchburg..	2768½	[illegible]	2,316,561	50,152.04
Chelsea......	[illegible]	[illegible]	335,454	16,507.29
Salem......	[illegible]	[illegible]	731,113	24,132.78
Haverhill....	2055 8/10	[illegible]	[illegible]	44,097.01
Charlestown..	743	166	197,450	12,305.21
Newton	[illegible]	168	198,606	13,102.42
Brockton....	[illegible]	[illegible]	1.247.979	44,052.97
Lynn	3863	629	2,977,674	70,918.59
New Bedford	[illegible]	[illegible]	265,256	15,520.69
Springfield	6428	767	[illegible]	97,778.85
Lawrence	[illegible]	556	850,000	34,622.09
Cambridge.	[illegible]	[illegible]	2,514,122	72,573.46
Lowell	5306¼	[illegible]	4,705,934	124,120.79
Malden.....	[illegible]	[illegible]	881,109	37,723.98
Fall River.	958	[illegible]	648,234	33,375.15
Worcester..	1959	[illegible]	916,642	53,915.96
Chicopee (municipal).....	96¾	12	No return	2,560.90
Taunton (municipal).....	1148	[illegible]	476,917	17,991.10
Holyoke (municipal)....	3667¼	[illegible]	3,309,853	60,431.89

directly in published reports of central stations. The data used are mostly derived from those published from several different sources.

Tables I and II give data taken directly from the reports filed with the Massachusetts Gas and Electric Light Commis-

TABLE II.—MOTOR DATA ON MASSACHUSETTS STATIONS.

Towns	Motors HP.	Motors No.	Kw-Hours Sold	Receipts
Greenfield....	1350	[illegible]	671,679	$18,047.83
Uxbridge	[illegible]	[illegible]	41,617	1,790.07
Weymouth	252	[illegible]	23,395	6,888.56
Ware..................	[illegible]	[illegible]	619	81 06
Gardner	483	[illegible]	233,827	7,050.99
Adams	123	[illegible]	24,534	1,214 65
Abington and Rockland	478	[illegible]	417,043	15,802.85
Attleboro	1636½	[illegible]	1,170,568	33,452.54
Plymouth.............	563	[illegible]	295,158	13,143.01
Milford	[illegible]	[illegible]	27,359	2,545 78
Hyde Park	[illegible]	[illegible]	25,379	2,565 78
Clinton	[illegible]	[illegible]	50,508	2,210.06
Leominster	577½	[illegible]	471,602	20,052.57
Revere...............	650⅓	[illegible]	55.800	5.150.61
Webster	206	[illegible]	141.764	[illegible]
Danvers (municipal)...	[illegible]	[illegible]	173,296	6,931 85
Peabody (municipal)...	[illegible]	[illegible]	19,227	2,164 71
Westfield (municipal)	[illegible]	[illegible]	247,700	6,102.55

sion for the year ending June 30, 1909; the first gives cities, the second towns, and the lower limit of population is about 10,000. Each table lists municipal plants by themselves. So far as possible, desk and ceiling fans of 1/10 hp and less have been excluded, although in some cases it has not been possible to learn whether such motors were included in the report or not. The reason for excluding them is that they belong to lighting service and very rarely is any income from this source included in receipts from motor service; hence, as the kw-hours and the income are not included in such reports, it would not be just to include the number and horse-power of the fans. It is positively known that such motors are excluded from 18 of the 44 reports used.

Aside from errors of bookkeeping to which the data in all four columns in Tables I and II are equally liable, the column headed "Kw-Hours Sold" is most liable to misrepresent the actual condition, as a few stations still sell energy for motors partly by contract, and while the income is correctly reported the kw-hours for such contract energy may not appear in that column. Where stations have a combined rate for lamp and motor circuits or take special contracts for lamps and motors at a single meter rate the latter element, unless estimated, is not likely to appear in either of the last two columns. While the presence of these sources of error is annoying to the investigator, the errors will be in some measure eliminated in the analysis that follows, and in any event, though having some influence on individual results, they will not seriously affect general conclusions.

The Edison Electric Illuminating Company of Boston is not included in the list of companies because it is impossible to distinguish between Boston and the twenty-five or more towns and villages covered by its lines, and combined contracts prevail to such an extent as to make the reported data valueless for the purpose in view.

Tables III and IV give, in addition to population, many other data derived in part from Tables I and II, and the order of presentation is based on population. The population given is not always that of the city itself. Central stations in some cities cover a considerable suburban population. To put all cities as nearly as possible on the same basis one-half of suburban population served has been added to the city population.

Column 4 gives the ratio of energy sold for motors to the combined energy sold for lamps and motors. For the purpose of this consideration all energy sold to other central stations and to street railways has been eliminated; this applies to all the data considered.

Column 5 gives the ratio of income from energy sold for motors to the total income from energy sold, and affords with column 4 a good basis for judging relatively the extent and profitableness of the motor load.

At this point it is desirable to determine approximately the relative cost of furnishing service. For this purpose the inventory values and operating costs of six representative central stations have been studied, the cities served having an aggregate population of about 205,000. The items of operating expense are as follows: Station, all items of outgo for operation and maintenance except labor; distribution, all items of outgo for operation and maintenance outside of office and station, except labor; fuel, all the stations included in this list used coal; labor, all except office; management, salaries, office expense, taxes and miscellaneous expense connected with these; depreciation, which represents 5 per cent on station and equipment and 10 per cent on lines, transformers, meters and arc lamps. The six stations average out as follows:

The first section of the table represents the average of the six stations under each item for combined service. The values in the last two columns are the estimated proportionate values on the same output for each of the two kinds of service. It will be noted that the ratio of one to the other is 1.94; therefore on this basis a kw-hour of energy for lamps delivered at meter is worth (costs) nearly double a kw-hour of energy used for motors. This value may be safely taken as, under ordinary conditions, between 1.8 and 2.

Referring again to Table IV, the items in column 5 should be approximately one-half the value of the items in column 4 if the two services are equally profitable. If the ratio is much less than 2, the power is charged relatively more than the lighting; if the ratio is more than 2, either the energy rate for motors is too low or the energy rate for lamps is too high. Exceptional local conditions will, of course, modify this relation of the two kinds of service.

Column 6 gives the total energy returned divided by the working hours for a year. This will in any given case be cut down by the amount of energy delivered outside of the hours

of the regular working day; 2800 hours have been taken as a fair average for the year. The great bulk of the energy is used within this period, which represents actually 9.12 hours per day for 307 days.

Column 7 gives the aggregate brake hp of motors corresponding to the continuous watts used as per column 6. The brake hp is found by taking a fair average working

of course, errors of bookkeeping. The majority are undoubtedly substantially correct. Naturally, one expects to find the average price as shown in this column within the maximum and minimum rates. The rate, however, does not always govern the results, for where most customers use a single motor on an intermittent load the minimum charge may become the determining factor and cause the average rate to be high.

TABLE III.—DATA OF MASSACHUSETTS STATIONS, CITIES.

[illegible]	Population (est.)	Population [illegible]	HP. per Motor	Ratios: Kw-Hour	Ratios: Income	Continuous Load: Watts	Continuous Load: HP.	Motor Load Factor	Cents per Kw Hour	HP Costs: Motor Pulley	HP Costs: I.H.P.	Transmission Efficiency
[illegible]	[illegible]	[illegible]	6.49	55.37	26.01	129,418	133.3	[illegible]	3.20	$87.23	$51.03	58.50
[illegible] ...	16,450	16	6.05	[illegible]	21.05	184,524	189.0	18.4	2.75	75.44	43.90	58.20
[illegible]	[illegible]	58.5	7.22	11.52	7.95	[illegible]	44.9	15.2	5.65	152.66	90.01	58.96
[illegible] ...	20,705	54.6	1.54	15.04	8.34	48,195	45.9	12.0	4.68	137.91	74.58	54.08
[illegible]	[illegible]	16.9	7.08	56.24	20.94	261,368	270.8	19.0	3.00	81.06	47.74	58.88
[illegible] ...	27,600	78.9	2.30	24.14	21.35	68,434	66.2	[illegible]	[illegible]	271.90	149.33	54.92
[illegible]	[illegible]	19.8	7.20	24.47	18.19	211,304	219.2	15.6	3.88	[illegible]	61.77	58.96
[illegible]	30,458	45	6.52	11.53	11.45	30,463	31.4	4.5	11.78	320.11	187.26	58.50
[illegible]	[illegible]	39.3	18.45	26.36	18.66	88,763	[illegible]	12.7	7.95	201.43	126.90	63.00
[illegible] ...	34,670	12.5	5.51	61.18	37.07	[illegible]	841.6	30.4	2.16	59.59	34.45	57.82
[illegible] ...	37,289	43.6	9.82	36.68	22.76	119,805	127.2	14.9	4.92	129.77	78.32	60.33
[illegible] ...	38,380	17.2	7.19	32.52	14.22	261,112	270.9	12.1	3.30	89.08	52.52	58.96
[illegible]	38,400	18.7	5.48	59.38	29.05	608,189	[illegible]	30	2.58	[illegible]	41.22	57.82
[illegible]	40,452	54.4	4.48	[illegible]	16.63	70,500	70.7	9.5	6.23	174.05	99.17	56.98
[illegible]	51,400	106.2	2.88	12.00	9.15	70,894	69.3	14.1	6.59	189.07	105.04	55.53
[illegible]	56,323	26	7.02	35.73	19.26	445,707	461.4	21.2	3.52	95.48	56.16	58.81
[illegible]	[illegible]	21.2	6.14	45.69	20.34	1,063,455	1090.7	28.3	2.38	65.02	37.89	58.27
[illegible]	82,464	113.2	3.75	14.96	9.84	[illegible]	94.0	12.9	[illegible]	165.11	93.07	56.37
[illegible]	84,348	13.1	8.38	32.28	19.69	1,397,157	1467.6	22.9	2.49	66.26	39.51	59.65
[illegible]	87,995	38.3	4.13	25.63	15.31	303,566	303.6	13.2	[illegible]	114.04	70.39	56.75
[illegible]	[illegible]	23.4	7.56	45.83	23.39	897,901	934.3	21.5	2.88	77.68	45.93	59.11
[illegible] ...	106,248	20	10.69	60.70	35.63	1,680,691	1795.6	33.8	2.63	69.12	41.97	60.71
[illegible] ...	109,200	62.3	5.63	24.82	13.88	314,682	320.8	12.6	4.28	117.62	68.10	57.89
[illegible] ...	109,463	114.3	2.33	20.29	14.56	231,513	223.9	23.4	5.14	149.06	81.55	54.93
[illegible] ...	137,632	70.2	4.84	18.78	15.41	327,158	329.8	16.8	5.88	163.48	93.68	57.28
[illegible]	[illegible]	223.2	8.06	....	10.9							
[illegible]	32,600	27.5	11.04	24.82	32.64	170,328	182.4	15.9	3.772	98.63	60.03	60.86
[illegible]		14.7	12.06	54.01	36.50	1,182,090	1274.0	34.7	1.826	47.43	29.02	61.24

value for the efficienty of the average-size motor given in column 3. It should be borne in mind that these efficiencies are for the average motor load, not for full load of the size motor given. If anything, these efficiencies are high.

Column 8 gives the ratio of continuous horse-power to the total horse-power in motors connected. It is hardly necessary to add that it is desirable to have this value as high as possible, and that high rates mean a low load factor. It will

This column will, of course, show a high value wherever all energy sold as covered by income is not included in the kw-hour return.

Again, where the station management has been induced to make a specially low rate to take on some large customer, the average price will be less than warranted by the regular price scale.

With competent engineering services furnished to all cus-

TABLE IV.—DATA OF MASSACHUSETTS STATIONS, TOWNS.

[illegible]	Population 1909 (est.)	[illegible] per HP	HP per Motor	Per Cent Power Ratios: Kw-Hour	Per Cent Power Ratios: Income	Continuous Load: Watts	Continuous Load: HP.	Motor Load Factor	Cents per Kw-Hour	HP Costs: Motor Pulley	HP Costs: I H.P.	Transmission Efficiency
Greenfield	9,609	[illegible]	[illegible]	57.51	28.26	329,885	243.5	18.0	2.68	$74.12	$42.72	57.66
Uxbridge..	11,810	128.00	[illegible]	17.45	6.49	11,292	11.4	12.3	4.30	157.00	90.29	57.51
Gardner ..	13,093	27.1	[illegible]	45.52	18.90	83,509	88.0	18.2	3.01	80.12	47.97	59.87
Adams....	13,610	110.6	[illegible]	[illegible]	4.95	8,764	8.8	7.2	4.95	138.02	79.38	57.51
Attleboro	13,970	8.5	[illegible]	[illegible]	39.11	418,053	421.0	25.7	2.85	[illegible]	45.46	57.21
[illegible]	14,018	29.3	[illegible]	59.86	25.93	148,944	152.8	31.9	3.79	103.42	60.27	58.27
Plymouth..............	14,790	26.3	[illegible]	45.39	28.53	105,414	113.6	20.2	4.45	115.70	70.81	61.24
[illegible]	14,810	26.7	[illegible]	11.78	9.95	9,771	9.4	17	9.30	270.83	149.16	55.07
[illegible]	15,526	265.4	[illegible]	[illegible]	[illegible]	9,135	9.4	16.1	10.10	[illegible]	159.69	58.50
Clinton	16,107	206.5	[illegible]	[illegible]	[illegible]	18,053	18.6	22.6	4.37	118.82	70.42	59.26
Leominster.	16,372	28.3	[illegible]	54.15	33.14	168,429	175.6	[illegible]	4.25	114.19	67.67	59.26
[illegible]	18,497	28.4	[illegible]	2.36	3.37	19,929	[illegible]	[illegible]	9.23	245.27	146.67	59.80
Webster ...	30,031	145.8	[illegible]	19.73	5.28	50,630	[illegible]	[illegible]	1.90	97.70	57.23	58.58
Danvers (municipal plant).	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	106.64	63.61	59.65
Peabody (municipal plant).	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	303.73	172.92	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	68.41	39.19	[illegible]

[illegible] load factor [illegible] and [illegible] realize less than 3 cents per kw-hour. With a load factor of 30 the fluctuations in load will be very much less than where the load factor is only 12.

Column 9 gives the price per kw-hour, and is derived from the energy income from motors and the kw-hours sold for the year. If all energy for motors sold is included in the kw-hour return the figures in this column will be correct barring,

tomers to assure the most advantageous use of energy and a proper price scale, every contract will produce its share of profit.

Column 10 gives the average cost per hp-year at motor pulley. These values are obtained from the motor energy income and the continuous motor load. If they favor either side the values are more likely to be a trifle high than low.

Column 11 gives the average price realized per engine ihp.

corresponding to the value per brake hp at motor pulley given in column 10. This includes all costs incident to furnishing electric energy at meter plus whatever profit is realized.

The values given run from $29.02 to $187.26, and it is significant that the lowest value is found in a municipal plant.

TABLE V.—[illegible]

Items	[illegible]		Pr[illegible]	
	[illegible]	Per Cent	Motors Per Cent	Lamps Per Cent
Station	$1[illegible]	10	[illegible]	13
Distribution	[illegible]	[illegible]	[illegible]	22
Fuel	[illegible]	16	11	2[illegible]
Labor	[illegible]	14	[illegible]	18
Management	19,654	20	14	2[illegible]
Depreciation	2[illegible]	2[illegible]	19	[illegible]
Totals	$1[illegible]	100	[illegible]	[illegible]

One is to be censured as much on the score of policy as is the other from the standpoint of profit.

In tables that follow returns that seem in any way abnormal, or give indications of error, have been omitted; likewise all that do not show a continuous motor load of 40 hp. Tables

TABLE VI—[illegible]

Place	Industry Per Cent	Population per HP	HP per Motor	Power Ratio Kw-H	Continuous Motor HP	Motor Load Factor	Cents per Kw-H	Price Realized per IHP
New Bedford	82	[illegible]	[illegible]	14 96	94.0	12.9	[illegible]	$93.07
Plymouth	[illegible]	2[illegible]	[illegible]	45.39	113.6	20.2	[illegible]	70.81
Taunton	39	27 5	[illegible]	24 82	182.4	15.9	[illegible]	60 03
Fall River	[illegible]	114	[illegible]	20 29	223.9	23.4	[illegible]	[illegible]
North Adams	[illegible]	[illegible]	7.08	56.24	270.8	19.0	3.00	[illegible]
Lawrence	81	[illegible]	[illegible]	25 63	303.6	13.2	4.07	70 39
Holyoke	[illegible]	14 [illegible]	12 [illegible]	54 01	1274.0	34.7	1.82	29 02
Lowell	[illegible]	2[illegible]	[illegible]	60 70	1795.6	33.8	2 63	41.97
Average		46 4	[illegible]	[illegible]		2[illegible]	[illegible]	
[illegible]								
Beverly	[illegible]	[illegible]	7 22	[illegible]	[illegible]	[illegible]	[illegible]	$90 01
Danvers		[illegible]	[illegible]	36.04	65.0	27	[illegible]	63 61
Abington		2[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60 27
Marlboro	[illegible]	16	[illegible]	49 68	189 0	[illegible]	2 [illegible]	[illegible]
Salem	[illegible]	[illegible]	[illegible]	32 52	270 9	12 [illegible]		52 52
Brockton	92	2[illegible]	[illegible]	35 72	461 4	21 2	3.52	56.16
Haverhill	[illegible]	[illegible]	[illegible]	59 38	618 7		[illegible]	41 22
Lynn	[illegible]	21 2	[illegible]	45 69	1090 7	28.3	2.38	37 89
Average		28 4	[illegible]	41 30		23	[illegible]	
DIVERSIFIED INDUSTRIES								
Northampton		54 6	[illegible]	15 04	49.5	12	4.68	$74 [illegible]
Newton & Watertown		106 2	2 [illegible]	12 00	[illegible]	14.1	6 59	[illegible] 04
Charlestown		54.4	[illegible]	38 49	70.7	[illegible]	6.23	[illegible] 17
Chelsea		43.6	[illegible]	36 68	127 2	14.9	4.92	[illegible]
Pittsfield		19 [illegible]	7 2[illegible]	24.47	219.2	15 6	3.88	[illegible] 77
Malden		62 [illegible]	[illegible]	24 82	320 8	12.6	4.28	[illegible] 10
Worcester		70 2	[illegible]	18 78	[illegible]	16.8	5.88	[illegible]
Fitchburg		12 5		61 18	[illegible]	30 4	2 16	34 45
Cambridge		23.4	[illegible]	45 83	934 3	21.5	2 88	[illegible] 93
[illegible]		[illegible]	[illegible]	32 28	1467 6	22 9	2 49	[illegible] 50
Average		[illegible]					4 40	

VI and VII, grouping the different stations according to the prominent industry, will be found of interest. The proportion of the different industries given is that found in Statistics of Manufactures (1908), and where the proportion is not given it was not obtainable.

Among those grouped under "Diversified Industries" none, so far as can be found, has any one industry that turns out 33 1/3 per cent in value of the total manufactured product. The other data in Tables VI and VII are from previous tables, the novelty being in the grouping.

The showing in Table VIII is worth careful study and may not accord with preconceived ideas. The group with diversified industries makes the poorest showing of all; this is doubtless [illegible]

to the high price of energy that prevailed, for the three last stations in the "diversified" list, with an average price of 2.5 cents per kw-hour, rank high—among the best as to motor service.

It may be remarked that with one insignificant exception all the factors considered in this table follow in order the range of average price per kw-hour.

Tables IX and X, grouping the straight electric and the gas-electric stations separately, present some interesting compari-

TABLE VII.—CLASSIFICATION BY SPECIALTIES

Place	Specialty Manufacture	Per Cent	Population per HP in Motors	H.P. per Motor	Power Ratio Kw H	Continuous Motor HP	Mot'r Load Factor	Cents per Kw H	Price Realized per IHP
Gardner	Furniture	83	27 1	[illegible]	45 52	88	18 2	3.01	$47.97
Westfield	Whips	37	40.5	[illegible]	32 26	89 2	24.5	2.46	39.19
Leominster	Combs, hairpins, etc.	37.	2[illegible]	7.80	[illegible]	175.6	30.4	4.25	67.67
Greenfield	Tools and machinery		7.1	5 33	28 26	243 5	18	2.68	42 72
Attleboro	Jewelry	[illegible]	8 5	4 70	[illegible]	421.0	25.7	2.85	45.46
Average			22 3	6 32	45.33		23.3	3.05	

sons. The usual opinion that the gas-electric station is not so keen after electric business as the straight electric is disproved in instances, but as a whole there seems to be ground for the opinion. As business getters the gas-electric stations

TABLE VIII.—[illegible]

Manufacture	Population per H.P.	Motor Load Ratio, Kw-Hour	Motor Load Factor	Cents per Kw-Hour
Specialties	22.3	45.33	23.3	[illegible]
Boots, shoes and leather	28.4	41 30	23	[illegible]
Textiles	[illegible]	37.75	21.6	[illegible]
Diversified	[illegible]	[illegible]	1[illegible]	[illegible]

lag 45.2 per cent behind the straight electric on the population basis. The latter have 1 hp in motors connected to 32.5 people, the former 1 hp to 47.2 people, although the group (gas-electric) includes the three stations having the lowest rates The group runs to extremes, for besides having the three

TABLE IX.—STRAIGHT ELECTRIC [illegible]

Place	Population per HP	HP per Motor	Power Ratio Kw H	Continuous Motor HP	Motor Load Factor	Cents per Kw H
Fall River	114.3		[illegible]	[illegible]	[illegible]	[illegible]
Worcester	70.2	[illegible]	18 78	[illegible]	16 8	[illegible]
Malden	62.3	[illegible]	24 82	320 8	12 6	[illegible]
Northampton	54.6	[illegible]	15 04	45 9	12 0	[illegible]
Danvers	40 1	[illegible]	36 04	65.0	27 3	[illegible]
Abington & Rock'd	29 3	[illegible]	59 86	152 8	31 9	
Leominster	28.3	[illegible]	[illegible]	[illegible]	30 4	[illegible]
Taunton	27.5	[illegible]	24 82	182 4	15.9	[illegible]
Gardner	27.1	[illegible]	45 52	88 0	18 2	[illegible]
Plymouth	26 3	[illegible]	45 39	[illegible]	20 2	[illegible]
Brockton	26		[illegible]	[illegible]	21 2	
Cambridge	23 4		[illegible]	934 3	[illegible]	2.86
Lowell	20		60 70			2.63
Pittsfield	19 8		24 47	219 2	15	
[illegible]	[illegible]		59.38	618 7	30	
[illegible]	[illegible]		32 52	270 9	12	
Marlboro	16		49.68	189 0	18 4	[illegible]
[illegible]	[illegible]		32 28	1467 6	22	2.49
Attleboro	8.5		66 48	421 0	25 7	2.85
Greenfield	7 1		57 51	243 5	[illegible]	2 68
Average	32 5		[illegible]			

stations with the lowest rates, it includes the three having the highest rates. This can hardly be considered complimentary [illegible] for the straight electric stations These two items afford the [illegible]

[illegible]

tendency to follow this order, although, as a rule, the low motor load-factors are found with the small sizes, together with a poor population ratio. With the exception of one station there is a consistent grouping of favorable characteristics from 5.33 hp to 7.20 hp, inclusive. This includes all of 5 hp and all of 6 hp. There are here 11 sizes, four in the 5-hp range, three in the 6-hp range and four in the 7-hp range. This seems to be a point worthy some consideration by the management of central stations.

TABLE X.—GAS AND ELECTRIC STATIONS.

Place	Population per HP	HP per Motor	Power Ratio Kw-H	Continuous Motor HP	Motor Load Factor	Cents per Kw-H
[illegible]	[illegible]	[illegible]	[illegible]	94.0	[illegible]	[illegible]
Newton & Watert'n	106.0	[illegible]	[illegible]	69.3	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	44.9	15.2	[illegible]
Charlestown	54.4	[illegible]	[illegible]	70.7	9.5	[illegible]
Chelsea	43.6	[illegible]	[illegible]	127.2	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	32.26	89.2	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	25.63	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	45.69	1090.7	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	56.24	270.8	[illegible]	[illegible]
[illegible]	[illegible]	12.06	54.01	1274.0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	61.18	841.6	30.4	[illegible]
Average	[illegible]	[illegible]			[illegible]	[illegible]

It is very significant that while those stations that have the poorest motor load have the highest rates, those that have the lowest rates do not have the best motor load, either on the basis of population or power ratio.

In Table XII stations are grouped according to (a), the three stations with the poorest business based on population; (b), the three with the best business on the same basis, and (c), the three selling energy for motors at the lowest price.

Schedule (a) simply emphasizes what is apparent from an inspection of the full list in Table XI, that high price is an invariable concomitant of a poor motor business relative to population, and with one exception the power ratio is found to be low with high prices. Contrariwise it is seen from schedule (c) that the best business does not necessarily accompany the lowest prices. Schedule (b), with an average rate 20 per cent higher, shows a better motor load, both with respect to population and proportion to lighting.

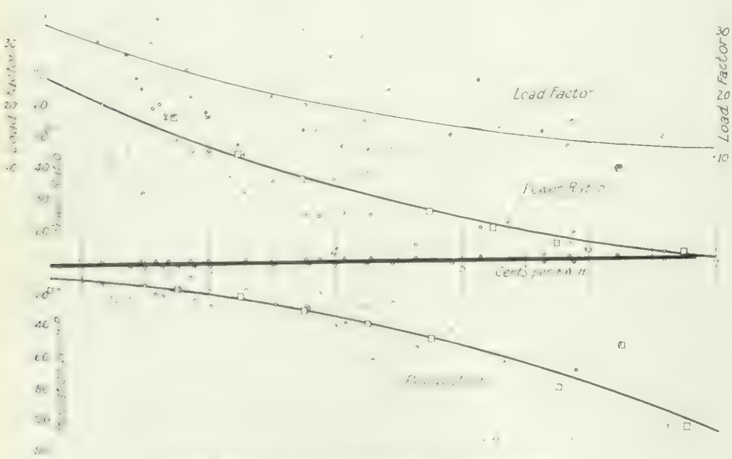
Schedule (b) is representative as to industries. Lowell is mainly textile; Fitchburg textile, paper and machinery; Attleboro, jewelry. Based on this showing, it might be said that a good motor load is one where the population does not exceed 20 to the horse-power, where the ratio of motor kw-hours to combined kw-hours exceeds 60 per cent and where the price realized is not less than 2.5 cents per kw-hour.

A motor load that meets these conditions is good both as regards amount of business and as regards the income derived. Incidentally it may be remarked that a miscellaneous central-station motor load that does not afford an average return of 2.5 cents per kw-hour is not showing the return it should. This price need not be reduced to secure a very much larger load than 1 hp to twenty people, as the schedule in Table XIII shows.

TABLE XI.—STATIONS ARRANGED ACCORDING TO HORSE-POWER OF MOTORS.

Place	Population per HP	HP per Motor	Power Ratios Per Cent Kw-H	Power Ratios Per Cent Inc'me	Continuous Motor HP	Motor Load Factor	Cents per Kw-H	Price Realized per IHP
Northampton	54.6	1.54	15.04	8.34	45.9	12	4.68	$74.78
Fall River	114.3	2.33	20.29	14.56	223.9	23.4	5.14	81.55
Newton & Wat'n	106.2	2.88	12.00	9.15	69.3	14.1	6.59	105.04
New Bedford	113.2	3.75	14.96	9.84	94.0	12.9	5.85	93.07
Lawrence	38.3	4.13	25.63	15.31	303.6	13.2	4.07	70.39
Charlestown	54.4	4.48	38.49	16.68	70.7	9.5	6.23	99.17
Attleboro	8.5	4.70	66.48	39.11	421.0	25.7	2.85	45.46
Westfield	40.5	4.84	32.26	25.10	89.2	24.5	2.46	39.19
Worcester	70.2	4.84	18.78	15.41	329.8	16.8	5.88	93.68
Greenfield	7.1	5.33	57.51	28.26	243.5	18.0	2.68	42.72
Haverhill	18.7	5.48	59.38	29.05	618.7	30.0	2.58	41.22
Fitchburg	12.5	5.51	61.18	37.07	841.6	30.4	2.16	34.45
Malden	62.3	5.63	24.82	13.88	320.8	12.6	4.28	68.10
Marlboro	16	6.05	49.68	21.05	189.0	18.4	2.75	43.90
Abington & Roc'd	29.3	6.13	59.86	25.93	152.8	31.9	3.79	60.27
Lynn	21.2	6.14	45.69	20.34	1090.7	28.3	2.38	37.89
Brockton	26	7.02	35.73	19.26	461.4	21.2	3.52	56.16
North Adams	16.9	7.08	56.24	20.94	270.8	19	3.00	47.74
Salem	17.2	7.19	32.52	14.22	270.9	12.1	3.30	52.52
Pittsfield	19.8	7.20	24.47	18.19	219.2	15.6	3.88	61.77
Beverly	58.5	7.22	11.52	7.95	44.9	15.2	5.65	90.01
Cambridge	23.4	7.56	45.83	23.39	934.3	21.5	2.88	45.93
Leominster	28.3	7.80	54.15	33.14	175.6	30.4	4.25	67.67
Springfield	13.1	8.38	32.28	19.69	1467.6	22.9	2.49	39.50
Danvers	40.1	8.48	36.04	27.29	65.0	27.3	4.00	63.61
Gardner	27.1	8.94	45.52	18.90	88.0	18.2	3.01	47.97
Chelsea	43.6	9.70	36.68	22.76	127.2	14.9	4.92	78.32
Lowell	20	10.69	60.70	35.63	1795.6	33.8	2.63	41.97
Taunton	27.5	11.04	24.82	32.64	182.4	15.9	3.77	60.03
Plymouth	26.3	11.98	45.39	28.53	113.6	20.2	4.45	70.81
Holyoke	14.7	12.06	54.01	36.50	1274.0	34.7	1.82	29.02

Taking the list shown in Table XI, the four most important factors of the data given, population per horse-power, power ratio, motor-load factor and price per kw-hour, seem to follow approximately the same law of variation. This is brought out graphically in the accompanying curves.



Power Service Data, Massachusetts Central Stations.

The basis of the three curves is the price per kw-hour plotted as abscissas on the center line. This has been made heavy, and succeeding values are plotted on opposite sides to avoid confusion where two values are nearly the same. Dotted diamonds on the upper part locate load-factor values for every price per kw-hour. The curve represents a fair average of these, the extremes being load-factor 33.5 for a rate of 1.75 cents to load-factor 12 for a rate of 7 cents. Small circles partly in the same field locate power ratio values for every price. These have been averaged for each half cent of price, as shown by the large squares, and show a fairly regular trend; the curve touches five of the ten squares, the extremes connected being seventy for a price of 1.75 cents to ten for a price of 7 cents.

Below the axis of abscissas small circles locate population values, the half-cent average being again shown by large squares, except where there is but a single value to the half cent. These squares are close to the line, five again being intercepted by it. While the same curve is used as before it is reversed—that is, the end farthest from the axis of abscissas is the same above and below. The curvature of the line is not quite uniform, but seems to increase slightly as it leaves the axis, indicating a parabolic tendency. Attention should be

TABLE XII.—STATIONS GROUPED ACCORDING TO PROFITABLE BUSINESS.

	Place	Population Ratio	Power Ratio	Cents per Kw Hour
(a)	Fall River	114.3	20.29	[illegible]
	New Bedford	[illegible]	[illegible]	[illegible]
	Newton and Watertown	106.0	12.00	[illegible]
	Average	[illegible]	[illegible]	5.865
(b)	Lowell	[illegible]	60.70	2.637
	Fitchburg	[illegible]	61.18	2.163
	Attleboro	[illegible]	66.48	2.858
	Average	[illegible]	[illegible]	[illegible]
	Lynn	[illegible]	45.69	[illegible]
(c)	Holyoke	[illegible]	54.01	[illegible]
	Fitchburg	12	[illegible]	[illegible]
	Average	[illegible]	[illegible]	[illegible]

called to the fact that the most numerous, as well as the most consistent, grouping of values is between 2.5 cents and 3 cents per kw-hour. It should be noted also that both as to power ratio and as to population the best values are within the same range of price.

These curves are not presented as limiting values for central stations to reach, but as the average values of Massachusetts central stations for one year ending June 30, 1909. Doubtless

TABLE XIII.—STATIONS HAVING BEST POPULATION RATIO.

Place	Population Ratio	Power Ratio	Cents per Kw Hour
Fitchburg	12.5	61.18	2.163
Attleboro	8.5	66.48	2.858
Greenfield	7.1	[illegible]	2.686
Average	[illegible]	[illegible]	[illegible]

many of them are doing much better now; some are certainly doing better because they are giving more attention to the matter of engineering for motor customers.

A better showing will certainly be made when more central-station managers appreciate the full significance of these facts: *a*, that motor load is quite a different thing from the lighting business; *b*, that it must be prosecuted along different lines to ensure any considerable measure of success; *c*, that the central station must take measures to assure an economical use of energy by motor users, and, *d*, that every new motor customer located makes some addition to the lighting field. Finally, the motor load is worth cultivating in any way; but it will pay better when cultivated right, not only for its own account, but for its influence in increasing the demand for light.

Wiring and Illumination

SPECIAL STREET LIGHTING IN CHICAGO

The number of special street lighting installations in Chicago, designed to increase the attractiveness of particular localities for the purpose of drawing trade, is constantly increasing. The Commonwealth Edison Company furnishes electrical energy for these lighting equipments, and there are now about 1200 or 1300 posts of this description in the city, supporting about 5000 lamps. [illegible] been adopted, such as is shown in Fig. 1. As illustrated, the post supports four lamps, but sometimes a fifth lamp is added directly on top of the post. Sixty-watt tungsten lamps are usually employed

A recent addition to the list of neighborhoods having this

Fig. 1—Four-Lamp Post.

special street lighting is West Chicago Avenue from Armour Street to the Metropolitan Elevated Railway tracks. The special street lighting extends for a distance of three and a half blocks and the posts are symmetrically arranged so that the appearance of the street at night is especially attractive. This is not universally the case, as it is not always possible to induce all the merchants to join the movement, so that gaps are sometimes left between the posts. One energetic business man on West Chicago Avenue, however, has secured the allegiance of all his friends and neighbors for the distance mentioned. Each merchant or property owner pays for the lights in front of his own premises. There are fifty posts in this

Fig. 2—Special Lighting on West Chicago Avenue.

installation, each supporting four 60-watt lamps. Fig. 2 is a general night view showing the equipment on West Chicago Avenue.

Another installation is on East Thirty-first Street from State Street to Cottage Grove Avenue. Here there are over fifty four-lamp posts. The special street lighting on Halsted Street, [illegible] is being remodeled. The [illegible]

[illegible] where arc lamps were used [illegible]. These 3co-watt direct-current arc lamps are now being superseded by the four-lamp fixtures, such as the ones illustrated.

TUNGSTEN STREET LIGHTING IN BUFFALO.

An initial installation of eighty-five ornamental tungsten posts was put in operation in Buffalo on Sept. 5 at the opening of the Genesee Street Carnival in that city. Early in July the Genesee Street Business Men's Association began making plans for this carnival and raised a subscription of $2,500 for decorative street lighting, which would, of course, be only temporary. When the matter was taken up with the assistant general manager of the Buffalo General Electric Company he suggested that instead of spending this money for temporary lighting decorations the amount should be increased to $4,000 and invested in tungsten posts, which would be distinctively decorative and after the carnival would still remain and continue to attract attention to the street and its merchants. The suggestion was accepted and in the end eighty-five posts were ordered at a cost of $50 per post, the Buffalo General Electric Company agreeing to furnish and install the posts for this price.

Each post holds five 60-watt tungsten lamps, four pendent and one upright. Thirty of these posts are connected to the

Tungsten Lighting in Buffalo.

underground Edison three-wire system, and the rest are temporarily connected to the overhead 60-cycle system, but are arranged for underground connection and will be changed over within the next year, when all wires on this street will be placed underground. The posts rest upon concrete foundations and are located about 120 ft. apart, as far as possible on the lot line and far enough from the curb to be out of the way of wagon hubs. They are made up of a double pressed-steel column with cast-iron top and base. The clusters remain as the permanent lighting for the street, the Buffalo General Electric Company agreeing to furnish energy and maintenance for 4000 hours' burning per annum at a cost of $37.50 per post. This expense will be borne by the city as the new lamps will take the place of the series arc lamps formerly used for street illumination.

ILLUMINATION AS A FACTOR IN MANUFACTURING COSTS.

At the recent meeting of the National Association of Cotton Manufacturers at the Hotel Wentworth, Newcastle, N. H., a paper on "Illumination as a Factor in Manufacturing Costs" [illegible] author pointed out that human skill is in the long run the final test of productive economy, and that ocular perception is the one controlling act upon which the final results of the human mechanism absolutely depend. Illumination is therefore of fundamental importance in relation to intensified production. Compared with the cost of labor and the value of the product turned out the cost of producing artificial light is so insignifi- [illegible]

One cent will pay for the illumination produced for ten hours by two 16-cp carbon lamps, one 80-cp tungsten lamp, one-fifth of an arc lamp or one-fourth of a Cooper-Hewitt lamp. At the rate of $2 wages per day, an operative would have to lose only three minutes to represent a money loss equal to the cost of more light than he would need for an entire ten-hour day. If fixed charges are included on the installation, and maintenance added, the figures can be doubled for the cost of light without any effect on the argument. The question whether to use one-half a watt or two watts per square foot of floor area is superficial unless the efficiency of the human machines is considered.

The general conditions of good illumination are proper intensity, absence of glare and steadiness. The eye can see very comfortably, when it does not have to focus accurately, by an illumination of from 0.25 to 0.50 ft.-candle. This intensity should be provided for passageways, storage-rooms and other places where close eye work is not required. For careful vision on light-colored objects, such as reading print on white paper, writing, etc., from 2.0 to 4.0 ft.-candles is satisfactory. For careful vision on dark colors this intensity should at least be doubled, and where unusually careful vision is required several times this intensity is often used. These figures are based on white light. Glare is the most important single item in artificial illumination. Highly polished surfaces of every description should be avoided where constant eye work is to be done. Streaky illumination, with a bare incandescent lamp and a polished reflector, is nearly as undesirable as unsteadiness of lighting.

Ultra-violet rays, by their intense chemical action, have a destructive effect upon certain tissues of the organs of vision, but no commercial light source at present gives as large a proportion of ultra-violet rays as sunlight. Ordinary lead glass, as used in incandescent bulbs, tubes for mercury-vapor lamps, and the better grade of globes, absorbs nearly all the ultra-violet rays. Most of the troubles attributed to ultra-violet rays are in reality due to direct glare. The mercury-vapor lamp differs from all other sources in leaving out the red rays, which are fatiguing and ineffective in producing vision in proportion to the energy that they contain. The prime essential in textile manufacture is distinctness of vision. The raw materials are made up of exceedingly fine fibers, and in almost the entire process of their treatment the eye must be focused carefully upon objects in which fineness of detail is the chief characteristic. The author pointed out the absence of glare in the mercury-vapor lamp, which requires no diffusing globe and presented the following table of total flux and wattage:

	Watts per Spherical Candle
Carbon incandescent	3.6 to 4.1
[illegible]	[illegible]
Tantalum	2.49 to 2.71
Tungsten	1.68 to 1.83
[illegible]	[illegible]
[illegible]	[illegible]
Flaming arc	0.28 to 0.5
[illegible]	[illegible]

The sawtooth roof construction is now generally utilized for weaving-rooms in modern factories for the reason that it gives the best possible distribution of daylight illumination, producing a uniform intensity over the entire space and still giving a directed light, the effect being perceptibly different from that of a flat skylight. The ideal disposition of artificial light sources is to place them in the angles of such a roof so that they will be out of the direct line of vision of the operatives. In a number of installations where mercury-vapor lamps have been used in textile service it has been found that the product during the hours when artificial light is used is fully equal both in quantity and quality to that produced under the best daylight conditions. The author closed with a discussion of the influence of the subconscious will upon the rate of production, pointing out the importance of good illumination in suggesting progressive application of labor.

WIRING EQUIPMENT FOR MOTOR TESTING.

By [illegible]

It is often desirable to test motors that are already installed in order to ascertain the power required for certain operations or to find whether a larger or smaller one than the one operating will best satisfy the existing conditions. In making such tests usually the most expensive and tedious portion of the work is connecting the measuring instruments into the motor circuit. This is particularly true where the motor is one of large capacity having large conductors. If motors are tested frequently it saves both time and money to arrange portable wiring equipment by means of which testing instruments can be quickly and effectively inserted in the motor circuits.

Fig. 1 shows the application of such a device that has worked out well. With it instruments can be connected into motor circuits without disturbing the permanent wiring. In the engraving a direct-current motor is shown, but the scheme is quite applicable to three-phase motors. Two dummy fuse connectors will be required for three-phase testing, whereas only one is required in direct-current tests. Referring to Fig. 1: Instead of disconnecting one of the leads to the motor in order to cut in the series coils of the wattmeter the connection is arranged at the fusible cut-out. Nearly all motors are protected with a cut-out of this type. One of the fuses is removed from the cut-out and in its stead is inserted a dummy-fuse-connector like that detailed in Fig. 2. The leads to the wattmeter are connected—frequently permanently—to the binding posts of the connector. There is no path directly through the connector because the old fuse, from which it is made, has been taken apart and all portions of the fusible conductor that it contained removed. The circuit to the motor must, therefore, be completed through the wattmeter.

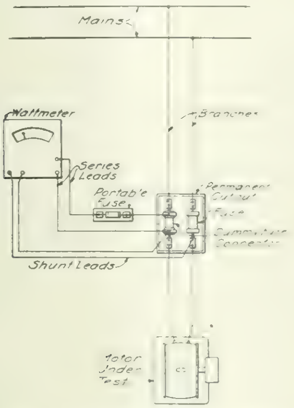


Fig. 1—Connections for Motor Testing.

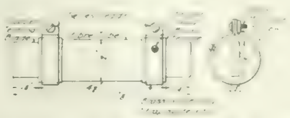


Fig. 2—Connecting Straps on 101-200 Amp. Fuse.

The details of Fig. 2 show how the connector is made. Connecting straps (see Fig. 3) are soldered to the ferrules of what was the fuse. The terminals are arranged by soldering on each connecting strap a nut (see Figs. 2 and 3) into which a brass machine screw turns. Wattmeter leads are either permanently clamped under the heads of the brass machine screws or soldered into lugs of the form shown in Fig. 4. The nut should preferably be of brass, as it can be soldered more easily; but an iron nut will do. In soldering iron the metal must be first filed so that a clean, new surface will be presented and then tinned, using ammonium chloride (sal ammoniac)—in crystalline or powdered form—as a flux, before an attempt is made to solder it to another metal. After the straps are affixed to the ferrules of the old fuse a hole for a small machine screw is drilled and tapped in one of them, as indicated in Fig. 2. This provides means for connecting one of the voltage leads to the wattmeter. Although Fig. 2 only shows a connector for 101-200-amp. National Electrical Code fuse holders, connectors for the other size code holders can be arranged in essentially the same way. All of the directions given on Fig. 3 are general and apply to all sizes of knife-blade contact fuses.

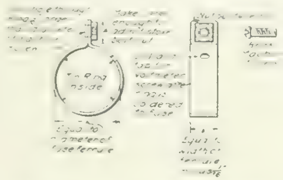


Fig. 3—Details of Connecting Strap.

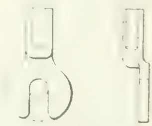


Fig. 4—Lugs for Current Leads.

Where connectors are to be made from ferrule contact fuses—those of capacities under 61 amp—it is best to solder the wattmeter leads directly to the ferrules. Conductors necessary for the relatively small currents involved will be so small that they will not be difficult to handle and there would be no advantage in being able to disconnect them at the ferrules.

The lug shown in Fig. 4, which may be used on the dummy-fuse-connector ends of the wattmeter leads, is made from an ordinary lug by filing out the portion enclosed within the dotted lines in the figure. The advantage of this type of "forked" lug is that it may be inserted under a machine screw head, on the connector, without removing the screw entirely from its hole. Time is thus saved and the possibility of the screw becoming lost is avoided.

Referring again to Fig. 1: A portable fuse is often inserted in the circuit leg that contains the dummy-fuse-connector so that the motor and instruments will be protected while the test is being made. Such a fuse is not always cut in; it is, however, safer to do so.

Provision is made on the connector for the attachment of one voltmeter lead. The other lead can be connected to its side of the circuit by inserting its thin metal terminal lug or its bared end between the fuse knife-blade and the corresponding contact clip.

LETTERS TO THE EDITOR.

Converter Substation Design.

To the Editor of Electrical World:

[illegible] view of the fact that [illegible] in the writer's article on "American Station Practice" in the first issue in August has been observed to be similar to the design of a converter substation developed by the Brooklyn Rapid Transit Company it might be of interest to state that the actual converter station shown in the illustration in question is that of the Boston Elevated Railway Company. The section shown was prepared from a preliminary drawing made under the writer's direction [illegible] of the station [illegible] by the engineers of the Boston Elevated Railway Company as it embodied their ideas [illegible] as those of the writer.

In many respects, however, the general scheme corresponds closely with the stations of the Brooklyn Rapid Transit Company [illegible] converters, transformers and switching

appliances in both stations were supplied by the same manufacturers and are of practically similar types. In most of the stations of the Brooklyn Rapid Transit Company, however, the converters are shunt-wound and provided with starting motors and the transformers are operated from 6600-volt circuits while the converters of the Boston Elevated Railway Company are compound-wound and are started by means of one-third and two-third voltage taps from the step-down transformers, which are operated from 13,200-volt circuits. A careful reading of the description and examination of the cut should convince one that the design is not that of one of the stations of the Brooklyn Rapid Transit Company.

It may be a matter of interest to know the names of the other stations illustrated in the article referred to. Fig. 2 shows the original arrangement of the station of the Union Electric Light & Power Company, of St. Louis; Fig. 3 shows the Williamsburg power house of the Brooklyn Rapid Transit Company, and Fig. 4 shows the Brunots Island power house of the Pittsburgh Railways Company.

Pittsburgh, Pa. STEPHEN Q. HAYES.

Arc vs. Tungsten Lamps for Indirect Illumination.

To the Editor of Electrical World:

SIR:—Referring to your editorial comment in your issue of Sept. 1, 1910, of the *Electrical World*, on the digest of the article by Dr. M. Monash, in the same issue, on "Indirect Illumination with Tungsten Lamps," the writer begs permission to offer further discussion on this subject, particularly on the subject of the units employed in the tests. It will be noted that the comparative test of the relative efficiency between tungsten and arc lamps was made, in the case of both types of lamp, with an arrangement of lighting depending upon a *double reflection*; that is, the light was thrown upon a reflector and redirected from this to the ceiling. The arrangement of lamps and reflectors employed in this test, particularly with reference to the arc lamp, is one that has probably never been put into extensive practice. As already pointed out in the editorial comment on this article, any system of lighting depending for its distribution upon redirection of light from a reflector must be less efficient than the "system in which the greater portion of the light from the lamps passes directly to the ceiling."

In making a comparison of the two systems depending on the redirection of the light to the ceiling from a reflector below the lamp the smaller efficiency of the arc lamp is largely due to three things: First, to the interposition of the relatively large body of the arc lamp between the light and the ceiling; second, to the increased distance of the light from the ceiling, and, lastly, in the case especially of a direct-current arc lamp, to the direction of the light, which is in the main downward.

An examination of more recent developments in indirect lighting will show that in the case of both tungsten and arc lamps the lamps are inverted in position. In the case of a tungsten lamp, the lamp is placed in an upright position in a bowl-shaped reflector, the latter being suspended from the [illegible] center rod, in the form of a chandelier. It is well known that the distribution of light from a tungsten lamp is greatest in a horizontal direction. The efficiency of the tungsten lamp in indirect lighting will, therefore, largely depend upon the proper redirection of the light from the reflector below the lamp, thus involving a considerable loss even with the most carefully designed reflector.

It was shown by Dr. Monash that an open direct-current arc lamp was found to be more economical than the tungsten lamp when the electrodes of the arc lamp were reversed, and this, apparently, with the body of the lamp (which is of considerable bulk) interposed between the light and the ceiling. It may also be assumed that the length of the arc lamp removed the light to a distance from the ceiling beyond that giving the most favorable results.

An inverted arc lamp, on the other hand, has the body of the lamp brought below the arc, giving the appearance of an ordinary arc lamp turned upside down. The arc itself is inverted and the ceiling receives the direct light of the positive carbon, which is more than 85 per cent of the total light. Consequently, there is a very small amount of "double reflection," the greater portion of the light passing directly upward to the ceiling. The value of the lower reflector becomes secondary, and while it serves to redirect the small percentage of light flux that reaches the reflector, its chief purpose will lie in its shielding the eye from the light source.

It will be observed that the horizontal distribution of the light in a tungsten lamp explains the greater efficiency of this lamp in comparison with an arc lamp which has a downward direction of light; but this horizontal distribution also accounts for the greatly decreased efficiency when comparing a tungsten lamp in either upright or downward position with an arc lamp in which the direction of the light is upward—that is, with the arc inverted.

The accumulation of dust on the reflector is one of the most important points in the comparison. Here the advantage is decidedly in favor of the inverted arc lamp, not only because the need of attention at stated intervals is more likely to provide for a periodic cleaning of the reflector, but also because the greater light flux reaches the ceiling direct and the lamp is less dependent upon the reflector than a tungsten lamp would be.

One point, however does not appear to have been brought out in the article. In determining the relative efficiency of the two kinds of lamps the rapid deterioration of the tungsten lamp should not be overlooked. The loss in efficiency due to this deterioration may be safely figured at 25 per cent to 40 per cent during the life of the lamp, and consequently the advantage is again in favor of the arc lamp. Whereas but a very slight decrease in efficiency in an arc lamp follows the accumulation of dust on the reflector and of carbon ash on the enclosing globe, the compulsory attendance required by the lamp in order to re-carbon it insures to a certain degree the cleaning of the inner globe and reflector at stated intervals, while a tungsten installation cannot be considered successful without arranging for the removal of dust accumulated on the bulb and reflector.

Philadelphia, Pa. H. [illegible]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

[illegible] *Parallel Operation of Direct-Current Machines.*—F. PUNGA AND A. NICOLAI.—A discussion of the difficulties of parallel operation of direct-current compound or over-compound machines. The conditions which should be fulfilled for perfect parallel operation are as follows: All machines must have the same characteristic curves, with the volts as ordi- [illegible] The voltage drop produced in the series exciting windings by the passage of full-load current in each machine must be the same. The resistance of the equalizing (compensating) wire connecting the different machines should be as small as possible. A numerical example is added to illustrate the above principles.—*La Lumière Elec.*, Sept. 10.

High-Speed Alternators.—C. F. GUILBERT.—An illustrated discussion of the considerations which govern the design of

the windings of stators of high-speed alternating-current machines. The e.m.f. in volts per turn reaches considerable values, which necessitates special care in the insulation.—*La Lumière Elec.*, Sept. 10.

Constant-Current Direct-Current Generators.—M. OSNOS AND L. MONATH.—A critical reply to the recent paper of Rosenberg, pointing out the differences between the constant-current machines of Osnos and Rosenberg and criticising some conclusions of Rosenberg.—*Elek. Zeit.*, Sept. 15.

Rotary Converters.—E. SCHULZ.—An article illustrated by diagrams on the different methods of regulating the voltage of rotary converters in comparison with motor-generators.—*Elek. Anz.*, Sept. 15.

Voltage Drop of Transformers.—K. FAYE-HANSEN.—The author discusses various methods for determining the voltage drop of transformers and thinks the best method is the direct measurement of vectorial voltage drop at load according to Bragstadt, who connects in parallel the primaries of two identical transformers, of which one is loaded and the other unloaded. The author has used this method for testing some transformers with considerable magnetic stray fluxes and high iron saturation, especially with respect to the charge of stray flux with load. It is recommended to make similar tests with three-phase induction motors with the rotor maintained at rest.—*Elek. u. Mach.* (Vienna), Sept. 11.

Three-Phase Transformers.—K. METZLER.—An article, illustrated by diagrams, giving formulas and numerical tables for determining the dimensions of three-phase transformers.—*Elek. u. Masch.* (Vienna), Aug. 28.

Lamps and Lighting.

Drawn Tungsten Filament.—An illustrated description of a new tungsten lamp ("wotan lamp") of the Siemens & Halske Company, the principal feature of which is the use of a drawn tungsten filament. The lamp and the method of suspension

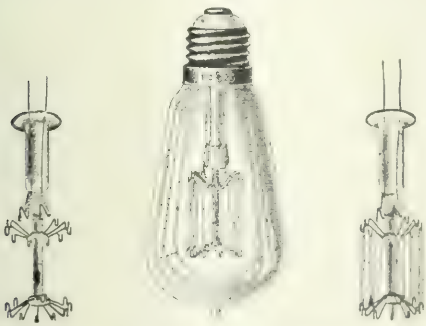


Fig. 1—Drawn Tungsten Filaments.

of the filament are shown [illegible] is 1 watt per hefner candle. A disadvantage of this new tungsten lamp compared with the tantalum lamp is due to the fact that a drawn tungsten filament loses part of its initial elasticity on account of the passage of the current, while the tungsten filament always maintains its original strength. This new lamp is made in small sizes for operation at from 1 volt to 16 volts with dry cells, etc., and, on the other hand, in large sizes for 100 cp, 200 cp and 300 cp. At present 100-cp and 200-cp lamps are chiefly made to compete with small arc lamps.—*Elek. Anz.*, Sept. 15.

Lamp Filament.—A note on a recent British patent (18,954, 1909; Sept. 8, 1910) of H. W. Lake (Parker-Clarke Electric Company of this country). The specification covers a strong filament which can be used at a very high temperature as a lighting or heating body in the open air. A core or filament of carbon is flashed in a vessel containing a mixture of hydrogen and benzol and silicon tetrachloride. The gases are decomposed and the filament is covered with a skin of silicon-dicarbide (SiC_2). Any desired [illegible] Such filaments are said to incandesce in the open air without oxidizing.—Lond. *Elec. Eng'ing*, Sept. 15.

Arc Lamp.—A note on a recent British patent (29,068, 1909; Sept. 8, 1910) of H. Hirst and A. E. Angold (British General Electric Company). This is a flame-arc lamp with two converging flame carbons, one of which rests on another short, hard carbon. The arc is normally struck between the two upper electrodes, but the supporting carbon is slowly consumed by the heat due to the arc, and is fed upward by lever mechanism to keep the arc in the same position. The unsupported electrode is mechanically connected with the supported electrode and feeds down at the same rate by gravity. The specification covers the lever mechanism acting on the supporting or abutment electrode, and operated by side pressure from the electrode holder as the electrode feeds down.—Lond. *Elec. Eng'ing*, Sept. 15.

Generation, Transmission and Distribution.

Power from Wind and Sun.—R. A. FESSENDEN.—To utilize the energy of the wind and the sun for commercial purposes a system of storage must first be provided. The method suggested by the author is storage by gravity. Two reservoirs are constructed one at a considerable height above the other, and water is first pumped up and then allowed to flow down as desired and to actuate a turbine. To facilitate construction the higher reservoir is located on the surface of the earth and the lower reservoir underground in a shaft or mine. The author points out the advantages of water storage over storage batteries. The method of utilizing the power of the wind is very simple. A number of steel rope drives run from each of the small windmills mounted in the frame to the mainshaft, which has its bearings fastened to the frame so that when the frame is turned round to face the wind the mainshaft moves with it. The mainshaft drives the pump, the pump rod being revolvable as the axis is shifted in position. The Pelton wheel drives the generator. The Pelton wheel may also be driven directly by a rope drive from the mainshaft of the windmill, the Pelton wheel being disconnected, or left connected. To utilize solar radiation use is made of a solar tank containing water which is heated until the steam reaches approximately the pressure of the atmosphere. The steam so generated at atmospheric pressure drives a low-pressure steam turbine or a special type of engine. The turbine operates the pump. Some estimates of cost are added, and in a long editorial the scheme is discussed in its general phases.—Lond. *Electrician*, Sept. 16

Utilization of Exhaust Steam.—An illustrated description of the utilization of steam in an iron works in Newport, England. In this station exhaust steam from blast-furnace blowing engines is collected, and after being superheated is passed to exhaust-steam turbines driving alternators which are coupled up on the electrical side of the mains of an electric supply company, which transmits the energy to its consumers throughout the district. The plant consists of two 1250-kw, three-phase, 40-cycle, 6600-volt turbo-alternator sets running at 2400 r.p.m.—Lond. *Elec. Review*, Sept. 16.

Traction.

Future of Electric Traction.—W. E. DAVIS.—A paper read before the Central Electric Railway Association on the destinies of 500-volt direct-current, 1200-volt direct-current and 6600-volt alternating-current motors. The 500-volt direct-current system is firmly entrenched in all the largest centers of population, with every indication of becoming permanent until some revolution of power application arrives. This condition will to a great extent govern the interurban or dependent lines. New and larger railways will be built, demanding higher voltage and less losses, mechanical and electrical, and to this end the higher potential direct-current system with from 1200 volts to 2400 volts seems very favorable. In the big work of the electrification of the trunk lines of the steam railways the single-phase system will find its own. It is noted that the com- [illegible] Lake Shore & South Bend Railway is probably due largely to the fact that the system is entirely alternating current at 6600 volts, with no

[illegible] Sept. 24.

Single-Phase Traction.—An editorial discussion of the decision of the New Haven railroad to adopt the single-phase system on the Hoosac Tunnel division and on its New York, Westchester & Boston line. The most important feature of all the new electrification work of the company is that it will be single-phase without direct-current complication, so that the equipment should be very much simpler and capable of very much better work than even the present equipment on the main line of the New Haven road. This decision not only guarantees an extended application of the single-phase system to trunk-line service, but it indicates that the results with the present system have been so satisfactory as to warrant its extension.—*Elec. Ry. Jour.*, Sept. 24.

Installations, Systems and Appliances.

[illegible] K. Ganza [illegible] author thinks it wrong that a tariff for charging for electrical energy should be devised from the standpoint of the central-station manager. He thinks it should be based on the viewpoint of the consumer. Such a rate should be charged to each consumer that it would not pay him to generate the energy himself. The author gives various tables showing the cost of generating energy. He recommends a maximum rate of 5 cents per kw-hour.—*Elek. u. Masch.* (Vienna), Aug. 21.

Rheostats.—H. Hecke.—An illustrated description of a new form of resistor units for rheostats. Each unit consists of a coil of wire wound on a metallic tube so that the heat is quickly carried away. Water cooling may be employed. The metallic tube is insulated by a thin layer of refractory porcelain enamel. For the resistor use is made of manganin wire, the surface of which is easily covered with a very thin film of oxide which is sufficient for insulation.—*Elek. Anz.*, Sept. 4.

Wires, Wiring and Conduits.

Temperature Coefficients of Electrical Resistances.—A. A. Somerville.—A continuation of his extended researches on the change of electrical resistance with temperature of various materials. The materials tested are aluminum, silver, iron, copper, gold, manganin, constantan, "advance," porcelain, quartz, mica, glass, carbon, "excello," "ia ia," "superior" and magnesium. The temperature range is from 0 deg. C. to 1100 deg. C., or to the melting point of the specimen. With copper the results depend on whether the wire is hard-drawn or how well it is annealed. Modern electrolytic copper behaves differently from the purest copper made twenty-five years ago. The effect of cold drawing and annealing is more noticeable in gold. The results found for the different materials are given in a series of diagrams and tables. Fig. 2 gives the results for copper

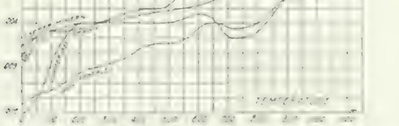


Fig. 2.—Temperature Coefficients of Electrical Resistances.

and gold, the temperature coefficients, that is, the slope of the temperature-resistance curves, being plotted against temperature.—*Phys. Rev.*, September.

Insulation.—A. O. Austin.—A paper read before the Central [illegible] high-tension insulators. The article is illustrated by various diagrams giving the relation between the diameter and surface resistance of insulators and weight and cost curves of pin and suspension insulators.—*Elec. Ry. Jour.*, Sept. 24.

Und[illegible] tension underground mains, referring especially to the methods of laying underground cables, the life and cause of breakdown of underground cables, and the limiting and the test voltages.—Lond. *Elec. Review*, Sept. 16.

Electrophysics and Magnetism.

Laws of Electromechanics.—S. P. Thompson.—A paper presented before the British association giving a concise mathematical statement of the six fundamental laws of electromechanics, namely, the law of the magnetic circuit, the law of induction (Faraday), the law of electric power, the law of work, the law of change of flux, and the law of force.—Lond. *Electrician*, Sept. 16.

Radium.—Mme. P. Curie and A. Debierne.—A description of their experiments in which they separated metallic radium. The principle of the method consists in preparing a radium amalgam and in expelling the mercury by distillation under favorable conditions. The amalgam was obtained by the electrolysis of a perfectly pure solution of radium chloride.—Lond. *Electrician*, Sept. 16.

Spark Discharge at Very Small Distances.—E. H. Williams. An account of an experimental investigation, the results of which are summed up as follows: The material of which the electrodes are made has no effect upon the discharge potential. The nature of the discharge for very short distances is the same as for greater distances. The discharge potential for a distance between the electrodes of one wave-length of sodium light is the same as for five wave-lengths, being in both cases the minimum potential, which is 372 volts. When the distance between the electrodes is very short, 5λ or less, the path of the discharge is not along the shortest distance. Ionization of the gas between the electrodes lowers the discharge potential. The electric force in a beam of ultra-violet light is, according to the wave theory, 0.5 volt per centimeter; yet the beam of light is able to produce an action which cannot be brought about by a constant electrostatic force of 5×10^6 volts per centimeter. This fact points to a modification of the wave theory as suggested by the electromagnetic emission of the theory of light. The nature of the dielectric affects the discharge potential—the presence of moisture lowering this potential. For dry air the minimum potential is 372 volts whether the distance between the electrods is 1λ or 5λ.—*Phys. Rev.*, September.

The Linear Electrical Oscillator.—James E. Ives.—An account of an experimental determination of the wave-length and logarithmic decrement of the linear electric oscillator with the interferometer. The wave-length of the linear oscillator is slightly greater than twice its length. The ratio of wave-length to length of oscillator was found to be 2.03, 2.04, 2.08 for the 10-cm, 7.5-cm and 5-cm oscillators, respectively. The logarithmic decrement was found to be of the same order as that given by Abraham's formula. For the same length or spark-gap the total decrement decreases as the length of the oscillator increases.—*Phys. Rev.*, September.

Magnetic Alloys from Non-Magnetic Metals.—E. B. Stephenson.—An experimental investigation of Heusler alloys, composed of copper, manganese and aluminum. The most magnetic specimens have the manganese and aluminum in appproximately the proportions of their atomic weights. Heating to various temperatures, cooling in air and testing at room temperatures gave for $H = 50$ a permeability-temperature curve with a slight minimum near 250 deg., a very pronounced minimum between 600 deg. and 700 deg., and a rise to higher than the original value at 900 deg. This series of changes are reversible for at least three times. The largest value of induction was obtained when the specimen was quenched in water from near its melting point. A series of cooling curves gave melting points between 910 deg. and 970 deg., and curves characteristic of solid solutions. The cooling curves for the two magnetic specimens showed transformation points with evolution of heat at 615 deg. Specimens cooled in air from this temperature are non-magnetic at room temperature. It seems evident that there is an allotropic form of the alloy which has a practically non-magnetic molecular arrangement. A series of photomicrographs showed differences in crystalline structure

due to thermal treatment, but no certain relation could be established between the magnetic properties and crystalline structure.—*Phys. Rev.*, September.

Electrochemistry and Batteries.

Electric Steel Making.—H. [illegible] conclusion of his detailed illustrated description of the electric-furnace plant in Dommeldingen, Luxemburg. Besides two single-phase furnaces it contains a 1.5-ton three-phase furnace. All these are "combination furnaces," being heated partly by induction and partly by direct-resistance heating by means of pole plates. The molten pig iron is supplied to the furnaces from a 20-ton mixer. It is intended to enlarge the plant for a production of from 70 tons to 80 tons of electric steel per day.—*Elek. Zeit.*, Sept. 15.

Units, Measurements and Instruments.

Photographic Photometry.—C. F. BRUSH.—The author states that photographic photometry may safely and usefully be employed for detecting and estimating moderate and small changes in light down to amounts considerably less than 1 per cent of the whole. Fig. 3 is a diagram of the apparatus employed. An incandescent electric lamp *h*, with heavily frosted bulb, is mounted in a well-ventilated box or lantern *i* adapted to be moved horizontally on a long bar *k*. Close to the surface of the lamp bulb is an iris diaphragm *l* controlling the diameter of a circular spot on the surface of the bulb, which spot is the source of light used in most parts of the experiments. A large, thick wooden screen *n* has an opening *o*, 5 mm high and 19 mm long, horizontally, with semicircular ends. A beam of light from *h* passes through the opening *o* and falls on a photographic plate *p* carried in a holder which may be quickly secured in any one of eighteen definite positions, as shown at *t*,

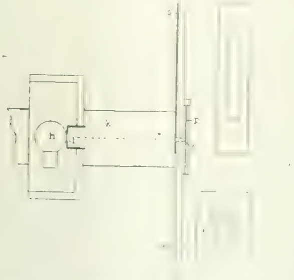


Fig. 3—Photographic Photometry

which is a front view of the plate. [illegible] normally by a drop-shutter *s* of thick sheet metal. A front view of this shutter, at the right, shows in dotted line the opening *o* behind it. The shutter moves with perfect freedom in vertical guides, and is retained in its upper position by a spring catch, which may be released at pleasure. The slot in the shutter is of such length as to give a mean exposure of one-ninth second. Of course, the lower part of the spot of light through *o* is exposed less than the upper part, on account of the different speed of the shutter in opening and closing *o*. The difference is found by calculation to be about 2 per cent. It is corrected by vertical adjustment of the lamp. Experience shows that this shutter may be relied on to give constant exposures. A screen, not shown, covers the opening *o* while the shutter is being raised. The lamp *h* is supplied with current from a large storage battery. The optical system or body the transparency of which is to be tested is placed in the path of the beam of light from *l* to *o*. The customary manner of using this apparatus is to expose one or two rows of five spots each on the photographic plate, as shown, in full lines at *t*, with four blank alternating spaces between them. These spots are termed "comparison spots," and are used as a standard with which to compare the intermediate spots shown in dotted lines, and exposed subsequently, after the introduction, removal or change of the optical system in the path of the light. Details of the photographic apparatus and methods applied are given, and some interesting photographic phenomena are described.—*Phys. Rev.*, September.

Measuring Heat Conductivity.—F. BACON.—A paper read before the British association on a method of testing heat-insulating materials. The method consists in measuring the drop of temperature between the two faces of a thin slab transmitting a known heat flux. Duplicate specimens of the material to be tested are obtained in the form of slabs measuring 18 in. x 18 in. and not more than 1.5 in. thick. A thin, flat heating net of uniformly wound resistance wire, interwoven with asbestos, measuring 12 in. x 12 in., is sandwiched in between these slabs, the marginal crack left all round the heating net being filled with strips of felt. Direct contact between the heating net and slabs of insulating material is avoided by interposing a thin sheet of asbestos millboard on each side. To measure the temperature of the faces of the slabs advantage is taken of the fact that there is no perceptible drop of temperature between the heat-insulator and a good conductor of heat in close contact with it. Sheets of zinc 12 in. x 12 in. are taken, and a flat resistance coil of fine double silk-covered wire wound uniformly over a central 6 in. square of one of their faces. The wire is wound non-inductively and secured to the zinc plates by stitches of thread passing through fine holes drilled in the metal. Zinc plates prepared in this way are inserted on each side of the slabs of insulation, the fine wire coils being in direct contact with the material to be tested. Thin wood covers are now put on both sides, and the whole is clamped firmly together by four bolts, with wing nuts passing through two skeleton frames of wood (Fig. 4). The apparatus is then hung in a vertical plane in a situation screened from drafts and sunlight. The terminals of the heating net are led away through a resistor of an adjustable resistance and suitable switchgear to a battery of accumulators. A voltmeter and ammeter are connected up to the circuit, from the readings of which the watts dissipated can be ascertained. As

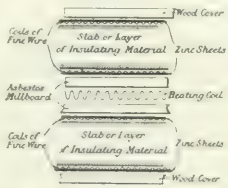


Fig. 4—Measuring Heat Conductivity.

the arrangement of slabs is identical on both sides of the heating net, the heat generated will divide equally, half escaping through one wall and half through the other. The terminals of the resistor of fine copper wire are connected to a Wheatstone bridge of the stretched-wire type through a system of plugs, which enables the ratio of resistances of either pair of coils to be determined. By assuming a value for the temperature-resistance coefficient of the copper wire, of which the coils are wound, the excess of temperature of the inner over the outer faces of the insulating material can be immediately determined. The system of plugs also allows of the resistance of any one of the four coils being compared with that of a fifth coil situated in the unheated surrounding air, the temperature of which is measured with an ordinary thermometer. This arrangement enables the absolute temperature at the inside or outside of either of the slabs to be determined. Since the coils which give the temperature of the faces measure only 6 in. x 6 in., while the heating net measures 12 in. x 12 in., there is a marginal guard ring of heat flux of 3 in. wide all round the central area, through which the heat gradient is determined. The chief results are given in the following table. The conductivities are given in kilogram-calories passing per hour through a cross-section of 1 sq. m when the temperature gradient is 1 deg. C. per meter. To convert the conductivities [illegible] for a tem-

perature gradient of 1 deg. Fahr, per inch the figures given in the table must be multiplied by 8.05. Thus for yellow pine, $0.13 \times 8.05 = 1.04$. As to the uses of silicate cotton the results show:

[illegible]	Spec. Gr.	Coeff. of Heat Conductivity
Yellow pine across grain....	0.360	
[illegible]	0.515	0.23
Expansit Schrot No. 1*.....	0.051	0.055
Expansit Schrot No. 2*.....	0.049	0.061
[illegible]	0.166	0.060
	0.330	
Silicate cotton or slag wool.	0.256	[illegible]
	0.141	
	0.113	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Air jacket in the vertical plane 1 in. wide, walls of asbestos millboard.....		0.26 to 0.31

*A special preparation of cork.

Experiments with silicate cotton show that loose packing makes slightly the best insulator for small differences of temperature, but firm packing is much the best when the temperature difference is considerable. On the whole, the results indicate that it is advisable to pack the silicate cotton as firmly as possible, especially as this ensures that the material will not afterward subside so as to leave holes which cannot afterward be filled. Results for asbestos lead to the conclusion that its value as a heat insulator is due rather to its fireproof qualities than to its low conductivity, which, indeed, appears to be no lower than the conductivity of wood.—Lond. *Electrician*, Sept. [illegible]

Mechanical Hysteresis of Rubber.—A. SCHWARTZ.—An abstract of a paper read before the British association on a machine for testing rubber by means of its mechanical hysteresis. The principle of the machine is indicated in the left-hand diagram of Fig. 5. The strip of rubber to be tested, usually measuring 3/8 in. x 1/10 in. x 4 in. long, is connected, by a flexible cord passing round a pulley, with a spring-balance as indicated. The upper ends of both the rubber test-piece and the spring are connected, the one to a drum and the other to the pencil of a recording gear. The load is applied to the specimen by pulling down the pulley, and it is seen that from the arrangement of the apparatus the pull on the test-piece and the pull on the spring are equal, though the corresponding extensions are different. The diagram obtained in a cycle comprising the gradual loading of the specimen and the gradual removal of the load has the character indicated in the right-hand diagram. On repeating the cycle the area of the hysteresis curve increases, the maximum extension under the same maximum load being greater. However, with high-grade rubber the area of the hysteresis diagram becomes practically constant after the sixth repetition of the cycle. The discussion was opened by Professor Fessenden, who said that the determination of the hysteresis diagram constitutes a fairly good method of testing the quality of rubber. He has, however, found that for the same quality of rubber the amount of hysteresis is dependent on the character of the adulterant or admixture employed. Rubber, he continued, has very peculiar mechanical properties, due as was originally pointed out by Faraday, to the circumstances that the gum is an aggregate of two substances—one horny and the other plastic— and to this is also due the unusual value of Poisson's ratio for the material. [illegible]

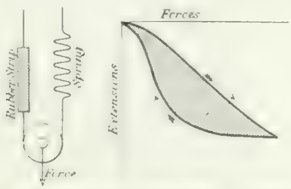


Fig. 5—Mechanical Hysteresis of Rubber.

imagining a series of spheres of copper connected together at their points of contact and filled with water. Such an aggregate would take a large extension under a tensile force, the spheres deforming into ellipsoids and compressing the contained fluid. If such a system were heated while under tension it would contract, owing to the expansion of the water tending to restore the deformed spheres to their original form. Such a system has also a large mechanical hysteresis. The heat generated on compression must leak out, and by using a good conductor for the admixture, in the case of india-rubber, its hysteresis is decreased and the rubber will in consequence last longer in service.—Lond. *Eng'ing*, Sept. 16.

Electricity Meters.—An illustrated description of various recent improvements in the design of electricity meters. A method of compensating friction is illustrated in Fig. 6, where

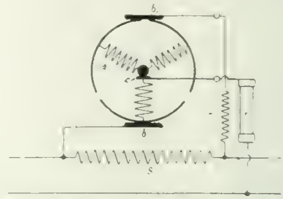


Fig. 6—Method of Compensating Friction in Meters.

a is the armature of the meter. Part of the current to be measured is supplied to the meter through the brushes b and b_1 in parallel with the shunt s in one main conductor. c is a third brush which is connected in series with the resistor r to the other main conductor. There is not only the current through the armature due to the potential difference at the terminals of the shunt s, but there is also another almost constant current in the armature which exerts no torque if the resistance w is zero, since in this case the positive and negative torques balance each other. If, however, the resistance w is inserted, the second current divides itself in the armature in a non-symmetric manner and there results a positive torque which compensates the friction. The resistance of the series resistor r is very large, from 50,000 ohms to 100,000 ohms per 100 volts, and the resistor is therefore made of carbon or graphite. Several new constructions of the form of the iron core in alternating-current induction meters and the combination of a meter with a maximum-demand indicator are also described.—*Elek. Anz.*, Sept. 15.

Telegraphy, Telephony and Signals.

Wireless Telegraphy in Japan.—WICHI TORIKATA.—The author first gives data on the Teishinsho system, which is a spark system as regards its transmitter, and makes use of a telephone and detector for its receiver. Many special devices are used to minimize the damping and get sharp tuning. Of detectors the Teppun, the tantalum and the Koseki are chiefly used. In the Teppun detector two steel poles are magnetized and arranged to be adjustable in their distance as in a coherer. Fine steel powder, oxidized on its surface by burning in a flame, is introduced between the poles so that the powder makes a bridge between them by the magnetic field of the poles. The powder must not be in too great a quantity, and each granule must be neither too large nor too small. The sensibility of the detector depends mainly upon the degree of the oxidation and also upon the adjustment. The tantalum detector of the author depends upon dipping a tantalum point into some alkaline or acid solution. The Koseki detector employs zincite, molybdenite or iron pyrite as a substitute for the oxidized iron-powder of the Teppun detector.—Lond. *Electrician*, Sept. 16.

Miscellaneous.

Diseases of Electrical Workingmen.—W. HANAUER.—The principal "professional" diseases of electrical workingmen are diseases of the respiration organs, heart disease, rheumatism and eye diseases. Poisoning, skin diseases and nervous troubles are not rare. Burnings and accidents due to high-[illegible] currents are also discussed.—*Elek. Zeit.*, Sept. 8.

BOOK REVIEW.

HAND-BOOK FOR STEAM EN[illegible] ELECTRICIANS. By Calvin F. Swingle. Chicago: Frederick J. Drake & Company. 1500 pages. 696 illus. Price, $3.

Although this is a new book in that its name is changed, actually it is the third edition of the author's hand-book for steam engineers, revised and greatly enlarged. This book may be likened to an intelligently prepared catalog of steam, gas and air apparatus, with some theory and a considerable amount of operating instructions. The different commercial types of boilers, stokers, feed-water heaters, steam turbines, gas engines and other apparatus are described in considerable detail. The steam engine being a more standard piece of apparatus, is treated in a general way by describing types and giving details of valve motions and instructions for setting them. The chapters on indicators, indicator card analysis, boiler operation and lubrication are among the most useful to operating engineers in general, while the chapters on air machinery and elevators will be of special interest to engineers in certain classes of isolated plants. An electrical section has been added to this edition. An attempt is made to give the reader some notion of the underlying principles of electricity, but here even more than in other parts of the book the reader will derive most from the questions and answers which follow the chapters.

New Apparatus and Appliances

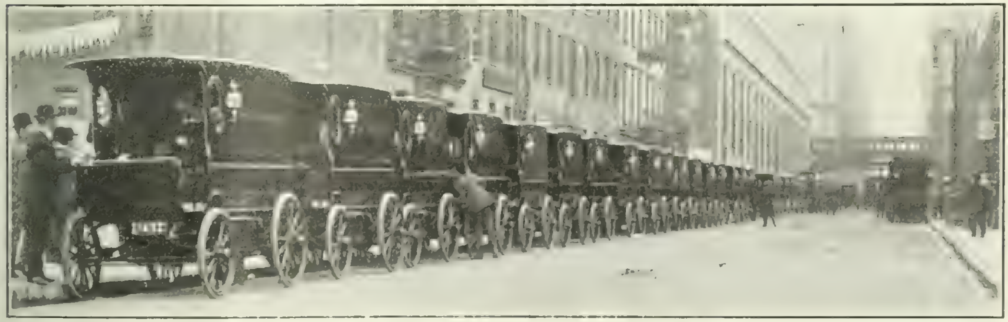
LARGE EQUIPMENT OF ELECTRIC AUTOMOBILES FOR NEW YORK DEPARTMENT STORE.

The complete equipment of Gimbel Brothers' New York department store in its delivery department with automobiles, to the exclusion of horses, marks an epoch which expresses the absolute confidence of the modern merchants in the superior economy and efficiency of machine transportation. Few single installations have had concentrated upon them the degree of investigation, forethought and detail consideration given to the one in question. Sufficiently far in advance of the requirements for service of these machines the whole problem, with all of its complicated phases, was completely digested and the conclusion reached that for the delivery of goods and the handling of incoming merchandise covering the entire district of Greater New York and the adjacent territory in New Jersey, on Long Island and through the residential districts along Long Island Sound and the Hudson River the electric vehicle represented the best economy; and as a result this type of vehicle constitutes almost the entire equipment with the exception of some five gasoline transfer trucks for service between the main store and the outlying distribution substations, together with five gasoline package-delivery machines for service over the far suburban districts where the deliveries are scattered, or in sections where the infrequency of delivery requirements does not warrant the regular service of a route wagon.

Sixty-six Studebaker machines went into immediate service at the opening of the store last week. Twelve or fifteen additional will be in service by the Christmas holidays, and it is expected that the equipment will amount to 150 machines early in the coming year, concurrent with the development of the business. The sixty-six machines include thirty-eight "package-delivery" panel-type vehicles, ten "bulk" delivery panel machines of approximately 1-ton capacity, seven screen-side 1-ton machines for the deli[illegible] two machines of the same size specially adapted for furniture delivery service. The service of both the latter type machines is supplemented by two screen-side machines and four machines for furniture delivery of a larger carrying capacity, and there are three freight trucks for the handling of incoming and outgoing freight, as well as for store to warehouse service.

The central garage for the operation, care and maintenance of these machines is located on Twenty-fourth Street west of Tenth Avenue, and is a specially constructed fireproof structure with a 150-ft. frontage and a depth from front to rear of 100 ft. This garage is equipped with the most modern devices which specialized engineering in this direction could provide, and it is confidently expected that the record system and other advanced details of management will characterize this installation as one of the foremost in verifying the predetermined accuracy and economy with which electric vehicles may be operated.

The electric service is provided by the New York Edison Company from an adjacent transformer substation and is delivered to the building in four circuits, as follows: One direct-current charging circuit at 120 volts, one direct-current charging circuit at 75 volts, one alternating-current lighting circuit and one alternating-current motor circuit for the operation of elevators and mechanical equipment. The switchboard occupies a space 30 ft. long and is located on a raised platform so as to give the operator a commanding view of the entire lower floor, and this switchboard is divided into thirteen panels, each controlling six charging stations, with provision for an extension to a total of 130 charging points within this building. The switchboard operator also controls a recording station equipped with the necessary instruments, time clocks, card-index system and other apparatus, providing for a complete and accurate registration of the entire station and the performance of each individual machine.



Electric Automobiles of Gimbel Brothers' New York Department Store.

The charging cables are led from this switchboard in metal

conduit to each of the charging stations, where they terminate in the charging plug for connection to the machine batteries, and the control of the charging function is completely under command of the switchboard operator, a signal system being installed, paralleling each of these charging cables, so that the operator is automatically made aware of the condition of each of the batteries undergoing charge. This function is largely rendered possible by the use of specially designed amp-hour meters and recording devices with which each of the machines is equipped, and such records will be kept as will indicate the periodic mileage of the vehicles, as well as the life or service of the batteries and tires and such other data as will afford the means of recording the performance by the vehicle and the life of each part of the equipment in terms of electrical energy units. This means that the cost of operation will be eventually determined in relation to the energy consumed by the machines in the daily performance of their work, so that knowing the kw-hours required to do certain work and cost of tires, batteries, etc., per kw-hour, the entire cost of any similar work may be determined by measuring the kw-hours required for such work.

Among the structural features of this garage building are three 12-ft. entrances from the street, which provide access to the corresponding bays on the ground floor, which are separated from each other by means of a slightly raised concrete bumper against which the front ends of the vehicles rest; the flexible charging cable suspended from the ceiling being inserted in the charging receptacle located at the front of the machine. This arrangement permits easy access to the motor equipment at the rear of the vehicles, which are consequently adjacent to the wide aisle between each row of machines.

Located at one end of the building is an elevator with a platform 10 ft. x 20 ft., having a carrying capacity of 10 000 lb., with a direct opening onto the street at the sidewalk, thus avoiding the necessity of machines intended for the second floor entering the building except by means of this elevator. At the opposite end of the ground floor are located the superintendent's office, storeroom for packages, lavatories, lubricating-oil vault and a gasoline pump vault communicating with four gasoline tanks of 275 gal. each located under the sidewalk.

At the rear of the ground floor are three washstands, each 15 ft. x 20 ft., provided with hot and cold water, illuminated at night by electric light and in the daytime from an 8-ft. wide skylight running the entire length of the rear, which lighting effect is accomplished by offsetting inward the second-story rear wall to this amount.

The second floor has two stairway communications from the ground floor in addition to the elevator and is equipped with unusual facilities for the adequate care and maintenance of machines. There is a battery-room, 38 ft. x 50 ft., for the formation and repair of batteries, supplied with energy from its own switchboard, having six outlets and recording and testing instruments to insure unusual accuracy. An enclosed varnish-room, 25 ft. x 25 ft., provides for the periodic repainting of the machines so that they may constantly present an attractive appearance.

The machine shop, 25 ft. x 50 ft., has an equipment of machine tools which is likely to meet any emergency which may arise from collision, accident or normal wear and tear. A washstand, 25 ft. x 35 ft., amply illuminated, provides for the cleansing of such machines as may be stored on this floor independent of the facilities on the floor below. Adequate provisions are made for the comfort of chauffeurs as inducement toward self-respect and *esprit de corps*. These are a tailor shop, in which their uniforms and clothing may be kept in condition; a lounging-room fitted with an equipment likely to stimulate interest in their work; a locker-room for the preservation of their clothing, and a lavatory and washroom fitted with shower bath and similar comforts.

The entire building is heated by steam and provided with an ample supply of warm water for the washing of vehicles in the winter season. In order to comply with insurance regulations [illegible] as not to communicate with the rest of the building.

In the Bronx and at Newark, N. J., are located two substations, the former being 50 ft. x 100 ft. and the latter 100 ft. square, each capable of caring for twenty-four machines. These are well lighted and heated and equipped with vehicle-washing facilities, gasoline storage tanks and charging equipment supplied from alternating-current service by means of mercury-arc rectifiers. These two substations will be later supplemented with others located on Long Island and probably at New Rochelle.

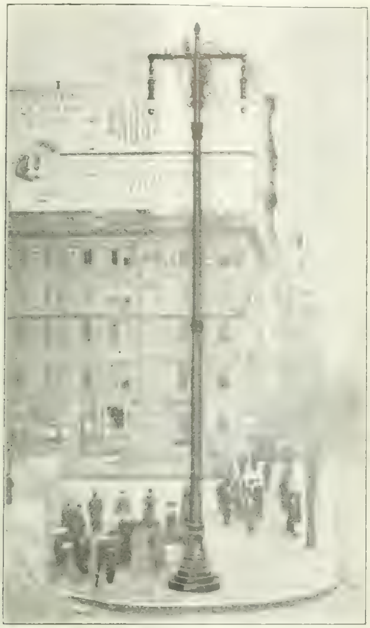
This entire delivery outfit has been installed with the idea of reducing operating cost to the lowest possible minimum, the cost of operation being figured at less than $1,000 per annum, to include perpetuation of the equipment, the interest on the investment, up-keep of the machines, superintendent's salary, labor and electricity. Among the features of the machines indicating the very latest developments are 42-in. driving wheels to reduce tire wear and energy consumption as well as lessen jolting or vibration; independent or auxiliary spring suspension of the battery equipment to preserve the battery plates; 3-in. bridge jars to reduce or eliminate battery cleaning; standard railway waste-box method of lubrication to insure protection of bearings with the least human effort; "odometers" to record the mileage and the tire life, and Sangamo amp-hour meters to indicate the state of charge in the battery and record the total life of the battery plates in amp-hour output.

By agreement the operation of this installation for a number of years will be under the supervision and direction of the engineering department of the Studebaker Company. This provision was made with the interests of both the manufacturer and the user in view, and to provide against any possible misapplication of the machines or unwarranted cost of operation. Arrangements are being made to furnish similar automobile service for the Philadelphia and Milwaukee stores of the Gimbel Brothers.

FLAMING ARCS FOR ILLUMINATING PUBLIC SQUARES IN NEW YORK CITY.

The Department of Water Supply, Gas and Electricity of New York City has been experimenting for some time with various types of flaming-arc lamps for illuminating large public squares. The ordinary enclosed-arc lamps are unsuited for this purpose because the area to be illuminated is too large and it is not desirable to erect numerous posts in the roadway, which would interfere with vehicular traffic. At Times Square, Madison Square, the Plaza and one or two other locations the New York Edison Company has erected 50-ft. poles which support two flaming-arc lamps of the Blondel type, as shown in the accompanying illustration. The lamps used are manufactured by the Charles L. Kiewert Company, of New York, Milwaukee and San Francisco, and are connected two in series across the Edison direct-current mains. The Kiewert company's "Alba" lamp is used because its voluminous vertical flame is adapted for uniform illumination of large areas. As is well known, the distinctive feature of the "Alba" flaming-arc lamp is the vertical arrangement of the electrodes, which possess a large chemical core. The positive as well as the negative electrode has merely a very thin covering of ordinary carbon material serving as a case for the core of impregnating material. The light has a pure white and soft color and the electrodes are short and self-focusing; that is, the positive and negative both feed thus maintaining the position of the arc in the economizer. The lamps employed consume 12 amp at 40 volts. An ash tray controls the amount of air admitted to the globe and directs its course so that it sweeps the metal oxides out of the globe with it. In the "Alba" lamp the differential horseshoe-type magnets are both vertically arranged. Between them moves a soft-iron armature which is attached to a swinging frame containing the regulating mechanism. The armature being under the joint influence of the series and shunt magnet always moves to the stronger one. When the lamp is switched into circuit, the shunt magnet attracts the armature and by this movement of the swinging frame the sensitive anchor escape-

ment is released and the electrodes feed slowly together. After they touch each other the series magnet pulls the armature its way, which movement locks the feeding mechanism so that the proper arc length is obtained. The intervals of feed are very



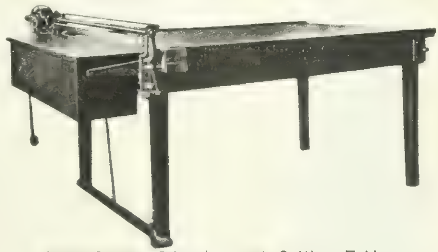
Flaming-Arc Lamps, Madison Square, New York.

small and the arc distance practically [illegible]. The lamp is also built for operating on alternating-current circuits. The manufacturer claims 2800 mean hemispherical candle-power, with electrodes giving a white flame.

MOTOR-DRIVEN CUTTING AND TRIMMING TABLE.

The accompanying illustration shows a motor-driven cutting and trimming table, arranged with a light-proof box for blue-print paper. This trimming table will be found of very great convenience and utility to all makers of blue prints, and it can also be used to excellent advantage for cutting tracing paper or cloth, detail paper, etc. This table is provided with a parallel clamp, operated with a foot treadle which holds the paper, tracing cloth or print securely while the revolving cutting knife is used. This device is very rapid and convenient in operation, and will trim a very narrow strip from the paper or print.

The revolving cutting knife is motor-driven, and is rotated positively by mechanical means not depending upon the friction against the blade or paper, and therefore will cut the thinnest paper and will also cut five to ten sheets at once. The knife is electrically operated in either direction at will, being stopped or started at any point by a specially designed wrist-controlled switch which leaves both hands of the operator free to handle the paper or prints. The table is constructed of hard wood with metal trimmings, arranged to be easily knocked down for shipment. The electrical equipment is complete and arranged so it can be fed from any incandescent light socket. The top of the table is scored in inches, and is provided with figures along the front edge, so that any size sheet can be instantly cut. A sizing diagram can also be provided for the top of the table, which gives at a glance the size of any tracing or print and the square foot measurement [illegible] necessary. The tables are also furnished [illegible] instead of a light-proof box, especially designed for cutting prints after they have been run in an automatic continuous printing, washing and drying equipment. The tables as regularly furnished are 4 ft. wide by 6 ft. long, but any width table up to 8 ft. wide can be supplied. This table is also furnished



Motor-Driven Trimming and Cutting Table.

in widths up to 42 in. wide, arranged for operating the cutting knife by hand instead of with motor. The cutting machinery is all self-contained, and can be furnished separately if desired, so it can be bolted on any table of appropriate width, and the cutting device can be used with or without the parallel clamp as desired. The apparatus is manufactured by the C. F. Pease Company, 167 Adams Street, Chicago, Ill.

A 100-HOUR FLAMING ARC LAMP.

Excessive maintenance charges because of frequent trimming has been a complaint against the flaming-arc lamp, for, as is well known, despite the long, fragile electrodes employed in most of these lamps, the number of hours burning per trim is very much less than is obtained from the ordinary enclosed-arc lamp. Fox Brothers & Company, of New York City, have just introduced a flaming-arc lamp which is guaranteed to burn 100 hours per trim and to yield approximately 3400 cp on a power consumption of 550 watts when operated two in series across 110-volt circuits. The "Multax Century" lamp is asserted to be as simple as the ordinary open-arc lamp, the electrodes feeding in a self-controlled manner with an entire absence of clockwork, escapement wheels, chains, cables, etc., and without any stop or rest in the arc chamber. The lamp operates on the differential principle and the position of the electrode tips is said to be fixed in the arc chamber at all times. When placed in circuit the shunt solenoids operate a slipper block, causing the electrodes to strike together. When this function is performed the series solenoids cause the slipper block to separate the electrodes, thus establishing and maintaining the arc at a constant value. The electrodes are arranged side by side and are inclined to form a "V" so that the arc is maintained across the lower extremities by the passage of the energy. The secret of the long life is found in the electrodes, which are of the bridge-core type, consisting of an outer zone of hard carbon of a high degree of purity and a central core of mineral salts, as shown in Fig. 2. The salts are proportioned to give a volume of rich yellow or white light. The electrodes are not of the fragile type and are quite broad, it being understood that the lamp is approximately 3.5 ft. long over-all and that two electrodes burn 100 hours. Instead of the porcelain economizer, a metal economizer is placed over and around the arc, serving not only as a protection from the heat of the arc, but also as a reflector to throw the light downward. The white deposit from the electrodes is said to keep the reflecting surface in perfect condition throughout the entire burning hours of the lamp. Each lamp is equipped with an opalescent globe provided with suitable ventilating arrangements and fitted so that the company's patent light deflector may be placed in the globe to increase the horizontal distribution, if so desired. [illegible] enamel with brass perimeters around the case collar and around the collar of the top cap enclosing the upper chamber. The [illegible]

The company is also bringing out a fifty-hour lamp called

"Multax Fifty," which is approximately 2.75 ft. long and weighs 36 lb. This lamp does not differ materially in construction from the 100-hour lamp. Both lamps are designed for

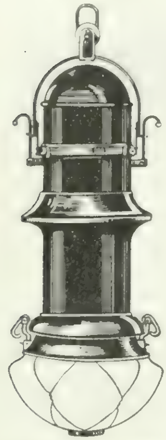


Fig. 1—100-Hour Flaming-Arc Lamp.

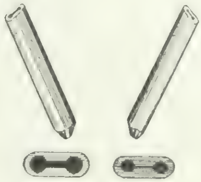


Fig. 2—Bridge-Core Type of Carbons.

operation on direct-current or alternating-current circuits and when connected in series on 240-volt or 550-volt direct-current circuits are equipped with an automatic cut-out arranged to cut into the circuit a compensating resistance, so that when the lamp is not burning from any cause whatever the other lamps in the circuit operate normally. These resistances are self-contained within the lamp casing. The claim is made that any electrician can handle and install the lamps.

ROTARY PUMP FOR AUTOMATIC HOUSEHOLD WATER SUPPLY.

A house-service pump employing the principle of the von Pittler positive, rotary pump, which has been in use in Germany for several years, is now being introduced into this country, and as applied to motor-driven household water-supply systems presents such obvious advantages in use as the avoidance of water-storage or compressed-air tanks, the delivery of water fresh from the source of supply, energy consumption proportional to a pumping lift only to the height of demand, and the combination of an efficient and compact high-speed motor with a rotary, piston-principle pump delivering continuous output.

The pump itself consists of a rotating solid-bronze cylinder having its surface crossed by transverse rectangular slots in which movable vanes are free to slide (at right angles to the direction of rotation) as propelled by the cam surfaces in the stationary side pieces between which the moving cylinder rotates. This arrangement will be clear from the accompanying diagram, which represents a development of these cylindrical parts rolled out into the plane surface of the page. This shows the central rotating part in which the vanes slide, actuated by the cam surfaces in the outer stationary parts. At the points indicated inlet and discharge ports open into the piston chambers from the outside cylindrical casing. The work of pumping is done, however, between *II* and *III*, as indicated, the vanes being maintained stationary while under pressure. There is accordingly no movement of the vanes except under balanced pressures, avoiding heavy friction, which would rapidly wear the parts. Wear on the ends of the vanes against the cam surfaces [illegible] and admitting pressure from the delivery side of the pump through a circumferential channel in the pump cylinder, thus holding the vane parts out against the cam surfaces at all times. Since two vanes are always moving through the pumping chambers the action may be compared to that of a cylinder of infinite length, with a piston moving through it forcing the water ahead at constant speed, without spurts or vibrations. This continuous delivery pressure is less severe on pipes and hose and reduces friction. The superior efficiency of the pump is credited to the absence of heavy reciprocating parts and the comparatively high speeds available.

For house service, as shown in the accompanying illustration, the pump is direct-connected to a suitable motor, and has its de-

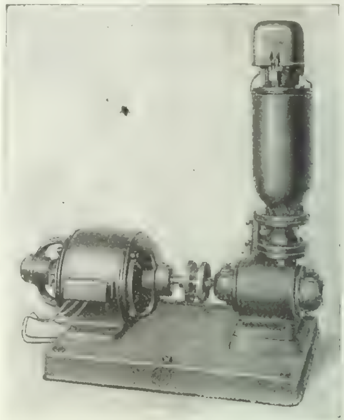


Fig. 1—Rotary Pump for House Service.

livery line connected to a small air cylinder the piston of which, moving against an adjustable spring, controls a switch in the motor circuit. As long as water is being taken from the system this switch remains closed, but as soon as all the faucets are closed the pump quickly raises the pipe pressure to some predetermined value at which the switch is opened, stopping the motor. When a faucet is again opened the fall in line pressure at once starts the motor. The pipe system may be entirely drained, as in the case of closing up a house, by shutting off the supply of energy to the motor. Closing the main switch will start the pump, instantly delivering water to any faucet, without delay incident to filling water or compressed-air tanks. The von Pittler pump, being of the positive type, requires no priming and experiments have shown that these pumps will develop extremely high suction lifts, raising water in some instances 25 ft. or more. As the water delivered by this system is raised only to

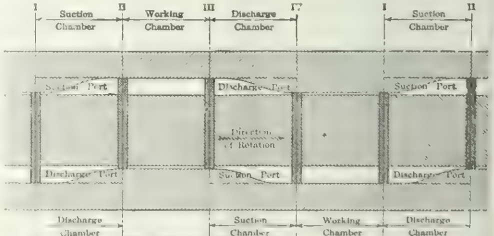


Fig. 2—Development of Cylindrical Parts of Pump.

the height of the demand, a saving in energy consumed is made over the gravity-tank method. The efficiency of the pump is also high, approximating even 85 per cent, it is said, in the small sizes. As the water is taken fresh from the supply, warm water from unsanitary tanks is avoided in summer and freezing is prevented in winter.

The American rights for the von Pittler pump are owned by the Rotary House Pump Company, 103 Park Avenue, New York, which is introducing the apparatus into this country.

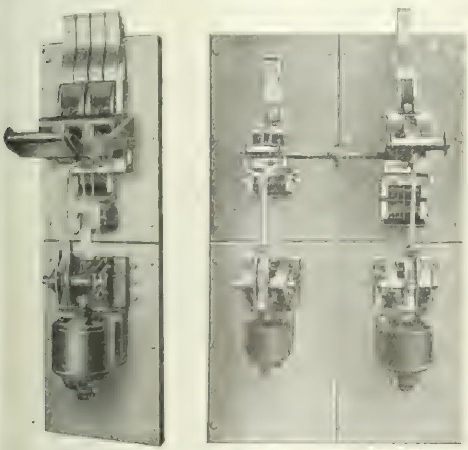
REMOTE-CONTROL CIRCUIT BREAKERS.

With the growth in the size of generating and motor units, which has been a prominent characteristic of recent developments in electrical engineering, there has arisen an imperative demand for reliable switching mechanism and protective apparatus which may be controlled from any required distant point. By the use of such appliances the engineer may secure economies of installation not otherwise available and at the same time improve the simplicity and increase the flexibility of the entire system. He is enabled also to locate his switchboard with due regard to space economy rather than with reference to immediate accessibility on the part of switchboard attendants, a consideration which is of the utmost importance where the room available is limited.

Remote-control circuit breakers and switches have the further advantage that they do not require to be massed together upon a single switchboard, but may be located in such a manner as will afford the most convenient and economical cable installation; for while the switching apparatus may be scattered around in various parts of the plant, as conditions dictate, the controlling devices therefor may readily be brought together at any point determined upon as the most convenient for the purpose. The switches and indicating devices for controlling a large number of circuit breakers may be placed upon a bench board of relatively insignificant dimensions, so that a large installation may by this means be placed virtually under the eye of, and within easy reach of, a single operator.

The Cutter Company, of Philadelphia, with a view to meeting the varied requirements of the modern plant has developed a complete line of this class of apparatus consisting of remote-control circuit breakers and switches operated by motor, solenoid or compressed air as best meets the conditions.

All of these forms have long since passed the tentative or exhibition stage and are in use or are being installed in some of the larger power plants in the country. To refer to only a few of these by name, probably the largest installation of Cutter apparatus is that of the United States Steel Corporation at Gary, Ind., where the use of the remote-control method resulted in such economies elsewhere as have long since paid for the remote-control equipment. The Interborough Rapid



Figs. 1 and 2—Motor-Operated Circuit Breakers

Transit Company, of New York City, [illegible] equipment employing somewhat similar apparatus. It was found an economical method by the Murphy Power Company, of Detroit, and in the new power plant of John Wanamaker, Philadelphia, the first large department store in the world to avail itself of this system, it proved to be an economical means of overcoming certain difficulties in the installation.

Fig. 1 shows an 11,000-amp. single-pole, motor-operated circuit breaker. The remote-control circuit breaker is so constructed that it responds instantly if closed upon abnormal conditions against which it is designed to give protection; in other words, it embodies the effective non-closable-on-overload feature.

This class of apparatus lends itself admirably to service where the voltage of the control circuit is subject to variation, being equally efficient in operation on wide ranges of voltage. Much of this class of apparatus has been installed to meet what might be termed extraordinary conditions in fluctuation of voltage; in one case the normal e.m.f. being 250 volts, the apparatus had to operate satisfactorily anywhere between 30 volts and 300 volts, which condition the instruments have fulfilled, consuming a minimum amount of current in the operation, in fact, considerably less than is required for the operation of the solenoid type arranged for operation at a fixed voltage.

Fig. 3—Pneumatic Breaker.

The motor-operated circuit breakers close without the least shock or jar to the switchboard. Instantly upon the start of the closing movement the control switch is automatically short-circuited by the closing mechanism and the movement is completed without further action on the part of the operator.

Another use to which this class of apparatus lends itself is for the protection of storage boosters. Apparatus for this service is shown in Fig. 2, the smaller breaker being for the alternating-current motor side and the larger for the direct-current generator side. They possess all of the features above described and are so interconnected both electrically and mechanically that the generator breaker cannot be closed until the motor breaker is closed, while the opening of the latter causes the immediate opening of the generator instrument.

There are almost innumerable places where motor-operated circuit breakers may be advantageously used. Where three-wire generators are installed this class of protection is particularly advantageous, because in such cases by placing the circuit breaker outfit close to the generator the saving in the cost of cable installation not infrequently results in a saving in first cost as well as in the cost of maintenance.

That the merits of the remote-control method described above are being fully appreciated is shown by the standing of engineers adopting it. Pierce, Richardson & Neiler, of Chicago, have adopted it for the new terminal of the Chicago & Northwestern Railway now being erected, while the largest and latest similar equipment is that of the Curtis Publishing Company for its new plant now building in Philadelphia for the publication of the *Ladies' Home Journal* and the *Saturday Evening Post*. An exhaustive study of the subject on the part of Frank C. Roberts & Co., the engineers, resulted in its selection for this installation.

For installations which are already equipped with pneumatic machinery or signaling devices the Cutter Company has developed a pneumatic remote-control which has already been extensively used. Fig. 3 illustrates one of the simplest methods of controlling the circuit breaker from a distant point. The operating feature in this case consists primarily of a double-acting piston moving within a cylinder, each end of which has a valve-control connection with the compressed-air supply. The circuit breaker is opened by a movement of the control valve in one direction admitting air to the upper end of the cylinder; the closing of the circuit breaker is caused by an opposite movement of the control valve admitting air to the lower end of the cylinder.

POCKET INSTRUMENT FOR ALTERNATING AND DIRECT CURRENT.

The instrument illustrated herewith is of the electromagnetic iron-disk type, and its readings are said to be practically unaffected by variations in the wave-form or frequency of commercial alternating currents. It can be used also satisfactorily on direct current if not placed in strong magnetic fields, such as are found near masses of iron or any apparatus containing a magnet or strong current. The moving element consists of a specially shaped iron disk attached to the indicating needle. The disk is placed within the field produced by a magnetic coil. This coil is formed of fine wire provided with enamel insulation. The instrument is inexpensive to construct, but is said

Pocket Meter.

to give reliable indications after having been properly calibrated. The weight of the instruments is only 12 oz., and the size only 3.25 in. wide, 4.5 in. long and 1.125 in. deep, hence it can be carried in the pocket conveniently. Nevertheless, over [illegible] range, the scale is open enough for [illegible] readings.

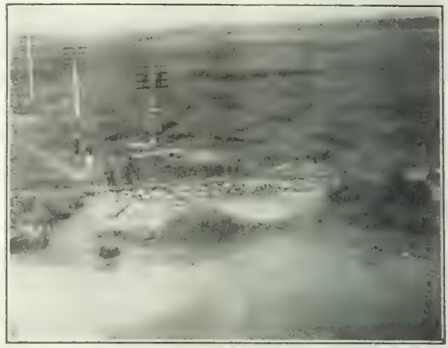
The voltmeter with single volt scale divisions between 100 volts and 120 volts is specially designed to give close readings on ordinary electric light circuits. The result is accomplished without increasing the size of the instrument by condensing the scales below 100 volts and above 120 volts where the readings are not of importance. The incandescent-lamp salesman, electrical contractor, inspector and others should find this instrument extremely useful and handy on account of its compactness.

[illegible]

SUBMARINE CABLES FOR THE PENNSYLVANIA RAILROAD.

The problem of satisfactorily caring for the numerous telephone, telegraph and signal wires necessary for the operation of a large and important railroad at points where its tracks cross a navigable river, making a drawbridge a necessity, has recently been solved by the Pennsylvania Railroad Company at its new Hackensack "draw" at the point where the Pennsylvania Terminal and Tunnel Division crosses the Hackensack River, a few miles west of Jersey City, by the use of submarine cables. There are two cables, one of thirty-five-pair No. 13 gage, triple-wrapped paper insulation, to be used for telegraph circuits, and the other of forty-five-pair No. 13 gage, double-wrapped paper insulation, having the wires of the inner core triple wrapped, and having eight pairs of this core twisted into double pairs, thus forming four phantom circuits. Each cable is 1225 ft. long, the thirty-five-pair cable weighing [illegible] tons. [illegible] lead sheath 5/32 in. thick. Each sheath was saturated with a non-corrosive preservative compound over which were wound two layers of saturated jute put on in the reverse direction. Over this jute was placed an armor of No. 4 B. W. G. iron wire, the armor being saturated with a preservative compound, and over this were placed two thicknesses of hemp rope laid on in the reverse directions and thoroughly saturated with preservative compound. The average mutual electrostatic capacity of this cable is between 0.06 and 0.074 microfarad per mile.

These cables were made by the Western Electric Company at the Hawthorne (Ill.) factory. The work of laying the cables was done by the Postal-Telegraph Cable Company under the personal supervision of Mr. M. Keily, who represented Mr.



Terminal Box and Concrete Poles, and Cable Laid Under Hackensack River for Pennsylvania Railroad.

J. C. Johnson, superintendent of telegraph of the Pennsylvania Railroad.

One very interesting feature aside from the laying of the cable was the very efficient and durable line of concrete poles which terminated on either shore. These poles were cast by the railroad company in accordance with its own specifications, and it is expected that they will be found much more suitable in the low, swampy ground where they are placed than wooden poles.

The weight of the cable was such that it was not necessary to do any dredging along the river bottom, as it is expected that the weight of the cable will cause it to sink far enough into the mud to prevent injury.

The engineers of the Pennsylvania Railroad Company, who worked in conjunction with those of the Western Electric Company, were kept busy for some time designing and developing this cable, which is the very latest product for submarine work.

TELEPHONE TRAIN DISPATCHING FOR PERE MARQUETTE RAILROAD.

The Père Marquette is soon to join the already long list of railroads using the telephone to dispatch trains, supplanting the telegraph, which was considered the standard for handling train movements for a great many years. The Père Marquette has ordered instruments, selectors and line material to equip a line from Saginaw, Mich., to Toledo, Ohio, approximately 135 miles in length, with the telephone system for train dispatching.

This is said to be the beginning of the adoption of the telephone system over the entire road, as other extensions will follow the completion of the first circuits. Between Saginaw and Toledo there will be thirty telephone stations. The chief dispatcher will be located at Saginaw. The entire equipment is [illegible] furnished by the Western Electric Company.

POT-HEADS FOR UNDERGROUND CONSTRUCTION.

The application of the porcelain pot-head to underground cable work is being extended every year. This development has led to the manufacture of the devices herewith illustrated, which embody detachable features for special underground installations. Fig. 1 illustrates the application of the detachable pot-head to an underground installation for the emergency switching of the load of one circuit to another. This installation consists of twelve type "S" single-conductor pot-heads installed in the manhole. The four pot-heads to the left terminate the feeder cables of one circuit and those at the right come from another feeder. The caps are cross-connected to the four pot-heads in the rear which terminate the cables which carry the load.

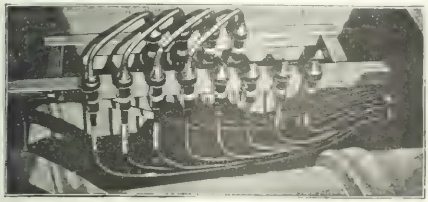


Fig. 1—Detachable Pot-Heads in Underground Work.

The holes in the tops of the caps to the right are closed with compound. If it is necessary to shut the feeder down in an emergency or for construction changes, its entire load can be carried by simply shifting the caps on the four pot-heads at the left to the four at the right in the front row. This installation has operated satisfactorily even when the manhole is submerged in water.

There are many other situations in which any of two circuits can be arranged to be joined together through pot-heads and special switching arranged for. This is very essential in underground systems, as the repair of cables requires considerable time, and it is necessary to arrange to carry the load by way of other circuits during repairs.

For cases where multiple-conductor cables are employed the apparatus illustrated in Figs. 2 and 3 has been designed. This consists of a rectangular cast-iron box provided with a lid. The edges of the lid overlap the box. The box is provided with three wiping sleeves, two in one end and one in the other. The lid of the box carries the necessary number of detachable devices. This device permits the multiple-conductor cable to enter the box through one of the outside sleeves and the distributing cables through the middle sleeve. The emergency tap or emergency circuit enters the box through the other outside sleeve. Each conductor is tapped inside the box to its respective disconnecting device and the box then filled with compound. Two rows of caps are then joined together by means of extra heavy rubber-covered wire well taped and compounded. The other row of caps are closed at the top.

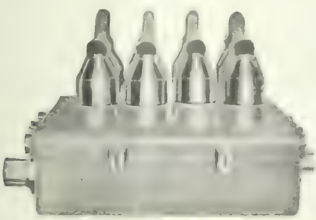


Fig. 2—Pot-Heads for Multiple Conductor Cables.

It can readily be seen that by the use of this box the entire load on the feeder can be switched to the emergency tap by merely throwing the caps to the other row. The cast-iron lid of the box contains a rubber gasket, and since the tubes and box are filled with compound, it is impossible for water to enter; the overlapping edges of the box and caps, retaining the air, will not allow the water to enter into the working parts. The application of these boxes can be extended to installations requiring a desired number of switching devices.

One advantage of these devices, which are manufactured by the G. & W. Electric Specialty Company, 6408 Jackson Park Avenue, Chicago, Ill., is the ready accessibility of the switching devices, which permits the switching to be done quickly, without requiring the removal of bolts which may have become rusty, and obviating entirely any interference with the interior of the box after it is once installed. All switching is done by merely transferring the caps. Fig. 3 shows the box with three caps connected and one blank cap removed from the box.

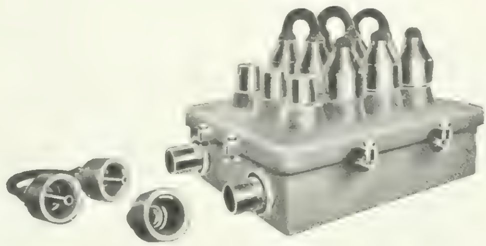


Fig. 3—Three Pot-Head Caps Connected.

ASBESTOS-INSULATED RECTANGULAR WIRES.

For several years the D. & W. Fuse Company, of Providence, R. I., has been manufacturing an asbestos-insulated wire known under the trade name of "Deltabeston." Its insulating and heat-resisting properties have brought it into extensive use for railway and hoisting motor, field, armature and controller coils, arc lamp magnets, heating units and for many other devices subjected to severe overloads or high temperatures. "Deltabeston" wire, it is claimed, requires a temperature of 1000 deg. Fahr. to start the disintegration of its asbestos covering, and a temperature of 1800 deg. to decompose the asbestos completely. Thus a coil can be run at a dull red heat without causing a breakdown in its insulation. These qualities created a demand for Deltabeston wire of rectangular section as well as round. At first it seemed an easy matter to treat a square or a flat wire in a manner similar to round "Deltabeston," but the company states it was only after a large amount of time and money had been expended in painstaking experimenting that the present method was perfected. The advantages of square or flat wires for certain purposes are numerous. For instance, it is a well-known fact that about 10 per cent greater copper section can be put into a given winding space by the use of rectangular wires than by employing round conductors. This is due to the perfect bedding secured by using wires with flat sides, between which practically no space is wasted. The reduction of lost space in a winding is advantageous in two other ways; first, less compound is needed to fill a coil if it is to be impregnated; and, second, the heat radiation is greatly improved by avoiding large spaces filled with a comparatively poor conductor of heat. An advantage of almost equal importance is that certain features of winding operations are facilitated by the use of flat-sided wires, especially when large conductors must be handled. Thus there is a great tendency for round wires to cut into any flat insulation between layers, due both to the tension in winding and chafing in service. With flat wires the pressure of the conductors on the between-layer insulation is distributed over large surfaces instead of being applied in lines at the centers of every wire. Therefore, greater stress can be applied in winding a flat wire with less chance of injuring the insulation underneath it.

EXHIBITS AT CONVENTION OF ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.

[illegible] at the recent annual convention of the Association of Railway Electrical Engineers in the Hotel La Salle, Chicago. The entire nineteenth floor was given over to the collection of exhibits and to the meeting place of the association. Following are brief notes relating to exhibits and exhibitors:

Adams & Westlake Company, maker of railway supplies, was represented by R. M. Newbold.

Automatic Annunciator Company attracted much attention by a loud-talking telephone device for announcing trains and stations. J. J. Comer, P. P. Hinckley and Lewis Cole were in charge.

Baird Electric Company exhibited a railway telephone signal system for steam and electric roads. A. E. Case and E. P. Baird represented the company.

Benjamin Electric Manufacturing Company exhibited a new line of reflector sockets ranging from 25-watt small standard bases up to 500-watt large bases. It also showed tungsten series fixtures. H. E. Watson and Geo. C. Knott represented the company.

Central Electric Company displayed Columbia incandescent lamps, Okonite wire, D. & W. fuses, Diehl fans, Opalux shades, junction boxes, train-line connectors, etc. The exhibit was in charge of J. M. Lorenz, G. M. Cox and D. Woodhead.

Columbia Incandescent Lamp Company exhibited a full line of its lamps, including 500-watt, 400-watt, 250-watt, 200-watt, 150-watt, 100-watt, 60-watt, 40-watt and 25-watt Mazdas for 110-volt circuits and also 25-watt and 15-watt train-lighting Mazdas for 32 volts and 60 volts. Train-lighting tantalums, including 80-watt, 32-volt and 60-volt lamps, also a 500-watt Mazda especially designed for factory and shop lighting, were shown. The exhibit was in charge of C. B. Oldham and J. G. Boyd.

Commercial Acetylene Company demonstrated its acetylene car-lighting system. The exhibit was in charge of Mr. H. G. Doran.

Consolidated Railway Electric Lighting & Equipment Company showed its axle-light system for train lighting.

Crouse-Hinds Company exhibited receptacles, knife switches, rosettes, sockets, harpoon guy anchors and the Imperial luminous headlight for electric and steam cars.

R. & J. Dick, Ltd., of Glasgow, Scotland, and Passaic, N. J., exhibited Dickbelt for train-lighting purposes. E. H. Griffith, H. W. Spalding and J. E. Macfarland were in attendance at the exhibit.

Edison Storage Battery Company showed the Edison nickel-iron battery for train lighting work. The display was in charge of H. G. Thompson.

Electric Storage Battery Company displayed storage batteries for signal and car lighting, as well as for vehicle use. The company was represented by G. H. Atkin, H. E. Hunt, T. A. Cressey, R. I. Baird, J. N. Rosholt and P. G. Downton. Included in the exhibit was a group of Manchester positives which had been in use for car-lighting service on the Chicago, Milwaukee & St. Paul Railroad for twelve years.

General Electric Company displayed modern Mazda lamps for train lighting and distributed copies of its various publications. The representatives of the company present were J. Scribner, E. M. Hawley, Henry Schroeder and W. S. Taussig.

Gould Storage Battery Company showed the Gould Simplex System in Exhibit Hall, and also a special operating exhibit on the floor below. The operating exhibit included the new Simplex regulator and mechanical polechanger. The interests of the company were in the hands of Rufus N. Chamberlain, G. G. Milne, W. F. Bouche, J. W. Jepson, Geo. R. Berger, W. M. Lalor and Chas. F. Krech.

Holophane Company was represented by C. A. Howe and showed a new line of train-lighting reflectors, including a steel [illegible]

Jandus Electric Company exhibited railway ventilating apparatus, comprising circulating and exhaust fans. B. A. Stowe, W. L. Cummiskey and C. W. Beach were in charge.

Kerite Insulated Wire & Cable Company made a display of its insulating wires and cables, in connection with the Watson Insulated Wire Company.

Luitweiler Pumping Engine Company showed models of non-pulsating pumps for railroad work. E. D. Williams was in charge.

W. N. Matthews & Brother were represented by V. L. Crawford.

Moloney Electric Company was represented by T. O. Moloney.

Monarch Incandescent Lamp Company, through Fairbanks, Morse & Company, was represented by J. S. Corby and J. S. Banks.

National Electric Lamp Association exhibited a full line of carbon, tantalum and Mazda lamps, including low-voltage lamps for train-lighting systems. The latter take 15 watts to 50 watts on 30-volt and 60-volt circuits. There were also large Mazdas, plain and frosted, up to 500 watts. C. W. Bender, J. T. Henninge and H. J. Raymond represented the association.

New York Leather Belting Company had a special belting for car-lighting systems.

Nungesser Electric Battery Company showed Acme Rapid dry batteries and "1900" dry batteries as well as carbon brushes.

Oneida Steel Pulley Company showed steel flange pulleys for railway car-lighting service and also a new split taper steel bushing. The exhibit was in charge of N. G. Stark and H. P. Gale.

Pyle National Electric Headlight Company displayed the Pyle headlight system. The exhibit was in charge of M. A. Ross.

Safety Car Heating & Lighting Company exhibited its axle-light train-lighting system and fixtures. Those representing the company were G. E. Hulse, H. H. Halm, J. G. Van Winkle, W. G. Hermsen, C. A. Pinyerd, C. A. Luckey and A. C. Moore, their Chicago manager.

Tipless Lamp Company showed its tipless tungsten lamps for railroad work. Among these is type G 18½ for 30 volts in units of 12 cp, 16 cp and 20 cp, for which an efficiency of 1 watt per candle is claimed. The exhibit also included the Heany tungsten lamp and the Heany fireproof wire. R. S. Carrick and R. P. Lee represent the company.

United States Light & Heating Company showed its axle-lighting system, including generators and controlling devices, as well as the National storage battery. The new automatic controller for variable output in axle lighting was a feature. The exhibit was in charge of C. E. Mead, C. A. Hooper, L. S. Cunny, J. E. Sinclair and W. Hungerford.

Western Electric Company displayed Hawthorn flaming-arc lamps, interphones for railway shops and offices, Hawthorn Mazdalier fixtures and Mazda lamps. George H. Porter George H. Lounsbery and R. N. Engers were in attendance. The lamp part of this exhibit showed the standard Mazdas in sizes from 16 watts to 500 watts, also train-lighting Mazdas, tantalums and Gems for 60 volts and 32 volts.

Westinghouse Electric & Manufactuing Company exhibited tungsten lamps for from 15 watts to 500 watts and also special metallic-filament car-lighting lamps of 6 cp and 8 cp. The principal feature of the exhibit was the new "wire-type" tungsten lamp, showing the several parts of the lamp. T. G. Whaling, B. F. Fisher, Jr., J. M. Schilling, A. N. Brown, L. N. Pyle, R. F. Moon and R. E. Schaulin were the representatives of the company.

Willard Storage Battery Company displayed the Willard standard train-lighting battery. T. A. Willard, R. Norberg, W. E. Ballantine and L. Sears explained the exhibit to interested visitors.

M. M. Wood gave a demonstration of the gyroscope on Thursday afternoon in the exhibit hall, and the exhibition was greatly appreciated.

Industrial and Commercial News

THE WEEK IN TRADE

REPORTS from trade centers last week were very little better than those for the previous week. There seems to be a slightly increased demand from jobbers and retailers, due to the advance of the season, but this increase is not sufficient to make manufacturers at all overjoyed. Distribution to consumers in some sections of the West has been improved by fall festivals and state fairs. Crop reports are all that could be desired, and the fact that no serious frosts have been reported in any portion of the corn belt assures the maturing and harvesting of this crop without any serious damage. Leading trade authorities contend that the disturbed political situation is acting as a deterrent upon business. Whether this is true or not it is certainly a fact that all lines of business are experiencing a period of quiet, if not of depression. In the industrial world there are few changes, and the majority of mills and factories are running far below capacity. High prices for raw material, particularly in the cotton and woolen industry, are making manufacturers conservative, and are rendering it difficult for them to figure clearly on the future. The iron and steel industries are quieter than at any period during the current year. The United States Steel Corporation reports that new orders are not now being taken in excess of 10,000 tons a day, which is only about 25 per cent of the capacity of the mills. It is said that the total tonnage taken in September will not exceed 300,000 tons. Commodity prices continue to sag, but as yet they have not declined sufficiently to furnish much encouragement to the export trade. Collections, especially throughout the West, are very much better, and there seems to be no tension among the Western bankers. Business failures for the week which ended Sept. 29, as reported by *Bradstreet's*, were 211 as against 190 the previous week, 195 in 1909, 225 in 1908, 177 in 1907 and 136 in 1906.

THE COPPER MARKET.

COPPER prices were a trifle stronger last week, and in the last few days of the week there was a little more activity and some evidence of speculative buying in standard warrants. The renewal of activity caused selling agencies and holders to refuse concessions, and in many instances even to advance the figures. The actual demand for consumption, both in this country and in Europe, showed very little improvement. It is generally predicted that the September statistics will show domestic takings to be considerably

Standard Copper:			Settling
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			
		Noon. £ s d	Close. £ s d
[illegible]		[illegible]	[illegible]
Extreme fluctuations for this year:			
[illegible]		[illegible]	[illegible]

smaller. It is also believed that the figures of production will be somewhat reduced. Quite a number of optimistic views are expressed in the market, and there is evidently more confidence in copper stocks in Wall Street, as is shown by the net gain of 3⅛ points for Amalgamated during the week. One of the best posted copper men connected with the selling end of the trade is quoted as saying: "As far as our business is concerned there is no falling off in demand, and I am giving the matter no serious thought, for I believe that Europe will be more than able to take care of any falling off in consumption in this country arising from curtailment in business. When Europe purchased large stocks of metal in July and August, it was because the foreign consumers had been fighting the market and had allowed their stocks to run down to a starvation basis. The American copper they bought at that time was not more than sufficient to fill up the gaps which their hand-to-mouth policy had allowed [illegible] principal foreign countries, especially Germany, is at the present time very encouraging." The exports for the month of September were 31,733 tons. Much of this, it is claimed, went into European warehouses. Standard copper was quoted on the Metal Exchange Oct. 3 as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Good Demand for Mica.—One of the principal importers of mica is responsible for the statement that the demand for mica has been very good throughout the current year, and that prices have been satisfactory. The consumption of mica is fairly steady, according to this authority, especially the demand from the electrical industry. It is claimed that the new tariff upon mica, which apparently reduced the rate of duty from 6 cents to 5 cents on untrimmed and from 12 cents to 10 cents on cut mica, has in reality resulted in importers paying a higher tax. This has been brought about by the difference in classification. Thumb-trimmed mica, which was formerly admitted as uncut and at the lower rate of duty, has been held by the treasury officials to be cut mica and dutiable at the 10-cent rate. Some months ago Eugene Munsell & Company secured a decision from the United States Board of General Appraisers declaring that mica of this character should come in at the lower rate. From this decision the United States government has appealed to the new Customs Court of Appeals, and this case will probably be heard during the current month. As the bulk of the mica that is used in this country is what is known to the trade as untrimmed, the final decision in this case is extremely important, and is awaited with great interest by importers.

Rubber Prices Lower.—The London market for crude rubber was considerably demoralized during the past week. It is even claimed that some of the large houses are in need of financial assistance to prevent failures. It is likely that assistance will be forthcoming in order that an open crisis may be averted. The London financial authorities charge the trouble in crude rubber to American manipulation. This may or may not be true, as London is in the habit of charging many of its troubles to "American manipulation." The market for shares in the many rubber development companies which were promoted last spring is practically dead. Very few transactions are now recorded. Crude rubber in the local market has been declining, and Para is now quoted at $1.45 a pound. This is encouraging manufacturers to buy a trifle more liberally. A steady market between $1.25 and $1.50 would be very satisfactory to manufacturers at the present time, and would do much to encourage the rubber trade.

Hall Signal Company.—The Hall Signal Company reports that its business is unusually good for this time of the year, and that the record of 1910 will probably be the largest in the history of the company. The books of the company are well filled with orders, although no very large contracts for signal apparatus have been placed recently by the railroads. The plants are being operated with a full day force, although the night shift which was employed up to a few weeks ago has been cut off. Dividends on the stock are not likely to be resumed, as the management intends to increase its working capital before making any disbursements.

Westinghouse Electric & Manufacturing Company.—The Westinghouse Electric & Manufacturing Company has recently received an order from the Simonds Manufacturing Company for six 500-kva transformers and two 200-hp rolling-mill motors to be used in the new Lockport (N. Y.) plant of the purchaser. One of the motors will be used on the hand saw-mill and the other on a cross-cut saw-mill. The motors will be geared to the mills, which will consist of two stands each. The motors will be so constructed as to permit the moving of the stator sideways in case of necessary repairs to the motor.

Long Island Railroad Cars.—The Long Island Railroad Company has received 65 of its new all-steel motor cars out of the order for 140 placed last year with the Pressed Steel Car Company. It is promised that 25 more cars will be delivered during October. These cars are for use on the main line between Jamaica and the new Pennsylvania Railroad station. They cost $18,500 each, and are asserted to be entirely fireproof and practically indestructible in case of collision.

New Westinghouse Plant.—Contracts will soon be awarded by the Westinghouse Electric & Manufacturing Company for the construction of the large foundry plant at Trafford City, Pa., mention of which was made in our issue of Aug. 4. The plant will be erected on the seventy acres of land recently bought by the company, and will be adjacent to the foundry of the Westinghouse Machine Company. The plans call for the investment of about $3,000,000 in buildings, and when completed 3000 men will be employed. Two foundries will be built, one for small castings, which will be a structure 200 ft. wide and 600 ft. long, with crane runways for handling the raw material and finished product; the other, which will be for large castings, will be 300 ft. wide and 800 ft. long and will be equipped with larger cranes. There will also be a pattern shop and pattern storage building, which will be 200 ft. wide, 600 ft. long and six stories high. The buildings will be constructed of fireproof material, with concrete floors. There will be added large shipping and receiving yards for railroad service. The entire trackage system in the plant will be constructed by the Inter-Works Railroad Company, which is controlled by the Westinghouse Company. A new power plant will also probably be built for operating these foundries. With the end of September the Westinghouse company concluded the first six months of its fiscal year, and reports that its average net earnings were about $500,000 per month. If this rate is kept up it will mean net earnings of $6,000,000 for the year, which is equivalent to 15 per cent on the company's capitalization.

Northern Colorado Power Company.—At the office of Henry L. Doherty & Company in New York an emphatic denial was given to the story, published in Denver, that plans had been formulated to take the Northern Colorado Power Company into the newly formed Cities Service Company. The new holding company has so far taken over no other property than those originally mentioned—the Denver Gas & Electric Company, the Empire District Electric Company and the Spokane Gas & Fuel Company. Other companies may be included later, but the intimation is made that the Northern Colorado Power Company is not one of those under consideration. The company was formed about three years ago and has several hydroelectric plants and extensive transmission lines in Northern Colorado and Southern Wyoming. The company furnishes energy to many towns and mines in the neighborhood of Boulder and has recently made arrangements to enter quite largely into the irrigation developments. It is capitalized at $3,000,000 but has never paid a dividend.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Salt Lake City, Utah; Williamsburg, Va.; Sharpsburg, Md.; Lakeview, Ore.; Fergus Falls, Minn.; Haverhill, Mass.; Marion, Ind.; St. Louis, Mo.; Asheville, N. C.; Harrisburg, Pa.; Farmington, N. M.; Athens, Ohio; Lancaster, Ohio; Avondale, Pa.; Philadelphia, Pa.; Richland, Ga.; Bayonne, N. J., and Walhalla, S. C.

Electrifying London Tramways.—It is announced in London that the County Council has decided to apply for parliamentary powers for the construction of 22½ miles of electric tramways, to replace the horse and motor omnibuses. There has been rapid progress in the construction of electric lines in the city of London within the last few years. In 1906 there were only 58½ miles of electric lines under the control of the London County Council, and at this time there are 113½ miles.

Edison Electric Illuminating Company of Boston.—At a recent meeting of the directors of the Edison Electric Illuminating Company of Boston, Robert Saltonstall was elected a member of the board to fill the vacancy caused by the death of George Dexter. Thomas K. Cummins, treasurer of the company and for some time a director, was elected a member of the executive committee to fill the vacancy caused by Mr. Dexter's death.

New Pennsylvania Power Companies.—Charters were issued last week at Harrisburg, Pa., for five new power companies in Northeastern Pennsylvania. These companies are to be located at Pen Argyl, Stockertown, East Bangor, Wind Gap and Tatamy. Each will bear the name of its town and is given an initial capitalization of $5,000. C. H. Briscoe, of New York, is named as the chief incorporator.

New Plant in Joliet.—Ground was broken last week at the [illegible] tric generating plant which will cost in the neighborhood of $1,000,000. The waste gas from the coke ovens will be utilized for fuel, and three 3000-kw generators will be installed. The appropriation for this improvement was recently allowed by the United States Steel Corporation.

Niagara, Welland & Lake Erie Railroad Company.—The Niagara, Welland & Lake Erie Railroad Company has applied to the Canadian Parliament for permission to construct an electric railway line from Niagara Falls, N. Y., to points on Lake Erie between Fort Erie and Fort Dover, via Welland and Port Colborne.

Financial.

THE WEEK IN WALL STREET.

WALL STREET enjoyed a more active period last week than in any of those which immediately preceded it. The total sales of stock amounted to 2,204,473 shares, which would not be considered large in the palmy days of the financial district, but which is double the record for some of the recent weeks. Prices also were considerably improved, and almost every active issue showed a net gain for the week of from two to five points. This improvement is surprising to some of the financial experts, in view of the complicated political situation and the free predictions that there will be a change of the political supremacy in several states. Wall Street no longer views with anxiety political changes. There have been so many political complications in recent years which were threatening to corporate interests, in which the party of opposition had no hand, that financiers have come to believe that one set of politicians is likely to be as bad as the other. The sentiment of Wall Street is very much improved, and it seems that the only thing lacking for the development of a material upward movement is the leadership of some strong and aggressive individual. A number of financiers who returned from Europe within the past fortnight have reported that both England and the Continent are anxious to buy our securities as soon as settled conditions in politics and business prevail in this country. It is believed that the time is not far distant when it will be able to place legitimate bond issues in Europe. Last week's developments in the international money market seemed to indicate that the end of the protracted period of cheap money in this country is at hand. The Bank of Germany has established an official rate of 5 per cent, and the Bank of England has fixed its discount rate at 4 per cent. American bankers must follow suit, and we may look for much stiffer rates on time loans. During the past two weeks the Southern borrowings have been heavy, and the drain upon the resources of Wall Street banks was shown in the loss of cash reported in the last statement. Rates for money Oct. 3 were: Call, 2@3 per cent; 90 days, 4½ per cent. The quotations in the table are those at the close on Oct. 3.

NEW YORK.

	Sept. 26.	Oct. 3.	Shares sold.		Sept. 26.	Oct. 3.	Shares sold.
All. Ch.	8¼*	8¼*	300	Int. Met., pfd.	56¾	56⅜	27,150
All. Ch., pfd.	30*	30*	——	Mackay Cos.	92½*	92	300
Amal. Cop.	62	65⅝	101,060	Mackay C., pf.	73⅞*	75½	364
Am. D. T.	20½*	20½*	——	Man. Elev.	138*	143½	4,630
Am. Loc.	37⅝	39	2,700	Met. St. Ry.	15*	15*	——
Am. Loc., pfd.	104½*	102½*	110	N. Y. & N. J. Tel.	139½*	139½*	——
Am. Tel. & C.	71*	75*	1,277	Steel, com.	68⅜	70⅞	316,500
Am. T. & T.	137⅛	137⅞	11,930	Steel, pfd.	116¼	117⅝	2,920
B. R. T.	76⅜	76⅞	25,880	W. U. T.	68½	74½	18,845
Gen. Elec.	145	146	1,200	West'h, com.	62¼	60½	3,400
Int. Met.	21½	21	27,100	West'h, pfd.	125*	128¾	400

PHILADELPHIA.

	Sept. 26.	Oct. 3.		Sept. 26.	Oct. 3.
Am. Rys.	43¼*	43¼*	Phila. Elec.	15⅞	15⅞
Elec. Co. of A.	11½*	11½	Phila. R. T.	18⅛	19⅛
Elec. St. Bty.	47	48⅜	Phila. Trac.	81*	83
E. S. Bty., pfd.	[illegible]*	[illegible]*	Union Trac.	43½	44

CHICAGO.

	Sept. 26.	Oct. 3.		Sept. 26.	Oct. 3.
Chi. City Ry.	180*	180*	Chi. Tel. Co.	120*	120
Chi. Rs., Ser. 1	61½	64½	Met. El. Com.	19*	19*
Chi. Rs., Ser. 2	15⅞	15½*	Met. El., pfd.	60*	60*
Com. Edison	112*	112*	Nat'l Carbon	123*	126
Chi. Subways	4½	4	Nat'l Car., pfd.	110½*	110½

BOSTON.

	Sept. 26.	Oct. 3.		Sept. 26.	Oct. 3.
Am. T. & T.	138⅝	138	Mex. Tel.	5¾*	5⅝*
Cum. Tel.	143	143*	Mex. Tel., pfd.	6½*	6½*
Edison E., Ill.	257½*	258	N. E. Tel.	130	130*
Gen. Elec.	145	145¼			
Mass. E. Rys.	18	[illegible]	W. T. & T., pfd.	83*	[illegible]*
Mass. E. Ry., pfd.	81½	84¼			

*Last price quoted.
Shares sold for week Sept. 26 to Oct. 1.

Financial Notes.

Philadelphia Rapid Transit.—The annual report of the Philadelphia Rapid Transit Company for the year which ended June 30, 1910, shows gross receipts of $17,991,100, as compared with $18,317,529 the previous year. The total net income, after paying taxes and other expenses, amounted to $7,044,741, as compared with $7,968,303 the previous year. Deducting from this the fixed charges, the company shows a deficit for the year of $1,329,723, as compared with $224,270 the previous year. The report of the president says that had it not been for the strike of the motormen and conductors, which lasted more than two months last spring, a very different statement would have been submitted. "At the time the strike was called," says the president's report, "the company had in the seven months of the fiscal year shown an increase of $681,964 in gross receipts, and $285,819 in net receipts. Had the same rate of increase continued for the fiscal year the company would have shown an increase in gross earnings of $1,261,469. The actual loss in passenger receipts during the sixty-six days of the strike, compared with the receipts of the year before, was $1,558,104. This is considering only the loss of receipts while the strike was in progress; it takes weeks and even months after a prolonged strike to get traffic back to its former condition, and it is doubtful whether even at the end of the fiscal year the receipts of the company had become normal. In addition there was a very heavy increase in the expense of the operation of the road, and it is estimated that extraordinary expenditures amounted to $836,855." The directors have charged off the entire strike expense, and provided for it by additional financing.

Earnings of Hydroelectric Development on Chicago Drainage Canal.—D. M. Deininger, comptroller of the Sanitary District of Chicago, has presented a report to the president and board of trustees for the first six months of the year 1910, showing the income and operating expenses of the electrical department of the district. The total income for the half year was $258,326, compared with $166,035 for the corresponding period of 1909, an increase of $92,291, or 55.5 per cent. The operating expenses, including depreciation, are placed at $113,795, an increase of 29.1 per cent over the corresponding period of the year before. The net earnings were $144,531, an increase of 85.5 per cent. The interest on cost of plant and the rentals are placed at $82,723, leaving $61,748 as profit. The operating expenses for the electrical department of the Sanitary District for the first half of 1910 are divided as follows: Production expenses, $15,623; transmission expenses, $21,194; distribution expenses, $8,184; utilization expenses, $6,260; commercial expenses, $5,677; salaries and general expenses, $21,169; depreciation, $35,686; total, $113,795. The total cost of hydroelectric plant and equipment as of June 30, 1910, is given as $4,267,614. The ratio of depreciation to cost of plant and equipment (per annum) is 1.67 per cent. Including depreciation, the net earnings are figured in Mr. Deininger's statement, for the first half of the year, at the rate of 6.77 per cent per annum. The greater part of the electrical output of the Sanitary District is sold to municipal bodies at low rates.

Montreal Power-Street Railway Merger.—During the past week a circular was issued by the board of directors of the Montreal Street Railway Company, through Secretary Patrick Dubee, to the shareholders, confirming the anticipated reports that it was proposed to unite the Street Railway Company and the Montreal Light, Heat & Power Company on the basis of the forecast figures of 250 per share for Montreal Street and 190 for the Power stock. It was proposed to form a holding company which would exchange its shares for those of the two companies on this basis. A statement of net income was made showing the combined net income to have been $2,687,824 in 1907, $2,882,258 in 1908 and $3,140,877 in 1909. Assuming that all the shares of the two companies were transferred upon the above basis, it would mean a holding company of $57,300,000, and the percentage of income upon this capital would be 4.69 in 1907, 5.03 in 1908 and 5.48 in 1909. The shareholders were asked for an expression of opinion on the proposed merger at the next general meeting. A great deal of opposition to the proposed amalgamation of the two concerns has been aroused by one of the papers, and it was rumored during the week that on account of the publicity given there was a likelihood of the consolidation not being carried through. Nothing authoritative on this point could be learned, and it is not probable that anything further will be done until the annual meeting of the Montreal Street Railway shareholders in November.

Telegraph Rumors in Wall Street.—A report was current in Wall Street last week that a deal had been effected between the Western Union Telegraph Company and the American Telephone & Telegraph Company, by which the latter company would take entire control of the former. The result of this report was a sharp advance in Western Union stock and some increase in the telephone stock. It was reported that plans had been developed by which the American Telephone Company would exchange five shares of its stock for seven shares of the Western Union stock. The rumors were emphatically denied by Theodore N. Vail, president of the American Telephone Company, who said: "There is absolutely not a shred of truth in these reports. The American company has not had and does not now have plans for the acquisition of any additional shares of the Western Union. We are satisfied to remain minority stockholders."

Federal Telephone & Telegraph Company.—The Federal Telephone & Telegraph Company, of Buffalo, which was formed in January, 1909, to take over a number of independent lines in the northern portion of New York State, has, according to the report of its president, B. G. Hubbell, been extremely successful and rapidly increased its earning capacity. During the six months ended June 30 last its revenues rose more than 50 per cent over the same period of 1909, and approximately 30 per cent over the six months which ended Dec. 31, 1909. The net profits of the company, after paying all fixed charges, for the six months which ended June 30 last were $120,978. The report of the president says that the City of Buffalo alone is using the company's service more than 6,000,000 times per year, which covers more than a majority of the telephone use in that city.

National Carbon Company.—The directors of the National Carbon Company last week declared the usual quarterly dividend of 1½ per cent on the common stock. The dividend is payable Oct. 15. There had been many rumors that the rate would be increased. Failure to do so, however, has not weakened the position of the stock. A year ago the company raised the rate of the common shares from 4 per cent to 5 per cent, and later on to 6 per cent. The company is said to be doing an immense business, and the price of the common shares, which are several points above the 7 per cent cumulative preferred, suggests that there is some plan ahead which will be more valuable to the stockholders than a mere advance in the dividend rate.

Connecticut Company Plans.—Plans for making the Connecticut Company stand in a new relation to the New York, New Haven & Hartford Railroad Company, which owns all of its stock, provide for a new capitalization to be based on the bonded debt and advances for improvements. The bonded debt of the Connecticut Company amounts to about $27,000,000, and advances for improvements to about $9,000,000. Under the new plan the parent company will take up all of the Connecticut Company's obligations, paying them as they mature, thus ultimately leaving the trolley company free from debt. The Connecticut Company owns or controls about 80 per cent of the trolleys in Connecticut, and its gross receipts last year amounted to nearly $8,000,000.

Northern Illinois Electric Railway Company.—A copy of the trust deed of the newly organized Northern Illinois Electric Railway Company has been filed by the Chicago Title & Trust Company in every county in Illinois through which the proposed line will pass. The first bond issue which is covered by this mortgage will amount to $2,000,000. It is proposed to construct a railway from Elgin to Peoria, and the line will pass through the counties of Kane, Kendall, DeKalb, Lee, Bureau, Stark and Peoria. E. P. King, of Lee Center, is president of the new Company.

Columbus (Ohio) Railway & Light Company.—The directors of the Columbus Railway & Light Company have failed to declare the regular quarterly dividend of ¾ of 1 per cent which would ordinarily have been paid Oct. 1. The reason for this omission is the strike which began July 24 and has not yet been settled. During the entire strike period the company has been in partial operation only and the extraordinary expenses have been very heavy.

Increase of St. Louis Company Capital.—In order to carry out its plans for extensions and improvements, the Suburban Electric Light & Power Company, of St. Louis, has increased its capital stock from $209,000 to $750,000.

Detroit United to Resume Dividends.—It is stated in Detroit that the United Railways Company of that city is planning to resume dividends on its outstanding capital stock. In order to do this, however, it will be necessary for the company to sell the bonds now held in the treasury. During the last three years over $4,000,000 has been expended for improvements and extensions out of the earnings. In addition to this, the floating debt, which in 1907 amounted to $1,500,000, has been taken up. J. C. Hutchins, president of the company, says that it is to be hoped that before the expiration of the present year the differences between the city and the company will be satisfactorily adjusted, enabling the bonds to be sold, and relieving the underwriters of their obligations, on which they will then receive a bonus of 2 per cent.

Chattanooga Railway & Light Company.—For the first seven months of the present year the gross returns of the Chattanooga Railway & Light Company showed an increase of $57,600, or 13.12 per cent over the previous year. The net for the same period showed a gain of more than $59,200, or 32.8 per cent over the corresponding period of last year. This company was recently chartered under the laws of the State of Tennessee as a successor to the Chattanooga Electric Company and the Chattanooga Railways Company, and has acquired all the property, rights, franchises and equipment of these companies. The company possesses liberal franchises, and the territory which it serves is rapidly increasing in population and business.

Public Service Corporation of New Jersey.—The Public Service Corporation of New Jersey has sold $4,000,000 of 5 per cent, three-year collateral gold notes to J. P. Morgan & Company, of New York, and Drexel & Company, of Philadelphia. These notes are secured by a deposit of $5,000,000 general collateral mortgage bonds of the company. These bonds are a portion of the $50,000,000 issue which was recently authorized, and of which $13,500,000 have been already sold. It was intended to dispose of other portions of this issue as the needs of the corporation required, but it has been decided that at the present time the bond market is not in a condition to make the sale of these securities advisable. This is the reason for the issue of the short-time notes.

Independent Telephone Company, Seattle.—The controlling stockholders of the Independent Telephone Company, of Seattle, Wash., who are citizens of Youngstown, Ohio, have sold their interests to a New York syndicate for $2,000,000. The purchase price has been deposited in a Youngstown financial institution, and will be distributed among the stockholders at once. It is reported that the syndicate buying this stock represents the Bell telephone interests, but this report has not been confirmed. The reason given by the Youngstown people for disposing of these securities is that they live too far away from Seattle to handle the property with convenience.

American Light & Traction Company.—The directors of the American Light & Traction Company have declared the regular quarterly dividends of 1½ per cent on the preferred stock and 2½ per cent cash and 2½ per cent stock on the common. In the first eight months of the current year the company earned a surplus, after preferred dividends, of $1,668,747, equivalent to about 16.5 per cent on the outstanding common stock. The earnings at the present time are running on the same high basis and it is believed that the annual report will show about 28 per cent on the common.

Chicago & Milwaukee Electric Company.—The report of the receivers of the Chicago & Milwaukee Electric Company for the first five months of the current year has been filed with the United States Circuit Court, and shows a deficit of $12,693 after meeting all operating expenses, taxes and interest on the receivers' certificates. The balance sheet of the company as of May 31 shows total assets of $498,934, including $68,639 spent for additions and betterments under the receivership, also $46,238 spent for equipment.

DIVIDENDS.

American Power & Light Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

Associated Gas & Electric Company, preferred, quarterly, 1½ per cent, payable Oct. 15.

Bell Telephone Company of Missouri, quarterly, 2 per cent, payable Oct. 1.

Bell Telephone Company of Pennsylvania, quarterly, 1½ per cent, payable Oct. 15.

Boston Suburban Electric Companies, preferred, quarterly, $1 per share, payable Oct. 5.

Cincinnati, Newport & Covington Light & Traction Company, preferred, quarterly, 1⅛ per cent; common, quarterly, ⅞ per cent, both payable Oct. 15.

Mexican Light & Power Company, quarterly, 1 per cent, payable Oct. 14.

National Carbon Company, quarterly, common, 1½ per cent, payable Oct. 15.

National Light, Heat & Power Company, preferred, quarterly, 1¼ per cent, payable Oct. 1.

New England Telephone & Telegraph Company, quarterly, 1½ per cent, payable Sept. 30.

Oklahoma Gas & Electric Company, preferred, quarterly, 1¾ per cent, payable Oct. 15.

Ottumwa (Ia.) Railway & Lighting Company, preferred, quarterly, 1¾ per cent, payable Oct. 15.

Philadelphia Company, quarterly, common, 1½ per cent, payable Nov. 1.

Public Service Corporation of New Jersey, quarterly, 1¼ per cent, payable Sept. 30.

San Diego (Cal.) Consolidated Gas & Electric Company, preferred, quarterly, 1¾ per cent, payable Oct. 15.

Standard Underground Cable Company, quarterly, 3 per cent, payable Oct. 10.

United Electric Securities Company, preferred, semi-annual, 3½ per cent, payable Nov. 1.

West Penn Traction Company, preferred, quarterly, 1½ per cent, payable Oct. 15.

REPORTS OF EARNINGS

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Cleveland, Southwestern & Columbus Railway Company:					
[illegible]	[illegible]	[illegible]	$50,457	$28,268	$22,089
[illegible]	[illegible]	50,964	39,754	26,824	12,930
[illegible]					
[illegible]	[illegible]	322,490	249,365	49,603	199,762
[illegible]	[illegible]	[illegible]	321,564	41,938	179,625
Detroit United Railway Company:					
[illegible]	[illegible]	587,863	311,151	178,463	[illegible]
[illegible]	[illegible]	507,002	294,098	162,998	[illegible]
Fairmont & Clarksburg Traction Company:					
[illegible]	[illegible]	[illegible]	38,874	12,609	[illegible]
[illegible]	[illegible]	[illegible]	28,888	12,310	16,577
Fort Wayne & Wabash Valley Traction Company:					
[illegible]	[illegible]	[illegible]	60,446	45,216	15,230
[illegible]	[illegible]	72,385	51,162	44,614	6,547
[illegible]					
[illegible]	[illegible]	[illegible]	62,070	19,858	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Keystone Telephone Company:					
[illegible]	[illegible]	47,206	46,790	24,266	[illegible]
August, 1909	89,923	[illegible]	45,003	26,343	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	......	......
[illegible]	[illegible]	[illegible]	[illegible]	......	......
Lake Shore Electric Railway System:					
[illegible]	[illegible]	[illegible]	79,933	34,718	45,214
[illegible]	[illegible]	55,522	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	89,845	66,570	[illegible]
[illegible]	[illegible]	106,088	79,064	[illegible]	15,714
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	......	......
[illegible]	[illegible]	917,844	[illegible]	......	......
Rio de Janeiro Tramway, Light & Power Company, Ltd.:					
[illegible]	[illegible]	[illegible]	[illegible]	......	......
[illegible]	[illegible]	[illegible]	[illegible]	......	......

General News

Construction News.

ALBERTVILLE, ALA.—[illegible] is reported to be contemplating the installation of new machinery.

MONTGOMERY, ALA.—The Montgomery Traction Company has awarded the contract for the construction of its new power house in Montgomery to the F. S. Royster Guano Company, of Norfolk, Va. The cost of the building is estimated at $14,000.

HEBER, ARK.—The plant and holdings of the North Arkansas Telephone Company are reported to have been purchased by L. E. Carmichael. The new owner, it is understood, will make improvements to the system.

ALHAMBRA, CAL.—The City Council has granted the Pacific Electric Railway Company, of Los Angeles [illegible] extension of its railway system [illegible].

BAKERSFIELD, CAL.—The Kern River Oil Fields, Ltd., is reported to have contracted with the San Joaquin Light & Power Company, of Fresno, Cal., to supply electricity to the amount of 2500 hp to operate the machinery in the oil fields of the company. It is understood that 200 motors are to be installed for the purpose of operating pumps, drills and other machinery.

BODIE, CAL.—Bids will be received by George Delury, county clerk, until Nov. 14 for the franchise applied for by the Hydro-Electric Company to erect and operate electric transmission lines in this county for a term of thirty years.

OROVILLE, CAL.—[illegible] of 20,000 cu. in. of water in the Middle Fork of the Feather River at a point 200 yards below the junction of the south branch of the river to be utilized for power development.

PARADISE, CAL.—W. H. Hanscom, of Paradise, has filed a notice of appropriation of 1500 miners' in. of water in Big Chico Creek, near Paradise. It is proposed to erect a 500-ft. concrete dam across the creek and to divert the water to be carried to a power house where electricity will be generated and distributed to the towns of Paradise, Orloff, Stirling, Concow and other places in this section.

RED BLUFF, CAL.—Notice of appropriation of 10,000 cu. in. of water in Mill Creek has been filed by T. H. Ramsey, manager of Cone ranch. The water will be diverted from the creek and carried in flumes to the Cone ranch, where it will be utilized to generate electricity.

REDLANDS, CAL.—The City Council has passed a resolution authorizing Mayor Strait to appoint a committee to confer with the Mayor and a committee of the trustees of San Bernardino regarding a proposal for the two cities to unite and build and operate a joint municipal electric light plant. The Redlands committee has been authorized to secure a price from the Southern California Edison Company on its distributing system in Redlands.

SACRAMENTO, CAL.—The Board of Supervisors has awarded a contract to the Pacific Gas & Electric Company to supply electricity for lighting the streets of the Curtis Oaks lighting district. The contract calls for twenty 200-cp arc lamps at $6.30 each per month, which is the same rate paid by the City of Sacramento for street lamps. Bids will soon be called for lighting the Highland Park district.

SALINAS, CAL.—Extensive improvements are contemplated by the Monterey Electric Light & Power Company in the next twelve months, which will involve an expenditure of about $500,000 and include the extension of the water system of Salinas and improvements to the gas service. The company has secured the right-of-way over the property of the Jacks Corporation for extension of its transmission line from Monterey to Salinas. It is expected that work will soon be resumed on construction of the line. John M. Gardiner is vice-president.

SAN BERNARDINO, CAL.—Bids will be received by the Board of Supervisors until Oct. 10 for a franchise applied for by the Pacific Light & Power Company for permission to construct and operate pole lines and other appliances for the transmission of electricity on the county roads for a term of [illegible] years.

SAN FRANCISCO, CAL.—[illegible] be planning to install 140 electroliers in the downtown district of the [illegible].

SAN FRANCISCO, CAL.—[illegible] Street Railroad Company for a charter to construct an electric railway in San Francisco to connect existing lines. The proposed railway will be about one mile long [illegible]. The company [illegible].

VISALIA, CAL.—The Mount Whitney [illegible] its transmission lines to McFarland. It is expected to have the line completed and in operation by Oct. [illegible].

DELTA, COL.—The Fairview Interurban Railroad Company has applied for a charter to construct an electric railway through the fruit and coal sections of Montrose [illegible] extend from Delta to Cedaredge and another to the coal mines at Fairview. A third line will extend from Delta along the California mesa. The company is to be capitalized at $250,000 and the incorporators are: Charles G. Montz, of Denver, Col.; Col. M. Zeigler, Henry Zeigler and Watson Zeigler, of Fort Collins, Col., and B. F. Hubbard, of Chicago, Ill.

FORT LUPTON, COL.—Plans are being considered for the construction of an electric interurban railway between Denver and Estes Park, via Fort Lupton. A company has been formed, known as the Denver & Greeley Interurban Railway. Business men of Lupton have already subscribed $15,000 toward the project. S. J. Rhodes, R. M. Barr and W. H. Davis, of Fort Lupton, Col., are interested.

WASHINGTON, D. C.—The Terminal Taxicab Company, 1225 Twentieth Street, Washington, D. C., would like to receive prices on equipment for electrical plants for charging storage batteries, etc.

MACON, GA.—The street lighting committee has reported to the City Council that fifty-five additional lamps will be required for the new territory recentlty annexed to Macon. The installation of the lamps [illegible] an expenditure of about $[illegible].

RICHLAND, GA.—Plans are being considered to increase the output of the municipal electric light plant at an early date. The new equipment will include an 80-hp Schofield boiler, a 100-hp Corliss engine and a 75-kw alternating-current generator. M. B. Brown is superintendent.

HONOLULU, HAWAII.—Contracts have recently been placed by the Honolulu Rapid Transit & Land Company for one 1500-hp Hamilton-Corliss, cross-compound engine to be direct connected to a 1000-kw, direct current, General Electric generator, Stratton steam separator, Cochrane oil separator and Wheeler & Edwards condenser and air pump. The company is installing two 420-hp Stiring boilers with superheaters. C. H. Ballentyre is manager.

ELK RIVER, IDAHO.—The new timber cutting mill now being constructed by the Potlach Lumber Company, of Potlach, Idaho, in Elk River, will be equipped for electric motor drive throughout.

AMBOY, ILL.—The City Council has granted the Northern Illinois Light & Traction Company a twenty-year franchise to construct and operate an electric railway on Main Street.

CHICAGO, ILL.—Negotiations have been closed between the City of Chicago and the trustees of the Sanitary Drainage District of Chicago whereby the latter is to provide street lighting for the entire city. The Sanitary Drainage District is to take over the transmission lines owned and operated by the city. It is proposed to double the number of street lamps now in use.

JERSEYVILLE, ILL.—The Alton, Jacksonville & Peoria Railway Company has awarded the contract for the construction of the roadbed and bridging for the seventeen-mile extension of its railway from Godfrey to Jerseyville to J. T. Scott & Son, of St. Louis, Mo. The company is also contemplating the installation of a 500-kw unit to increase the output of its power plant to meet the present demands made upon it.

KANKAKEE, ILL.—The contract for the construction of the power plant of the Kankakee Power Company has been awarded to C. Hoertz & Son. The cost of the plant is estimated at about $40,000.

KIRKWOOD, ILL.—The Kirkwood Electric Company is planning to erect a transmission line to Monmouth, seven and one-half miles, where the company will purchase energy of the Monmouth Public Service Company, which will be transmitted at 6600 volts. When improvements are made a twenty-four-hour service will be established. J. F. Kyler is secretary.

PRINCEVILLE, ILL.—The municipal electric light plant was recently sold to E. L. Brown, owner of the Elmwood electric light plant, for $[illegible].

GREENTOWN, IND.—Preparations are being made by the Greentown Telephone Company for rebuilding its telephone lines, which will include replacing the open wire with cables and running the lines through alleys as far as possible.

INDIANAPOLIS, IND.—City Engineer Klausmann is contemplating the installation of electric incandescent lamps in the residence district of the city where gas pipes are not laid. Bids have recently been received [illegible] the electric lighting companies electric lamps may be installed.

MARION, IND.—The City Council is reported to have voted to issue $75,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

MAUCKPORT, IND.—The Eureka Telephone Company is reported to [illegible] president of the company.

NEW ALBANY, IND.—[illegible] converted into a manufacturing plant. The factory has about ten acres [illegible]

[illegible] Adam Heimberger, president; H. Runyan, vice-president; George Summers, secretary, and C. W. Inman, treasurer.

[illegible] has been granted a franchise by the City Council to extend its railway in Clear Lake.

[illegible] ported to have authorized an issue of $20,000,000 in bonds, of which the proceeds of $10,000,000 will be used to refund outstanding obligations of the company; $2,000,000 will be used for extensions and improvements to its system during the next two years and the remaining $8,000,000 will be held for future requirements. The construction of the Muscatine Interurban Railway will be included in the expenditure during the next two years.

MAGNOLIA, IA.—It is reported that a special election will be held Oct. 11 to vote on the proposition to grant an electric light franchise to the Bullock Public Service Company. If the franchise is granted, the transmission line will be extended from Missouri Valley to Magnolia.

MARSHALLTOWN, IA.—Steps have been taken towards organizing an independent telephone company in Marshalltown. The new company will have a capital stock of from $75,000 to $100,000. W. H. Jones, M. E. Melvin and E. E. Benedict.

SPENCER, IA.—The contract for twenty-eight electroliers to be erected on Main Street has been awarded by the Council to the McDonnell Iron Works, of Des Moines. Efforts are being made to extend the system north on Main Street to Twentieth Street.

OAKLEY, KAN.—The Wesco Supply Company, of St. Louis, Mo., is reported to have secured the contract for the construction of the municipal electric light plant. Burns & McDonnell, Scarritt Building, Kansas City, Mo., are engineers.

RUSSELL, KAN.—The contract for the construction of the municipal electric light plant is reported to have been awarded to the Wesco Supply Company, of St. Louis, Mo. Burns & McDonnell, Scarritt Building, Kansas City, Mo., are engineers.

HOPKINSVILLE, KY.—The Kentucky & Tennessee Traction Company has petitioned for a charter for the purpose of constructing an electric interurban railway to connect Hopkinsville and Guthrie. Charles Vanderburg, of Toledo, Ohio, has charge of the preliminary work.

LOUISA, KY.—The Big Sandy Milling Company is reported to be in the market for dynamos with sufficient output to supply 100 lamps. John G. Burns, of Louisa, Ky., is secretary.

THIBODAUX, LA.—Contracts were awarded by the Board of Aldermen on Sept. 23 for the municipal electric light plant as follows: For power house to George Kettriham, at $4,950; for engine to the Diesel Engine Company, at $22,000; to the Fort Wayne Engineering & Manufacturing Company for pumps, at $7,125; Fort Wayne Electrical Works for wiring, at $1,012; for poles to A. C. Jones, of Opelousas, for $3,549.

BANGOR, MAINE.—John R. Graham, president of the Bangor Railway & Electric Company, is reported to have taken a sixty-day option on the property of the James Walker Company at Basins Mills. The property has valuable water rights and if purchased by Mr. Graham will probably be used for the development of electricty.

SKOWHEGAN, MAINE.—The contract for the construction of a dam across the north channel of the Skowhegan River has been awarded by the Skowhegan Water Power Company to J. L. Parker & Son, of Fairfield, Maine. C. S. Humphreys, of Madison, Maine, is engineer.

SHARPSBURG, MD.—The City Council is reported to have accepted the proposition submitted by the Antietam Light & Power Company, of Boonsboro, Md., to install electric lamps in Sharpsburg. The company will also supply electricity for lamps for business places and residences.

BOSTON, MASS.—At a special meeting of the stockholders of the Massachusetts Lighting Company held recently the stockholders voted to increase the capital stock of the company by an issue of 8700 shares at $130 per share, the proceeds to be used for paying for the stock of the Gloucester Gas Light Company and the Lexington Gas Company, recently acquired, and for extensions to the various operating plants.

CHARTLEY, MASS.—The Norton Electric Light & Power Company has applied to the Legislature for a franchise to extend its service through East Norton.

COLRAIN, MASS.—The Greenfield Electric Light & Power Company has purchased the plant and holdings of the Colrain Electric Light Company and will take possession Nov. 1. It is understood that the present plant will be closed and electricity for operating the local system will be supplied from the Shelburne Falls plant.

GLOUCESTER, MASS.—The Oceanside Company has applied to the City Council for a franchise to erect and maintain electric transmission lines on certain streets in the Magnolia district for the purposes of supplying electricity for lamps. The company has recently installed an electric plant in the Hotel Oceanside, in Magnolia, for the purpose of lighting the hotel and the several cottages connected with the hotel. Charles E. Phenix is president of the company.

[illegible] Electric Company to extend its transmission lines to the Atkinson town line.

HAVERHILL, MASS.—The New Hampshire Electric Railways Company is contemplating the purchase of 500-hp boilers with superheaters [illegible]

MARLBORO, MASS.—The Boston & Western Electric Railway Company, of Boston, Mass., has applied to the town officials for a franchise to construct and operate an electric railway in Marlboro. The proposed railway will be about sixteen miles in length and will connect Marlboro, Weston, South Sudbury and Waltham. At South Sudbury a branch, five miles in length, will be built to connect with the main line at Maynard.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company is contemplating extending its railway from the present terminus in Uxbridge to Manchaug, a distance of fourteen miles, via Whitinsville and East Douglas.

PITTSFIELD, MASS.—The Berkshire Street Railway Company has awarded the contract for the construction of its power house in Zylonite to F. T. Ley & Company, of Springfield, Mass. The building will be 120 ft. x 150 ft. in size. The plant will cost about $75,000, and, it is understood, will supply electricity for the Bennington railway and the Greylock electric railway when completed.

SPRINGFIELD, MASS.—The City Council has appropriated $400 to be utilized by the street lighting committee to investigate different methods of street lighting with a view of improving the street lighting system in Springfield.

SWAMPSCOTT, MASS.—The contract for street lighting has been awarded to the Lynn Gas & Electric Company, of Lynn, Mass., for a period of five years. Under the terms of the contract the company is to suppply arc lamps as follows: For the first year, $73 each; second year, $72.50 each; third year, $72 each; fourth year, $71.50 each; fifth year, $71.50 each, and incandescent lamps at $17.50 each per year. The contract is based upon the service of 90 arc lamps of 1200 cp each and 120 incandescent lamps.

DETROIT, MICH.—Announcement has been made by the Pere Marquette Railway Company that telephones will be installed for train despatching on the Toledo-Saginaw division. If it proves satisfactory the entire system will be equipped with telephones. The cost of the work is estimated at about $16,500, and 140 miles of track will be equipped.

HOUGHTON, MICH.—The Calumet & Hecla Company is reported to be contemplating remodelling its Osceola stamp mill. The company is gradually replacing underground pumps with new motor-driven units, electricity for which is supplied from its electric plant at Lake Linden, Mich.

KALAMAZOO, MICH.—Plans are being prepared by the Lake Michigan and Kalamazoo Railroad Company for the construction of an electric railway from Kalamazoo to Benton Harbor, for which application for a charter has been made. The capital stock is placed at $25,000 and the officers are: William A. Baker, of Coloma, Mich., president; William C. Klumb, of Kansas City, secretary and treasurer, and John M. Notley, of Kalamazoo, Mich., attorney.

ST. CHARLES, MICH.—The City Council is reported to have decided to appropriate $14,000 for the construction of an electric light plant.

FARIBAULT, MINN.—It is reported that the Consumers' Power Company is planning to supply electricity in Faribault from its plant now under construction at Cannon Falls, Minn.

FERGUS FALLS, MINN.—It is reported that the Otter Tail Power Company, owing to the dry summer, is contemplating the installation of a large auxiliary steam plant. The headquarters of the company are located in Fergus Falls, Minn., but it is expected that the steam plant will be installed at Wahpeton, N. D., and supply electricity in Fergus Falls, Wahpeton and Breckenridge, Minn. It is expected to have the plant in operation by Dec. 1, 1910.

HATTIESBURG, MISS.—The Hattiesburg Traction Company is reported to be contemplating the construction of an extension to Laurel, a distance of about thirty miles.

APPLETON, MO.—A franchise has been granted to E. A. Hookas to erect and operate a telephone system for a term of twenty-five years.

COLUMBIA, MO.—At an election held Sept. 27 the citizens voted in favor of the proposition to issue $125,000 in bonds, the proceeds to be used for constructing an electric light plant and water-works system. As yet a superintendent for the plant has not been engaged. John S. Bicknell is city clerk.

MEXICO, MO.—A deal has been consummated whereby the Mexico Waterworks Company and the Mexico Electric, Heat & Power Company has been consolidated under the name of the Mexico Public Service Company. The new company is capitalized at $300,000. Negotiations have been closed whereby the company will supply electricity for lighting the Town of Centralia, fifteen miles distant. The directors are: S. M. Locke, E. R. Locke, P. E. Locke, Mary E. Locke and J. J. Steele.

MACON, MO.—It is reported that the Gary system will soon commence work on construction of toll lines from Macon to Sedalia, and St. Joseph to Hannibal.

ST. LOUIS, MO.—Following a decision handed down by the Circuit Court holding its franchise valid, the West End Light & Power Company is reported to have made arrangements to finance its undertaking. The company is operating a franchise obtained from Browning, King & Company granted by the city in 1885. Steps will be taken at once for building the plant. The company is operating a transmission line from Kings Highway to Sarah Street and is furnishing electricity for lamps to the Buckingham Club and residences in that vicinity. The company, it [illegible] than is

now supplied by the Union [illegible] Company. [illegible] Dana is president of the company.

ST. LOUIS, MO.—The Board of Public Improvements is considering plans for enlarging the power plant in the city hall, which supplies electricity for lighting the municipal buildings. Four different plans are under consideration, a change being necessary on account of the additional service required for the municipal courts building, when completed. The first plan is to enlarge [illegible] the city hall: the second is to erect another building, to be used especially for a light and heating plant; the third to construct a separate boiler house on a lot to be purchased in the Mill Creek Valley, where it would be convenient to a coal switch, and convert the entire space now used in the basement of the city hall to steam turbines and generators with steam sent through a pipe line from the boiler house; the fourth plan is to purchase energy from the Union Electric Light & Power Company and take out the electric apparatus from the city hall and use the space to enlarge the heating plant. If the last plan is adopted, the electric generators will be sent to the City Hospital plant, which is too small for the extra load it will have to carry when the new buildings are completed. The Union Electric Light & Power Company has submitted a proposition to the Board of Public Improvements offering to supply electricity for lamps and motors for the downtown group of city buildings as follows: For service up to 60,000 kw per month, at 2.17 cents per kw-hour; from 60,000 to 70,000 kw, for 2.06 cents per kw-hour; from 70,000 to 80,00 kw, at 1.99 cents per kw-hour, and 1.95 cents per kw-hour for all above 80,000 kw. It is estimated that the amount needed for the buildings, including the new municipal building, will be between 60,000 and 70,000 kw per month. The above rates do not include lamps or appliances. The city is now generating electricity at the city hall plant at a cost of 1.08 cents per kw-hour, which includes the cost of heating the city hall, but does not include such expenses as insurance and depreciation.

CHOUTEAU, MONT.—The Automatic Telephone Company is contemplating improvements to its system, including overhauling its exchange.

MILES CITY, MONT.—Contracts for the installation of machinery for the municipal electric light plant are reported to have been awarded as follows: For engine to Whiteacre & Company, of St. Paul, Minn., and electrical equipment to the General Electric Company, of Schenectady, N. Y.

BROCK, NEB.—Preparations are being made by the Farmers' Telephone Company to erect a telephone line to Julian for toll connections.

MILFORD, NEB.—The citizens are reported to be considering the installation of an electric power and pumping plant for municipal service.

BAYONNE, N. J.—It is reported that the Texas Company, 17 Battery Place, New York, N. Y., is contemplating the erection of a power plant at its works in Bayonne.

EDGEWATER, N. J.—The New Jersey Board of Public Utility Commissioners has approved of the proposed bond issue of the New Jersey & Hudson River Railway & Ferry Company of $100,000, the proceeds of which are to be used for the extension of its tracks and additions to its generating plant.

SWEDESBORO, N. J.—The Gloucester County Electric Company, of Pitman Grove, N. J., has applied to the Borough Council for a twenty-five-year franchise in Swedesboro.

FARMINGTON, N. M.—Extensive improvements are contemplated to the local electric light and power plant, which will include the erection of a new dam, an ice and cold-storage plant, concrete spillway, bulkheads, etc., which will involve an expenditure of about $100,000. R. L. Knowles is president of the company.

ROSWELL, N. M.—A new schedule of prices for electricity for lamps was put into effect Sept. 16 by the Roswell Gas & Electric Company, under which the average consumer will secure a reduction of 6⅔ per cent. The minimum cost has been reduced from $2 to $1.50 per month. For all bills paid by the 10th of the month the price is reduced from 15 cents to 14 cents per kw-hour. To large consumers a greater discount is given.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, N. Y., until Oct. 10 for installing electric equipment in new public school 167, located on Eastern Parkway, Schenectady Avenue and Lincoln Place, Brooklyn Borough.

BROOKLYN, N. Y.—The Public Service Commission has granted the Brooklyn Rapid Transit Company permission to begin work on an extension of its Church Avenue line from Rockaway Avenue through a section of East New York and Brownsville, known as the South Side. Application will be made to the borough officials for a permit to begin work [illegible]

EAST RANDOLPH, N. Y.—The Public Service Commission, Second District, has granted George B. Woodmancy, of Randolph, N. Y., permission to commence work on the construction of an electric light plant [illegible] motors in this village.

HORNELL, N. Y.—The Hornell Electric Company is installing a large boiler in its power plant on Hill Street and has prepared plans for [illegible] its [illegible] system.

JAMESTOWN, N. Y.—The power house of the Salisbury Wheel Company, located on East Second Street, was destroyed by fire Sept. 21. The [illegible] ing the streets of Falconer, one of the suburban towns adjoining Jamestown. It is understood that the power plant will be rebuilt.

NEW YORK, N. Y.—The Fay Machinery Company, 126 Liberty Street, New York, N. Y., is reported to be in the market for a 75-kw, two-phase, 60-cycle, 2300-volt generator, belted. J. M. Fay is manager.

OGDENSBURG, N. Y.—Plans are being considered by the Long Sault Development Company to develop the water power of the South Sault channel of the St. Lawrence River, between Long Sault Island and the mainland, which is entirely American territory.

ONEIDA, N. Y.—The Rome & Oneida Electric Railway Company, which proposes to construct an electric railway to connect Rome and Oneida, via Verona, Blackman's Corners, Greenway and Hatch's Corners, thirteen miles in length, will apply to the City Council for a franchise to construct a railway in Oneida. D. C. Hadcock, of Oneida, N. Y., is promoter of the project.

ASHEVILLE, N. C.—Preparations are being made by the W. T. Weaver Power Company to extend its transmission lines to Canton, where it will furnish 1500 hp to the Champion Fibre Company to operate part of its plant. The Fibre company has a hydroelectric plant, which supplies power for a greater portion of the plant, also an auxiliary steam plant which is operated all the time. Owing to the expense of operating the steam plant the Champion company has decided to secure energy from the power company. The line will be erected from the plant on French Broad River and pass through the Juno and Leicester sections across Newfound Mountain to Canton and probably will be extended to Waynesville eventually. The W. T. Weaver Company is erecting an additional power plant on the French Broad River, below Marshall, at which 4000 hp will be developed. Electricity generated at this plant will be transmitted to the power house near Craggy, where it will be distributed.

SPRING HOPE, N. C.—D. L. Culpepper is reported to be interested in a project for the development of water power and the erection of a cotton mill on Tar River, six miles distanct from Spring Hope. It is esti [illegible]

WADESBORO, N. C.—Initial steps have been taken by A. H. Richardson, of Ansonville, N. C., and others toward the development of the northern section of the county. The plans include the construction of a large hydroelectric power plant near Kendall Ferry, in Rocky River, 15 miles north of Wadesboro. It is proposed to build a dam and power house at this point at a cost of about $400,000, and develop from 6000 to 7000 hp. The erection of a large cotton mill, near Ansonville, is also under consideration.

ALLIANCE, OHIO.—The Alliance-Akron Railroad Company is reported to have financed its project and plans are being made to commence work on the construction of its proposed railway this fall. The railway will be about twenty-six miles in length. Charles Keith is president of the company.

ATHENS, OHIO.—Bids will be received until Oct. 22 by the Board of Trustees of Athens State Hospital for furnishing and installing two 150-hp boilers, standpipe 22 ft. x 80 in., system of steam and water piping and hydrotherapeutic plant. For further information address the Osborne Engineering Company, consulting engineers, Cleveland, Ohio.

COLUMBUS, OHIO.—The ordinance providing for a vote at the November election on the question of issuing $225,000 in bonds to enable the municipal electric plant to supply electricity for commercial purposes and to light annexed territory was defeated by the City Council. A new measure asking for a $75,000 bond issue for the erection of substations and to purchase other equipment necessary to light the recently annexed territory will be introduced at the next meeting of the Council.

GALLIPOLIS, OHIO.—The Gallipolis telephone system was sold at auction Sept. 27 to E. L. Coen, of Vermillion, Ohio, for $14,450, which was two-thirds of the appraisement price.

LANCASTER, OHIO.—Sealed proposals will be received until Oct. 27 by the Board of Trustees of the Boys' Industrial School, Lancaster, Ohio, for furnishing and installing additional boilers for the light, heat and power plant at the institution. Plans and specifications are on file in the above office. Harold M. Bush, 69 North Fourth Street, Columbus, is engineer in charge of the work. F. C. Gerlach is secretary of board of trustees.

NELSONVILLE, OHIO.—Announcement has been made that the Hocking-Sunday Creek Traction Company will use electricity as motive power, instead of gasoline cars as first planned, on its proposed railway which is to connect Nelsonville, Gloucester and Athens, a distance of about thirteen miles.

MUSKOGEE, OKLA.—Plans are being considered by the Muskogee Industrial Development Company for the construction of a dam across the Grand River. Gov. C. N. Haskell is president of the company.

CORVALLIS, ORE.—The Portland, Eugene & Eastern Railway Company has applied to the City Council for a thirty-year franchise to construct and operate an electric railway in Corvallis.

LAKEVIEW, ORE.—Plans are being considered by the South Oregon Water Power Company to develop the water-power of Deep Creek in [illegible] will ultimately generate 10,000 hp. Electricity generated at the plant [illegible]

[illegible] of the City Council with the Rogue River Valley Electric & Power Company for the installation of thirty additional lamps on the streets in [illegible] Street to arc lamps.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., until Oct. 27 for steel cable, portable electric grinder, etc. Blanks and general information pertaining to this circular (No. 608) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 55 National Realty Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

ALLENTOWN, PA.—The Lehigh Valley Transit Company has recently secured franchises permitting the company to build a new electric railway from Quakertown to Perkasie. The company has operated its cars over the leased line of the old Quakertown Traction Company, which the Lehigh company has decided to cancel. The cost of the proposed new railway is estimated at about $200,000.

AVONDALE, PA.—The power house and boiler plant of the Pennsylvania Marble & Granite Company was destroyed by fire on Sept. 28, entailing a loss of about $25,000. Work will be suspended temporarily at the quarries, as the cranes and derricks were operated by electricity. A new building will be erected and machinery installed.

CARBONDALE, PA.—The New York, Ontario & Western Railway Company has awarded the contract for the erection of railroad shops at its Mayfield, Pa., yards, near Carbondale, to J. G. White & Company, 43 Exchange Place, New York, N. Y. The work will include a 10-stall roundhouse with turntable, machine shop with power plant complete, storehouse, oil building, and a complete coaling station with a storage capacity of approximately 1000 tons, at an estimated cost of about $150,000.

CARLISLE, PA.—Contracts have been awarded by the Cumberland Railway Company for the construction of a three-mile extension to the Tye Fork branch and also a three-mile extension of the main line to the Gibson-Carr Construction Company, of Middlesboro, Ky. An extension to reach Jellico, Tenn., a distance of twenty-seven miles, is also under consideration.

CHAMBERSBURG, PA.—Plans are being considered by local capitalists and residents of St. Thomas for the construction of an electric railway between Chambersburg and St. Thomas. The railway will be seven and one-half miles in length. It is said that as soon as $100,000 in capital stock is subscribed work will commence on construction of the road. A company was chartered four years ago under the name of the Chambersburg & Western and surveys were made.

CHESTER, PA.—The Philadelphia Electric Company, which controls the Beacon Light Company, of Chester, Pa., has purchased a site on the river front on which it will erect an overhead or an underground carrier system across the Reading Railway to facilitate the unloading of coal.

ELLWOOD CITY, PA.—The City Council has granted the Pittsburg, Butler, Slippery Rock & Grove City Railway Company a franchise to construct and operate an electric railway in Ellwood City. The company proposes to build a railway to connect Butler, Slippery Rock, Grove City, Prospect and West Liberty, a distance of twenty miles.

HARRISBURG, PA.—Sealed proposals will be received at the office of Board of Commissioners, Water and Lighting Department, Harrisburg, Pa., until Oct. 18 for furnishing and installing gas power and electric power pumping machinery, ready for continuous service, at the high service pumping station of the Water Department. Specifications, blanks, etc., can be obtained on application at the office of the commissioners. John A. Affleck is president of the commission.

HIGH SPIRE, PA.—The Borough Council has decided to light the borough by electricity. It is expected that the borough will erect its own distributing system and make arrangements with the Steelton Light, Heat & Power Company, of Steelton, Pa., for energy to be supplied from the York Haven plant.

LAIRDSVILLE, PA.—The Muncy Creek Telephone Company has in- [illegible]

LEBANON, PA.—The directors of the Ephrata & Lebanon Street Railway Company have financed the construction of a new electric railway between Ephrata and Lebanon, twenty-three miles long. The cost of the road is estimated at $400,000, work on which will begin this fall. George [illegible]

MAUCH CHUNK, PA.—It is reported that a movement is under way by local capitalists for the construction of an electric railway from [illegible]

[illegible] Westmoreland Railway Company have decided to make extensions to the [illegible] miles.

[illegible]

[illegible]phia & Western Railway Company for the construction of a branch line from the main division at a point between Villa Nova and Radnor, extending into West Conshohocken.

PHILADELPHIA, PA.—It is reported that George Sachsenmaier & Company, 1309 Race Street, Philadelphia, Pa., are in the market for a 15 or 20-hp, 208-volt, 60-cycle, single-phase generator (Wagner preferred), and a 100-kw, 220-volt, 60-cycle, three-phase alternator, standard make.

YORK, PA.—Extensive improvements are being made to the plant of the S. Morgan Smith Company, in York, Pa., including additions to the power plant and the installation of electric cranes. It is understood that a large part of the power plant equipment has already been purchased.

DILLON, S. C.—At an election held Sept. 27 the proposition to issue $15,000 in bonds for improvements and extensions to the municipal electric light plant was carried.

NEWBERRY, S. C.—It is reported that contracts have been placed by the Mollohon Manufacturing Company and the Newberry Cotton Mills with the Southern Power Company, of Charlotte, N. C., for electricity to operate their plants. It is understood that the service will be secured from the transmission line which the Southern Power Company is now preparing to erect. About 1200 hp will be required by the Mollohon mill and 500 hp by the Newberry mill to operate about one-third of its plant, the remainder operating by steam power.

WALHALLA, S. C.—The City of Walhalla is reported to be contemplating the installation of a municipal electric plant and would like to receive prices on equipment for same, including water wheel, alternating-current generator, switchboard, transformers, line material, etc.; water wheel to develop 450 hp under 60-ft. head. The street lighting system will require seven and one-half miles of wire. George L. Wilson is Mayor.

BELLEFOURCHE, S. D.—The electric plant of the Bellefourche Light, Heat & Power Company was recently destroyed by fire.

AUSTIN, TEX.—The Austin Electric Railway Company is contemplating extending its railway system to South Austin, a distance of about two miles.

CALVERT, TEX.—It is reported that the Calvert Water, Ice & Electric Lighting Company is contemplating making extension to its plant.

CLARKESVILLE, TEX.—The plant of the Clarkesville Light Company was destroyed by fire on Sept. 26, causing a loss of about $40,000. The city will be without electric service until the plant is rebuilt. The plant was insured for $25,000.

FLORESVILLE, TEX.—The installation of an electric light plant in Floresville is reported to be under consideration. For further information address L. G. Wilder, secretary of the Business Men's Club.

GONZALES, TEX.—Preparations are being made by the Gonzales Telephone Company to move its local exchange. It is understood that a new switchboard carrying 1000 drops will be installed.

LOCKNEY, TEX.—The electric light plant which is being installed by local capitalists is nearly completed and will soon be placed in operation.

SAN MARCOS, TEX.—The San Marcos Utilities Company is contemplating the erection of about six miles of new transmission lines and overhauling one Corliss engine. W. N. Joiner is manager.

TYLER, TEX.—J. L. Worthman Construction Company, of Beaumont, Tex., is reported to have submitted a proposition to the Tyler Commercial Club offering to construct an electric railway from Tyler to Paris, Tex., and to establish machine and repair shops in Tyler, in consideration of a bonus of $300,000 upon completion of the road.

KAMAS, UTAH.—Application has been filed with the state engineer by John A. Knight, of Woodland, Utah, to appropriate 15 cu. ft. of water of the Provo River, to be utilized for power purposes. Mr. Knight proposes to supply electricity for lamps and motors in Kansas and vicinity.

SALT LAKE CITY, UTAH.—Bids will be received by the Utah Light & Railway Company until Oct. 15 for the erection of a steel transmission line from Salt Lake City to Ogden. Plans and specifications can be seen at the office of the electrical engineer, 133 South West Temple, Salt Lake City, Utah.

RICHMOND, VA.—The Richmond & Henrico Railway Company is planning to build a power house on Lester Street, between Louisiana and Orleans Streets, at a cost of about $23,000.

RICHMOND, VA.—The Virginia Railway & Power Company has applied to the City Council for a franchise to extend its railway up Hanover or Stuart Avenues from Harrison Street to Kensington, thence along that thoroughfare to the Boulevard and beyond to Roseneath Road.

RICHMOND, VA.—The Richmond Power Company has applied to the City Council for a franchise to erect poles and wires and subways for the transmission of electricity from the Midlothian coal mines in Chesterfield to Richmond. Miles M. Martin is attorney for the company.

WILLIAMSBURG, VA.—Plans are being considered by the Board of Trustees of William and Mary College for the construction of a water and light system for the institution to cost about $25,000. The trustees have engaged Architect Wiley, of Lynchburg, Va., to prepare plans and [illegible]

BURDOIN HEIGHTS, WASH.—The Hamann Lumber Company has installed an electric plant in its mill to supply electricity for lighting its works and to furnish power for operating machinery for clearings on Kabekona Ranch.

ELLENSBURG, WASH.—[illegible] E. I. Butler, superintendent of the municipal electric plant, recommended the installation of arc lamps instead of cluster lamps in the business district as proposed.

NORTH YAKIMA, WASH.—[illegible] North Coast Company, now building a railway across Washington, are contemplating operating a railway across the Cascade Mountain range by electricity. An electric power development is now under way at Packwood Lake, near the headwaters of Cowlitz River, about ninety miles from Spokane. The power plant with transmission lines to Tacoma, Seattle, North Yakima and other towns in Central Washington will cost about $3,000,000. The project is reported to be connected with the North Coast Railway for the purpose of supplying power to operate the trains across the Cascades. F. L. Pitman, of Spokane, Wash., is chief engineer.

SPOKANE, WASH.—The City Council is considering the question of installing a municipal electric power plant at the up-river pumping station. Under the proposed plan the city will be able to construct a plant with an output of 6000 hp at a cost of about $150,000. The proposed plant will furnish power to operate all the city's pumping machinery, which at the present time cost $28,000 annually.

SPRINGDALE, WASH.—The new street-lighting system has been completed and put into operation; the principal business and residence streets are lighted by electricity for the first time. The service is furnished by the Kulzer Electric Company, of Valley, Wash., which has supplied electricity in Springdale for two years. The Town Council has contracted with the company for the service for one year.

WALLA WALLA, WASH.—Bids will be received by the City of Walla Walla until Oct. 15 for lighting the streets of the city with 186 or more arc lamps beginning Nov. 1, 1910. Bidders are requested to submit proposals covering a period of three and five years from Nov. 1, 1910. T. D. S. Hart is city clerk.

CHARLESTON, W. VA.—The Kanawha Water & Light Company has recently installed one 500-hp Babcock & Wilcox boiler, and also has recently placed a contract with the Allis-Chalmers Company, of Milwaukee, Wis., for practically a duplication of its electrical equipment, including a 750-kw steam turbine set and one 200-kw, direct-current, motor generator set, together with additional pumping equipment. W. C. Davisson is treasurer.

SUMMERSVILLE, W. VA.—Application has been made to the Nicholas County Court by W. H. Campbell for a twenty-year franchise to construct and operate an electric light and power system in this city.

BELOIT, WIS.—It is reported that contracts have been awarded by the Beloit Iron Works for equipment for its new power plant as follows: For boilers to the Reliance Boiler Works, of Oshkosh, Wis.; to the C. & G. Cooper Company, for engine, and the General Electric Company for generator.

BELOIT, WIS.—The Gardner Machine Company, of Beloit, Wis., is reported to have equipped its new plant for electric motor drive throughout. It is understood that electricity for operating the plant will be secured from the Beloit Water, Gas & Electric Company. All equipment needed for the present is said to have been purchased.

BOYD, WIS.—The Yellowstone River Telephone Company is reported to be contemplating extending its telephone lines this fall.

GREEN BAY, WIS.—The plant of the Northern Hydro-Electric Power Company at High Falls is nearly completed and will soon be put in operation. The new plant will supply electricity to operate the interurban cars of the Green Bay Traction Company and for lighting and manufacturing purposes in Green Bay.

LA CROSSE, WIS.—At an election to be held Nov. 8, it is reported, that a proposition to issue $50,000 in bonds will be submitted to a vote, the proceeds to be used for the construction of a municipal electric light plant.

NEENAH, WIS.—It is reported that arrangements are being made to begin work on construction of the large power plant at Gardner dam, above Shawano, on the Wolf River. John I. Beggs, of Milwaukee, Wis., is said to be interested in the project.

OSHKOSH, WIS.—The Wisconsin Telephone Company is contemplating extending its telephone line from Oshkosh to Franklin, a distance of six miles.

EDMONTON, ALTA., CAN.—It is reported that the City of Edmonton is contemplating the development of the water power of the Athabasca River. It is proposed to utilize several of the falls on the Athabasca River, including Grand Rapids, Pelican Rapids, Stony Rapids and the Rap du Joli Falls. Engineer Fielding has been engaged by the city to investigate the proposition.

ST. VITAL, MAN., CAN.—Application has been made to the Municipal Council of St. Vital by Joseph Bernier, secretary of the Rural Railway Company, for a thirty-year franchise to construct and operate an electric railway in St. Vital. If granted a franchise the company agrees to build a railway five miles in length from either Winnipeg or St. Boniface.

WINNIPEG, MAN., CAN.—Bids will be received by the Board of Control until Oct. 20 for furnishing one 15-hp, 60-cycle, induction motor [illegible]

BROCKVILLE, ONT., CAN.—It is reported that bids have been asked by the City of Brockville, Ont., for debentures, the proceeds of which will be used for improvements to the municipal light and power plant.

GUELPH, ONT., CAN.—[illegible] majorities, one granting a franchise to the People's Railway Company and the other authorizing the City of Guelph to subscribe for $85,000 in capital stock of the company. Under the terms of the franchise the entire railway system connecting Guelph with Berlin, Elora, Fergus, Arthur, Hespeler and Puslinch Lake is to be completed by July, 1912. Work will commence at once on grading of the railway between Guelph and New Berlin. The road between Berlin and New Germany is well under way. A. W. Bugg, of Berlin, Ont., Can., is secretary.

HAMILTON, ONT., CAN.—The Canada Steel Company is reported to have decided to establish its plant in Hamilton. It is proposed to erect and equip a plant at a cost of about $400,000. The proposed plant will be equipped for electrical operation.

HAMILTON, ONT., CAN.—Mayor MacLaren and Controller Allen have succeeded in reaching a tentative agreement on certain points that have been in dispute between the City of Toronto and the Cataract Power Company for some years, under which the company has agreed to pay the city $14,000 for a period of three years under the street lighting arbitration award. The power contract of July 18, 1908, will be cancelled.

OTTAWA, ONT., CAN.—Bids will be received at the office of the Commissioners of the Transcontinental Railway, at Ottawa, Ont., until Oct. 18, for equipment of a roundhouse at Lake Superior Junction, Ont., and for centrifugal pumps and motors required for the sewage pump house at the Winnipeg shops, Winnipeg, Man. Plans and specifications may be seen and full information obtained at the office of Gordon Grant, chief engineer, Ottawa, Ont., Can., and of S. R. Roulin, district engineer, St. Boniface, Man. P. E. Ryan is secretary of the commissioners.

ST. CATHARINES, ONT., CAN.—Plans are being considered by the Niagara, St. Catharines & Toronto Railway Company for building an extension of its railway from Fonthill to Fernwich.

TORONTO, ONT., CAN.—The Toronto Electric Light Company has obtained an injunction restraining the City of Toronto from erecting any more poles in connection with its hydroelectric system, or from stringing wires on those already erected.

TORONTO, ONT., CAN.—A report has been presented to the Board of Control by the city engineer and city solicitor recommending that the city construct electric surface railway lines on Gerrard Street, in North Rosedale, on St. Clair Avenue and in other newly annexed districts, comprising 9.7 miles of track. The cost of the work is estimated at $570,000, including $250,000 for overhead and track work and $320,000 for permanent pavements.

TORONTO, ONT., CAN.—It is reported that the Hydro-Electric Power Commission has decided upon further development and has applied to the interests which control the power production on the Trent Valley for power to be supplied in Cobourg, Whitby and other towns in the Midland district. With this extension the commission will cover the whole Province, the Ottawa Valley, St. Lawrence frontier, Midland district, Niagara power zone, Fort William and Port Arthur.

TORONTO, ONT., CAN.—The Canada Paper & Power Company, recently incorporated with a capital stock of $10,000,000, is reported to be closely allied to the Quebec & Lake St. John Railway, which is controlled by the Canadian Northern Quebec Railway system. It is understood that the company proposes to develop a water power on the Saguenay River, near Chicoutimi, where it is estimated that between 150,000 and 200,000 hp can be developed. William MacKenzie is reported to be interested in the project.

MONTREAL, QUE., CAN.—The Board of Control has awarded the contract for lighting the streets of the city to the Montreal Light, Heat & Power Company, for a period of ten years, to take effect on Nov. 1, 1910. Under the terms of the new contract the company is to furnish 572 6.6-amp arc lamps at $72.70 each per year, 1650 4-amp lamps at $63.15 each per year, 80-cp incandescent electric lamps at $23 each per annum, and 40-cp incandescent lamps at $16 per lamp per year. J. S. Morris, general manager of the Montreal Light, Heat & Power Company states that it will take six months to install the lamps and accessory station equipment and will involve an expenditure of at least $200,000.

WALLACE, SASK., CAN.—The Hypotheck Mining Company, which owns a mining property at Kingston, is reported to be contemplating the installation of electric power in its mines at a cost of about $12,000. Steam power is now being used.

DAWSON CITY, YUKON.—The power plant of the Northern Light, Power & Coal Company has been completed. The plant has an output of 9000 kw and cost $2,000,000.

MEXICO CITY, MEX.—The Mexico Tramways Company has been granted concessions by the Federal Government for the construction of two electric interurban railways; one to extend from Mexico City to [illegible] miles in length.

New Industrial Companies.

[illegible] ing automatic gas igniters and other gas and electric appliances. The incorporators are: Henry T. Barker, Paul R. Stockton and Frank L. Gifford.

[illegible] MOTOR & ENGINEERING COMPANY, [illegible]

[illegible] with a capital stock of [illegible] by A. C. Allen, A. E. Roof, G. T. Clithers and A. E. Church, of Chicago, Ill. The company proposes to manufacture engines and machinery.

THE [illegible] MACHINE COMPANY, of New York, N. Y., has been chartered with a capital stock of $25,000 by D. A. Garber, J. B. Wolff and H. R. Burt, of New York, N. Y. The company proposes to do a general contracting business.

THE EDISON-BEACH CAR COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $5,000 by William W. Wheatley, L. Wheatley and William S. Gore. The company proposes to manufacture electric batteries and appliances.

THE INDEPENDENT ELECTRICAL SUPPLY COMPANY, of New York, N. Y., has been chartered with a capital stock of $200,000 by H. H. Kabat, J. Snyder and A. W. Palmer, of New York, N. Y. The company proposes to do a general electrical engineering business and deal in electrical supplies.

THE ISBELL-CHAPMAN ELECTRICAL COMPANY, of Bowling Green, Ky., has been incorporated with a capital stock of $5,000 by William H. Isbell, W. W. Chapman and G. L. Mercer. The company proposes to deal in electrical equipment.

THE JAMES GOLDMARK COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $20,000 for the purpose of carrying on a general electrical engineering business. The incorporators are: Rupert Jencks, Richard V. Pell and Karl Ambrock, all of 83 Warren Street, New York, N. Y.

THE KOCH ELECTRICAL SUPPLY COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $5,000 by Benjamin F. Koch, Florence B. Koch, 1311 Sterling Place, Brooklyn, N. Y., and Herbert S. Slocum, 507 Fifth Avenue, New York, N. Y. The company proposes to manufacture and deal in electrical devices and appliances.

THE O'NEIL-BRUCE LIGHT COMPANY, of Memphis, Tenn., has been incorporated by H. T. Bruce, C. W. Churchill, Eugene Sutcliffe and others. The company proposes to manufacture and sell lamps.

THE POWELL ENGINE CORPORATION, of Brooklyn, N. Y., has been incorporated by L. P. Powell, R. W. Powell and C. L. McLaughlin, of Bensonhurst, N. Y. The company is capitalized at $50,000 and proposes to manufacture machinery, engines, automobiles, etc.

THE SHUR-ON TROLLEY GUARD COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $25,000 by Henry J. Tiedt, 438 North Hamilton Street; Frank J. Nolan, 449 West Ferry Street, and Harold J. Young, 40 Winslow Avenue, all of Buffalo, N. Y. The company proposes to manufacture all kinds of appliances for electric cars.

THE WILSON MOTOR CAR COMPANY, of Newark, N. J., has been chartered with a capital stock of $50,000 by S. F. Wilson, J. Foley, Jr., of Newark, N. J., and G. A. Lutz, of Jersey City, N. J. The company proposes to manufacture motors, engines, machinery, etc.

New Incorporations.

HACKETT, ARK.—The Hackett Telephone Company has been incorporated with a capital stock of $5,000 by William Hastings and others.

AUGUSTA, GA.—The Greenville, Greenwood & Augusta Railway Company has been chartered with a capital stock of $1,000,000 to construct a railway from Augusta, Ga., to Greenville, S. C., via Greenwood, 125 miles in length. The incorporatorts are: Henry Briggs, Frank Hammond and J. P. Charles, of Greenville, S. C.; J. C. Fawcett and Henry Zimmerly, of New York, N. Y.

HAGERMAN, IDAHO.—The Hagerman Valley & Western Railway Company has been incorporated with a capital stock of $200,000 for the purpose of constructing a railway to be operated by electric, steam, compressed air, gasoline or other motive power. The directors are J. Morton, W. Coltharp, H. Stroud, W. Clifford, E. M. Bell and J. Stewart Clark.

BELLEVILLE, ILL.—Articles of incorporation have been filed for the St. Clair Traction Company with a capital stock of $2,500. The company proposes to construct an electric railway from Belleville to a point in the southeastern part of St. Clair County. The directors are: Edward L. Thomas, C. A. Heinzelman, L. D. Turner, Jr., and William A. Twenhoefel, all of Belleville, Ill.

ST. PAUL (P. O. ST. PETER), ILL.—The St. Paul Telephone Company has been incorporated with a capital stock of $2,300 by Louis Opfer, Henry Moeller, Jacob Yund, Henry Opfer, Jr., and William Wissman.

FRANKFORT, IND.—Articles of incorporation have been filed for the Logansport & Southern Traction Company by Owen C. Brumbough, Elmer E. Sheridan and James R. Brown. The company is capitalized at $25,000 and proposes to construct and operate an electric railway between Frankfort and Logansport.

GREENFIELD, IND.—The Gem Telephone Company has been incorporated with a capital stock of $4,500 for the purpose of building and operating a telephone system in Gem and Hancock counties. The directors are: L. N. Larabee, Albert Buesking and F. M. Thomas.

KOKOMO, IND.—Articles of incorporation have been filed for the Kokomo Public Utility Company with a capital stock of $10,000 for the purpose of operating a public utilities company. The directors are: George [illegible] Kokomo, Ind.

LA GRANGE, IND.—The Riverside Electric Company has been chartered with a capital stock of $10,000. The directors are: J. C. Cain, W. H. Cain and A. L. Cain.

LINTON, IND.—The Linton Mutual Telephone Company has been incorporated with a capital stock of $10,000 by David R. Scott, Likens Littell and others.

ONTARIO, IND.—The Riverside Electric Company has been incorporated with a capital stock of $10,000 for the purpose of constructing a plant to generate and transmit electricity for lamps, heat and motors. The incorporators are: John C. Cain, H. F. Cain and A. L. Cain.

HERNWOOD (R. F. D., GRANITE), MD.—The Hernwood Telephone Company has been organized to construct a telephone line between Hernwood and Pikesville, Md., a distance of nine miles. The incorporators are Albert Ferrell and others.

MINNEAPOLIS, MINN.—Articles of incorporation have been filed for the Minneapolis Northern Suburban Railway Company by Charles Sherman, John J. McCarthy, Paul J. Marvin, L. L. McCulloch and William Lampert. The company is capitalized at $250,000 and proposes to construct and operate an electric railway from Minneapolis to Little Falls.

SPRINGFIELD, MO.—Articles of incorporation have been filed for the Springfield & Eastern Railroad Company by Hector D. Mackay, president, and Mortimer M. Hollemback, chief engineer, both of Springfield, Mo. The company is capitalized at $2,000,000 to construct and operate an electric railway from Springfield to Carthage and Joplin, with a branch from Paris Springs, via Mount Vernon and Monett to Pierce City. The proposed railway will be about 100 miles in length.

CONCORD, N. H.—Articles of incorporation have been filed for the Central New Hampshire Power Company with a capital stock of $2,000,000. The company proposes to develop the water power of the Blackwater River and will establish power stations in Webster and Salisbury for the distribution and sale of electricity. The incorporators are: Nathaniel E. Martin, of Concord, N. H.; Edward C. Crosby, F. L. Houghton, Dennison Cowles, of Brattleboro, Vt., and Edwin D. Clough, of Concord, N. H.

JERSEY CITY, N. J.—The Sheridan County Electric Company has been organized in this city for the purpose of transmitting and distributing electricity. It is capitalized at $25,000 and the incorporators are: F. W. Longfellow, Riverdale-on-Hudson, New York City; A. Gregory, P. K. Walcott, Brooklyn, N. Y.; E. M. Southern, Staten Island, and others.

JERSEY CITY, N. J.—Articles of incorporation have been filed for the Indiana & Kentucky Power Company by H. O. Coughlan, S. A. Anderson and J. R. Turner, of Jersey City, N. J. The company is capitalized at $50,000 and proposes to construct and operate electric light, heat and power plants.

MILLVILLE, N. J.—The Millville, Tuckahoe & Ocean City Electric Transportation Company, of this city, has been incorporated with a capital stock of $100,000 to construct a fright and passenger electric railway between Millville and Ocean City.

LITTLE VALLEY, N. Y.—The Clean Interstate Telephone Company has been incorporated by E. M. Earley, A. Larkin, D. A. Allen, Olean E. Campbell, all of Little Valley, N. Y.

NORTH TARRYTOWN, N. Y.—The Philips Manor Electric Light Company has been chartered with a capital stock of $50,000 by E. P. Benjamin, of Tarrytown, N. Y.; D. Elder, Tompkinsville, N. Y., and H. V. M. Dennis, Jr., of New Brunswick, N. J. The company proposes to generate and distribute electricity.

PORT CRANE, N. Y.—Among the newly incorporated companies is the Fenton Telephone Company, organized to construct a telephone line between Port Crane and Chenango Forks. It is capitalized at $500, paid in, and the following directors have been elected: E. W. Neff, Alvah Shepardson, Harvey Grippen, of Port Crane, N. Y., and E. E. Mowrey, D. D. Engle, Chenango Falls, N. Y.

CLEVELAND, OHIO.—The Home Light & Ice Company has been chartered by J. R. Collins, E. J. Knott and others. The company is capitalized at $10,000.

CLEVELAND, OHIO.—The American Subway Company has been chartered with a capital stock of $200,000 to build and operate a subway for the transportation of passengers and freight in Cleveland, Ohio. The incorporators are: A. B. du Pont, John N. Stockwell, Jr., Fred C. Alber, E. C. Hibbs and C. A. Nau.

MILLERSPORT, OHIO.—Articles of incorporation have been filed for the Ohio State Interurban & Electricity Promoting Company by Albert E. Boone, H. A. Axline, Lawrence S. Climer, Levi Bright and E. O. Boone. The company is capitalized at $99,000 and proposes to construct an electric railway from Lake Erie to the Ohio River. Under its charter the company has the right to furnish heat, light and fuel.

JESTER, OKLA.—The Jester Telephone Company has been incorporated with a capital stock of $2,000 by W. F. Corder, A. W. Lock and L. J. McMinn, of Jester, Okla.

MOODYS, OKLA.—Articles of incorporation have been filed for the Moodys Telephone Company by W. Combs, W. T. Williams and Walter R. Gourd, directors, all of Moodys. The new concern is capitalized at $3,000, and proposes to build a system of rural telephones.

OKLAHOMA CITY, OKLA.—The Home Heating & Lighting Company has been incorporated with a capital stock of $100,000 by E. J. Dupree, J. D. Dupree, W. G. Croslen, W. E. Hudson and R. J. Morgan.

[illegible] PA.—The [illegible] & Lehigh Telephone Company will apply

for a charter with a capital stock [illegible] purpose of constructing a telephone line through Greenwich, Albany and Maxatawny townships in Berks County and points in Lehigh County. The incorporators are: William Y. Fetherolf, Jesse M. Lengel, Elmer J. Bachman and Edgar Greenawald. James S. [illegible] P., is secretary and treasurer.

BURGETTSTOWN, PA.—The Burgettstown Farmers Telephone Company, with an authorized capital stock of $5,000, has filed articles of incorporation.

DENVER, PA.—The Denver & Ephrata Telephone Company has been organized with the following officers: Silas E. Bard, president; John G. Mentzer, vice-president; Alvin W. Mentzer, secretary and treasurer. The company will apply for a charter with an authorized capital stock of $25,000. Exchanges will be established at Denver and Ephrata with connection with the Bell telephone system.

GREENVILLE, S. C.—The Home Light & Power Company has been chartered by local capitalists and W. S. Lee, of the Southern Power Company. The company is capitalized at $100,000 and proposes to furnish electricity for lamps and motors in Greenville. Energy for operating the system will be purchased from the Southern Power Company, of Charlotte, N. C. Thomas J. Arnold is president and treasurer of the company.

ARMOUR, S. D.—The Howard Telephone Company has been incorporated with a capital stock of $1,000 by John Staufer, of Tennis, S. D.; and Samuel Teske.

OKOBOJO, S. D.—The Little Bend Okobojo Telephone Company has been chartered with a capital stock of $24,000 by H. P. Knox, of Little Bend; W. H. Green and W. E. Jenkins, of Okobojo,, S. D.

TENNIS, S. D.—The Banner Telephone Company has been incorporated with a capital stock of $1,000 by John Staufer, of Tennis, S. D.; J. J. Ernesti, of Goudville, S. D., and Charles Schmidt, of Tennis, S. D.

ELIZABETHTON, TENN.—The Watauga Power & Lighting Company has been organized and the following officers elected: Lee F. Miller, president and treasurer; W. E. Hunter, vice-president, and J. H. Grayson, secretary and general manager. The company is erecting a large concrete dam on the Watauga River and has a contract to furnish electricity for lamps and motors in Bristol, Tenn. The dam will be 50 ft. in height and will develop about 3000 hp. W. J. Oliver, of Knoxville, has the contract for construction of the dam.

DONNA, TEX.—The Donna Gin & Power Company has been incorporated by A. F. Hester, J. L. Guernsey and B. H. Hooks. The capital stock of the company is placed at $8,000.

GATESVILLE, TEX.—Articles of incorporation have been filed for the Gatesville Light & Power Company with a capital stock of $15,000 by J. A. Gilcrist, C. F. Caruth and J. R. Raby.

LOGAN, UTAH.—The Cache County Amusement Company has been incorporated in Utah to construct an interurban railway through Cache County to Preston, Idaho. It is capitalized at $100,000, and the incorporators are: Leo Nielson, Logan; F. J. Gustin, J. H. Garrett and Finlay Brooks, Salt Lake City.

MOSIDA, UTAH.—The Mosida Telephone Company has filed articles of incorporation with the Secretary of State, with a capital of $2,500. The officers of the company are: L. B. Curtis, president; W. F. R. Mills, vice-president, and H. C. Allen, secretary and treasurer.

SALT LAKE CITY, UTAH.—The Blacksmith Fork Light & Power Company has been chartered with a capital stock of $100,000 for the purpose of developing water power in the Blacksmith Fork on Bear River. M. S. Browning is president; Alfred Budge, vice-president, and A. B. Irvine, secretary and treasurer.

ENOSBURG FALLS, VT.—Articles of incorporation have been filed for the Van Horne Electric Light & Power Company with a capital stock [illegible]

ROANOKE, VA.—Articles of incorporation have been filed for the Foster Falls Power Company with a capital stock of $100,000. The charter of the company gives it the privilege of establishing dams and storage basins within 15 miles of Foster Falls, in Wythe or Pulaski counties; also to erect transmission lines and distribute power within 150 miles of that place, and to furnish electricity in the towns of Wytheville, Pulaski, Radford, Christiansburg and Salem and the City of Roanoke; Henry K. McHarg, of Stamford, Conn., is president; John B. Newton, vice-president, and J. W. Cure, secretary and treasurer.

SOUTH BEND, WASH.—The Twin City Electric Company has been incorporated with a capital stock of $10,000 for the purpose of supplying electricity in South Bend and Raymond, Wash. The incorporators are: J. B. Crary and J. B. Bridges.

SOUTH BEND, WASH.—Articles of incorporation have been filed for [illegible] electric railway between Raymond and South Bend, Wash.

WESTON, W. VA.—The Buckhannon, Weston & Glenville Electric [illegible] from Sago to Buckhannon, via Weston and Glenville. The incorporators are: S. C. Rusimell, L. H. Morrison, J. G. Hall, L. H. Treppett, W. H. Gaston, G. F. Day, C. E. White, D. O. B. Hall, of Buckhannon, and J. A. Crislip, of Clarksburg, W. Va.

OTTAWA, ONT., CAN.—The Ottawa, Rideau Valley & Brockville Railway Company has been granted a charter to construct an electric railway about sixty miles long from a point near Ironsides, Que, south through Ottawa and the counties of Carleton, Grenville and Leeds to Brockville, Ont., on the St. Lawrence River, opposite Morristown, N. Y., where connection will be made by ferry with the New York Central & Hudson River Railroad.

Personal.

MR. THOMAS [illegible] was a guest at the luncheon given by Gimbel Brothers on the occasion of the opening of their new store in New York on Sept. 28.

MR. JAMES S. WEEKS, formerly superintendent of the Lyons (N. Y.) Gas Light Company, has been appointed superintendent of the Palmyra (N. Y.) Gas & Electric Company.

MR. E. K. FORD has been appointed commercial agent of the Albany Southern Railroad, Hudson, N. Y. Mr. Ford was formerly connected with the Wilkes-Barre Gas & Electric Company.

MR. JAY THORN has resigned his position as chief engineer of the Geneseo (N. Y.) Gas & Electric Company to enter the sales department of the Wayne County Electric Company, Lyons, N. Y.

MR. G. W. ROUNDS has been appointed general superintendent of the Tacoma Railway & Power Company, Tacoma, Wash., and has resigned as general superintendent of the Savannah (Ga.) Electric Company.

PROF. MORGAN BROOKS, of the electrical engineering department in the University of Illinois, has resumed his work after a year's leave of absence, during which he made a journey around the world for study and recreation.

MR. A. J. PURINTON has resigned as manager of the Toledo & Chicago Interurban Railway, Kendallville, Ind., to become general superintendent of the St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo.

MR. T. D. JENSEN, for the last year with the Shawinigan Water & Power Company, at Montreal, has been appointed assistant in the department of electrical engineering of the engineering experiment station of the University of Illinois.

MR. NORMAN W. HARRIS, president of the Harris Trust & Savings Bank of Chicago and prominent in the financing of telephone and other public utility properties, has been elected a director of the American Telephone & Telegraph Company.

MR. L. B. WICKERSHAM, formerly general manager of the United Railways, Portland, Ore., has been appointed chief engineer of the company. His successor is Mr. C. A. Coolidge, recently appointed general manager of the Oregon Electric Railway, Portland.

MR. CHARLES H. COURSER, formerly with the Edison Electric Illuminating Company of Brooklyn, N. Y., has accepted a position with the New England Engineering Company, of 50 Church Street, New York City, and is at present superintending extensive additions being made to the plant of the Dayton (Ohio) Lighting Company.

MR. GUGLIELMO MARCONI has denied the report recently circulated that he was in bad health. Latest reports place him in the Argentine Republic, where he claims to have received wireless messages from Glace Bay, Nova Scotia, and Clifden, Ireland. The distance covered is estimated at 5600 miles, which represents the longest distance thus far reached.

MR. W. S. LEE, vice-president and general manager of the Southern Power Company, is now in Europe, where he will continue his investigations of electrochemical processes for extracting nitrogen from air for manufacturing fertilizer. The Guye process will soon be employed by the Southern Power Company at Great Falls, S. C., under the direction of Mr. Lee.

MR. JAMES M. KITE has been appointed by the New York Public Service Commission, Second District, engineer of its division of telephones and telegraphs. Mr. Kite completed an electrical engineering course in the Drexel Institute in Philadelphia. Shortly after graduation he entered the engineering department of the New York & Pennsylvania Telephone & Telegraph [illegible] became assistant engineer and traffic engineer.

[illegible] feeders of the Metropolitan Street Railway Company, of New York City, to accept a position as representative and construction engineer with Mr. T. J. Cope, of Philadelphia, electrical construction contractor and manufacturer of underground specialties. For the past twelve years Mr. Brockway has been engaged in the underground electric railroad work with the Metropolitan Street Railway Company, superintending the feeder system during the change from cable to electric.

[illegible] Public Service Commission, Second District, telephone and telegraph accountant in its division of telephones and telegraphs. Mr. Wilcox was selected by the legislative committee which investigated the question of placing telephones and telegraphs under the jurisdiction of the com- [illegible]

[illegible] pany, examining accounts of various public service corporations.

[illegible] tric Company, has been appointed executive head of the new Appraisal Department established at the home office of Stone & Webster, Boston, Mass., for work in connection with the appraisal of railroad and electric properties. Mr. Potter became connected with the Seattle Electric Company in November, 1907, as assistant to the late Mr. Howard F. Grant, who was then general manager of the company. In April, 1908, he was appointed manager of the Seattle Electric Company. His duties as manager began immediately following the financial depression of 1907, and continued through the preparations for the Alaska-Yukon-Pacific Exposition, as well as during the period of the Exposition. Mr. Potter was largely instrumental in organizing the Stone & Webster Club of Washington, which comprises in its membership officials and department heads of properties controlled by Stone & Webster in Seattle, Tacoma, Bellingham and Everett. Mr. Potter will assume his new duties on Oct. 15, 1910. His successor as manager of the Seattle Electric Company will be Mr. H. T. Edgar, at present manager of the Northern Texas [illegible]

Trade Publications.

INSULATING VARNISH.—Much interesting information relating to insulating properties of paraffine varnish is contained in bulletin No. 12 of the Dielectric Manufacturing Company, of St. Louis, Mo.

MOTOR FANS.—Ventilating fans driven by motors of either the alternating-current or the direct-current type are described briefly and listed in bulletin 27 of the Ilg Electric Ventilating Company, of Chicago.

SILENT CHAINS.—Booklet No. 102 of the Link Belt Company, Philadelphia, Pa., is devoted to silent chains for use with motor drives. Numerous illustrations are given of chains utilized in connection with motor-driven machine tools.

LIGHTING SUPPLIES.—Catalog No. 20 of the Crescent Company, 206 South Clinton Street, Chicago, Ill., is an illustrated price list containing brief descriptions of lamp guards, cord adjusters, soldering compounds, wireless clusters, and pendent fixtures.

ALTERNATORS.—The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has issued bulletin No. 1051, dealing with revolving field alternators of the belt-driven type. These machines are designed for single, two or three-phase, in ratings ranging from 15 to 200 kw.

AIR COMPRESSORS.—The National Brake & Electric Company, Milwaukee, Wis., has issued publication No. 391, devoted to motor and belt-driven air compressors. Portable and stationary outfits for all classes of service, together with the necessary accessories, are described in detail.

VACUUM CLEANERS.—The Keller Manufacturing Company, Philadelphia, Pa., has issued a well-prepared pamphlet giving instructions for unpacking and installing its vacuum cleaners. Diagrams are given of both the vacuum piping systems and the electric circuits of the motors.

ARC LAMPS.—The Adams-Bagnall Electric Company, Cleveland, Ohio, has issued a leaflet giving illustrations and brief descriptions of its regenerative flame arc lamps. It is stated that the electrodes have a life varying from sixty hours with alternating current to seventy hours with direct current.

SWITCHES.—The Hart & Hegeman Manufacturing Company, Hartford, Conn., has issued Catalog G, illustrating the well-known H & H surface snap, push button, rotary floor and door switches. Included in the catalog are also bases, boxes, conduit fasteners, handles, mats, plates, receptacles and wall cases.

ELECTRIC VEHICLES.—The Waverley Company, Indianapolis, Ind., has issued an instructive bulletin giving specific information concerning the cost of maintaining an electric vehicle in actual service. The information given in the bulletin is based upon replies received to letters sent to various users of the Waverley electric vehicle.

SIGN FLASHERS.—Motor-driven switches intended for use in the circuits of electric signs are described briefly in bulletin and price list No. 7 of the Reynolds Electric Flasher Manufacturing Company, 191 Fifth Avenue, Chicago, Ill. Many illustrations are given of signs employing these switches which are now in active service.

DIRECT-CURRENT MOTORS.—Many hints relating to the proper selection of motors for driving machine tools are given in bulletin No. 391 of the Triumph Electric Company, Cincinnati, Ohio. These motors are of the direct-current, steel-frame type, and have been designed with special reference to obtaining the requisite strength with the minimum of weight.

WELDING MACHINES.—The Thomson Electric Welding Company, Lynn, Mass., has issued a neatly executed catalog illustrating and describing its welding machines arranged for various services. It is shown that electric welders are particularly useful in connection with the manufacture of carriages, bicycles, tools, wire, pipe, automobiles and various domestic appliances.

CENTRIFUGAL PUMPS.—The De Laval Steam Turbine Company, Trenton, N. J., has issued a 96-page book entitled "High Efficiency of Centrifugal Pumps," which contains a large amount of information relating to the testing of pumps. Numerous charts are shown of the results of such tests, the charts being interpreted particularly from the viewpoint of the engineer.

MINE TELEPHONES.—Much interesting information of an engineering nature concerning telephones of the mine type is given in bulletin No. 1000 of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. The bulletin is well illustrated, views being given of iron-clad telephones, and diagrams are given of the circuits arranged with particular reference to use in mine installations.

BUSINESS NOTES.

[illegible] COMPANY.—The [illegible] Charles I. Kiewert Company, maker of flaming arc lamps, has been removed from 110 South Clinton Street to 58 Plymouth Place (Manhattan Building). Mr. H. W. Fowzer is in charge.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has announced the following change in address and management of its Chicago office: Mr. W. R. Bonham succeeds Mr. F. L. Merrill as manager of the office, which is located at No. 275 La Salle Street, instead of in the Manhattan Building, as formerly.

THE GOLDSCHMIDT THERMIT COMPANY.—On Oct. 1 Mr. E. Stutz, vice-president and general manager, retired from the direction of the Goldschmidt Thermit Company, to be succeeded in that post by Mr. William C. Cuntz. Mr. Cuntz brings to his position a thorough knowledge of the steel business and a wide acquaintance with steam and electric railway officials of the country, having been connected for eighteen years with the Pennsylvania Steel Company.

STONE & WEBSTER.—At their home office in Boston, Mass., Stone & Webster have established a new department which will be officially known as the "Appraisal Department," which has become necessary by reason of the growing business of the corporation in the appraisal of values and readjustment of franchises of many electric service and railway systems in the East and South. Stone & Webster were employed by the bondholders' reorganization committee of the Metropolitan Street Railway, of New York, in an advertising capacity, and have also been called on to appraise and fix values, earning capacity, etc., of many independent plants in other parts of the country, street railways, banks, and state railroad commissions. The executive head of the new department will be Mr. E. E. Potter, at present general manager of the Seattle (Wash.) Electric Company, who will take charge on Oct. 15.

THE CUTLER-HAMMER MANUFACTURING COMPANY.—Mr. George B. Katzenstein, Jr., has been appointed manager of the new heating appliance department of the Cutler-Hammer Manufacturing Company, with headquarters for the present in the Chicago office of that company. Mr. Katzenstein has been engaged in the development and marketing of electric heating appliances for many years. Formerly he was vice-president and general manager of the Consolidated Electric Appliance Company, of San Francisco, and he has devoted a great deal of attention to the heating of water by electricity. Very largely through his efforts the instantaneous type of electric water heater has been developed. In this apparatus the use of resistance wire is avoided, carbon electrodes being substituted. In securing one of the leading American specialists in electric heating, the Cutler-Hammer Company has placed its new department in strong hands.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

[illegible] 11 N. Royal St., Mobile, Ala. Third annual convention, Anniston, Ala., [illegible]

[illegible] W. H. Tapley, Engineering Societies Building, 29 West 39th St., New [illegible]

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

[illegible] ENGINEERS. Secretary, Ralph W. [illegible] Societies Building, [illegible] West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and [illegible]

AMERICAN STREET & INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Next meeting, Atlantic City, [illegible]

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, John W. Corning, Boston Elevated Railway Company, Boston, Mass. Next meeting, Atlantic City, N. J., Oct. 10-14, 1910.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Next meeting, Atlantic City, N. J., Oct. 10-14, 1910.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, Little Rock, Ark.

[illegible] G. H. W[illegible] [illegible]

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago. Next meeting, Boston, Mass., June, [illegible].

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Ry., Chicago. Next annual meeting, Chicago, [illegible]

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allen H. Royce, 48 King St., W., Toronto, Ont.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Indianapolis, Ind.

CHICAGO ELECTRICAL SHOW. Manager, H. E. Niesz, 150 Michigan Boulevard, Chicago. Next [illegible]

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Acting Secretary, F. D. Morris, 323 Hagerman Bldg., Colorado Springs, Col.

EASTERN STATES INDEPENDENT TELEPHONE ASSOCIATION OF PENNSYLVANIA, NEW JERSEY, MARYLAND AND DELAWARE. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

ELECTRIC VEHICLE AND CENTRAL STATION ASSOCIATION. Secretary, H. T. Sands, [illegible] Pleasant St., M[illegible]

ELECTRIC CLUB, Chicago. Secretary, F. S. Hickok, 824 Marquette Building, Chicago. Meets every Wednesday noon, 303 Wabash Ave.

ELECTRIC CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Next meeting, Albany, N. Y., Jan. [illegible]

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next annual meeting, Chicago, Nov. [illegible]

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Credit Association). Secretary Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

ENGINEERING SOCIETY OF WISCONSIN. Secretary, W. G. Kirchoffer, 31 Vroman Building, Madison, Wis.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, C. H. Lembower, Reading, Pa.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., April 4 and [illegible], 1911.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago. Annual convention, Baltimore, October 24 and 25, 1910.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntington, Ind.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Next meeting, St. Paul, Minn., 1911.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, [illegible] Wednesday in March each year.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, [illegible]

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., Sept. [illegible]

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October, each year.

MAINE ELECTRICAL ASSOCIATION. Secretary, Fred D. Gordon, Auburn, Maine.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. P. Biggs, Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, B. W. Cowperthwait, Faribault, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Railway & Light Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Schweer, Windsor, Mo. Next meeting, St. Louis, May, 1911.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, [illegible]

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn. Next meeting, New York, March, 1911.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, L. D. Gibbs, 39 Boylston St., Boston, Mass.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRICAL SHOW, Oct. 10-20, 1910. General Manager, Geo. F. Parker, 124 W. 42d Street, New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Next [illegible]

OKLAHOMA PUBLIC UTILITIES ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next reunion, Atlantic City, N. J., 1911.

[illegible] Van Vleet, 1157 Monadnock Building, Chicago, Ill. Annual meeting, Birmingham, Ala., Oct. 13, 14 and 15, 1910.

PACIFIC COAST ELECTRIC VEHICLE ASSOCIATION. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

PITTSBURG ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburg, Pa. Meetings, fourth Monday of each month.

RAILWAY ELECTRIC SUPPLY MANUFACTURERS' ASSOCIATION. President, A. C. Moore, Safety Car Heating & Lighting Co., Chicago.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D. Next meeting, Redfield, S. D., Jan. 11 and 12, 1911.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electri-[illegible] nual meeting, March, 1911.

[illegible] Secretary, Lena M. Owen, St. Johnsbury, Vt.

[illegible] Association. Secretary, A. B. Marsden, [illegible], Vt.

[illegible] Electrical Show. October [illegible] November [illegible].

[illegible] Association of Electrical Inspectors. Secretary, W. S. [illegible]. Next meeting, Omaha, Neb., Oct. [illegible].

[illegible] Society of Engineers. Electrical Section [illegible] Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block. [illegible] Regular meetings, first Friday of each month, except January, June and August. Annual meeting, first Tuesday after Jan. 1, each year.

Wireless Institute. Secretary, Sidney L. Williams, 42 Broadway, New York.

Wisconsin Electrical Association. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association. Secretary, John S. Allen, Lake Geneva, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. [illegible]

[Prepared by W. F. Bowers, Patent Law, 1 Reaver St., N. Y. [illegible]]

971,[illegible]. SYNCHRONOUS INDUCTION MOTOR; [illegible] [illegible]

971,[illegible]. CIRCUIT BREAKER; F. L. [illegible] [illegible] with a series [illegible] circuit breaker for the single circuit with two or more actuating coils, each connected to the said translating devices.

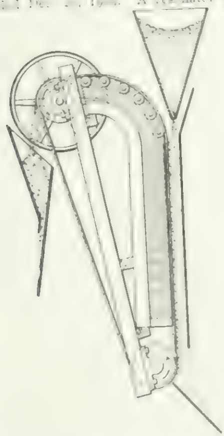
971,101. ELECTRIC HEATING UNIT; T. Van Aller, Schenectady, N. Y. App. filed July 23, 1908. A resistance ribbon wound into a [illegible] and [illegible] itself.

971,[illegible]. PROTECTIVE SCREEN FOR APPARATUS WHICH IS EXPOSED TO HIGH TEMPERATURES; G. [illegible] [illegible] rounds the heater.

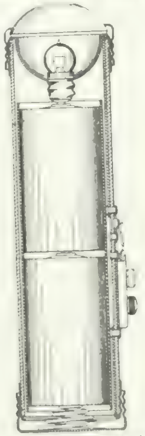
971,[illegible]. DIFFERENTIAL SPEED MOTOR; H. A. Rhodes, Denver, Col. [illegible]

971,[illegible]. MAGNETIC SEPARATOR; [illegible]

971,[illegible]. AUTOMOBILE HORN; [illegible] App. filed [illegible]. A resonator with a vibratory [illegible] plate and



971,163.—Magnetic Separator.



[illegible]—Portable Electric Lamp.

a vibratory actuating lever for the plate with electrical means [illegible]

971,[illegible]. VOLTAGE REGULATOR; [illegible] circuited and the other charged by the line so that the [illegible] in the short-circuited coil varies with the line voltage, which varies [illegible] between the coils.

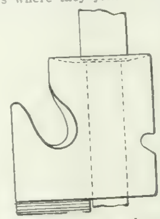
971,[illegible]. PROCESS FOR THE MANUFACTURE OF METALLIC [illegible] Process for [illegible] soda to electrolysis, withdrawing the cathode periodically and bringing it into contact with water to restore its efficiency, replacing it [illegible]

971,[illegible]. [illegible]

[illegible] batteries. The batteries are first connected in parallel for starting and in series for running and a protected resistance is inserted when [illegible] from series to parallel.

971,[illegible]. FUSE MOUNTING; W. Merz, New York, N. Y. App. filed Oct. [illegible]. A tubular shell with a [illegible] metal cap at one end, a terminal bolt in the cap and a fuse wire passing through the shell and [illegible] connected to the bolt.

971,210. FITTING FOR ELECTRIC CONDUITS; W. C. Robinson, Pittsburgh, Pa. App. filed May 29, 1909. A metallic cap for enclosing branch conductors where they join conductors enclosed in a conduit, having resilient gripping portions to clamp the conduit on opposite sides of the junction and an opening in the cap for the branch conductors and a lining of insulating material within the cap near the junction.



971,322.—Mine Insulator.

971,237. TELEPHONE; J. W. Atlee, Riverton, N. J. App. filed June 4, 1908. A stand with a bracket, the latter carrying a sound amplifier or horn, and also holding the receiver in position to communicate with the horn, instead of it being necessary to hold the receiver by hand.

971,241. PORTABLE ELECTRIC LAMP; J. Block, New York, N. Y. App. filed Feb. 21, 1910. A portable electric lamp with a circuit closer comprising a fixed plate and a two-part box comprising a second fixed plate and an upper slotted section with prongs for securing it to the plate, a slotted spring tongue within the box to which a threaded pin is secured.

971,244. APPARATUS FOR OZONIFYING; C. S. Bradley, New York, N. Y. App. filed Oct. 20, 190[illegible]. Electrodes, dielectrics, corner blocks on the electrodes and clamps for the parts with funnels secured at the ends of the electrodes by the corner block, with means for maintaining the pressure below atmospheric.

971,3[illegible]. SAFETY LIMIT SWITCH; W. W. and G. A. Pierce, Philadelphia, Pa. App. filed Feb. 27, 1909. For preventing jamming of a chain block in an electric hoist by means of a fixed screw and nut, the latter actuating a switching mechanism.

971,322. MINE INSULATOR; C. W. Speakman, Monongahela, Pa. App. filed Nov. 29, 1909. Includes an anchoring element with a stop and an insulator body loosely mounted upon the element and arrested by the stop.

971,3[illegible]. PARTY LINE INDICATING SYSTEM; C. C. Bradbury, Chicago, Ill. App. filed March 13, 1908. The combination with a cord circuit with a plurality of ringing keys and lamp signals to indicate the key last depressed, the signals serving both as supervisory and party line indicating signals.

971,390. TROLLEY; J. Orszag and John Orszag, Ashtabula, Ohio. App. filed Jan. 12, 1910. A trolley pole and harp with a harp frame pivoted thereon and held horizontally and a trolley wheel in the harp, together with spring-pressed guard arms extending over the wheel and carrying idler wheels to prevent the trolley from leaving the wire.

971,[illegible]. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed Dec. 17, 1908. Electric switch or spindle carrying a contact and an operating handle insulated therefrom. For incandescent lamps. Details.

971,[illegible]. LOCK; T. Walters, Spokane, Wash. App. filed May 6, 1910. [illegible] controlled lock with a pivoted latch and pivoted armature connected with the latch, magnet for moving the armature, another [illegible] for locking the latch and magnets for moving the second [illegible] so as to permit the latch to move.

971,[illegible]. METALLIC INCANDESCENT FILAMENT; A. Lederer, Atzgersdorf, Austria-Hungary. App. filed Aug. 25, 1908. A central support with a metallic filament having loop members arranged around the support and anchors for the bent portions of the members, the members being bowed and pressed against the anchors.

971,[illegible]. INCANDESCENT ELECTRIC LAMP; A. Lederer, Atzgersdorf, Austria-Hungary. App. filed Aug. [illegible]. The light-giving portions of filaments arranged in the form of a hollow cylinder, the lines of the filaments being parallel with the axis.

971,[illegible]. TROLLEY HARP; [illegible], Santa Monica, Cal. App. filed [illegible]. A [illegible] wheel on each side of the trolley wheel and having a groove to retain the trolley wire.

971,[illegible]04. TROLLEY CAR POLE ATTACHMENT; G. R. Dunn, San Pedro, Cal. App. filed Oct. 13, 1909. A fork bar carrying the trolley wheel and pivoted to the end of the pole and having a shank and spring chain connecting it to the pole.

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GROWING EXPORTS.

Our last summary of electrical export trade showed that throughout the year ending June 30 there had been a steady gain month by month in the totals, but with a lagging behind as to heavy electrical machinery. We have now the figures for July, and it is gratifying to find that whether as to instruments or machinery, an advance over previous figures is apparent. The export of heavy electrical machinery for July, 1910, is not less than $745,419, as compared with $391,195 in July of the previous year. This is a remarkable gain of nearly 100 per cent, and indicates a very brisk revival of foreign demand. In electrical instruments and apparatus the gain is not less gratifying. This year in July the amount was $839,059, as compared with $567,795, so that here again a much better demand is to be noted. The two items, together, amount to $1,584,378, as compared with $958,990. It seems unquestionable that dullness and depression prevailed in the electrical industry during the later summer months, but, as these figures prove, the slackness certainly did not affect the export trade.

Analyzing the data it cannot be said that the gains were widespread. On the contrary, they were "spotty," but they came from quarters where of late little desire for American goods had been shown. The most spectacular instance is Japan, which in July, 1909, took $1,132 in heavy stuff, but which took this July a quantity valued at $168,019. A more violent contrast could hardly be presented. The larger amount may be due to Japanese trolley and transmission enterprises now being pushed and marking the initial stages of recovery from the frightful effects of the war with Russia. In like manner, Mexico jumped from $48,486 to $135,026, and Canada from $86,199 to $149,529. Mexico also doubled its purchases of light material, from $65,072 to $120,607, while Japan increased from $78,935 to $102,185. A few more gains of this character would soon leave all previous records far behind and in the shade, offsetting such losses as with France, which country in July, 1909, took $125,918 in heavy electrical machinery, but which in July, 1910, took $6,233. Of course, individual orders of some bulk account largely for such an exhibition, but nobody wants a load curve of that kind if it can be helped. On the whole, export conditions seem to be more hopeful and satisfactory than for many years past.

Just as we go to press the figures for August have come to hand. These we are glad to note maintain and accentuate the upward tendency observed in July and lift the curve higher in a steady sweep. The export in August of heavy electrical machinery was $708,100, as compared with $448,976 in August, 1909, while the export of electrical instruments was $852,958, as compared with $590,864. These are most gratifying gains, making a total of $1,561,058 against $1,039,840. Thus there is an increase of over half a million in the single month. It is, moreover, observable that the gains are quite evenly distributed, except that [illegible]

with a spurt of buying which carried her total purchases from $97,280 to $316,901. We would like to see our other customers triple their requirements in the same way.

ADJUSTABLE-SPEED ALTERNATING-CURRENT MOTORS.

As a competitor of the constant-speed, shunt-wound, direct-current motor, the polyphase induction motor has in general proved highly advantageous, both by reason of its simpler mechanical construction and on account of the higher efficiency and better economy with which it can receive energy from high-voltage transmission circuits. Where only constant-speed service is desired the polyphase induction motor operates with mechanical characteristics that are in many respects ideal; but where variable speed or adjustable speed is desired the induction motor, considered alone, is at a considerable disadvantage when compared with the series-wound or the adjustable-field, direct-current motor. However, where the conditions are such that all energy is received over high-tension circuits, and the use of direct-current motors would involve the installation and operation of extra machinery for converting to direct current, the disadvantages of the induction motor are more than balanced by the decrease in efficiency and increase in cost of equipment and operation incident to the employment of direct-current machinery.

A case of the kind just mentioned is outlined in an article by Mr. R. E. Hellmund in this issue. The author shows that an induction motor especially designed for four different speeds possesses mechanical and electrical characteristics which render it a worthy competitor of the series-wound, direct-current motor and the accompanying converting machinery for receiving energy from high-potential transmission circuits. The induction motor discussed is provided with two separate primary windings, each arranged for pole changing in the ratio of two to one. When operated as proposed by the author, its mechanical and electrical characteristics are identical with those of a direct-current, shunt-wound motor equipped with two separate armature windings with individual commutators upon which may be impressed two different values of voltage. That is to say, the machine is an "adjustable-speed" motor, and in performance resembles the double-commutator, two-voltage, direct-current machine. Moreover, in constructive material it would compare with the ordinary induction motor somewhat as the double-commutator shunt machine compares with the single-commutator series motor. In whatever service the former can be substituted for the latter, the four-speed induction motor can be used with equally satisfactory performance, combined with the highly desirable elimination of all converting apparatus.

In comparison with the direct-current motor of either the constant-speed, adjustable-speed or variable-speed type, the induction motor retains the desirable feature of being without a commutator. The most unsatisfactory detail of the single-phase series motor is its commutator, but numerous schemes [illegible] sparking, and in many respects this machine operates almost as satisfactorily as the direct-current series motor. It would seem that, for the service outlined by the author, the single-phase series motor should be preferable to the four-speed induction motor. Moreover, the known characteristics of the polyphase commutator motor, which has reached scarcely more than the experimental stage, are such that it offers highly inviting possibilities for just such purposes as those for which the author suggests the use of the four-speed induction motor. It is not too much to expect within the next few years a rapid development of the alternating-current commutator-type motor, which is likely to supplant the direct-current motor in installations where all of the energy is received over high-tension transmission lines, and where variable-speed or adjustable-speed work forms only a small part of the whole service needed.

THE LIGHT OF THE FIREFLY.

Our readers will remember the interesting research by Messrs. Ives and Coblentz regarding the light of the firefly published a year ago and tending to confirm the judgment of Langley regarding the efficiency of light production. In the current issue Dr. Ives reports a continuation of the work with reference to clearing up some of the dubious points of the earlier investigation. Briefly, the matter in question was as follows: The light of the firefly as studied photographically showed practically just what the visual studies of Langley disclosed, that the light emitted is practically confined to the most luminous part of the visible spectrum. Of course, the photographic method was incapable of showing the existence or non-existence of infra-red radiations, which, if they existed, would tend greatly to reduce the efficiency of the light-producing process. Langley had shown that there were no material radiations of very great wave length, but a considerable gap remained between the visible band and the region in which it was certain that radiations did not exist. The region concerned is one far from easy to investigate, and the method taken by Dr. Ives was to fall back on the phenomena of phosphorescence which is excited by so-called actinic rays in certain substances, but may be extinguished by red or infra-red rays. This reducing power of infra-red rays should, if these rays existed in the light of the firefly, show their existence. Dr. Ives found no evidence of any radiation from the firefly between that visible to the eye and a region well into the infra-red, nor in extending the photographic operations was there any evidence of ultraviolet activity. The region investigated by phosphorescence does not cover the whole dubious space left by Langley's investigations, but it covers so considerable a part of it as to render the existence of any considerable amount of radiation from the firefly somewhat unlikely.

The results, therefore, tend strongly to confirm the conclusions of the previous investigations, that the firefly actually does produce radiation of a very high order of efficiency, confined to a narrow region of the visible spectrum—that region in fact which is of the highest luminosity so far as the human eye is concerned. It is singular enough to find nearly monochromatic radiation from a living organism, but it is doubly curious to find that radiation of the wave length to which the human retina is most sensitive. The interpretation of the fact is dubious. At first thought it would certainly indicate a strong probability that the photochemical substances concerned in vision are substantially the same in all classes of eyes, including those of insects like the firefly. From an evolutionary standpoint and bearing in mind the fact that all organisms have been evolved under sunlight, this point of view would seem reasonable, but it certainly opens up a wide field for investigation. Especially it would seem worth while to examine the various species of fireflies and other light-producing organisms to find out what range of variation in color may be

observed in the light emitted. That there are such variations from species to species seems pretty well established. Particularly should such researches be made with reference to the behavior of the light-producing bacteria, the study of which gives apparently a better chance for the investigation of the photochemical processes concerned than is possible in the case of the other more complex organisms like the firefly.

THE ISOLATION OF AN ION.

Most observers, be they astronomers or not, usually recognize a sensation of solitude and isolation when contemplating the majesty of the starry heavens. This is the isolation of the immensely great. In another way, the contemplation of a single ion and its segregation produces a sense of isolation of the immensely small. In regard to mass a single ion is estimated to be about 7×10^{-28} gm., or a mass which bears approximately the same ratio to that of an ordinary pocket pencil, weighing 2 gm., that the mass of the pencil bears to the mass of the whole earth. We cannot see a molecule of any substance, even with the aid of the most powerful microscopes yet produced. With the aid of the so-called ultra-microscope it is believed that interference images are produced on the retina by particles of matter not much larger than certain big and unwieldy complex chemical molecules. But the mass of the ion is supposed to be about 2000 times less than that of an atom of hydrogen, the smallest acknowledged atom, so that our present expectation of being able to see an ion is ultra-microscopic.

Recently, however, certain experiments have led to the belief that ions can be counted one by one like sheep, not by seeing them, but by seeing the electrical effects which they individually produce. This is equivalent to convicting ions on circumstantial evidence. A paper by Prof. R. A. Millikan on this subject has recently been abstracted in *Science*. The method employed droplets of oil, created by an atomizer, and allowed to fall through a pinhole into a circular air chamber 20 cm in diameter. The floor and ceiling of this chamber were flat plates of brass, separated from each other by insulators 1.6 cm high. The air in this chamber is carefully protected from draughts. After one or more oil droplets have chanced to fall through the pinhole this aperture is closed. Such droplets may have a radius of about 1μ. They cannot fall rapidly, owing to the viscosity of the air. They may take a minute or more to fall 1.6 cm from ceiling to floor. By means of arc-light illumination the slowly falling droplet can be seen and watched, through a telescope, as a bright speck on a dark background. The droplets are always initially charged, by atomization, and when they have nearly reached the floor they can be raised against gravitation through electrical force by applying an electrical difference of potential to the floor and ceiling plates of the chamber. The droplet then reverses its motion and rises like any small electrified pith-ball. When it has nearly reached the ceiling the electric charge is removed from the plates, which are then short-circuited, and the droplets fall again by gravitation.

This process of electro-gravitational battledore-and-shuttlecock can be continued indefinitely. The times of rising and falling past the cross-wires of the telescope may be recorded. The times of falling are stated to be identical, for the same droplet, within the errors of observation, but the times of rising are not always the same. They may be the same for half a dozen successive ascents, and then the lifting speed will change suddenly. On computing the cause of the changes in ascending velocity, it is reported that they can only be due to changes in electric charge. These charges are always taken on during gravitational descent and they are always simple multiples of 4.9×10^{-10} electric units of quantity, about the size of the supposed ionic charge. Consequently it is inferred that the droplet swallows up neighboring free ions during its descent, and compounds their electric charge with that which it previously held, hence the change in the subsequent lifting force.

IMPEDANCE PARADOXES.

An arrangement of electrical circuits giving results differing from what would probably be expected was described in an article by Prof. F. M. Denton which appeared in our issue for Aug. 11. The author showed that in a circuit consisting of a non-inductive resistance in series with, say, an inductive reactance, the impedance may be increased by shunting the reactance with a resistance. This relation is interesting and is rendered none the less so by reason of the fact that its existence has been known for some time and it has been described in certain text-books used in England. The author employed a method of demonstration characterized by lack of the many complications that would ordinarily be introduced in dealing with such a circuit problem.

Our present issue contains a communication from Mr. H. F. Hagen in which is given a more general solution of the problem as outlined for certain limited conditions by Professor Denton. The author develops an equation showing the relations which must exist in order to permit the impedance of the circuit to be increased by shunting a certain portion thereof. He finds that when the resistance which is to be placed in shunt with the reactance portion of a series impedance circuit has a certain "critical" value, the impedance of the circuit will be increased no matter how small or how large may be the values of the resistance or reactance of the series circuit. The author's treatment might lead one to believe it to be possible to find a value for the shunting resistance such that an increase in impedance would take place for any value whatsoever for the series impedance or its components. However, attention should be called to the highly significant fact that the "critical" value upon which the author's treatment is based depends wholly upon the relation of the components of the series impedance to each other and to the shunting resistance so that the shunting resistance ceases to have its "critical" value when either component of the series impedance is altered.

In connection with the above-outlined "impedance paradox," mention may be made of a second interesting circuit relation, which likewise is not entirely novel. This relation is that existing when the field coil of a compensated single-phase series motor is shunted with a condenser. The circuit is that of an apparent resistance in series with an inductive reactance; the apparent resistance increases in value with the increase in the capacity of the condenser in shunt with the field coil. When the condensive reactance equals the inductive reactance, the apparent resistance has infinite value, yet a definite current of practically unaltered value continues to exist in the field coils, the return circuit being locally through the condenser. The conditions here assumed are ideal, but they can be closely approximated in practice.

Illuminating Engineering Course at Johns Hopkins University.

An attendance of over ninety is already registered for the course of lectures on Illuminating Engineering to be given at Johns Hopkins University, Oct. 26 to Nov. 8, under the joint auspices of the university and the Illuminating Engineering Society. A number of colleges maintaining courses in electrical engineering are planning to send representatives to attend the lectures, some of which institutions contemplate founding undergraduate courses in illuminating engineering. There will be a considerable representation from central-station and gas companies, some of the former proposing to send as many as ten members of their technical staff. Consulting engineers, and shade and fixture designers will also be represented.

Those planning to attend the course should forward their applications to the secretary of the Illuminating Engineering Society, 29 West Thirty-ninth Street, New York, or to the university, within the next week, in order that the university may definitely know the number of attendants for whom class-room and laboratory facilities must be provided.

As previously stated in these columns there will be thirty-six lectures, embracing every subject included in electrical engineering. The lecturers include the principal authorities in this country in the various subjects, and form perhaps the most authoritative body of men representing applied science that has ever appeared in a university course in this country.

The officers of the Illuminating Engineering Society are formulating plans for a formal opening of the lecture course, which will take place on Tuesday, Oct. 25. A number of representative men connected with the lighting interests will be present at this time, including the presidents of several of the national professional bodies interested more or less directly in illumination and illuminants.

American Manufacturers' Export Association.

An association said to represent more than $250,000,000 capital has been formed by American manufacturers for the purpose of increasing export trade.

The chief objects of the association are as follows:

1. To bring united influence to bear on the State Department and the Department of Commerce and Labor in Washington looking to the advancement of our foreign trade interests.

2. To bring similar pressure to bear on transportation companies looking to the establishment of equitable freight rates and better service.

3. To protect trade marks of American manufacturers by combating the common practice of unscrupulous foreign firms or individuals in registering and doing business under trade marks not rightfully their own.

4. To look out for those members who get into the meshes of customs authorities, aiding them in reaching an equitable adjustment of their difficulties.

5. To combat the many evils now existing in the field—evils which thrive on the general ignorance of business conditions—and to take steps toward the elimination of concerns whose crooked export methods are reflecting discredit on the entire nation, and who now operate with little or no fear of interference. United action by members would speedily reform these conditions.

6. To enhance the dignity and standing of the manufacturers making up this association in the eyes of foreign importers and large foreign buyers generally, to whom membership in the proposed association will be an indication of good general standing in the business world.

7. To dignify, broaden and render more effective the great work that is now being done by individual export managers by bringing them together periodically for their own good and for the good of the houses they represent.

8. To investigate, for the benefit of members, organizations purporting to exist for the purpose of aiding the American [illegible] and buyers.

9. To secure the proper interpretation of foreign customs regulations, resisting unfair or ignorant constructions thereof which an individual shipper could not afford to fight, but which the association could resist as matters of precedent and principle.

The president of the association is Mr. W. B. Campbell, of the Perkins-Campbell Company, Cincinnati, Ohio. One of the directors is Mr. Maurice Coster, of the Westinghouse Electric & Manufacturing Company.

Montreal Lighting Controversy.

The arbitrators, experts and lawyers asssembled in the City Court House at Montreal on Oct. 4 to proceed with the hearings in the controversy between the local lighting company and the city, which have extended over three months. Again the counsel for plaintiff and defendant united in asking a further adjournment to permit the continuance of negotiations looking to a settlement of the differences, and the arbitrators consented to a three weeks' adjournment, or until Oct. 26.

Since the last meeting of the arbitrators, held the day after the opening of tenders for a ten-year contract for city lighting, the board of control and City Council have passed the necessary resolutions awarding a contract to the Montreal Light, Heat & Power Company for a period of ten years, for all arc and incandescent lighting and energy that may be required by the municipality at the prices tendered, which are as follows:

For 6.6-amp arcs, $72.70 for the total number, or ranging up to $91.50 for 500 lamps or less. For 4-amp lamps, $63.15 and $82.26, respectively. For 40-cp and 80-cp tungsten lamps, $16 and $23 per year, respectively. For lighting the buildings by meter, 5 cents per kw-hour for all the business, with increasing rates for less proportions. For 2200-volt alternating-current energy, $25 per horse-power per annum in units of 150 hp and over.

To comply with the terms of the new contract the Montreal company has already issued specifications and is taking bids for magnetite-arc lighting apparatus. There will be installed at once about 500 6.6-amp and 1200 4-amp magnetite lamps with regulators, rectifiers, etc. In view of this re-establishment of amicable business relations between the city and the Montreal company, it is but natural both sides are deeply interested in settling the old claim, approximating $250,000, of the company against the city, especially as both the city's and company's expenses in the matter of arbitration are being said to aggregate nearly $1,000 per day for each day the arbitrators sit.

The board of control at its meeting on Monday of last week took the matter of settlement under serious consideration, and as it is understood that the company's representatives are in an approachable mood, especially since the return from Europe last week of Mr. H. S. Holt, president of the Montreal Light, Heat & Power Company, an early adjustment of the matter is expected.

Single-Phase Railway for Sweden.

In the electrification of the Swedish railroad between Kiruna and Riksgraensen use will be made of the 15-cycle, single-phase system with an e.m.f. of 15,000 volts at the trolley.

The main transportation over the railroad is represented by the haulage of iron ore to the Norwegian frontier at Riksgraensen. The ore trains are unusually heavy, the total weight being more than 2000 tons. Each train of this weight will be hauled by two locomotives, each equipped with two 1000-hp motors. These 4000-hp locomotives will be among the largest ever constructed.

There will be a certain amount of passenger traffic, which will be handled by means of express trains, each of which will be provided with a single 1000-hp locomotive, designed for a speed of 100 km (62 miles) per hour.

The hydroelectric generating station will be located at Porjus Falls, 120 km (75 miles) from Kiruna and 130 km (80 miles) from Riksgraensen. The station will be equipped with three

10,000-kva, single-phase alternators. The energy will be transmitted at an e.m.f. of 80,000 volts to four transformer substations, where the e.m.f. will be reduced to 15,000 volts.

The contract, which has been let to the Siemens-Schuckert-Werke, Berlin, Germany, and the Allmaenna Svenska Elektriska Aktiebolaget, Westeras, Sweden, calls for the completion and operation of the line in the latter half of 1914. According to the official estimate the total amount involved in the undertaking will be about $4,000,000.

Telephone and Gas Rates in Chicago.

As already related in these columns, the committee on gas, oil and electric light of the City Council of Chicago is studying the question of a possible revision of telephone rates for the city, as the time when such revision may be made under the existing ordinance is drawing near. An elaborate report on the cost of telephone service by the Chicago Telephone Company in Chicago for the year ended March 31 last, under the ordinance of Nov. 6, 1907, has been made to the city comptroller by D. C. & W. B. Jackson, engineers, and Arthur Young & Co., certified public accountants. This report is in turn being analyzed by experts retained by the City Council committee, of which Alderman W. J. Pringle is chairman .

Another important subject to which the committee on gas, oil and electric light is devoting its attention is a possible revision in the price of illuminating and fuel gas. The present net rate to consumers is 85 cents per 1000 cu. ft., and by the existing ordinance this rate will obtain until Feb. 25, 1911. Meantime, the committee will make a study of the subject and report whether, in its judgment, the People's Gas Light & Coke Company can afford to make a lower rate.

At the meeting of the City Council on Oct. 3 Alderman Pringle presented a request from his committee that an appropriation of $10,000 be made to carry on its work of investigating telephone and gas rates. This request was referred to the finance committee.

Convention of the American Street & Interurban Railway Association.

The annual convention of the American Street & Interurban Railway Association and its affiliated Accountants', Engineering, Claim Agents' and Transportation and Traffic Associations opened at Atlantic City, N. J., Oct. 10, with meetings of the Transportation and Traffic Association and the Claim Agents' Association. During the morning the delegates and guests were registered and received badges at the booth at the entrance to Young's Million Dollar Pier. The meeting of the claim agents was held in the Traymore Hotel on the Boardwalk and the transportation and traffic men met in the Greek Temple on the convention pier, both sessions being held in the afternoon. The usual addresses and reports were presented at the two meetings and a paper, entitled "Creation of Passenger Traffic," by Mr. J. F. Keys, of Detroit, Mich., was read before the traffic association. Mr. E. C. Carpenter, president of the Claim Agents' Association, was unable to be present at the meeting of that body, and Mr. J. S. Harrison, the vice-president, presided. Owing to the absence of Mr. J. R. Pratt, of Baltimore, Md., his paper on "What Matters Particularly Interesting to Claim Departments Ought to Be Subjects of Legislation and How Can the Claim Agents Best Exert Proper Influence to Obtain Such Legislation" was not read at the first session.

That portion of the pier occupied by the Manufacturers' Association and devoted to exhibits is very attractively decorated. An open lobby is left in front of Building No. 1 for reception purposes. The booths around this space are designed especially for artistic effect with pergolas flanking the central booth. The pergolas are draped and decorated with vines and serve to set off the exhibits to advantage.

On Monday evening the annual reception in honor of the presidents and other officers [illegible] the convention pier. Dancing and refreshments followed, interspersed with songs by a quartet of ladies. On Tuesday afternoon a psychic entertainer and comedienne occupied the attention of the ladies in the solarium of the Marlborough-Blenheim Hotel. Other entertainment features on Tuesday were a smoker, entertainment and indoor baseball game between the railway men and supply men in Marine Hall on the convention pier in the evening, and a progressive euchre party for the ladies in the ballroom of the Marlborough-Blenheim Hotel.

On Tuesday morning the accountants met in the Annex Court Hall, the Engineering Association in the Aquarium Court Hall and the transportation men in the Greek Temple on the convention pier, while the claim agents held a meeting in the Traymore Hotel. In the afternoon the parent body met in the Greek Temple, and the accountants and engineers met in the Aquarium Court Hall, the claim agents meeting, as usual, in the Traymore. The attendance as we go to press promises to be the largest on record.

In his address before the parent association, Tuesday, President James F. Shaw, of Boston, dwelt on the work of the association during the past year. He cited the need of cooperation between the state, sectional and the national bodies and mentioned the arrangements made for the interchange of information pertaining to legislation in the various states. The work of the various affiliated bodies was briefly summarized. Mr. Shaw dwelt on the part played by the association in the sound development of the industry and on the remedial measures suggested last year to enable the electric railways of the country to fulfil the due measure of service demanded of them by the public. The closing sessions will be held on Friday afternoon.

Ohio Telephone Situation.

It is believed in Cleveland that some understanding has been reached between the dissatisfied independent telephone faction and J. P. Morgan & Company whereby the suits instituted months ago to prevent the transfer of stock of the Cuyahoga and United States telephone companies to the firm will be dismissed. This belief has been strengthened somewhat by the conferences that have been held in Cleveland the past few days and the fact that buying orders for the securities were received from a number of Eastern houses.

Mr. H. B. McGraw, attorney for the parties who brought the suits, has asked that J. P. Morgan & Company be dismissed as party defendants in the suits, and the request for the appointment of receivers for the companies was withdrawn. This is looked upon as further evidence of a compromise of some kind. It will be recalled that Mr. Morgan and his associates were alleged to be the agents of the American Telephone & Telegraph Company in the petitions. J. P. Morgan & Company filed an answer to the allegations some days ago, in which it was denied that they acted as representatives of this company and asserted that the securities were purchased as an investment, the same as any other securities would be. The answer further stated that the firm would do everything possible to aid the companies in which it is interested and that the properties will all be put into the best shape for satisfactory operation.

Electrical Inspection from the Fire Underwriter's Viewpoint.

At the annual convention of the Fire Underwriters' Association of the Northwest in Chicago, on Oct. 6, Mr. George E. Bruen, of New York, engineer and superintendent of the electrical department of the National Board of Fire Underwriters, read a paper on "Theory and Practice in Electrical Inspection." The speaker told how the National Electrical Code came into being in 1892, and he said that the Code represents to-day "the best thought of all the more important and influential electrical engineers of the country." A fundamental principle underlying

the code is the minimization of the cost of insurance on such buildings as are wired and electrically equipped in accordance with the rules laid down.

Mr. Bruen said that any electrical inspection department for fire underwriters must first be governed by a clear conception of its duty to the insurance companies, but having fulfilled this, there remains a degree of responsibility toward the assured, who is to be protected "from the incompetent electrical contractor, as well as from the errors which will inevitably be made by the employees of the best electrical concern; and, furthermore, toward the electrical contractor himself, whose co-operation is to be sought, and whose education, in the full intent and meaning of the National Electrical Code, is to be fostered and encouraged." Care should be taken in the selection of inspectors. A comprehensive scheme should be worked out to bring the home office of the electrical inspection department into the closest contact with the electrical contractor in the field.

The speaker described the methods employed by the National Board of Fire Underwriters in the local territory which is inspected from the office of that board. In the usual routine inspections are made only upon receipt of written applications, signed by the electrical contractor who is employed to install the wiring or by the assured himself. These applications are card-indexed for future reference, and the originals are placed in the inspector's hands. The inspector proceeds to make a report, which is checked over by the chief inspector. A letter is then written to the contractor, giving him a verbatim copy of the report. In case the equipment is seriously hazardous, a copy of this letter is forwarded to the assured. Further inspections during the progress of the work are made only on written order, received, as a rule, from the contractor. If such notification is not received within a reasonable time, a letter is mailed to the assured to advise him of the condition of the work at the last inspection. Usually this action meets with the appreciation of the assured, who generally gives attention to any defects or unfinished details. When the inspector finds that the entire electrical equipment is complete and in accordance with the rules, he makes a report to that effect and a certificate of approval is issued and forwarded to the assured.

Another class of applications is that relating to requests for the inspection of alterations, repairs or additional work in buildings already wired. In such cases the existing certificate covering the original installation is endorsed to cover the approval of the additional work. But if it is found that the original equipment is out of repair or has become hazardous, an "old-work report" is attached to the approval for the new work. The contents of this report are communicated to the assured, with the suggestion that repairs and corrections should be made, in order to safeguard the building against possible loss or damage by fire.

The issuing of a certificate to cover such buildings as have been approved in relation to their electrical equipment is regarded by Mr. Bruen as especially important. As the public becomes educated, it will demand such a certificate as a condition of any contract made with electrical contractors. The certificate should bear a clause to the effect that no alterations after its date shall be made without the consent of the board of fire underwriters. This clause is seldom, if ever, enforced by insurance companies in the event of a fire loss; yet it has a deterrent effect upon the assured, who will usually order an inspection of additions when made. It is the practice of the National Board of Fire Underwriters to re-inspect old equipments as frequently as possible without undue expense.

In closing Mr. Bruen spoke of the invaluable co-operation of electric light companies and of electrical contractors, as well as of architects and builders. With all these factors tending toward the desired end, he believes that diligent effort will reduce the number of fires from electrical causes almost to the vanishing point. Furthermore, in buildings in which the electrical equipment has not been disturbed by unauthorized and [illegible] should be [illegible] which will show that a standard electrical equipment is the safest means of supplying and distributing light and power that engineering science has thus far been able to devise.

Annual Meeting of the Empire State Association.

The sixth annual meeting of the Empire State Gas and Electric Association was held in the United Engineering Societies Building, New York, on Oct. 5. In the absence of the president and vice-president the meeting was called to order by the second vice-president, Mr. R. M. Searle, of Rochester. Mr. Searle explained that, following a custom which had been successful in the past, the meeting would be informal and no stenographic report of the discussions would be taken.

Mr. C. A. Graves, Southern New York Power Company, had suggested the subject of "Tungsten Street Lighting," and the discussion was opened by him. Rates charged for this service and operating problems and conditions arising in connection therewith were discussed by the following: Messrs. H. M. Beugler, Newburgh Light, Heat & Power Company; George L. Colgate, Canandaigua Gas Light Company; F. B. H. Paine, Niagara, Lockport & Ontario Power Company; James C. DeLong, Syracuse Lighting Company; Stuart Wilder, Peekskill Lighting & Railroad Company; J. T. Hutchings, Rochester Railway & Light Company; C. G. Durfee, Rochester Railway & Light Company; A. S. Ives, Poughkeepsie Light, Heat & Power Company, and M. Webb Offuff, Schenectady Illuminating Company.

A paper on the "Fundamental Principles of Rates" was then presented by Mr. J. T. Hutchings, general manager, Rochester Railway & Light Company. It described the extensive study which has been made of this subject by this company and outlined the conclusions reached. The presentation of the paper was followed by a joint discussion by Mr. John C. Parker, mechanical and electrical engineer, and Mr. H. C. Deffenbaugh, of the Rochester company. An abstract of the paper and its discussion will appear in another issue.

After the close of the morning session the delegates had lunch at the Engineers' Club. The afternoon session was called to order by Mr. M. J. Brayton, first vice-president.

Mr. Charles H. B. Chapin, the secretary, read the report of the executive committee. The report called attention to the various meetings which have been held in different parts of the State during the year, and have demonstrated the value of informal gatherings. The practice of holding these sectional meetings will be continued. The report also called attention to two matters of general interest which were brought up by the Public Service Commission of the Second District during the year. The first was the question of establishing a calorific standard for gas, and the second that of filing schedules of rates. The report stated that the executive committee had maintained steadily the policy of candor in all its dealings with the commissions, without attempt to suppress or misrepresent the facts and that it was believed that the commissions were pleased to have the co-operation of the companies under their jurisdiction in the solution of the many difficult problems which they were required by law to solve. The executive committee urged the members to make more use of the association by consultation with the secretary, officers or committees.

Mr. T. R. Beal, on behalf of the committee on taxation, submitted a report in which he called attention to ten changes in the tax law which had been passed at the last session of the Legislature and approved by the Governor. Only two, or possibly three of the charges applied directly to public-service corporations. Special attention was also called to the annual report of the tax commissioners transmitted to the Legislature on Feb. 7, 1910, with particular reference to the statements made by the commissioners of their method of determining special franchise assessments. The report also mentioned three court decisions which were of particular interest and the [illegible] Federal corporation tax

The committee called attention to a paper entitled, "Taxation of Telephone Companies in the State of New York," presented by Mr. Hugh Taylor at the National Conference on State and Local Taxation held in Louisville, Ky., Sept. 1, 1909.

The nominating committee then submitted its report, and the following officers were elected for the ensuing year:

President, Mr. M. J. Brayton, secretary, Utica Gas & Electric Company; first vice-president, Mr. R. M. Searle, vice-president, Rochester Railway & Light Company; second vice-president, Mr. G. W. Curran, comptroller, Syracuse Lighting Company; treasurer, Mr. A. B. Beadle, vice-president, Bath Electric & Gas Light Company; secretary, Mr. Charles H. B. Chapin, New York City.

Mr. C. G. Durfee, of the Rochester Railway & Light Company, mentioned a change in the Public Service Commissions law which required that no type of electric meter should be installed which had not been approved by the commission. He stated that the meter committees of the National Electric Light Association and the Association of Edison Illuminating Companies had done a great deal of work on this subject and suggested that a committee be appointed to co-operate with the other two associations. The president will appoint a committee.

After the adjournment of the afternoon session a number of the delegates visited by invitation the showrooms of the Consolidated Gas Company.

Denver Electrical Show.

The first annual electrical show of the Colorado Electric Club was opened Monday evening, Oct. 10, and will continue during the present week. Capt. W. H. Green, the oldest pioneer of Colorado, pressed a button at 7:30 p. m., thereby closing the various electrical circuits producing spectacular effects. Simultaneously four tons of red fire were lighted on the streets and on the roofs of large business buildings in the city, cannons were fired, bombs exploded and all factory and locomotive steam whistles in the city shrieked. It is estimated that 25,000 visitors will be in the city during the exposition. Among the special trains will be one from Salt Lake City. The streets have been illuminated with portière effects, and some 25,000 additional street lamps have been installed for the occasion, aside from the exterior lamps in the vicinity of the auditorium where the electrical show is held.

Ten thousand incandescent lamps are used for the lighting of the interior. Among the lighting features is a sunrise effect showing a mountain scene characteristic of the Rocky Mountain region, with a running stream. The interior is darkened while the picture is shown in order to bring out the full effect of the rising sun, which measures about 8 ft. in diameter and is studded with 2500 lamps. By means of clockwork the rising sun is given a uniform movement, and the effect of moving water is produced by a number of flashers.

At the opening the Denver Gas & Electric Company's new building was lighted for the first time, 12,000 lamps on the façades forming a handsome decorative design. The booth at the show of the Denver Gas & Electric Company is in the form of an electric home equipped with electrical conveniences. In the kitchen are the various electrical heating and cooking devices, and electrical appliances designed for the general comfort of the home are distributed among the various rooms, all of which are lighted according to the latest illuminating engineering practice. The booth of the telephone company contains the old switchboard used by that company in 1878, alongside of which is a portion of a modern switchboard. The basement is devoted to spectacular displays, including high-voltage demonstrations. Denver boys have on exhibition there a number of wireless outfits of their own construction, which have been entered in competition for a money prize offered.

New York Electrical Show.

New York's fourth annual electrical show was opened to the public on Monday afternoon with an electric luncheon given in the restaurant of Madison Square Garden to the representatives of the metropolitan press by the New York Edison Company. Speeches fitting to the occasion were made by Mr. J. W. Lieb, Jr., of the New York Edison Company, and ex-Secretary of the Treasury G. B. Cortelyou, president of the Consolidated Gas Company, after which the company adjourned to the arena to view the exhibits.

This year's exposition has all the salient features of its forerunners, with much added material to interest the engineer, user of electrical energy, and the general visitor. There is a large display of electric vehicles and an interminable amount of electrical aids to the housekeeper, such as vacuum cleaners, electric heating and cooking apparatus, pumps, buffers, ozonizers, art glass shades, portables, lamps without number, and all sorts of little things for the home. The electrical laundry is shown with all its appurtenances, and flaming arcs pile on their rays where the tungstens give them a chance. The large manufacturers of electrical apparatus fill in the gap with specimens of motors and heavier apparatus, so that the show is not unbalanced.

The illumination and decorations in Madison Square Garden for the show beggar description, and betoken excellent taste and skill on the part of the management and the decorator, Mr. M. A. Singer, who was also responsible for previous creations in the Garden and at N. E. L. A. exhibits. The bleak walls and girdered roof of the arena are hidden from view behind pale-green and white bunting draped over the galleries above the first, which is given over to the electric light companies of the city. Fig. 1 herewith gives a general view of the show looking toward the booths of the New York Edison Company, which occupy the entire west half of the first gallery. This view shows the lighting arrangements. Over the center aisle of the arena are suspended three immense crystal chandeliers holding 548 25-watt, plain-bulb tungstens and 448 40-watt frosted-bulb tungstens. The twenty-eight smaller chandeliers suspended from the roof and encircling the arena are octagonal in shape running to a point at the top and fitted with mirrors and crystal chains. These hold 2940 25-watt, plain-bulb tungstens. Around the sides and balconies and under the signs are 1619 25-watt tungstens in Alba shades; the posts around the balcony holding sixty-four 250-watt tungstens in heavy glass globes and the small chandeliers over the central-station booths holding 252 25-watt clear-bulb tungstens in addition. On top of the posts holding the signs on the arena floor are thirty-four 40-watt tungstens in art glass shades and 306 25-watt lamps arranged in circles below the tulip globes. At the main entrance is an arch 30 ft. long and 24 ft. wide, the walls of which are fitted with mirrors and the ceiling of which is made up of 480 mirrors and studded with 250 lamps, giving a very dazzling effect. The exhibitors' booths are of Dutch Colonial design and the withdrawal of the electric light companies to the balcony has given more room on the main floor, which is distributed among the booths and passages to advantage. The combination of the white light from the tungstens, the pale-green and white decorations and the arrangement of the booths serve to accentuate the huge proportions of Madison Square Garden in a manner seldom, if ever before, attained.

Four electric light companies are represented at the show. Facing the entrance on the main floor is the booth of the Public Service Electric Company of New Jersey, where are shown all kinds of household electric appliances, including a display of high-grade portable and standard lamps. A feature of the display is the practical demonstration of the various kinds of electric cooking apparatus and small motor appliances. The booth is arranged to interest the user of domestic appliances and all things electrical which are conducive to the comfort of the home are shown.

The New York Edison Company does not exhibit any apparatus and devotes its space to reception rooms, etc.; facilities being provided for telephoning and writing, the negotiation of contracts, the distribution of advertising literature and for personal meetings between the public and the company's representatives. The walls are hidden by a very interesting and imposing array of photographs of lighting and other installations made by the company. When desired, visitors are escorted to the various exhibits on the floor below for the purpose of explaining the more important features and for the exploitation of the sale and use of the apparatus shown. A portion of the company's space on the north side of the Garden is given over to Prof. Ovington for experiments and demonstrations in high-frequency currents. At the rear end of the Garden is a wax figure of the Edison man, familiar instruments and a complete motor installation are also shown in this section. The next section shows the service methods and appliances of the company. Various forms of line instruments, types of meter and typical installations are here exhibited. Forms of contract available to the public are pictorially represented and explained and general information as to cost of service, equipment, wiring, etc., is given. The third section is devoted to electric sign, outline and window displays. Pictures thrown on the screen from a lantern back of the booth illustrate the best and most attractive types of this kind of lighting, and apparatus showing methods of regulation and control is exhibited. In section four are shown in vivid fashion many modern applications of electricity to the home. Motion pictures show household work being performed by electricity and indicate how this method eliminates all the

Fig. 1—General View of Madison Square Garden During Electrical Show.

to all New Yorkers, throwing red, white and blue lights from one hand to the other.

The Edison Electric Illuminating Company of Brooklyn, with its "Brighter Brooklyn" slogan and its now famous "Belighted" illuminative cartoon of one of the shining lights of the universe, never fails to attract attention to its booths. The exhibit this year, which occupies the north side of the Garden balcony, portrays in picture and by representation some of the principal divisions into which the varied activities of the Brooklyn Edison company's business naturally falls. The display is divided into four sections. The first section indicates some of the many applications and advantages of electric motors in the industrial work of the community. Meters, test household drudgery. At the east end of the exhibit is a spacious reception room.

The United Electric Light & Power Company, of New York City, features modern window lighting installations, supplementing the exhibit by advertising matter pointing out the advantages to be derived from properly illuminated windows and giving several hints on the best methods to employ in this work. The company has had erected five store fronts, covering a total floor space of 100 ft., which are exact reproductions of the windows of four of the best merchants on the company's lines, who display their wares and merchandise in the respective windows. The exhibits portray four different window lighting schemes and the effects actually realized in

practice from them. In one of the windows, that of a New York department store, the display of electric lamps and apparatus represents over $9,000. The rest of the space on the south balcony is occupied as a sales office with a reception room at the end of the aisle. In the sales office regular business

Fig. 2—United Electric Light & Power Company's Exhibit.

is transacted. A list of exhibitors with the locations of the booths is distributed at the booth, and every convenience is offered visitors.

The general exhibits are described elsewhere in these pages. The show will remain open until Oct. 20. On Friday evening the New York Edison Company will entertain the electrical

Fig. 3—Brooklyn Edison Exhibit

contractors in the concert hall, and on Oct. 18 the first annual convention of the Electric Vehicle Association of America will be held. After the morning session an electric luncheon will be served and the Edison company will give a smoker to the delegates in the evening.

Massachusetts Commission News.

A hearing was held by the joint board on metropolitan improvements at Boston on Oct. 6 upon the proposed tunnel between the North and South Stations. The board is composed of the Massachusetts Railroad, Boston Transit, Harbor and Land, and Metropolitan Park Commissions. Chairman George G. Crocker presided. Mr. W. Rodman Peabody, Boston, appeared on behalf of the Boston Chamber of Commerce, which believes that the tunnel should be built by the New York, New Haven & Hartford Railroad Company and not by the City of Boston; also that it should be held by the railroad on terms which would give a fair compensation to the city for its use, with the ultimate right of the city to purchase the tunnel if deemed desirable. The tunnel would be operated by electricity, and according to the plans already outlined by the New Haven company would afford large economies in the operation of suburban service by the elimination of much of the present shuttle-train movements which are a handicap to the traffic at the great terminal stations. It would also afford better distribution of passengers than is now possible with the terminals practically isolated from each other. A feature of the ultimate scheme would be the electrification of much of the nearer suburban service outside Boston on the north, south and west. Mr. W. B. Lawrence, of Medford, Mass., appeared in opposition, on the ground that the estimated cost of $16,000,000 for a length of 6000 ft. was excessive. The board continued the hearing for two weeks to receive further evidence.

The Boston Elevated Railway Company has filed plans with the Massachusetts Railroad Commission showing proposed changes in the elevated terminal station at Sullivan Square, Charleston, in connection with the extension of the elevated lines to Everett and Malden. The new arrangement of the Sullivan Square station provides for the abolition of surface-car stub tracks on the west side of the main waiting-room and transfer shed, the building of a new loading platform for elevated trains and surface cars, and the erection of a foot bridge to facilitate the separation of inward from outward bound traffic. The tracks will be arranged so that the elevated trains running out of Boston can be turned back to the city proper at Sullivan Square or else continued to Malden and Everett. Trains from Malden to Boston are to pass around the outside of the terminal to the special loading platform, instead of entering the train shed. The board will give a hearing upon the plans.

New Jersey Commission News.

The Board of Public Utility Commissioners for the State of New Jersey has refused to issue a certificate of approval of a proposed merger and consolidation of the East Greenwich Gas Company and the New Jersey Gas Company. The board directs attention to Chapter 331, P. L., 1906, which requires that a company subject to its provisions shall not "hereafter issue, sell and deliver any of its capital stock except for cash of a like or greater amount than the par value of the stock issued therefor, or for property of at least the actual cash value of the amount of stock at par value issued in payment therefor." In its finding the board states, "In the papers filed with the board there is nothing to show that the provisions of this statute were observed in the issuance, sale and delivery of the capital stock and bonds of the East Greenwich Gas Company."

The board has also refused to approve the proposed increase of capital stock from $300,000 to $1,600,000 of the Newark & Bloomfield Railroad Company (part of the Delaware, Lackawanna & Western Railroad system). In filing this opinion the board finds that "there is nothing in the papers submitted to indicate that action of any kind has been taken by the board of directors of the company with respect to issuance, sale and delivery of 29,923 shares remaining unissued or any part thereof. Although the joint affidavit of the president and treasurer of the company avers 'that new capital stock to the amount of $1,496,150 is to be issued, sold and delivered for cash, at the par value thereof,' there is nothing in the papers to show that this statement is based upon action taken either by the stockholders or board of directors of the company."

Wisconsin Commission News.

The case of the National Travelers' Association of America against certain Milwaukee hotels, the prime contention of which related to the extra charge of 5 cents exacted by hotel proprietors for outgoing city calls from rooms, has been dismissed by the commission for want of jurisdiction. The petitioner is a voluntary organization whose general purpose is to promote the welfare of its members. Only mercantile, agricultural and manufacturing societies, bodies politic and municipal corporations can, acting individually, invoke the jurisdiction of the commission. The commission, however, contemplating another petition upon the same subject, deemed it advisable to foreshadow the probable conclusion that would be reached in event the matter should again be submitted for consideration.

The petitioners contended that in view of the fact that the telephone company charges but 5 cents for each call at its public pay station, it may not either directly or indirectly establish or caused to be established any pay station where it may charge in excess of 5 cents for a similar service. This view the commission also seemed inclined to take.

An examination of the contracts between the telephone company and the various hotel proprietors involved disclosed the fact that the company agreed to furnish one unlimited service telephone free of charge as an additional consideration to the commission paid to the hotel for collecting tolls. The commission considers that such an arrangement operates unjustly between hotel subscribers. Furthermore, the statute requires every public utility to file with the commission schedules of all rates, tolls and charges which it has established, and also as a part of such schedules "all rules and regulations that in any manner affect the rates charged or to be charged for any service." Consequently, the above provisions of the contract are in violation of the statute, for the published schedule makes no such provision. In commenting upon this point the commission says "the exchanging of services in the manner provided in the contracts is indefensible from any point of view. Services, whether rendered by or to the company, should be estimated upon a definite monetary basis, and not otherwise. By so doing all unjust discrimination will be avoided." Furthermore, "as we view the situation, the private system within the hotels is but an extension of the telephone company's system as far as the former is used to furnish telephone service to the public in connection with the latter. In such connection the stations in the rooms of the hotels are as much pay stations as those located in the company's booth in the hotel lobbies." In conclusion the commission says "the duty of the telephone company under the circumstances is either to make such arrangement with the hotels that the charge from the stations located in the rooms of the hotels shall be no greater than those exacted at other public pay stations of the telephone company, or to discontinue the rendering of joint service in connection with such hotel systems."

The commission has authorized the Menominee Gas Company to issue bonds to the extent of $100,000 par value, in denominations of $500 each and to bear interest at the rate of 5 per cent per annum. The bonds are to be issued and sold for the purpose of supplying the company with funds for the payment of an outstanding indebtedness of $70,000, incurred in the purchase of the gas plant of the Menominee Light & Fuel Company; for the purpose of supplying funds for working capital, and for making extensions and additions to the property. The bonds are to be issued for money only and for not less than 75 per cent of the par value.

The Clifton Light & Power Company, of Hudson, Wis., has been authorized to issue stock and bonds as follows:

(1) Seven hundred and fifty shares of common stock of the par value of $100 each, said stock to be issued for money only and for not less than par value.

(2) Twenty-five thousand dollars par value of bonds, dated [illegible] num; ten bonds to be of the denomination of $500 each and to mature in five years from date; twenty bonds to be of the denomination of $1,000 each, two to mature in six years and the remainder in two years.

(3) The proceeds of the sale of said stock and bonds shall be used for the purpose of purchasing real estate and flowage rights, pole line and right-of-way therefor, upon which is to be constructed a dam, power site and other structures convenient in the carrying on of a hydroelectric power plant and the distribution and sale of electric current produced thereby. Also, for the purchase of an existing pole line running from the site of the proposed power plant to the village of Prescott, in Pierce County, Wis., and for the purchase of the electric light and power plant located in the village of Prescott. The funds are also to be used in the purchase of the necessary machinery for the operation of the main power plant to be located in the town of Clifton, Pierce County, Wis., and also for the construction of a transmission line from such power plant to the city limits of the City of Hastings, Minn., and for the construction of a substation at that point. The bonds authorized shall be issued for not less than 75 per cent of their par value.

New York Commission News.

The Public Service Commission, Second District, will during the present week hold public hearings as follows:

At Albany the commission will hear the complaint of the Civic League of Albany as to prices charged by the Municipal Gas Company for electricity. The complaint alleges excessive charges for light and power for window lighting, for sign lighting, power meter service and elevator service. Business men on North Pearl and State Streets, and Maiden Lane and Broadway, are the principal complainants.

The commission will also hear at Albany the petition of the Westchester Lighting Company for permission to issue $1,433,000 in bonds, and the application of said company for a modification of an order of this commission, and the petition of the Northern Power Company for permission to exercise franchises for supplying electric current in the village of Richville, St. Lawrence County.

AMERICAN ELECTRICAL ENGINEERS—XVI.

A. B. Field.

Allan Bertram Field was born at Barnet, near London, in 1875. He received his primary education at Highgate Grammar School, London, his technical education at Finsbury Technical College, London, and later, his scientific training at St. John's College, Cambridge.

In conformity with traditional English ideas as to the training required by an engineer, he followed his technical training by a period of service in mechanical engineering shops as machinist and fitter in order to become practically acquainted with shop work. In 1900 he joined the engineering staff of the British Thomson-Houston Company and was engaged on preliminary work in connection with some of the London "tube" railways, now operating, and other power plants. He was later transferred to the American works of the General Electric Company, at Schenectady, and engaged in testing work and transformer design.

In 1904 Mr. Field made the acquaintance of Mr. B. A. Behrend, to a study of whose work and to whose generous assistance so many engineers have owed their successful advancement, and who at that time was chief engineer of The Bullock Electric Manufacturing Company and chief electrical engineer of the Allis-Chalmers Company. Shortly afterward he became the chief assistant on alternating-current work to Mr. Behrend, and had charge of the design of alternators, synchronous motors and induction motors, which post he held through a period of considerable commercial activity and until the close of 1908. During this time a number of interesting

problems presented themselves for solution in connection with comparatively new applications of alternating-current apparatus, the further development of turbo-generators, etc. Large alternators for direct coupling to gas engines began to take a more important place in the industrial world, and the application of this class of apparatus in steel-mill work, on a scale hitherto unattempted, called for a considerable amount of study and experiment in which Mr. Field co-operated with Mr. Behrend. As an instance of large gas-engine operated power plants installed by the Allis-Chalmers Company may be mentioned that at the Gary works of the U. S. Steel Corporation, where alternators aggregating 40,000 kva rated output are operated together. Early in 1909 Mr. Field accepted an invitation to join the Westinghouse Electric & Manufacturing Company in its engineering department and has since been engaged on electrical and mechanical designing work, principally in connection with new large generators.

Several patents have been granted to Mr. Field relating to constructions of electrical machinery in commercial use. He is the author of an important investigation of the eddy-current losses occurring in deep conductors carrying alternating current, some of the results of which were published in a paper presented to the American Institute of Electrical Engineers at its annual convention in 1905 and in an article in these columns in the issue of Sept. 29, 1906. The conclusions originally arrived at have since been amply confirmed experimentally, both by direct laboratory measurements and by evidence from numerous commercial tests, and the methods advocated for minimizing these losses are in general commercial use in large generators. For an original communication, entitled "The Dissymmetry of a Three-Phase System," and dealing with some features of two-to-three-phase transformation, a premium was awarded to him by the Institution of Electrical Engineers of Great Britain in 1905.

A. B Field.

Mr. Field is a member of the American Institute of Electrical Engineers, member of the (British) Institution of Electrical Engineers and of other engineering and scientific societies. He holds the M.A. degree of the University of Cambridge (Mathematical Tripos) and the Hon[illegible] of London.

CURRENT NEWS AND NOTES.

Telephone Activity in Chicago.—For the month of August the Chicago Telephone Company reports a net gain of 2370 stations. For the first eight months of this year the net gain has been 23,332. The total number of telephone stations (city and suburban) connected to the exchanges of this company on Sept. 1 was 285,691, a gain in one year of 37,022, or 14.9 per cent.

One Municipal Plant for two Cities.—A municipal electric light plant to serve San Bernardino and Redlands, Cal., is projected by the City Councils of both cities. It is planned to erect a large generating station between the two cities. The trustees of Redlands have appointed a committee to confer with the city officials of San Bernardino on the subject. This committee will also endeavor to secure from the Southern California Edison Company a price on that company's distributing system in Redlands, and estimates on the supplying of electricity at wholesale rates.

Wireless Interference.—Newspaper dispatches relate that a "wireless" operator was charged in the City Court of Buffalo on Sept. 28 with having wilfully prevented the transmission of a wireless message from the steamer *Western States* on Sept 21 when disabled in Lake Erie off Long Point. The operator on the steamer tried for several hours to ask assistance both from Buffalo and from Erie, but it is alleged that an opposition company, for which the defendant worked, interfered and "smothered" the wireless signals from the boat. It is said that the maximum penalty for this offense in New York State is four years' imprisonment. The case was adjourned.

A Village Electric Light Situation.—A newspaper in the West prints the following survey of the electric light situation in its town, following a visit there of an electrical man: "The object of his visit to Oak Grove, as he informed us, was to agitate the electric light question to light our town, the power to be furnished by this railways electric plant which perhaps was legitimate and all right, but a company had just been organized for the same purpose, composed of some of our best citizens, and the only reason why it is not in operation now, was the question of power, some of the members of the company were in favor of water power and others favored a solar engine, the objection to water power was because we have no fall of water, and the objection to a solar engine was that it cannot be operated only when the sun shines and that is the way the matter stands at present."

Canadian Business-Getting Methods.—It is estimated that the United States is now selling to Canadians $750,000 worth of products every business day in the year. This trade has attracted many American manufacturers, who have set up branch works in the Dominion with investments in plants and working capital that now total about $275,000,000. In the Canadian West cities and towns are bidding for American enterprises by the establishment of municipal leagues and bureaus through which advertising campaigns are being vigorously pursued. Winnipeg, Manitoba, is an example of what can be accomplished by united efforts of this nature. Four years ago that city formed an official institution composed of representatives of several business bodies, headed by the City Council, Board of Trade, bankers' association, etc., entitled the Winnipeg Development and Industrial Bureau. It now has representatives of sixteen business bodies on its board of directors, having 8700 affiliated members, 425 of whom are business firms who contribute to its financial requirements. Memorials are being prepared for presentation before the next session of the Dominion House opposing any general reduction in the tariff, all of which forms a part of the argument for the establishment of branches of United States industries in Canada.

Iron and Steel Electrical Engineers.—The next meeting of the Association of Iron and Steel Electrical Engineers will be held at Hotel Schenley, Pittsburgh, Pa., on Oct. 17, 18, 19 and 20. The secretary is Mr. G. H. Winslow, 509 Perry-Payne Building, Cleveland, Ohio.

Electricity from Wind Power.—It is reported that one of the largest windmills in the world has just been completed at Willesden, England, which will be used to generate electricity for supplying energy for operating crushing machinery, pumps etc. The energy will also be employed for operating lamps and for various domestic purposes.

Proposed Electric Club in Butte, Mont.—Electrical men in Butte, Mont., are considering the possibility of forming an electric club, something after the plan of the successful organization bearing that name in Chicago. Mr. L. C. LaMont, of the Butte office of the Westinghouse Electric & Manufacturing Company, is one of the gentlemen interested.

Annual Meeting of Empire State Gas & Electric Association.—No formal program of papers was prepared for the annual meeting of the Empire State Gas & Electric Association at the United Engineering Societies Building, New York, on Oct. 5. Morning and afternoon sessions were held and lunch was served at the Engineers' Club.

Pittsburgh Electric Club.—At a meeting of the Pittsburgh Electric Booster Club, held at the Duquesne Hotel on Sept. 30, Mr. Morris Knowles, a member of the Pittsburgh Civic Commission, as the principal speaker, pointed out wherein the club as a whole and its members individually could be of assistance in promoting the welfare of the city.

Wireless Telegraphy in Russia and Siberia.—The Russian government is reported to have under contemplation the establishment of an extensive system of wireless-telegraph stations across Siberia, and also probably a network of communications over Russia proper. Tests and experiments are being made with several different systems, preliminary to determining which one will be used on a large scale.

Indiana Telephone & Railway Valuations.—The total valuation of telephone lines and property in the state of Indiana, as fixed by the state board of tax commissioners on appeal, is $11,146,832. This is an increase over the valuation in 1909 of $1,050,558. The valuation of the electric railways in Indiana is placed by the commissioners at $22,376,238, an increase over the valuation in 1909 of $840,197.

Motor Manufacturers' Association.—The annual meeting of the American Association of Electric Motor Manufacturers will be held in the Blackstone Hotel, Chicago, on Nov. 14 to 16. There will be a number of committee reports, and during the convention the annual dinner of the association will be held. Mr. H. H. Smith, of the Chicago office of the Diehl Manufacturing Company, is in charge of the local arrangements.

Instruction in Wireless Telegraphy.—Announcement has been made that a theoretical and practical course in wireless telegraphy will form part of the physics course of the McKinley Manual Training School in Washington, D. C. A complete equipment for practical work will be erected at the school, the object being to train young men to become wireless telegraph operators. A course in wireless telegraphy is being offered at the Baltimore Polytechnic Institute. A complete standard wireless station will be installed in the school building, which will soon be completed, on North Avenue.

Steinmetz Lecture in Chicago.—Dr. C. P. Steinmetz, of [illegible] address on the "Industrial [illegible]ance of Electrostatics and Electric Impulse Forces" before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the electrical section of the Western Society of Engineers in Fullerton Hall, Art Institute, Chicago, on the evening of Oct. 19. This is an interesting and rather unusual subject, and there is no doubt that Dr. Steinmetz will be greeted by a large audience, as in former years when he has opened the season's program of joint meetings in Chicago at the same place.

Grand Canyon Power Dream.—According to a report from Los Angeles there is a project afoot to build a dam 700 ft. high that will store the water of the Colorado River in the Grand Canyon and develop 1,500,000 hp. Mr. Irving E. Bush, a mining engineer of Rialto, Cal., and Mr. Thomas Fellows, a Los Angeles architect and engineer, are stated to be in charge of the project. Their plans call for the expenditure of $2,000,000. The site for the proposed dam is just across the California line in Arizona, within 360 miles of Los Angeles and close to the Nevada border. It is claimed by the promoters that this electric power would lead to the mining of lower grade ores that cannot now be worked at a profit because of the high cost of fuel and power.

Driver Stepped on Match; Gasoline Auto Truck Exploded.—The gasoline tank of a large motor truck, valued at $1,000, the property of the Reid Ice Cream Company, exploded with a loud roar in front of 846 Atlantic Avenue Brooklyn, Oct. 5, compelling the driver to jump for his lif[e] and resulting in the total destruction of the vehicle by fire. Th[e] cause of the explosion is not known. Henry Tiedmann, th[e] driver, says that in some way a match had fallen on the foo[t] rest and was ignited by his shoe. The gas from the 10-ga[l] gasoline tank flamed up and instantly there followed an explo[-] sion that nearly overturned the truck. Tiedmann protected hi[s] face with his hands and sprang from his seat. He struck th[e] ground heavily and was severely bruised, but escaped the flame[s].

Wireless from Aeroplane.—It is reported that satisfactor[y] success was obtained from experiments carried out by M[r.] Robert Loraine in maintaining wireless communication betwee[n] an aeroplane in flight and a land station in London. Th[e] portable wireless apparatus weighed only 14 lb. The transmi[t]ter was attached to the passenger seat, and the aerial wir[es] were stretched along the length and breadth of the biplan[e.] The key for sending the messages was fixed at the airman['s] right hand. The detector used was of the Marconi electr[o-] magnetic design. Communications were maintained with th[e] biplane up to a distance of about one quarter of a mile. Th[e] information thus obtained will be utilized in making improv[e]ments for covering longer distances.

Hydroelectric Power in Turkey.—The streams and river[s] of Turkey present a wealth of hydroelectric power accordi[ng] to travelers who have penetrated into the interior of th[e] country, but until two years ago even the importation of [a] electrical apparatus was strictly prohibited. An awakening [to] the use of this power is now due, it is said, and Europe[an] electrical manufacturers are prepared for the boom whi[ch] seems certain, having agencies already established in the pri[n]cipal cities of the Sultan's domain. A recent report fro[m] Consul-General Ernest L. Harris, at Smyrna, calls attention [to] a remarkable lake, fifteen miles across, at the summit of [a] mountain 2500 ft. above the surrounding plain. This lake [is] estimated to discharge 3000 cu. ft. of water per second duri[ng] the winter season, and half this amount during the summer a[nd] autumn months. On a conservative estimate, taking the mi[ni]mum figures for flow and available fall, this lake overfl[ow] should develop at least 300,000 hp continuously. The surroun[d]ing country is in distressing need of irrigation and transport[a]tion facilities, both of which could be supplied on an am[ple] scale by the water-power development of the stream. T[he] mountain is also said to be a veritable mine of minerals

New York-Denver Long-Distance Telephony.—At the beginning of next year long-distance telephone communication will be established between New York and Denver, a distance of 2200 miles. Phantom-loaded overhead circuits will connect the two cities.

German-American Patent Reform.—Reports are current that German manufacturers are desirous of having the existing patent convention between the United States and Germany amended on the lines of the existing British patent treaty, so as to require Americans taking out German patents to manufacture the patented articles in Germany.

London-Paris Telephone Line.—The telephone connection of Great Britain with the mainland of the Continent has been established, and communication is now rendered easy from London to Paris and to north French and Belgian cities. The lines are reported to be working distinctly, and the authorities hope to establish regular service between London and Marseilles and German cities.

Increase in Rubber Supply.—An extensive source of supply of crude rubber, said to be equal in quality to Para, has been discovered in the palo amarillo tree which is found over a considerable territory near Guanajuato, Mexico. A plant for the manufacture of crude rubber from the sap of the trees has been established at Empalme de Gonzales, and five others will soon be placed in operation in the States of Guanajuato and Michocan.

Postponement of Russian Electrical Exposition.—The Technical Society of St. Petersburg has postponed until April 28, 1911, which is the seventy-fifth anniversary of steam locomotion in Russia, its exhibition of electric railway and power plant apparatus, which was to have been opened Aug. 28. The exhibition will be divided into several sections: The electrification of steam railroads; main-line electrification; local branch-line electrification; operation of street railways, and the use of water-power.

Telephones in New York City.—In a paper presented at the recent Paris International Telegraph and Telephone Conference Mr. J. J. Carty stated that in 1900 there were 51,398 telephone stations in Greater New York served from forty-three central offices. In 1910 the plans provide for 376,000 stations served from fifty-two central offices, with an estimated population of 4,800,000. In 1930 the plans provide for 2,142,000 stations to be served from 109 central offices, with an estimated population of 8,800,000.

Examination for U. S. Hydroelectric Engineer.—The United States Civil Service Commission announces an examination on Nov. 9 and 10 to secure eligibles from which to fill two vacancies in the position of hydroelectric engineer at San Francisco, at $2,100 and $2,400 per annum, and other vacancies as they may occur at salaries ranging from $2,100 to $3,000 per annum. Applications should be made to the United States Civil Service Commission at Washington [illegible] throughout the country.

Commonwealth Edison Branch of N. E. L. A.—[illegible] first of the fall meetings of the Commonwealth Edison Branch of the National Electric Light Association on Sept. 29 Mr. B. E. Roffee, of the construction [illegible] "The Application of Electric Motors to Group and Individual Drive for Different Kinds of Industrial Power Purposes." Mr. N. A. Rollins, of the engineering department, followed with a paper on "Building Construction and Alterations Exclusive of Generating Stations," referring to the practice of the Commonwealth Edison Company. Both [illegible] lantern-slide pictures. Some of the first motors placed in service were shown, and the gradual development of motors, up to the present day, was illustrated. The methods of the engineering department in erecting new buildings and making changes were explained. Chairman J. C. Manley presided and addressed the meeting on the opportunities of the organization.

Electrical Illumination of Ottawa Streets.—The Ottawa Electric Company is making a proposition to the merchants of Ottawa, Ont., for the illumination of certain streets. It is proposed to install on Sparks Street, for a distance of about three blocks from Sapper's bridge, thirty-six standard steel posts, each supporting five 50-cp tungsten lamps. The maximum height of the standard is 15.5 ft. and the base 24 in. They will be placed on both sides of the street at alternate distances of 50 ft. apart. The lamps will be kept lighted from sundown till midnight, and the cost is to be divided among the ground-floor tenants of the premises at the rate of 10 cents per month per foot frontage. Thus a store with 33-ft. frontage will be charged $3.33 per month, or 74 cents per week. The lighting company will furnish the standards, lamps and all equipment, together with the energy. The scheme is said to be meeting with favor among the merchants, most of them having already signed the proposed contract with the company.

Preparations for Illinois Convention.—The annual convention of the Illinois State Electrical Association will be held in the Safety Building, Rock Island, Ill., on Oct. 25, 26 and 27. This building contains the offices of the People's Power Company, and in connection with the convention there will be a display of electrical exhibits in charge of the Illinois Electrical Exhibitors' Association, of which Mr. W. R. Pinckard, Westinghouse Electric & Manufacturing Company, Chicago, is president, and Mr. W. S. Taussig, General Electric Company, Chicago, is secretary. The area available has been divided into about twenty exhibit spaces. The People's Power Company will issue an invitation to the citizens of Rock Island, Ill., Moline, Ill., and Davenport, Ia., to attend, free of charge, the electrical display which the exhibits will afford. Thus there will be a much larger attendance at the exhibition than that afforded by the number attracted by the convention itself. The entertainment features will include a smoker on the evening of Oct. 25 and a theater party the next evening.

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on Oct. 5 Mr. George H. Porter, chairman of the entertainment committee, reported that the total expenses of the August outing of the club at Ravinia Park were $373.41. Receipts from all sources amounted to $393, leaving a balance of $19.59. Mr. James H. Delany reported from the rallying committee, and Mr. Robert S. Mitten gave some account of the plans for increasing club membership. Mr. W. R. Pinckard called attention to the annual convention of the Illinois State Electrical Association, to be held in Rock Island on Oct. 25 to 27, and explained the preparations under way for the exhibits and entertainment features. The speaker of the day was Mr. Gale Blocki, of the Chicago bar, whose subject was "The How and Why of a Contract." Mr. Blocki, in the course of his talk, remarked that the formality that formerly surrounded the making of contracts is gradually disappearing, common sense taking its place. In drawing a contract, it is important to be sure that it is as simply worded as possible, while still covering all contingencies. A contract executed on Sunday is good in Illinois. Business men should be careful in fixing the time limit of a contract, and should then live up to the time limit imposed. By far the greater proportion of contracts are verbal and implied, not written, and every man should endeavor to carry out faithfully the obligations of the unwritten contracts into which he enters. There was no discussion but Mr. C. Walter Jones, of Newark, Ohio, general manager of the Holophane Company, was introduced and made a few remarks.

Philadelphia Meeting of the I. E. S.—A meeting of the Philadelphia Section of the Illuminating Engineering Society will be held on Oct. 21, the speaker of the evening being Mr. Francis H. Gilpin.

Public Service Laws for Japan.—The Imperial Japanese Parliament is investigating the New York Public Service Commission laws with a view to adopting similar laws for Japan.

Water-Powers in Asia Minor.—United States Consul-General Ernest L. Harris, at Smyrna, states that Asia Minor abounds in opportunities for the installation of hydroelectric equipments, although no attempts have as yet been made to utilize the numerous water-powers of the country.

Large Generators in Mexico.—Two of the largest hydroelectric generator sets ever built are now being erected in the Necaxa station of the Mexican Light & Power Company. Each generator is capable of carrying a maximum load of 15,000 kw. It is a three-phase machine designed for 4400 volts, 50 cycles and will be driven at 300 r.p.m.

Value of Electric Property in North Carolina.—The assessments of electric light and gas companies, and of street-railway companies, in North Carolina for 1910, as compared with 1909, show the following: Electric light and gas companies from $1,588,000 to $2,220,000, an increase of $632,000; street railways from $2,116,000 to $2,035,000, an increase in [illegible]

Wireless and the Electric Vehicle.—Reports from Los Angeles state that Mayor Alexander has received a wireless telegraph message sent from the top of Lookout Mountain by means of a portable set receiving energy from the storage battery of an electric vehicle which had conveyed the operator and witnesses to the top of the mountain for the purpose of experimenting with the equipment.

Chicago Section, I. E. S.—The first fall meeting of the Chicago Section of the Illuminating Engineering Society is announced for 12:30 p. m. on Oct. 13 at the Great Northern Hotel. After luncheon Mr. Joseph Newman, Jr., of the International Harvester Company, is down for a paper on "Good Lighting from a Factory Viewpoint." A secretary for the section will be elected. It is announced that over 200 members have been added to the Chicago Section during the summer.

Brazilian Wireless Telegraph Station.—The Brazilian government has erected a wireless telegraph station on the beach at Amaralina, close to the village of Rio Vermelho. The new station is equipped with the Telefunken system and has a guaranteed range of 400 miles. The principal features of the station are as follows: Height of mast, 197 ft.; primary power 20 amp and 220 volts; speed of generator, 1500 r.p.m.; high-tension of transformer, 15,000 volts to 20,000 volts; number of jars (Leyden), 4; length of waves, 600 m, 1000 m and 1600 m (656.1 yd., 1093.6 yd. and 1749.7 yd.).

Electrical Industry in England.—The British Board of Trade returns state that the imports of electrical machinery into the United Kingdom in 1908 amounted to 6353 tons and in 1909 to 5461 tons, a reduction of over 16 per cent, while the exports for those years were 18,482 tons and 18,698 tons, showing an increase of about 1.1 per cent. The value of the imports of other electrical goods and apparatus increased from $6,318,810 in 1908 to $6,612,545 in 1909, while that of the exports rose from $9,715,520 to $11,153,995 in those years, equal to increases of 4.6 per cent and 14.7 per cent, respectively.

Norwegian Hydroelectric Undertaking.—At Bergen, Norway, electric generators which are now being driven by steam [illegible] hydroelectric generated. The undertaking involves the blasting of a water tunnel which will exceed two miles in length, and which, it is expected, will take two and one-half years to complete. The new station is being erected at Samananger, to the east of Bergen, and will generate energy at 7500 volts, transformed to 40,000 volts for transmission to Bergen. It is anticipated that the undertaking will be finished during 1912, and that the cost will be about $1,000,000 for a 30,000-hp installation.

Serious Electric Railway Accident.—As the result of a head-on collision between two trains on the Illinois Traction system near Staunton, Ill., on Oct. 4, thirty-six lives were lost and nearly as many persons were injured. The wreck appears to have been due to the disregarding of train orders by one of the train crews. The financial loss to the company, including the payment of claims for the deaths and injuries, may amount to $500,000 or more. Among those killed were three officials of the Illinois Traction System—Mr. W. W. Street, superintendent of the St. Louis-Springfield division; Mr. John E. Barry, land commissioner, and Mr. D. E. Black, master mechanic.

Electrical Industry in Germany.—Statistics relating to the imports and exports of electrical material show that 371 tons of electric lighting apparatus were imported into that country last year, and that 7185 tons were exported, the imports being 3.3 per cent above and the exports 11 per cent below the figures for 1908. During 1909 69 tons of telegraph and telephone appliances were imported and 1601 tons were exported; in this case the imports were stationary, but the exports show an increase of 5.7 per cent as compared with 1908. Measuring instruments formed the third largest item; of these 95 tons were imported and 1223 tons exported, these figures being 19 per cent and 15 per cent above those for 1908.

Projected Electric Development in Peru.—According to an official decree a syndicate has been granted the right to develop power from the River Chancay, in Peru, and to build and operate an 80-mile electric railway between Ancon and Huacho, and supply electric energy to large farming estates in the neighborhood. Consul-General Robertson states that if the project materializes there should be an excellent opening for American rolling stock, which is already largely used in Peru on steam and electric roads, and for electric machinery, fixtures, etc., and for other articles entering into the construction of both the water-power plant and the road itself, as well as for machinery and equipment for the farming estates.

Western Society of Engineers.—At a meeting of the Western Society of Engineers of Chicago, on Oct. 5, a proposed revision of the constitution to meet the present needs of the society was presented. Among other things it is proposed that there shall be a new classification of members, including student members, with branches in engineering schools. An effort will be made also to weld the various sections of the society, of which the electrical section is one, more closely to the main body. The occasion was interesting as being the first meeting of the new hydraulic, sanitary and municipal section, Mr. John Ericson, city engineer, of Chicago, and chairman of that section, presiding. There was a general and rather desultory discussion of the address of Mr. B. E. Sunny, president of the Chicago Telephone Company, on "The Engineering of Chicago," delivered at the last annual dinner of the society, but not discussed at that time. Mr. Sunny was out of town, but he was represented by Mr. J. G. Wray, chief engineer of the Chicago Telephone Company, who abstracted his paper. Mr. Sunny suggested the appointment of a board of high-class consulting engineers to study such subjects as subways, water system, sewerage, railroad terminals, deep waterways and harbors. This proposal was discussed, but no definite conclusion was reached, several of the speakers being in favor of coordinating and systematizing the work of the present municipal engineers rather than appointing an outside independent board.

A LOW-HEAD HYDROELECTRIC PLANT.

Engineering and Economical Features of the Electric Generating Equipment at the University of Iowa.

By Arthur H. Ford.

THE hydroelectric plant of the University of Iowa furnishes an excellent example of a low-head installation operating with a load having a load-factor between that for a plant having a large motor load and one with a lighting load exclusively. The load closely approximates that of an office building, as most of the buildings are in use, with halls and some rooms lighted, until 10 o'clock at night and are supplied with electrically driven ventilating fans. The hospital, which is one of the university buildings, demands twenty-four-hour service, which fact is taken advantage of in supplying energy for the campus lighting. Previous to the installation of the present plant, energy was supplied by an 80-kw, direct-current, 110-volt, three-wire engine-driven set located at the heating plant, the hospital being lighted from the plant of the Iowa City Gas & Electric Company.

Fig. 1—Concrete Dam and Power House.

The water rights belonging to an abandoned grist mill located about a mile above the campus having been presented to the university for development, it was found, upon investigation, that there was a good site for a dam, which would allow of a slightly increased head being obtained at a point adjoining the campus. The head developed varies from 9 ft. to 1 ft., depending on the stage of the river. The extreme variation is due to the slight grade of the river below the power house, which causes the tail water to rise much faster than the head water during a flood. On this account the hydraulic equipment has been so designed that the plant is able to operate and supply a moderate amount of power when the head is as low as 3 ft. An investigation of the stream flow, as determined by readings taken at the government gaging station formerly located a few hundred feet above the site of the plant, showed that 200 kw could be counted on for eight months in the year and that floods great enough to reduce the output materially seldom occurred at the time of the yearly peak load.

Dam and Power House.—The concrete dam and power house foundation, shown in Fig. 1, have a combined length of 300 ft. and extend to rock foundation, 10 ft. below low water. There are six gates having a clear waterway of 40 sq. ft. each, three being provided for each wheelpit. Each wheelpit contains two 51-in. vertical-shaft turbines geared to a horizontal shaft running at 300 r.p.m. when the head on the wheels is more than 7 ft. This shaft is connected to the wheels and generator pulleys in such a manner that generator No. 1 may be driven by one, two or three wheels as desired and generator No. 2 may be driven by one or two wheels. In order to be able to run the generators at full speed when the head on the wheels is low each machine is provided with three pulleys of different sizes, which are changed as the head varies. One man can easily make the change by the use of the traveling crane. Two electrically controlled governors are provided, one for controlling the gates of each pair of wheels.

The electrical equipment consists of two 100-kva, two-phase, 2300-volt, 900-r.p.m., revolving-field generators with directly connected exciters, and a three-panel switchboard. The switchboard is unusually complete for a plant of this size, as it was designed for purposes of instruction as well as regular operation of the plant. Each of the two generator panels is equipped with two main ammeters, one voltmeter, one indicating wattmeter, one field-circuit ammeter, one watt-hour meter, one power-factor meter, one governor control switch, one compound rheostat, one field switch, two main line oil switches, one voltmeter receptacle and one synchronizer receptacle. The feeder panel is equipped with two double-throw oil switches and four static ground detectors, two for each feeder. Two sets of busbars are provided. On a swing bracket are mounted a frequency indicator and a synchronizer.

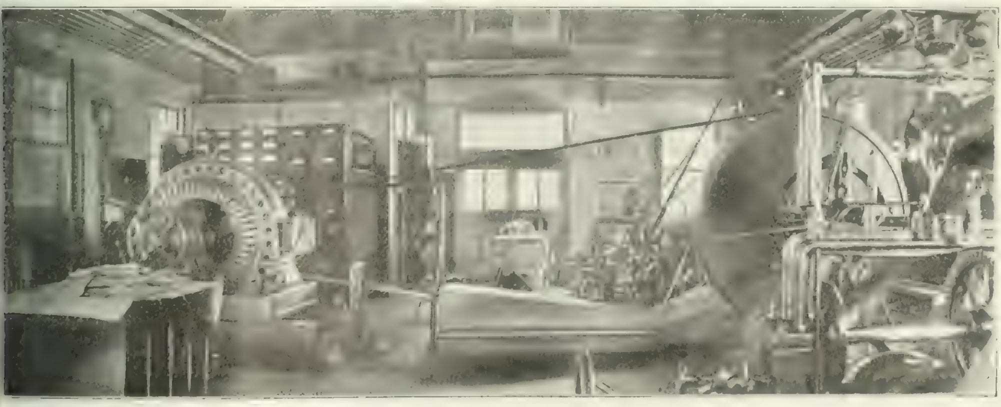


Fig. 2—Interior View of Power House, Showing Generator, Switchboard and One of the Changeable Pulleys.

Transmission Lines.—Two overhead transmission lines of No. 4 wire extend a distance of 2500 ft. from the generating station to the substation.

Substation.—The substation contains a motor-generator set consisting of a 50-kw, two-phase, 2300-volt synchronous motor

directly connected to two 22.5-kw, 125-volt direct-current generators. A shaft extension is provided for this set so that it can be driven from a 150-hp internal-combustion engine by means of a belt. This engine and the older three-wire, steam-driven set constitute a reserve plant for use when the hydraulic plant requires help.

The alternating-current section of the switchboard contains three feeder panels, each equipped with a double-throw oil switch, and a motor panel which is the duplicate of the generator panels at the power station. In addition there are a synchronizer and two recording voltmeters, one for each set of busbars. The two sets of busbars are the continuation of the transmission lines, there being no switches at this end of the line. The starting device for the synchronous motor consists of a pair of series reactors with a short-circuiting switch.

The direct-current section of the switchboard consists of one generator panel with an ammeter, a voltmeter, a three-pole knife switch and a field rheostat for each generator and a three-wire watt-hour meter, and one feeder panel with five three-pole knife switches and a ground detector.

Distribution Circuits.—Conduits extend underground from the substation to the various buildings, and in these are 2300-volt, paper-insulated cables terminating in transformer chambers in the various buildings. The direct-current feeders which were in place when the new plant was constructed were run in the steam-pipe tunnels and in conduit to places where the tunnels did not reach, while the new direct-current feeders have been run in ducts in the high-potential conduit line.

Operation.—As previously stated, the plant is operated twenty-four hours per day, except on Sunday, when it is operated during the day for about two hours at noon only. The motor-generator set is run from 7 a. m. to 10.30 p. m. only. This set is normally started from the alternating-current end, as the direct-current lines are dead when it is not running, unless the steam-driven set is running. The normal method of starting is to connect the synchronous motor to the busbars through the series reactors; then as the machine approaches synchronous speed, which usually takes about a minute, close the field switch; after the machine has dropped into step adjust the direct-current potential, and finally close the switch which short-circuits the reactors. The starting of this machine lowers the line potential for a minute or two, but as there are few lamps lighted at 7 a. m. this is of no great moment. When the steam-driven set is running the motor-generator can be started and run from the direct-current end, thus supplying alternating current to assist the hydraulic plant.

When the generators are operating in parallel the load is divided between them, according to the wattmeter indications, by operating the governor control switches while keeping the frequency constant. When adjusting the potential, by operating the field rheostats, the power-factors of the two generators are kept alike, as indicated by the power-factor meters. This method is much more satisfactory than the usual one of adjusting the field currents according to the indications of the main and field ammeters when adjusting the potential, both on account of the superior accuracy of the adjustment made possi-

TABLE I.—TESTS OF GENERATOR.

Field Current Amperes	Power Factor Per cent	Phase Difference Degrees	Armature Current Amperes
[illegible]	[illegible]	[illegible]	[illegible]
5	75.0	—41	17.0
6	86.0	—30	15.5
[illegible]	[illegible]	—14	13.0
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	+24	14.5
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

ble and the smaller manual effort required. A test on one of the generators which was carrying a load of 58 kw showed the variations of power-factor and armature current with field current as indicated in Table I.

The comparison of sensitiveness should be made between the variation of phase difference and the variation of armature current, because power-factor meters have their needles deflected in direct proportion to the phase difference, while their graduations show the cosine of the angle of phase difference. This test shows that a change in the field current which does not affect the main ammeter appreciably causes a variation of twenty-four degrees in the position of the needle of the power-factor meter.

The operating force consists of the superintendent and two men; the former devotes about half his time to the plant, having his office adjoining the substation.

The load curves for Sept. 1, 1909; Dec. 1, 1909; March 1, 1910, and June 1, 1910, are shown in Fig. 3. The increase of

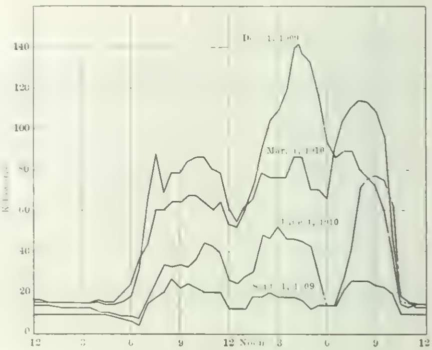


Fig. 3—Load Curves.

the morning and evening load for March 1 over the load for Dec. 1 is due to the opening of the new Law Building. In this building there is a motor-driven ventilating fan, while the library is open until 10 p. m.

Finances.—A summary of the installation cost, the expense account and the output for the three years during which the plant has been operated is given in Table II. It will be noted that the total cost per kilowatt rating is rather high

TABLE II.—FINANCIAL STATEMENT.

Investment Account	Year Ending June 30 1907	1908	1909	1910
Hydroelectric plant				
Land	$1,000.00	$1,000.00	$1,000.00	$1,000.00
Building	3,800.00	3,800.00	3,800.00	3,800.00
Hydraulic works	22,000.00	22,000.00	22,000.00	22,000.00
Hydraulic equipment	8,500.00	8,500.00	8,570.00	8,750.00
Electrical equipment	3,400.00	3,443.00	3,525.00	3,825.00
Total	$38,700.00	$38,743.00	$38,895.00	$39,195.00
Substation	$3,000.00	$3,240.00	$3,240.00	$3,240.00
Transmiss and distribution	4,500.00	5,350.00	5,350.00	5,675.00
Reserve plant	2,500.00	2,500.00	2,615.00	7,135.00
Total investment	$48,700.00	$49,833.00	$50,100.00	$55,195.00
Depreciation Account				
Value of fund at begin. of year			$1,891.00	$3,914.09
Interest 4%			$75.64	130.56
Machinery displaced				650.00
Hydroelectric plant				
Building, 2%		$76.00	76.00	76.00
Hydraulic works 2%		440.00	440.00	440.00
Hydraulic equipment 8%		680.00	680.00	685.60
Electrical equipment 5%		170.00	172.15	176.25
Total		$1,366.00	$1,368.15	$1,377.85
Substation 5%		$150.00	$162.00	$162.00
Transmission system, 5%		225.00	267.50	267.50
Reserve plant 6%		150.00	150.00	156.90
Value of fund		$1,891.00	$3,914.29	$5,3[illegible]9.10

for a plant having such a small distribution system. This fact is due primarily to the high cost of the hydraulic development per kilowatt on account of the low head.

The cost of service per kw-hour is fairly low, due to the good load factor for a plant of this character.

TABLE III.—[illegible]

Expense Account	1908	[illegible]	JUNE 30 1910
Hydroelectric plant			
Fixed charges			
Interest, 6%	[illegible]	[illegible]	$2333.70
Depreciation	1366.00	1368.15	1377.85
Taxes, 1½%		581.14	583.42
Insurance, 1%	157.00	157.43	158.95
Maintenance....	450.00	250.00	211.00
Total....	[illegible]	[illegible]	$1664.92
Operation			
Superintendent, half time	[illegible]	$500.00	$500.00
Two operators	1320.00	1320.00	1320.00
Supplies	30.00	30.00	30.00
Total....	$1800.00	$1850.00	$1850.00
Transmission and distribution			
Interest, 6%	$280.00	$321.00	$321.00
Depreciation....	225.00	267.50	267.50
Taxes, 1½%	67.50	80.25	80.25
Total....	[illegible]	$668.75	$668.75
Reserve plant			
Interest, 6%	$150.00	$150.00	$156.90
Depreciation..	150.00	150.00	156.90
Taxes, 1½%	37.50	37.50	[illegible]
Total....	$337.50	$337.50	$353.02
Total expense for year	[illegible]	$7537.55	$7536.60
Total output kw-hours	[illegible]	236,073	294,251
Maximum load kw	[illegible]	155	[illegible]
Yearly load factor, per cent	16.1	17.4	20.8
Demand cost at switchboard, per kw....	[illegible]	$30.20	[illegible]
Energy cost at switchboard per kw-hour..	.0086	.0078	[illegible]
Total cost at switchboard per kw-hour	.0319	.0277	[illegible]
Total cost at buildings per kw-hour..... 20% allowance for loss	.045	.040	[illegible]

Hydraulic Data.—The maximum possible output of the generators, for various heads on the wheels, is as follows:

Head (feet)....	[illegible]
Power (kw)....	[illegible]

This table was compiled from tests for heads up to 6 ft., the output for greater loads being estimated. The majority of the time the head is between 7 ft. and 9 ft., as shown in Tables IV and V for the head of water on the wheels for two years.

TABLE IV.—NUMBER OF DAYS ON WHICH WATER WAS AT VARIOUS HEIGHTS ABOVE CREST OF DAM. HEIGHT GIVEN IN INCHES AT 7 A. M.

		Below		Above					
[illegible]	Height	6 to 0,	0 to 6,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] to 3
	Days ..	15	[illegible]	[illegible]	46	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Height	0 to 6,	6 to [illegible]	12 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Days ..	73	176	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE V.—EFFECTIVE HEAD ON WHEELS [illegible] AT 7 A. M.

[illegible]	Head	3 to 4,	4 to 5,	5 to [illegible]	[illegible] to 7,	[illegible]	[illegible]	[illegible]	[illegible]
	Day..	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Head...	0 to 2,	2 to 3,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Days..	1	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

When the head is over 9 ft. the flow is so small that the full load cannot be carried for very long without drawing on the storage.

Interruptions to Service.—The service was interrupted or the steam plant run each year as follows:

TABLE VI.—INTERRUPTIONS IN 1907-1908.

July [illegible]—Plant shut down at 8 [illegible]
July [illegible]—Plant shut down all day [illegible]
July [illegible] to [illegible]—Plant shut down [illegible]
[illegible]—Load reduced at [illegible]
July 20 to 22—Plant shut down all day on account of flood.
[illegible]—Plant shut down at [illegible] trouble with gate [illegible]
Feb. 4—Steam plant run from 12:40 p. m. to 9:30 p. m. on account of low water.
Feb. [illegible] p. m. on account of low water.

TABLE VII.—INTERRUPTIONS [illegible]

July [illegible]—Ten-minute shut-down [illegible]
[illegible]—Twenty-minute shut-down [illegible]
[illegible]—Part of the load [illegible] low water.
[illegible]—Part of the peak [illegible] of low water.
Mar. [illegible]—Part of the load [illegible] flood.
Mar. [illegible], April [illegible] account of high water.
Apr. 29, 30—Part of the peak load carried by steam plant on account of high water.
May 3, 5, 19 and 20—Load reduced on account of high water.

TABLE VIII.—INTERRUPTIONS IN 1909-1910.

July 7—Steam plant started at noon on account of high water.
July [illegible]—Steam plant run all day on account of high water.
Dec. 3—Steam plant run 4:00 p. m. to 6:30 p. m., high water.
Dec. 6—Steam plant run 3:30 p. m. to 6:00 p. m., high water.
Dec. 7—Steam plant run 9:30 a. m. to ——, high water. Ice clogged racks so that plant had to be shut down at 8:30 p.m.
Dec. 8—Steam plant run until 6:00 p. m. Hydraulic plant started at [illegible] p. m.
Dec. 10—Steam plant run 2:30 p. m. to 5:00 p. m., high water.
Dec. 13—Steam plant run 2:30 p. m. to 4:30 p. m., high water.
Jan. 13—Steam plant run 2:30 p. m. to 6:00 p. m. Generator No. 1 out of commission, due to burn-out.
Jan. 17—Steam plant run [illegible] p. m. to [illegible] p. m. Generator No. 1 out of commission, due to burn-out.
Mar. 8—Steam plant run from [illegible] p. m. [illegible] account of high water. Hydraulic plant shut down at 10:00 p. m. [illegible] went out.
Mar. 9—Steam plant run until 10:00 p. m., high water. Hydraulic plant started at 2:00 p. m.
Mar. 10—Steam plant run from 5:00 p. m. to 10:00 p. m., high water.
Mar. 11—Steam plant run from 3:30 p. m. to 10:00 p. m., high water.

Where the load was reduced to avoid starting up the steam plant it was done, in most cases, by stopping some of the ventilating fans as the lighting load increased late in the afternoon. This change could be made without serious inconvenience, as few of the classrooms are occupied at this time of the day. A study of the interruptions to service shows that most of them were due to high water, as indicated in Fig. 4.

Fig. 4—View of Dam During High Water.

To insure continuous service it is necessary to have a power reserve of some sort with a sufficient equipment to drive at least one generator at full load. The gasoline engine at the substation serves this purpose, the possible output of the motor-generator set being 100 kw when driven from the engine. This engine was not put in service until May, 1910, so that the data given do not show its operation. An internal combustion en-

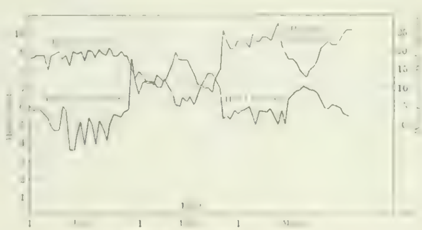


Fig. 5—Hydraulic Data.

gine is superior to a steam engine [illegible] can be put into service [illegible] help for its operation.

A study of the hydraulic data for a period of low water followed by one of high water is interesting on account of the sudden changes shown. The data for such a period are shown in Fig. 5, the curves being plotted from data taken each day

[illegible] during January the water was below the [illegible] the dam for a part of the time during nearly every day. The river was frozen over until the flood period in the latter part of February, during which the ice went out.

Experience with this plant has led the writer to draw the following conclusions: The cost of hydraulic works and equipment for plants having heads lower than 10 ft. is so great per kilowatt rating that such plants are apt to be unprofitable investments unless the yearly load factor is greater than 15 per cent. Where the water-power is as variable as in this case a reserve plant is a necessity. In case the maximum load is greater than the hydraulic power developed the load factor for the hydraulic plant can be materially increased by operating the rest of the plant only when the load is in excess of that which can be carried by the hydraulic plant, thus making the investment in the hydraulic plant a profitable one.

The field-circuit ammeter, which it is customary to place on a generator switchboard, can be replaced to great advantage by a power-factor meter.

THREE-PHASE TRACTION IN ITALY.

Some Practical Problems Encountered on the Three-Phase Giovi Line.

By Warren H. Miller

UP in the mountains back of Genoa, Italy, near Lake Giovi, the Italian government has electrified a portion of the steam line running into Genoa from Milan via Novi and Pontedecimo, as mentioned in the *Electrical World,* Sept. 8. The mountains which encircle Genoa slope up very abruptly from the sea, rising to from 1500 ft. to 3000 ft., and the railroad follows the valley of the Pescara mountain stream down to

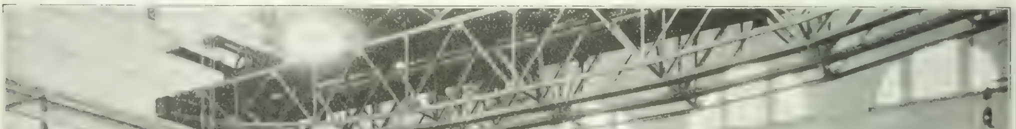


Fig. 1—Turbo-Alternators in Giovi Line Power House.

[illegible] per cent [illegible] The electrified section covers the grades from Pontedecimo to Busalla, a distance of about thirteen miles, and the Genoa tunnel through the mountains. Owing to favorable experience during the last seven years with the Valtellina Railway, the Italian government adopted three-phase traction for all its electric lines, including the 225-mile stretch from Lucerne to Chiasso over the Gotthard-Bahn, undertaken in conjunction with the Swiss State Railways. Mr. Karl von Kando, director-general of all of these electrical lines, succeeded in pushing the Giovi line, as the Genoa-Pontedecimo-Busalla section is called, through to operative completion during the past summer. The line, which is used mostly for freight traffic, operates thirty 2000-hp, 60-ton locomotives each with two 3000-volt, 15-cycle induction motors directly coupled by connecting rods to five wheels on a side. These locomotives were fully described in the issue referred to above, so that the present article will be limited to a study of the effects of three-phase traction on the generating equipment and the solution of overhead problems.

Fig. 2 shows the general arrangement of overhead lines. The two conductors are run side by side about 1 m apart, hung from a single catenary with flat tie-bars thinned down to a circular section at the junctions with the trolley wire and with the suspension wire.

A single trolley bow takes current from both wires, the roller of the bow being composed of two hard-bronze sleeves separated by a 30-cm insulated section and insulated by a bushing from a solid steel mechanical axle passing through them and carried by ball-bearing races at the ends. The wires are supported by long cantilevers made of two 6-in. I-beams extending from structural steel poles with three tie wires running to the top of the pole from points over the center of each trolley bracket and at the end of the cantilever. The idea in extending the arms so far beyond the outer wire is not only to get a firmer suspension of the wire, but to provide a strut for guy-wires in arranging cross-overs and turnouts, when they prove exceedingly convenient in attaching anchor wires.

Fig. 3 shows details of the trolley wire hangers. There are two beam-clamps attached to the under flange of the cantilever I-beams and these grip the high-tension spool insulators. There are four of the latter, all identical, two of which are enclosed by the beam-clamps and two by the wire hangers. A 1.5-in. iron pipe, to which they are cemented, passes through them. The wire hanger-post has a movable clamp to adjust the height of the catenary suspension wire and a pair of parallel

motion links holding the triangular frame to which the trolley wire is clamped. The latter is of T-rail section.

It has been found advisable not to put any collars over the insulated section of the trolley bow, nor to raise it above the periphery of the bronze sleeves. There is practically no swaying of the bow in practice, and even if one wire were to travel over on the insulated section the motors would simply be operated single-phase for a moment. The bow frame is raised up by compressed air pistons equipped with a suitable oil damper, which will permit slow changes of level of the wires above the top of the rails from 15 ft. to 19 ft., but resists instantly any shocks or jars tending to throw the bow out of contact while running.

It is in the overhead work that the three-phase presents undoubted disadvantages over the single-phase. There are many roads where the extra cost of a double-wire system would prohibit its use. Besides the extra cost there are the greater complications of a double trolley line. However, the possibility of three-phase traction under all sorts of heavy service has been proved beyond doubt, and there are at least three European firms of the first rank prepared to undertake such con-

Fig. 2—Overhead Construction of the Three-Phase Giovi Line.

struction under loads for [illegible] having heavy traffic and many locomotives it is the cheaper installation in the long run. It works out as follows: At 100 sq. mm of copper cross-section of trolley wire the difference of cost of installation between the double wire and the single wire runs from $700 to $800 per kilometer. Taking the specific case of the Gotthard-Bahn, there are 367 km of track between Lucerne and Chiasso, or 440 km, including stations and yards. This puts the difference in cost of a double line against a single at between $308,000 and $352,000. When this difference is offset against the greater cost of the single-phase locomotives, about seventy-five locomotives will be the least that will be wanted. (There are now on the line 160 steam locomotives.)

At the price of $28,000 per locomotive, the total will run $2,100,000 for locomotives. As the single-phase locomotives cost about 17 per cent more per ton, the difference will amount to $357,000, thus balancing the extra cost of wire. The real difference will be much greater, since it takes twice as much weight of single-phase locomotives to move the tonnage over heavy grades as with the three-phase. This means extra locomotives on heavy trains, so that the real outlay for single-phase locomotives will far overbalance the extra cost of the double-wire overhead work.

Fig. 1 is a view of the interior of the generating station with the two 6000-kw, 3000-volt, 15-cycle turbo-alternators as installed by the Société Anonyme Westinghouse, of Havre. The locomotives, one of which is shown in Fig. 4, were built at

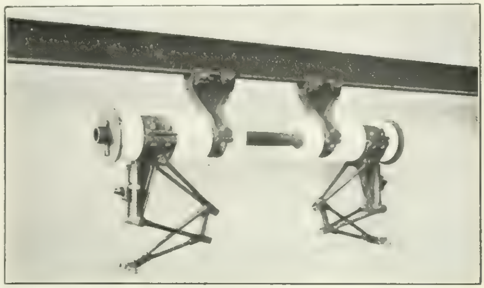


Fig. 3—Three-Phase Hanger Details.

the shops of the Italian Westinghouse Company at Vado Ligure, on the Mediterranean coast.

Regarding the economy of the three-phase equipment for the generating station, it is well known that with the same output the single-phase equipment costs about 40 per cent more than the three-phase. This is not the only advantage, for experience has shown that on overload the single-phase alternators are subject to exceptional eddy currents which produce corresponding overheating, so that still larger machines must really be provided and the actual constructive material takes the proportion of about 3 to 2 as compared to a three-phase alternator of equal power. On the other hand, the single-phase equipment has a somewhat simpler and less expensive switchboard arrangement, having only two poles instead of three in switches, breakers, etc. This advantage should not be overestimated, since the three-pole breakers have only one-third the current to handle for the same total power sent out and only one more pole than the single-phase.

Fig. 5 is a view of the outgoing feeder panels. These panels are provided with two-pole combined oil-switches and breakers and an 800-amp ammeter in each of the two overhead legs. The adjacent panel has a single-pole circuit breaker connection to the ground circuit or third-phase lead. On the outging lines are two choke-coils and low-equivalent lightning arresters.

Fig. 4—Three Phase, 60-ton Freight Locomotive for Giovi Line, Italian State Railways.

These are of the well-known American type, with a set of milled cylinders, series gaps, a second set of shunted gaps consisting of similar cylinders around which is a resistor and, finally, a heavy non-inductive resistor in series with the gaps, which latter is connected to ground. A lightning discharge [illegible] to ground through the main resistor

Any arc which follows it is opened by the actions of the shunt and series resistors together, while the initial flow is kept down by the series resistor.

The question of voltage enters strongly into any consideration of the respective merits of the three-phase and single-phase equipments. With three-phase it has developed into a medium e.m.f. on the trolley line of 3000 volts (6000 volts in the Cataract Tunnel line of the Great Northern) and for single-phase it has reached 15,000 volts in the Seebach-Wettingen line. The advantages in copper economy are self-evident when the further simplicity of avoiding transformers on the locomotive can be obtained. But high voltages in the locomotive introduce very heavy insulation in the motors, making it difficult to get an economical design for the rotor and stator slots. It is difficult to provide a strong, well-insulated overhead system for the high-tension lines, and hence the problem is one of long-distance transformer substations distributed along the line with a moderate voltage taken off the trolley line directly into the motors, or else transformers on the locomotive with a fairly high voltage on the trolley line.

Mr. von Kando's argument in solving the problem in figuring energy economy and installation costs for the Lucerne-Chiasso line is as follows: With seventy-five locomotives he found that, allowing 1600 kw in transformers for each, 120,000 kw of transformers would be needed as extra installation charges,

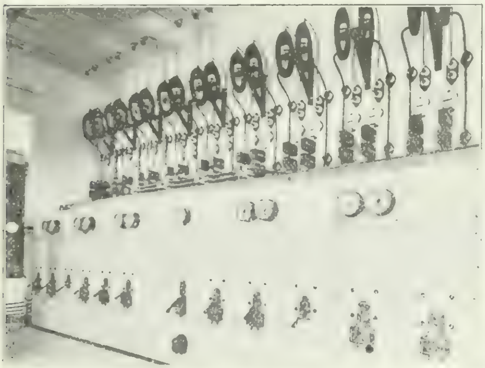


Fig. 5—Outgoing Feeder Panels, Giovi Line Power House.

whereas the average power over the whole line used throughout the day was 20,000 kw, whence only this amount would be needed in substation transformers, the expense being only one-sixth as great as when installed on the locomotives. On the Valtellina line 3800 kw of transformer substations suffices in practice to serve 18,000 hp of total locomotive motor rating. Assuming 15,000 kw of transformers needed on these locomotives, 4-to-1 is the ratio of expense of locomotives with transformers versus substations. On the Giovi line, with transformers at both ends feeding energy to the line in two directions, the entire transformer equipment rating is 12,000 kw to serve a total of 50,000 hp in electric locomotives. Taking 40,000 kw of transformers as needful on the locomotives there is still 3.5 times the transformer expense. However, the locomotive equipment of this line can be very much increased without overloading the transformer substations as already installed.

The above, however, takes the hour-load rating of the locomotive transformers against the day-load rating of the substation transformers. Therefore the size and cost of the former may be only one-half that of the latter. Even then the cost remains three times as great in the theoretical case of the Lucerne line and twice as great in the actual case of the Valtellina line. One might also urge the cost of buildings and switch panels of the substation transformers, but these are [illegible] mechanical part due to having transformers installed, their extra switching and controller complications, division of switch-rooms, etc.

Aside from the cost advantages there is an operating advantage in the line using substations over that using high-tension transformers on the locomotives, especially in large installations. On dead short-circuit with turbo-alternators of great kinetic energy no breaker can handle the tremendous rush of energy, whereas with substations and step-up transformers a short-circuit on the road is dampened by them enough to allow the circuit to be opened safely at the generating station.

In general, in choosing between the two forms of alternating-current traction, it is necessary first of all to provide sufficient load equipment and adaptability for the special service of the particular road and not to try to compete with steam locomotives with lighter or scarcely heavier electric locomotives. The selection of the details can then be decided by the specific technical advantages, such as the simplicity of the single-phase overhead or the traction advantages of the three-phase, as fits best the particular line.

RECENT STUDY OF THE FIREFLY.

By HERBERT E. IVES.

IN the summer of 1909 the present writer, with Dr. W. W. Coblentz, obtained a photograph of the spectrum of the firefly's light. The photograph showed the light to consist of a narrow band of radiation confined to the yellow and green region of the visible spectrum. On the assumption that this photographed light constitutes the total radiation from the insect it would follow that the firefly is the most efficient known illuminant. It was calculated that its radiant output corresponds to nearly fifty candles per watt, as against the two or three candles per watt of the most efficient mercury arcs or flame arcs.

At the time of the publication of that work some question was raised as to the validity of assuming the visible radiation to be the only radiation. This assumption was based on Professor Langley's bolometer measurements made twenty years ago. These proved that the emission of light by the firefly is accompanied by an exceedingly small amount of heat as compared with any artificial illuminant of the same brightness. Examination of his work shows that it is not actually proved, however, that the visible radiation is the total radiation. It is nevertheless probable, and in the graphical comparison so often copied from his paper this assumption is embodied.

Perhaps our greatest interest in the study of the firefly lies in answering the question: Has Nature actually produced the most efficient possible light? If so, then we may hope some day to do the same. If, as is usual in Nature, a process of selection has been gone through, we may expect to find other light-producing substances of similar nature but of wider color range. Although of lower efficiency as light producers, these would be more acceptable to human use. If, on the other hand, the firefly light should be proved not the ideally efficient radiation it has been supposed, but merely an approximation, our interest in it would be materially reduced, and our hopes of securing a similarly efficient, but more pleasing, light would lose much of their support. It becomes, therefore, of importance to know definitely if the conclusion of Professor Langley is true.

Langley's experiments in brief were these: Bolometer deflections were obtained from the total radiated energy of the insect—none or next to none when that having a wave-length longer than 3μ was obstructed by a glass screen. On the other hand a flame of the same brightness as the firefly gave considerable deflections of the bolometer through the same glass. The radiation obstructed by the glass Langley classed as "body heat" due to the bodily temperature of from 40 deg. C. to 50 deg. C. Specifically the criticism of his work is this: In those cases where no deflections were obtained all of the bright visible radiation was incident upon the bolometer. Since

this had little or no effect, could there not be radiation anywhere between it and 3μ of similar order of magnitude? If, for instance, the spectrum consists of several bands of nearly equal intensity, their existence would have escaped the tests imposed. Had the bolometer been sensitive enough to respond unquestionably to the visible radiation, the point at issue could have been determined by absorbing that radiation by a properly chosen red glass and then noting the remaining deflection, if any.

This summer an attempt was made to extend the definite knowledge of the firefly's light into the infra-red region. A bolometer of great sensitiveness for this purpose was not available, so another method of investigating the infra-red was tried. It will be remembered that the great advantage of photographic observation over visual lies in the integrative action of the photographic plate, which adds the effect due to each flash of the firefly. There was some promise that the method used this summer would possess this desirable characteristic in respect to the infra-red, and might therefore be superior to the bolometer. This method is that of phosphor-photography used by Draper, Lommel and others. Phosphorescence, which is excited in certain substances by blue, violet or ultra-violet light, is extinguished by yellow, red or infrared radiation. The extinction may be recorded by taking a photograph of the phosphorescent surface. In this way photographs of the infra-red spectrum of the sun and of various elements have been obtained.

Phosphor-photography was investigated at length with a view to applying it to this study. The various tests will be given in detail elsewhere in the fuller publication of the work of which this is an abstract. The conclusions reached in brief were as follows: Sidot blende; the most suitable phosphorescent substance, is sensitive to reducing action as far into the infrared as 1.5μ; it is sensitive for four or five hours after excitation; the reducing action is, like photographic action, integrative; finally, the sensitiveness to reduction is of nearly the same order of magnitude in the infra-red as it is in the visible region at 0.57μ. The importance of this last observation lies in its making possible a rigid proof of the main point at issue, for if reducing action is produced by the visible firefly radiation, but not with the visible radiation obstructed, then none of similar magnitude exists in the region to which the Sidot blende is sensitive.

Fireflies caught in Druid Hill Park, Baltimore, were studied by the phosphorescence method. It was found that an exposure of only twenty minutes to the firefly flashes was sufficient to produce strong reduction of phosphorescence. On the other hand, an exposure of three hours and a half through a ruby glass, opaque to yellow-green light but transparent to infra-red, produced no effect. It therefore appears that there is no radiation between the visible region and 1.5μ of the same order of magnitude as the visible radiation.

At the same time advantage was taken of the opportunity to search for ultra-violet radiation by means of a quartz spectrograph. The photograph obtained showed a strong impression from the light at 0.57μ, but no trace of action elsewhere. The result was thus again negative, so that in the whole region from 0.2μ to 1.5μ there was found no radiation except that previously investigated at 0.57μ.

Following these experiments some tests were made to see if the firefly's light possesses any of the characteristics of true phosphorescence; that is, whether it is emitted only after previous exposure to light. Experiments of this kind were suggested by observation of the effect of warming a phosphorescent substance during its period of decay. Warming produces a flash of light very similar to the flash of the firefly. While no great confidence was felt that the insect's light would prove of this character, it was thought at any rate worth while to apply some of the characteristic tests of phosphorescence. These are: First, dependence upon previous exposure to light; second, sensitiveness to excitation by ultra-violet light; third, sensitiveness to reducing action by infra-red rays.

To none of these tests was there any positive response. Insects kept in the dark for twenty-four hours and those open to the light behaved exactly the same. Infra-red and ultraviolet light had no effect on the insects or upon the luminous matter removed from their abdomens. The only observed effect of light was that strong illumination caused the living insects to cease flashing as though from realization of the futility of their own light. Their light is therefore not true phosphorescence.

The results of the present investigation may, therefore, be said to be entirely negative, but so far as they go they lend probability to the supposition that the visible radiation is the only radiation other than "body heat." The spectral region in which we have definite knowledge has been extended to cover the interval from 0.2μ to 1.5μ. It has been surmised by Coblentz that the abdominal skin of the firefly, being a complex organic substance containing water, is opaque beyond 2μ, so that 2μ, or perhaps 1.5μ, is the limit of the possible radiation. If so, the present investigation would cover nearly the whole region of interest. Following the work described above a bolometric test was made of a piece of this skin to obtain information upon this point. It was found that the skin in its natural thickness is about as transparent in the deep infra-red (about 3μ) as at the edge of the visible region. It is hence possible that radiation of wave-length greater than 1.5μ is produced and can pass out through the skin. There still remains for investigation, therefore, the radiation of wave-lengths greater than 1.5μ to which the phosphor-photographic method is not sensitive. As to the mode of light production, no positive information has been obtained, but by the exclusion of phosphorescence it is made still more probable that the insect produces its light by some unknown, but not necessarily unknowable, bio-chemical process.

MULTI-SPEED SQUIRREL-CAGE INDUCTION MOTOR.

Comparison of Multi-Speed Induction Motor with Direct-Current Series Motor.

By R. F. Hellmund.

THE squirrel-cage induction motor, on account of the absence of all moving contacts and insulated conductors on the rotor, is the most rugged and simple electric motor now built, and because of its mechanical superiority it is especially well adapted to industrial and other severe services. In cases where frequent starting under load is necessary, the ordinary induction motor is at a considerable disadvantage due to its inherently constant speed. For intermittent service involving high starting torques the direct-current series motor is well adapted; however, this motor requires a more expensive distribution system and heavier maintenance charges than does a corresponding induction motor.

In view of these facts, the writer has designed a multi-speed squirrel-cage induction motor which comes within the economic limits set by the series motor and at the same time compares favorably with the latter as regards its starting and operating characteristics.

Practically all large electric systems now furnish alternating current, and in this article the distribution system is assumed to carry alternating current. A direct-current motor will, therefore, require a corresponding equipment of transforming devices, such as synchronous converters and transformers or motor-generator sets. In view of these facts, it appears to the writer that an additional investment in the induction motor itself, in order to obtain characteristics approaching those of the series motor, is amply justified even from a purely commercial standpoint.

In order to demonstrate these views, the writer has designed a squirrel-cage motor which is somewhat larger than a normal

constant-speed induction motor and a good deal heavier, but only moderately more expensive than the corresponding direct-current motor. It is equivalent to a direct-current series motor having a full-load rating equal to that of the induction motor at its highest speed. The general data for the motor are as follows: Terminal e.m.f., 3000 volts; frequency, 25 cycles; with dimensions in inches, the product D^2L in the air-gap is 49,000; the weight of active core iron is

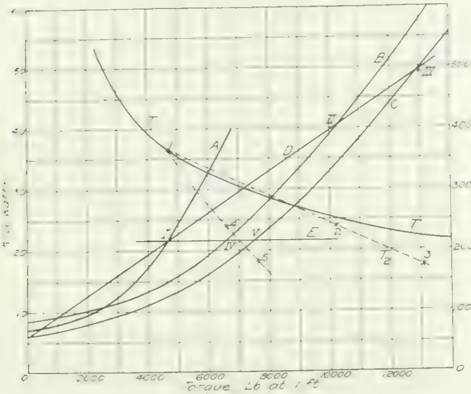


Fig. 1—Curves of Comparative Losses and Speed Torque of a Direct-Current Series Motor and Multi-speed Squirrel Cage Induction Motor.

5500 lb.; the weight of active copper is 1900 lb. The over-all dimensions of the frame are: Height and diameter, each 75 in.; width, 40 in.

The multi-speed feature is obtained by providing the motor with two two-speed windings in the primary, which correspond to 24, 16, 12 and 8 poles, giving as synchronous speeds 125, 187.5, 250 and 375 r.p.m. respectively. The motor is designed to operate at only the three higher speeds, the lowest speed being used only for starting. Forced ventilation is employed.

The curves *A*, *B* and *C* in Fig. 1 show the losses in the motor for the three operating speeds in terms of torque at 1 ft. radius. The ventilation of the motor is such that it will dissipate 39,000 watts continuously. Making considerable allowance for starting losses, it was determined that the admissable full-load losses could be taken as 21,800 watts, which corresponds to a rating of 325 hp at 365 r.p.m. (Point *I* on curve *A*.) For the purpose of comparison, assume a direct-current series motor with the same continuous rating, normal speed and losses. Curve T_1 in Fig. 1 shows the ideal speed-torque characteristic of this series motor, the speed decreasing in inverse proportion to the torque. The copper losses in this motor will increase in approximate proportion to the torque, other losses not being materially affected. Therefore, the total loss in the motor is a straight-line function and is represented in Fig. 1 by line *D*. It will be noted that this line crosses curve *B* in point *II*, and curve *C* in point *III*, which determine the speeds at which the losses in the two motors are equal. The ability of the motors to carry the loads represented by the points *I*, *II* and *III* depends upon their radiation power, and although assumed to be equal in this case, that of the induction motor, on account of its larger masses, is superior.

The speeds of the induction motor corresponding to points *II* and *III* are indicated by points 2 and 3 on the dotted curve T_2, which may be considered as representing the speed-torque curve of the induction motor. The proximity of the curves T_1 and T_2 indicate that the imitation of a series characteristic has been practically attained. It would be well to point out here that the induction motor has a very important advantage over the series motor in that it can carry at low speeds for an indefinite time torques largely in excess of its full load torque, while the series motor can do so for only a limited period. This characteristic is shown by drawing a horizontal line *E*, which corresponds to the continuous loss previously assumed. This line cuts curves *B* and *C* in the points *IV* and *V*, the corresponding speeds being indicated by the points 4 and 5 on the curve, which is plotted through these points. This curve may be considered as the continuous rating speed-torque curve of the induction motor, and ratings corresponding to this curve and the performance of the motor at these rating are given in the table herewith:

Continuous rating hp	Speed r.p.m.	Torque lb at 1 ft Rad. Continuous rating	Torque lb at 1 ft Rad. Pull out	Efficiency at Various Loads 0.50	0.75	1.0	1.50	Power Factor at Various Loads 0.50	0.75	1.00	1.50
325	365	4,670	16,700	92.2	92.5	91.7	89.0	86	91.5	93.5	94.8
[illegible]	240	6,550	29,700	90.0	91.5	91.1	89.5	65	79	85	89.5
265	182	7,650	24,800	89.5	90.5	90.0	87.5	59	72	80	86.5

It will be seen that the efficiencies are high and compare favorably with the direct-current series motor. They are considerably higher than would be attained by those of a direct-current machine operating in connection with transforming devices from an alternating current system. From an operating standpoint the series motor has the advantage of being able to run at any speed between the limiting ones, while the induction motor is confined to three positive speeds. However, the plain series motor is limited to one speed for each torque, while the induction motor may be operated near each of its synchronous speeds at any torque between zero and maximum; by the use of shunt field circuit regulation with a direct-current machine, this latter characteristic may also be obtained within certain limits.

In order to attain a satisfactory starting characteristic special provisions have been made. As was previously stated, the lowest speed is used for starting only, and therefore it was possible to provide means for rendering this step particularly effective. A special arrangement of secondary resistor rings

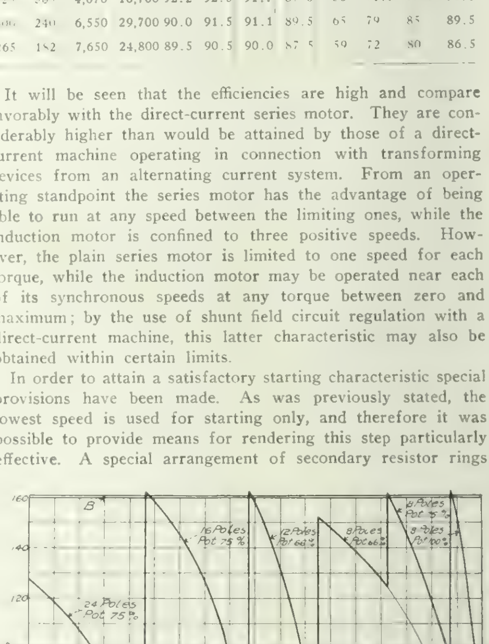


Fig. 2—Curves of Current of Multi-speed Squirrel Cage Induction Motor During Starting Period.

was devised by which the bars are connected through these rings in such a manner that the effective resistance of the rotor is high for the lowest speed and low for the three operating speeds. In order to reduce the complication and expense of control apparatus to a minimum, only two starting potentials, namely, 66 and 75 per cent, have been used.

As starting conditions, it has been assumed that the current shall not exceed three times the full-load current and that the

motor shall start under load, which is equivalent to accelerating a mass of 375,000 lb. at 1-ft. radius. In order to gain a proper conception of this last condition, it might be stated that starting with full-load is equivalent to the acceleration of a 190-ton train to a speed of about 26.5 miles per hour.

Speed torque curves for the various steps during the period of acceleration are shown in Fig. 3, while Fig. 2 gives the corresponding current values. Only the lower voltages are used at the low speeds. This was done in order to simplify the control equipment, and although by using also full potential on each speed connection the acceleration might have been somewhat more rapid, and the extra expense would not have been justified by the slight gain that would be obtained. In Fig. 2 the straight line *A* indicates the full-load current, while line *B* shows the maximum permissible current, which is three times the full-load current. Line *A* in Fig. 3 represents the full-load torque, while line *B* shows the total resisting torque, an allowance having been made for the friction of rest. In order to simplify calculations, it has been assumed that the speed-torque curves in Fig. 3 could be represented by the straight dotted lines as shown. From an examination of the curves it is evident that the distances between these dotted lines and the lines *A* and *B* represent the torque values available for acceleration. These values have been replotted in Fig. 4, and based on these curves

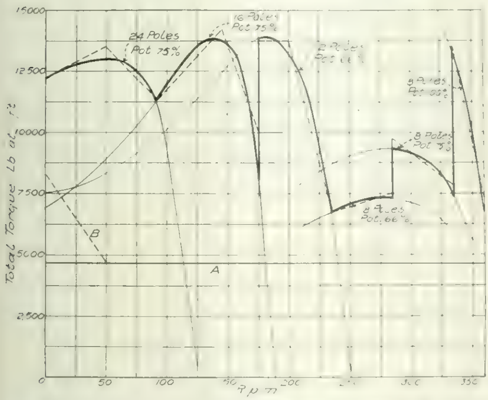


Fig. 3—Speed Torque Curves of Multi-speed Squirrel Cage Induction Motors.

the curves shown in Fig. 5 have been constructed. Curve *A* shows the speed plotted with time. It will be noted that the acceleration takes place at a fairly uniform rate and is completed in a period of about 88 seconds. Curve *B* shows the losses corresponding to the above speed-time curve. The total acceleration losses amount to 5.6 kw-hours. As previously mentioned the motor can dissipate continuously 39,000 watts, but at full load the losses are only 21,800 watts; therefore, distributing the starting losses over the running period in such a way that the average losses come up to 39,000 watts, it is found that the motor may be started from rest with full load every (1000 × 5.6 × 60 × 60) ÷ (39,000 − 21,800) = 1175 seconds = 19.6 minutes, and carry its rated load continuously.

The above assumed conditions are exceedingly severe, and will practically never occur in industrial work. The mass to be accelerated is usually less than one-quarter of the value assumed above. Assuming quarter load acceleration, the motor will carry its rated load continuously and start every five minutes without exceeding its normal working temperature.

From the above discussion, it is evident that this type of induction motor would withstand almost every starting service which will normally be encountered in practice, except perhaps certain cases where the motor is called upon to reverse every three or four seconds, as when operating reversing rolling mills.

Attention might be called to the fact that the total starting loss is generally decreased by an increase in starting voltage. Increasing the starting voltage increases the current and therewith the losses. However, the starting torque also increases, and by reducing the period over which these losses take place the practical result usually is that the total energy lost during starting is reduced when the voltage is increased. For ex-

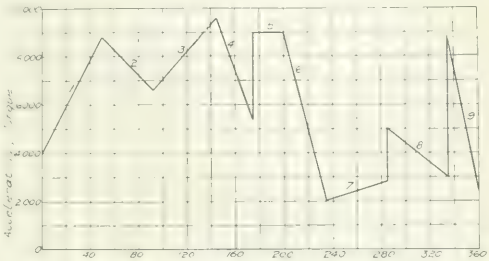


Fig. 4—Torque of Multi-speed Induction Motor Available for Acceleration.

ample, in the present instance, for the starting period of Fig. 4, for a starting voltage of 60 per cent the loss is 4.36 kw-hours, while on the other hand, with a voltage of 66 per cent, as shown in the curves, the loss is only 1.78 kw-hours. For this reason it is always advisable to choose a starting voltage as high as possible, with due regard to other conditions, such as line current, mechanical limitations, sparking in the controller, etc.

The control apparatus for a multi-speed induction motor of the type discussed involves certain difficulties, since the power which must be handled by the switches is larger than it would be in a corresponding series motor. However, in the matter of expense there is a considerable margin between the direct current and the induction motor outfits, which may be balanced against the increased cost of the induction motor controller. Naturally the induction motor will affect the line and generator

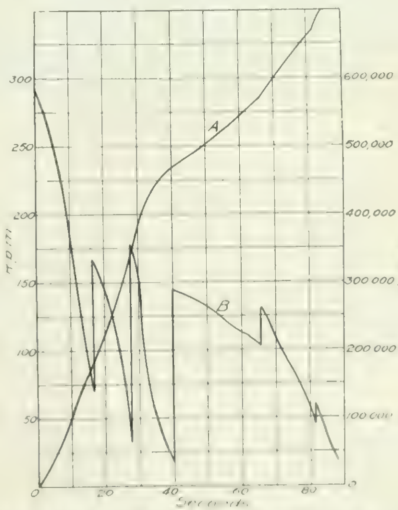


Fig. 5—(A) Speed-Time Curve of a Multi-speed Induction Motor; (B) Starting Losses of Multi-speed Induction Motor.

during its starting period more than will a series motor. However, by referring to Figs. 2 and 3 it will be seen that the increase of current during the starting period over the full running load value is accompanied by a corresponding increase of torque above the normal full-load value, which is a compensating advantage.

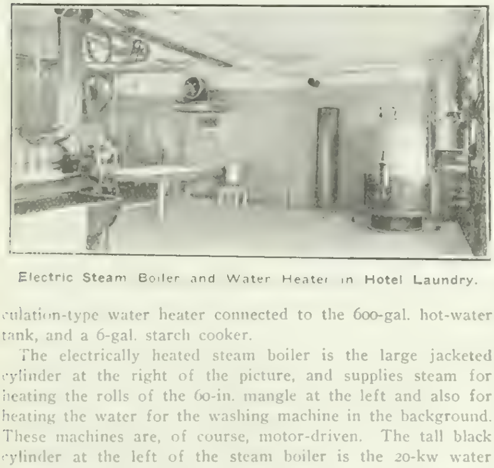
Central Station
Management, Policies and Commercial Methods

A CASTLE-FORM CENTRAL-STATION BUILDING.

The new municipal electric generating station to be erected at Halle, in the north-central part of Germany, will be given the architectural form of an ancient castle, complete with towers, turrets, gables, battlements, buttresses and donjon-keeps. The massive main tower will be an eight-sided structure, 95 ft. high and 35 ft. in diameter, marking its practical purpose as a cooling tower for lowering the temperature of the condenser circulating water. The tower will stand at the center of a courtyard, 80 ft. x 60 ft., surrounded by a moat and by a wall 31 ft. high. The whole design has been prepared by one of Germany's leading architects, who has planned many of the castles of the nobility, and the idea for this odd central-station structure is due to the superintendent of the Halle municipal plant, Mr. Jung.

ELECTRICALLY HEATED LAUNDRY.

The accompanying illustration shows the interior of the electrically heated laundry at the Hotel Stanley, Estes Park, Col., to which reference was made in the issue of Aug. 25. The electrical equipment of this room includes an 85-kw, 250-gal. boiler generating steam at 80 lb. per square inch; a 20-kw circulation-type water heater connected to the 600-gal. hot-water tank, and a 6-gal. starch cooker.



Electric Steam Boiler and Water Heater in Hotel Laundry.

The electrically heated steam boiler is the large jacketed cylinder at the right of the picture, and supplies steam for heating the rolls of the 60-in. mangle at the left and also for heating the water for the washing machine in the background. These machines are, of course, motor-driven. The tall black cylinder at the left of the steam boiler is the 20-kw water heater, which is one of four in use in the hotel for supplying the guest-rooms, toilets, laundry and kitchen. The kettle shown at the center is the starch cooker.

INCREASE IN MOTOR LOAD AT WINONA, MINN.

[illegible] Winona Railway & Light Company at Winona, Minn., to develop the business of supplying electrical energy to motors. For instance, the gross receipts for "commercial power" in June, 1909, were $2,406, and in June, 1910, $7,509. A more detailed statement of the comparative gross earnings of the company for July, excluding railway earnings, is given in the following tabulation.

Mr. F. H. Plaice, who has been manager of this company since Sept. 3, 1909, is a firm believer in the desirability of increasing the motor load. He thinks that any central-station company which has fostered a motor load as it should do will find that its revenue from the sale of electricity for motors is such a large percentage of the whole that fluctuations in the demand for electricity for lighting, due, for instance, to the introduction of the tungsten lamp, will hardly be noticed. He believes that the ratio of central-station light

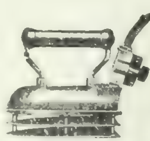
	July, 1909	July, 1910
[illegible]	$1,049 66	$1,082 [illegible]
[illegible]	3,902 05	5,424 21
Motor service	1,974.71	9,390.42
Total	$6,926 42	$15,896 96

ing earnings compared to earnings from motor service should be not greater than 1 to 3, and with most companies the proportion of earnings from motor load should be considerably greater than this.

Mr. Plaice thinks that any company depending upon lighting for its revenue may find itself sooner or later greatly handicapped by reason of the reduced income derived from customers on account of the substitution of tungsten lamps for carbon lamps. Therefore, it is of great importance to rely on the motor load as the principal source of revenue. In Winona it is not thought desirable to encourage the use of tungsten lamps smaller than the 40-watt size, while it is considered that for general purposes the 100-watt size is as small as can be pushed to good advantage. The latter lamp, however, forms a somewhat unwieldly unit for residence purposes and calls for considerable judgment in installation.

ELECTRIC-SIGN AND FLAT-IRON CAMPAIGNS IN TORONTO.

In January, 1910, the Toronto Electric Light Company inaugurated an electric-sign campaign which has been highly successful. A very low rate was offered for the energy used by signs "off the peak," the charge being 8 cents per month per



FREE TRIAL IRON ORDER

Toronto 19

Sales Manager,
Toronto Electric Light Co., Limited

Please send me, without obligation on my part, one six-pound Electric Glad Iron which I promise to try for thirty (30) days. If I find I can do without the appliance at the end of the trial period I will notify you to remove the Iron. I understand the price is Six Dollars ($6.00) including attachments, payable in monthly instalments of One Dollar ($1.00) with my electric light bill

Name

Address

Fig. 1—Flat-Iron Order on Postal Card.

2-cp, 14-watt lamp, or 5 cents per kw-hour for "off-peak" sign loads. The signs have been sold outright to the different merchants, the two local sign companies having taken care of all financial arrangements, except the consumption of the energy.

Some of the signs that have been erected are very striking. The *Saturday Night*, a weekly paper, on Sept. 24 printed four photographs on its front cover showing electric-sign installa-

tions. The *News* contained a two-column article on the number of electric signs, and other papers gave shorter notices.

The *Saturday Night* makes use of an immense fountain sign on a roof at the corner of Yonge and Queen Streets, a like sign at the corner of College and Spadina, and a vertical sign on the façade of its building on Adelaide Street. The Red Rose Tea Company has a very elaborate sign representing tea flowing from a pot into a cup; the steam rises, and the whole

Fig. 2—Electric Sign in Toronto.

is very striking and effective. A certain "Fairweather's" sign is of the rocket type; the rocket flies upward and falls into varicolored streams of light, which in turn break forth into the word "Fairweather's." The Brown Furniture Company has

Fig. 3—Electric Sign in Toronto.

lately installed a sign of a jumping rabbit that is very striking. "Adams," a rival concern, has installed a lightning sign. The Salada Tea Company has a sign on the roof of its building with letters 10 ft. high, in four rows, with 16-cp lamps in each letter. This is a very striking advertisement. One of the large bakers has installed an immense sign with 4-ft. letters reading "Eat Bredin's Bread" on the roof of the large bakery; this sign may be read by the passengers coming into Toronto on the steam trains. The business is taken "off the peak" without any trouble. In an eight-month campaign there have been installed over 100 signs ranging in price from $250 to $2,700.

On April 1 the Toronto Electric Light Company started an electric-iron campaign, the irons being placed on trial for thirty days. The irons are of United States manufacture and owing to the high duty on them, each 6-lb. iron is sold for the relatively high price of $6, which covers also a self-contained switch.

In inaugurating the campaign all of the residence customers of the company were solicited by young ladies after other plans had been tried and found unsuccessful. One of the schemes tried was that of delivering the irons from the company's wagons after letters had been sent to the customers stating that the irons would be sent and a demonstrator would be provided in case the irons were accepted. This plan had proved successful in introducing toasters, but proved ineffective with the irons. The direct-solicitation plan has been highly fruitful of results. Two wagons were kept busy delivering the irons, and at the end of thirty days' trial over 75 per cent of the irons were retained by the customers.

Nearly 2000 irons have been sold in this way to date, and the demonstrating solicitors report that the people are highly pleased with the results.

The company augmented the soliciting canvass with advertisements in the daily papers, sent enclosures with its bills to residence consumers and gave office demonstrations. Use is now being made of post cards, such as are shown on the preceding page, which are sent out with the monthly bills to the present customers.

In order to maintain proper interest in the flat-iron campaign and ensure a sale of irons during the coming winter months, the company displayed on the roof of its booth at the Canadian National Exhibition an electric sign 21 ft. by 14 ft., showing a G.E. model flatiron. The iron was complete with switch, cord, etc., and was accompanied by the words, "Electricity Makes the Sad Iron the Glad Iron," arranged with 14-in. letters. The iron was outlined continuously, but the wording alternated with two rockets which flashed into many colored stars.

A SAFE ENERGY RATE FOR SMALL CENTRAL STATIONS.

By S. W. Borden.

The principles governing the making of central-station rates have been pretty fully discussed of late and need not be gone into here. It is taken for granted that most companies prefer a rate which will produce a fixed income for fixed expenses and a profit on each kw-hour measured by a customer's meter, and it has been contended that an ideal rate should be capable of producing an equal net profit from each dollar of investment and each kw-hour manufactured. The author believes that such a rate is not a practical one at the present time, especially for small companies, as it seems to be necessary to accept a smaller profit from some classes of business in order to develop them to the best advantage and thus reap the greatest ultimate reward. For example, the fixed charges on small residential lighting must be kept pretty low in order to secure this class of business at the present time, and a smaller profit per kw-hour must be taken from large "long-hour" users in order to close down private plants and do the cooking for the hotels.

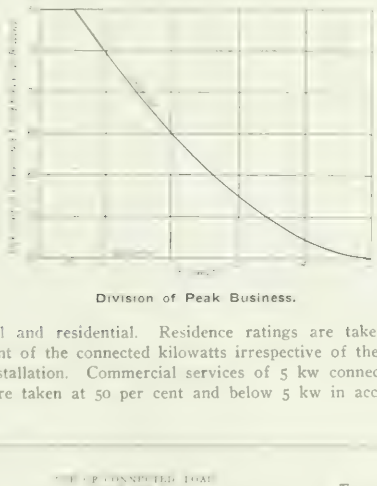
When adopting a new rate of this kind it is not good policy, even though franchises and the law permit, to make the new rate compulsory. The fixed charge should be made high enough at the start so that should all those customers who would profit by it accept it and all those who would not profit by it reject it the loss to the company would not be great.

With this start the company is in a position to make a fairly good proposition to any long-hour user, whether he be an old customer desiring increased consumption or a new customer. As fast as the increased business permits, the fixed charge should be reduced and at the same time the old rates should be put as much in the background as possible finally being made into a special rate if it is not possible to eliminate them entirely without causing too much trouble from the short-hour users.

The manager must decide what constitutes "peak load" and "off-peak load" for his particular business and what he will place in the "residential class" and what in the "commercial class." He must be permitted to exercise his business-getting ability and to adapt the rate to the business without adapting the business to the rate and he must know how much it costs to turn out one more kw-hour than his present output.

This system calls for the classification of each customer in accordance with certain rules and regulations, but in case the rating thus obtained is not satisfactory to either the central station or the customer it may be checked by means of a curve-drawing instrument, the rating for peak-load business being taken as the average demand during the one hour of the station's maximum demand and that for off-peak business as one-half of the customer's maximum one-hour demand at any time.

The service is divided into two general parts, "peak" and "off-peak" business. Peak business is subdivided into commercial and residential. Residence ratings are taken at 50 per cent of the connected kilowatts irrespective of the size of the installation. Commercial services of 5 kw connected and over are taken at 50 per cent and below 5 kw in accordance with the curve herewith reproduced. "Off-peak" business should be rated as follows:



Division of Peak Business.

TABLE I.

Connected Load in KW	No. of Appliances	Per Cent.	Class (for Reference)
0—7.5	One	40	OPA
[illegible]	Over one	35	OPB
[illegible]	Any Number	30	OPC
40 and over	Any Number	25	OPD

In classes OPB, OPC and OPD the rating must not be less than the rating of the largest single device alone.

Mixed loads should be rated as follows: When the peak load predominates the peak portion should be classed at the regular peak-load rating and nothing should be added for the "off-peak" portion. When the "off-peak" load predominates the peak portion should be classed at the regular peak-load rating and to this should be added the "off-peak" rating for an "off-peak" load equal to the difference between the "peak" and "off-peak" loads.

The minimum rating in all cases must be such as to produce a service charge of not less than $1.00 per month. All ratings should be expressed in kilowatts and fractions thereof.

The rate will consist of two parts, a service charge and a consumption charge as follows:

X dollars per kilowatt of rating per year and 5 cents per kw.-hour, or
X plus $20.00 per kilowatt of rating per year and 4 cents per kw.-hour, or
X plus $40.00 per kilowatt of rating per year and 3 cents per kw.-hour, or
X plus $60.00 per kilowatt of rating per year and 2 cents per kw.-hour, or
X plus $80.00 per kilowatt of rating per year and 1 cent per kw.-hour

The above prices cover the lamp renewals (ordinary) for "peak-load" customers. In case the "peak-load" customers do not require lamp renewals no deductions will be made. In case "off-peak" customers require lamp renewals an additional charge of 0.5 cent per kw-hour must be made.

The value of X must be determined for each central station individually and also, as before stated, the lowest rate permissible must be decided upon individually. When the lowest rate has been decided the intervening rates should be eliminated since any customer who earns a lower rate than the 5-cent rate will, at the same time, earn the lowest rate. The turning point from the 5-cent to the lowest rate will come when the customer has used his rated load five hours per day or his connected load approximately as in Table III.

TABLE II.

	[illegible] Connected Load [illegible] Hours per Day — Off Peak Classes					Consumption Charge 5 Cents per KW Hour — Service Charge per KW of Rating						Consumption Charge 2 Cents per KW Hour — Service Charge per KW of Rating					
						$20 per Year		$40 per Year		$60 per Year		$80 per Year		$100 per Year		$120 per Year	
Peak Class 50% Rating	OPA	OPB	OPC	OPD	KW hours consumed per month per KW of rating	Total monthly charge, dollars	Cents per KW hour	Total monthly charge, dollars	Cents per KW hour	Total monthly charge, dollars	Cents per KW-hour	Total monthly charge, dollars	Cents per KW hour	Total monthly charge, dollars	Cents per KW hour	Total monthly charge, dollars	Cents per KW-hour
[illegible]	0.2	0.175	0.15	0.125	15	2.42	16.1	4.08	27.2	5.75	38.4	6.97	46.5	8.63	57.5	10.30	68.7
[illegible]	[illegible]	0.35	0.30	0.25	[illegible]	3.17	10.6	[illegible]	16.1	6.50	21.7	7.27	24.2	[illegible]	29.8	10.60	35.3
[illegible]	0.6	0.525	0.45	0.375	[illegible]	[illegible]	[illegible]	5.58	12.4	7.25	16.1	7.57	16.8	9.23	20.5	10.90	24.2
[illegible]	0.8	0.7	0.6	0.5	60	[illegible]	7.8	6.33	10.55	8.00	13.33	7.87	13.13	9.53	[illegible]	11.20	18.7
2	1.6	1.4	1.2	1.0	[illegible]	7.67	6.4	9.33	7.75	11.00	9.20	9.07	[illegible]	10.73	8.88	12.40	10.33
[illegible]	2.4	2.1	1.8	1.5	[illegible]	10.67	5.9	[illegible]	6.85	14.00	7.78	10.27	5.70	11.93	6.65	13.60	7.55
[illegible]	3.2	2.8	2.4	2.0	[illegible]	13.67	5.7	15.33	6.40	17.00	7.10	11.47	4.78	13.13	[illegible]	14.80	6.15
[illegible]	4.0	3.5	3.0	2.5	300	16.67		18.33	6.11	20.00	6.67	12.67		14.33	4.78	16.00	5.33
[illegible]	4.8	4.2	3.6	3.0	360	19.67		21.33	5.95	23.00	6.38	13.87		15.53		17.20	4.78
[illegible]	5.6	4.9	4.2	3.5	420	[illegible]		24.33	5.8	26.00	6.20	15.07		16.73		[illegible]	
[illegible]	6.4	5.6	4.8	[illegible]	480	25.67		27.33	5.7	29.00	6.05	16.27		17.93		19.60	
[illegible]	7.2	6.3	5.4	4.5	540	28.67		30.33		32.00	5.93	17.47		19.13		20.80	
[illegible]	[illegible]	7.0	6.0	5.0	[illegible]	31.67		33.33		35.00	5.85	18.67		20.33		22.00	
11	8.8	7.7	6.6	5.5	660	[illegible]		[illegible]		38.00	5.77	19.87		21.53		23.20	
[illegible]	[illegible]	8.4	7.2	[illegible]	720	37.67		39.33		41.00	5.70	21.07		22.73		24.40	
[illegible]	[illegible]	9.1	7.8	[illegible]	780	40.67		[illegible]		44.00		21.27		23.93		25.60	
[illegible]	[illegible]	16.8	[illegible]	12.0	1440	73.67	5.12	75.33	5.23	77.00	[illegible]	35.45	2.46	37.13	2.58	38.80	2.70

For shorter use than this the 5-cent rate will be the cheapest and for longer usage the lower rate will be the cheapest. In Table II is the total bills per kilowatt of rating per month and the net rate paid for different hours of use for

TA[illegible]

Lighting (50%, class [illegible])	2[illegible] hours per day
Class OPA	[illegible] hours per day
Class OPB	[illegible] hours per day
Class OPC	[illegible] hours per day
Class OPD	1.25 hours per day

a service charge of $20, $40 and $60 per kilowatt of rating per year and a 5-cent rate per kw-hour and the corresponding figures for a low rate of 2 cents per kw-hour.

Wiring and Illumination

ORNAMENTAL ARC-LAMP POSTS.

Arrangements have been completed for decorating the arc-lamp posts along Market Street in Philadelphia with flower boxes placed at a height of about 12 ft. above the street. This arrangement, which is the result of a design submitted by Chief McLaughlin, of the electrical bureau, has been approved by Mayor Reyburn. The cost of maintaining the flower boxes will be met by Market Street merchants. The flower boxes will be constructed of wrought iron, with divisional interior boxes for holding the plants and flowers and for draining them.

LIGHTING OF SUNKEN GARDENS.

Interesting lighting effects are obtained in the new Sunken Gardens on the West Side in Denver. These gardens are built on bottom land, filled in by the city along Cherry Creek, and constitute a municipal improvement. A feature is a pergola presented by the Westinghouse Electric & Manufacturing Company. There is a small artificial lake supplied with water by means of a dam built in the creek. Grass has been planted in the gardens, and next spring trees and shrubbery will be set out. Several hundred incandescent lamps are arranged along the surface of the water under the coping of the concrete wall which surrounds the lake. They are in various colors and give first red, then white and then blue light. The effect of this light so near the surface of the water is very pleasing. The pergola is also electrically lighted. During the winter the lake will be used for skating and will be illuminated for that purpose. The Sunken Gardens will be one of the city's beauty spots. They are noteworthy because less than two years ago the site was a dumping ground and an eyesore to the community.

ARC LAMPS FOR PROJECTION.

By Henry P[illegible]

The arc lamps used for projection purposes, such as the "magic" lantern, the projection microscope and moving-picture machines, are in general of three types: (1) With inclined carbons (Figs. 1 and 2); (2) with electrodes at right angles (Fig. 3); (3) with converging electrodes (Fig. 4). The first two are used on either direct current or alternating current the third is used only on alternating current. The last named has the advantage that the hot tips of both electrodes throw the light forward, but is open to the objection that there are two sources of light instead of one. The most favorable condition is when the source is a single point of light. When there are two sources of light, if the lantern is not in perfect focus, the picture instead of being merely hazy is doubled, which is very trying to the eyes.

The right-angle lamp is the most satisfactory for many purposes, as the upper electrode feeds forward and is always in the axis of the optical system. However, the inclined-electrode arrangement is the one most frequently used.

EXPERIMENTS MADE AT CORNELL AND IN SCHENECTADY.

Investigations of the subject of illuminants for projection have been carried on for some time in the Physical Laboratory at Cornell University. Candle-power measurements have been made with alternating current and with direct current. These tests showed so favorably for direct current that the General Electric Company at Schenectady was asked for similar figures on the direct current furnished by the mercury-arc rectifier. When tests were made for this purpose the author was invited to assist.

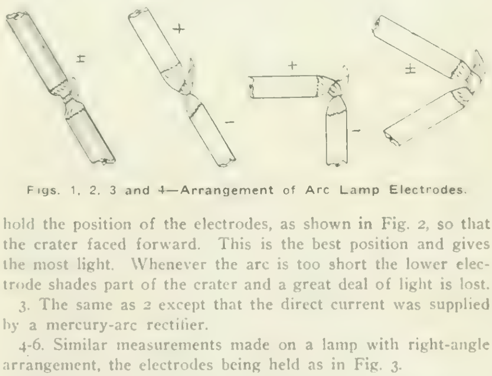
The results with alternating current and direct current were in very close agreement with those previously obtained at Cornell, and hence, to avoid confusion, only the results of the Schenectady tests are given here.

The experiments were made in the illuminating engineering laboratory of the General Electric Company. The apparatus was a Lummer-Brodhun photometer 20 ft. from the arc, used in connection with a 3-to-1 or 5-to-1 sectored disk and a 35-cp tungsten incandescent lamp. Ten settings were made for each current. One person made all of the settings of the photometer, so that any error due to differences in color would be the same for all readings. Measurements were made of the candle-power of the various lamps in the direction of the axis of the lantern in which they are to be used.

The sources were:

1. Inclined-electrode lamp such as is used in moving-picture outfits; 5/8-in. cored carbon electrodes. Tested with from 20-amp to 60-amp, alternating-current electrodes held as in Fig. 1.

2. Same kind of lamp except that direct current was used. The upper electrode was positive and great care was taken to



Figs. 1, 2, 3 and 4—Arrangement of Arc Lamp Electrodes.

hold the position of the electrodes, as shown in Fig. 2, so that the crater faced forward. This is the best position and gives the most light. Whenever the arc is too short the lower electrode shades part of the crater and a great deal of light is lost.

3. The same as 2 except that the direct current was supplied by a mercury-arc rectifier.

4-6. Similar measurements made on a lamp with right-angle arrangement, the electrodes being held as in Fig. 3.

Besides the candle-power, measurements were made of all electrical quantities. The results are given herewith in the form of tables and curves.

REGULATION OF CURRENT AND LOSSES.

The energy delivered at the arc depends only on the current and voltage (the power-factor with alternating current is nearly 1.0), but the energy drawn from the line, which is what the consumer pays for, depends also on the kind of apparatus used for "ballast," such as a resistor or a choke coil.

For direct current a rheostat is generally used. As much energy is wasted in the rheostat as is used at the arc, for the pressure across the arc is only about 55 volts, while commercial lighting systems have a 110-volt supply. The difference is lost in the rheostat. There is available a kind of rotary converter which if used on a 110-volt supply will deliver from [illegible] depending on the current drawn. This

machine consumes little energy in friction and is much more economical than a rheostat.

For alternating current either a resistor, a reactor (choke coil), a transformer or a rectifier may be used. The alternating-current arc is usually operated with inclined electrodes

[illegible]

[illegible]	[illegible]	[illegible]	[illegible] With Resistance	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1,000	2,200	4,900
[illegible]	[illegible]	1,270	2,750	[illegible]
[illegible]	[illegible]	1,590	[illegible]	8,750
[illegible]	[illegible]	[illegible]	4,400	12,350
Mean	[illegible]			

[illegible] AT RIGHT ANGLES

10	56	560	1,100	2,300
[illegible]	50	750	1,650	3,680
[illegible]	52	1,020	2,200	[illegible]
25	62	1,550	2,750	7,500
30	58	1,740	3,300	10,150
Mean	55.6			

and uses only 30 volts across the terminals. When used with a resistor the efficiency is very low. When used with a choke coil the efficiency is good (92 per cent), but there is such a low power-factor (30 per cent) that many lighting companies will not permit its use. To overcome this disadvantage a step-down transformer in connection with a small choke coil is employed. This arrangement gives the usual high efficiency of a transformer and a reasonable power-factor (96 per cent efficiency and 85 per cent power-factor).

Direct current is preferable to alternating current and for difficult projections such as with the microscope it is a necessity. When only alternating current is available a motor-generator set could, of course, be used, but a much simpler method is to use the mercury-arc rectifier. The primary of the rectifier is connected to either a 110-volt or a 220-volt alternating-current supply, and the secondary direct current is connected directly to the arc. The regulation ballast is a choke coil connected in the alternating-current side. There being no resistance, there is no loss except in the rectifier tube itself.

TABLE II.—ALTERNATING CURRENT; INCLINED ELECTRODES.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible] Efficiency	[illegible]
20	28	[illegible]	2,200	585	620
25	27.5	[illegible]	2,750	715	[illegible]
[illegible]	26.5	795	3,300	[illegible]	1,700
40	27	1,080	4,400	[illegible]	1,830
50	35	1,750	5,500	[illegible]	4,566
60	[illegible]	1,920	6,600	2,000	4,650
Mean	29.2				

[illegible]

[illegible] AT RIGHT ANGLES

10	[illegible]	430	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	600	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	920	[illegible]	[illegible]	1,050
25	[illegible]	1,370	[illegible]	1,430	1 690
[illegible]	57	1,600	3,300	[illegible]	2, 540
Mean	[illegible]				

[illegible]

The current furnished by the rectifier is not quite continuous, but is pulsating. As might be expected, there is a slight flicker in the light which can be seen if one is looking for it, but it is not at all noticeable as it is when using alternating current The light for the same current is practically the same as with direct current supplied from a generator.

BEHAVIOR OF THE ARC WITH DIFFERENT CURRENTS.

In an alternating-current arc the light comes from the white-hot ends of the electrodes. With the direct-current arc the light comes mostly from the brilliant crater of the positive electrode.

With low currents and cored carbon electrodes the behavior of the arc is satisfactory, but at greater currents the soft core begins to burn out faster than the end of the electrode, resulting in a hissing and sputtering of the arc, which leads to an unsteady light.

TABLE III.—RECTIFIER; INCLINED ELECTRODES.

Direct Current Secondary			Alternating Current Primary						
Amp	Volts	Watt	Amps.	Volts	Watts	Volt Amps	P F	Eff	C. P.
15	51	765	7	175	1,100	1,225	.898	.695	3,100
20	54.5	1,090	9.5	188	1,500	1,786	.84	.727	4,720
25	54	1,350	12	194	1,900	2,330	.816	.711	6,470
30	62	1,860	14.5	220	2,600	3,190	.816	.716	8,600
40	52	2,100	19	215	3,120	4,070	.768	.672	12,150
Mean	54.7						.828	.704	

TABLE IIIa. RECTIFIER, ELECTRODES AT RIGHT ANGLES.

10	58	580	5.5	195	850	1,070	.794	.683	1,900
15	45	675	7	180	1,000	1,260	.793	.675	3,000
20	51	1,020	10	[illegible]	1,500	2,030	.739	.680	5,600
[illegible]	66	1,650	12	235	2,300	2,820	.816	.718	7,370
[illegible]	62	1 860	14	233	2,600	3,260	.798	.716	9,450
Mean	56.4						.786	.694	

The lamp with the right-angle arrangement cannot be used much above 25 amp on account of the "magnetic blow" effect of the current. Many electrodes cause sputtering at currents above 30 amp and it is difficult to get a good arc with currents above 40 amp either alternating or direct.

With alternating current and inclined electrodes it is possible to get as much as 5000 cp with 60 amp. This arrangement gives an uncertain light, because the arc wanders around the carbon tips and the hot spot is often at the back of the electrode.

TABLE IV.—POWER IN KILOWATTS DRAWN FROM THE LINE FOR DIFFERENT VALUES OF LIGHT. INCLINED ELECTRODES, 110-VOLT SUPPLY, TRANSFORMER 96 PER CENT EFFICIENCY

Candle Power	Kilowatts				
	D. C. [illegible]	D. C. Resist.	A C Trans	A. C. Resist	Rectifier
1,[illegible]	[illegible]	—	.6	2.7	—
1,[illegible]	—	—	.8	3.2	.7
2,[illegible]	.4	1.1	1.1	3.75	.8
2,500	.55	1.3	1.2	4.3	.9
3,000	.6	1.5	1.4	4.9	1.1
4,000	.76	1.9	1.7	5.8	1.3
5,000	1.1	2.25	2.0	6.9	1.5
[illegible]	1.2	2.6	—	—	1.8
7,500	1.45	3.1	—	—	2.15
10,000	1.8	[illegible]	—	—	2.75

A steadier light is obtained with the right-angle arrangement for all currents up to 25 amp.

COMPARISON OF ALTERNATING AND DIRECT CURRENT.

A comparison of alternating current and direct current shows that the energy consumed at the arc with alternating current is nearly twice as great as with direct current and a much higher amperage is needed. Taking 40 amp as the upper limit for

satisfactorily working an arc, the light available is limited to 2500 cp. Now, 2500 cp can be got with from 10 amp to 13 amp direct current depending on the style of lamp used; with 40 amp direct current 12,000 cp is possible.

For good results on a 15-ft. screen[1] there should be at least 2500 cp with the magic lantern and 4000 cp with moving-picture lamps. However, a fairer test is to compare the power drawn from the line with available apparatus. For 2500 cp 1.3 kw would be drawn from the line using direct current, 1.2 kw using alternating current with a transformer, and 0.9 kw using the rectifier.

TABLE V.—LIGHT GIVEN FOR [illegible] OF KILOWATT CONSUMPTION.

Kilowatts	[illegible]				
1.0	5,500	2[illegible]	2,200		3,200
1.5	7,800	[illegible]	3,400		4,800
2.0	12,000	4[illegible]	4,800	500	6,900
3.0	———	7,300		1,300	11,000
4.0	———	11,000		2,200	———
5.0	———	———		3,100	———

DATA AND CURVES.

The results of the tests are recorded in Tables I to V and plotted in Figs. 5 to 8. Fig. 5 shows the relation between the current and the candle-power for lamps using inclined electrodes, while Fig. 6 shows the same relation for right-angle lamps. These illustrations show that for the same amperage the direct current gives the most light, the rectified current gives almost as much and the alternating current gives only a very small amount (one-fifth as much).

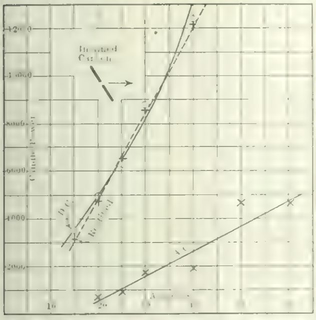


Fig. 5—Relation Between Current and Light in Inclined-Electrode Lamp.

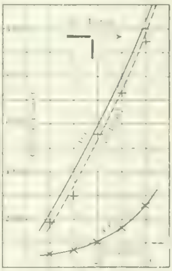


Fig. 6—Relation Between Current and Light in Right-Angle Lamp.

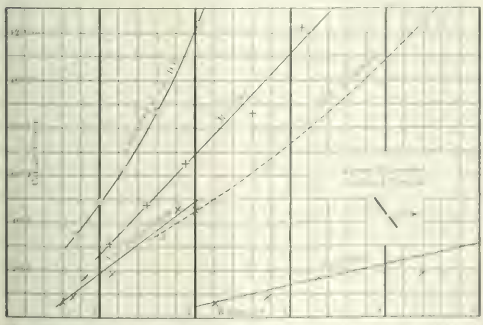


Fig. 7—Relation Between Power Consumption and Light in Inclined-Electrode Lamp.

[1] [illegible]

Figs. 7 and 8 show the relation between candle-power and power input. The top curve gives the power in kilowatts actually consumed at the arc with direct current. All other curves represent the power drawn from the line with existing apparatus. The power drawn from line through the mercury-arc rectifier was delivered to the arc at 70 per cent efficiency. This power is about the same as would be required if direct current were available at 75 volts instead of 110 volts. The power drawn from line with direct current and a rheostat is based on a line e.m.f. of 110 volts. The power drawn from line through a transformer was delivered at 96 per cent efficiency, the power consumed at the arc being slightly less than the value shown. The power drawn from line with alternating current and a resistor is for a line e.m.f. of 110 volts. This method is extremely wasteful; it is employed on small installations which are used only a few times a week. Fig. 9 illustrates the low power-factor obtained when using a choke coil as ballast.

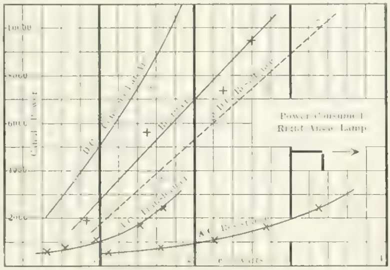


Fig. 8—Relation Between Power Consumption and Light in Right-Angle Lamp.

If the sets of curves for the right-angle lamp and those for the inclined-electrode lamp are compared it will be found that the right-angle lamp gives the most light for the same current in every case. The light given for the same power input is the same with rectified current for both styles of lamp. With either alternating current or direct current and resistance the right-angle lamp gives the greater light, but with alternating current and a transformer the right-angle lamp gives less light.

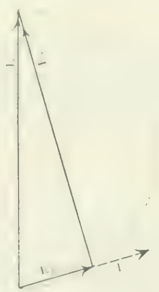


Fig. 9—Vector Diagram of Voltage Relation.

CONCLUSION.

Direct current obtained from a rectifier gives almost as much light as direct current from a generator. In every case direct current gives much more light for equal current values than does alternating current.

Evidently the power drawn from the line depends upon the power consumed at the arc and the efficiency of the ballast or transforming device. Of the devices tested the rectifier was the most efficient, and the least efficient was a resistor used with alternating current.

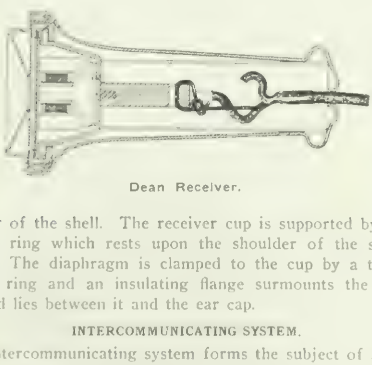
NEW TELEPHONE PATENTS.

SELECTIVE IMPULSE SENDER.

With all automatic systems the sender must cause a prescribed number of impulses to be sent out on the line, each group of impulses being separated by a short interval. Usually such senders are arranged so that each digit or figure is sent by an individual manual operation. However, in the sender recently patented by Mr. E. E. Clement, of Washington, D. C., the desired number is set up and then sent by a single sending operation A knob is provided for each digit, which is carried by a stem projecting through a notched slot in the body of the sender. Each notch is numbered. When the desired number is set up the operating crank at the end of the case is given a turn, whereupon the sender acts to deliver all necessary impulses. The mechanism is very simple. A single wheel sends all impulses. Its periphery carries several groups of 10 teeth each with blank spaces between. One group is for each digit. Upon the side of the wheel is a raised flange for each group of teeth, the flange being of the same angular length as the corresponding group of teeth upon the periphery. Each flange has a different length radius. When all the knobs of the sender are at zero, if the wheel be turned, as each group of teeth comes under the contact maker the stem of the knob corresponding will bear upon the flange. It must be understood that each stem is so formed and of such length as to strike only the flange corresponding to its own group of teeth. The electrical circuits are so arranged that the contact between a flange and a knob stem is a shunt upon the impulse contact maker. Thus with the knobs at zero no impulses occur. With the knobs displaced as many impulses occur at each set of teeth as there are teeth of that set which pass the contact maker before the flange reaches the displaced knob stem. The North Electric Company is assigned this patent.

METAL SHELL RECEIVER.

In the cut is shown in section a metal shell hand-type receiver invented and patented by Mr. W. W. Dean, of Elyria, Ohio. his patent being assigned to the Dean Electric Company. An insulating tube within the shell protects the receiver body from



Dean Receiver.

the rear of the shell. The receiver cup is supported by an insulating ring which rests upon the shoulder of the shell, as shown. The diaphragm is clamped to the cup by a threaded flanged ring and an insulating flange surmounts the flanged ring and lies between it and the ear cap.

INTERCOMMUNICATING SYSTEM.

An intercommunicating system forms the subject of a patent issued to Mr. W. W. Hawkins, of Cleveland. A novel feature is an electromagnetic release device for the keys. If the key at any station be depressed while the receiver is on the hook and so left, an arriving call will serve to shift the locking device and thus restore the key to normal.

AUXILIARY EARPIECE.

There are several kinds of auxiliary earpieces, one type of which is connected by a flexible tube to a sound box inserted in the regular receiver between the diaphragm and the ear cap. The present patent, granted jointly to Mr. K. Nichols and Mr. S. W. Nichols, of Newark, N. J., relates to the sound box, which in this case has a conical bore. Thus, while the base of the cone is of practically the same diameter as the diaphragm, [illegible] the same diameter as the sound [illegible]

SERVICE METERS.

Mr. O. C. Dennis, of Chicago, has patented a call counter for telephones with a rebate device. It is intended to operate interchangeably with prepayment coin collectors. The counter is located at the subscriber's premises and must be operated by a push to initiate a call. The operator is then able to give credit for the call in case it fails or to count it if it succeeds. This is accomplished through a polarized control magnet operated over the telephone line. For a credit call the operator lifts the operating pawl clear of the counter wheel.

Another meter patent has been granted to Mr. A. M. Bullard, of New York City. His patent relates to the use of push-button meters with semi-automatic or other systems where the potential existing upon the sleeve wire of the jack is likely to vary in sign according to the connection existing. His device consists of a combination of polarized relays such that the counter current supply is automatically shifted to conform to that existing on the sleeve at the time. Both the above patents are assigned to the Western Electric Company.

LETTERS TO THE EDITOR.

The Constitution and General Welfare.

To the Editor of Electrical World:

SIR:—It is not, I suppose, to be wondered at that technical writers should not be familiar with the Constitution of the United States and with the decisions interpreting it any more than that lawyers should be ignorant of technical matters; but the editorial in the issue of Sept. 22 seems to the writer to assume, as things admitted fully and about which there can be no controversy, matters which have been definitely closed to all discussion by decisions of the Supreme Court of the United States to the contrary.

In dealing with the advisability of "conservation," so called, being undertaken by the United States and not by the several states, the editor draws conclusions from an assumed case of a river flowing across the boundary line between two states, and assumes as quite a matter of course that in that case the federal government can and should act. That precise case was before the Supreme Court of the United States and is one of the most conclusive which that court has ever decided, the decision being unanimous by all of the nine judges. It is reported as Kansas vs. Colorado, 206 U. S., 46. No longer ago than November this case was cited with full approval, on this very point, by the Supreme Court.

There the two states differed as to their use of the waters of the Arkansas River; and because of that river's relation to certain works undertaken by the federal government, the United States, by its attorney-general, sought to intervene. The Supreme Court refused to permit intervention upon the distinct ground that, the river being not navigable and the works undertaken by the United States not being within the authority of any power granted in the Constitution, they had no right to interfere with the river or to intervene so as to be heard concerning the disposition made of its waters by the authority of the two states.

The second underlying assumption is that the federal government, or to be specific, the Congress, may do anything which it decides to be for "the general welfare." That is not the law. The United States may carry out to any extent which in their discretion is desirable any of the powers granted them by the Constitution, and no others. It is not strange that in the midst of popular clamor at the present time, most often raised by interested parties, such a view should be assumed to be correct by persons unfamiliar with the course of decisions in the Supreme Court; this is particularly true when even a United States judge in a very recent case has stated that "Congress is given the power to provide for the welfare of the United States." The words upon which this interpretation is based are as follows

"The Congress shall have power:

"To lay and collect taxes to provide for the common defence and general welfare."

It would be too didactic and would take too much of your space to cite decisions and expound the full meaning of the clause; but the "general wefare" clause, so-called, is a *restriction* upon the power of taxation, and is not a power in itself. The decisions and the text-books upon constitutional law all uniformly so explain it.

Indeed, this must be so, or else the Constitution becomes mere waste paper, so far as any definition of constitutional powers is concerned, for if the Congress may do anything which it conceives to be for the general welfare then there is no need for any further consideration of the Constitution.

The third matter of criticism in your editorial is the sentence:

". . . Yet in cases of possible or probable conflict between local rights it is the general tendency to harmonize the difference through Congressional action, for which there is ample though somewhat ill-defined authority in the Constitution." . . .

The Constitution is not to be quite so liberally interpreted. The tenth amendment specifically excludes powers which are "ill-defined"; if they are not plainly and clearly granted, they do not exist.

The truth is that the states have dumped upon the federal government functions which do not belong to it and which they themselves should perform at the expense of their own citizens; yet, that self-government has been mismanaged is not a reason for taking it away. The distribution of general powers to the United States, local powers to the states and the reservation of powers, not granted to either, in the people can only be changed by amending the Constitution. It is on the whole the best that the wit of man has yet devised.

There are so many plainly granted powers which the Congress has not seen fit to exercise that it seems a pity for it to go out of its way to strain after more not granted. For example, it might, as it has been given power to do, "fix the standard of weights and measures" which we have all so long and so earnestly urged upon it, and might punish the scandalous misbehavior such as is now attracting attention in New York of using false weights and false measures; and it might provide for an adequate inspection all through the country so that there might not be six "bushels," four "gallons," ten "casks" and several "barrels" of different sizes in different parts of the country—even if it did not go so far as we all wish it would, and adopt the metric system *in toto*.

New York. T. J. Johnston.

[We cannot, of course, venture into argument with our accomplished legal correspondent on the points of law involved in the interpretation of the Constitution of the United States. We may, however, be permitted to disagree with him on the point that there can be no controversy on matters "which have been definitely closed to all discussion by decisions of the Supreme Court of the United States." Decisions wise in their day may, in the course of social evolution and industrial development, become anachronistic; and a later generation will not be withheld from discussing the application of such decisions to changed conditions. Not being divinely inspired the founders of the Constitution could not in 1787—many years before the discoveries of Volta and Faraday upon which a great branch of modern industry is founded—provide for the future when the energy of water [illegible] means of electricity even hundreds of miles from the point of hydraulic development, thereby giving to such water-powers an importance, socially and industrially, undreamed of a century ago. Moreover, the existence of a state line cannot, in accordance with modern ideas of right and wrong, be held as a justification for the destruction of a property right having no relation to state boundaries, as in the case cited; and we do not believe that the spirit of the Constitution involves the commission of a wrong in order to uphold a doctrine of strict interpretation regardless of [illegible]

Analytical Investigation of an Impedance Paradox.

To the Editor of Electrical World:

Sir:—In an article in the Aug. 11, 1910, issue of the *Electrical World,* on page 329, entitled "An Impedance Paradox," is given an interesting graphical analysis of an unexpected increase in impedance obtained, in a circuit composed of a resistance and reactance in series, by shunting a second resistance across the reactance.

The following is an analytical investigation of the same circuit which leads to a more general conclusion:

Let R be a fixed resistance, x a fixed reactance, r a variable resistance, g the conductance and b the susceptance of circuit BC.

Then $g = \frac{1}{r}$ and $b = \frac{1}{x}$ as r and x are assumed to be ideally pure resistance and reactance respectively.

The admittance, Y, of circuit BC is

$$Y_{BC} = \sqrt{\frac{1}{r^2} + \frac{1}{x^2}}$$

The resistance of circuit BC is

$$r_{BC} = \frac{g}{Y^2} = \frac{rx^2}{r^2 + x^2}$$

The reactance of circuit BC is

$$x_{BC} = \frac{b}{Y^2} = \frac{r^2x}{r^2 + x^2}$$

The total resistance of circuit AC is

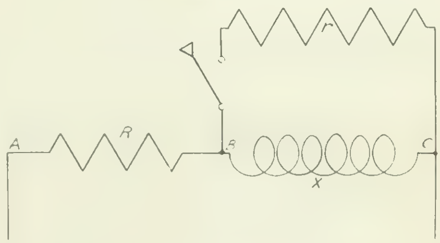
$$r_{AC} = R + r_{BC} = R + \frac{rx^2}{r^2 + x^2}$$

The total reactance of circuit AC is

$$x_{AC} = x_{BC}$$

Therefore the total impedance of circuit AC is

$$Z = \sqrt{\left(R + \frac{rx^2}{r^2 + x^2}\right)^2 + \left(\frac{r^2x}{r^2 + x^2}\right)^2} \qquad (1)$$



Impedance Circuit.

which is the equation of the curve shown in Fig. 4 of the original article with z and r as the variables.

Differentiating and simplifying gives

$$\frac{dZ}{dr} = \frac{x^2(Rx^2 + rx^2 - Rr^2)}{(r^2 + x^2)^2\sqrt{\left(R + \frac{rx^2}{r^2 + x^2}\right)^2 + \left(\frac{r^2x}{r^2 + x^2}\right)^2}}$$

Then, placing the numerator equal to zero,

$$r^2 - \frac{x^2}{R}r - x^2 = 0$$

and

$$r = \frac{x^2}{2R} \pm \sqrt{\frac{x^4}{4R^2} + x^2} \qquad (2)$$

This equation gives the critical value for r, which, when substituted in equation (1), gives to Z a maximum value or a minimum value. (The value $r = \infty$ will also make $\frac{dZ}{dr} = 0$, but this value merely indicates that the asymptote of the curve is parallel to the r axis.)

As the original function and the second derivative are quite cumbersome, an examination is made below of the first deriva-

tive to determine the nature of the critical point in the curve. As only the signs are of interest, the denominator of the first derivative, which is positive for any value of r, may be disregarded.

Then $f(r) = $ [illegible] $Rx^2 + x^3$ [illegible] Rr [illegible]

Let a be a very small quantity which may be taken as small as may be desired, but not equal to zero.

Substituting in (3) values of r: r_1, a little less than the critical value; r_2, equal to the critical value; r_3, a little greater than the critical value, gives, after simplifying,

$$f(r)_{r_1} = a[\sqrt{x^4 + 4x^2R^2} - aR]$$

which is a positive value, because the expression under the radical is greater than $2xR$ and a is as small as desired; that is, it is less than $2x$.

$$f(r)_{r_2} = 0$$

and

$$f(r)_{r_3} = -a[\sqrt{x^4 + 4x^2R^2} + aR]$$

a negative value.

Therefore, the value of Z is a maximum when (r) equals the value given in equation (2), for the tangent has been shown to change from positive to negative, and to pass through zero.

One is permitted to conclude, therefore, that, by making r equal to the value given by equation (2), the phenomenon of increase in impedance upon shunting a resistance across the reactance can be obtained for any finite value of R or x, no matter how small or how large.

Numerical Calculation.—The value for the maximum impedance is here calculated for the same values as given in the original article.

$R = 100$ ohms, $x = 133.8$ ohms.

At Z_{max}

$$r = \frac{\frac{17900}{100} + \sqrt{\frac{3204 \times 10^4}{10^2} + 71600}}{2} = 250.5 \text{ ohms}$$

$$Z_{max} = \sqrt{\left(100 + \frac{250.5 \times 17900}{62700 - 17900}\right)^2 + \frac{62700 \times 133.8}{62700 + 17900}}$$
$$= 187.4 \text{ ohms,}$$

which is the same as the maximum point on the curve in the former article. The values here recorded were calculated by means of a slide rule and are therefore only approximately correct.

Jersey City, N. J. H. F. HAGEN.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Control of Three-Phase Motors.—F. J. MOFFETT AND N. B. ROSHER.—The authors first discuss time-lag attachments to circuit breakers for use in connection with three-phase motors and then describe a new slow-motion device for starters as shown in Fig. 1. Each operation of the starting-switch handle

Fig. 1—Slow Motion for Starter.

rocks a lever, and thus causes the plunger of a dash-pot to be depressed. Until the plunger has been forced back to its normal position by means of a spring further operation of the switch handle is impossible, since a stop, or retaining dog, has been moved into its path. The interval between successive movements of the handle can be regulated within wide limits by adjusting the air vent in the plunger or the strength of the spring which acts upon the same. As a general rule starting switches are provided with too large a number of steps or contacts, the necessity for these arising out of the desire to provide for a gradual rising of the voltage applied and the avoidance of current rushes. With the mechanism above described the need for a large number of steps disappears, since a sufficient pause is enforced on each step to enable the motor speed to attain the value corresponding to that step. The advantages of this device are specially evident when it is applied to a two-position switch, such as the star-delta or auto-transformer, where a prolonged pause on the intermediate position is an absolute necessity.—Lond. *Elec. Eng'ing,* Sept. 22.

Transformers.—E. F. COLLINS.—A continuation of his long serial on commercial electric testing. The author continues the discussion of transformer tests, dealing especially with core loss and exciting current, parallel test, normal load heat run, overload heat runs, insulation tests, and high-potential tests.—*Gen. Elec. Review,* October.

Voltage Drop of Transformers.—K. FAYE-HANSEN.—A translation of his recent German article in which the author discusses the testing of transformers for voltage drop and emphasizes the desirability of using Bragstad's method for this purpose. A number of test results are given for transformers having high reactance.—Lond. *Electrician,* Sept. 23.

Lamps and Lighting.

Electricity versus Gas for Street Lighting.—An editorial pointing out that according to the figures of the gas people it would seem that some of the recent contracts made by British gas companies for street lighting show the tendency to carry on street lighting by gas in these cases for the sake of advertisement and at a figure which is unremunerative. While they have a right to do so they have no right to claim, as a result of these contracts, that street lighting by gas is cheaper than by electricity. It is pointed out that in various British cities gas lamps are now being replaced by electric lamps.—Lond. *Electrician,* Sept. 23.

Metallic-Filament Lamps in English Practice.—A review, based on statements of various British central-station managers, of the use of metallic-filament lamps for lighting streets, railway yards, etc. Comparisons are made with gas. For instance, at Harrowgate the cost of gas from the gas company to the city, including everything except labor, cleaning and lighting, is $4.25 per lamp per year, and the lights are extinguished about 12:30 a. m. The electricity department has, nevertheless, received instructions to change 500 gas lamps to electricity. They will be able to provide a better light, furnished by means of metallic-filament lamps, at an actual cost to the city of $2.80, including lamp renewals and everything except cleaning and lighting, or a reduction on the former price of one-third. There will be some saving also in the cleaning, as electric light does not coat the glass with a smoky film as does gas; furthermore, in most of the lanterns there will be no glazing, excepting in the nature of a reflector over the lamp

itself. The city is paying to the electricity department $4.25 per year, the same price as to the gas company excepting that the $4.25 per post for electric lighting includes lamp renewals, and the difference in the actual cost and the amount received will pay for the cost of the conversion in a very few years. The 500 new electric lamps referred to are to be located in positions where there are already low-pressure electric mains. The experience of Christie in Brighton with the leading makes of these lamps is that they are steadily improving, both as regards efficiency and life, and in many cases individual lamps are actually burning for upward of 5000 hours without any apparent diminution in the candle-power. The average life of the best makes of these lamps, however, is, he considers, not as good as it might be, and he thinks the low consumption of a little over 1 watt per candle might be sacrificed to a small extent with advantage both to the lamp-making industry and to the user if a longer life could be assured. Christie considers few users would object to 1.5 watts per candle as a standard, and the extra 0.3 watt or 0.4 watt would give the makers a wider margin to work on, which, in time, should tend to reduce the cost of manufacture. A. Dimmack gives data on the life of metallic-filament lamps in Swindon. Since March, 1908, the following is a record of lamps that have failed: Between 0 hour and 110 hours, 27 lamps; between 100 hours and 200 hours, 23 lamps; between 200 hours and 500 hours, 61 lamps; between 500 hours and 1000 hours, 59 lamps; betweer 1000 hours and 2000 hours, 76 lamps; between 2000 hours and 3000 hours, 62 lamps; between 3000 hours and 5000 hours, 45 lamps. Many lamps have burnt over 5000 hours and are still burning. The average life of the lamps has been 1534 hours. Notes are added on the use of metallic-filament lamps for lighting railway stations, railway yards, etc.—Lond. *Electrician*, Sept. 23.

Metallic-Filament Lamps.—Some notes on the production of metallic-filament lamps by British manufacturers. Osram lamps can now be had in all sizes from 0.5 cp to 1000 cp. The 400-cp, 600-cp and 1000-cp lamps have taken the place of small arc lamps in many instances. Tantalum lamps are now being made in all candle-powers from 5 to 50 and for all voltages between 20 and 250. They are made in several different types, including candle, tubular and focus lamps. The "onewatt" tantalum lamp, besides being specially designed for use with batteries—that is, for burning on voltages from 4 volts to 8 volts and in candle-powers from 3 to 6, is made in moderate sizes of 10 cp and 16 cp, and in the large size of 100 cp. Some notes are added on the drawn-tungsten-filament lamp of the British Thomson-Houston Company, and several other tungsten lamps.—Lond. *Electrician*, Sept. 23.

Long-Burning Flame-Arc Lamp.—An illustrated description of a new flame-arc lamp giving from 80 to 100 burning hours with one pair of electrodes, placed on the market by a British company. The principle adopted in this lamp to secure long-burning periods is the total enclosure of the arc. The difficulty, however, that has to be overcome is satisfactorily to dispose of the fumes resulting from the arc, which, owing to enclosure of the latter, cannot be disposed of by ordinary methods of ventilation. This is effected by novel arrangement of the globe and burning chamber. The globe is divided into two parts as shown in Fig. 2. The upper portion is clear, to allow of the light being distributed. The lower portion is opaque, as clear glass would serve no useful purpose. The appearance is also better. Naturally this lower portion is cooler than the upper, which is heated by the arc. Consequently, all the heavy ash sinks to the bottom. Above the arc itself a heavy deposition chamber is arranged, which, owing to its large radiation surface, causes all the lighter gases to condense inside it. A constant circulation is thus set up, and the ash or deposit is so completely got rid of that the loss of light through the clear portion after 100 hours of burning is insignificant. The mechanism in the direct-current lamp is of the differential pattern, while in the alternating-current lamp it is of the motor type. The arc e.m.f. is about 45, so that two lamps can be used on 110 volts, four on 220 [illegible] recommended that a series of over two lamps should be fitted with automatic safety devices. The curve in Fig. 3 shows how the light is distributed. The maximum is at an angle of 20 deg. below the horizontal, so that the lamps need not be hung so high as an ordinary flame arc with converging electrodes. Thus the cost of poles and installation is reduced. The power-factor of the alternating-current lamp is 0.86, and the mean hemispherical candle-power in Hefner candles is 800

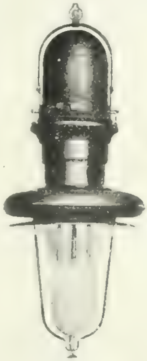


Fig. 2—External View of Flame Lamp.

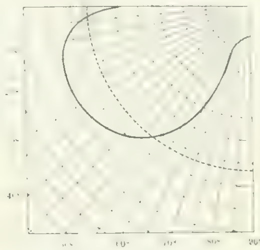


Fig. 3—Distribution of Light from Flame Lamp.

for the 8-amp lamp and 1500 for the 12-amp lamp. The practical specific power consumption is of the order of 0.33 watt to 0.36 watt per candle.—Supplement to Lond. *Electrician*, Sept. 23.

Long-Burning Flame-Arc Lamp.—W. Hechler.—In order to construct a flame-arc lamp with long-burning hours the principle of the enclosed arc may be employed, but it is then necessary to provide means for removing the chemical vapors and condense them in a separate condensing space so that they will not condense on the globe and diminish the candle-power. The gradual development of lamps based on this principle is shown in various diagrams and finally a description is given of a new long-burning arc lamp of the Allgem. Elek. Ges. which seems to be identical with the British lamp described in the preceding abstract. *Elek. Zeit.*, Sept. 22.

Flame-Arc Lamp.—A note on a recent British patent (19,387, Sept. 15, 1910) of S. C. Mount and Beck Flame Lamp, Ltd., describing mechanism for multiple-electrode lamps, to move the swinging electrode of the second pair of electrodes nearer its fellow electrode than is the case with the other pair when the first pair is consumed, so that the arc is struck between the fresh pair. For several pairs of electrodes the mechanism is arranged so that only one pair is brought together each time the striking mechanism is operated.—Lond. *Elec. Eng'ing*, Sept. 22.

Electric Arc in an Atmosphere of Low Pressure.—H. Buisson and C. Fabry.—Electric arcs between electrodes of a metal which is difficult to volatilize, like iron, are in general unstable when the pressure of the atmosphere is reduced. However, they can be made stable by covering the surface of the negative electrode with a layer of oxide. For this purpose the arc may be started in air and the vacuum may be produced later. The same observation was made with nickel and copper electrodes. The relation between current, distance of electrodes, atmospheric pressure, and potential difference was studied for gradually decreasing atmospheric pressure.—*L'Industrie Elec.*, Sept. 10.

Mercury-Vapor Lamp.—J. Pole.—An illustrated description of two new automatic forms of Cooper Hewitt mercury-vapor lamps receiving energy from alternating-current circuits by means of mercury-vapor rectifiers.—*Elek. Zeit.*, Sept. 15.

International Candle-Power.—In a report of the German Reichsanstalt it is stated that the endeavor of the United States, Great Britain and France to introduce a new "international

[illegible] Germany, since the definition of the new unit is not free from objections. The Germans, therefore, protest against the name "international candle." However, they acknowledge that an accurately defined international unit of candle-power is the goal to strive at.—*Elek. Zeit.*, Sept. 22.

Generation, Transmission and Distribution.

British Central Stations.—A list of 119 British central stations giving details of the history, equipment, rates, etc.—Supplement to Lond. *Electrician*, Sept. 23.

Traction.

Single-Phase Traction in Switzerland.—A note on the new single-phase railway connecting Orsières with the Swiss State Railway system at Martigny (Canton Valais) which was opened to public service last month. The railway has been constructed for the Cie. du Chemin de fer Martigny-Orsières, in connection with the British Aluminum Company's water-power works now under construction at Orsières, but may become of considerable national importance, as it may form the first section of a suggested new line connecting Switzerland with Italy. The length of the line is about 20 km (12 miles). The trolley-wire supplies single-phase energy to trains at 8000 volts, 15 cycles, and consists of an 8-mm wire with simple suspension, except in the stations, where catenary suspension is employed. Each passenger motor-coach is fitted with four 80-hp, single-phase motors of the Brown-Boveri type, in which regulation is effected by altering the position of the brushes on the commutator. The weight of a complete motor-coach is 45 tons.—Lond. *Elec. Eng'ing*, Sept. 22.

Car Meters.—Abstracts of two papers read before the Tramway and Light Railway Congress in Brussels on checking the energy consumption of tramways by means of meters on the cars. One of these, by Battes, general manager of the Frankfort municipal tramways, contains a résumé of the opinions expressed at previous congresses, when Otto, of the Berlin street railways, and the author himself both spoke from experience of the advantages to be obtained and favored the use of simple hour meters as cheaper than watt-hour meters and sufficiently accurate. M. Bouton, of the East Paris Tramways, however, advised the use of amp-hour meters. A considerable amount of information has now been obtained, and a digest of the experience at different towns in Continental Europe is given in the report. Of some thirty-four cases where particulars are given the largest total saving is that of the Berlin company, all of whose cars (1491) have been fitted with hour meters at a cost of $10 each, and a total saving due to their use of $106,720 per annum, or 7.8 per cent, is reported. At Cologne, where all the cars are also equipped with hour meters, a saving of 8.6 per cent is given, and at Dresden the figure is as high as 10.95 per cent. The highest figure given is for Magdeburg, where only 42 out of 130 have meters, but a saving of 19 per cent is recorded. All the cars are equipped with meters also at several other towns, and savings varying from 1.25 per cent to 15 per cent are reported where figures are available. Other companies are still experimenting, and only three cases are mentioned where car meters have been discontinued. In eleven cases out of the thirty-four of which particulars are given, hour meters are used, in three cases amp-hour meters are preferred, while the remainder use watt-hour meters. In some cases it is reported that the use of car meters made is possible to provide accelerated service, and the Cologne tramways declare that the use of meters has led to a decrease in the number of accidents. The other report is by Bouton, general manager of the East Paris Tramways Company, who compares the advantages of watt-hour, amp-hour and hour meters. He considers most of the watt-hour meters too delicate and liable to become inaccurate, and prefers a simple form of amp-hour meter. He does not think that the hour meter gives sufficient information. Various methods of rewarding drivers whose meters show economy are suggested.—Lond. *Elec. Eng'ing*, Sept. 22.

Installations, Systems and Appliances.

[illegible] the Metropolitan Electric Supply Company, of London, has decided to raise the price of electrical energy, supplied on the flat rate, from 11 cents to 12 cents, on account of the reduced specific power consumption by metallic-filament lamps. The company offers, however, as an alternative a "telephone tariff" according to which in addition to a fixed annual charge payable in quarterly instalments, a predetermined number of kw-hours, depending on the installation, is to be charged at 4 cents per unit, and all additional kw-hours will then be charged at 2 cents.—Lond. *Electrician*, Sept. 23.

Electricity Supply in Paris.—A note on two new generating stations which are to be constructed, one in the north and the other in the south of Paris, in connection with the new energy supply scheme which was formulated some time ago. Each generator set will consist of a steam turbine, with surface condenser, directly coupled to a two-phase alternator supplying energy at 12,300 volts, and a frequency of 41.66. The output of these sets will be 10,000 kw. There will also be two continuous-current generators mounted on the same shaft as the alternator, the purpose of these generators being to supply energy to the condenser motors and for excitation purposes respectively. Each turbo-generator will be capable of taking a load of 12,500 kw for two hours after having run fully loaded, and a load of 15,000 kw for half an hour directly after the smaller overload.—Lond. *Electrician*, Sept. 23.

Dangerous Rise of Voltage.—G. GILES AND M. WOHLLEBEN.—The first part of a paper in which the authors reply at great length to the recent criticisms of Schrottke. They maintain the position that if discharges of atmospheric electricity are high-frequency discharges protective apparatus with air-gaps are useless. Several results from practice are given where horn lightning arresters had proven unsatisfactory and had been replaced by condensers with good success. The authors then take up the discussion of resonance phenomena. The paper is to be concluded.—*Elek. Zeit.*, Sept. 22.

Wires, Wiring and Conduits.

Mains Extensions in Great Britain.—In the counties of Northumberland and Durham some important extensions of the network of two power companies have recently been carried out. Upon the route from Holywell to Seghill a 12,000-volt feeder has recently been erected in order to duplicate the existing supply. The normal span between the poles on this feeder is 80 yd., each pole carrying three conductors, each of 0.05 sq. in., the conductors being of copper. For roads and railways catenary guarding has been adopted, while lace guarding is used for footpaths. The feeders commence by a junction with the underground cable near the Holywell Colliery, and a three-cored lead-covered pilot cable is also carried along the route. A pole line has also been erected from the Rising Sun pit to Backworth in the County of Northumberland, in connection with the same mains system. A 12,000-volt feeder will also be run from the Newsham switchhouse to Seaton Delaval, a distance of 3.5 miles. The line is of the same dimensions as the one mentioned above, and also carries lead-covered pilot and telephone cables slung from the catenaries. Another important extension which is in prospect and has just been placed on order is a new 20,000-volt pole line from Carville power station to Burradon. This line is of three-phase supply with 0.1 sq. in. copper conductors, a pole line joining the underground cable at a point just outside Wallsend. The purpose of this pole line is to duplicate the existing supply.—Lond. *Electrician*, Sept. 23.

Electrophysics and Magnetism.

Ionization by Alpha Rays.—F. F. WHITLOCK.—An account of an experimental investigation the results of which are summed up as follows: For a gas ionized by alpha rays the ions are formed in columns along the trajectory of the alpha particle. These columns are not broken up by a field applied along the axes of the columns, and the positive and negative ions have to pass each other in going to the plates of the ionization chamber, while a field at right angles to the columns produces a separation of the positive and negative ions by breaking each column up into two. With the parallel field the ionization is proportional to the intensity of the source, even when far from

saturation. The equation obtained by assuming columnar ionization with the ions uniformly distributed within the columns does not represent the curve experimentally obtained with the parallel field. The experimental curve lies below the calculated curve, except for small potential gradients, when the ordinary Bragg chamber is used. The lack of agreement between the experimental and calculated results is not due to an inclination of some of the columns in the ionization chamber. The lack of saturation obtained at different parts of the range, when the field is applied parallel to the path of the ionizing alpha particle, is not completely accounted for by initial recombination; neither does columnar ionization completely explain the results obtained with the perpendicular field. The saturation value of the current is obtained more easily as the pressure of the gas is diminished. This would be expected in either hypothesis. However, the results obtained appear to indicate that the lack of saturation is not all due to the effect of general recombination of the ions within the columns. Undoubtedly a considerable part of the anomalous behavior of the ions produced by alpha rays (in respect to saturation, etc.) is due to the columnar arrangement of the ions; it is possible that this would be sufficient to account for all the facts if the distribution of the ions within the columns were known. On the other hand, it appears probable that certain outstanding discrepancies may be due to initial recombination.—*Amer. Jour. of Science*, October.

A Magnetic Field Moving through Space.—W. F. G. Swann.—A paper read before the British Association on the magnetic field produced by a charged condenser moving through space, in which the author raised the old controversy of the motion of ether through space. He explained that as it is impossible to detect magnetic flux with the aid of a compass he tried detection by means of a moving coil. He showed that in the case of a closed circuit (a coil) at constant potential moving through space in company with a system of charged bodies the total magnetic flux through the circuit is zero. When, however, the space within the coil is partially filled with a dielectric then a magnetic flux through the coil should exist, provided the specific inductive capacity could be looked upon as an absolutely continuous quantity throughout the dielectric; but if the dielectric action is to be explained entirely by the presence of electric charges or doublets no resultant flux should be observed even in this case. His apparatus gave practically no flux, and he hence regarded his experiments as supporting the doublet theory of dielectric action. In his experiments two coils, wound in opposite directions, were mounted on the same horizontal axle and rotated between three parallel condenser plates, such that coil 1 was between plates 1 and 2, and coil 2 between plates 2 and 3; the opposite winding would eliminate the earth's field. The coils were partly embedded in paraffine; condenser plate 2 was charged, and the other two were earthed; after discharging the condenser the apparatus was turned through 180 deg. In the discussion which followed Sir J. J. Thomson considered the paper very important, but did not see how, in the absence of any relative motion between condenser and dielectric, any effect should be expected. Prof. A. W. Conway thought that an effect might be anticipated, and not completely be masked, because the electrons were supposed to move freely in a conductor, but not in a dielectric; if Sir J. J. Thomson were of the opposite opinion he seemed to believe in the principle of relativity.—Lond. *Eng'ing*, Sept. 23.

Units, Measurements and Instruments.

Resistance Standards.—In the calorimetric researches of the German Reichsanstalt the problem came up to devise an easily and exactly reproducible empirical temperature scale. For this purpose mercury-resistance thermometers were devised as shown in Fig. 4. The mercury is enclosed in W-formed capillary quartz tubes *a* the ends of which communicate with additional quartz tubes *b* which contain the electrodes *c* consisting of pairs of platinum wires in glass tubes. The whole apparatus is enclosed air-tight. The two wires on each side are used as ammeter and voltmeter connections. Two such mercury-resistance thermometers made of quartz agree together at any temperature between 0 deg. C. and 100 deg. C. to even a few thousands of a degree. Such a result cannot be obtained with mercury elongation thermometers. These mercury resistors seem to have a very constant resistance and two of them may be used as secondary ohm standards.—*Elek. Zeit.*, Sept. 22.

Fig. 4—Mercury Resistance Thermometer.

Weston Cell.—In continued experiments in the Reichsanstalt it was found that mercurous sulphate may give cells of normal e.m.f. when used right after being prepared, but may change in its electrometer behavior if stored for several months in a dry place. It was further found that storing of the fresh mercurous sulphate in vacuo or below a cadium sulphate solution prevented these changes. It is believed that now the last trouble in the use of mercurous sulphate has been overcome.—*Elek. Zeit.*, Sept. 22.

Photographic Recording Meter.—L. M. Aspinwall.—In making tests on electric locomotives and cars it is necessary to have a complete set of current, voltage, power and speed readings in order to determine accurately the performance of the equipments. The necessary readings are usually obtained by having a number of observers on the locomotive to read portable instruments simultaneously at equal predetermined time intervals. To obviate the necessity of having a number of observers the use of the kinetoscope type of camera which would photograph a number of indicating instruments at the rate of one or more exposures per second has been suggested at various times. The author has developed another method which is based on the following principle: If edgewise indicating instruments—that is, instruments with the pointers moving in a vertical plane—are used with a black scale and white divisions and pointer, they can be photographed on a film moving at a constant rate of speed at right angles to the meter, and the white divisions will trace horizontal co-ordinates and the white pointer will trace a continuous curve, thus giving a finished record at one operation. Some details of the camera used are given with reproductions of curves obtained by this method.—*Elec. Journal*, October.

Vacuum Bolometer.—In an investigation of the radiation loss made at the Reichsanstalt use was made of a vacuum bolometer in which the intensity of radiation was measured not by galvanometer deflections, but by a zero method as shown in Fig. 5.

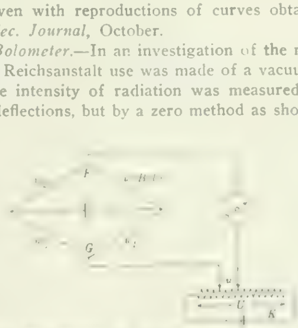


Fig. 5—Diagram of Bolometer Arrangement.

The radiation falls on the bolometer resistance *w*. The voltage thereby produced between *F* and *G* is compensated by regulation of the resistance *U*. Nothing is required but the constancy of the source of current in *K*.—*Elek. Zeit.*, Sept. 22.

Registration of Thunderstorms.—P. Jegou.—An account of experiments in which the author used an electrolytic wave-detector in connection with an ordinary galvanometer and photographic recorder for registering atmospheric discharges and thunderstorms. When a telephone is placed in series with the electrolytic detector and galvanometer it is possible to listen with the ear to the discharges or to the thunderstorm without

any effect on the photographic record.—*La Lumière* [illegible], Sept. 24.

Reichsanstalt.—An abstract of the annual report on the work done in the German Reichsanstalt in 1909. Some of the chief results obtained are given in other abstracts in the Digest.—*Elek. Zeit.,* Sept. 22.

Telegraphy, Telephony and Signals.

Submarine Telephone Cable.—A note on a recent British patent (26,250, Sept. 15, 1910) of Siemens Brothers & Company, Ltd., and W. Dieselhorst. The Pupin or inductance coils of submarine telephone cables are wound with more or less hydroscopic material, and to prevent moisture being gradually absorbed by this the coils are provided with a light sheathing of impermeable material, such as tin or leadfoil. This sheath may be placed between the coil itself and the gutta-percha protecting tube.—Lond. *Elec. Eng'ing,* Sept. 22.

Wireless Telegraphy.—W. H. ECCLES.—The conclusion of his illustrated article on recent patents in wireless telegraphy. A combination of wireless telegraphy and the method of submarine bells due to J. Schiessler is mentioned. Its purpose is to obtain a measurement of the distance of a ship or other station emitting both kinds of signals simultaneously. The principle employed is the simple one of measuring at the receiving station the time interval between the arrival of the Hertzian wave and of the sound wave. The suggested receiving apparatus comprises five circuits—a circuit containing a submerged microphone, a telephone relay circuit, the circuit of an electrical chronometer, a circuit comprising an electromagnet that sets a tuning fork in vibration, and the telephone circuit of a wireless receiving installation. Several new designs of antennæ are also noticed and notes on a few patents on wireless telephony are added.—Lond. *Electrician,* Sept. 9.

Miscellaneous.

Plastic Insulating Materials.—A. HAKANSSON.—The first part of a paper on plastic insulating materials. In many cases of failures the trouble is not with the material, but with an unsuitable design of the form of the insulator. This fact is illustrated by various examples from practice. The insulation resistance, which is the property of greatest importance, does not remain constant, but changes due to aging. Illumination seems to have a considerable effect on the insulating resistance. With traction insulators, which had been in use for eight or ten years those parts which were enclosed in cast-iron fittings had not been changed at all with respect to insulation resistances and mechanical strength, while both had considerably decreased on those parts which had been subject to light. Moreover, insulators on which dust is liable to be deposited quickly lose their insulation resistance. With high voltages aging is far more noticeable than with lower voltages. The formation of ozone seems to have some effect in this respect. To maintain the insulation resistance constant it is necessary to clean and wash the insulators at intervals in order to remove any dust, etc. The mechanical strength of insulators depends as much on their form as does the insulation resistance. The insulation resistance depends to a large extent on the absorption of moisture. Several curves are given showing the increase in time of the weight of hygroscopic insulators due to absorption of moisture. The paper is to be concluded.—*Elek. Zeit.,* Sept. 22.

Insulating Material.—A note on a recent British patent (23,351, Sept. 15, 1910) of the British Thomson-Houston Company (General Electric Company of this country). Talc or clay is mixed with a compound of titanium and a silicate binder, and the product is compressed and fired at a temperature of 900 deg. C. to 1500 deg. C. The presence of the titanium has been found to increase the strength and refractory qualities of the material.—Lond. *Elec. Eng'ing,* Sept. 22.

Röntgen Society.—An account of the proceedings of the sixth congress of the German Röntgen Society held in Berlin. Brief abstracts are given of the different papers presented, all of which are of medical interest.—*Elek. Zeit.,* Sept. 22.

Education Address.—The presidential address delivered to the Educational Science Section of the British Association dealt especially with the radical difference which should exist between school and university teaching. The business of direct mental training should be finished at school and at the university material should be given the trained mind upon which to do responsible work in the spirit of inquiry. Preparatory exercises belong to school life and should be abandoned at the university. All this seems so obvious that it might appear to be hardly worth saying were it not that the methods which actually prevail are so far removed from this ideal. At school no subject should be taught to a class as though it were intended to be their life work. On the other hand at the university each subject should be studied as though it really were the life work both of teacher and student. In replying to the question what sort of school education affords the best preparatory training for the university, the author thinks that a literary education at school is at present a better intellectual training for general university work than a scientific education. —Lond. *Electrician,* Sept. 9.

Avoiding the Spark in Opening a Circuit.—S. RIEFLER AND C. PAULUS.—In electric clocks and similar instruments it is of importance to avoid the spark when the circuit of an electromagnet is opened. The author has investigated by means of an oscillograph the different methods by which the spark may be avoided. With respect to the certainty with which the spark may be avoided, condensers and ohmic resistances in parallel to the switch are equivalent, but with respect to lower cost of operation the condenser is superior to the ohmic resistance. Moreover, the condenser may always be so designed that the excess voltage on opening the circuit remains within permissible limits. Polarization cells (small storage batteries of low capacity) combine at least for low voltages the advantages of the condenser and of the ohmic resistance.—*Elek. Zeit.,* Aug. 25.

Reinforced Concrete for Chimney Construction.—P. S SHEARDOWN.—A paper read before the Dublin congress of the Tramways and Light Railways Association giving notes on the reinforced-concrete lining of the steel chimney shafts at Ringsend generating station of the Dublin United Tramways Company, and on reinforced concrete for chimney construction.—Lond. *Electrician,* Sept. 16.

Logarithmic Paper.—G. MEYER.—An article illustrated by diagrams on the advantages of logarithmic paper for engineering purposes, for instance, for the representation of the work of pumping, etc.—*Elek. Anz.,* Sept. 8.

BOOK REVIEWS

FUNKTIONENTAFELN MIT FORMELN UND KURVEN. By Dr. E Jahnke and Fritz Emde. Leipzig: B. G. Teubner. 176 pages, 53 illus. Price, 6 marks.

There are many books, both of pure and of applied mathematics, that contain treatises on some particular function or functions, such as elliptic functions, Bessel's functions, or the like, but this treatise sets itself the useful task of collecting into a single volume all of the principal mathematical functions for comparison and reference It is true that no very complete treatment can be given to any single function when so many have to be considered, but at least the student is given a bowing acquaintance with all of them so that after going through the list he is able to recognize and name a function at sight. The genealogy and family relations of the functions are also explained.

Among the functions discussed are the following: Complex quantities, hyperbolic functions, potential functions, Bessel functions, Fresnel integrals, gamma functions, Gauss' error integral, Pearson functions, elliptic functions, spherical harmonics, and numerous subtypes.

A few decades ago all of the above functions, so far as they were known, were the exclusive property of pure mathematicians and philosophers. Now most of these functions are

harnessed to engineering formulas for the everyday work of practical men. One of the authors of the book is an engineer. To the student of applied mathematics the volume will be a valuable reference book. It is hardly to be considered as a text-book. Numerous references to text-books appear, however, in the text.

DIE MECHANISCHE BEANSPRUCHUNG RASCH LAUFENDER MAGNETRÄDER. By Ch. A. Werner. Halle: Wilhelm Knapp. 95 pages, 47 illus. Price, 4.50 marks.

The use of turbines for driving generators has greatly increased the difficulties of mechanical design of the rotating members of the generators, and in this connection Mr. Werner has produced a timely book which should be of use to designers and those engaged in teaching design. The different types of revolving-field structures are first described, then the general laws of stress in curved members and their application to the parts of a revolving-field structure are discussed. Practical examples are worked out and stress diagrams for different types of structure given.

DER KUPFERMARKT UNTER DEM EINFLUSSE DER SYNDIKATE UND TRUSTS. By Rudolf Lenz. Berlin: Velag für Fachliteratur. 156 pages. Price, 3 marks.

Germany being one of the greatest manufacturers of electrical machinery and other products which require copper, and being obliged to import over 80 per cent of the total amount used, feels somewhat concerned over the probable results of a complete monopoly of the copper production of the world. The author traces briefly the history of the copper industry and gives in great detail the development of the Amalgamated Copper Company and the moves of the Standard Oil Company to control the copper market. Germany's position as one of the principal consumers of copper is set forth and the effects of a complete Standard Oil monopoly discussed. However, the author sees great difficulties before the Standard Oil in bringing about such a monopoly. He points out the difference between the copper situation and the oil monopoly, showing that the oil industry is peculiarly well adapted to assist in the maintenance of a monopoly. The book contains a mass of data in tabular form showing the growth and present state of the copper industry in the different countries of the world. The author has developed his subject in a clear-cut and entertaining manner. A mass of digested statistics are presented and there is presented much food for thought.

DAS RADIOTELEGRAPKISCHE PRAKTIKUM AN DER TECHNISCHEN HOCHSCHULE IN DARMSTADT. By H. Rein. Berlin: Julius Springer. 100 pages, 89 illus. Price, 3 marks.

The present is a text book of experimental work in the study of wireless telegraphy and high-frequency phenomena and apparatus. It is intended especially for use in the Technical Institute at Darmstadt, which possesses a very complete wireless equipment. The course covers the following ground: The calibration of condensers for various kinds of service; listing of condensers and dielectrics to determine their properties: calibration of reactors: measurement of inductance of various types of apparatus; testing of oscillating transformers; calibration of wave meters and measurement of wave lengths; tests to determine the damping characteristics of circuits; testing of various types of high-frequency apparatus (generators, transformers, interrupters); calibration and testing of various types of receivers; construction of sending and receiving stations.

The work is based upon the lecture course given by Prof. K. Wirtz at Darmstadt. The course is very complete and is developed in such a way as to equip the student with full knowledge of the principles and characteristics of every type of apparatus used in the generation, transmission, reception and measurement of electromagnetic waves.

ELEKTRO-INGENIEUR KALENDER. 1910. Ninth edition. By Arthur H. Hirsch and Franz Wilking. Berlin: Oscar Coblentz. 308 pages. Price, 2.50 marks.

This book might well have been called a central-station handbook, since practically the whole work is given up to the design of central-station plants, followed by a discussion of the characteristics of various classes of loads. The book is extremely condensed and yet by suitable typography the important reference items are made to stand out in such a way as to render them easy to locate. The complete design of the system, including buildings, selection of equipment, design of distribution system, etc., are covered; the method of treatment somewhat resembling specifications. Tables are used profusely. The part of the book which is devoted to the load characteristics contains much information regarding the power required to drive different machines, such as pumps, machine tools, cranes, etc. Local manufacturers contribute much of the tabular data, giving dimensions and operating data regarding their machines. This data is valuable and handy to have in such form, where the apparatus is used, but here could only be of interest in making comparisons.

LES COMPTEURS ÉLECTRIQUES À COURANTS CONTINUS ET À COURANTS ALTERNATIFS. By L. Barbillion. Paris: Gauthier-Villars. 234 pages 126 illus. Price, 3.25 francs.

The subject of central-station rates is among the most live topics of the day and new types of meters are continually being developed to provide means of practically carrying out the various complicated systems of rates. Mr. Barbillion's book shows that the rate subject is about as unsettled in France as here. The book does not go into the economics of rate making, but simply states the different methods in vogue and discusses the instruments used to measure the service.

The historical side of the subject has been omitted except for the mention of a few of the electrochemical types of meters. Modern Continental types of direct-current and alternating-current watt-hour and amp-hour meters are discussed, as well as a large number of special energy meters, such as the double-rate meter, the excess-demand meter, the prepayment meter, etc. The discussion is confined to a description of the meters, the theory of operation, directions for installing and methods of testing. The work is laid out as a course of instruction given at L'Institut Electrotechnique de Grenoble

New Apparatus and Appliances

A 38-HOUR FLAMING ARC LAMP.

Some time ago there was introduced into the United States a flaming-arc lamp known as the "Main." This lamp, it is claimed, has been thoroughly tested by three years of service before being put on the market in this country. In this lamp the complications are minimized in order to permit the use of two sets of electrodes the consumption of which independently of one another is regulated by a simple mechanical device.

The details of the lamp are shown in Fig. 1, which indicates the exceedingly simple arrangement of sliding bars so placed that they in no way interfere with the cleaning that is periodically necessary. This illustration also shows the first set of electrodes burned down to half length, while the second set is still kept in reserve with their full length. After the first set of electrode holders reach a "stop" the automatic switching over takes place in a simple manner. This result is accomplished by a lever holding the suspension chain drum for the

second pair of electrodes being released by a pin placed just above the tube wherein the chains for the first pair of electrodes move upward. The first set of electrodes retains the

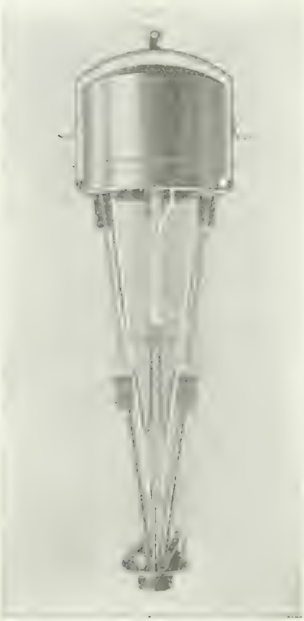


Fig. 1—Flame Arc Lamp.

arc until the rising of the arc's e.m.f. causes the second pair to move downward and form the new arc at the same instant that the first set is extinguished so that the light is never extinguished.

It is said that the gaseous materials cannot form an insulating cover on the reserve electrodes and therefore the proper and

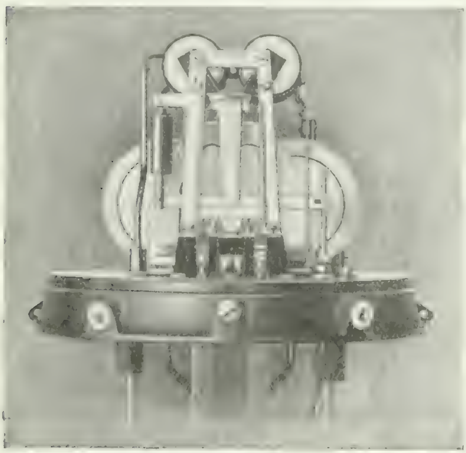


Fig. 2—Magnet System.

prompt striking of the arc is always obtained. The reserve set of electrodes is kept above the "economizer" by a gate arrangement, and is fed into the arc chamber only after the

It is claimed that the regulating clockwork is the simplest ever placed in any flaming-arc lamp. Fig. 2 gives a good view of the single magnet system employed, and shows also the

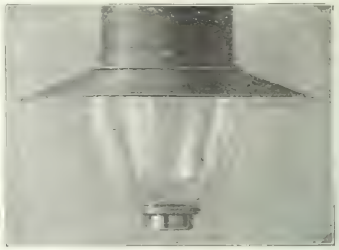


Fig. 3—Globes After 114 Hours' Service in Open Air.

mutual brake and regulating device for both sets of electrodes. The two large gears shown in the illustration are continually catching into one another and each one is connected to the suspension chain drum of each set of electrode holders by a sensitive locking device. The arc-deflecting magnet is arranged in a very simple way; a single device is used for both sets of

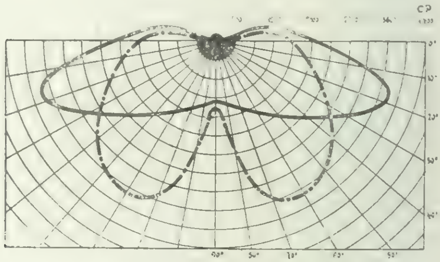


Fig. 4—Candle-Power Distribution.

electrodes, and hence the bottom plate is kept clear for viewing.

In the Main lamp use is made of a well-ventilated outer globe so as to eliminate the otherwise unavoidable fogging of the globes due to gaseous materials which would cause a loss of perhaps 30 per cent of light. The ashtray is so arranged that even in the strongest wind it will not allow the gases to pass downward, because the openings on the opposite side are automatically closed and the gases are forced to escape through the upper chamber of the lamp casing by reason of the free entrance of the outer air current. Ventilation is provided between the outer and inner globes, thereby allowing the swifter

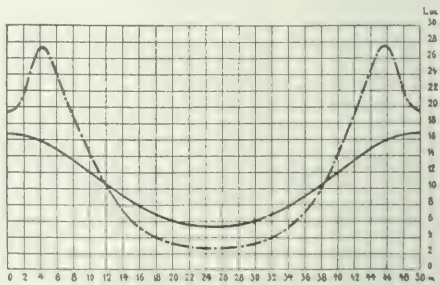


Fig. 5—Street Illumination with Two Lamps.

air currents to pass through the upper chambers without being forced into the inner globe first, and thus a uniform air circulation around the arc is maintained. The passing of air through the globe also assists greatly in the cooling of the lamp.

Fig. 3 shows the position of the inner and outer globes. It shows also the enameled reflector, which has been designed particularly for street lighting where the illumination of large areas is required, and the lamps are supported on tall masts. For local lighting the reflector is not used, a rounder and more opalescent globe being employed.

A prominent feature of the Main lamp resides in the use of an inner prismatic globe, the prisms of which have been accurately designed to throw a large part of the light in a horizontal direction. The candle-power distribution is shown in Fig. 4, while Fig. 5 indicates the illumination, in luxes, obtained in street service from two lamps placed 10 m (33 ft.) above the ground and 50 m (164 ft.) apart; in each illustration the continuous line is for the lamp with prismatic-reflector and the broken line without reflector.

The lamp operates thirty-eight hours on direct-current and thirty-five hours on alternating-current circuits with a power consumption of 550 watts when operated two in series across 110-volt circuits. For series connection at from 240 volts to 450 volts an automatic device is provided for the switching in a compensating resistance in case any of the lamps in the line for some reason should fail to work.

The above described lamp is extensively used in Germany where it has been on the market for about three years. It is used in the railroad yards at Hanau, Posen, Frankfurt, Hagen, Breslau, Hameln, Dortmund, Elberfeld and Cologne; and is employed in municipal lighting at Cassel, Barmen, München, Nürnberg and Stuttgart. The lamp is handled in this country by the Main Electric Company, Marbridge Building, New York.

SINGLE-PHASE TRACTION IN FRANCE.

One of the latest electrifications of steam railroads in France is that which the Midi Railway of France will make in connection with the Montrejeau-Pau portion of the Toulouse-Bayonne line. The portion to be electrified has a length of some 70 miles; the country is very hilly and the line has a number of gradients, one of 3½ per cent being about seven miles in length. This is the largest scale upon which electrification of existing lines has been attempted in France, and later the electrification is to be extended to the entire Toulouse-Bayonne line, a distance of 200 miles.

The Midi Railway Company has ordered from the French Westinghouse Company, whose works are at Havre, the equipments for 30 double bogie electric motor coaches for the passenger service and one complete electric locomotive for the freight service of this line. The locomotive and motor car equipments will be built entirely at the Havre works of the French Westinghouse Company, while the mechanical part of the locomotive will be built by the Italian Westinghouse Works. The design and construction is based on the results obtained in connection with the very successful electrification by the Italian Westinghouse Company of the Giovi tunnel section of the Italian State Railways on the dense traffic line between Genoa and Milan.

Each of the 30 motor coaches, each seating about 50 passengers, will be equipped with four 125-h.p. Westinghouse single-phase motors, 16 2-3 cycles, 285 volts, and with Westinghouse multiple control. These motor coaches will be able to haul trains weighing 100 metric tons—including the motor itself—at a speed of 45 miles per hour on level track. The weight of a motor coach in running order will be about 56 metric tons.

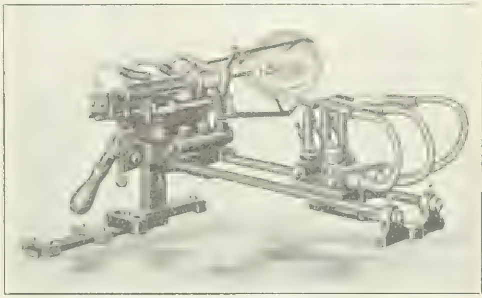
The Midi locomotive will be provided with five axles, three of which will be driven by the motors through jack shafts and connecting rods. The locomotive, which will be equipped with two 600-hp single-phase motors, will weigh 80 metric tons and will be able to haul trains weighing 400 metric tons, inclusive of the locomotive. With a haulage load of 280 metric tons the speed will be 25 miles per hour, and with 100 metric tons about 38 miles per hour.

The current will be supplied to the motors by means of a 12,000-volt overhead catenary line. The pantagraph type of trolley will be used.

SEALING-IN MACHINE FOR METALLIC-FILAMENT LAMPS.

The accompanying illustration shows a sealing-in machine which is being used in the works of the Foster Arc Lamp & Engineering Co., Ltd., London, England.

It is stated that with a few days' practice an intelligent worker can manipulate the machine, and that with it filament breakage is reduced to a minimum. As will be seen, the apparatus consists of a frame holding the bulb with forks adapted to fit any size and shape of bulb, this frame resting on and being rotated by two pulleys. One of these and the end of the shaft of the other is shown in the illustration lying horizontally above and to the right of the inclined handle. These pulleys are in turn revolved by means of an endless band passing over them and connected to a small shaft under the bench. The amount of power taken for driving is practically



Sealing-In Machine.

negligible. An important feature is that the central support of the lamp carrying the filaments is always maintained true and central.

Referring again to the illustration the inclined handle shown moves in the arc of a circle and lowers or raises the lamp in a vertical direction and also operates the gas valve fitted to the machine which automatically lowers the gas on the lamp frame being moved from the range of the gas jets. Immediately behind this handle will be seen a vertical trigger terminating in a rounded knob which is used for moving the lamp in a horizontal direction in and out of the frame, so that the position of the lamp with relation to the gas jets can be adjusted at will. The remaining portion of the apparatus is the blow pipe which is of the six-flame variety converging on practically a central point, the blow pipes being fitted with rubber tubes and glass air jets. The apparatus is stated to have been used with much success in the works mentioned above.

SECTIONALIZED HYDROELECTRIC GENERATING PLANT.

The El Tajo Mining Company, of San Sebastian, State of Jalisco, Mexico, has recently ordered a very unique sectionalized generating plant to supply energy for its new mill. The head of water available is 500 ft., and there is being supplied a special Pelton water-wheel of the two-unit type capable of developing 125 hp at this head when running at 1200 r.p.m. With this water-wheel will be supplied two pairs of jaw-clutch couplings, thus rendering it possible to disconnect either of the two generators which are driven by this wheel. The water-wheel will be sectionalized for mule-back transportation and no piece will weigh over 300 lb. A mechanical governor will [illegible]

The [illegible] driven by this wheel will be of

50-kw rating each. These also will be sectionalized in pieces not weighing over 300 lb. These generators will be three-phase, 60-cycle, 600-volt machines. They will have extended shafts for belt driving the exciters. The generating station also provides for the usual switchboard, lightning arresters and protection apparatus.

The power generated is to be consumed at the mill by various alternating-current motors, one of which belt-drives the stamp mill line shaft at a speed of 150 r.p.m., resulting in 100 drops per minute. The tube-mill line shaft runs at 200 r.p.m., the mill itself making 37 r.p.m. Other motors are scattered about the mill for the usual drives in a mill of this kind.

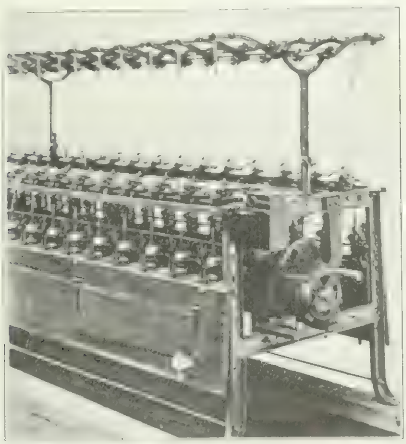
Since the generating plant is located close to the mill, the generator gives 600 volts and the motors employed are wound for 550 volts. The lighting is taken care of by separate transformers.

McKeever Brothers, of Philadelphia, are largely interested in this property. The manager of the plant is Mr. Robert H. Lilly. The equipment is being supplied by Messrs. G. & O. Braniff & Company, of Mexico, who represent the manufacturers of the machinery purchased. The electrical equipment will be supplied by the Westinghouse Electric & Manufacturing Company.

MOTOR-DRIVEN QUILL WINDER.

The forty-spindle quill winder shown in the accompanying illustration is the first motor-driven machine of its type made by the Oswald Lever Company, Philadelphia, Pa. The motor is securely fastened to the machine frame. The driving connection is through single gear reduction to the shaft of the winder. This application marks another step in the adaptation of electric motors to the silk industry and will serve to demonstrate again the inherent advantages of individual drive.

The motor has been specially designed for textile service and is designated as "textile type." It has dust-proof bearings and a dust-proof rotor; that is, no ventilating ducts are provided. In spite of the absence of all rotor ventilation, however, the distribution of material is such that the motor operates exceedingly cool. It is rated at 0.5 hp, 1140 r.p.m. for use on a three-phase, 60-cycle, 220-volt circuit. Being of the squirrel-cage induction type, the motor has no commutator, collector rings or other exposed current-carrying parts. The equipment includes an enclosed "textile-type" switch, which is operated by means of the shipper handle, thus placing its control within easy reach of the operator from any part of the machine. Both the motor and the switch were made by the Westinghouse Electric & Manufacturing Company.



Motor-Driven Quill Winder.

MOTOR-DRIVEN AND MAGNET-OPERATED CIRCUIT BREAKERS.

A good example of an installation using motor-driven circuit-breakers is found in the plant of John Wanamaker, Philadelphia. To develop the energy required for 50,000 or more electric lamps and approximately 1000 hp in motors, there were installed in the Wanamaker power plant ten direct-current generators of a total rating of 3000 kw. The circuit of each generator is controlled by a motor-operated circuit breaker placed directly alongside of the generator, as shown in Fig. 1, and controlled from a bench board located in the mezzanine gallery

The circuit breakers can be opened or closed from a distant point with ease and certainty. The instant handling of a number of generators from one central point occupying the least possible space is thus secured, care being taken that the bench board is so located as to enable the switchboard attendant to face the machinery which he is operating.

Directly behind the bench board and adjacent to it is placed the main distributing board. It receives the current supply of 15,000 amp from a single set of busbars installed under the engine-room floor and connected with the generators by means of their respective motor-operated circuit-breakers.

Such an arrangement has the advantage of keeping in service at practically all times the entire amount of copper connections between the generators and the distributing switchboard. The arrangement was designed by the Walker Electric Company, of Philadelphia, which also installed the apparatus.

The circuit breakers furnished in connection with this class of controlling apparatus are equipped with the "non-closable-on-overload" device which allows the switch member to open independently of the movement of the closing arm. Should an attempt be made to close the circuit breaker upon overload it is free to respond instantly and without restraint from the closing mechanism. Where the operator is sufficiently near the circuit breaker to have it in view the control valve may be operated by hand, but where the instrument is located at some considerable distance from the point of operation the valve may be opened electrically, suitable signals at the point

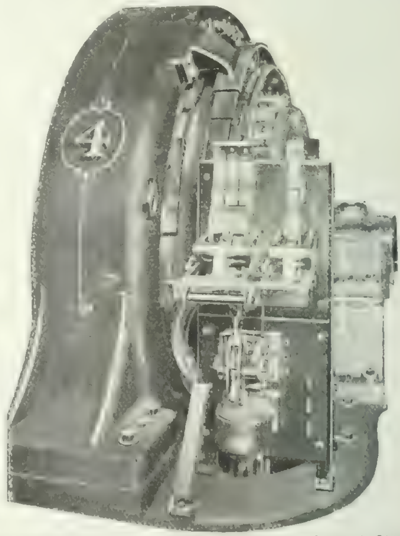


Fig. 1—6000-Amp. Motor-Operated Remote Control Circuit Breaker.

of control indicating the open or closed position of the circuit breaker. The simplicity and ruggedness of this type of apparatus render it particularly suitable for use in mills and foundries and also in those installations in which the apparatus is exposed to atmospheric changes. The above-described circuit-breakers were made by the Cutter Company, Philadelphia.

For circuit breakers of large rating either motor-operated or pneumatically operated equipments are employed, but for the small equipments the Cutter Company has standardized a complete line of solenoid or magnet-operated apparatus. A single-pole equipment of this character is shown in Fig. 2, the circuit breaker in this case being of the plain overload type. The breaker immediately opens when closed on overload or short-circuit; hence, the usual switch in series may be omitted, which provision makes for the utmost simplification in switchboard construction combined with increased flexibility of operation.

Magnet-operated circuit breakers also afford a very effective means of bringing the electrical equipment of a manufacturing plant under the immediate and complete control of the switchboard attendant. The circuit breaker may be located where economy of cable installation dictates. A twin conductor of small size running back to the main switchboard from each circuit breaker provides for signals showing whether the circuit breaker is opened or closed, thereby enabling the switchboard attendant to control it at will. This class of apparatus may also be used with advantage in street railway work for controlling from the central station the connections of outlying feeders as the necessity of traffic requires.

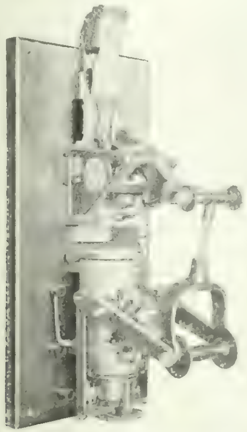


Fig. 2—Magnet-Operated Breaker.

ELECTRIC HEATING DEVICES.

The Cutler-Hammer Manufacturing Company, of Milwaukee, has established a department for the manufacture and sale of electric heating and cooking devices. The appliances include, at present, flatirons, disk stoves, curling-iron heaters, shaving mugs, portable water heaters and various types of water heaters designed to be permanently attached to water pipes. There are also several types of electric radiators, and later on a full line of electric cooking utensils will be available. The accompanying illustrations show some of these new appliances.

In the electric flatiron the heating element is so constructed that the heat is evenly distributed over the whole face of the iron. On top of the heating element and separated from it by a sheet of mica insulation is placed a thick piece of cast iron, known as the "storage plate," which serves in maintaining the even distribution of heat and also in retaining or storing the heat. This feature gives the necessary body for conserving heat, so that, like the old-fashioned hand iron, the tool will retain its heat for a considerable period of time. The energy may thus be turned on for five minutes and sufficient heat will be stored to do ten or fifteen minutes' work.

Another feature of the Cutler-Hammer iron which tends to keep the iron hot is the stand provided for it when not in use. This back-stand consists of a T-shaped bar attached to the heel of the iron. When not in use the iron is turned on end, the bar holding it clear of the ironing-board. This renders unnecessary the use of a metal stand, which tends to conduct the heat out of the iron. The back-stand may also be adjusted so as to support the iron face upward, as shown in Fig. 1, and in this position it may be used for heating water, milk, etc.

Between the storage plate and the top plate of the iron, serving to insulate the latter, is an air-gap, keeping the handle comparatively cool. A spring is used to hold the storage plate, heating element and bottom plate in close contact.

The heating element can be readily removed by the user, and an old one replaced by a new unit in case of burn-out. All irons are guaranteed for one year, however, and it is expected

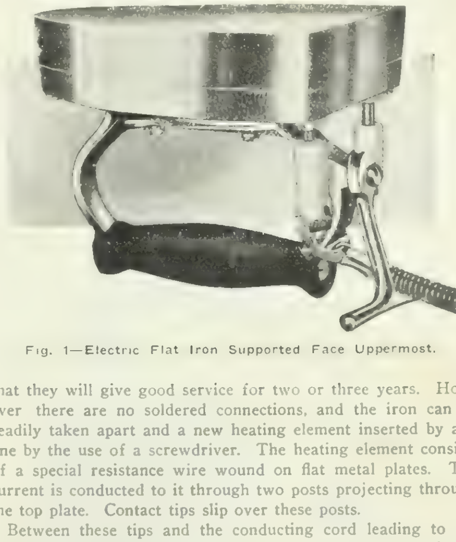


Fig. 1—Electric Flat Iron Supported Face Uppermost.

that they will give good service for two or three years. However there are no soldered connections, and the iron can be readily taken apart and a new heating element inserted by any one by the use of a screwdriver. The heating element consists of a special resistance wire wound on flat metal plates. The current is conducted to it through two posts projecting through the top plate. Contact tips slip over these posts.

Between these tips and the conducting cord leading to the socket there is a "ring-and-spring" connection, which is an especial feature of the iron. This attachment prevents kinking and chafing at the point where the cord is attached to the iron, which has heretofore caused considerable trouble. As clearly shown in Fig. 1, the wire itself is firmly attached to a metal ring surrounding one of the handle supports, this serving to remove all strain from the contact tips, which, except for this device, might be accidentally pulled off the contact posts. The household and laundry irons are made in three sizes, weighing 5 lb., 6 lb. and 7 lb., and there is also a special sleeve iron weighing only 4 lb., with a long, narrow body. Heavy irons for tailors, weighing up to 20 lb., and also shrinking irons are available.

The Cutler-Hammer disk stove consists of a nickel-plated disk measuring 7 in. in diameter, beneath which is a sealed chamber containing the heating element, the whole being sup- [illegible] ing an attractive appearance. By the use of this utensil water may be heated and eggs or cereals cooked, while many other uses will suggest themselves. Cooking may be done directly on the dining table or at the bedside of an invalid, if desired. In

households possessing a disk stove but no electric iron the disk may be used to heat ordinary flatirons.

Fig. 2 shows the electric curling-iron heater. This device is attachable to a marble or slate base and may be used on the dressing table, or, as shown in the illustration, attached to the wall. The metal casing is nickel-plated and its top plate is provided with four openings, the two outer ones being designed to hold the curling iron when not in use. The two inner openings (both of which may be used at once if necessary) lead to the heating chamber in which there is an automatic switch closing the circuit to the heating element as soon as the iron is thrust into either of the openings. On withdrawing the iron the supply of energy is automatically cut off.

An electric shaving mug, nickel-plated inside and out, is also included in this new line of heating devices.

Instantaneous water heaters form an interesting feature of the Cutler-Hammer Company's new line. Fig. 3 shows a portable buffet heater with a capacity of 3 qt., which is intended for household use, a larger size, designed for bars and restaurants, having a capacity of 1 gal. Either of these heaters will furnish hot water in less than one minute after the switch is turned. Starting cold, the first glassful of steaming water can be drawn in forty-five seconds, a second glassful can be drawn 15 seconds later, and so on until the globe is emptied. The heating element is concealed in the metallic base.

For permanent attachment to water pipes, five types of instantaneous water heaters are provided. There are the therapeutic heater, the smallest of the permanently attached water heaters; the bar heater, the lavatory heater (Fig. 4), the bath heater and the tank heater. While these heaters differ in size and in some details, the general principle of construction is the same in all. The heating element consists not of wire, but of the water in the heater itself, through which current is passed by carbon-rod electrodes varying in size and number with the capacity of the heater. These rods are enclosed in a metallic cylinder through which the water flows and are so arranged that there is an open circuit between them. Hence, when the heater circuit is switched on the heater does not become operative until water enters the heating compartment. The water itself thus bridges the open circuit between the carbon rods and is almost instantly raised to a high temperature by the passage of the electricity through it.

This arrangement has manifest advantages. Turning on the

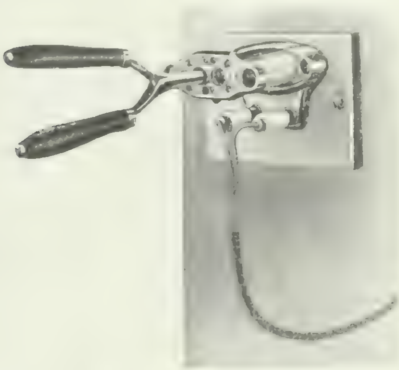


Fig. 2—Curling Iron Heater.

electrical energy produces no effect in the heater whatever. Nothing happens until the water is turned on, since the water itself forms the connecting link between the carbons, which serve as electrodes. This arrangement prevents waste of electricity, destruction of the heating elements and danger resulting from the sudden admission of cold water to a superheated cylinder.

[illegible] to turn off the electricity after [illegible] the hot water required, no damage will be done, since the water remaining in the cylinder will in a short time be evaporated in the form of steam, and with the disappearance of the water electricity will cease to flow even though the switch remains closed. The water itself automatically makes and breaks the circuit. The time required to obtain a continuous flow of hot water from any of these heaters is only fifteen seconds.

The type illustrated in Fig. 4 is designed for use in connec-

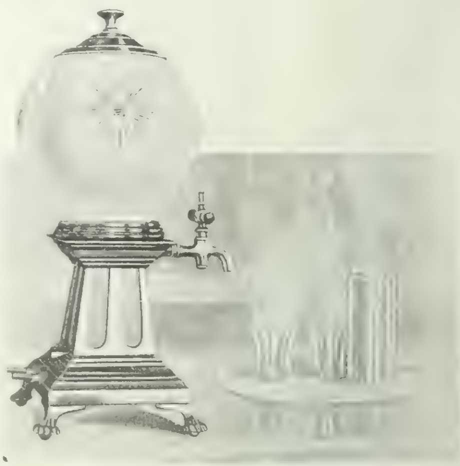


Fig. 3—Portable Buffet Water Heater.

tion with washbowls. It is provided with a regulating device so that the temperature of the water to be drawn from it may be varied from lukewarm to scalding hot. Where furnace heat is used to supply hot water in winter the use of this heater will be found a great convenience in the summer. All of the

Fig. 4—Lavatory Heater for Permanent Attachment to Wash Bowl.

instantaneous water heaters require a considerable consumption of electrical energy, of course.

The Cutler-Hammer Company also manufactures electric radiators designed for the heating of rooms. Three sizes are available, giving, respectively, one two and three degrees of heat. A complete line of electric culinary devices, such as chafing dishes, coffee pots, teapots and tea kettles, will soon be ready for the market.

COMPOSITE INSULATION FOR HIGH VOLTAGE.

About eighteen years ago there was developed and placed on the market a form of composite insulation possessing many unusual characteristics. Although the material was non-fireproof yet it was found to be well adapted to high-voltage work and capable of withstanding arcing without destruction. Beginning in 1902 the material was employed for high-tension

Fig. 1—Strain Insulator.

line insulators on the circuits of the Niagara Falls Power Company and the Canadian Niagara Power Company. It is claimed that although lightning has frequently caused arcs to form around the insulators not one has been damaged by lightning.

Fig. 2—Strain Insulator.

This result is attributed to the inherent flexibility of the material, which permits it to withstand heat expansion strains which would immediately rupture either glass or porcelain.

The material, which is known as "Electrose," possesses hardness and toughness without brittleness, great strength, a smooth

Fig. 3—Wall Bushing.

polished surface and is moisture, water and oil proof. It will not shrink, warp or change its form under ordinary conditions, and is suitable for use in temperatures below 200 deg. Fahr.

The insulating, puncture-resisting and mechanical characteristics of the material are shown by the following tests: A sheet 12 in. x 12 in. x 1/8 in. arced around at 75,000 volts, but

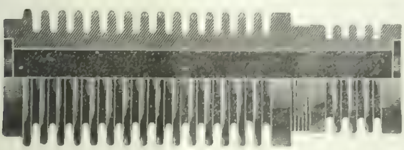


Fig. 4—Transformer Bushing.

did not puncture; a similar sheet 1/4 in. thick withstood 80,000 volts without puncturing. A sheet 12 in. x 12 in. x 1/2 in. sustained a mechanical crushing pressure of about 10,000 lb. per square inch. A corrugated rod-type strain insulator 7 in. long by 15 in. in diameter (Fig. 1) arced over from terminal to terminal at 80,000 volts, but did not puncture; the mechanical strength was about 1500 lb. A corrugated rod-type strain insulator 18 in. long by 2 in. in diameter (Fig. 2) arced over from terminal to terminal at 175,000 [illegible] the mechanical strength was about 3000 lb. A wall and bulkhead water-tight locking bushing 23 in. long and 4.5 in. in diameter, having a 1-in. hole extending through it (Fig. 3), arced from center of bushing to the extreme end at 90,000 volts, but did not puncture; this type of bushing has become standard with the United States Navy and practically all of the commercial wireless telegraph and telephone companies as a bulkhead bushing. Fig. 4 shows a type of wall and bulkhead locking bushing employed by the General [illegible] and transformers of the highest [illegible] The electrical strength of the bushing is given any desired value by properly selecting the length.

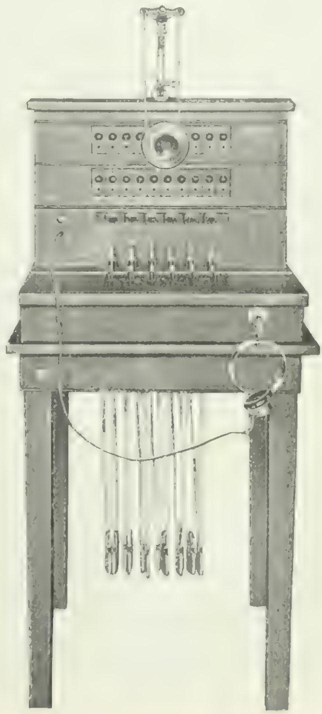
Electrose insulation is the invention of Mr. Louis Steinberger and is made by the Electrose Manufacturing Company, Brooklyn.

CONVERTIBLE TELEPHONE SWITCHBOARD.

A type of small switchboard capable of being not only easily increased in capacity but at the same time readily converted to suit various service conditions has been placed on the market by the Western Electric Company.

The switchboard is built up of several separate units, comprising the following: Top units, line units, cord units and supporting units.

As the telephone company's requirements increase so can the switchboard capacity be increased and at all times the telephone company has a minimum investment. With the sectional unit scheme, a switchboard can not only be increased in capacity, but it also can readily be converted to any desired type.

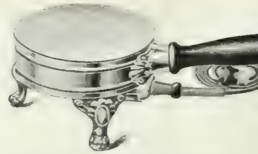


Convertible Telephone Switchboard.

There are many hundreds of switchboards capable of giving several years of good service that are stored away because the telephone companies have no further use for them since they no longer fit in with the new order of things. Such switchboards are sometimes a bad investment because the telephone companies do not realize the full value from them. On the other hand the unit-type of switchboard should be a good investment, since, on account of its elasticity, a place of service either in whole or in part, could usually be found. It is claimed that the design of the switchboard has been carried out in a very comprehensive manner. The series includes a total of thirty different units, which should enable a telephone company to meet every legitimate condition.

ELECTRIC DISK HEATER.

In the design of the disk heater illustrated herewith special attention has been paid to the factors giving speed in starting and efficiency in operation. The use of a special under-truss has permitted the manufacturer to utilize a thin top of high thermal conductivity so that heat inertia and radiation losses are minimized. It is said that the efficiency of the design in transmitting the heat to the surface desired is about 68 per cent, and that the stove attains a temperature rise of 250 deg. during the first minute and 200 deg. during the second minute. It is claimed that the copper top is much more effective in delivering heat where wanted than is a top made of iron or other metal by reason of the high thermal conductivity of the copper.



Electric Disk Heater.

The heater described above is made by the Pelouze Electric Heater Company, Chicago, Ill.

Exhibits at the New York Electrical Show.

ELSEWHERE in this issue is an account of the opening of the New York Electrical Show, with a description of the decorative and lighting effects. The withdrawal of the electric light company exhibits from the main floor of the Madison Square Garden arena to the balcony has enabled the various exhibitors to make a better showing of their products and has served to spread the crowds over a greater area, adding much to the comfort of visitors and permitting every exhibit to be seen. Below is given in alphabetical arrangement a description of the various exhibits. The half-tone engravings show the general arrangement of the booths.

American Metal Hose Company, Waterbury. Conn., shows a sample board on which are mounted various kinds of flexible hose for steam, water and air and for electric wires. Messrs. A. Ruhin and C. Neudoerffer are present.

American Z Electric Lamp Company, New York, shows a monogram at the back of its booth studded with 18-watt tungsten lamps. As is well known, a feature of the American Z lamp is its non-blackening quality. In the booth is also shown an ultra-violet-ray sterilizer used for purifying water. Mr. M. B. Kitt is in charge.

Anderson Carriage Company, Detroit, Mich., builder of the Detroit electric, exhibits through its New York office 1911 models of a victoria and brougham. The vehicles are equipped with Edison batteries and have shown excellent results as regards mileage on a single discharge. The company has recently undertaken the manufacture of electric trucks and delivery wagons, the latter being now ready for the market. Like the pleasure cars these vehicles will be equipped with Edison batteries. Three methods of driving are standardized by the Anderson company—shaft, double chain and tandem chain. The company now manufactures sixteen models and prides itself on the finish of all its cars, attention being given to the minutest details. Those in attendance include Messrs W. C. Anderson, E. E. Higgins and Albert Weatherby.

Babcock Electric Carriage Company, Buffalo, N. Y., displays the following models: A victoria, finished in maroon; roadster, finished in primrose yellow with green stripes and leather upholstering, and a four-passenger coupé finished in Brewster green and upholstered in dark green Bedford cord. A feature of the latter vehicle is the seating arrangement whereby the customary front seat is replaced with two revolving chairs equipped with folding backs so that when not in use they can be folded up out of the way. With the chairs revolving one can face forward, backward or sidewise, allowing the operator a clear vision and view ahead. Both seats are removable and are easily lifted out of the car if not required. Three passengers can ride comfortably in the rear seat. All Babcock electrics are fitted with either the Edison battery or [illegible]

E. V. Parker & Company, [illegible]

hibition an electric victoria phaeton equipped with Edison batteries. This car has a wheel base of 82 in. with wheels and tires 34 in. x 3.5 in. and a drop frame. The battery is underhung and a wheel is used for steering. A General Electric motor is used with a continuous torque controller. The car is a duplicate of one used by Mr. Edison in making runs in and about New York City and which has just completed the 1000-mile ideal tour through the White Mountains on a gasoline car schedule. The construction of the car for exhibition purposes is improved somewhat over the other as the one on view is a 1911 model.

Baker Motor Vehicle Company, Cleveland, Ohio, has two commercial cars on exhibition. The 1000-lb. chassis is fitted with a panel side body and is built to the following specifications: Wheel base, 85 in.; tread, 56 in.; tires, 34 in. x 3 in., solid rubber front and rear; frame, pressed steel; steering gear, wheel; spring, semi-elliptic front and rear; brakes, internal expanding on rear wheels; motor, 2.5 hp series wound, 300 per cent overload capacity; battery, 42 cells, 9 P. V. Exide; transmission, Renold silent chain from motor to countershaft, oil and dustproof encased, double chain from countershaft to rear wheels, new quick detachable suspension, four bearings; bearings, ball throughout; axles, I-beam drop forged in front, forged in rear; battery suspension, cradle underslung; weight complete chassis with battery, 2400 lb.; carrying space, length 76 in., width 42 in. and height 60 in. The 2000-lb. chassis is fitted with an express wagon body and follows the same general construction as the lighter vehicle, except that the motor and battery equipment are larger and that Timkin roller bearings are used in the front and rear wheels and annular ball bearings in the motor and countershaft.

Campbell Electric Company, Lynn, Mass., has on exhibition electromedical and central-station apparatus of its manufacture. The former comprises portable X-ray and high-frequency apparatus and a physician's outfit capable of giving all forms of current used for therapeutic work. The central-station apparatus comprises electric time switches for automatically controlling electric circuits used for flat rates, and two meter service, primary circuits to transformers in outlying districts and show-window lighting circuits. Transformers for bell-ringing circuits and for low-voltage tungsten lamps are also shown in addition to thermo flashers, etc. The electromedical apparatus is demonstrated by the J. W. Hughes Company, New York

Columbia Phonograph Company has a number of "Dictaphones" in operation in its booth. These instruments are business phonographs driven by small motors and typists are busily engaged in writing on a typewriter what is spoken on the record. The instrument is intended for office use, for which purpose it has many advantages. Messrs. A. W. Miller, [illegible] Smith, O. Brushaber, E. Flynn and S. Bruce explain the operation of the machines

Conduit Machine Company, [illegible] is showing two types of wire fishing machines. The [illegible] sends a snake through a conduit at the rate of [illegible] and takes and pulls wires through base plugs, wall and ceiling outlets, floor plugs and distribution boxes with equal speed. Slack is taken care of automatically and because of the continuous motion a conduit machine will fish more turns and sharp bends than can possibly be fished by hand snaking. No operation is necessary in threading the snake to the outlet box, the mechanic merely inserting the flexible shaft which contains the snake. The smaller machine shown is intended for interior wiring work, and the larger machine for underground conduit and extra heavy work. Mr. H. R. Burt is in charge of the booth.

Consolidated Telegraph & Electric Subway Company, controlling the underground electric construction work in New York City, shows an induction motor, direct-connected to an air compressor and feeding into a storage reservoir. The equipment is mounted on wheels and is used by the company in its work throughout the city, it being understood that air drills are employed very extensively in connection with underground conduit work in New York. A section of a manhole equipped with a 45-kw subway-type transformer and showing the mains and feeders as they enter and leave in conduit is on view. Cable racks, wiped joints, drainage pits, etc., serve to make the exhibit realistic, and manhole covers, sections of iron and vitrified conduit., etc., are spread about in the space allotted to the company at the rear of [illegible]. Mr. [illegible] is in charge of the exhibit.

Crane Company, Chicago, has a working exhibit of "Cranetilt" steam traps. For convenience in place of steam compressed air is used in a tank representing a steam boiler. A non-return trap is shown discharging water into a receiving tank, a lifting trap [illegible] water to a direct-return trap on top of the tank and [illegible] water by gravity into a boiler under pressure. In addition there are a 6-in., motor-operated, cast-steel, gate valve with near as well as remote control; a 6-in. emergency butterfly valve with electric release; a 6-in. ferrosteel stop and check valve which closes automatically with drop in boiler steam pressure; a 12-in., cast-steel, flanged gate valve; a piece of pipe having a "Craneweld" flanged joint on one end and a "Cranelap" joint on the other end, numerous small brass valves of special superheated metal, together with samples of "Klingerit" and "C. C." packing.

Cutler-Hammer Manufacturing Company exhibits for the first time its complete line of carbon instantaneous water heaters in which no wire is used at all. The line comprises bath, lavatory, bar, therapeutic and kitchen tank heaters from which hot water can be obtained in from fifteen to twenty seconds. The portable heaters on display comprise devices for buffet and bar use fitted with handsome cut-glass globes, in addition to a bar urn. There is a complete line of electric flatirons, disk stoves, curling iron heaters, radiators, chafing dishes, coffee percolators, tea kettles, etc., on view. In the specialty line there are displayed the company's well-known push-button switches [illegible]

Fig. 1—General View of New York Electrical Show, Looking Northeast

pendant switch and a cleat switch. Mr. G. B. Katzenstein is in charge of the company's interests.

Joseph Dixon Crucible Company, Jersey City, N. J., has a line of its graphite brushes, resistance rods, crucibles, lubricants, greases, etc., on exhibition. Mr. M. A. Koerber and Messrs. Williams and Brooks represent the company.

Duntley Manufacturing Company, Chicago, Ill., has on exhibition pneumatic cleaners of various sizes to meet the requirements of homes and business houses. The cleaners are fitted with universal motors so as to be applicable to both direct-current and alternating-current circuits. The company also has on exhibition an air-washer which cleanses the air by drawing it in from outside, passing it through water and expelling it into the room. In summer the air thus treated is claimed to be from 5 deg. to 10 deg. cooler than the air in the room and in winter by the addition of a heating coil in the water the air can be tempered so as not to cause any ill effects. The cleaners manufactured by the company are too well known to require detailed description.

Economical Electric Lamp Company, New York, displays the "Hylo" and "Economical" turn-down lamps consisting of pull-string, turn-bulb and long-distance turn-down types with both carbon and tungsten filaments. Several automatic machines demonstrate the turn-down features of the lamps and instruments in the lamp circuits show the difference in energy consumption between the large and small filaments employed to obtain the two candle-power ratings. Descriptive literature illustrating all types of lamps manufactured by the company is distributed. Messrs. M. Lobenthal and L. Lobenthal are in attendance.

Edison Storage Battery Company, Orange, N. J., has an exhibition board showing all parts of the Edison battery from the raw material to the finished product. In addition there are the following batteries on view: One 5-cell battery for sparking and lighting gasoline automobiles and launches; one 5-cell battery for sparking purposes; one 25-cell battery for lighting country houses; one 25-cell battery for lighting sailing yachts; one 40-cell (225-amp-hour) battery for electric pleasure vehicles; one 60-cell (150-amp-hour) battery for 1-ton electric wagons; one tray of four 300 amp-hour cells such as are used in electric commercial vehicles and one tray of three 300 amp-hour cells, such as are used in car-lighting service on railroads. Messrs. H. L. Davisson, J. H. Gill, W. G. Bee, E. J. Ross, Jr., A. J. Doty and J. Kelly are in attendance. Mr. Walter E. Holland, who has assisted Mr. Edison during the nine years of experimental work on the battery, will also be present at various times during the show.

Edison Manufacturing Company, Orange, N. J., shows a motion-picture machine in connection with a Helios motor-generator set. Mr. Petzer is in charge of the machine, which is in operation.

Electrical Contractors' Association, of New York City, comprising some thirty-four concerns, has an exhibition panel illustrating all standard methods of wiring, such as wooden molding, open knob-and-tube, metal molding, concealed conduit, both rigid and flexible, and marine wiring. Bells, annunciators, panel boards, switches of various types, connection blocks, and other devices used in household wiring work are shown connected.

Electric Motor & Equipment Company, Newark, N. J., features its G-M lamp. This is a portable reading lamp fitted with an art-glass shade and a lower and inner prismatic glass globe for diffusing and redirecting the rays of light. In the base is a switch for regulating the intensity of the light to suit the requirements of the reader, it being understood, of course, that resistance is inserted in the circuit to reduce the potential at the lamp. The manufacturer has sought to provide a really good, library-table, reading lamp designed on scientific principles. Those in attendance are Messrs. S. H. M. Agens, E. B. Wolfe, F. Nesbit, P. A. Cooper, W. Cooke, D. [illegible]

Electric Storage Battery Company has an immense end-cell switch arranged at the back of its booth and shows, besides sparking and vehicle batteries, insulators, connectors, spacers, etc., used in battery work and an automobile lighting outfit. Mr. R. S. Garton is in charge.

Electrical Testing Laboratories, New York, has sought in its exhibit to emphasize some of the new lines of testing which the company has developed during the past year and for which an extensive equipment has been installed. A very complete laboratory for testing paper is shown. The equipment includes not only the testing machine by which the bursting strength of paper is obtained and which is very commonly used in this country, but also German standard machines such as are employed in the Bureau of Standards in Washington and in the Royal Testing Office in Berlin. These include a Schopper machine for determining the tensile strength and extension of samples of paper and also a machine by which the paper is creased repeatedly back and forth under a uniform tension until rupture occurs. The methods of determining the composition of paper by microscopical analysis are also illustrated. There is also a laboratory for the calibration of thermometers. This includes a comparator for the ordinary sizes of chemical and industrial thermometers reading up to 100 deg. C. or 212 deg. Fahr. and another comparator using a bath of oil and serving for comparisons up to 300 deg. C. There is also a smaller comparator for testing clinical thermometers in large quantities. The baths of these comparators are heated electrically. The standard thermometers used have been calibrated at the Bureau of Standards or at the Reichsanstalt. Apparatus is also shown for testing the tensile strength of briquettes of cement. No attempt is made to show the complete outfit for the preparation as well as the testing of cement which is installed at the Electrical Testing Laboratories. In the domain of fuel testing an Atwater bomb calorimeter is shown, together with its accessories. The method in which this calorimeter is used is illustrated. Photographs illustrative of the work of the laboratories, and particularly of the large machines for testing materials of construction, are on view.

Feature Advertising Company, New York, exhibits six different types of its "Ad-o-Scope" which, as the name suggests, is an automatic machine for throwing stereopticon projections of photographs, advertising cuts, labels and trademarks. These are reproduced in the original colors upon a small screen attached to the case containing the mechanism, and changed by an electric motor every seven seconds. A window model shows how the manufacturer may display his products, step by step, from field to table; while a theatrical model gives colored photographic transparencies of the principal scenes and portraits of the different artists, thus reproducing a play act by act and scene by scene. The special feature of this company's exhibit, however, is its new automatic stereopticon for throwing large projections on a screen erected on the roof or suspended from the sides of a building, and shown for the first time in public. Mr. W. Nephew King is in charge of the exhibit, assisted by Mr. Maximilian Klaiber.

Federal Electric Company, Chicago, Ill., exhibits its usual line of porcelain-enamel, steel, sectional letter and panel signs with some special signs. A good showing is made of Federal clusters for tungsten lamps, and fixtures for residence lighting are also on view. In addition to these well-known products of the company several items of special interest are featured. The first of these is a vacuum cleaner, a noiseless and practical machine shown and demonstrated for the first time. The Federal kitchen cabinet also makes its initial appearance. The cabinet is equipped with an electric motor and many ingenious devices for use with electricity in the kitchen. Another exhibit of special interest is the Spaulding system of ozone machinery which includes a large ozonizer and a smaller machine for use on office desks. An ozone water purifier is also shown. This device automatically treats the water when the tap is turned on and although certain types of machines

have been successfully employed for this purpose in Germany this is claimed to be the first in use in this country. Mr. Russell G. Spaulding is in personal charge of the ozone exhibit. Central-station men will be interested in the Willis "Straight Line" meter, which the company has recently placed on the market and which was described in detail in our issue of Sept. 15. This watt-hour meter has a direct-reading dial—that is, the energy consumption is registered directly in numbers and not indicated on a clock dial. Those in attendance are Messrs. J. J. Magee, G. H. S. Young and A. R. Dean.

Fox-Multax Electric Company, New York, has its booth fitted with a regulation Edison post equipped with two 100-hour flaming-arc lamps. The posts are similar to the ones erected at Churchill's and at the Kaiserhof on Broadway at Forty-ninth and Thirty-ninth streets, respectively. In addition the Fox-Watkins switch for regulating the light of lamps is demonstrated. According to the Faraday House certificate this device, which contains a resistance of patented composition in a very contracted space, saves from 12.5 per cent to 80 per cent of the energy, depending on the dimness of light desired. The 100-hour flaming arc was described in these columns last week. Messrs. J. J. Batterman, F. F. Fox and J. F. Fitzgerald are in attendance.

General Electric Company has its exhibit in the central part of the Garden. One of the most interesting features is a model kitchen furnished with a complete equipment of electrically heated cooking utensils, and a new domestic range is shown in operation. The latter resembles the ordinary gas range in construction and is [illegible] of dimensions 18 in. x 18 in. x 12 in. The three disk stoves on the top correspond to the burners of a gas range, and the range affords the same conveniences and facility in cooking that the ordinary gas range does. Some of the other heating devices on exhibition are cereal cookers, coffee percolators, chafing dishes, etc. A complete line of motors is exhibited ranging from small ones suitable for household service to those suitable for factory and mill installation. The lamp exhibit is very complete, comprising both the arc and incandescent types. An interesting feature of the latter exhibit is the new vertical electrodoe lamp, the most efficient illuminant in commercial service. The series lamp has a specific consumption of 0.178 watt and multiple type a specific consumption of 0.252 watt per mean hemispherical candle-power. This consumption is due, in a large measure, to the lower electrodes—a carbon tube with a specially prepared core—the successful result of an extensive research covering a period of years. The light from the intensified arc lamp is a near approach to daylight, and the lamp is employed principally for store lighting. The lines of this lamp are graceful and special attention has been given to the casings, which are made in Renaissance, fleur-de-lis, wreath and shield and other designs, permitting the choice of a lamp to harmonize perfectly with the store trimmings. The G.I. flame-arc lamp is also exhibited and represents the latest developments in this type of lamp. The multiple luminous-arc lamp is meeting with great favor for the illumination of mills, factories, etc., while the series luminous-arc lamp is used for street lighting. A cabinet contains different types of G.E. miniature and low-voltage lamps, while the [illegible] carbon, tantalum and

Fig. 2—General View of New York Electrical Show, Looking Northwest.

"Mazda" lamps is illustrated by the exhibit in a second cabinet. To show the difference between the current consumed by a 100-watt carbon lamp and a 40-watt "Mazda" lamp, both of which give the same candle-power, an ammeter has been connected into the circuit. Incandescent lamps of all sizes from 25 watts with prismatic glass shade to the 500-watt lamp with "Monolux" fixtures are displayed in a rack. There is also an exhibit of 220-volt multiple "Mazda" lamps. On an automobile dashboard are displayed two headlight lanterns with lamps, two side light lanterns with lamps, one dashboard lantern with lamps and one trailer light with lamps. A new type of 30-amp mercury-arc rectifier for charging electric vehicles is on exhibition. It is designed for charging 24-cell to 30-cell batteries and can be operated from 110-volt or 220-volt alternating-current circuits. The rectifier is made up in one complete unit. A solenoid-operated oil switch and circuit-breaker is shown and represents the latest design in this type of remote-control device.

General Vehicle Company, Long Island City, N. Y., which manufactures electric commercial vehicles exclusively, has an interesting exhibit of vehicles which it has recently sold. One is a 2000-lb. wagon which will be operated by the United Electric Light & Power Company, of New York, and is one of seven vehicles recently ordered to complete that company's equipment of electrics. The other exhibit is a 3½-ton chassis which has been sold to the Schwarzschild & Sulzberger Company, of Chicago. This vehicle is equipped with an underslung battery, which can be readily removed and a newly charged battery installed, thus enabling the owners to obtain double the radius of the rated capacity of the vehicle. The machine is jacked up in order that the operation of the chassis can be easily demonstrated. In addition the General Vehicle Company has on exhibition in its booth one of its new commercial arc rectifiers for use in charging electric vehicles. The company is represented by Messrs. C. W. Squires, A. P. Bourquardez, W. L. Brown and Louis Ruprecht.

Goulds Manufacturing Company, Seneca Falls, N. Y., shows one of its triplex power pumps working in connection with a glass tank illustrating the automatic operation of the motor by the rise and fall of water in the tank, which is intended to correspond to the house tank in a residence. A number of triplex pumps are also shown lying idle. The following representatives of the company are in attendance: Messrs. W. E. Dickey, W. H. Hopper, F. R. Harty and W. H. Valentine.

Gould Storage Battery Company, New York, has sparking, vehicle and street-car storage batteries on exhibition. Details of the grids and photographs of the Third Avenue storage-battery cars are shown. The Gould company has developed both pasted and Planté plates to cover the varying conditions of service. The thin plates are pasted and have high capacity without sacrifice of durability. The Planté form of positive plate is spun from a blank sheet of lead into thin, close-spaced parallel ribs and grooves resulting in large grid surface. The active material is formed electrochemically. It is stated that Third Avenue cars equipped with Gould batteries have given 105 miles on a single charge. Messrs. W. J. Dowd, G. Hayes and H. Seikerman represent the company.

Gudeman & Company, New York, exhibit their regular line of electrical decorations augmented by some designs which have never been shown before. A feature of the display is an electric fountain, which the company has recently started to manufacture. The electric decorative designs cover all kinds of flowers and fruit, the latter being represented by the lamp bulb itself and the former being made of fireproof material in which an electric lamp is hidden. Mr. L. Gudeman is in attendance.

C. J. Halle Sales Company, New York selling agents for the Nuway Electric Cleaner, has a working exhibit of vacuum cleaners. The cleaner comprises four parts—the casing with its wires, the hose, brush and nozzle. Within the casing is a [illegible] universal motor and a [illegible] chamber in which the fan deposits the dust and dirt. The mechanism is enclosed in a hardwood cabinet 14 in. x 14 in. and the entire device weighs 25 lb. Those in attendance are Messrs. C. J. Halle, M. C. Beard, J. J. Flanagan, J. T. Robinson and I. A. Nohe.

Helios Manufacturing Company, Bridesburg, Philadelphia, Pa., in its booth near the entrance shows its arc lamps, storage batteries, meters and the Helios economic lighting system. The latter is shown in operation in connection with a motion-picture machine and comprises a motor-generator set whose installation not only enables the operator to obtain a clearer and steadier light, but it is claimed also avoids waste of energy which would otherwise obtain through the resistance necessary in connection with the hand-fed arc lamp. The arc lamps shown include, besides the line of lamps which the company has been manufacturing for over seventeen years, the Helios flaming arcs applicable for both direct-current and alternating-current circuits and giving about 2300 cp. Storage batteries for lighting and vehicles are on view, as well as Bastian meters. The latter are intended for direct-current circuits and are especially applicable for residence work where the number of lamps in use is small and where the installation of an expensive meter would be a consideration.

Holophane Company has two sample boards erected in its booth. The rear board is fitted with residence-type glassware showing against a black background and a board or rack at the side is fitted with the company's various forms of prismatic-glass reflectors in different finishes and its metal reflectors. Two posts at the entrance to the booth are equipped with tungsten lamps and glass shades, and are intended for street-lighting service. The new "Stilleto" prism is shown developed in the extensive, intensive and focusing types. The reflector is more efficient than the old style of prism and admits of more graceful designs. The following persons are attending: Mr. J. W. Foster, Mr. A. Marshall, and Messrs. Miller, Grotz, Bradbury, Timper, Feher and Whiting.

Hughes Electric Heating Company, Chicago, Ill., shows its line of electric cook stoves. These appliances resemble an ordinary gas or gasoline stove and are equally as cheap in first cost. They are built so that the housewife can perform all kinds of cooking, baking and other work required of a kitchen stove with the ordinary kitchen utensils. The heating units are removable and can be renewed by the housewife without the slightest difficulty. The latest product of the company shown is a kitchen range with self-contained oven and broiler. This stove is attractive in appearance and is of substantial construction. The company is represented by Messrs. G. A. Hughes and G. D. Smith. Lady demonstrators show the method of operating the stoves and obtaining the three degrees of heat.

Hurley Machine Company, New York, is exhibiting the famous "Thor" electric home laundry machine and Thor ironing machine. At various electric shows this machine has been operated in a competitive test again women actually washing clothes, and one Thor machine has washed and wrung by electricity three times as many clothes as three women using the old-fashioned rub-board method. A new feature in connection with this machine is the Thor universal rod, which is attached to the flywheel of the washer and will operate an ice cream freezer, grindstone, churn, cream separator, or any other small article around the house. The Thor exhibit is in charge of Mr. Neil C. Hurley and Mr. William A. Murfey. Many of the sales force from the Chicago office are also at the exhibit, including Messrs. Nolan, Conlon, Haynie, Contzen and Kaynor.

International Correspondence Schools, Scranton, Pa., features its Electrical Engineer's Handbook and seven other handbooks. Besides these the numerous courses in electricity are shown and the methods of teaching explained. Some of the work of students who have graduated is on exhibition as well as the International Library of Technology, consisting of [illegible] bound volumes covering 210 courses.

Kinetic Engineering Company, Philadelphia, has two organ-blower outfits on exhibition, one being equipped with a single-phase induction motor and the other with a direct-current motor, both of which are ready for service. These blowers are used quite extensively in New York churches, and are very quiet in operation. Mr. S. H. Ebert is in charge.

Lansden Company, Newark, N. J., exhibits an ambulance, a standard, one-ton, rack truck, and a three-wheel industrial truck. The ambulance has 65 cells of Edison type-A4 battery and is rated to carry a load of 600 lb. for 45 miles at a speed of 15 miles per hour. The wheelbase is 112 in. and the tread 56 in. Sweinhart cellular solid rubber tires, 32 x3½ in., are used, and a General Electric motor giving four speeds forward and two speeds backward. The fittings include standard sliding bed, upholstered in leather; standard brass hand-lantern with bracket attached to inside of body; dome lamp in roof; medicine case; bandage boxes and splint racks; speaking tube from doctor to driver; doctor's seat across rear hinged at one side to fold up out of the way; doctor's back straps across side openings; doctor's arm loops suspended from roof; sides padded and trimmed with leather for a height of one foot above bed [illegible] natural wood; tail gate and rear step. The outside fittings include two electric side lamps, one electric tail lamp, rotary foot gong and electric horn, odometer, charging plug, battery filler, storm apron and tool kit. The particular feature in the ambulance to which attention is called is the coil-spring suspension. This is a matter which has been very carefully worked out through a series of exhaustive experiments covering over three years, and it is now developed to a point where most remarkable riding qualities are achieved. In no class of vehicle is this more essential than in an ambulance, and it is claimed by the maker that no vehicle ever built to be operated over ordinary streets and highways has equaled the perfect smoothness of this construction. The standard rack truck is equipped with 60 cells of the Edison type-A6 battery and rated to carry its full load of one ton a distance of 45 miles on each battery charge at a speed of 10 miles an hour. The three-wheel industrial truck is said to be the smallest electric vehicle for its rated load capacity ever built. The top of the platform is only 27½ in. from the ground, and the platform dimensions are 6 ft. long by 54 in. wide. The truck is rated to run 18 miles on each battery charge at a speed of 4½ miles per hour, carrying its full load of two tons the entire distance. The driving wheels are 24 in. in diameter, shod with 6-in. rubber tires. The single steering wheel is 18 in. in diameter with a 6-in. steel tread. Various sizes and types of industrial trucks are built to suit the individual requirements of the purchasers. They are designed for use in and about steamship piers, railway terminals, warehouses, factories and mills. They eliminate the expensive and troublesome tracks, switches and turntables required when industrial railways are employed, can be run all over the plant, onto elevators and through narrow passage ways, picking up and delivering their loads exactly where wanted.

Fig. 3—General View of New York Electrical Show, Looking Southwest.

A few general characteristics of all Lansden construc-

tion are the employment of a wood frame which is much lighter and more flexible for a given strength than pressed steel or channel iron frames; the use of a single motor, driving to a differential countershaft, thence by side chains to the rear wheels; the employment of the Lansden patent self-oiling, loose-sleeve bearings; the Lansden continuous torque controller giving a constant, uninterrupted driving effort through all speeds, the use of a flat, spring steel countershaft which absorbs the sudden pull of starting by torsion and which, with the continuous torque controller, prevents any violent strains on chains and tires, thereby materially increasing their life. In attendance are Messrs. John M. Lansden, Jr., F. A. Whitten, John Milliken, W. J. Joller, J. R. Kinsey, F. B. Tyler, Harry Taylor, A. Figman and Victor Villar.

Macbeth-Evans Glass Company, Pittsburgh, Pa., displays special lines of glassware for use in connection with electric fixtures with particular reference to the new "Alba" glass reflectors for use with tungsten lamps. These are all shown under actual working conditions, and, in addition to the reflectors in this glass of varied shapes, the company exhibits this glass made in structural forms and illuminated. Throughout the Garden "Alba" glass reflectors are used in connection with the illumination. There is a fairly comprehensive line of electric globes which are made for home lighting, etc., in varied shapes and finishes also on exhibition. Messrs. L. W. Young and G. N. Lukens are in attendance.

Manhattan Electrical Supply Company has a line of electric heating, therapeutic and telephone instruments and other supplies on exhibition. The company manufactures the "Red Seal" dry battery, as well as other batteries and specialties, and in the center of its booth has a large section of a battery within which is depicted the North Pole with a number of red seals on the ice, the idea that the company wishes to convey being that its batteries are used everywhere. Messrs. P. R. Frost, A. B. Cole and Nate Walker are present.

Metropolitan Engineering Company, Brooklyn, N. Y., has a display board fitted with a complete line of Murray protective devices, including meter seals, fuses, cut-outs, terminal protectors, etc. Electric signs of various types and a meter distribution panel board are on view. A new type of interior illuminated sign employing tungsten lamps is featured. Mr. R. M. Mann represents the company. Immediately adjoining the booth is one of the National Ball Game Company, where several ball games are demonstrated by Mr. K. S. Chamberlain. At the rear of the booth is a revolving base ball made up of red, white and blue lamps connected to a flasher.

Moore Electric Company, Newark, N. J., makes a display of its white light especially suitable for matching colors. The lobby of the Garden is also fitted with the Moore tube. Messrs. R. F. Riblet, W. T. Dixon and V. Burnett represent the company.

National Electric Lamp Association.—The Engineering Department of the National Electric Lamp Association occupies two large booths immediately to the right of the main entrance to the arena. An unusually elaborate display of incandescent lamps is made. There is a complete line of "Mazda" 110 and 220-volt lamps from the 25-watt to the 500-watt size, together with the "Mazda" street series, sign, miniature and low-voltage lamps. The tantalum line is shown complete, including the regular 110-volt and 220-volt lamps and the street railway types. Many of these lamps are shown burning on two attractive racks while the remainder are arranged in tastily decorated display cases. A very attractive feature is presented in the "Holophane Tree," a special fixture for showing "Mazda" lamps with the different sizes of the new "Holophane Stilleto" reflectors. This unit is connected to a flasher and each size of unit is flashed separately. An automobile electric lighting outfits is displayed with head lamps, side lamps, tail lamps, limousine and meter lamps. The booth is in charge of Mr. A. J. Hitzker and Mr. H. J. Raymond of the engineering department, and a large number of representatives of the association are in attendance.

New York Electrical School has placed on exhibition the Korn photo-telegraphic machine and also exhibits by means of photographs the practical work being done in the school and the methods pursued in teaching. Drafting specimens executed by students are shown and literature bearing on the aims of the institution, methods of instruction, etc., is distributed at the booth. Since the work done in this school is primarily of a practical nature, it is hardly possible to do justice to it in an exhibit of the kind given in Madison Square Garden. Messrs. J. L. O'Connor and George J. Cox are in charge of the booth.

Opalux Company, New York, shows new wide, medium and narrow angle types of reflectors as well as the older flat and bowl types. From these styles is offered a choice of form best suited to the particular use to which the reflectors are to be put. All the forms are applicable to residential as well as to public and commercial lighting. The aim of the company is to perfect and standardize the various lines without impairing the high efficiency possessed by the reflectors. Several new forms for all popular sizes of lamps and for various lighting conditions have been brought out. Messrs. L. R. Hopton and H. M. Slauson are in attendance.

Otis Elevator Company has a working exhibit of a traction elevator giving car speeds of from 500 ft. to 600 ft. per minute. Automatic stops such as are used to stop the car at the top or bottom of the elevator hatch regardless of the operator are also shown in operation. Mr. G. H. Malcolm is in charge of the exhibit.

Pelouze Electric Heater Company, Chicago, shows for the first time its complete line of electric heating devices, including coffee percolators, chafing dishes, teapots, frying pans, boilers, water cups, etc., in addition to a full line of the well-known Pelouze irons. The stoves of this company have a patented truss structure which concentrates the heat in a copper top.

Philadelphia Storage Battery Company has an exhibition board fitted with grids and parts of batteries illustrating the make-up of the battery. A special feature of the display is its long-distance battery, which is made up of thin plates for electric vehicle work. Various types of pleasure and commercial vehicle batteries are arranged in the booth. Mr. W. L. Thompson is in charge assisted by Messrs. Davis, Marr and Everett.

Charles S. Powell & Co., New York, exhibit a 70-hour Star flaming-arc lamp and some large tungsten lamps. The largest tungsten lamp shown is rated at 1000 watts and has a specific consumption of 1 watt per candle-power. Representing the company are Messrs. C. S. Powell, W. M. Murphy, R. Irving and W. Cummings.

Reimer's Electric Heater Company, New York, has a large number of electric flatirons on view, some of which are fitted with regulating switches and some of which are not. With the former type of iron five degrees of heat are available. Demonstrators show the application of the iron in pressing cravats and clothes, and in the center of the booth is an electrically operated pleating and ironing machine. Messrs. M. V. Darcy and A. Reimer are in attendance.

Richmond Sales Company, New York, is exhibiting the "Richmond" suction cleaner in a booth bearing the inscription "One dollar puts the 'Richmond' in your home." This accords with the advertising campaign carried on by the manufacturer of the cleaner, the McCrum-Howell Company. Four of the most popular types of machines are shown as follows: The "Richmond" No. 11, a 1-hp, one-sweeper, motor-driven, direct-connected rotary-pump machine; the motor, vacuum producer, dust separator with automatic dust trip, automatic oil separator and clarifier being all mounted on a single cast-iron base. This machine is designed for residences of moderate size, or for other buildings with similar floor, wall and ceiling areas. "Richmond" No. 121, a 2-hp, one-sweeper, electric motor with a horizontal, double-acting, cylinder pump, belt-driven from

motor, complete, with dust separator, mounted on a single cast-iron base. This machine is also designed for small and medium-size residences and other similar buildings. It is silent running, positive in its action and has a dry-strainer dust separator with automatic strainer cleaner. "Richmond" No. 21, a 2-hp, one-sweeper, motor-driven, positive-acting rotary pump; direct connected and silent running with automatic control, automatic oil separator and clarifier, centrifugal-vertical dry dust separator and automatic dust trip, all mounted on a single cast-iron base. This machine is intended for large residences, small hotels, small schools, small club houses and buildings with similar floor, wall and ceiling areas. "Richmond" Nos. A-1 to A-6. This is a series of steam aspirator vacuum producers (one size of which, only, is shown) built in units of six different styles, namely, one-sweeper, two-sweeper and so on up to and including a six-sweeper unit. These units are coupled in parallel to furnish plants requiring more than six sweepers up to any number desired. The system is for heavy service in large buildings having steam of 60 lb. and over, boiler pressure. "Richmond" aspirator vacuum cleaning systems operate entirely by means of an expansive steam jet. Once the steam is turned on the vacuum is literally "on tap," like water, gas or electricity. An automatic control valve governs the steam supply, and when the tools are not in use acts as a position cut-off, thus closely proportioning the amount of steam used to the amount of work performed.

Rider-Ericsson Engine Company, New York, has as the special feature of its exhibit a working model of the "Reeco" pressure tank system. This outfit is automatically controlled; the pump maintaining a constant pressure in the tank containing the water and starting and stopping automatically according to the amount of water used by the various fixtures. Present at the booth are Messrs. W. Sayer, F. R. Chinnock and H. L. Shartle.

Rosenfield Manufacturing Company, New York, is exhibiting the "Magic" electric suction cleaner, which weighs 10 lb. The device is of the type having the bag for the dust and dirt attached to the handle. The motor runs in a horizontal position and is mounted on a carriage with two wheels. Self-feeding wick oil cups are mounted underneath each bearing and by tilting the handle downward a chain attached to the handle lifts the suction nozzle from the floor, enabling the machine to be wheeled over obstructions or to be moved about without carrying it. The suction slot is over ½ in. wide, the idea being to displace a large quantity of air under low pressure. For this purpose also a 2-in. hose is used.

Safety Insulated Wire & Cable Company, New York, exhibits a service box about 3 ft. x 4 ft. and 4 ft. high, built of brick, showing a 16-duct run, such as is installed by the company's underground construction department, connected to the box. The method of connecting a New York City fire-alarm box is shown and an ornamental tungsten post connected to the service box by short runs of conduit is on exhibition. A board having several styles of joints for deep sea submarine and underground rubber and paper-insulated cable, together with numerous photographs illustrating underground installations in various stages of completion, is displayed. Other boards illustrate in a general way the types of paper-insulated and rubber-insulated cables manufactured by this company. Fine Para rubber, which is used in making up rubber cables, is shown in the form of biscuits. Mr. G. M. Haskell is in charge of the booth. Others in attendance include Messrs. R. C. Smith, O. R. Grant and R. C. Wilson.

Santo Sales Company, New York, representative of the Keller Manufacturing Company, of Philadelphia, has on exhibition three special display Keller-Santo cleaners placed on a table or pedestal, the casing being white, red and blue. Each case has a window with corresponding colored lamps to show the working parts. Nickeled sign holders accompany the machines with silk transparent [illegible] "Keller-Santo vacuum cleaners—Made in America—Used all over the World." Use is also made of a school-house globe with a transparent sign reading "Keller-Santo cleans up the earth." Another novelty which attracts attention is a miniature house on a table with a sign reading "Have a Dustless Home." There is a large lobby frame showing interior and exterior views of the factory employees, etc., and signs indicating the nature of business, location of factory, etc. The staff of representatives is as follows: Messrs. Knowles, King, Kelsey, Nestor and Colvin. In addition Mr. David M. Wattel, besides showing pictorially the practical usages of the device from a cleaning standpoint, illustrates by means of sketches what can be done with it from an artistic standpoint.

Shelton Electric Company, New York, makes an imposing display of its hair dryers and therapeutic machines, which are made in various sizes. The company features its white enamel "Dragon" pedestal vibrator, the vibrations from which pass through the fingers of the operator, thus combining mechanical and hand massage. The strength of the vibrations is controlled by means of an ingenious lever regulating device which instantly changes the strength of vibration from a mere tremor to the most powerful stroke that can be used in vibratory massage. The Shelton portable hair dryer weighs only 2.75 lb. and throws a powerful stream of either hot or cold air. All the devices are made for standard voltages and circuits. The following persons are in attendance: Messrs. Gentry Shelton, A. J. Crowley, John Kelly, A. H. Mood, Joe Irwin, George Mood, John Mulvey and J. H. Rees.

Simplex Electric Heating Company, Cambridge, Mass., through Roger Williams, its New York agent, shows its regular line of goods, consisting of flatirons, toasters, water cups, heating pads, glue pots, boilers, irons, double boilers, frying pans, etc., etc. There is also shown a new signal switch approved for New York City use by the New York Board of Fire Underwriters which will allow the ordinary plain handle iron to be used in that district. There is also on exhibition a new, flush-type, curling-iron heater which sets into the wall, only the front plate being exposed. Three hundred and seventy-five of these devices are being installed in the Ritz Carlton Hotel, Madison Avenue and Forty-seventh Street. In addition the company shows its theater-type, curling-iron heater, which is very popular in New York. Toasters are in operation, but general cooking is avoided, as the Public Service Electric Corporation has an exhibition alongside in which Simplex goods are used to demonstrate cooking. The exhibition is in charge of Mr. Roger Williams, assisted by Messrs. Clyde A. Flint, Charles O. Haggist, John Ehler, William Weiler and Mrs. S. McGeorge.

Simes Company, New York, exhibits a line of artistic fixtures, including glass domes, shades, portables and brackets. Representing the company are Messrs. Miller, Simes and Hawkins.

Spencer Turbine Cleaner Company, of New York, shows its standard, permanently installed, turbine-type of vacuum cleaning apparatus, together with a smaller model recently designed for use in the average-sized residence. Both machines are in operation. The feature which distinguishes the Spencer from other vacuum cleaners is the very large quantity of air moved per minute and at low pressure. Cigar stumps, nails, metal rings, etc., are taken up with ease by the machines and yet, owing to the low nozzle pressures, the fabric of rugs, carpets, etc., is not destroyed. The tools employed are larger than the ordinary and possess features of merit not found in other tools. Messrs. Ira H. Spencer and E. W. Muzzy, of the home office at Hartford, Conn., are in attendance, as are also Messrs. Guy H. Noble, S. W. Bowerman and R. P. Hoover, of the New York office.

Studebaker Brothers Company, of New York, is represented at the show by Messrs. Wm. P. Kennedy, R. R. Clayton and R. W. Knowles. There are two commercial and one pleasure vehicle on exhibition. The Model 25 commercial vehicle exemplifies the latest development of electric machine

for package delivery and is intended for two lead battery equipments, each of twenty-six cells. Each of the batteries is capable of a daily city service of thirty-five miles and the two batteries can render a continuous daily service of seventy miles, which is a greater radius than can usually be covered in the time available for delivery. The battery compartment is arranged for the accommodation of the Edison battery, only forty-four cells being required either of the "A-4" or the "A-6" type, depending on the mileage desired. The machine is fitted with ball bearings throughout, and has 42-in. driving wheels. Over seventy-five machines of this size and design are in daily service in New York City. Model 27 commercial machine is intended as a light two-ton truck or for such service where two tons is the occasional maximum load. Among the features of this machine is the supplementary suspension of the battery independent of the regular vehicle springs by means of a spring cradle within the battery compartment. This has the effect of preserving the battery from vibration and consequently prolonging the life of the plates. The battery jars in this equipment are fitted with 3-in. bridges, so that sufficient space is provided for the collection of such active material as may be deposited during the useful life of the plates. The model is equipped to accommodate four sizes of lead battery and two sizes of Edison battery. Large 42-in. driving wheels reduce the jolting or vibration of the machine, lengthen the tire life by providing a greater and slower moving circumference and the increased leverage proportionately reduces the energy consumed. In the lubrication of the principal bearings oil cups and similar devices are done away with and in their stead is substituted the railway waste-box method of lubrication. The pleasure vehicle exhibited is a ladies' victoria phaeton in which the comfort of the occupant in riding has been a prime consideration and the vehicle is hung so low as to make access and egress easy. The mechanical construction is of the best and is indicated principally by the rear-axle equipment, which is of the floating type. The chassis can be equipped with a variety of bodies to suit the customer's individual requirements. The electrical and mechanical control is of the simplest type and is designed to be used in the most automatic manner suiting the convenience of the operator.

Sunray Electric Lamp Manufacturing Company, New York, shows twelve of its arc lamps in various ornamental fittings and equipped with different shapes of globes. Instruments showing the consumption of the lamps are connected in circuit, and literature describing the company's product is distributed. Mr. Max Mayer is in charge of the exhibit.

United States Lighting & Heating Company has on exhibition parts of the National batteries as well as complete vehicle batteries, sparking batteries, stationary batteries and a tungsten automobile lighting outfit. Messrs. A. H. Ackermann, A. Russell and W. G. Davis are present.

Unique Art Glass & Metal Company, New York, makes a very creditable showing of art-glass domes and portables. Mr. Bayley represents the company.

Watson-Stillman Company, New York, is exhibiting five motor-driven "Twinvolute" turbine pumps as follows: A 2-in. two-stage pump driven by a 10-hp General Electric motor and suitable for delivering 100 gal. per minute in twelve-story to twenty-story buildings. A 2-in. one-stage pump driven by 5-hp Westinghouse motor and suitable for delivering 100 gal. per minute in eight-story to ten-story buildings. Two 1-in. pumps, one driven by a direct-current and the other by a two-phase Westinghouse motor. Both of these pumps are suitable for furnishing water supply in tenement houses, six-story to seven-story buildings, factories, etc. A single-stage turbine pump driven by ½-hp Wagner motor is also shown and is suitable for water supply in private residences. In connection with the last pump there is applied the Watson-Stillman system of automatically controlling the level in the tank. This is accomplished by an automatic tank switch which starts the motor as the water level gets low, and stops it as the level reaches the desired limit. Twinvolute turbine pumps are made for any delivery from 2 gal. to 150,000 gal. per minute and for discharge pressures up to 500 lb. The exhibit is in charge of Messrs. Harry A. Prindle, John Ketcham and Frank Clark.

Westinghouse Electric & Manufacturing Company has on exhibition a representative line of the different pieces of apparatus which the company has shown for some time, the apparatus on view being the complete outfit which was shown at the Ohio Valley Exhibition in Cincinnati during the month of September. Type "S" and "SA" motors, together with controlling apparatus for constant and variable-speed work, and type "MT" and "K" motors for direct-current work, such as hoists, cranes etc., are on exhibition. Among the alternating-current motors is shown a type "MS" motor especially designed for heavy duty, such as is found in steel mills and where the service is usually hard and severe. This "MS" motor is partly dismantled to show the rigid construction of the brackets and frame. Among the small motors for use in stores and in the home there are different sizes of type "DA" and type "DZ" motors, together with representative sizes of a complete line of buffing motors for both alternating current and direct current. An interesting feature of the exhibit is a counter given over to heating and cooking apparatus. On this counter is shown a complete line of electric apparatus, such as disk stoves, toaster stoves, etc., electric radiators, air heaters and tailor's irons. A part of the tailor-iron exhibit is an automatic tailor's iron, complete with stand, this iron being so designed that it takes energy only when the iron is placed on the stand so that the operator does not have any cord attached to the iron when pressing. In the meter exhibit the company shows a graphic recording voltmeter connected to a circuit showing the fluctuations in voltage as supplied to the booth. Among the portable instruments shown are voltmeters, ammeters and wattmeters complete, with the necessary portable shunts and series transformers. The line of switchboard instruments is represented by several different types of voltmeters and ammeters. In this section of the exhibit are also shown a static ground detector, syncroscope and several types of watt-hour meters. In the arc-lamp exhibit are several magnetite arc lamps partially dismantled to show the simplicity of the design of this piece of apparatus. Controlling apparatus such as oil switches and oil circuit-breakers, some of which are provided with overload and no-voltage release devices are set up so as to be easily operated and to show the principal parts of the operating mechanism.

Westinghouse Lamp Company had burning one of each size of its new wire-type tungsten lamps for 110 volts ranging in size from 15 watts to 500 watts. As an operating exhibit for 220-volt tungsten lamps, the company shows the complete line ranging in size from 40 watts to 500 watts. The lay exhibit of lamps includes sign lamps of both carbon and tungsten filaments and a complete assortment of metalized filament lamps of all standard sizes and for all standard voltages. The company also has in its lay exhibit a few of the wire-wound street series tungsten lamps for street lighting. Among those in attendance at the exhibit are representatives from the New York offices, including Messrs. W. S. Ru[illegible] W. Nesbit, Charles Owens, C. E. Ripenski, S. Adams, [illegible] Conwell, G. F. Marriott, Phil Clegg, J. Kelly, W. C. Wa[illegible] Paul Gerhart, H. W. Flashman. Mr. W. Barnes, Jr., representing the Westinghouse Department of Publicity, of Pittsburgh, is in charge of the exhibit.

L. A. Williamson Company, Boston, Mass., shows by means of photographs and demonstrators the application of the "Flexilyte." The booth is equipped with household furniture and the demonstrators move the small portable lamps from place to place. The "Flexilyte" consists of a case containing about 15 ft. of lamp cord, an attachment plug and a crank for winding the cord on the center portion, which is a lamp socket. Messrs. L. A. Williamson and F. E. Knight are present.

Industrial and Commercial News

The Week in Trade.

PROBABLY the best thing that can be said of the condition of trade last week is that it showed some improvement in tone. There is as yet very little enlargement in general demand, and buying shows very little increase. There is little disposition to anticipate distant requirements, and trade lacks character. The same conservatism that has been referred to so often is still in evidence. Neither jobbers nor retailers are willing to invest very heavily. In fact, many retail establishments are now running on lower stocks than is customary, and are inclined to buy from hand to mouth. In the iron and steel industry there is a rather better feeling, but not much increased activity. The wire products are the best in this line. The production of pig iron continues to run ahead of requirements, but prices have not as yet been shaded. The demand for structural material is of the small lot order, but the volume in the aggregate is as satisfactory as can be expected at this season of the year. One important railroad last week placed an order for 15,000 tons of steel rails, which is the first considerable order for this commodity that has been placed for several months. Weather conditions during the week have not been satisfactory. In the East there have been unseasonably high temperature and extended drought, while the Southwest has suffered from an excess of rain. Collections as a whole are fairly good, and have been much helped in both the West and South by the free marketing of crops. Business failures for the week which ended Oct. 6, as reported by *Bradstreet's*, were 192 as against 211 the previous week, 203 in the like week of 1909, 256 in 1908, 192 in 1907 and 192 in 1906.

The Copper Market.

WITH the exception of January, the report of the Copper Producers' Association for September showed the greatest decrease on surplus stocks of any month during the year. The decrease as reported was 2,008,753 lb. The figures given out by the association for September were: Production 119,519,983 lb.; domestic deliveries 64,501,018 lb.; export deliveries 75,106,496 lb., making total deliveries of 139,607,514 lb. The decrease in production was 8,283,635 lb., and the increase in total deliveries was 10,044,463 lb. The total amount of surplus stock that is now reported to be on hand

Standard copper:

	[illegible]	[illegible]	Settling
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

The London market, Oct. 10, was as follows:

	Noon.	Close.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Extreme fluctuations for this year:

	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

in this country is 148,793,714, which is about 7,000,000 lb. more than the total stock at the beginning of the year. One of the most interesting features of the report is that production fell off during the month in actual daily average. Producers, however, are of the opinion that this decrease did not come from the curtailment policy which was adopted Aug. 1, because the results of this cannot how in refinery figures until the next statement appears. It is anticipated that the effects of curtailment will show very markedly in the report for October. It is claimed by some market authorities that the apparent decrease of 20,000,000 lb. in the surplus stocks of copper does not mean that consumption has at last caught up with production. It is said that this decrease resulted mainly from the shifting of [illegible] Such shifting, of course, does not cut any figure with actual consumption, and it is claimed that the actual melting is still as far behind the actual production as ever. In the meantime many copper authorities are very much encouraged over the situation, and Daniel Guggenheim, president of the American Smelting & Refining Company, who has just returned from Europe, declares that he has never known a period when the actual consumption of copper in Germany and England was as large as it is at the present time. Prices during the week were slightly advanced, and selling agents and producers were not inclined to make concessions. Exports for October up to and including Oct. 10 were 7202 tons. Daily call on the Metal Exchange, Oct. 10, quoted standard copper as per the accompanying table.

Industrial and Commercial Notes.

General Electric Company Contracts.—The General Electric Company is building for the Indiana Steel Company, Gary, Ind., a seven-panel switchboard to control feeders of 220 volts in its coke oven plant. The combined rating of this switchboard is 22,000 amp. The company will furnish the entire controlling equipment, among which will be four 6000-amp, six 3000-amp and two 2000-amp circuit-breakers mechanically interlocked in pairs on the outside legs, and twelve 5000-amp lever-switches. All of these parts are stock equipment. The company is also building for the Long Beach, Cal., steam station of the Southern California Edison Company a large switchboard to control one 15,000-kva, 11,000-volt turbo generator; three 2000-kw, 11,000-volt local feeders; two 11,000-volt to 70,000-volt 6000-kw step-up transformers; two 35,000-volt and two 70,000-volt outgoing lines. The company has also received an order from the Union Light & Power Company, of St. Louis, for sixteen series mercury-arc rectifier outfits for use in connection with direct-current series arc lamps. Each consists of panel, two tubes, constant-current transformer, exciting transformer, static discharger and direct-current circuit reactor. Each set will take alternating current from the line at 6600 volts and 25 cycles, and will rectify it to operate seventy-five 6.8-amp series luminous arc lamps. The General Electric Company installed for this same concern eight of these outfits about a year ago, and it is claimed that their operation has been so satisfactory that the additional order has been placed.

Moore Lamps in Europe.—The rights for France and Belgium of the Moore vacuum tube lamp have just been acquired by a group of capitalists headed by Otto Markiewicz. The new company bears the title of "La Lumière Moore," and will have its headquarters in Paris, temporarily at Hotel Regina. In connection with these transactions a series of experiments and tests of all the colors on both the tube and window forms of the lamp was conducted for the foreign capitalists by Professor Wedding, of the University of Charlottenburg. He is quoted as giving his conclusion that the Moore lamp is "the most advanced of all forms of illumination." A year ago the "Allgemeine Moore-Licht Gesellschaft" was established in Berlin and a little later an auxiliary operating company, the Moore Licht Aktiengesellschaft. Russian, Norwegian and Swedish companies have been organized within the last year and the lamps are said to be in use in more than thirty European cities.

McAdoo Tunnel Extensions.—[illegible] Railroad Company, which has received a franchise from the Public Service Commission to extend its lines from the Thirty-third Street station at Sixth Avenue to the Grand Central Station, in New York, has asked for and received an extension of six months in which to begin work. The company states that it found it impossible to prepare the necessary plans and specifications for the beginning of work on Sept. 1.

Hupp Automobile Company to Build Electrics.—[illegible] subsidiary company for the manufacture of electric vehicles. The new cars, the first one of which was recently exhibited on the streets of Detroit, embody several distinctive features [illegible]

Street Lighting in Europe.—Theodore Stave, president of the Stave Electrical Company, has recently returned from an extended trip in Europe. Mr. Staye spent several months abroad, and devoted his time largely to a careful study of the lighting situation in Europe. He says that the flaming arc for street purposes is rapidly coming into favor, and that the only drawback is the shortness of life of the electrodes. "I found that the most serious problem which is confronting the lamp people abroad, especially on the Continent, is the competition that has arisen from high-pressure gas lamps. In Berlin especially some of the important streets and many of the side streets are being lighted by these lamps. The Grætzin inverted mantle is the type of lamp that is most generally used. There has recently been a proposition made to install these lamps on high poles similar to those now used for arc lighting, and to employ enough lamps to make each unit about 3000 cp. The lamp is very satisfactory for street purposes, and its economy is recommending it. It is estimated that in Berlin there is a saving of about 300 marks per year per lamp. This, of course, includes maintenance and all costs. I found that in all of the European countries the best effort of illuminating engineers is being devoted to increasing the life of the flaming-arc lamp. In England this is being done by the use of multiple electrodes and employing a magazine type lamp. On the Continent the principal efforts are being directed toward increasing the longevity of the electrode itself. The multiple system, of course, saves nothing in the cost of electrodes, but only in the labor of trimming. There are many places, however, in both England and on the Continent where arc lamps are being taken down and being replaced by high-pressure gas installations. One notable instance is on Regent Street and the Strand in London. It is generally admitted that the flaming arc is the ideal lamp for street lighting, but the question of economy is causing municipalities to hesitate about installing it. I believe, however, that before many months there will be on the market a number of long-burning lamps, and that the expense of flaming arcs for street lighting will be materially reduced. In many of the small cities, especially in England, gasoline lamps are being used for street lighting, the gas being distributed from central stations. Of course, the candle-power of these lamps is small, and they are mainly replacing tungsten and old-style gas lamps. I was told, while in Europe, that the Allgemeine Elektricitäts Gesellschaft had developed a flaming-arc lamp with a life of 150 hours. General trade conditions in the electrical industry are very satisfactory abroad, especially in Germany. It appeared to me that more business was being done over there than in this country."

Baltimore Consolidated Gas, Electric Light & Power Company.—S. Davies Warfield has resigned the chairmanship of the board of directors of the Consolidated Gas, Electric Light & Power Company of Baltimore. He has been succeeded by James E. Aldred, president of the Pennsylvania Water & Power Company, who was also elected vice-president and chairman of the executive committee. It is the general understanding that this change in the management of the Consolidated Gas, Electric Light & Power Company means that hereafter the counsels of the Pennsylvania Water & Power Company will be important in the management of the concern. H. S. Holt, Montreal; E. R. Wood, Toronto; Charles E. F. Clark, vice-president of the Pennsylvania Water & Power Company, and Norman James, Baltimore, were elected to the board of directors of the Consolidated company to fill vacancies. It is given out that the policy of the new management, when the energy from the McCall Dam installation is brought in, will be to encourage manufacturing plants in Baltimore. Especial concessions will be granted new concerns locating in the city, and the effort will be to make the manufacturing cost in Baltimore as low as in any city in the country. The annual report of the company for the year ending June 30, which was filed last week, showed gross earnings of $4,699,097, as against $4,449,275 in 1909; operating expenses were $2,265,533 as against $2,279,577 in the year previous. The surplus available for dividends at the end of the year was [illegible]

Baltimore Refrigerating & Heating Company.—A plan for the reorganization of the Baltimore Refrigerating & Heating Company, of Baltimore, has been agreed upon. The court will be petitioned to sell the property at once. The old com- [illegible] a new one which is to be formed It was explained that New York financiers who were interested in the company have assisted Richard B. Fentress, of Norfolk, in re-financing the corporation, and are largely instrumental in perfecting the plan which has been agreed upon. The new company will ask consent of the Public Service Commission of Baltimore for authority to issue at least $2,000,000 worth of treasury bonds, which will be sold from time to time to develop the property. The new interests in the company will provide for the immediate expenditure of $100,000 for improvements to the plant. An extension of the corporation's pipes down to the City Hall will be made so as to carry out the contract for heating that building recently received from the municipality. It is not yet known whether the corporation will add an electric lighting feature to its business. From an authentic source it was learned that a meeting of the new interests behind the corporation would be held some time next week, and at this meeting the fate of the electric lighting business will be determined, which it is claimed they have a right to do under the Fentress-Medairy ordinance.

Favors a Municipal Plant.—The report on the city of Baltimore's electric light rates which Superintendent of the Department of Lamps and Lighting Robert McCuen has had in preparation for the past six months was made public last week. Among the most important recommendations was that a municipal electric lighting plant for municipal buildings and street lighting be erected to cost, including power plant, real estate, transmission lines, horses, wagons, tools, etc., $909,050. The report also says that the maintenance cost, including interest on investment, taxes, depreciation, rentals, etc., would be $247,606. Mr. McCuen further says that the cost of arc lamps would be per annum, $43.29. Present prices charged by the Consolidated Gas Electric Light & Power Company: In underground districts, $75; in overhead districts, $60.25. The report says that the cost of current for buildings would be 1.9 cents per kilowatt hour. Present price to municipal buildings 3 to 6 cents per kilowatt hour. The report declares that competition of private interests with the Consolidated company is practically impossible.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Eaton, Ind.; Jacksonville, Fla.; Hudson, Wis.; Colfax, Ia.; Broadlands, Ill.; Mason City, Ia.; Orlando, Fla.; Columbia, Mo.; Morganton, N. C.; Erwin, Tenn.; Foster Falls, Va.; McPherson, Kan.; Quesnal, B. C., Can.; Dillsburg, Pa.; Belair, Md.; Halifax, N. S., Can.; Springfield, Cal.; Kankakee, Ill.; Greensboro, N. C.; Wamego, Kan.; Hunters, Wash.; Drexel, Mo.; Sidney, Neb.; Seward, Neb.; Kansas City, Mo. and Youngstown, Ohio.

Central Colorado Power Company.—The main office of the Central Colorado Power Company has been moved from Denver to New York City, and will be located at 24 Broad Street. G. H. Walbridge, president of the company, O. B. Willcox, vice-president and head of the legal department, and John T. Adams, attorney, have moved from Denver to New York. E. L. West, who was made general manager to succeed Mr. Walbridge, when the latter was elected president, will be in complete charge in Denver.

Pennsylvania Railroad Tunnels.—The Pennsylvania Railroad Company has officially announced that it will begin service through its Hudson River tunnels between Harrison, N. J., and the new station in New York City on Nov. 27. The company has had delivered enough electric locomotives for the service, and the electrical equipment was installed some time ago. The delay in opening the tunnels was due to the fact that the signal service installation had not been completed.

Electric Delivery Wagons for Detroit Store.—The Anderson Carriage Company, Detroit, has furnished to the Newcomb-Endicott Company, of Detroit, the first consignment on an order for thirty 1,000-lb. Detroit Electric delivery trucks, for its retail business. The wagons will be equipped with Edison storage batteries.

Equipment for New York Lighting Companies.—The General Electric Company has recently sold to the Bronx Gas & Electric Company one 2000 kw turbo generator, and to the Queens Borough Gas & Electric Company a unit of the same size.

Financial.

THE WEEK IN WALL STREET.

SENTIMENT as regards securities and money conditions continues to improve, according to the majority of authorities in Wall Street. In the meantime there is very little improvement in business, and while prices have advanced there is little evidence of outside buying. Apparently the stock market has been pretty well liquidated, and there is not a great deal of stock offered for sale. This is especially indicated by the fact that adverse news, political or otherwise, seems to have little effect upon the market and causes no slump. If long lines of stock were being carried, this would not be the case.

NEW YORK.

	Oct. 3.	Oct. 10.	Shares sold.		Oct. 3.	Oct. 10.	Shares sold.
All.-Ch.	[illegible]	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All. Ch., pfd.	[illegible]	34	1,675	Mackay Cos..	92	[illegible]	[illegible]
Amal. Cop...	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am. D. T....	20½*	20½*	—	[illegible]	[illegible]	[illegible]	[illegible]
Am. Loc.....	39	37⅜	4,200	Met. St. Ry..	15*	[illegible]	———
Am. Loc., pfd	102½*	[illegible]	1,200	N.Y.&N.J.Tel.	139¼*	[illegible]	———
Am. Tel. & C.	75*	[illegible]	1,100	Steel, com...	70⅛	[illegible]	[illegible]
Am. T. & T.	[illegible]	137⅝	4,755	Steel, pfd....	117⅝	[illegible]	[illegible]
B. R. T....	[illegible]	76½	11,200	W. U. T....	74½	[illegible]	[illegible]
Gen. Elec....	146	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Int.-Met.	21	20⅝	12,350	West'h, pfd..	128¼	[illegible]	[illegible]

PHILADELPHIA.

	Oct. 3.	Oct. 10.		Oct. 3.	Oct. 10.
Am. Rys.	43¼*	[illegible]	[illegible]	[illegible]	[illegible]
Elec. Co. of A.....	11½	[illegible]	[illegible]	[illegible]	[illegible]
Elec. St. B'ty......	48⅜	[illegible]	[illegible]	[illegible]	[illegible]
E. S. B'ty, pfd.....	30*	[illegible]	[illegible]	[illegible]	[illegible]

CHICAGO.

	Oct. 3.	Oct. 10.		Oct. 3.	Oct. 10.
Chi. City Ry........	[illegible]	180*	Chi. Tel. Co.......	120	[illegible]
Chi. Rs., Ser. 1.....	64½	[illegible]	[illegible]	[illegible]	[illegible]
Chi. Rs., Ser. 2.....	15½*	[illegible]	[illegible]	[illegible]	61*
Com. Edison........	112*	[illegible]	[illegible]	[illegible]	[illegible]
Chi. Subways.......	4	[illegible]	[illegible]	[illegible]	[illegible]

BOSTON.

	Oct. 3.	Oct. 10.		Oct. 3.	Oct. 10.
Am. T. & T.......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cum. Tel..........	143*	[illegible]	[illegible]	[illegible]	[illegible]
Edison E., Ill......	258	270	N. E. Tel..........	130*	131½*
Gen. Elec..........	145¼*	151	W. T. & T..........	15	[illegible]
Mass. E. Ry.......	[illegible]	19⅝*	W. T. & T., pfd....	90*	[illegible]
Mass. E. Ry., pfd...	84¾	[illegible]			

*Last price quoted.
Shares sold for week Oct. 3 to Oct. 8.

The most important news feature that has occurred within the last week is the announcement of the United States Steel Corporation that unfilled orders at the end of September amounted to only 3,158,106 tons, which is the lowest monthly report ever made by the big corporation, with one exception, since its organization. Orders for new business have been coming in at a very slow rate, although it said that prices in many instances have been shaded in order to encourage business. Although it is generally admitted that the political situation is more complicated than for a number of years, it apparently has less influence upon the Street. In fact, there is less political talk in financial centers than in many years when the situation was of far less importance. The bond market, which showed some little improvement a few weeks ago, has not continued to develop. While there are quite a number of inquiries, there is not a great amount of buying and prices have not advanced to any material extent. The money market continues to be easy, but the situation is not altogether as lovely as it was three months ago. The banks have lost a considerable amount of their surplus reserve, and the report of the New York bank examiner that the savings institutions had lost a large number of deposits has been somewhat disturbing. Quotations Oct. 10 were: Call, 1½@2⅞ per cent.; 90 days 4⅝@4¾ per cent. The quotations in the table are those of the close Oct. 10.

FINANCIAL NOTES

Western Union Valuation.—At the meeting of the executive committee of the Western Union Telegraph Company last week a report was received from the special auditing committee consisting of Edward J. Hall, Jacob H. Schiff and Henry A. Bishop, which has for a number of months been making a thorough examination of the books and property of the company. In this work the committee was assisted by Price, Waterhouse & Company, expert accountants, and Westinghouse, Church, Kerr & Company, engineers. The report shows assets: Property account, $135,169,171; other securities owned, $30,033,640; material and supplies, $2,752,089, and current assets, $4,613,188, making a total of $172,568,088. The total liabilities, including $144,265,093 capital account, amount to $164,834,396, leaving a surplus of $7,733,692. The value of the telegraph property is stated at adjusted book figures, and represents the approximate replacement cost. No provision was made in the report for accrued depreciation, nor was any allowance made for the going value of the company's organization. With the report the accountants submitted a report of the business for the fiscal year which ended June 30, 1910, showing total earnings of $32,752,111, and operating expenses, including taxes, of $26,614,303. The net profit, including income from loans and investments, was $7,274,904.

Union Switch & Signal Company.—The stockholders of the Union Switch & Signal Company, of Swissvale, Pa., have been notified that a special meeting will be held Dec. 14 to vote on the proposition to increase the capital stock from $2,500,000 to $5,000,000. It is understood that the approval of the proposed increase will be followed by the declaration of a 60 per cent stock dividend out of the new stock, which will be distributed to both common and preferred stockholders pro rata. The remaining 40 per cent will be held in the treasury, and the directors will issue it from time to time to increase the working capital to meet the increased demands of the company. This proposed increase in the capital stock of the company is the first since it was organized. The present capitalization is divided into $500,000 preferred and $2,000,000 common, on both of which there have been regularly paid 12 per cent dividends each year.

Westinghouse Machine Company.—A special meeting of the stockholders of the Westinghouse Machine Company has been called for Dec. 8 to vote on a proposition to increase the indebtedness. While it is not definitely given out what this proposition will be, it is assumed that it is for the purpose of authorizing the financing of a new form of notes. The plan through which the company emerged from the receivership in March, 1908, provided for the issue of three-year, 6 per cent notes. The total amount of notes issued was $7,200,000, and of this amount there were outstanding at the time of the annual meeting last June $6,473,000. These notes fall due next spring, and some provision must be made for taking care of them.

Michigan Companies Issue Bonds.—The State Railway Commission of Michigan has granted to the Grand Rapids & Muskegon Power Company the authority to issue $2,215,000 in bonds; to the Pontiac Power Company to issue $114,000, and to the Bay City Power Company to issue $500,000. These properties are all subsidiaries of the Commonwealth Power Railway & Light Company, the holding concern which was organized last year by Hodenpyl, Walbridge & Company and E. W. Clark & Company. The Michigan authorities declined to allow the holding company to issue bonds, because no appraisement had been made of the physical value of the properties.

Luzerne County Gas & Electric Company.—The Luzerne County Gas & Electric Company, of Plymouth, Pa., has purchased the plant of the Wyoming Electric Light & Power Company, which has been controlled by the Temple Coal & Iron Company. The towns of Wyoming and West Wyoming have been supplied with energy from this plant, and notice has been sent to the municipal authorities of these towns that the company would begin at once to improve both the plant and distributing service. The Luzerne County company now controls the lighting systems of quite a number of townships, including the gas service, in that section.

Southern New England Telephone Company.—The Southern New England Telephone Company has increased its capital stock by $1,099,100. This increase was made to provide for extensions planned and in progress. The stockholders who are recorded Oct. 15 have the right to subscribe to the new stock at par in the proportion of one share of new stock for each multiple of seven shares held. Subscriptions will be payable $50 on Jan. 18, 1911, and $50 on Oct. 18, 1911. Last week Messrs W. F. Henney, of Hartford; A. H. Bullard, of Bridgeport, and Charles E. Lyman, of Middlefield, were elected members of the board of directors.

Commonwealth Edison Company.—The Chicago Stock Exchange has just added to its list $2,875,000 Commonwealth Edison stock, and $9,022,000 first mortgage, 5 per cent bonds. This stock is the increase which was authorized a year ago, the final payment on the subscription for which will be due Nov. 1. The bonds were sold to a syndicate a couple of months ago, and part of them were used to refund Chicago Edison 5 per cent bonds. The company's total stock listed in Chicago is $32,875,000. The total bonds listed are $27,022,000.

Great Maryland Combination Reported.—There are rumors in Baltimore that plans are being formed for a great public utility consolidation which may involve a capitalization in the neighborhood of $150,000,000. This rumor has grown up since James E. Aldred has become the dominant spirit in the Baltimore lighting situation. The corporations that are named in connection with the rumored consolidation are: Consolidated Gas, Electric Light & Power Company; Pennsylvania Water & Power Company; Washington, Baltimore & Annapolis Electric Railway; United Railways & Electric Company; Maryland Electric Railways and Annapolis Short Line. Details for the merger have not as yet been made public, but it is believed by many financiers that such a deal is being contemplated and that the Maryland Public Utilities Commission will be called upon to give its consent.

General Motors Company.—Practically all the details of the negotiations of the $15,000,000 issue of the General Motors Company 6 per cent five-year notes have been arranged, and within a few weeks the company will be perfectly easy in its finances. The notes were put out by Lee, Higginson & Company, J. & W. Seligman & Company, Kuhn, Loeb & Company and the Central Trust Company, of New York. The total authorized issue is $20,000,000, and the $5,000,000 balance between the authorization and the present issue is to be held for future uses. These notes will be redeemable at 102.5 and interest on any of the interest paying dates.

Rockingham Power Company.—When the property of the Rockingham Power Company, near Wadesboro, N. C., was offered at auction last week by the reorganization committee, there was no bid received. The upset price was $1,000,-000, and the sale only covered the interest of the reorganization committee in the property.

DIVIDENDS.

American Light & Traction Company, preferred, quarterly, 1½ per cent; common, quarterly, 2½ per cent cash, 2½ per cent stock, all payable Nov. 1.

Brooklyn City Railroad Company, quarterly, 2 per cent, payable Oct. 15.

Dallas Electric Corporation, semi-annual first preferred, 3 per cent, second preferred 1 per cent, both payable Oct. 10.

East St. Louis & Surburban Company, preferred, quarterly, 1¾ per cent, payable Oct. 15.

Edison Electric Illuminating Company of Brockton, semi-annual, $4 per share, payable Nov. 1.

Fort Smith Light & Traction Company, preferred, quarterly, 1¾ per ecnt, payable Oct 15.

Lowell Electric Light Corporation, quarterly, 2 per cent, payable Nov. 1.

Northern States Power Company, Chicago, preferred, quarterly, 1¾ per cent, payable Oct. 15.

Public Service Investment Company, Boston, preferred, quarterly, 1½ per cent, payable Nov. 1.

Rio de Janeiro Tramway Company, quarterly, 1¼ per cent, payable Nov. 1.

United States Rubber Company, quarterly, first preferred, 2 per cent, second preferred, 1½ per cent, both payable Oct. 31.

J. G. White & Company, preferred, quarterly, 1½ per cent, payable Nov. 1.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Baton Rouge Electric Company:					
[illegible]	[illegible]	[illegible]	[illegible]	$1,945	[illegible]
[illegible]	8,681	[illegible]	[illegible]	1,951	[illegible]
[illegible] Company:					
[illegible]	[illegible]	40,236	[illegible]	30,222	10,918
[illegible]	74,405	40,071	34,334	30,441	4,893
Cape Breton Electric Company, Ltd.:					
[illegible]	[illegible]	15,703	[illegible]	6,174	8,900
[illegible]	[illegible]	13,806	12,863	[illegible]	6,056
Dallas Electric Corporation:					
[illegible]	[illegible]	82,637	[illegible]	25,659	9,961
[illegible]	[illegible]	72,270	[illegible]	28,649	11,883
Columbus (Ga.) Electric Company:					
[illegible]	39,328	16,539	22,789	17,887	4,902
August, 1909	31,783	20,311	11,472	12,677	*1,205
Edison Electric Illuminating Company, of Brockton:					
[illegible]	[illegible]	14,281	9,029	4,864	4,165
[illegible]	19,792	12,734	7,058	3,620	[illegible]
El Paso (Tex.) Electric Company:					
[illegible]	46,897	[illegible]	[illegible]	8,215	[illegible]
August, 1909	46,447	28,546	[illegible]	8,259	9,642
Galveston Houston Electric Company:					
[illegible]	124,764	65,932	58,832	[illegible]	32,867
[illegible]	[illegible]	[illegible]	48,319	21,679	26,640
[illegible] Electric Company:					
[illegible]	47,043	27,100	19,943	9,494	10,449
[illegible]	38,782	[illegible]	17,490	9,520	[illegible]
Lowell (Mass.) Electric Light Corporation:					
[illegible]	[illegible]	19,636	12,031	4,863	7,168
August, 1909	26,665	15,048	11,617	4,817	6,800
Minneapolis General Electric Company:					
[illegible]	[illegible]	38,734	[illegible]	31,753	[illegible]
August, 1909	77,508	36,896	40,612	30,027	[illegible]
Norfolk & Portsmouth Traction Company:					
[illegible]	188,834	100,500	88,334	64,865	[illegible]
[illegible]	[illegible]	96,336	[illegible]	63,118	14,756
Northern Texas Electric Company:					
[illegible]	[illegible]	63,953	55,860	20,300	[illegible]
August, 1909	109,422	57,893	[illegible]	17,190	[illegible]
Paducah Traction & Light Company:					
[illegible]	20,780	[illegible]	8,973	7,071	1,902
[illegible]	[illegible]	11,281	8,649	6,618	[illegible]
Pensacola Electric Company:					
[illegible]	24,177	14,482	9,695	5,244	[illegible]
[illegible]	22,205	12,514	9,691	4,373	[illegible]
[illegible] Electric Railway Company:					
[illegible]	173,989	100,169	73,820	[illegible]	[illegible]
[illegible]	194,383	[illegible]	80,516	48,800	31,716
Quebec Railway, Light & Power Company:					
[illegible]	[illegible]	64,029	65,294	......	......
[illegible]	[illegible]	[illegible]	57,377	......	......
Savannah Electric Company:					
[illegible]	56,870	38,680	[illegible]	18,181	9
[illegible]	53,931	36,384	17,547	17,435	112
Seattle Electric Company:					
[illegible]	[illegible]	[illegible]	220,824	[illegible]	[illegible]
[illegible]	610,816	[illegible]	298,697	108,588	[illegible]
Sierra Pacific Electric Company:					
[illegible]	[illegible]	14,206	[illegible]	6,028	[illegible]
[illegible]	44,054	11,891	[illegible]	[illegible]	[illegible]
Tampa Electric Company:					
[illegible]	[illegible]	25,070	[illegible]	[illegible]	[illegible]
[illegible]	48,468	28,803	19,665	4,595	[illegible]
Twin City Rapid Transit Company:					
[illegible]	660,656	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	661,086	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	353,190	[illegible]	125,181
[illegible]					
[illegible]	[illegible]	26,614,303	[illegible]	1,687,830	[illegible]
Year ended June 30, 1909	30,541,072	[illegible]	7,347,106	1,732 250	5,614,856

General News

Construction News.

MONTGOMERY, ALA.—The City Council has granted the Montgomery Traction Company a franchise to construct and operate an electric light and power plant in Montgomery. It is understood that the plant will cost about $500,000.

NORTH BIRMINGHAM, ALA.—The Greensboro Supply Company is reported to be in the market for a 100-kw, 440-volt, 60-cycle, 3-phase alternator, belted type, speed not to exceed 900 r.p.m., complete with exciter, switchboard, etc.; also a generator with a rating of from 65 to 100 kw, 2-phase, 60-cycles, and one 25-hp motor for same.

ASHDOWN, ARK.—John P. Logan, of Grannis, Ark., is reported to have applied to the Council for a franchise to construct and operate an electric light plant and ice plant in Ashdown.

ELDORADO, ARK.—It is reported that negotiations have been closed whereby the plant and holdings of the Eldorado Light & Water Company have been purchased by A. B. Banks & Company, of Fordyce, Ark. It is understood that the consideration was about $125,000.

FRESNO, CAL.—The San Joaquin Light & Power Company, it is said, will issue at once $1,500,000 in capital stock, the proceeds to be used for developing and extending its system. The stockholders also authorized an issue of $25,000,000 in bonds. The company has absorbed all other light and power companies in the valley.

LONG BEACH, CAL.—The Southern California Edison Company has recently placed an order with the General Electric Company, of Schenectady, N. Y., for a large switchboard to control one 15,000-kva, 11,000-volt turbo-generator; three 2000-kw local feeders; two 11,000-35,000 to 70,000-volt, 6000-kw step-up transformers; two 35,000-volt and two 70,000-volt outgoing lines.

LOS ANGELES, CAL.—Irving E. Bush, of Rialto, Cal., and Thomas Fellows, of Los Angeles, Cal., are reported to be interested in a project to build a dam 700 ft. high across the Colorado River, just across the California line in Arizona and close to the Nevada border. The proposed dam would form a lake 55 miles long, about a mile in width with an average depth of 350 ft. It is estimated that 1,500,000 hp could be developed.

LODI, CAL.—Plans are being considered by the City Council for the installation of a municipal electric light plant in Lodi.

MARICOPA, CAL.—The Midway Light & Power Company is reported to have taken over the plant and holdings of the West Side Electric Company. E. H. Rose, of Los Angeles, Cal., has been appointed local manager.

MARTINEZ, CAL.—The Richmond Light & Power Company has been granted a franchise by the Board of County Supervisors to erect transmission lines along the public highways of the county.

MARTINEZ, CAL.—The Town Trustees are reported to be contemplating the installation of a new water plant, equipped with electric power and gasoline apparatus, the cost of which is estimated at $31,000.

MORGAN HILL, CAL.—The citizens are reported to be considering the question of calling an election to vote on the proposition to issue $20,000 in bonds for the installation of water and light systems.

PASADENA, CAL.—Announcement has been made by Mayor Earley that the City of Pasadena will put in an application at once for energy to be supplied by the Owens River electric plant, owned by the City of Los Angeles, when completed.

SANTA CRUZ, CAL.—The City Council has accepted the proposition submitted by the Coast Counties Light & Power Company for lighting the city for a term of years. Under the terms of the contract the company is to furnish arc lamps for lighting the entire city at the rate of $4.50 per arc lamp per month.

SMARTVILLE, CAL.—Work has commenced on the construction of a substation in Smartville. The plant will supply electricity for lamps and motors in this town and vicinity. The Tarr Mining Company has equipped the machinery in its mines for electrical operation.

SPRINGVILLE (P. O. OXNARD), CAL.—The Holley Electric Railway Company has recently purchased a site in Springville on which it will [illegible]t a power plant. Work on construction of the plant will begin in the [illegible] future.

[illegible], CAL.—The West [illegible] property of the Moran Electric Company, owned principally by the busi[illegible] the [illegible] side [illegible] be [illegible] from [illegible]

[illegible], CAL.—The [illegible] a new transmission line with heavier wires, preparatory to making a change in its power plant. The generator, which has been located one-half mile east of the town will be moved to the town and installed so as to work in conjunction with the power house of the Truckee Lumber [illegible]

NEW BRITAIN, CONN.—The contract for lighting Central Park has been awarded by the Board of Public Works to the Housatonic Power Company. The company agrees to furnish 70-watt lamps at $20 each per year.

JACKSONVILLE, FLA.—The Board of Trustees has engaged the Scofield Engineering Company, of Philadelphia, Pa., to prepare plans and supervise the construction of the new municipal electric plant to be erected on the property recently acquired on Talleyrand Avenue. The new station when completed will have an output of 7000 kw, provisions being made for future extensions. The two 500-kw units and two 1500-kw units in the present station will be utilized. The entire cost of the new plant is estimated at $375,000, but with the present equipment to be utilized, it is estimated that the city will only have to meet an actual expenditure of $280,000 in the next fourteen months.

ORLANDO, FLA.—Plans and specifications for an electric light plant, water works and sewer systems are reported to have been submitted to the committee by W. W. Lyon, civil engineer, of Jacksonville, Fla. A. L. Beck is chairman of committee in charge.

FAIRBURN, GA.—The Fairburn and Atlanta Railway & Electric Company has applied to the State Railroad Commission for permission to issue $75,000 in capital stock and $50,000 in first mortgage bonds. The company is building an electric railway from Fairburn to Union City, via College Park.

MADISON, GA.—An extensive survey of the water power of the Apalachee River has recently been made by the Apalachee Power Company, of Madison, Ga., under the direction of T. B. Johnson, engineer. It is understood that the company is contemplating the erection of a large power plant to supply electricity to towns and villages in this section.

WAILUKU, HAWAII.—Plans are being considered by the Wailuku Electric Company to install an electric light plant. It is understood that the company will only furnish electricity for lamps at first, but later will provide for power service.

WEISER, IDAHO.—The Weiser Pipe Line Company is reported to have awarded a contract for the installation of an electric pumping plant to Charles L. House, of Weiser, Idaho. Water will be pumped from the Snake River for irrigating purposes.

BROADLANDS, ILL.—It is reported that negotiations have been closed whereby C. W. Hagerman, of Villa Grove, Ill., will supply electrical service in Broadlands. Electricity will be supplied from the plant at Villa Grove. It is understood that additional machinery will be installed at the Villa Grove plant.

CARLYLE, ILL.—The contracts for construction of an addition to and equipment for the municipal electric light plant have been awarded as follows: For construction of building to W. T. Fink, of Carlyle, Ill., for $3,181, and to the Russell Manufacturing Company, of Massillon, Ohio, for machinery, including a 225-hp engine, two new boilers and generator.

CHAMPAIGN, ILL.—The Illinois Traction System, it is reported, will commence work on the construction of interurban railways out of Atchinson, Kan., next spring. It is proposed to build one line up the Kansas side of the Mississippi River, another to Leavenworth, and one to Topeka.

CLINTON, ILL.—The Mayor is reported to have appointed a committee from the City Council to make investigations in regard to using electricity instead of steam power for the municipal water works system.

DECATUR, ILL.—It is reported that the Decatur and Macon County Hospital Association is contemplating the erection of a new power house to supply electricity for the new hospital, which is to be erected in Decatur.

EAST ST. LOUIS, ILL.—Plans are being considered by the lighting committee of the City Council to install cluster lamps in the business district of the city, if satisfactory arrangements can be made with the lighting company. The city now has a contract with the Consumers' Light, Heat & Power Company, under which arc lamps are supplied at $70 each per year. The members of the Retail Merchants' Association pay the cost of the arches strung across the streets.

ELGIN, ILL.—The Elgin Traction Company has applied to the City Council for a franchise to construct and operate an electric railway in [illegible]

KANKAKEE, ILL.—The Chicago, Kankakee & Champaign Electric [illegible] power plant at Urbana, and also one at Kankakee. George M. Bennett, of Urbana, Ill., is president

[illegible], ILL.—[illegible] recently incorporated for the purpose of manufacturing sheet specialties of all kinds, it is understood, will purchase machinery, including electric motors, for its palnt.

MOUNT CARMEL, ILL.—J. M. Mitchell, receiver of the Mount Carmel Gas & Electric Company, is reported to have applied to the United States Court for permission to issue receiver's certificates to the

[illegible] plant in this city. A. R. Manley is superintendent.

ROCK ISLAND, ILL.—Sealed proposals will be received at the office of the commanding officer, Rock Island Arsenal, Rock Island, Ill., until Oct. 20 for furnishing at the Rock Island Arsenal one 50-hp, 50-volt, compound-wound, double-connected motor, with pulley, slide rails and starting rheostat.

SIDNEY, ILL.—Preparations are being made for the construction of a municipal electric light plant in Sidney.

SPRINGFIELD, ILL.—Steps have been taken toward the organization of a new company for the purpose of constructing an interurban railway connecting Springfield, Cantrall, Athens, Petersburg, Sweetwater and Greenview. An appropriation of $6,000 has been made for surveys and other expenses. Homer J. Tice, of Greenview, Ill., is president of the company; George L. Harnsberger, of Springfield, Ill., vice-president, and Samuel E. Prather, secretary.

SPRINGFIELD, ILL.—The repair shops of the Wabash Railroad in Springfield are being equipped for electrical operation. Electricity for operating the machinery will be supplied by the Springfield Light, Heat & Power Company. The steam service will be discarded.

STERLING, ILL.—It is reported that the Sterling Hydraulic Company has rejected a proposition submited by J. G. White & Company, of New York, N. Y., to rent the new power station at the government dam for a period of thirty years. It was decided to make a proposition to Chester Griswold, of J. G. White & Company, that a new company be formed, consisting of the members of the present hydraulic company, to take over the new power plant, refund the money invested there by R. Griswold Wire Mill Company and pay a larger annual rental per horsepower to the old company than that offered by J. G. White & Company.

TAYLORVILLE, ILL.—It is reported that the Taylorville Gas & Electric Company and the City of Taylorville have come to an agreement, and a resolution has been passed by the City Council granting the company a franchise for a term of twenty-five years.

TROY, ILL.—The St. Louis & Eastern Traction Company, which proposes to construct an electric railway to connect Granite City, Greenville, Troy, Highland and Pocahontas, will soon apply for a franchise to build its road through Troy. A. W. Crawford, of Hillsboro, Ill., is interested in the project.

BOONVILLE, IND.—The City Council has passed an ordinance favoring the construction of a power plant for the water works system.

EATON, IND.—The Town Council has granted the American Gas & Electric Company a franchise to construct and operate an electric system in Eaton, the service to be in operation within 18 months. The town has contracted with the company for street lighting, under the terms of which the company is to furnish arc lamps at the rate of $100 per lamp per year. Ultimately the transmission lines of the company will be extended to other towns and cities from its central power plant in Muncie. William T. Haywood, of Muncie, is attorney for the company.

EVANSVILLE, IND.—The Evansville & Eastern Electric Railway Company is reported to be contemplating the extension of its railway to New Albany, for which surveys are now being made.

EVANSVILLE, IND.—Preparations are being made by the Evansville, Mt. Carmel & Olney Electric Company for the construction of its proposed electric interurban railway to connect Evansville, Ind., Mt. Carmel and Olney, Ill., 65 miles in length. A. Knoph, of Olney, Ill., is president of the company.

FORT WAYNE, IND.—The Home Telephone Company has begun work on the erection of a new telephone line from Fort Wayne to Hicksville, Ohio.

GARY, IND.—The Indiana Steel Company, of Gary, Ind., has recently placed a contract with the General Electric Company, of Schenectady, N. Y., for a seven-panel switchboard to control 220-volt feeders in its coke oven plant. The General Electric Company will furnish the entire controlling apparatus, including four 6000, six 3000 and two 2000 amp circuit breakers mechanically interlocked in pairs on the outside legs and twelve 5000-amp lever switches. The combined feeder capacity of this switchboard is 22,000 amp at 220 volts and 25 cycles.

ONTARIO, IND.—It is reported that the Riverside Electric Company is contemplating the erection of an electric light and power plant in Ontario. W. H. Cain is president.

SOUTH BEND, IND.—The Indiana & Michigan Electric Company has commenced work on the rebuilding of its plant in this city. The new building is being built around and over the old power house.

SULLIVAN, IND.—The new central station of the Sullivan County Electric Company is practically completed and the company will soon supply electricity to a number of surrounding towns from six to twelve miles distant.

[illegible] electric light and power plant, has secured a franchise in Prairie City, six miles distant. A 6600-volt transmission line will be erected; the company is in the market for materials for the same. C. A. Archer is superintendent.

DES MOINES, IA.—The construction of an electric interurban railway to Red Oak is under consideration. The members of the Greater Des Moines committee are reported to have agreed to raise $200,000 for construction of the proposed railway.

LEON, IA.—The Leon Electric Company, it is reported, is extending its transmission lines to Decatur for the purpose of supplying electricity in that town.

MASON CITY, IA.—The Missouri Iron Company is reported to have entered into a contract with the Upper Iowa Power Company for electrical power. It is understood that an 800-hp turbine and a 750-kw generator will be installed at once.

CAWKER CITY, KAN.—The contract for electrical equipment for the municipal electric plant, including wire, poles, switchboard, lamps, insulators, etc., has been awarded to the Fairbanks-Morse Company.

EMPORIA, KAN.—It is stated that a franchise has been granted to Dayton, Ohio, parties for the construction of an electric street railway in Emporia. It is understood that the deal includes the purchase of the local municipal electric plant by the same parties. O. M. White, of Emporia, is chairman of the local committee.

FORT SCOTT, KAN.—The contract for the construction of the new power house of the Fort Scott Gas & Electric Company has been awarded to William Cassell, of the Fort Scott Planing Mill Company, to cost about $6,000. H. Wurdack, of St. Louis, Mo., electrical engineer, is reported to have been engaged to take charge of the installation of the plant.

HUTCHINSON, KAN.—The City Council of South Hutchinson has granted the United Water, Gas & Electric Company, of Hutchinson, Kan., a franchise to furnish electricity for street lighting in that city.

KANSAS CITY, KAN.—The Metropolitan Street Railway Company is preparing plans for the extension of its system in Kansas City, Kan.

McPHERSON, KAN.—Preparations are being made to enlarge the municipal electric light plant, including the installation of additional equipment, as follows: A 150-kw generator, Corliss engine with a rating of from 100 to 150 hp, boiler, switchboard and transformer.

PARSONS, KAN.—It is reported that the proposition to issue $50,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant, will be submitted to a vote at the general election in November.

SYLVIA, KAN.—At an election to be held soon the proposition to issue $5,000 in bonds for the construction of an electric light plant will be submitted to a vote.

TONGANOXIE, KAN.—Plans are being considered for the organization of a company to construct an artificial lake and power plant on the low lands, north of Tonganoxie. The proposed plant will furnish power to manufacturing industries in Tonganoxie.

WAMEGO, KAN.—The City Council is considering the question of increasing the output of the municipal electric light plant. It is proposed to install a 150-kw generating unit, either steam turbine or direct-connected unit. The question of furnishing approximately 50 hp to single-phase motors is under consideration. D. A. Course is superintendent of the light and water systems.

HOPKINSVILLE, KY.—Plans are being made to organize a company, to be known as the Kentucky & Tennessee Traction Company, for the purpose of constructing an interurban railway from Hopkinsville to Guthrie.

LOUISVILLE, KY.—It is reported that the J. M. Robinson-Norton Company is contemplating the construction of a power plant.

MIDWAY, KY.—At the election to be held in November the proposition to issue $6,000 in bonds, the proceeds to be used for the construction of an electric light plant, will be submitted to a vote.

EUNICE, LA.—R. Lafleur, Mayor, is reported to have recommended to the Town Council that an election be called to submit the proposition to sell the municipal water works system to the company which proposes to build an electric light plant in Eunice, to a vote.

PICAYUNE, LA.—The Ross Lumber Company, it is reported, has been granted a franchise to construct and operate an electric light plant in Picayune. It is understood that machinery for the plant has already been purchased.

BALTIMORE, MD.—Announcement was recently made by Richard B. Fentress, of the Baltimore Electric Light & Power Company, that all opposition to the development of the Fentress-Mediary lighting franchise had been withdrawn, and that arrangements would soon be made to supply electricity to consumers in Baltimore. It is stated that Mr. Fentress is prepared to spend $2,500,000 for the erection of a plant and distributing system in this city.

BALTIMORE, MD.—Robert J. McCuen, superintendent of department of lamps and lighting, has submitted a report to Mayor Mahool recommending the installation of a municipal electric light plant. He estimates the cost of such a plant, including value of real estate, transmission lines and other equipment at $909,050; the cost of maintenance, allowing for interest on investment, loss in taxes, depreciation, loss in municipal subway rentals, insurance, repairs, labor, etc., for a plant producing 6,470,779 kw at $247,606. The cost of arc lamps for street lighting is estimated at $43.29 each per year, while electricity for public buildings would be 1.9 cents per kw-hour. Under the present contract the city pays the Consolidated Gas, Electric Light & Power Company for arc lamps in the underground districts, where duct rental is charged, $75 each per year, and in the overhead districts $60.25. Electricity for the public buildings from 3 cents to 6 cents per kw-hour.

BALTIMORE, MD.—Application has been filed by the Baltimore

County Water & Electric Company with the Public Service Commission asking permission to separate the two branches of the business, the electrical portion to be operated entirely through a subsidiary company, to be known as the Batimore County Electric Company, which was incorporated under an act of the last legislature. The petition states that the property of the electrical end is worth approximately $350,000, and that the electrical company will pay the water company for the property in its own securities. Under the new arrangement the water company will furnish the new company with water and steam for the next two years under a contract which has been made subject to the approval of the commission. The electrical company is contemplating extensive improvements to its service during the next two years. The Baltimore County Water & Electric Company is a consolidation of the Catonsville Water Company and the Chesapeake Electric & Water Company and the Towson Water Company. The company practically controls the water and electric business in Baltimore County. Albert H. Wehr is vice-president and manager of the Baltimore County Water and Electric Company.

BELAIR, MD.—The electric plant of the Belair Electric Company, located on Winter's Rune, two miles distant, was destroyed by fire on Oct. 5. The company has just completed its auxiliary plant, which will be put into use immediately. It is understood that the plant will be rebuilt as soon as possible.

BOSTON, MASS.—The contract for the installation of two main steam turbine-driven centrifugal pumping units at the Calf Pasture pumping station, Dorchester, Mass., on foundations already in place, has been awarded to the Power Equipment Company, of Boston, Mass., for $36,063. L. K. Rourke is superintendent of streets.

GREAT BARRINGTON, MASS.—The New York, New Haven & Hartford Railroad Company, which has acquired the Berkshire electric railway system, has applied to the State Railroad Commission for an approval of the construction of an extension of the railway from the present terminus at Great Barrington, through Sheffield to Ashley Falls, a distance of ten miles.

HOLYOKE, MASS.—Announcement has been made by the Gas and Electric Department that the wires of the municipal electric plant will be placed underground before any further concessions in rates are allowed to consumers.

HULL, MASS.—The War Department has contracted with the Town of Hull to supply Fort Andrews, Peddocks Island, with electricity from the municipal electric plant at Whitehead. The cost of connecting the fort with the electric plant is estimated at about $10,000. Work has already commenced on laying the cable across the bay to the island.

WORCESTER, MASS.—The factory at 50 Kinsbury Street, formerly occupied by the Litchfield Cushion Heel Company, has been purchased by Dr. Julius Garst. The new owner is equipping the same for the manufacture of porch shades. The machinery will be equipped for electric motor drive.

HOUGHTON, MICH.—The Houghton Copper Company is reported to be considering the question of using electricity for hoisting and air compressing at its mines. This, it is said, will be the first use of electricity for air compression in the copper country, although the Winona and King Philip mines use electricity for hoisting. It is expected that the plant of the Houghton County Electric Light Company, which will supply the service, will be enlarged.

SAGINAW, MICH.—The City Council has adopted a resolution rescinding the franchise granted to the Chippewa Power Company in December, 1909, the company not having complied with the terms of the franchise.

CHISHOLM, MINN.—Preparations are being made by the Range Power Company for improvements to its power plant, including the installation of a new 400-hp engine.

DULUTH, MINN.—The City Council has granted the Duluth Street Railway Company a franchise to extend its railway system on Grand Avenue in Duluth to Fond du Lac. The new line will extend through Ironton, Smithville and New Duluth.

MANKATO, MINN.—It is reported that the farmers living along the transmission line from Mankato to the Rapidan dam are preparing to equip their residences and buildings for electric light and power.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company is contemplating the erection of two steel stacks at its power house in Minneapolis, to cost about $50,000.

PIPESTONE, MINN.—Preparations are being made to rebuild the local telephone exchange. The cost of the work is estimated at about $25,000.

ST. PAUL, MINN.—Surveys are being made by the St. Paul Railway Promotion Company for its proposed system of interurban railways radiating from St. Paul to Mankato, Eagle Lake, Faribault, Northfield and other southern Minnesota towns. W. L. Sontag, of St. Paul, Minn., is general manager.

MERIDIAN, MISS.—It is reported that a contract has been awarded by the Meridian Light & Railway Company for the construction of an addition to its boiler house; the company is installing a 500-hp boiler.

COLUMBIA, MO.—Extensive improvements and extensions are contemplated to the municipal [illegible] for which bonds to the amount of $125,000 were recently voted. The work in connection with the electric light plant includes the erection of building and boiler plant, changing present arc lamps to magnetite system and rearrangement of the [illegible] a 500-kw, high-pressure, steam turbine generating unit and a 250-kw generating unit.

DREXEL, MO.—It is reported that plans are being prepared by A. J. Harbison for the installation of an electric light plant to furnish electricity for lighting his property. The proposed plant will have sufficient output to supply electricity for lighting the business portion of the town.

KANSAS CITY, MO.—Plans are being prepared for the construction of a large dam for the Big Niangua Hydro-Electric Company on the Niangua River, 6 miles southwest of Linn Creek and about 120 miles from Kansas City. The proposed dam will be 160 ft. high, 1458 ft. long, of stone and concrete construction. The cost of the dam, equipment and transmission line into Kansas City is estimated at about $2,500,000. Burns & McDonald, Kansas City, Mo., are engineers; Roland E. Brunner, 914 Commerce Building, Kansas City, Mo., is interested in the company.

KING CITY, MO.—It is reported that Fred Thompson has submitted a proposition to the City Council to install an electric light plant in King City.

PLATTSBURG, MO.—The City Council has granted the Home Telephone Company, of St. Joseph, Mo., a franchise to construct and operate a common battery system in Plattsburg.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company is preparing plans for the construction of an extension of its railway system from Twenty-sixth Street to the State Hospital.

ST. LOUIS, MO.—The capital stock of the Suburban Electric Light & Power Company has been increased from $200,000 to $750,000.

ST. LOUIS, MO.—The Union Electric, Light & Power Company has recently installed an additional 12,000-kw. turbo-generator set, making 80,000 hp. The Union Electric Light & Power Company has recently placed an order with the General Electric Company, of Schenectady, N. Y., for sixteen eight-series mercury arc rectifiers for use in connection with direct-current arc lamps, each outfit consisting of panel, two tubes, constant-current transformers, exciting transformer, static discharger and direct-current reactor. Each set will take alternating current from the line at 6600 volts and 25 cycles and will rectify it to operate 75-68 series luminous arc lamps.

CHARDON, NEB.—The plant and holdings of the Chardon Electric Light & Power Company has been purchased by Messrs. Kass & Klingaman, who, it is said, will reorganize the company and enlarge the entire plant to meet the requirements of the increasing demands made upon it.

OMAHA, NEB.—The installation of an ornamental illuminating system in the business district of the City of Omaha is under consideration by the Commercial Club.

SEWARD, NEB.—Sealed bids will be received at the office of the village clerk, Seward, Neb., until Oct. 28 for furnishing material and installing an electric light and water works plant. The cost of the work is estimated at $7,000. Martz Brothers, of Seward, Neb., are engineers.

SIDNEY, NEB.—We are informed that the property of the Sidney Electric Service Company has changed hands and is now owned and operated by C. G. Leseur and A. S. Hardy. The new owners are making improvements and extensions to the plant, including the installation of a new Frost boiler, a Skinner engine and a 35-kw generator, direct-connected. An addition is also being erected to the power house. C. G. Le Seuer is president of the company; A. S. Hardy, vice-president, and C. B. Hardy, secretary and treasurer.

BAYONNE, N. J.—The Smith & Cox Company, of Bayonne, N. J., recently incorporated to manufacture all kinds of pipes, tube bends and coils of all descriptions, is reported to be receiving bids for equipment of its plant. The company will require, in addition to power equipment, electric and gas lamps, heating plant, electric welding machinery, threading machinery, welding apparatus, cutting machinery, etc. For further information address J. Fillmore Cox, Twenty-sixth Street and the Boulevard, Bayonne, N. J.

TRENTON, N. J.—Announcement has been made by the Public Service Corporation that it will place lamps in Hamilton Township wherever it has gas or electric conduits. Lamps will be erected on East State, Greenwood, Johnson, Norway, Robert Streets, Whitehead Road and Victor Park Lane.

UNION, N. J.—The Public Service Corporation of New Jersey is contemplating building a new electric railway on Stuyvesant Avenue in Union, for which an application for a franchise will soon be made.

BUFFALO, N. Y.—The Beaver Company, of Buffalo, N. Y., is reported to be erecting two additions to its plant at Black Rock, Buffalo. It is understood that the company will be in the market for electric motors.

LANCASTER, N. Y.—Plans have been prepared by the New York Telephone Company for placing its wires underground on the principal streets in Lancaster.

NEW YORK, N. Y.—Sealed bids will be received at the Bureau of [illegible] Washington, D. C., until Nov. [illegible] for furnishing and installing one electric motor-driven capstan at the United States Navy Yard, New York, N. Y. Plans and specifications can be obtained on application to the above bureau or to the commandant [illegible] bureau.

NEW YORK, N. Y.—[illegible] Board, at the office of the Department of Parks, Arsenal Building, Fifth Avenue and Sixty-fourth Street, New York, N. Y., for furnishing and installing electric lighting fixtures in the Metropolitan Museum of Art, New York, N. Y. Plans may be seen and blank forms obtained at the above office. Charles B. Stover is president of park board.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov 3, for an electric elevator equipment at the new United States post office building, New York, N. Y., in accordance with plans and specifications, copies of which can be obtained at the above office, or at the office of McKim, Mead & White, 160 Fifth Avenue, New York, N. Y. A deposit of $100 will be required to insure return of plans and specifications. James Knox Taylor is supervising architect.

NEW YORK, N. Y.—Sealed bids will be received by Henry S. Thompson, commissioner of Department of Water Supply, Gas and Electricity, Room 1904, Park Row Building, New York, N. Y., until Oct. 20 as follows: Section 1—For furnishing and installing electric control cables in underground ducts, from the South Street high-pressure pumping station to the gate valve vaults in New Chambers Street, east of the Bowery, and in East Houston Street, east of the Bowery. Section 2—For furnishing and installing motor-operated gate valve, subsidiary ducts, etc., with all appurtenances complete in the high-pressure fire service mains in New Chambers Street, east of the Bowery, and in East Houston Street, east of the Bowery. Bidders are requested to make their bids on blank form prepared by the department, copies of which can be obtained on application to the above office.

SENECA FALLS, N. Y.—Negotiations have been closed between the Village of Seneca Falls and the Geneva-Seneca Electric Company whereby the village will secure a better distribution of lamps and an all-night service, to take effect Dec. 1, 1910. Under the present contract there are about eighty arc lamps and twenty-five incandescent lamps of 25 cp. Under the new contract the company will supply twenty arc lamps at $70 each per year and 267 incandescent lamps at $18 per lamp per year. per year.

SYRACUSE, N. Y.—Plans are being prepared by the New Central Railroad Company to equip the Auburn Railroad between Syracuse and Geneva, a distance of fifty-four miles, for electrical operation. The third-rail system will be used. The cost of the work is estimated at $1,000,000. It is expected to have electric trains running between Syracuse and Geneva in time for the State Fair next year.

UTICA, N. Y.—The new mill of the Frisbe & Stansfield Knitting Company, to be known as Richelieu Mill No. 2, has been completed. The new building is 154 ft. x 54 ft. and is equipped for electric motor drive. An electric power plant will be installed in an adjoining building. The equipment will include a 150-hp boiler, engine, generator and transformer.

WILSON, N. Y.—Plans are under consideration for the construction of an electric railway to extend from the New York Central Railroad station in Wilson to Lake Island Harbor and Sunset Beach, a distance of about 2 miles. S. M. Conant, president of the Conant-Bryant Company, which supplies electricity for lighting the village, is interested in the project.

GREENSBORO, N. C.—The Town Council has accepted the proposition of the North Carolina Public Service Corporation for lighting the streets of the town, under the terms of which the company is to supply 175 arc lamps at $58 each per year and 80-cp tungsten at $20 per lamp per year, for a period of ten years. Work on the installation of the new lamps will begin at once.

GREENSBORO, N. C.—The Southern Power Company has secured a site in the heart of Greensboro to be used for its passenger and freight terminals upon the completion of the interurban railway from Anderson and Greenville, S. C., 200 miles in length. The company has commenced work on the excavation for its reservoir in connection with its auxiliary steam plant to be erected in this city at a cost of about $300,000. It is reported that the interurban railway, which is operated largely by the Southern Power Company interests, has made arrangements to utilize 110 miles of tracks of the Seaboard Air Line, from Rutherford, 85 miles west of Charlotte, to Monroe, 25 miles east of Charlotte. It is understood this will be a cross line of the interurban, as the main railway, it is assumed, will pass directly through Charlotte. The railway will eventually extend to Raleigh and possibly to the coast.

MORGANTON, N. C.—[illegible] Glen Alpine, N. C., [illegible] to have commenced work on the construction of a dam and electric plant on Canoe Creek, about four miles above Morganton, where about 250 hp will be developed, at a cost of about $20,000. The plant will furnish electrictiy in Morganton and Glen Alpine.

MURPHY, N. C.—The plant and holdings of the Cherokee Telephone Company, of Murphy, N. C., have been purchased by the Southern Bell Telephone Company, including 100 miles of telephone line, throughout the extreme western and mountain part of North Carolina and Georgia.

WADESBORO, N. C.—The Wadesboro Telephone Company is reported to be contemplating rebuilding its entire system, including the erection of new poles, wires, switchboard, etc.

BELLEFONTAINE, OHIO.—The Big Four Railroad is reported to be considering the installation of a new central power plant at its shops [illegible]

[illegible] OHIO.—[illegible] Price Company for the construction of a factory and power plant at Cedar Avenue and C. & P. tracks to cost $60,000. The company manufactures printing presses.

CLEVELAND, OHIO.—It is reported that plans have been prepared by W. S. Lougee, architect, for the construction of a large warehouse for wholesale groceries and a factory building for the William Edwards Company. The equipment of the power plant, it is said, will include two 500-hp boilers, engine, generators and motors for operating six elevators, driving printing presses and other machinery.

COLUMBUS, OHIO.—Charles Kircher, of Athens, Ohio, is reported to have secured the contract for the construction of the power house at the State University.

YOUNGSTOWN, OHIO.—Preparations are under way for the construction of an electric railway between Painesville and Youngstown, for which right-of-way has been secured. J. R. Curtis and George H. Carpenter are interested in the project.

YOUNGSTOWN, OHIO.—In a report submitted to the City Council by J. B. Meriam, an engineer of the Bruce Macbeth Engine Company, of Cleveland, Ohio, in connection with the installation of a municipal electric plant to supply electricity for the proposed new lighting system of 150 lamp standards. The cost of installing the plant is estimated at $35,450 and an annual maintenance expense of $6,625, which includes labor, fuel, interest at 6 per cent and depreciation at 8 per cent, making the cost per lamp standard equivalent to $44 per year, against $64.50 offered by the Youngstown Consolidated Gas & Electric Company, which would result in a saving of $3,075 a year. It is proposed to locate the plant in the basement of the market house in Boardman Street and the equipment would include two 100-kw generators, engines, underground conduits and the entire expense of installing the system, with the exception of the pedestals, which are to be furnished by the Merchants' Association. The plant will be capable of taking care of 150 additional lamp standards, making 300 in all.

SALLISAW, OKLA.—Bonds to the amount of $16,000 are reported to have been voted, the proceeds to be used for extensions to the water and electric light service.

PORTLAND, ORE.—The East Side Business Men's Club is reported to have adopted a plan for the installation of an ornamental illuminating system in the center district of East Portland. It is expected to have the lamps in place before winter.

PORTLAND, ORE.—The Mount Hood Railway & Power Company is reported to have engaged Smith, Kerry & Chase, of Toronto, Ont., to supervise the construction of its power plant at the confluence of the Bull Run and Sandy rivers. The proposed plant will supply electricity to operate the railway of the company and for other purposes.

CHAMBERSBURG, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 16, for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office building at Chambersburg, Pa., in accordance with plans and specifications, copies of which may be obtained from the custodian of site at Chambersburg, Pa., or at the above office. James Knox Taylor is supervising architect.

COLUMBIA, PA.—The construction of an electric railway from Dover to New Oxford is reported to be under consideration, for which surveys have been made. The road is operating from York to Dover, and it is understood that it is proposed to build a connecting link with the railway from McSherrystown to New Oxford, making a circuit from Spring Grove, Hanover, McSherrystown, New Oxford, East Berlin and Dover.

DILLSBURG, PA.—The Dillsburg Light, Heat & Power Company has applied for a charter for the purpose of supplying electricity in Dillsburg. It is reported that the company is planning to erect a 200-kw hydroelectric plant on the Yellow Breeches Creek.

NORTH YORK (P. O. YORK), PA.—The Council is reported to have granted the North York Electric Light Company permission to construct and operate an electric lighting system in this borough.

PITTSBURGH, PA.—It is reported that preliminary arrangements are being made for the construction of an electric railway to connect Pittsburgh, Wellsburg and Wheeling. H. M. Rodgers and C. B. Reeves are interested in the project.

SCRANTON, PA.—Plans for equipping for electrical operation a portion of the Delaware, Lackawanna & Western Railroad, on what is known as its "pusher" service from Lehigh to Clarks Summit, have been approved by President Truesdale of the company. About twenty-three miles of the railroad will be euipped for electrical operation.

FLORENCE, S. C.—Extensive improvements are being made to the plant of the Florence Electric & Utility Company, which, when completed, will more than double the output of the plant. This company is successor to the Florence Light & Power Company.

NEWBERRY, S. C.—The new mill of the Oakland Manufacturing Company will soon be completed. The factory will be equipped for electric motor drive, electricity for which will be supplied by the Southern Power Company. William H. Hunt, of Newberry, is president of the company.

[illegible], S. C.—Owing to the report that the Southern Power Company, which now supplies electricity for operating the municipal electric plant, proposes to increase its rate from 1 cent per kw-hour to 1.9 cents per kw-hour, the town is considering the question of installing

a complete generating plant [illegible] distributing system, the Southern Power Company supplying energy for operating the same. The five-year contract with the company will soon expire.

ERWIN, TENN.—Ladshaw & [illegible] S. C., are reported to have prepared plans for the Nolachucky Power Company for the construction of a hy[illegible] River. W. C. Heath, of Monroe, N. C., is president of the company.

MEMPHIS, TENN.—Plans are being made by the Memphis Street Railway Company to construct and operate a double-track railway on Cleveland Street in Memphis.

NASHVILLE, TENN.—The Louisville & Nashville Railroad Company is reported to have decided to equip its line from Cincinnati, Ohio, to Birmingham, Ala., with telephones for train dispatching, which will cover the Cumberland Valley and Kentucky divisions from Cincinnati to Norton, including 304 miles, the equipment to consist of four train wires and two message [illegible]

AUSTIN, TEX.—N. A. Dawson, of San Antonio, Tex., and associates, who were recently granted a franchise by the City Council for the construction of an electric street railway in South Austin and through portions of Austin, have made a voluntary bond to the city to the amount of $20,000 that they will complete not less than two and one-half miles of track within one year.

AUSTIN, TEX.—Negotiations for the transfer by the Dumont-Holmes Steel Concrete Construction Company of its contracts for the reconstruction of the large dam across the Colorado River at Austin to the Hydraulic Properties Company, of New York, N. Y., are said to be practically completed. The Board of City Commissioners of Austin does not object to the transfer being made. Announcement has been made by the representatives of the Hydraulic Properties Company that work will soon commence on the construction of the dam and hydroelectric plant. It is proposed to erect a dam 65 ft. in height.

BROWNSVILLE, TEX.—The City Council is reported to be considering the question of calling an election to vote on the proposition to issue $50,000 in bonds, the proceeds to be used for the installation of additional street lamps, extensions to water mains, etc.

FORT WORTH, TEX.—It is reported that extensions to the street lighting system are being considered by the City Council. Charles F. Crabtree, chief electrician, has submitted a report to Commissioner Powell, calling for 250 additional arc lamps and 800 75-watt tungsten lamps.

LEAGUE CITY, TEX.—It is reported that the Galveston-Houston Electric Company has decided to locate its main power plant on Clark Creek, about one-half mile distant from this city. The power house will be 70 x 100 ft. and the equipment will include three 520-hp boilers, one 1100-kw and one 500-kw turbo-generator, with necessary condensers, water heaters, feed pumps, air compressor, etc. Electricity will be generated at 2300 volts and stepped up to 3300 volts for transmission to three substations, for which locations have not yet been decided upon. At the substations power will be stepped down to 2300 volts and delivered to motor generators supplying direct current at 600 volts for railway service. Mark Lowd, of Houston, Tex., is southwestern manager for the Stone & Webster Corporation, Boston, Mass., which has charge of the work.

NEW BRAUNFELLS, TEX.—The construction of a dam across the Guadalupe River, near New Braunfells, in connection with a hydroelectric power plant, is under consideration. Adolph Henne, of New Braunfells, and others are interested in the project.

PARIS, TEX.—The City Council is considering the question of constructing combined electric light and water works plants; the electric plant to have sufficient output to provide for 300 lamps of 2000 cp and the water works to have a daily capacity of 1,000,000 gallons per day. An election will be held within a few months to vote on the proposition. E. H. McCuiston is Mayor.

TEXAS CITY, TEX.—The Texas City Company is reported to be contemplating the construction of an electric light plant in Texas City. A. B. Wolvin, of Duluth, Minn., is president.

BRIGHAM CITY, UTAH.—The report of the electric light committee on its investigation of enlarging the municipal electric plant in Box Elder Canyon estimates the cost of installing an additional generating unit at $7,814 and $800 for an addition to the power house. The committee asked for authority to make further investigations, which was granted.

OGDEN, UTAH.—Notice of appropriation of 50 cu. ft. of water of Paradise Creek in Cache County has been filed by H. C. Baker and H. J. Craven, of Ogden, Utah, to be used for power purposes. It is proposed to erect an electric plant and distribute electricity for lamps and motors throughout Box Elder and Cache counties.

SALT LAKE CITY, UTAH.—It is reported that the question of equipping the Salt Lake-Nephi branch of the Salt Lake Route is under consideration. If it is decided to equip that branch for electrical operation, the interurban line of the street railway will not be extended beyond [illegible]. The building of a [illegible] the Redwood Turnpike has been abandoned.

TOOELE, UTAH.—Notice of appropriation of water from Settlement Canyon, in Tooele County, has been filed by A. F. Doremus, of Salt Lake City, Utah, with the state engineer. The water will be carried down the canyon in the mains of the Clark Electric Company as far as its plant, where it will be piped into Tooele City, to be used for domestic purposes.

EMPORIA, VA.—The Emporia Manufacturing Company has changed the driving power of its plant from steam to electricity. Power for operating the works is supplied by the Emporia Hydro-Electric Corporation, which has entered into a ten-year contract with the Emporia Manufacturing Company to supply the same. The hydroelectric company also supplies electricity for street lighting and other industries in Emporia.

FOSTER FALLS, VA.—The Foster Falls Company, recently incorporated with a capital stock of $100,000, is contemplating the construction of a hydroelectric power plant at Foster Falls, on New River. It is estimated that from 3,000 to 4,000 hp can be developed, which will be utilized to operate the mining plants of the Virginia Coal & Coke Company, of Bristol, Va. Henry K. McHarg, 40 Wall Street, New York, N. Y., is president; John B. Newton, vice-president, and John W. Cune, secretary and treasurer, both of Roanoke, Va.

HUNTERS, WASH.—M. W. Thompson, who recently purchased the local electric light plant, has secured water rights on the upper Hunters Falls, and has also leased a site from J. B. Cameron, and will transfer the plant to the falls. Electricity generated at the plant will be utilized to pump water from the Columbia River and for lighting purposes in Hunters.

PULLMAN, WASH.—Arrangements are being made by E. A. Bryan, president of the State College, also president of the Riveria Company, which owns 300 acres on Snake River, for the erection of a transmission line from Starbuck to the Riveria tracts.

SEATTLE, WASH.—The controlling interest in the Independent Telephone Company, of Seattle, which was formerly owned by Youngstown, Ohio, capitalists, has been sold to New York parties.

SEATTLE, WASH.—The first of the improvements to be made by the Hannaford Irrigation & Power Company, it is said, will be the deepening of the main power canal for about a mile above Priest Rapids, work on which will begin at once. The cost of the work is estimated at about $200,000.

SEATTLE, WASH.—The contract for furnishing the lighting department of the City of Seattle with incandescent lamps amounting to $60,000 has been awarded to the Novelty Incandescent Lamp Company.

SPOKANE, WASH.—Preparations are being made by Stoolfire Brothers, owners of the Arlington mine, at Ruby, for the installation of a power plant on the property.

SPOKANE, WASH.—Plans have been prepared by the Inland Empire Paper Company for the construction of a dam across the Spokane River at a cost of about $350,000. Work on construction of the dam will commence at once. W. A. Brazeau is manager of the company.

TRINIDAD, WASH.—Surveys are being made by the Entait Light & Power Company for its proposed transmission line which will supply electricity for lamps and motors and for irrigation plants on the river. The transmission line will be extended to Ephrata.

HUDSON, WIS.—The Clifton Light & Power Company, of Hudson, Wis., has been authorized by the State Railroad Commission to issue 750 shares of capital stock at $100 per share, to be issued at not less than par, and $25,000 in bonds, the proceeds of both stock and bonds to be used for extensions and improvements to its property, including the purchase of real estate and flowage rights, pole line and right of way for the erection of a dam, in connection with a hydroelectric plant for the distribution of electricity; also for the purchase of an existing pole line, extending from the site of the proposed power plant to the Village of Prescott, and for the purchase of the electric light and power plant in Prescott; the funds are also to be used for the construction of the main power plant to be located in the Town of Clifton, Wis., and for the erection of a transmission line from the proposed power plant to the city limits of Hastings, Minn., and for the erection of a substation at that point.

MERRILL, WIS.—The local telephone system, owned by the Merrill Telephone Company, has been purchased by the Wisconsin Telephone Company. W. E. Thielman is local manager.

NEW GLARUS, WIS.—Plans are being considered for enlarging the municipal electric light plant.

WAUSAU, WIS.—The City Council is reported to have adopted an ornamental street lighting system to be installed on the main business streets of the city, which later will be extended to the residence sections. About 100 lamp standards will be installed at first.

SHERIDAN, WYO.—Preparations are being made by the Sheridan Railway & Light Company for the construction of its proposed interurban railway to extend from Sheridan to the government reservation, thirteen miles in length, work on which will begin in the near future. Ernest Boehme, of Sheridan, Wyo., is engineer in charge.

BARKERVILLE, B. C., CAN.—Preparations are being made by the Barkerville Willow River Company for the survey for an electric railway down the Willow River to the Grand Trunk Pacific Railroad, at or near Fort George, a distance of 120 miles.

NEW WESTMINSTER, B. C., CAN.—[illegible] is reported to be under consideration by the Board of Trade of this city [illegible]

QUESNELL, B. C., CAN.—The installation of an electric light and [illegible] consideration. The

[illegible] Wallace [illegible] in the project.

WINNIPEG, MAN., CAN.—The Manitoba Government Telephone Commission has awarded the contract for the construction of the new St. John's exchange to be erected at the corner of Salter Street and Burrows Avenue to J. M. and J. J. Kelly. The cost of the building is estimated at $38,000. The new exchange will provide for 10,000 lines and will serve all patrons north of the Canadian Pacific Railroad.

HALIFAX, N. S., CAN.—The East Pubnico Amusement Company, recently granted a charter, is planning to construct and operate an electric railway from Halifax to the amusement park at East Pubnico, four miles in length, for which surveys have been made and rights of way secured. The company, it is said, will erect a power house on Grafton Street and a substation on Albermarle Street, Halifax. It is understood that work will begin at once on construction of the road. Daniel Hawksmarth is president of the company and G. C. McClure, chief engineer, both of Halifax.

TORONTO, ONT., CAN.—Contracts have been awarded by the Board of Control for equipment in connection with Toronto hydroelectric system as follows: For storage batteries to Chapman & Walker Company, at $2,870; to the Canadian General Electric Company for transformers, for $15,800; for motor generator sets to the Lancashire Dynamo & Motor Company, at $2,262.

GUANAJUATO, MEX.—The Guanajuato Power & Electric Company is extending its transmission lines to San Luis Potosi, which will soon be completed, where it has a contract to supply electricity for lamps and motors for the large smelter of the American Smelting & Refining Company and other large industrial plants. The company has recently erected a transmission line to the San Felipe mining district, where it will furnish electricity for operating the machinery in the mill and mines of the Providencia San Juan de la Luz and other mines.

MEXICO CITY, MEX.—The installation of two additional generating units at the Necaxa plant of the Mexican Light & Power Company will soon be completed. Each of the generators now being installed has a rating of 12,500 kw and will increase the total output of the company to about 90,000 hp.

PACHUCA, MEX.—The Compania Minera Santa Ana y Anexas, of Pachuca, has equipped its mines and mill for electrical operation throughout. Electricity for operating the machinery is furnished by the Compania Electrica e Irrigadora, a subsidiary company of the Mexican Light & Power Company.

PACHUCA, MEX.—The Compania Electrica e Irrigadora, a subsidiary of the Mexican Light & Power Company, has contracted with the Compania Minera Santa Ines Carretera to supply electricity for operating the machinery at its mines, located near Pachuca. The mining company has also installed an electric hoist.

POZOS, GUANAJUATO, MEX.—The Compania Minera Augustias y Anexas has recently installed an electric power plant at its mines, located near Pozos. The plant will supply electricity to operate the pump and machinery in the mines.

SANTA ROSALIA, CHIHUAHUA, MEX.—The Mexican Northern Power Company, which is erecting a large hydroelectric power plant on the Conchos River, nineteen miles from Santa Rosalia, has enlarged upon its original plans. Announcement has been made that plans have been adopted by the company which will call for an expenditure of about $20,000,000 in gold, one-half of which will be used in the construction of the large dam across the Conchos River and the installation of an electric power plant and transmission system; the remainder will be expended for the construction of a large irrigating system. The initial output of the power plant will be 40,000 hp, which will later be increased to 90,000 hp. Transmission lines will be extended to Chihuahua, to the mining camps of Santa Eulalia, Santa Barbara, Jiminez, and to the town and mining district of Parral. It is stated that tentative contracts have been made for the full amount of power that the initial installation will provide for. In order to provide means for transporting the material for the dam and hydroelectric plant a railroad, nineteen miles in length, has been built from Santa Rosalia to the site of the dam. S. Pearson & Son have the contract for construction of the plant.

SAN SEBASTIAN, JALISCO, MEX.—The El Tajo Mining Company has recently installed a hydroelectric power plant on its property near San Sebastian to supply electricity to operate the machinery in its mill and mines.

New Industrial Companies.

THE [illegible] MANUFACTURING COMPANY, [illegible] has been incorporated with a capital stock [illegible]

THE [illegible] ELECTRIC MOTOR MANUFACTURING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture small electric motors and specialties. The office and factory will be located at 222-224 South Canal Street, Chicago. C. V. Mowat is vice-president and secretary, and Charles Endorf, Jr., [illegible]

THE [illegible] TELEGRAPH & TELEPHONE [illegible]

of $40,000 for the purpose of dealing in electrical goods and other supplies.

THE ELECTRICAL IMPROVEMENT COMPANY, of Nyack, N. Y., has been incorporated by William B. Brewster, of Orange, N. J.; Frank J. V. Beck, 167 Gates Avenue, Brooklyn, N. Y., and George H. [illegible], 53 Parkhurst Street, Newark, N. J. The company is capitalized at $100,000 and proposes to manufacture and deal in electrical and mechanical devices and maintain a laboratory for perfecting apparatus.

THE ELGIN WHEEL & ENGINE COMPANY, of Elgin, Ill., has been incorporated by Herbert L. Thompson, Nelson W. Johnson and C. F. Trehune. The company is capitalized at $30,000 and proposes to manufacture engines and machinery.

THE ELKHART MANUFACTURING COMPANY, of Elkhart, Ind., has been incorporated with a capital stock of $25,000 by Walter Brown, Harvey H. Alberts and Horace S. Hubbard. The company proposes to manufacture and deal in electrical and mechanical devices and appliances.

THE GOLDSBOROUGH COMPANY, of Portland, Maine, has been incorporated with a capital stock of $1,500,000 for the purpose of doing a civil, mechanical, electrical, mining and irrigating engineering and construction business. The officers of the company are: T. L. Croteau, president, and A. F. Jones, treasurer, both of Portland, Maine.

THE INTERNATIONAL ELECTRIC WELDING COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 as electricians, engineers, etc., by E. D. Loughman, V. H. Downes, of New York, N. Y., and J. S. Darcy, of Brooklyn, N. Y.

THE NATIONAL TIME SWITCH COMPANY, of South Bend, Ind., has been chartered by N. C. Morrison, E. L. Betts and Carl Lindwald. The company is capitalized at $25,000 and proposes to manufacture electrical time switches, mechanical time switches, electric motors, dynamos and other electrical supplies.

THE W. H. MICKLEY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $2,000 as electrical engineers, machinists, tool makers, founders; also to manufacture machinery of all kinds. The incorporators are: John C. Quinn, William G. Austin, 39 Cortlandt Street, New York, N. Y., and William H. Mickley, 19 Thames Street, New York, N. Y.

THE RICE & GREEN ELECTRIC COMPANY, of Hartford, Conn., has been chartered with a capital stock of $10,000 by Willard A. Rice, Alfred W. Green and Harold C. Green. The company proposes to manufacture and deal in electric lighting and heating apparatus, etc.

THE WEBB MOTOR FIRE APPARATUS COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $1,500,000 and the incorporators are: C. H. Dawes, G. B. Arnold, of St. Louis, Mo., and E. B. Waples, of Wilmington, Del.

New Incorporations.

EATON, IND.—Articles of incorporation have been filed for the Eaton Electric Company with a capital stock of $10,000. The company proposes to generate and distribute electricity for lamps, heat and motors to towns and cities in this vicinity. The principal operating office will be located in Eaton and business office in Muncie, Ind. The directors are: Frank B. Ball, R. E. Breed, Frank B. Hunter, H. L. Lindley and A. L. Melton.

MINOT, N. D.—The Farmers' Co-operative Telephone Company has been incorporated with a capital stock of $50,000 by D. E. Kidder, C. G. Richards and others, of Minot, S. D.

STILLWATER, OHIO.—The Stillwater Telephone Company has filed articles of incorporation with a capital stock of $5,000. A. Dornberger and others are incorporators.

HARRISBURG, PA.—Charters have been granted by the State Department to the Hughestown Electric Company, the Dupont Electric Company, West Pittston Electric Company and the Pittston City Electric Company, of Pittston, Pa., each having a capital stock of $5,000.

HARRISBURG, PA.—Articles of incorporation have been filed for the Interborough Electric Company. The company is capitalized at $1,500,000 and proposes to take over all the electric plants in the Beaver and Ohio River valleys, and has secured all the electric lighting plants from Rochester to Sewickley, Pa., giving it control of all lighting and power privileges for 100 miles along the Ohio River and upper Ohio Valley.

HARRISBURG, PA.—Charters have been issued by the Secretary of State to the companies in the western part of Pennsylvania as follows: The Aliquippa Electric Company, of Aliquippa, Pa.; the Haysville Borough Electric Company, Moon Township Electric Company, Leet Township Electric Company, Harmony Township Electric Company, Hopeville Electric Company, West Side Electric Company, Sewickley Heights Electric Company, Sewickley Township Electric Company, all of Ambridge, Pa. Each company is capitalized at $5,000 and the incorporators are: John Read Miner, C. A. White, C. H. Kennedy and Julius Theobald, of New Brighton, Pa., and E. S. Wheeler, of Pittsburgh, Pa.

WILKES-BARRE, PA.—The Wilkes-Barre & Luzerne Street Railway Company has been chartered with a capital stock of $6,000 for the purpose of building an electric railway in Kingston. The directors are: E. L. Hessler, president; Don A. Gilbert, F. J. Northcote and John A. [illegible], of Wilkes-Barre, Pa.

Personal.

MR. VAL. A. FYNN has [illegible] several months in Europe.

MR. MORRIS MOSKOWITZ, the pioneer inventor in electric train lighting, has resigned his connections with the United States Light & Heating Company, New York.

MR. AUGUST BOISSONNAS, electrical engineer, of Geneva, Switzerland, is in this country for the purpose of visiting electric generating plants operating under various conditions.

MR. W. E. NOURSE, for the past six years with the Boston Edison Company, has accepted a position with the Cutler Hammer Manufacturing Company, of Milwaukee, with headquarters at the Boston office, 176 Federal Street.

MR. R. NAKASHOJI, vice-minister of the department of communication of Japan, who has been studying European telephone and telegraph systems for the past four months, is visiting this country to investigate the American systems.

MR. WILLIAM T. DONNELLY will present a paper on the evening of Oct. 13 before the Brooklyn Engineers' Club at the Brooklyn Engineers' Club House entitled "Electrification of the works of the John H. Robins Company, Erie Basin, Brooklyn."

MR. RALPH E. MOORE has been appointed assistant district manager of the General Electric Company at Philadelphia. Mr. Moore has heretofore been manager of the railroad department of the company in the same territory. He succeeds the late Theodore P. Bailey.

MR. JOHN J. SCHAYER has resigned as manager of the Commonwealth Edison Company's electric shop in Chicago to accept a joint position with that company and the Automobile Maintenance Company to create an increased use of electric traffic wagons in Chicago.

MR. WALTER S. RODMAN, formerly instructor in electrical engineering at the Rhode Island College, who has been following a postgraduate course at the Massachusetts Institute of Technology for the past two years, is now adjunct professor of electrical engineering at the University of Virginia.

MR. W. R. BONHAM has been appointed manager of the Chicago office of the Triumph Electric Company, which has been removed from the Manhattan Building to 275 La Salle Street. Mr. Bonham succeeds Mr. F. L. Merrill, who is now connected with the Cosmopolitan Electric Company, of Chicago.

MR. GEORGE B. JOHNSON, formerly in charge of the special industries branch of the contract department of the Commonwealth Edison Company, has been appointed manager of electric shop of that company, reporting to Mr. John F. Gilchrist, assistant to the president, and succeeding Mr. John J. Schayer, resigned.

DR. W. H. TOLMAN, who has been making a study of recently adopted methods and devices in Germany for the elimination of danger to employees in industrial plants, has returned to this country. Dr. Tolman served as chairman of the American delegates to the International Conference on Social Insurance at The Hague.

MR. D. McFARLAN MOORE lectured before the Franklin Institute on Sept. 21, his subject being the "Progress of Vacuum-Tube Lighting." A demonstration was given of the tube lamps containing carbon dioxide gas, which provides a light showing excellent spectum analysis, which Mr. Moore has been developing for use by color workers.

MR. H. E. HEATH has recently moved his offices to 1328 Broadway, New York. After over twenty years' experience with the Eddy Electric Manufacturing Company, the General Electric Company, the Baker Electric Company and in other fields, he entered into consulting work in which he has been engaged for some time, and more recently in New York City.

Obituary.

MR. WILLIAM M. STEWART, division equipment superintendent of the New York Telephone Company, died suddenly on Oct. 5 at his home in Westfield, N. J., in his fifty-fifth year of age. Mr. Stewart has been in the service of the New York Telephone Company for the past twenty years. During this period he supervised the construction of many new central offices, and did much to develop the telephone service to its present high efficiency. He was a member of the Telephone Society of New York and of the New York Electrical Society. He is survived by his wife and son.

Trade Publications.

WIRING DEVICES.—The Pettingell-Andrews Company, Boston, has issued a 120-page catalog containing illustrations and price lists relating to the various wiring devices manufactured by the Bryant Electric Company and the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Attention is called to the fact that all of the devices shown in the catalog have either been approved by the Underwriters' Laboratories or are being tested with that object in view.

HYDRAULIC TURBINES.—Bulletin No. [illegible] of S. Morgan Smith Company, York, Pa., is a handsome pamphlet of fifty-two pages giving illustrations and data of Smith hydraulic turbines. Among the engravings are excellent views of a number of large hydroelectric equipments, some of which have not yet been described in the technical press. Of particular interest to electrical engineers are views and data of hydroelectric equipments for the Connecticut River Power Company; Chattanooga & Tennessee River Power Company; Roosevelt Salt River plant, Great Falls (Mont.) Water-Power Company; Winnipeg Electric Railway Company and La Crosse Water-Power Company. Another bulletin recently issued by the same company illustrates and describes head-gate hoists.

BUSINESS NOTES.

KIEWERT COMPANY.—The Chicago office of the Charles L. Kiewert Company, maker of flaming arc lamps, has been removed from 110 South Clinton Street to 58 Plymouth Place (Manhattan Building). Mr. H. W. Fowzer is in charge.

THE COLONIAL SIGN & INSULATOR COPANY, South Akron Ohio, has announced that a patent covering its "Colonial" pot-head has been issued as No. 969,816, granted to Messrs. H. L. Wallan and E. E. Noble on Sept. 13, 1910.

MASSACHUSETTS CHEMICAL COMPANY.—Mr. Charles A. Baldwin has been appointed manager of the New York office of the Massachusetts Chemical Company to succeed Mr. Henry E. Cozzens, who has resigned to enter other business.

THE SCOFIELD ENGINEERING COMPANY, Philadelphia, Pa., has been retained by the Browning Manufacturing Company, Cleveland, Ohio, to design and supervise the construction of a cantilever material handling bridge, which is to be built near Lockport, N. Y.

RIDGWAY ISOLATED PLANT EQUIPMENT.—The Schoenbrun Building, a large building for manufacturing purposes at West Adams and Peoria Streets, Chicago, now nearing completion, will be equipped with a private power plant. Conspicuous in this installation will be one 60-kw generating unit and one of 100 kw, built by the Ridgway Dynamo & Engine Company, will consist of 250-volt direct-current generators directed-connected to single-valve side-crank engines. Mr. C. Hartman, of Chicago, is the consulting engineer who designed the plant.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 4, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

971,[illegible]. MACHINE FOR [illegible] LAMPS; G. W. Beadle, [illegible] 1909. For shaping the anchor for fila[illegible] ing device for marking the voltage data on [illegible] that the anchors are being formed.

971,[illegible]. RESISTANCE COIL; [illegible] Lawton, Oklahoma. App. filed Oct. 12, 1908. For induction coils, including a pair of cores [illegible] side by side with binding [illegible]

971,[illegible]. TELEGRAPH-KEY; F. G. [illegible] making the other by means [illegible] of contacts with manual means for closing the first contacts, the second pair being closed when the first are opened.

971,574. ELECTRICALLY-OPERATED AGRICULTURAL IMPLEMENT; C. Taurman, Cincinnati, Ohio. App. filed Dec. 30, 1909. A laterally movable trolley line, supported by portable towers mounted on wheels with a truck carrying agricultural implements and trolleys, electric motors on the truck, one of the trolley poles telescoping.

971,597. BATTERY TANK SYSTEM; F. A. Decker, Philadelphia, Pa. [illegible] ticularly when used with automobiles, the tank being pivoted to the vehicle and communicating with the battery so that the liquid may be drained into it and the tank operated to discharge the liquid.

971,598. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Aug. 10, 1903. Complete metallic circuit and central energy system, avoiding the use of grounded circuits, supplied by a common battery, provided with a line signal, a supervisory lamp and relay and connections for supplying current to the lamp, through the talking conductor with a listening key for disconnecting lamp and relay from the circuit.

[illegible] a fork, whose prongs are screwed together by a bolt.

971,623. ELECTRIC SWITCH; W. S. Mayer, Philadelphia, Pa. App. filed Jan. 2, 1907. A two push button switch in which the switch member is mounted upon a pivot and co-operates with contact springs on opposite sides, the springs being reversible.

971,641. ART OF ENAMELING METALS; G. L. Rice and B. W. Gilchrist, Woodhaven, N. Y. App. filed Feb. 2, 1909. Interposes between the body of the article and the enamel a binding of magnetic material and sulphur.

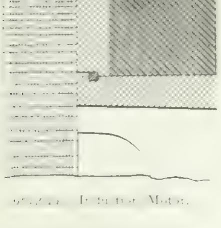
971,648. ELECTRIC SWITCH; S. P. Watson, Brooklyn, N. Y. App. filed May 3, 1909. For indicating the movements of an elevator car by means of two lamps, one "up" and the other "down," a normally open circuit for the lamps and a normally open two-armed switch for closing the circuit, the switch being operated by the car.

971,649. INDUCTION-MOTOR; J. E. Webster, Pittsburg, Pa. App. filed July 6, 1908. The secondary member includes conducting bars and conducting blocks secured between the ends of the bars.

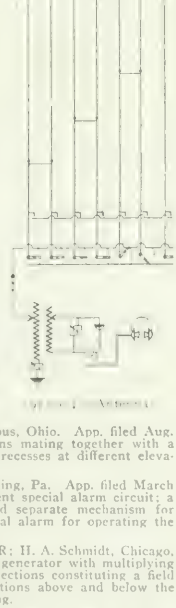
971,650. PARTY LINE RINGING KEY; A. H. Weiss, Chicago, Ill. App. filed Feb. 17, 1906. The ringing key contacts are normally removed from the talking circuit and electromagnetic means connect the contacts with the talking circuit during the operation of ringing, these means preferably being also employed for opening the strands of the cord circuit back of the ringing generator.

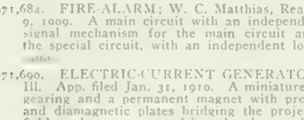
971,651. TELEPHONE TRUNKING SYSTEM; C. S. Winston, Chicago, Ill. App. filed Nov. 17, 1906. Trunking system for use between toll cords and common battery subscribers' line with a cord circuit and a telephone line, a source of direct-current connected with the incoming end of the trunk, a ringing key for the cord circuit and a ringing relay actuated by the change in the direct-current caused by the ringing key, the current flowing through the trunk line.

971,667. ELECTRICAL CONDENSER; W. W. Dean, Elyria, Ohio. App. filed Oct. 25, 1909. Strips of insulating material with thin layers of conducting material deposited thereon, which is dissipated at punctures and a strip of metallic foil of low resistance all wound together.



[illegible]—Induction Motor.





9[illegible].—Method of and Apparatus for Generating Electricity.

[illegible] Antenna.

971,683. INSULATOR; H. R. Markel, Columbus, Ohio. App. filed Aug. 13, 1909. A block insulator of two sections mating together with a central orifice and opposing wire receiving recesses at different elevations..

971,684. FIRE-ALARM; W. C. Matthias, Reading, Pa. App. filed March 9, 1909. A main circuit with an independent special alarm circuit; a signal mechanism for the main circuit and separate mechanism for the special circuit, with an independent local alarm for operating the [illegible]

971,690. ELECTRIC-CURRENT GENERATOR; H. A. Schmidt, Chicago, Ill. App. filed Jan. 31, 1910. A miniature generator with multiplying gearing and a permanent magnet with projections constituting a field and diamagnetic plates bridging the projections above and below the field, and an armature driven by the gearing.

971,692. MAGNETIC SEPARATOR; F. O. Schnelle, Frankfort-on-the-Main, Germany. App. filed Oct. 9, 1902. An iron-clad magnet [illegible] between the poles gradually decreasing in the direction of the flow of the material to be treated, with means for feeding the material to the zone.

971,722. ELECTRICALLY OPERATED VALVE; P. A. Brown, Denver, Col. App. filed Oct. 18, 1909. For use with alarm and signal whistles, ventilators and the like, in which a resilient diaphragm divides a chamber into upper and lower compartments and a magnet [illegible]

971,737. VENT-TUBE FOR STORAGE BATTERIES; Melcher Ekstromer, Cambridge, Mass. App. filed March 31, 1909. A vent for the escape of gases and a plunger enclosed with the tube constructed to rise and close the vent by the impact of the liquid of the battery against the plunger.

971,767. THERMO-ELECTRIC COUPLE; A. L. Marsh, Detroit, Mich. App. filed Sept. 3, 1909. The positive element consists of an alloy containing nickel and two per cent of aluminum.

971,776. BURGLAR ALARM; L. Myers, Newark, Mich. App. filed Nov. 9, 1909. A circuit wires the doors and windows and a pivoted arm [illegible] fingers, and a lock holds the pivoted member in inactive position and a strand or cord extends from the lock to the point to be protected.

971,782. METHOD OF CHARGING ELECTRIC-RESISTANCE FURNACES; A. Petersson Odda, Norway. App. filed Nov. 27, 1909. Furnace of the shaft type having electrodes of different polarity in the walls in which a part of the charge is introduced from above, while a charge of cold material is introduced between electrodes of different polarity to maintain a cold layer on the wall in the hot zone, thereby preventing short circuiting through the walls.

971,785. TREE INSULATOR; A. L. Pierce, Wallingford, Conn. App. filed April 21, 1910. An insulator to be attached to trees for holding a wire, the insulator being made in two parts between which the wire is clamped.

971,795. MAGNETIC BRAKE; C. Shears, Manchester, England. App. filed Jan. 21, 1909. Includes side plates, coils thereon, casings surrounding them, pins for holding the coils in position with a water-tight packed joint between the casings and the plates.

971,820. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINES; B. A. Behrend, Norwood, Ohio. App. filed Nov. 27, 1905. A stator with a winding of coils having end turns arranged at two different angles to the axis of the machine, the end turns being clamped at one angle and separate means for clamping the end turns arranged at the other angle.

971,843. ELECTRIC SWITCH; L. W. Horting, Lancaster, Pa. App filed Dec. 14, 1909. When the electric current is broken the arcing is reduced to a minimum by a quick and positive movement of the switch, which switch can be set to various points necessary for current regulation, the switch including an operating lever, a cam operated by the lever and engaging a roller mounted for wabbling movement with relation thereto.

971,847. SWITCH AND CIRCUIT-BREAKER FOR HIGH-POTENTIAL CIRCUITS; J. N. Kelman, Los Angeles, Cal. App. filed Jul 29, 1908. Makes use of a plurality of solenoid coils in the main circuit moving a soft iron core to operate a circuit closer in th auxiliary circuit which controls a soft iron core which releases a catch engaging a lever against which a spiral spring presses upward which pulls the movable blades of the high-potential circuit-breake of an oil switch.

971,864. MOVING-PICTURE PROJECTING LANTERN; W. N. Selig Chicago, Ill. App. filed April 20, 1909. Arc light lantern in whic the carbons can be swung out of the box, protection against flyin sparks being provided.

971,868. DYNAMO-ELECTRIC MACHINE; R. B. Williamson, Milwaukee, Wis. App. filed Oct. 29, 1909. For anti-hunting device for synchronous machines, the field magnets having poles with coil surrounding them and a collar at the outer end of each field havin a portion between the coil and the coil-retaining portion on the pol with damping bars extending through the poles and secured t flanges, which flanges carry short-circuiting rings.

971,869. DYNAMO-ELECTRIC MACHINE; R. B. Williamson, Milwauke Wis. App. filed April 8, 1910. For preventing displacement of coi at high speeds by means of bracing members bearing against th sides of the coil and located between adjacent field magnets an annular members mounted on the shaft at the ends of the core t which the bracing members are connected.

971,935. SPARK GAP FOR RADIOTONE WIRELESS-TELEGRAP SYSTEMS; E. J. Simon, New York, N. Y. App. filed March 1 1910. For producing powerful electric oscillations, with spark gap including a plurality of disk electrodes with thin rubber gaskets b tween to form short airtight sparking spaces.

971,961. TELEPHONE RECEIVER HANDLE; C. A. Barnes, Si Greenfield, Ind. App. filed June 3, 1910. A removable handle wi a holder portion holding a receiver between its end and a hand portion extending at an angle therefrom to be inserted between th ends of a telephone hook so as to support the handle on the hoo and the receiver on the handle while the latter is on the hook.

971,976. SECURING MEANS FOR ELECTRIC LAMP SOCKETS AN THE LIKE; J. S. Crossley, Solvay, N. Y. App. filed Sept. 1, 190 A securing bolt and an engaging nut having opposite integral dow ward extensions with the tips bent to clamp the nut on the body.

972,004. ANTENNA; Robert H. Marriott, Brooklyn, N. Y. App. file April 8, 1910. A plurality of antennæ having different natural perio any of which may be used for receiving and all together for sendin so that the operator may tune by connecting that particular antenn in circuit to which the receiving tuner best responds and by whi interference is prevented by grounding the antennæ which respond the interfering waves.

972,007. AUTOMATIC DANGER-SIGNAL AND INTERMITTENTLY ILLUMINATING ADVERTISER FOR ELECTRIC CARS; A. Ma New Orleans, La. App. filed June 16, 1909. Operates a display si from the controller handle and also a signal to warn passenge when alighting from a car.

972,029. METHOD OF AND APPARATUS FOR GENERATIN ELECTRICITY; B. Schwerin, Frankfort-on-the-Main, Germany. Ap filed May 12, 1909. A layer of coal with minute apertures throu which an electrolyte is forced and electrode plates for collecting t current.

972,048. INDICATING SWITCH-BUTTON; J. A. York, Frankli Conn. App. filed Feb. 17, 1909. A thumb button with an indicat within the button.

972,109. MAGNETIC ORE-SEPARATOR; A. G. Holmberg, Langgr van, Sweden. App. filed Nov. 27, 1908. A trough in which the c is carried in water with a belt running in the trough and electr magnets above the belt.

972,111. TELEPHONE MOUTHPIECE ATTACHMENT; A. P. Le H. and M. Schlessinger, San Francisco, Cal. App. filed May 1909. Antiseptic attachment fitting the mouthpiece on the outsi the mouthpiece being perforated so as to permit the disinfectant pass through the perforations into the mouthpiece.

972,131. ELECTRICAL HEATER; H. M. Schoenberg and G. T. Mar San Francisco, Cal. App. filed Jan. 28, 1909. For heating wat using a single pipe for hot and cold water, the heater being immers in the branch of the pipe.

[illegible] FUSE BATTERY; A. [illegible] Porter, Pompton Lake, N. J., a [illegible] P. [illegible], New York, N. Y. App. filed Jan. [illegible], 1909. For bla ing purposes, including a generator, contacts arranged in pairs, ea pair connected to a fuse, and electric circuit including the genera and contacts, an arm to complete the circuit to each pair in sequer and means for giving the arm a step-by-step movement.

[illegible] DEVICE FOR SINGEING TEXTILE FABRICS; G. G Paris, France. App. filed July 10, 1910. A pair of electrica heated bars with a movable conducting member for short-c cuiting the bars and limiting the extent of bars heated.

Octo[illegible]

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EMINENT DOMAIN FOR POWER TRANSMISSION.

An important series of hearings has recently been held before the Massachusetts Gas and Electric Light Commission regarding the granting of the right of eminent domain for electrical transmission and supply companies. The right of eminent domain is one which has been already granted to power transmission and similar companies in several States, but as a rule such cases have involved somewhat different issues from the present one, in that they mostly have been in regions less densely settled and with fewer local supply companies than in Massachusetts. The work of transmission companies in that State, and generally in communities well populated, has tended more and more to become a wholesale proposition, the energy generated not being distributed by the generating company save to local electrical supply companies and to factories using power in large blocks. A tentative bill submitted to the commission seems a praiseworthy endeavor to straighten out the situation for cases of this kind. It permits granting a certificate of exigency under which the line may be located and built, the municipal authorities retaining the right to specify the locations and construction along the route in their respective domains, with the proviso that the route laid out may not be along any public way without the consent of the local authorities. Further, it is proposed to give the electrical companies the right of eminent domain for cases in which the exercise of that right may be necessary. The provisions of the proposed bill apply both to transmission companies and to electrical supply companies, and there is a restriction that the transmission companies may not sell their electricity in any municipality through which their lines pass without special authorization to this effect by the authorities. In case of dispute there is the opportunity for an appeal to the commission.

If such a bill as this is enacted into law it will certainly encourage the growth of electrical transmission in Massachusetts. The claim was strongly made by the representatives of the various companies concerned that the rights proposed to be given would tend to reduce the cost of energy to consumers on account of lessening the necessary costs of construction which now have to be faced in the absence of any right of eminent domain. One of the counsel for companies interested emphasized especially that the commission ought not to take any steps toward recommending eminent domain unless on the ground that lower rates to the consumer would result. Just at this point there arose an interesting question. How can transmission companies which have no permission to sell electricity except in bulk reduce charges to the ultimate consumer who is supplied through another company? Doubtless the tendency to lowering the cost of electrical energy to the distributing companies would lead toward this result, but in [illegible] that the right of eminent domain could hardly be granted to private persons or

corporations not concerned with public use of the service; and that if a man's land is taken and he is unable to avail himself of the electrical energy transmitted except through an intermediary to whom the transmitting company is not responsible there is question as to the constitutionality of the act. In other words, is there any equitable reason for granting eminent domain for supposedly public service corporations which are really restricted in their sales to a limited number of other corporations and cannot reach the general consumer? Such an objection would not lie against granting eminent domain to bona fide distributing companies standing ready to serve any customer in the territory covered by their lines. In point of fact, such distributing companies work largely along the public ways, and the granting of eminent domain to them is only important in case of the great consolidated plants that stretch out over a large expanse of territory previously served by small independent corporations. For such cases the granting of eminent domain affects directly the needs of the territory served.

The situation is a curious one brought about by the rapidly growing tendency of transmission companies to sell in bulk only, in order to avoid the friction and expense which necessarily arise from establishing distributing lines in territory already occupied, even supposing that rights for such work are legally obtainable. Nevertheless, it would seem to be the larger view of the subject that power transmission companies, which on the whole tend to lessen the cost of electrical energy, should be encouraged and should not be liable to obstruction on the part of avaricious or unreasonable citizens. There is a strong tendency toward the use of private rights of way by transmission companies owing to the more complete control over the lines thus obtained, and in part to a somewhat ill-grounded fear on the part of the public that danger may arise from transmission lines along public ways. Granted that on account of these sentiments and expediency generally transmission lines should preferably acquire private rights of way, it certainly seems that it is the business of the State authorities to facilitate this admittedly desirable end by granting the right of eminent domain even although the connection between the ultimate consumer and the transmission company is not a direct one.

Without such a right it would be possible for one company by purchase of a strip of land across the proposed line of another to force the latter into a long deflection not only inconvenient and unnecessary, but ultimately expensive to the consumer; and it would certainly seem unreasonable to draw a line between the transmission company that sells power to a central station and the transmission department of the latter, which is occupied in filling precisely the same mission. No constitutional question could well be raised concerning the propriety of granting eminent domain to a public service corporation which did its own transmission. And since the power transmission companies acting independently accomplish the same result, sometimes more economically, there seems to be no sound reason for ruling against their participating in the benefits of eminent domain. We know of no case in which such rights granted the transmission companies have worked badly from the standpoint of the public interest. On the contrary, they have greatly facilitated improvements, which in the long run cannot fail to be a public benefit.

ILLUMINATION AND THE EYE.

A valuable paper on this subject abstracted in a foreign contemporary was read by Dr. Broca before the second Congrès International des Maladies Professionelles recently held in Brussels. It follows much the same line as the important paper by Broca and Laporte published two years ago, and deals especially with questions of brightness in relation to pupilary aperture and acuteness of vision. It is only recently that the effect of bright lights on pupilary aperture, and hence secondarily on ability to see by them, has received much attention. Pupilary aperture is a peculiarly difficult and unsatisfactory thing with which to experiment, inasmuch as the pupil is in constant slight activity and responds to psychological as well as physiological stimuli. Until within a few years ago the only data on the subject were those published more than a century ago by Lambert. Broca lays particular stress upon the effect of bright lights in the field of view on the visibility of objects in the same field, and his results show that brilliant lights may easily reduce the aperture of the pupil to a point that utilizes only 20 per cent or 30 per cent of the effective light. The full text of his paper not being at hand, it is impossible to say at what angle to the line of fixation the lights with which he experimented were placed, a matter which is evidently important both on account of the effect on the position of the bright image on the retina as influencing its light sensitiveness and also by reason of the fact that the pupil reacts differently to bright stimuli on different parts of the retina. The difference produced by bright light also depends greatly on the absolute amount of light energy that reaches the eye. Taking all these things into consideration, it seems likely that Dr. Broca rather understates than overstates the loss of efficiency due to pupilary reaction when a bright light is in the field.

He also touches on a very important phase of the matter—the difference due to the actual size of the image of the bright light upon the retina. When this image is so small as to fall within the area occupied by a single cone it is almost self-evident that the effect of lights of the same total intensity will remain the same irrespective of their intrinsic brilliancies. This fact was pointed out by Charpentier years ago, although Charpentier found that this condition was reached considerably before the image actually fell to the size of a single cone. From his experiments it would appear that the critical size of the image was at least a full tenth of a millimeter in diameter and probably more. Two conditions are therefore found with respect to bright lights in the field of view, one in which the intrinsic brilliancy of the source plays a very important part, the other in which it does not. The latter condition corresponds fortunately to that of relatively distant lights, in which case the total energy falling upon the eye is very much reduced so that for most purposes of illumination the former condition in which intrinsic brilliancy is a matter of considerable importance, is the common one. One of Dr. Broca's important practical conclusions is that the ordinary artificial illumination is not strong enough, on the ground that while it may be quite sufficient for reading or other work at ordinary distances from the eye it does not permit sufficient ease of vision of detail at greater distances. He suggests that the illumination should be approximately three or four ft.-candles while reading or similar work is going on. His figures are quite in keeping with previously published data on the subject, which indicate that

the eye works excellently well for reading and similar purposes when the light available at the object viewed is two ft.-candles, or even less. This smaller quantity divided by the coefficient of reflection brings up the illumination desirable reckoned at its incidence upon the object to approximately Dr. Broca's figures.

POTENTIAL STRESSES IN DIELECTRICS.

The paper read by Messrs. Harold S. Osborne and Harold Pender at the last meeting of the American Institute of Electrical Engineers contains some important features in relation to the design and use of high-tension cable conductors. If two large circular metallic disks are mounted parallel and facing each other in such a manner as to be capable of connection to the terminals of a suitable high-tension source, it is known that the electric field between the plates is uniform at all points not too near the edges. That is, the electric flux distribution is everywhere in parallel straight lines perpendicularly across the space between the plates. Under such conditions the voltage that the gap can sustain, whether the gap is composed of gaseous, liquid or solid material, is found to be sensibly in direct proportion to the gap widths, so that if an air-gap of 1 cm takes a continuous potential difference of 40 kilovolts to produce puncture, a gap of 2 cm will take 80 kilovolts, and so on. This may be described by saying that air, under the particular pressure and temperature considered, withstands an electric intensity of 40 kv per centimeter, or 4 kv per millimeter. This statement may be further simplified by saying that the dielectric strength of the air is 4 kv per millimeter. In general, the dielectric strength of good solid insulators is greater than that of good liquid insulators, which, in turn, is greater than that of good gaseous insulators. Thus rubber has a strength of about 14 kv per millimeter, oil 8 kv per millimeter, and air, at ordinary pressures and temperatures, about 4 kv per millimeter.

When a dielectric is tested between two metallic surfaces that are not parallel plates the behavior of the substance in regard to electric disruption is much more complex than the above. Thus, to take a comparatively simple case for practice, a copper wire 1 mm in diameter is covered with an insulating material to a total diameter of 5 mm and then lead-covered to an outside diameter of 7 mm. Suppose the dielectric strength of the insulation is 8 kv per millimeter. Then, since the wall of insulator separating the copper wire from the lead sheath is everywhere 2 mm thick, it might be supposed, at first sight, that the insulation would withstand 16 kv continuous e.m.f. between wire and sheath. Experiment shows, however, that it will not stand more than about 7 kv. The explanation for the apparent weakness of the insulating layer on the wire is that the field of electric force to which it is subjected is not a uniform parallel field, like that between two large flat plates, but is a field that radiates from the surface of the wire. In any such divergent field the intensity increases with the density of the flux, so that the volts per millimeter are greater at the surface of the wire than at the inner surface of the sheath. When the continuous e.m.f. applied between the wire and sheath, across the 2-mm wall of insulation, is 7 kv with an apparent average intensity of 3.5 kv per millimeter, the maximum intensity—at the wire surface—is about 8 kv per millimeter and the minimum intensity—at the sheath surface—is only 1.6 kv per millimeter. Consequently, the inner layers of the insulation are being strained to the rupture point, while the outer layers are in easy circumstances.

By applying a plurality of layers with materials of successively diminishing inductive capacity the dielectric stresses on the different layers will be made more nearly uniform, and the insulation will be worked more nearly up to its proper strength with greater economy of material. Such graded cables are already in service to some extent and their behavior has justified the above course of reasoning. There are, however, certain complicating influences to be taken into account, especially the influences of heating and of moisture. The subjection of a dielectric layer to alternating electric stress produces a certain amount of heat therein by electric hysteresis akin to the heat hysterically produced in iron by alternating magnetic stress. This heat generated in the dielectric, together with the heat produced in the wire by the load current, raises the temperature of the dielectric and reduces its dielectric strength. Unless kept cool the insulating coating may thus soon weaken sufficiently to be ruptured by a very moderate electric intensity. Moreover, moisture, or even air, occluded between successive layers of a graded cable, may readily cause break-down under alternating electric stress in such a manner as to extend the rupture into the neighboring layers and so undo the benefit of the grading.

The paper here considered extends the theory of the subject by giving formulas and curves for finding the total electric strength of a graded cable, and also for finding the most economical distribution of the layers. The original rule had been, make the specific inductive capacity of each layer inversely proportional to the radius of the layer. The new rule is, make the product of the dielectric strength and inductive capacity of each layer inversely proportional to the radius of the layer, if every layer is to be worked to the same factor of safety. The bad effects of occluding an air layer between two layers of a graded cable was made evident by the authors by an experiment in which a piece of rubber-covered wire was drawn into a glass tube. By applying an alternating voltage to the combination the rubber gave way not as a whole but in spots, so that the stress was delivered to the outside glass tube unevenly and destructively. The experiment indicates that in certain cases where powerful alternating electric stresses have to be withstood it may be advantageous to insert tinfoil between the successive layers. If one layer then breaks down, the next, at least, will be likely to receive the stress uniformly.

The advantage possessed by fluid insulating substances, that they are automatically capable of healing any puncture that may be made in them by overvoltage, compensates in considerable measure for their lower dielectric strengths. It is to be remembered that there are now transmission circuits operating industrially at 100 kv and experimentally at 150 kv, using air insulation between overhead wires, whereas very little cable is used at pressures above 20 kv and none above 50 kv. The above great disparity between the present possibilities of high-voltage insulation in aerial versus cable conductors makes the commercial disparity appear still greater. Any resource which will increase the dielectric strength or reduce the cost of cable conductors is to be welcomed greatly in the present state of the art's development. The judicious grading of cables is certainly likely to help, but the most nearly perfect grading must fall far short of existing needs.

Baltimore Convention of Illuminating Engineering Society.

The social portion of the program for the coming annual convention of the Illuminating Engineering Society at Baltimore has been designed to bridge the interval between the meetings of the convention and the opening of the course of lectures on illuminating engineering to be held at the Johns Hopkins University.

On Tuesday evening, Oct. 25, will be held the annual banquet of the society, to which will be invited all in attendance at the course of lectures. President Remsen, of the Johns Hopkins University, and Dr. Hyde, president of the Illuminating Engineering Society, as well as many other speakers of note, will address the gathering. Invitations have been extended by the officers of the society to the following organizations to be represented at this occasion:

American Institute of Electrical Engineers, American Gas Institute, National Electric Light Association, American Institute of Architects, American Ophthalmological Society, Academy of Ophthalmology and Oto-laryngology, International Acetylene Association, National Commercial Gas Association and Association of Electric Railway Engineers.

The attendance at the Johns Hopkins lectures promises to reach 150. While no time has been fixed for closing the attendance list, the authorities of the university are desirous that applications should not be delayed beyond the present week in order that proper classroom and laboratory arrangements may be made to accommodate those taking the course.

Standard Electrical Rules for Mines.

The National Bureau of Standards has issued a circular (No. 23) entitled "Standardization of Electrical Practice in Mines," which forms a valuable contribution to the subject of the safe use of electricity in mining.

In an introduction a history is given of the movement which led to the publication of the present work. At a meeting of the American Mining Congress in Denver, Col., in 1909 a committee of seven members was appointed to report on the subject of the standardization of electrical practice in mining work, the membership consisting of one electrical engineer, two representatives of electrical manufacturers, two representatives of mine operators and two representatives of mine workers. Dr E. B. Rosa, of the Bureau of Standards, was selected as the electrical engineer, and one member from the staff of the General Electric Company and one from the Westinghouse Electric & Manufacturing Company represented the electrical manufacturers. As it became necessary for the Bureau of Standards to do a much larger share of the work than was at first contemplated, Mr. Burton McCullom, of the bureau, was detailed to assist Dr. Rosa, who was appointed chairman of the committee. A preliminary report of the committee was made Sept. 20, 1909, and a special meeting of its members was to be called for January, 1910, when it was learned indirectly that at the Goldfield meeting of the American Mining Congress the committee had been dismissed and the president authorized to appoint a new committee. It appears that there was opposition from some mine operators against the work which the original committee had undertaken. They believed that the mine owners and operators could safely be left to themselves without any limitation or supervision, such as would be entailed if the proposed standardization of electrical practice were made the subject of state legislation. The chairman of the new committee appointed stated that he did not intend to take up the work the original committee had commenced. In view of the considerable work already done along the original lines, it was finally decided that the bureau should carry on the work to completion and publish the results. The bureau invites criticism and suggestions concerning the rules submitted in the circular, in order that they may be improved as much as possible in the next edition, which will be carefully revised. In continuation of the work the bureau will have the co-operation of the Bureau of Mines, which has recently been established and which will continue the experimental work begun in the technological branch of the Geological Survey relative to the use of electrical apparatus in explosive atmospheres.

The proposed rules for the installation of electricity in mines number fifty-four, and there is an additional section on the inspection of the electric equipment of mines, and on the dangers of electric wires and how to avoid them. There is also a section containing explanatory statements applying to a number of proposed rules on which there appears to be considerable diversity of opinion, and an appendix of fifty-one pages giving a compilation of the electrical mining laws of the different States that have done anything in this direction, and of the principal foreign countries.

These rules are classified under the heads of Definitions; General; Transmission Lines and Cables; Switches, Fuses and Circuit-Breakers; Motors; Special Rules Governing the Use of Electricity in Gaseous Mines. A further section on the inspection of the electrical equipment of mines gives the form of an act providing for the appointment of an examining board for electrical mine inspectors, describing the nature of examinations, the salaries and the duties of electrical inspectors, etc.

The rules are in such detail that only a few can here be noticed. Electrical mining systems are defined with respect to voltage as low pressure, not exceeding 300 volts; medium pressure, between 300 volts and 600 volts, and high pressure, exceeding 600 volts. Under the head of "General" are rules prescribing the grounding of machine frames and electric circuits, and prohibiting the use of voltages above 600 for portable motors and other purposes underground except for alternating-current transmission or for application to alternating-current apparatus in which the high-pressure circuit is stationary. It is further provided that all transformers in the latter case shall be of the oil-insulated type, and that no motor shall have a normal rating less than 20 hp.

One of the rules requires that in every mine where electricity is used below ground a competent mine electrician, and where necessary an assistant mine electrician also, shall be employed, who shall have full charge of the electrical apparatus used in connection with the mine. A requirement is that instructions shall be placed at the mine entrance and in every generator, transformer and motor house for the resuscitation of persons suffering from electric shock, and all employees operating electrical apparatus shall be required to acquaint themselves with these instructions. The insulation of conductors and the installation of circuits are closely covered, as well as the details of electric haulage installations. The work reflects great credit on the bureau and should do much in furthering the application of electricity to mining by removing grounds for criticism based upon the slipshod manner in which many electrical mine plants have been installed or left without competent supervision and inspection.

Annual Convention of Illinois State Electric Association.

The officers of the Illinois State Electric Association with the co-operation of the Illinois Electrical Exhibitors' Association are endeavoring to make the coming annual meeting of the association at Rock Island, Oct. 25-27, the most successful in the history of the organization.

President McKinley, of the Illinois Traction System, has placed at the disposal of the executive committee a special car for the convenience of those whose plants are near the traction company's line. This car will leave the Illinois Traction System's station, Twelfth Street and Lucas Avenue, St. Louis, at 6:35 on the morning of Oct. 25, reaching Peoria at 1:40 p. m., from which point the members will take a train over the Rock Island road to Rock Island. A special time card has been issued for this car and a copy sent to those operating central stations in the southern and eastern part of Illinois, giving the time of its departure from various stations along the line. A lunch will be served on the car.

The program begins with a smoker, vaudeville and "get to-

gether" meeting at 8:30 p. m., Tuesday, Oct. 25, at the Elks' Club Room. At this smoker the members of the association will be the guests of the supply men.

Wednesday, Oct. 26, has been designated "New Business Day." After the report of committees and other routine business, the first paper will be *Signs and Window Lighting*, by Mr. E. W. Osborn, advertising manager of the Rockford Electric Company. After this will be a paper on *The Radical Tendency in Rates*, by Mr. J. S. Maltman, new-business manager of the Kankakee Gas & Electric Company. The next paper, concluding the morning session, will be *Electric Shows in the Smaller Cities*, by Mr. J. E. Johnson, general superintendent of the Danville Railway and Light Company. The first paper at the afternoon session will be *Promoting New Business*, by Mr. T. P. Pinkard, new-business manager of the Peoria Gas & Electric Company, followed by a paper on *How to Get New Business*, by Mr. Max Heiliger, assistant manager of the Rockford Electric Company. The concluding paper of the day's program will be *New-Business Ideas*, by Mr. O. C. Macy, superintendent of the Alton Gas & Electric Company. In the evening the members of the association will be the guests of the salesmen at a theater party in the Illinois Theater.

The morning session of Thursday, Oct. 27, will be opened with a paper entitled *Des Moines Plan of Meter Reading*, by Mr. P. B. Sawyer, general manager of the Des Moines Electric Company, followed by a lecture on *Hunting of Synchronous Apparatus*, by Dr. E. J. Berg, professor of electrical engineering, University of Illinois. The session will close with a paper on *Publicity and Public Policy*, by Mr. C. W. Lee, secretary and treasurer of the C. W. Lee Company, New York. At 2 p. m. the executive meeting and election of officers will be held, after which a trip will be taken over the Tri-Cities railway in a special car. The People's Power Company will be the hosts at a banquet for the association in the "Black Hawk Watch Tower."

The following firms will have exhibits in a special room set aside for that purpose: Fairbanks, Morse Company, Dearborn Drug & Chemical Company, Wagner Electric Manufacturing Company, Tri-City Electric Company, Electric Appliance Company, Central Electric Company, General Electric Company, Ft. Wayne Electric Company, Johns-Manville Company, Westinghouse Electric & Manufacturing Company, Valentine-Clark Company, W. R. Garton Company, Simplex Company, Western Electric Company, Hughes Electric Company, Holophane Company, W. N. Matthews & Brother.

The People's Power Company will extend an invitation to the citizens of Rock Island, Ill., Moline, Ill., and Davenport Ia., to attend, free of charge, the electrical display.

Hydroelectric Energy Advocated for All Municipal Requirements in Chicago.

President R. R. McCormick, president of the board of trustees of the Sanitary District of Chicago, believes that all the municipal bodies in Cook County will do well to meet their power requirements of whatever nature by buying electrical energy, generated by means of the water-power of the Drainage Canal, from the Sanitary District. The City of Chicago secures all the electricity used for street lighting at the present time from this source, and is arranging to take nearly double the amount at present consumed. In addition, the new city hall and county building is to be supplied with electrical energy by the Sanitary District at the low rate of 1¼ cents per kw-hour. The District also sells electricity to some of the park boards and for some other municipal purposes. Mr. McCormick, however, contends that inasmuch as the Sanitary District is in itself a municipal corporation, the Drainage Canal being built and utilized by the taxpayers' money, the various other public utilities requiring power should avail themselves of this cheap supply. In particular he advocates the operation of the waterworks pumping stations by the use of electrical energy from the Drainage Canal, with perhaps steam reserves as a standby. One objection to this, however, has been that as the transmission line is thirty miles long, it would be dangerous to place sole reliance in it for power in case of a great fire.

Mr. McCormick also thinks that such bodies as the library board, school board, Cook County Hospital, Detention Hospital and other public institutions in Chicago, as well as the cities of Evanston, Oak Park and other smaller communities in Cook County outside of Chicago, should utilize the cheap electricity of the Sanitary District.

At a public hearing of the Merriam Commission to improve municipal service, held on Oct. 14, Mr. McCormick pointed out the extravagance of a number of plants for various municipal services. He cited the report of Sargent & Lundy to the Illinois Manufacturers' Association to show that the cost of pumping the city's water by steam is 0.5 cent per 1000 gal. On the basis of electrically driven pumps, with energy purchased at $26.40 per kilowatt per year, Mr. McCormick estimates that the cost of pumping would be reduced to about 0.3 cent per 1000 gal. This is figured on the entire separation of the waterworks buildings from the electrical pumping stations. By combining the two in one building, as might perhaps be done, a further economy could be effected.

During his address Mr. McCormick made the interesting statement that the Sanitary District made its bid for lighting the City Hall at the rate of 1¼ cents per kw-hour, with the knowledge that it would be required to spend $150,000 for the transmission lines and other investment required. One-half of this, he said, was for a storage battery which will be sufficiently large to carry the building load for two hours if necessary.

The use of electricity was advocated for the operation of the pumping stations used in sewage disposal, and the speaker also thought that Sanitary District energy might be used in lighting police and fire department stations. The speaker also made the interesting statement that all new substations of the Sanitary District of Chicago will be located in or near the pumping stations of the city water works, as far as practicable.

Meeting of the Brooklyn Company Section of the N. E. L. A.

The Brooklyn Company Section of the National Electric Light Association began its work for the season with a social meeting in Johnston Building on Oct. 3. The chairman, Mr. E. A. Baily, in addressing the 350 members and guests present, briefly outlined the work for the season with three goals in perspective—the winning of the Doherty medal, increased efficiency and membership of the section, and unstinted support of Mr. Freeman in his office as president of the N. E. L. A. Following his address Mr. Baily introduced Mr. B. W. Stilwell, vice-president of the Westchester Lighting Company, who spoke on co-operation and good fellowship. Dr. Stilwell's remarks were largely centered around the Golden Rule, his particular point being that the most satisfactory way of achieving success is by elevating one's associates rather than by holding them down.

The second speaker of the evening was Mr. Justice F. E. Crane, of the New York Supreme Court bench, who pointed out particularly that the man who pays strict attention to his present duties is assured of a successful future, whereas the man who in his desire for future welfare is unmindful of the present never attains success. The keynote of the judge's speech was: "I do not know what the future is going to be; I only know this: Here I am, and this is my task. Be the present what it may, let people think what they will, the work I have to do will be done honestly." Mr. W. W. Freeman, president of the N. E. L. A., was the final speaker and based his talk on organization. He showed how the company sections cover a field as important and as beneficial to its members as that of larger and national organizations. He said that the Brooklyn company section served as an example for other larger companies. Mr. R. D. Rubright, chairman of the committee on meetings and papers, made some announcements regarding future speakers and meetings, stating that ex-Secretary

of the Treasury G. B. Cortelyou and Mr. A. E. Steers, president of the Borough of Brooklyn, would address the section at an early meeting. The rest of the evening was given over to social functions followed by refreshments. A business meeting of the section is scheduled for Nov. 7.

Rehabilitation of Chicago Consolidated Traction Properties.

Ending a long contest in the courts and out of them, the ordinance providing for the rehabilitation of the physical property and operating methods of the Chicago Consolidated Traction Company was passed by the Chicago City Council on Oct. 10. The Chicago Railways Company is empowered to purchase the Consolidated Company, and, with this addition, it will be in possession of all the North Side and West Side surface street railway lines in Chicago. Rehabilitation will be begun immediately under an ordinance similar to those governing the Chicago Railways Company and the Chicago City Railway Company, expiring at the same time as the other ordinances. The work will be done under the direction of the Board of Supervising Engineers, Chicago Traction. Track must be rebuilt, new cars must be purchased, substations constructed and arrangements made for securing additional electrical energy to operate the cars. Increased car-house facilities are to be provided also. About 118 miles of street are covered by the ordinance. It is said that the lines which will receive first attention are those on West Madison Street between Fortieth and Sixtieth Avenues, Milwaukee Avenue from Logan Square to the city limits, and Belmont Avenue between Sheffield Avenue and the North Branch of the Chicago River. The Elston Avenue line, which is badly in need of improvement, will also be among the first to be rehabilitated.

The Pacific Coast Electrical Exposition a Success.

The committee in charge of the Pacific Coast Electrical Exposition announces that it will be able to pay back to exhibitors between 50 per cent and 60 per cent on their original subscriptions. It is found that the total expenses of the exposition were approximately $10,200. The total attendance for the eight days, Sept. 17 to 24, was about 40,000, including complimentary admissions. Practically all the exhibitors are unanimous in saying that the exposition was a success and that they derived considerable business from it. This being the first show of its kind on the Pacific Coast many of the electrical firms were skeptical as to its value from a business-return point of view, but they are now convinced that it was well worth the expense and many of them are ready to get up a similar exposition next year. The prevailing sentiment, however, seems to be to have an exposition every two years. As has already been mentioned in these columns, the success of the show was largely due to the untiring efforts of the executive committee, of which Mr. W. W. Briggs, of the Westinghouse Electric & Manufacturing Company, was chairman.

Industrial Exposition at Buffalo.

The third annual exposition of Buffalo manufacturers is being held at Buffalo, Oct. 3 to 15, under the auspices of the Chamber of Commerce and Manufacturers' Club and is the largest and most successful of the local expositions held thus far, in point both of attendance and exhibits. The former armory of the Sixty-fifth New York State Regiment, on Broadway, has been fitted up as an exposition hall and in it are installed 140 exhibits of the varied products of local manufacturers, sixty of them being working, or demonstrating, exhibits under power.

One of the chief attractions of the exposition is the electrical display, which surpasses anything of the kind undertaken in Buffalo since the Pan-American Exposition in 1901, both as regards the illumination in the exposition building, which was exceedingly brilliant, and the street illumination on Broadway between the exposition and Lafayette Square on Main Street a distance of seven blocks. The most effective and spectacular feature of the electrical display was the aerial flight of a huge red ball of electric lights from the top of a tall Japanese pagoda in Lafayette Square, which was festooned with electric lights in Japanese lantern designs. The ball passed from the tower down the center of Broadway to the top of an imposing electric arch in front of the exposition building, ricocheting in its course through a series of rings of fire. The flights —or apparent flights—of the ball, which were made in quick succession during each evening, were produced by the successive lighting and shutting off of current in a large number of duplicate red balls of electric lights located at equal distances between Lafayette Square and the exposition.

Many novel and interesting exhibits were made. In electrical lines the largest and most complete was that of the Buffalo General Electric Company, which gave an illustrative exhibit of the generating of electric power at Niagara Falls by means of working models of the great electric generating plants there, showing power houses, canals, tunnels, penstocks, turbines and generators to the minutest detail, together with the transformers, switchboards, distributing apparatus, cables, etc., carrying the current to distant cities. Other exhibits of the same company comprised a "House Electric" of five rooms fitted with all the latest electric devices for domestic uses and performance of various household functions, and a modern printing shop equipped with electrically operated linotype machines, presses and stereotyping room.

New York Edison Company Entertains Contractors.

On the evening of Oct. 14 the New York Edison Company gave its annual smoker to the electrical contractors of New York in the Concert Hall of Madison Square Garden. An excellent vaudeville entertainment was given by professional performers, who appeared as soon as they were released from engagements in the various theaters of the city, and prior to the performance each guest received a bag containing a program, a number of cigars and cigarettes and a package of matches. The music hall was filled to overcrowding with electrical contractors and guests of the company, including the city officials of the Boroughs of Manhattan and the Bronx. The performance fulfilled the traditions of the New York Edison Company for giving the best that the market affords, and at its conclusion a buffet lunch was served in the restaurant of Madison Square Garden. It being then almost midnight, the electrical show was closed to visitors and the electrical contractors and other guests of the New York Edison Company were permitted to inspect the exhibits at leisure. The Edison smokers are always very enjoyable functions and every electrical contractor in New York usually makes it a point to attend them.

The Electric Railway Convention.

The American Electric Railway Association, the new name adopted by the American Street and Interurban Railway Association, finished last week the convention at Atlantic City, N. J., which was the most successful in the history of the industry. Similar changes of name were made by the allied and affiliated associations in the belief that the new title is more appropriate under present conditions than the old.

More than fifty papers and committee reports were presented before the various associations during the week, embracing the wide range of subjects necessary to interest every department of an electric railway organization. Several of these, read before the Engineering Association, were of particular interest from an electrical standpoint.

A report of the committee on power distribution was made by Messrs. A. F. Hovey, vice-chairman; L. L. Foster, E. J. Dunne, E. J. Burdick and William Roberts. Owing to unavoidable delay in the commencement of the work and to the death of the chairman, Mr. James Helwood, no formal report was prepared. However, the specifications for high-tension, three-conductor cable and for low-tension, single-conductor cable, which were included last year in the appendix to the re-

port, were revised and were presented to the convention for discussion. This report was discussed by Messrs. George H. Hill, G. W. Palmer, E. N. Lake, E. J. Dunne and J. W. Corning. Mr. Lake said that the practice in Chicago had been to specify, for cables that were not subjected to any particular mechanical strain, a conductivity of 99 per cent. Mr. Hill read a criticism of the specifications which had been written by Mr. Wallace Clark, General Electric Company. Mr. Clark suggested that the requirement of 98.5 per cent conductivity was rather high. As an appendix the committee submitted specifications for overhead crossings of electric transmission lines, prepared as a proposed joint report of the committee on electricity of the American Railway Engineering and Maintenance of Way Association and the committee on overhead line construction of the National Electric Light Association.

The Engineering Association received also a report of the committee on equipment, composed of Messrs. John Lindall, chairman; H. A. Benedict, M. V. Ayres, R. C. Taylor, Terrance Scullin and A. T. Clark. This report included a "Consideration of Methods of Reducing Weights of Cars on New Construction, with Due Allowance for Strength of Parts." In connection with the consideration of this subject the reduction in weight of electrical equipment was taken up with the electrical manufacturers, and it appeared that the motor frames have been lightened from time to time until they are made as light as possible, consistent with mechanical strength and magnetic sections, renewable shaft, wearing depth of commutator bars, etc. Some saving of weight can be made by substituting sheet steel for malleable iron in gear cases, motor covers, etc., but in many instances this change has not been acceptable to the purchaser.

The manufacturers also suggested four possible means of reducing weight of electrical equipment, as follows:

"First—By increasing armature speeds—recent improvement in pinions, carbon brushes, commutator surfaces and brush holders tending to make this possible.

"Second—By forced ventilation of motors.

"Third—By the use of fireproof insulation and operating motors at higher temperatures.

"Fourth—By the use of field control, which would permit reduction of rheostat weights."

The committee stated that it believes these suggestions are worthy of very careful consideration.

A report was also presented by the committee on heavy electric traction, consisting of Messrs. J. S. Doyle, chairman; E. R. Hill, E. B. Katte, W. S. Murray and J. H. Davis. It included a report on the standard location of third-rail working conductors. The committee confined its considerations mainly to the standard adopted by the American Railway Association. It assumed that the third rail will be used only in connection with strictly heavy electric traction operations and, therefore, confined its attention chiefly to conditions that obtain on American steam railroads, such as have already adopted or might be expected to adopt heavy electric traction on one or more of their lines. On this basis of procedure it was found that the data and conditions governing the adoption of a standard location at this time are practically the same as those upon which the American Railway Association based its action in 1908, and the committee considered that the conclusions reached by that association are consistent with the data and, therefore, recommended the same standards. The committee also recommended terms and definitions for adoption in connection with third-rail working conductors. Mr. Katte wrote that a meeting of a committee of the American Railway Engineering and Maintenance of Way Association would be held at which a third-rail clearance diagram somewhat different from the one in the committee report would be considered, and he therefore suggested that consideration of that portion of the committee report be deferred. The recommendations for standard location of third-rail working conductors were, therefore, referred back to the committee for further consideration during the coming year.

The committee on standards recommended that the section of No. 4-0 grooved trolley wire [illegible] committee on power distribution be adopted as a standard. It recommended that the committee on power distribution consider the design of standard sections for other sizes of grooved trolley wire, all to have, if possible, the same contour of groove in order that one hanger may be used for all sizes. The committee voted for approval of the copper-wire table recommended by the committee on power distribution. The committee also recommended that cables be specified in orders by circular millage instead of by gage number. The committee asked that the committee on power distribution be requested to prepare a standing table and to define the difference between a "strand" and a "cable." The association adopted, in accordance with the recommendations of the committee, the section of grooved trolley wire and the wire table. The committee on standards consisted of Messrs. Paul Winsor, chairman; H. H. Adams, E. O. Ackerman, W. S. Murray, John Lindall, J. H. Hanna, G. W. Palmer, Jr., and Martin Schreiber.

A report of the committee on power generation was submitted by Messrs. H. G. Stott, vice-chairman; G. H. Kelsay, C. E. Roehl, J. D. Andrew and E. D. Smith. The subjects considered in the report were as follows: "Forced Draft"; "Flue Gas Analysis"; "Low-Pressure Steam Turbines"; "Steam Meters," and "Peak Loads."

The exhibits were easily accessible in the booths on Young's Million Dollar Pier and made an attractive appearance. Over 180 manufacturers made exhibits and the decorations made a fine setting for the many varieties of apparatus displayed.

Mr. Arthur W. Brady, Anderson, Ind., was elected president of the American association for the ensuing year. The newly elected presidents of the other associations are as follows: Engineering, Mr. W. J. Harvie, Syracuse, N. Y.; Accountants', Mr. William H. Forse, Jr., Anderson, Ind.; Claim Agents', Mr. H. V. Drown, Newark, N. J.; Transportation and Traffic, Mr. H. C. Page, Worcester, Mass.

Annual Meeting of Sons of Jove.

The eighth annual meeting of the Order of Rejuvenated Sons of Jove was held at Birmingham, Ala., on Oct. 13, 14 and 15, with headquarters at the Hotel Hillman. The convention was one of the most enthusiastic and successful in the history of the order. The local arrangements for the regular sessions, entertainment and "rejuvenation" were excellent. Out-of-town delegations arrived early and remained until the final adjournment on Saturday night. The entire business section of the city was elaborately decorated by day and brilliantly illuminated by night. Flags, bunting, cards of welcome and electric signs, especially designed, were in evidence everywhere.

Business sessions were held in the City Council chambers. The Mayor of the city, Hon. Culpeper Exum, extended the freedom of the city at the opening session on Thursday, and after being duly initiated into the mysteries of the Order proved himself a loyal Jovian.

The entertainment features included a theater party, visit to the Alabama State Fair, banquet, automobile trips about the city, and a trip to the great steel plants, the coal mines and the iron industries that, in the past ten years, have given Birmingham the largest proportionate increase of population in the whole United States—38,000 in 1900 and 133,000 in 1910, nearly 250 per cent.

The retiring head of the Order, Jupiter Oscar C. Turner, of Birmingham, reported an increase of over 1000 members during the year, making a total membership of nearly 4000. Greater plans for increasing the usefulness of the order as the one great co-operative force in the world of electricity to-day were inaugurated; the spirit of "All Together, All the Time, for Everything Electrical"—the slogan of Jovianism—received a new impetus; the idea of fraternity and good fellowship as the fertile seed of sound commercial growth in prosperity was born anew; the creation of a greater market, common to all, by the elimination of trade jealousies, unfair methods of commercial competition, suspicion and misunderstanding, was the keynote of the convention spirit.

A [illegible] initiation, was held on the last night, at

which time thirty new members were received. The order now numbers among its four thousand members many of the most influential and most prominent men engaged in the electrical industries throughout the United States, Canada and Mexico.

The officers elected for the next year are as follows: Jupiter, Mr. John F. Dostal, Denver Gas & Electric Company, Denver, Col.; Neptune, Mr. H. B. Crouse, Crouse-Hinds Company, Syracuse, N. Y.; Pluto, Mr. J. P. Lawrence, Nashville, Tenn.; Vulcan, Mr. C. C. Hillis, Electric Appliance Company, San Francisco, Cal.; Mercury, Mr. R. M. Van Vleet, Cutler-Hammer Manufacturing Company, Chicago, Ill.; Mars, Mr. A. C. Beattie, Cincinnati, Ohio; Hercules, Mr. M. F. Sterritt, Hobson Electric Company, Dallas, Tex.; Apollo, Mr. W. N. Matthews, W. N. Matthews & Brother, St. Louis, Mo.; Avrenim, Mr. R. C. Kemp, Montana Electric Company, Butte, Mont.

One hundred telegrams from the Governor of Colorado, the Mayor and President of the City Council of Denver, Frank W. Freuauff, ex-president of the National Electric Light Association, and all the leading electrical men of Denver secured for the "City in the Clouds" the next annual meeting, and the high office of Jupiter, whose throne is on Mount Olympus, the goal and Mecca of every true and loyal Son of Jove.

Boiler Manufacturers in Convention.

The American Boiler Manufacturers' Association held its twenty-second annual convention in the Auditorium Hotel, Chicago, Oct. 10 to 13. This association is composed of about seventy-five manufacturers of steam boilers in the United States and Canada, who operate "contract shops," that is, manufacture boilers on a commercial scale for sale to the trade rather than make boilers for their own use, as is the case with some steam-railroad companies and other concerns. Allied with the parent association is a supply men's association, which provides the entertainment at the annual conventions.

Various questions of interest to boiler makers were discussed at the open and executive sessions of the association. Mr. George A. Uhler, chairman of the Board of Supervising Inspectors of Steam Vessels for the United States government, was present as an invited guest and addressed the association. He said that the boiler plate produced to-day is better than ever before and that this is true both in respect to marine boilers and those used in power plants on land. In relation to the question of spring safety valves versus lever safety valves, Mr. Uhler expressed his personal preference for spring safety valves, but, nevertheless, the majority of the board of which he is chairman permits the use of lever valves under certain conditions, and, therefore, this is the ruling that obtains, as the decisions of the board are made by a majority vote.

Some time was devoted to the discussion of boiler explosions, particularly whether they are to be ascribed to defects of material and workmanship or to carelessness or neglect in operation. One speaker recounted several instances of failure where it was found on investigation that the boilers did not conform to a true circle at the longitudinal joints. This possibility of flattening at the joints is an important consideration in the construction of steam boilers having butt-strap joints. However, care and management after the boiler is installed have a vital bearing on the question of safety. The rules formulated by the Board of Boiler Rules of Massachusetts were referred to with approval, and the general opinion seemed to be that the carefully worked-out regulations of the Massachusetts board are worthy of adoption elsewhere. Copies of the engineers' and firemen's license law, the boiler inspection law and the boiler rules prevailing in Massachusetts were distributed among the members present.

Mr. W. S. Blake, of the Hartford Steam Boiler Inspection & Insurance Company, was present, and in response to a request for his views said that the responsibility for boiler failures should be divided between manufacturers, owners and operators. He laid stress on the point that the owner of the plant at fault could not evade his fair share of responsibility when the accident may have been caused by his neglect or carelessness. Mr. Blake also pointed out that there is room for improvement in the material used in the manufacture of boiler tubes. There has been great improvement in the manufacture of steel plate for boilers, and now the tubes are apparently the weak link. The manner of welding the tubes is also important, as examination after failures of tubes often shows that the tube has given way at the joint or weld.

President Meier said that the boiler-insurance companies should protect the manufacturers by detecting and endeavoring to correct bad practice in their operation of boilers.

Another speaker dwelt earnestly on the deplorable lack of uniformity in relation to the local laws and regulations governing the manufacture, installation and operation of steam boilers. The government has very rigid requirements in relation to boilers designed for the navy and for marine use generally. A man's life on land is worth as much as on shipboard, and the speaker thought that the government restrictions might well be applied to land plants. However, the difficulty is that Congress has no jurisdiction in this matter, as regulations of this kind are reserved to the several States under our form of government. The consequence is that there are many sets of rules and regulations referring to boiler practice that are most vexatious to boiler manufacturers. For instance, a boiler that may be installed in most Pennsylvania cities will not be accepted in Philadelphia, and a boiler that will pass inspection in Philadelphia will be rejected in Massachusetts. Again, a boiler considered satisfactory in Massachusetts will not be accepted in Philadelphia. Thus the matter of uniform specifications is very important, for not only do boiler regulations vary in different States, but in some cases in different cities of the same State.

Captain Norton, of the United States Navy, referred briefly to boiler practice on warships. One point he brought out was that in the navy a boiler is never blown off to clean it. The water is allowed to cool in the boiler first to prevent undue contraction.

A member from Toronto explained that the same difficulty in relation to uniform boiler regulations is experienced in Canada as in the United States. An effort is now being made to induce the legislatures of the various provinces to enact a uniform law on this subject.

Mr. Brown, a delegate from the International Master Boiler Makers' Association, was introduced and spoke briefly.

Officers were re-elected as follows: President, Mr. E. D. Meier (Heine Safety Boiler Works), New York. Vice-presidents, Mr. T. M. Rees, of Pittsburgh; Mr. J. Don Smith, of Charleston, S. C.; Mr. W. A. Brunner, of Phillipsburg, N. J.; Mr. H. D. MacKinnon, of Bay City, Mich., and Mr. M. A. Ryan, of Duluth, Minn. Secretary, Mr. J. D. Farasey (H. E. Teachout Boiler Works), Cleveland. Treasurer, Mr. Joseph F. Wangler, St. Louis.

Boston was selected as the place of next year's convention.

Discussion on New York Subway Situation.

At an informal public engineering meeting held in the Engineering Societies Building on Oct. 17 the rapid transit requirements of Greater New York were discussed by Messrs. F. J. Sprague, formerly member of the electrification committee of the New York Central Railroad; W. J. Wilgus, formerly vice-president of the New York Central Railroad; L. B. Stillwell, formerly consulting engineer of the Interborough Rapid Transit Company; W. S. Murray, electrical engineer of the New Haven Railroad, and R. W. Dowling, president of the City Investing Company.

The paper of the evening was presented by Mr. Sprague. In this paper was given an outline of the early history of traction commissions in New York, and the success attending the operation of the present subway system. The author discussed in detail the proposed route known as the "Tri-borough," which he criticised as being divided into two entirely separate divisions; that is, instead of there being a track system permitting through train movement over the entire line, there are north and south Manhattan and Bronx routes

constituting one entity, and the Canal Street, bridge loop and Brooklyn extensions another, intersecting at different levels, without track connections, at Canal Street and Broadway only. He claimed that the Tri-borough system is mistakenly conceived and unwisely promoted, and that if its construction as now planned is persisted in the result will be a far-reaching disaster.

On the other hand, the Interborough Rapid Transit Company has proposed Lexington Avenue and Seventh Avenue subways, which constitute a natural H-formation with the existing Manhattan routes, and in addition there is at the lower end a duplicate line to Brooklyn, while at the upper end the two branches of the present system are bifurcated by an elevated extension connecting with the Lexington Avenue subway and with the Eighth Avenue elevated, and a short distance south of this junction connection is made with the West Farms branch of the present subway. In addition, and independently of extra tracking, the Third Avenue elevated is extended to the Yonkers line, and the Second Avenue elevated over the Queensboro Bridge.

Mr. Sprague contended that the extensions thus projected are entirely natural, are well planned, and constitute a logical development. Operated as a single system, if satisfactory terms can be made with the city, there is here promised the maximum of relief and accommodation to the greatest number of people—to the extent of doubling the present capacity—in the shortest time, and at the least possible capital expense. It would afford direct north and south through-travel on the east and west sides of the city through non-competitive territory, free interchange between the two sections, and alternative connections to Brooklyn, as well as transfer to Long Island City by way of the Steinway Tunnel. It would tap the terminus of the New York Central, Harlem and New Haven Railroads, and would equally serve the new station of the Pennsylvania and Long Island Railroads, with its daily movement of a thousand trains, and through the Hudson & Manhattan Railroad Company afford connections with Jersey City and Hoboken, and the Pennsylvania, Erie and Lackawanna stations across the river.

Mr. Wilgus remarked that the construction of a subway along some such route as that proposed by the Interborough would prove of much benefit to the property located on the west side of the city below Forty-second Street, while the building of a subway according to the Tri-borough plan would be of little benefit to the property in any locality.

Mr. Stillwell said that the plans of the Tri-borough system would involve the expenditure of much money uselessly for an opening too large for the present cars and too small for foreign cars. He expressed the opinion that it is altogether proper for engineers to exert their influence in insuring the selection of proper plans for engineering work in which the public is interested.

Mr. Murray claimed that no mistake would be made in building the future subways with greater clearances, because the time will surely arrive when it will prove advantageous to admit foreign cars to the subway system.

Mr. Dowling said that real estate men are vitally interested in transportation problems, and he believed it to be to the best interest of the city as a whole to provide improved transportation facilities in territory as yet undeveloped. A route connecting the upper east side with the lower west side, as proposed by the Interborough, would prove of great benefit to property holders in these localities. The increased taxes accompanying the increase in property values would go far toward paying for the transportation system.

Potential Stresses in Dielectrics.

At a meeting of the American Institute of Electrical Engineers held on Oct. 14 a paper by Messrs. Harold S. Osborne and Harold Pender was presented by Dr. Osborne. This paper dealt with the potential stresses in dielectrics, especially in the insulation used in cables.

Particular attention was paid to the equalization of the stresses within the dielectric in order that all parts may benefit by equal factors of safety. The layers of dielectric may be subjected to equal stresses either by separating the layers by metal foils subjected to proper potential differences or by increasing successively the capacity of the inner layers. The first method, requiring sources of various potentials, is not adapted to many cases, but can conveniently be applied in the insulation of a transformer, where any desired voltage may be tapped from the high-tension winding.

The most obvious way of applying the method of increasing the capacity of the inner layers is to separate the layers by metal foil and connect additional condensers across the inner layers. This method has been suggested for underground cables, but it has the disadvantage that it requires apparatus external to the cables themselves. This method has, however, been applied very ingeniously and successfully to the design of the condenser type of transformer terminal.

A method of increasing the capacity of the inner layers which is capable of a broader application, and which does not require the insertion of metallic layers, is the "grading" of the specific capacity of the dielectric, making it higher in the inner layers than in the outer. This method has the advantage that it does not require the insertion of metallic layers between the layers of insulation. It is this method which is being applied in the manufacture of extra-high-tension cables.

The authors outlined the mathematical theory of grading and showed the advantages to be obtained from using two, three, four or more layers of different material for the dielectric. They developed formulas for showing the best theoretical design of a graded single-conductor cable of certain given types for any given conditions. The effect of the conductivity of the dielectric was found to be entirely negligible for ordinary materials and ordinary frequencies of alternating-current working. Results of experiment indicate that a solid dielectric, when overstressed, becomes pricked with a number of needlepoints of disrupted material. By this hypothesis these results, and those of earlier experiments, are explained without violating the assumption with regard to the electric strength of a dielectric which is the basis of all analytical work on the subject. The authors expressed the opinion that their analytical results are based on proper assumptions, but when they deal with cases of partial breakdown they must be modified to take account of the true character of that breakdown.

DISCUSSION.

In a written communication Prof. J. B. Whitehead, of Johns Hopkins University, explained the phenomena described by the authors on the basis of the ionization theory. He stated that since the distances between the ions which enter into the phenomenon of disruption in solid dielectrics are very much smaller than those involved in gases, by steadily decreasing the size of wire any tendency of the electric strength to present an apparent increase must occur at very much smaller diameters than those obtaining in the case of a gas.

Mr. Milton Franklin, Schenectady, N. Y., remarked that the dielectric stress corresponds to a mechanical stress similar to a hydrostatic pressure and is accompanied by a proportionate strain, the values being expressible in pounds per square inch. The failure of the dielectric is due to the periodic application of this stress and the ultimate fatigue of the material.

Dr. A. E. Kennelly called attention to the impossibility of practically rendering the layers in a graded cable homogeneous by reason of the inevitable presence of imperfect joints in the electrostatic circuit. Local concentration of electrostatic flux may cause a partial breakdown which by spreading will result in total rupture.

Prof. W. S. Franklin, of Lehigh University, explained the progressive rupturing of a dielectric by means of an analogy with the movement of a crack across a pane of glass when subjected to a very slight stress.

Mr. W. I. Middleton, of Boston, compared the results obtained with old formulas with those due to the newer formulas and showed that whereas in a certain cable designed according

to the old formula a 4 5/32-in. wall was used, at present a 9/32-in. wall is found to be satisfactory.

Mr. H. W. Fisher, of Pittsburgh, expressed the belief that breakdowns of overstressed cables must be caused, in the first place, by a gradual puncturing of the insulation around the conductor at the weakest point. An absolutely continuous disintegration of overstressed portions is impossible, and until an actual breakdown occurs between the conductor and the sheath the action of isolated discharges must take place more or less all along the conductor.

Mr. Henry Morse, of Boston, stated that in the actual manufacture of cables final dependence must be placed upon test data rather than upon theory, especially when dealing with the smaller sizes of wire.

Mr. Percy H. Thomas, of New York, called attention to the effect of temperature upon the breakdown of dielectrics. To this effect he attributed the fact that, say, fifty thin sheets can withstand perhaps only as much e.m.f. as five times that withstood by one sheet. There will be some spot where the loss will be locally a little larger than elsewhere, and here the temperature will rise, thereby increasing the local loss, the character of the material being such that the loss in energy is not dissipated as rapidly as formed, and hence a breakdown occurs.

Mr. C. J. Fechheimer called attention to the fact that graded insulation is used to advantage on the coils of high-voltage alternators. Use is made of an inner covering of flexible mica and a binder of varnished cloth or linen tape.

Mr. A. H. Pikler remarked that it is not practicable to use graded insulation in high-voltage transformers. The ability to construct high-voltage transformers depends mostly upon the possibility of removing moisture from the insulation and maintaining the equipment free from moisture.

Dr. C. P. Steinmetz said that high-voltage cables are probably never broken down by their operating voltage, but they break down at a weak spot, such as an air bubble, a lack of homogeneity in the insulating material or by reason of a transient over-voltage due to an electric impulse of limited energy but more or less unlimited voltage. It is of prime importance to eliminate all weak spots from the insulating material, and to employ material requiring an appreciable amount of energy as distinguished from power to cause disruption. The deterioration of insulation when stressed beyond its dielectric strength by the formation of pinholes is a fairly well known fact. In the early days of the application of high-voltage cables it was suspected from the life history of the cables that a deterioration of the insulation takes place by the formation of pinholes, and evidence of these phenomena was afforded by the investigation and study of the insulation in very high voltage transmission systems. In those cases where the insulation had been strained beyond its dielectric strength under conditions where no secondary phenomena, such as short-circuiting arcs, had destroyed the evidence, it was common to find the surface perforated by innumerable pinholes which, in the case of a very high voltage transmission line where the electrostatic energy is very large, reach visible size. Thus if the over-strained insulation is perforated by pinholes, either microscopic or visible, then the electrostatic field is brought to bear on the outer insulation in a concentrated form and the outer insulation is exposed to what may be called an electrostatic shearing strain. This fact explains the breakdown of a glass tube in tests at a voltage far below that which it would stand when exposed to a uniform static field.

Mr. C. O. Mailloux outlined experiments showing that when a dielectric is subjected to an excess voltage that will in time cause rupture it will always return almost to its initial condition if the e.m.f. is applied for a time less than that necessary for a breakdown and then removed. The phenomenon seems to be one of temperature effect.

Street Lighting Discussion by I. E. S.

At the meeting of the New York Section of the Illuminating Engineering Society held on Oct. 13 the general subject for discussion was street lighting, upon which subject three papers were presented. A paper by Mr. P. S. Millar dealt with the bearing of silhouetting on illumination, which was illustrated by means of a model of three blocks of city streets, while a paper by Mr. A. J. Marshall described a new street-lighting installation in Washington. Abstracts of these papers are given elsewhere in this issue.

Mr. H. S. Whiting discussed the phenomenon of glare in illumination and described a street-lighting unit which allows the glare to be reduced to a satisfactory value. The unit consists of a tungsten lamp equipped with a prismatic reflector for delivering the major portion of the light between 25 deg. and 60 deg. below the horizontal plane, and provided with an opal envelope for reducing to practically zero all light above the 25-deg. angle. He called attention to the work of investigation done by Mr. A. J. Sweet, who found that when the light is concentrated below 26 deg. all glare is avoided.

The discussion on the paper was opened by Dr. C. H. Sharp, who attributed largely to the introduction of the high-efficiency incandescent lamps the marked improvements that have been made in the illumination of streets during the past few years. Marked changes have taken place not only in the effectiveness of the illumination, but also in the appearance of the lighting equipments. By eliminating glare the effectiveness can be greatly increased. In the lighting unit described by Mr. Whiting the glare has been minimized and the appearance is highly satisfactory.

Mr. W. H. Gardiner remarked that there are three general classes of street lighting. The first of these is the mere marking of the way so that one may find the road readily. The second is the class mentioned by Mr. Millar, namely, silhouetting. The third is the true illumination of the streets in order that objects thereon may be seen directly rather than by contrast. The last named is sometimes overdone, as in St. Louis, where the street illumination is so excessive that the signs of the merchants are rendered inconspicuous and hence ineffective.

Mr. A. J. Marshall expressed the opinion that the light of street lamps in the upper hemisphere should be suppressed in both the residence district and the business district. In the former district the residents object to the light thrown against the houses, while in the latter district the merchants wish their signs to remain conspicuous.

Mr. V. R. Lansingh said that in street lighting a variation in illumination of less than four-to-one along the street should be considered highly satisfactory. With the type of equipment described by Mr. Whiting such a result can readily be obtained. The opal envelope used with the equipment serves to protect the prisms of the reflector from moist dirt, which would absorb much of the light. It can be used as a street marker, by reason of the light which escapes through its opalescent sides. In reply to a question by Mr. Gardiner Mr. Lansingh stated that while the electric power consumption for store-window lighting may reach 100 watts per front-foot, that for street lighting seldom exceeds 10 watts.

Factory Lighting.

Mr. F. J. Pearson, the recently elected chairman of the Chicago section of the Illuminating Engineering Society, presided at the first meeting of the section for the season held after luncheon at the Great Northern Hotel in Chicago on Oct. 13. Mr. Pearson announced that nearly all the subjects to be discussed at the monthly meetings during the entire season had already been determined by the board of managers. The calendar is as follows:

November—Résumé of the Johns Hopkins University course of lectures in Baltimore on illuminating engineering, by members of the Chicago section who attend.. December—Results of original research at the laboratory of the University of Illinois. Papers to be presented by Prof. J. M. Bryant and Mr. Hick. January—Discussion of Dr. E. P. Hyde's lectures on *Luminous Efficiency*, led by Mr. A. L. Eustice. February—*Illuminating Problems in the Smaller Cities*, by a central-sta-

tion manager to be announced. March—*Illuminating Features of the New Building of the People's Gas Light & Coke Company in Chicago*, by Mr. Charles A. Luther. April—*Train and Car Lighting*, by Mr. C. R. Gilman, of the Chicago, Milwaukee & St. Paul Railway Company. May—*The Lighting of Small Rooms*, by Mr. J. R. Cravath. June—*Natural Daylight Illumination*, by an author or authors not yet announced.

The election of a secretary for the Chicago section resulted in the unanimous choice of Mr. F. H. Bernhard.

Chairman Pearson remarked that during the last three months the society had secured 500 new members and that 200 of these belong to the Chicago section. He then introduced as the speaker of the day Mr. Joseph Newman, Jr., of the International Harvester Company, who read a paper on the subject "Good Lighting from a Factory Viewpoint," which was followed by a discussion.

Mr. Newman pointed out that the keynote of the modern factory system is efficiency, and efficiency is greatly aided by keeping production at its maximum during the entire length of the working day. Few factory managers in the past have been willing to believe that money spent to make the transition from daylight to artificial light as little apparent as possible will pay dividends. Lack of light has undoubtedly caused a large amount of waste of human energy and of material. Well-lighted, well-ventilated shops make for peace of mind, and are important factors in the foundation of an efficient organization.

Further, good lighting is an economy in the bearing it has on the accident account. Millions of dollars are paid every year because of unguarded machinery and badly lighted shops. It is perfectly feasible to eliminate accidents due to lack of light.

In factory lighting all the attending conditions must be considered. Among these are the possibility of keeping shop walls and ceilings clean and of a light tint, the color of the manufactured product, the size of the parts made and the operations performed upon them. The shape of the machines used and the degree of accuracy necessary in the operation of these machines have also to be taken into account in planning the amount and distribution of light. Also the number of parts handled per unit of time and the closeness with which it is necessary to inspect them must be considered. Where the factory is on a piece-work basis, it is to be remembered that poor light means that careless work may pass undetected.

In the foundries where large castings are made the lighting must be fairly even, avoiding dense shadows, but the intensity need not be great. Units of high candle-power hung high enough to avoid the cranes and powerful enough to overcome the great absorptive power of the black molding sand must be used. For small castings there must be in addition a small lighting unit at the bench or stall of each molder. Malleable-iron foundries require a greater amount of general illumination than those in which gray iron is made. This is due to the greater quantity of steam and smoke. In foundry work where no help can be obtained from reflecting surfaces, it is necessary to expend enough energy to furnish from ½ cp to 1 cp per square foot of floor area, depending upon the height at which it is necessary to hang the lamps and the amount of smoke and vapor present. This will be sufficient for general illumination, but for the finer work a few portable lamps may be necessary. For heights of less than 20 ft. units of 300 cp or 400 cp, with good reflectors, give the best results.

In machine shops a smaller expenditure of energy than in foundries will give good results. Here the work must be well lighted, but the general surroundings do not require a high degree of illumination. An expenditure of energy resulting in the lighting of 4 sq. ft. per candle-power, with good reflectors, should be sufficient if well distributed. This means from ½ foot-candle to 1½ foot-candles on a plane 30 in. from the floor, the lamps being hung 10½ ft. high. Tungsten 100-watt lamps form a convenient unit. Large enameled intensive reflectors are the most useful. Lamps may be placed at irregular intervals, concentrating on the work and tools, except in the main gangways. Lathes, punching and forming presses will probably require individual lamps, and these may be 8 cp in size. Of course, much will depend on the character of the work done in the shop.

Woodworking shops are easily lighted by the judicious placing of the intensive units over the machines. Almost all of the work can be lighted from the top, the ability to see the grain of the wood being one of the most important points. From its color, woodwork is easy to light, and the results from the same expenditure of energy as in the machine shops are gratifying.

In paint shops where the results wanted are broad and considerable dipping is done the illumination needed is no greater than in machine shops. Striping and work of that nature require a greater intensity of light. This is obtained by lowering the lamp and using a closer spacing of units.

Warehouses used only for storage require but a low intensity of light, except along the main gangways, where there is much traffic. Lamps of 16 cp spaced 16 ft. apart under flat shades will answer very well. These lamps should be placed as close to the ceiling as possible, so that the stock may be piled high.

In factory lighting generally the one feature to which all others must be subordinated is reliability. Simplicity comes next, and the cost of maintenance is third. The first cost is often a determining factor when the necessity for a change in the lighting system has made itself apparent. In improving old lighting systems the value of the tungsten lamp is apparent, for a few lamps can be purchased at a time, and, with suitable shades, attached to the old system of wiring.

Mr. Newman told of a case where in a foundry having an open-arc installation it was necessary to keep a man on night duty the year around to prevent outages and open-circuits. A large number of incandescent lamps are used as auxiliary to the arcs, but the lighting was uneven and unsatisfactory. Gradually tungsten lamps were introduced, equipped with simple shades. The foundry men found that they always had light when they needed it, without the aid of a trimmer, and that the distribution was far more efficient. In about eighteen months the night trimmer was dispensed with, and the system required only about three hours' attention a week for cleaning. Gradually 100-watt tungsten lamps were introduced throughout the whole factory. They are provided with 16-in. porcelain-enameled bowl shades, and are spaced 18 ft. apart, suspended at a height of 10½ ft.

The speaker contended that the reflector is the factor upon which the success or failure of factory lighting depends. Porcelain enamel finish is the only one which has proved itself sufficiently durable, and the intensive distribution of light is the form which finds the largest use. Reflectors are most efficient with the larger sizes of lamps.

In concluding Mr. Newman declared that the factory wants a lighting system at a minimum first cost, even at the sacrifice of some efficiency. It wants a system which will give twenty-four-hour service, with a minimum of unskilled attention. It wants a unit which will fit naturally into the divisions of shop space made by the post-supported mill construction. It wants a large percentage of the light concentrated on the machines and work, but enough general illumination in all parts of the shop to make movements as safe as under daylight conditions.

DISCUSSION.

Mr. Price, of the International Harvester Company, spoke of the beneficial effect of good lighting on the workmen. The men are better satisfied with their work where the lighting is good. The old-style dark factory is passing, for it is found that good lighting has a distinct economic value.

Mr. J. R. Walter, of the Curtis Publishing Company, of Philadelphia, which is erecting a large printing and publishing plant, where modern methods of illuminating engineering will be employed, spoke briefly. He referred to the losses in workplaces from thoughtless, careless and inefficient lighting. He pointed out that women, in particular, are often affected by nervous troubles due to eye strain, and where large numbers of women are employed particular attention should be paid to the lighting facilities.

Mr. Frost, of the Atchison, Topeka & Santa Fé Railroad, stationed at Topeka, Kan., said that he was convinced that good illumination in shops increased the efficiency of the men, reduced the danger from accidents and resulted in increasing the output. Particular attention should be given to general illumination, making the general appearance of the factory bright and cheerful. Money spent in this way produces dividends.

Mr. A. T. Hunt, of the Arnold Company, consulting engineers, agreed with the preceding speakers that good illumination paid in increasing the efficiency of the men. He added that the effect on the men depends largely upon the general and complete illumination of the entire floor.

Answering a question put by Mr. Albert Scheible and relating to the reduction in accidents due to improvement in lighting, Mr. Price told of one large company which found that 43 per cent of its operatives were disabled by accident for one day or more during the year. By the use of modern methods of sanitation, ventilation, welfare work and lighting this percentage was reduced to 19. This greatly improved result was due largely to better illumination.

Another gentleman pointed out the necessity of maintaining the lighting system after it had been installed. Cleanliness is needed to make the lighting effective. Lamps, globes and reflectors should be frequently cleaned, and in this way perhaps 33 per cent may be added to the efficiency of the system. Mr. Newman remarked that two men were kept busy all the time in the factory of the International Harvester Company, in Chicago, in cleaning lamps, globes and reflectors. Sometimes it is necessary to employ a third man. In the foundry the lamps are cleaned once a week.

Mr. A. D. Curtis inquired if in factory lighting it was not considered desirable to conceal the source of light from the direct line of vision. Mr. Newman answered that the reflector used in his company's factory is 7 in. deep and hence the 100-watt tungsten lamp is concealed unless one is almost underneath the lamp and looks up at it.

Omaha Meeting of the Western Association of Electrical Inspectors.

The sixth annual convention of the Western Association of Electrical Inspectors was held in Omaha, Neb., on Oct. 11, 12 and 13. The opening session began promptly, and Mayor Dahlman, of Omaha, very wittily and heartily presented the association with the freedom of the city, President Dustin responding for the association.

In an address by Mr. Dustin, city electrician of Minneapolis, was emphasized the "local authority" difficulty existing among Central and Western electrical inspectors generally before the association had been formed. The immense gain by increasing uniformity of interpretation and of construction requirements was noted. It was recommended that members endorse and promote state legislation to control electrical construction and inspection where municipal control of good grade cannot be secured.

A report from the executive committee by Mr. J. H. Montgomery, of Detroit, especially brought out the difficulties of committees in securing whole-hearted co-operation even from committee members, to say nothing of other members of the association. The committee reports must be the substance and form the particular value of conventions and the personal note of them is too often unavoidably evident.

The secretary's report by Mr. W. S. Boyd, of Chicago, among other matters, particularly recommended a campaign to secure municipal members from small cities. The objections to October as a meeting time have become so pronounced that an effort will be made to change to the first of the year. A bulletin plan which has been in effect during the past year has been producing excellent results.

A considerable portion of the meeting was spent in the presentation and discussion of reports of committees, to which the sessions of Oct. 11 and Oct. 13 were largely devoted. On Oct. 12 papers were presented as follows: *Rubber-Covered Wire*, by Mr. Lewis G. Martin, engineer of the Okonite Company; *The Influence of Electrical Inspection on the Operation of the Telephone System*, by Mr. A. S. Rogers, plant engineer of the Nebraska Telephone Company; *Packing House Wiring*, by Mr. T. J. Brynes, chief electrician of the Cudahy Packing Company; *The Legal and Ethical Responsibility of the Electrical Inspector*, by Mr. John A. Rhine, assistant city attorney, Omaha, Neb., and *The History and Development of the Incandescent Lamp Industry*, by Mr. R. E. Campbell, of the National Electric Lamp Association. Among the reports of committees were the following, which were prepared by the chairmen indicated: *Uniformity in Rulings*, by Mr. William S. Boyd, Chicago; *National Electrical Code*, by Mr. J. H. Montgomery, Detroit; *Outside Wiring*, by Mr. Waldemar Michaelson, Omaha; *Theater Wiring and Show Equipment*, by Mr. V. H. Tousley, Chicago; *Construction and Installation of Electric Signs*, by Mr. Emil Anderson, Minneapolis; *Show-Window and Display Lighting*, by Mr. Fergus P. McGough, Omaha; *Instructions to the Public Concerning the Safe Operation and Maintenance of Electrical Wiring and Apparatus*, by Mr. Thomas D. McColl, Toledo; *Underground Systems*, by Mr. Hugh T. Wreaks, New York; *Installation and Operation of Induction Motors*, by Mr. Charles W. Arrick, Minneapolis; *Electrical Hoisting Apparatus*, by Mr. W. J. Gilsdorf, Lexington, Ky.; *Laws and Ordinances*, by Mr. William S. Boyd, Chicago; *Architects' Specifications*, by Mr. F. H. Moore, Indianapolis; *Signal Systems*, by Mr. Frank S. Anderson, Evanston, Ill.; *Public Safety*, by Mr. W. J. Canada, Denver; *Electric Traction Systems*, by Mr. F. R. Daniel, Indianapolis.

Among the entertainment features was an informal dinner given to the members by the Omaha Electrical Club on the evening of Oct. 11. The table was wired in an "approved" exposed conduit construction with condulets, 2-in. conduit being used, and portable lamps tapped at intervals. Signal wires, bells, etc., made applause most effective. Some "defective cord" which was much in evidence was dramatically "cut out" with a pair of pliers by Mr. McGough, assistant city electrician.

REPORTS.

Secretary Boyd read the report of the committee on uniformity in rulings. The tendency of conventions and the discussions that arise has been not only to secure uniformity, but to improve the standards in certain respects in every locality, while acting as a flywheel to the ambitious efforts of some members for wholesale, and perhaps ill-considered, advances in construction methods.

Mr. Michaelsen read the report of the committee on outside wiring. The desirability and obstacles in the way of joint-pole construction were summarized. The problem of safeguarding the public was shown to lie largely in the 2300-volt lines, since higher voltages have infrequent crossings with building services and the still higher voltages are usually on private rights of way. The apparent impossibility of any positive protection to linemen was discussed, and it was recommended simply to advise eternal vigilance and to emphasize at all times the essentially hazardous character of such work. State and ultimately interstate regulation of pole-line construction methods, especially safeguards against communication of higher voltages to lines of normally lower voltage, was recommended.

Many of the recommendations brought out by the "code" committee were not approved because of ambiguity or uncontemplated breadth. The tendency toward conservatism in endorsement of new rules to the Underwriters' National Electrical Association is very evident and commends the work of the association.

The sign committee's report during discussion brought out the general demand of members for final insertion of definite sign construction rules in the National Electrical Code proper. The use of single-braid wire and withdrawal of demand for spacing were endorsed by the association. The use of wood in sign construction was condemned. The 12-amp limit for

series multiple circuits of low voltage lamps was deemed necessary, but such systems were not generally believed extra-hazardous where on low-voltage circuits. The endorsed recommendations are to be presented to the Underwriters' National Electrical Association for consideration at its spring meeting, when action on sign rules in the "Code" will be taken.

The committee report on instructions to the public, which recommended that instructions be placed on or near electrical equipment, which has been found the only effective check on the abuses to which wiring is heir, was adopted. Overfusing and mechanical injury were most discussed and their special emphasis was recommended.

The committee report on theater wiring and show equipment elicited much discussion. The suggested amendments to sections of the existing "Code" rules were generally endorsed, as securing more definiteness and tending to cover more properly the requirements contemplated by the existing rules. The question of what constitutes a safe and convenient stage receptacle was much argued. Consensus of opinion favors open hole, but enclosed receptacle placed at side of the hole. Mr. H. C. Harris, theater expert with the General Electric Company, gave an interesting account of the problem involved and the manufacturers' difficulty in getting desirable uniformity of construction during the dissension of inspectors on the subject.

Some action to eliminate dangerous traveling-show equipment by communication of previous inspection reports to interested members was endorsed and the committee asked to formulate some definite plan.

RUBBER-COVERED WIRE.

The paper by Mr. Martin discussed fully the defects in commercial rubber-covered wire. He said that the low-grade and easily met original tests of "Code" rubber-covered wire have become a byword among manufacturers, jobbers and contractors alike. No one seems to have courage to take the initiative toward the formulation of effective specifications. Life is the main measure of quality and original cost, but while life cannot be tested for, quality can. Twenty-five per cent increase in original cost will secure practically unlimited life, and save the added expense in the average five-year maintenance, outside of the question of safety. The question obtains increasing consideration by architects and by builders, but the "Code" standard covers a multitude of sins in poor-grade competition. Specification for chemical, specific density, tensile strength, tests, and examination for character of application were recommended as a standard for approval, and a 30 per cent dry Para rubber with maximum allowable proportions of waxes, dry minerals, sulphide, etc., was recommended as a minimum specification.

Cheap oils and cheap rubbers reduce value in proportion as they are present, and extraction of resins does not restore quality. The high-potential tests were criticised except for sample lengths, because commercial quantities should not have their structure subjected to possibly permanent fatigue.

RESPONSIBILITY OF THE [illegible]

In his paper on "The Legal and Ethical Responsibility of the Electrical Inspector" Mr. Rhine covered the general status of inspection work, the limitations in authority and responsibility of the inspector, his relation to city or underwriters as agent, and similar matters. The fiduciary nature of his position was emphasized. The lower demand for competency from municipal than from underwriters' inspectors was noted to be passing away. The qualifications for an ideal inspector were discussed. The paper went into the legal phases of refusal to allow connection to service, refusal to complete wiring, condemnation of defective new and old wiring. The particular case of old wiring formerly complying with law but now not complying was interesting, as proving that where installation is now dangerous to life or property, either from deterioration or from original faulty construction (though approved at the time), its condemnation is proper. Various authorities were quoted and interesting cases were discussed.

At the last session, which opened on the morning of Oct. 13, with the reading of the reports on "Induction Motors," "Law and Ordinances" and "Public Safety," it was voted, after much discussion, to recommend definite action on the fusing question, with tables compiled from experience, at the next meeting of the Underwriters' National Electrical Association committee on this subject. The same uniformity as has proven so advantageous in "Code" interpretation was found to be desired also for electrical ordinances, so far as municipal charters would allow. One very complete ordinance on motion-picture-machine theaters was submitted and considered. The confinement of theater wiring requirements to large auditoriums was criticised, and Mr. Tousley, of Chicago, recommended that "places of assemblage seating over 200" be made amenable to theater rules so far as they apply.

The report on "Public Safety" by Mr. Canada simply repeated former suggestions of the committee for abolition of ungrounded metallic surfaces in electrical fittings accessible to the public where other grounded surfaces are also present; continued campaign for grounded secondaries; the use of better publicity methods in hastening the adoption of safeguards by ordinance or otherwise. The necessity was shown for electrical inspectors, in the absence of other special inspectors, to note the fire and life hazard of gasoline lighting, where it exists, and to use publicity methods for its regulation by ordinance. Too often a species of discrimination exists against the safer electrical lighting by reason of exploiting its remote hazards while apparently not recognizing hazard in other more hazardous systems.

Upon the conclusion of discussion the nominating committee made its report and officers were elected as follows for the ensuing year:

Mr. V. H. Tousley, of Chicago, president (Mr. Tousley is well known, particularly as the author of several books on practice and problems in interior electrical installations); Mr. W. J. Canada, of Denver, electrical engineer for the Rocky Mountain Fire Underwriters, first vice-president; Mr. James Bennett, of Montreal, electrical engineer with the Canadian Underwriters' Association, second vice-president.

Visits to various theaters, the packing house district, the Fort Omaha wireless station and dirigible experimental station concluded the yearly program.

Chicago Meeting of the American Electrochemical Society.

The eighteenth general meeting of the American Electrochemical Society was held on Oct. 13, 14 and 15, in Chicago, Ill. This was a departure from established practice in two respects, firstly, because former fall meetings in recent years had always been held in New York City, and secondly, because the society went to the West for the first time. The success of the convention proved the justification of the selection of Chicago as the meeting place. The society has long ceased to be chiefly an Eastern organization, and, with its steadily increasing membership in foreign countries (which is now approaching 20 per cent of the total membership), it is now assuming an almost international character.

The attendance at all the sessions was very satisfactory. The last printed registry list contained 213 names. The mornings were devoted to professional sessions, the afternoons to visits and excursions, while on Friday evening a very enjoyable informal subscription dinner was held at the Congress Hotel.

A great many alternative excursions had been arranged, and all of them were well attended. Of especial electrical interest were visits to the Fisk Street power house and the Market Street transformer and storage battery station of the Commonwealth Edison Company, the works of the Western Electric Company, the Automatic Electric Company, the Washington and Franklin Street exchanges of the Chicago Telephone Company, the Lockport power station and the Drainage Canal. Concerning the latter and its relation to politics, some

Interesting remarks were made by Mr. [illegible] in an after-dinner speech.

The visits of great metallurgical interest were the excursions to the South Chicago works of the Illinois Steel Company and the Gary works of the Indiana Steel Company. At South Chicago the 15-ton electric Héroult furnace—the largest one now in operation for electric steel refining—was seen in regular commercial operation. Considerable general interest was manifested in the visits to the packing houses with their allied chemical industries (manufacture of soap, butterine, etc.), and to the mail-order establishment of Sears, Roebuck & Co. The Hoskins Manufacturing Company had arranged an interesting demonstration exhibit of laboratory electric furnaces.

On the afternoon of Saturday the laboratories and the museums of the University of Chicago and the Field Columbian Museum were visited by part of the members. Of the three professional sessions, the Saturday session was held in the lecture room of the Kent Chemical Laboratory of the University of Chicago, while the Tuesday and Friday sessions were at the Congress Hotel. All arrangements had been made with great foresight and carefulness, and much credit is due to the local committee and especially to its chairman, Dr. H. N. McCoy, and its secretary, Mr. Arva B. Marvin.

The first meeting was called to order on Thursday morning by the president, Dr. William H. Walker, of the Massachusetts Institute of Technology.

THERMAL CONDUCTIVITY.

The first paper was presented by Mr. Carl Hering, and dealt with a method for determining the thermal conductivity of insulators, such as are used for electric furnace walls. The object of his arrangement is to avoid any leakage of heat sidewise from the test piece, and this is accomplished by so shaping the test piece that it has no lateral sides at all. In the ideally perfect form, use is made of a hollow sphere in the inside of which the heat is generated electrically; the heat then flows from the inside to the outside. When the stable state of heat flow has been reached the watts consumed for the production of heat and the two temperatures of the inside and outside surfaces of the sphere are measured. The thermal conductivity is then easily determined by simple formulas. It is, however, not practicable to use the test piece in form of a hollow sphere. Mr. Hering suggests, as the most convenient form of the test sample, a cylindrical cup rounded at one end and open at the other, and gives the formulas for this case.

The conductivity ascertained by this method is the correct average or effective mean for the range of temperature between the inside and outside temperatures of the sphere; that is, it is that conductivity which an equivalent piece of material would have whose conductivity is constant over the range of temperature, and which as a whole acts just like the sample.

In the discussion, in which Messrs. Richards, Browne and Lidbury also participated, Mr. Snyder called attention to a method used by Clement and Egy at the University of Illinois. They employed a long cylinder, the heat flowing from the inside to the outside. The method depends on the fact that there is no escape of heat longitudinally at the middle of the cylinder. The heat generated electrically inside and the outside and inside temperatures at the middle of the cylinder are measured.

FLOW OF HEAT THROUGH FURNACE WALLS.

In a paper on the flow of heat through furnace walls Mr. F. T. Snyder discussed first the rôle which heat connection and heat radiation play, especially in furnaces the walls of which are composite—that is, consist of layers of different materials. The radiation from the surface varies with the difference between the fourth powers of the absolute temperatures of the surface and the air, multiplied by a constant to deduce the results in Mr. Snyder's formulas to kilowatts of heat flow per square foot. This constant varies with the material of the surface and its condition.

For the flow of heat through the wall material an experimental constant is determined, giving the temperature drop in degrees C. through one inch of thickness of the material for a heat flow of 1 kw per square foot. This constant varies for any material with the temperature range for which it is determined. A table of this constant, for various materials and various temperature ranges was given by Mr. Snyder.

The "contact resistance" to the transfer of the heat flow from one layer of material to the next is determined from an experimental constant giving the difference in degrees C. between the fourth powers of the absolute temperatures of the opposing surfaces for a heat flow of 1 kw per square foot.

For practical use curves are calculated giving the temperature drops for the common furnace materials and conditions under the different practical rates of heat flow. Such curves were given in the paper, together with tables of constants, and an example was added of the calculation of the temperature distribution through the bottom of a small steel furnace for two rates of heat flow.

Mr. Snyder's paper was discussed by Messrs. Frary, Hering and Richards.

REDUCTION OF TIN DROSS.

A paper by Mr. R. S. Wile dealt with the reduction of tin dross in an electric furnace. Electrical heat was resorted to for the smelting of tin dross because of the fact that the heat could be internally applied to the slag, which is on the bottom of a shaft type of furnace, thus enabling the dross to be thrown on top of the slag instead of being mixed with it as is done in the old style of furnace. The dross, being on top, comes in contact with the slag only at the point of reduction. The liberated gases filter through the dross, while any tin oxide which is volatilized is condensed in the colder portion of the dross, which is on top of the slag. The globules of tin produced in smelting pass downward through the slag and lose most of the impurities, so that very little refining of the resultant product is necessary.

A brief description of a commercial plant of this type was given. The furnace has two carbon electrodes, the upper being movable, the lower stationary.

CAST COPPER OF HIGH ELECTRIC CONDUCTIVITY.

A paper on cast copper by Dr. E. Weintraub, Schenectady, was then presented. The problem is to use a thorough deoxidizer which does not react or alloy with the copper. The usual deoxidizers, such as zinc, alloy with the copper, and while sound castings are produced, yet electric conductivity of the alloy is much lower than that of pure copper. Pure boron may be used, but it is cheaper to use boron suboxide, which is prepared by a modification of the reduction process of boric anhydride by magnesium.

Its action as deoxidizer is perfect, so that sound castings are obtained; on the other hand, the conductivity of the copper is not reduced, as is the case if zinc, magnesium, etc., are used as deoxidizers. The electrical conductivity obtained can be as high as 97.5 per cent if the copper melted down is perfectly pure. In the foundry, where the copper scrap which is melted down cannot always be very carefully selected, a conductivity of from 91 to 95 per cent is obtained, and a guarantee of 90 per cent is at present given.

The use of copper castings of this kind lies in two different directions. First, it can replace forged copper, whereby a great saving of cost is obtained. Secondly, it can replace alloys of copper, in which case the gain in conductivity allows the reduction in bulk and thus a saving in material.

Even in the past, in spite of the fact that cast copper has considerably lower conductivity than forged copper, in many cases cast copper has been used to eliminate riveted, screwed or soldered joints, whereby a number of poor contacts are avoided.

In the discussion which followed the great possibilities of this method were discussed by various speakers.

ELECTRIC STEEL REFINING.

Prof. Joseph W. Richards then delivered a lecture on the present use of the electric furnace in the iron and steel industries of Sweden and Norway, and especially on the Hiorth electric steel furnace which is in commercial operation in a plant in Norway. It is an induction furnace of modified con-

struction, there being two [illegible] communication with each other in the middle, while a working hearth of considerable area is provided. The working hearth may receive additional heat, in a manner similar to that in the Roechling-Rodenhauser furnace, but this is not found absolutely necessary.

There is no refining done in this plant. Use is made of the same starting materials which are melted in Sheffield in crucibles, Dannemora pig iron and Dannemora soft iron. The electric furnace is simply used for melting these materials. The ingots are shipped to Sheffield. The steel is equivalent to the best crucible steel. The special field of this furnace is, first, for melting down high-grade material, and, secondly, for dead-melting ordinary open-hearth and Bessemer steel. A certain amount of refining can also be done in the hearth in the center.

TRIBOLUMINESCENCE.

The first paper of the Friday session dealt with triboluminescence, the author being Mr. W. S. Andrews. Triboluminescence is the property possessed by certain bodies of emitting light when rubbed or scratched. An artificial product of this kind may be easily prepared from 70 parts by weight of chemically pure zinc carbonate, 30 flour sulphur, and a trace of manganese sulphate. The method of preparation was described.

CALCIUM.

The electrolytic preparation of metallic calcium was the subject of two different papers. Prof. Arden R. Johnson in a paper described a series of experiments which he had made some years ago. He distinguishes two different methods—first, the apparatus of the Rorchers type for utilizing an extremely high-current density, and consequently obtaining the calcium in a molten condition, in which it rises to the surface and is skimmed off, and, secondly, the Rathenau type, which requires that the calcium come out in a compact form; that is, is plated out at a moderately low current density, and gradually removed from the electrolyte in form of a solid stick.

The author describes experiments which he has made with this latter method and difficulties which he has thereby encountered, and describes a modified apparatus in which a ribbon cathode was used. Considerable data were given on current efficiency and decomposition voltage curves. In the discussion which followed, Prof. Frary expressed the opinion that most of the difficulties of the author were due to the fact that he did not cool the cathode artificially.

A paper by Prof. Francis C. Frary, H. R. Bicknell and C. A. Tronson was then presented on efficiency in the electrolytic production of metallic calcium. It is produced in form of a cathode stick and gradually and slowly pulled out. Great care must be taken to pull the stick out with the right speed. The authors give the results of ten different runs, in none of which the ampere-hour efficiency was below 450, while in two runs it was 100 per cent. Plain calcium chloride seems a little more satisfactory as electrolyte than a mixture of the chloride and fluoride in point of efficiency, and is decidedly easier to manipulate. The ampere-hour efficiency obtained is largely a matter of careful regulation of conditions.

RADIO-ACTIVE ELEMENTS.

A paper by Prof. A. R. Johnson dealt with experiments on the electrolytic deposition of polonium and other radioactive elements. He also added some remarks on the bearing of Faraday's law on the fact that a very large number of coulombs is required to get a very small polonium deposit (not weighable, but only determined by radioactivity). In the discussion Dr. Kahlenberg pointed out that the direct application of Faraday's law would indicate that nothing but polonium was obtained at the cathode. Mr. Hering pointed out that the author experimented with an exceedingly dilute solution.

OZONE.

A paper by Mr. R. D. Small discussed the present status of ozone. The increased use of ozone in numerous European cities for the sterilization of water was outlined and a brief review was given of different [illegible] Heat and humidity are unfavorable conditions for the production of ozone. That is the reason why the electrodes are often cooled.

The author dealt at great length on the combination of ozonizers with fans for air purification. Carbon dioxide in air is only harmful as it replaces oxygen; it is not in itself harmful. It is only a danger sign as it indicates the presence of organic impurities. This organic matter is the dangerous element. While ventilation is necessary, yet outdoor air is not sufficient, as it does not destroy the organic matter. For this purpose ozone is required. The use of ozone as a deodorizer was dealt with. When ozone is used in air in the usual suitable quantity, which is small, ozone does not kill the bacteria directly, but by destroying the elements on which they live.

LEAD STORAGE BATTERY.

A paper by Mr. Pedro G. Salom dealt with the evolution of the lead storage battery. The first step was the Plante cell, with its great number of alternate charges and discharges, lasting for weeks and months. Then came the Faure-Brush type of cell as the second step; that is, the cell with a pasted active material and subsequent formation. Since 1881 there has been made no improvement over this type, except in mechanical details. The logical evolution is to go a step further, as has been done in the "initially formed cell" of the author. The active material is produced in bulk outside of the cell and applied mechanically to the grid, whereby the plate is finished. The author did not go in detail into the manufacture of the active material and plate, but compared the relative advantages of the Plante cell, the pasted cell, and the initially formed cell. The chief advantages of the latter are that the new plate, while remarkably homogeneous, carries a greater quantity of spongy lead and that the cost of producing the spongy lead electrolytically in bulk and applying it mechanically to the grid is less than the cost of an equivalent amount of litharge, as employed in actual practice.

The paper elicited considerable discussion, in which Messrs. Berg, Frary, Hepburn, Hering, Kohn and Salom participated. In reply to questions, Mr. Salvin said that no one knows yet what the life of the negative will be. It is probable that it will be as long as that of Plante cells; that is, ten years. The current capacity of the negative plate per ounce of active material is 2 amp. That means that about four times as much active material is put in as is theoretically required. This is about the same as in other properties.

Mr. Hering pointed out that the determination of the most economical life of a storage battery is quite similar to the determination of the economical life of an incandescent lamp. Both the depreciation of the battery and the cost of a new battery must be considered, and he agreed with Mr. Salom that a battery with a shorter life and lower price may be better than an expensive battery of longer life.

[illegible]

The self-discharge of Plante and Faure storage batteries was the subject of a paper by Prof. O. W. Brown and W. G. Bowers. Comparative tests were made with various types of cells and the following conclusions were reached:

The Plante type of cell looses its charge when allowed to remain on open circuit for periods of from ten to twenty days. The Faure cell, when made from pure materials, suffers only very slight loss in capacity when left on open circuit; in every test the self-discharge of the Faure cell was much less than that of the Plante type.

The data of the authors also show that the Plante cell suffers permanent injury when considerable periods of time [illegible] recharges of a Faure cell restore it to its original capacity.

In the light of these results the Faure type of cell is best suited for [illegible] in some telephone plants, in isolated lighting plants, and where cells are used for ignition purposes and for the operation of signal systems.

In the discussion which followed, and which also related to some points of Mr. Salom's paper, the Edison battery was referred to. Mr. Salom acknowledged that the Edison cell has an advantage over the lead cell in the number of watts per pound of total weight (including retaining jar, connections, etc.). The figure was given by Mr. Salom as 15 watts per pound for the Edison battery and 10 watts per pound for the lead cell. But Mr. Salom denied that the watt-hour efficiency of the Edison cell is 100 per cent better than that of the lead cell, as has been claimed. Dr. Gudeman pointed out that for certain purposes the available space is a consideration and that the power per weight per volume might be given as a characteristic figure.

OVER-VOLTAGE PHENOMENA.

A paper by Mr. Carl Hambuechen referred to the practical significance of the over-voltage phenomena. According to the electrolytic theory of corrosion, the corrosion of metals is caused by galvanic couples due to impurities or electronegative elements in the metal under consideration. Within limits, the electrochemical potential series will state whether a current will flow and in which direction. However, this is not the only determining factor, since the over-voltage phenomenon changes the situation somewhat. It means that to set free hydrogen gas at a metallic surface an excess voltage is necessary, and that this excess voltage or over-voltage differs for different metallic surfaces.

While the electrochemical potential table indicates that tin is as bad an element as is iron for producing corrosion of zinc, the correction for over-voltage shows that tin is far less harmful. And this is borne out by the facts in various practical instances. It is a matter of practical knowledge that iron or copper introduced as an impurity in dry cells is very harmful, producing rapid deterioration, while lead and tin (having high over-voltages) are almost harmless. This is fortunate, as otherwise the solder for making the seams would have to be prevented absolutely from entering the container and making contact with the electrolyte. The dry cell construction would therefore be more difficult and expensive.

A well-known household method of cleaning silverware of tarnish consists in placing the silverware in a zinc vessel and covering it by an electrolyte, such as baking soda, and salt. The tarnish is removed by electrochemical reduction, the zinc acting as anode and the silver surface as cathode. In studying this process the writer noticed that a zinc vessel, after being used thus a few times, lost its effectiveness owing to the formation of a high-resistance film on the zinc surface which prevents the silverware from making electrical contact therewith when resting upon it.

It was found that a grating of tinned iron wire soldered to the zinc entirely prevented this difficulty. The tin acting as the cathode surface is always maintained bright and chemically clean; owing to the overvoltage of tin, this is kept clean at the expenditure of a minimum amount of current. And when the silverware is placed upon such tinned grating it cannot avoid being placed in electrical contact, and the current generated by the dissolving of the zinc is concentrated upon the silver to the practical exclusion of the tin.

Several other practical applications of the same principle were quoted.

METALLIC FOOD CONTAINERS.

In a paper on the corrosion of metallic food containers, Dr. Edward Gudeman pointed out that in view of the fact that food products are now being condemned by food chemists for exceedingly small quantities of impurities contained (something like 0.001 per cent), the corrosion of metallic food containers with the result of impurities being introduced into the food has become a very serious matter. He has tried in various ways to produce a non-corrosive metallic food container.

The solubility of tin is small, but a complete uniform covering of iron with tin, without any pores, is impossible. The author has tried to impregnate iron with an exceedingly small amount of gold for protection. This is done by means of a gold amalgam, the mercury being subsequently distilled off; but while it can be done, the process involves considerable practical difficulties. He has also tried to enamel sheet iron with glass under pressure. This has been found possible, but not all difficulties have yet been solved. For instance, a fusible glass is required; this means lead glass, but lead is not wanted in food. The paper was stated to be only preliminary.

ELECTRIC FURNACES.

A paper read by Mr. Marcus Ruthenberg on the electric furnace and its applications was then presented. The author dealt with the history of electric furnaces, beginning with the old furnace of Siemens and discussed the advantages of alternating current over direct current for furnace operation.

As to the waste of electrodes, he stated that it was not all at the ends and that water-jacketing of the electrodes was very useful. He then referred to the usefulness of the electric furnace treatment for complex ores, such as nickeliferous iron ores, lead-iron-zinc ores, etc.

ELECTROSTATIC SEPARATION.

A paper by Mr. F. S. MacGregor dealt with the application of electrostatic separation to ore dressing. The system dealt with is that of the Huff Electrostatic Separator Company, which was described by H. A. Wentworth in the *Electrical World* on October 6, page 789. The new details given in Mr. MacGregor's paper are chiefly of metallurgical interest.

IONS.

A lecture by Prof. Robert A. Millikan on the isolation of an ion and a precision measurement of its charge proved one of the most interesting features of the convention. The method consists essentially in holding a given small droplet of oil (or other non-volatile substance) under observation for a considerable time, which may be four or five hours, and watching it catching ions from the air.

The oil droplet is introduced into the space between the plates of a horizontal air condenser charged from a large storage battery. In this space it will catch one or more ions which normally exist in air or which have been produced in the air between the plates by some ionizing agent. The movement of the oil droplet is observed when the field is zero and gravity acts alone. Its movement is also observed when the field exists. This is done repeatedly until the oil drop catches a new ion. In that moment the speed under the influence of the electrostatic field changes immediately, although its speed under gravity remains constant. From this change of speed the charge of the new ion which has been captured by the oil drop is determined.

Only very simple mathematics are required for this calculation, and no assumption is made except the correctness of Stokes' law, which is found to hold true if the drop is not too small. For sizes below a certain limit, Stokes law has been modified by Prof. Millikan.

Numerous determinations have been made by Prof Millikan with this method, and from the results, which are very accurate and agree exceedingly well together, it follows conclusively that electricity is granular or corpuscular in structure. All charges are built up of unit charges. The initial charge of an oil drop is always a multiple of the charges of the ions which it catches later on. It catches positive as well as negative ions. The charge of any positive ion is the same as that of a negative ion. The elementary charge is 4.9016×10^{-10} c.g.s. electrostatic units. The measurement of the ionic charge by this method is directly comparable with atomic weight determinations.

In the brief discussion which followed, Prof. Millikan was enthusiastically complimented on the success of his measurements. The apparatus used by Prof. Millikan was afterward shown and demonstrated by him in the physical laboratory of the University of Chicago.

PHYSICAL CHEMISTRY RESEARCH.

The last three papers of the convention dealt all with important research work on physical chemistry carried out at the University of Wisconsin. They were presented in abstract by Prof. Kahlenberg. A paper by Dr. J. H. Walton dealt with the phenomenon of crystallization through membranes. Super-

saturated solutions are used on both sides of the membrane. When crystallization is started on one side it sometimes continues to expand to the other side. In other cases it does not

A paper by Dr. Louis Kahlenberg himself dealt with the relative basicity of the metals as shown by their power to replace one another in chemical compounds. In aqueous solutions there is an arrangement of the metals in a certain series. But when such a series is formed according to the results obtained with non-aqueous solutions the arrangement of the series is entirely changed.

A paper by Dr. David Klein dealt with the effect of water in causing chemical reactions. It has often been claimed that water is a unique substance, in so far as its presence is necessary to cause certain reactions. However, Dr. Klein's research shows that the position of water is not so unique.

The next meeting will be held in New York in the spring of 1911.

Convention of the Electric Vehicle Association of America.

The Electric Vehicle Association of America held its first annual convention in the Concert Hall of Madison Square Garden, New York City, on Oct. 18. Seldom have national bodies launched their first public sessions under such auspicious circumstances. The attendance was approximately 250, and the program such as to hold the attention of all those present during the morning and afternoon sessions. Prior to the delivery of his address President W. H. Blood, Jr., expressed the debt of gratitude which the association owed to Mr. Arthur Williams, of the New York Edison Company, to whom was due in a large measure the phenomenal success which thus far has attended the deliberations of the infant organization. Mr. Blood then invited Vice-President Williams to take the chair while he read his address.

PRESIDENT BLOOD'S ADDRESS.

President Blood in opening his address said that he had no apologies to offer for the modern electric vehicle, for none are needed; but the unsatisfactory record made by the earlier vehicles of some ten years ago has resulted in an unfortunate prejudice which must be overcome. Wonderful progress in the development of the electric vehicle has been made in the past few years, but there has been little or no effort made to tell the public of the changed conditions. The need, therefore, of an association to correct these conditions, and to enlighten the public, is self-evident. The idea of the association originated in Boston, where the New England Association was organized March 11, 1908. It became apparent, however, that the movement to be of the greatest value must be national in scope, and consequently the Electrical Vehicle Association of America was incorporated Sept. 1, 1910, with a charter membership of twenty-nine, to which has been added the New England membership of ninety-one, making a total of 120. The Pacific Coast Electric Vehicle Club and a similar organization in Chicago are already seeking affiliation. The matter of securing new members will be undertaken immediately by a carefully selected committee, and regular monthly meetings will be held in New York for the reading and discussion of papers and reports. Provision is also made for the formation, in centers of local activity, of branch organizations. There will be a large fund by means of which to advertise all over the land that the electric vehicle is a perfected device and that it can and does perform certain services better and cheaper than any other agency.

Among the work coming within the scope of the association is that of standardization, as, for example, the adoption of a standard charging plug; the selection of standard motor voltage, securing uniformity in the size of batteries; the adoption of a standard type of chassis, uniformity in the gage or track of cars, and an agreement on the principal dimensions of a one-ton, two-ton and five-ton truck. Moreover, manufacturers of electric vehicles should be encouraged to get together and agree upon a small number of standard [illegible] vehicles, thus making it easier for the customer to use such vehicles, and simpler for the garage to carry a proper stock of tires. The association might also with benefit undertake the publication of an electric vehicle "Blue Book," giving a list of charging stations and rates for electrical energy in the various cities and towns throughout the country, and include a list of responsible garages which did not differentiate against the electric in favor of the gasoline car. It was suggested that manufacturers should, for a time at least, have in each large city a paid representative who should be primarily a battery expert, and also a good mechanic, who would go from garage to garage and customer to customer giving free advice and assistance, and doing whatever possible to obtain better service from the electric vehicle and so increase its adoption and use. The association has also an opportunity to see that the installation of charging plants in garages and elsewhere is taken up in a systematic manner, and some method of financing should be devised for the worthy garage handicapped by limited capital. Broadly speaking, it should be the aim of the association, through its members and committees, and by every legitimate means, to make it so easy and simple to operate electric vehicles that prospective users may have no valid excuse for not purchasing electric cars.

Having assumed that all of the above has been accomplished the time may come when an association—perhaps the present one—would take up the question of the universal exchange of batteries. An entrance fee, dependent upon the cost of batteries, would be required, and yearly dues covering the average cost and maintenance and depreciation of the battery would be charged; then the individual user would pay for the energy which he used at standard rates, and a recharged battery could be had at all official stations supported by the association. While this may be somewhat visionary and not possible of solution, it can already be seen that where electric cars travel over regular routes of considerable length a system of relay batteries ready for instant use could and would be easily established, and the general exchange of batteries would simply be carrying this idea one step further.

Mr. Blood stated that while the present prices of electric vehicles are not as low as they should be, with the manufacture of standard machines in larger quantities a material reduction should necessarily be the result. The price of batteries is tending downward, and from the increase in mileage very satisfactory results are now obtained. The handling of batteries is becoming simplified, and they are rapidly approaching a condition of being practically "foolproof." Rates for charging batteries are not at all uniform, but great progress has been made in adjusting these rates and in making them commercially reasonable.

There is, however, room for further revision along all of these lines, but by proper effort the electric vehicle can be made a still more attractive proposition than it is now. It is to such work that the association will address itself. The modern electric vehicle is a commercial success; the public is ready to use the car and has the wherewithal to pay for it. The duty of the association is to bring these two interests together; in doing this the cars are sold, the batteries installed, the central-stations' energy used, and everyone reaps the benefit, including the user, who gets both pleasure and profit from the transaction.

At the conclusion of the address Mr. Williams said that it contained information and suggestions of such importance that it should be published broadcast for the benefit of central stations and electric vehicle manufacturers. Mr. Hayden Eames, of Cleveland, moved that the matter be referred to a committee of three, who were afterward appointed as follows: Messrs. Hayden Eames, W. C. Anderson and F. W. Smith.

In a paper entitled "Problems Involved in Advancing the Use of Electric Vehicles" Mr. William P. Kennedy gave an account in extenso of the historical development of road vehicles from the time of the Egyptians to the present day

The advantages of the electric vehicle were then pointed out, and the obstacles in the way of its use reviewed. Heretofore, it was stated, almost the entire burden of introducing the electric vehicle has been carried by the manufacturer. The educational value of instructive literature was dwelt on, and also the influence of the electric pleasure vehicle in aiding in the introduction of the commercial vehicle. The type of the desirable salesman was sketched, and also methods which he should use in presenting his case. The long and persistent effort to awaken the central station to a realization of the important and profitable share it should take in the electric vehicle movement had, he said, culminated in the organization of the present association, but there remains the evolution of practical, extensive and effective plans of procedure, including dissemination of information, and the execution with determination of a program which will be as irresistible as it may be comprehensive.

There was no discussion on this paper and the next paper on the program was taken up without delay. This paper by Mr. F. L. Dyer, of Orange, N. J., was preceded by a motion-picture film illustrating the experiences of a purchaser of a gasoline car and also of a horse-drawn carriage and their final adoption of the electric vehicle. The picture-story was well told, and the new method of advertising electric vehicles is certain to meet with widespread adoption.

RECENT VEHICLE PERFORMANCES.

"Recent Electric Automobile Performances with the Edison Storage Battery" was the title of a paper presented by Mr. F. L. Dyer, of Orange, N. J., in which an account was given of a series of one-day trips covering the country around and about New York City, each trip calling for the accomplishment of from 85 miles to 100 miles on a single charge of the Edison battery. An account in detail was given of the trips made by cars entered by the S. R. Bailey Company, Amesbury, Mass.; the Anderson Carriage Company, of Detroit; the Baker Company, of Cleveland, and the Babcock Company, of Buffalo. The first run was made by the Detroit car, the distance being 84 miles, at an average speed of 12.07 miles per hour, over freshly tarred roads with grades as high as 9 per cent. Excess battery capacity subsequently run off showed a safety surplus of 18 miles, making a total of 102 miles on a single charge. The second run was made by the Bailey car, the total mileage being 76, at an average speed of 13.19 miles per hour. The excess mileage run off showed a surplus of 40 miles, making the total for the day 116 miles on a single charge. On some parts of this run grades of 10 per cent were frequently met. The three other cars made records of, respectively, 122¼ miles at a speed of 12.38 miles per hour; 139½ miles at 13.71 miles per hour, and 113 miles at 12.47 miles per hour. One test consisted in running a vehicle for an hour and a half per day for a week in Central Park on a single seven and one-half hour charge at normal rate. In this test no water was given to the batteries, and for the seven days the charging socket was sealed. At the end of the week the odometer reading was 120 miles at an average speed of 12.32 miles per hour, and the cost of electricity was $1.42, or 21 cents per day for a trifle over 18 miles.

Another trial consisted in climbing Fort George Hill, the length of ascent being 2138 ft. at a grade of 11 per cent. The car made twenty-one successful trips up the hill under a single charge of the battery. This particular performance meant a climb of almost one mile into the air in eight miles, to say nothing of going up a grade for nine miles from the garage to reach the hill. Another trial consisted in circling the State of New Jersey, making charging stops at Asbury Park, Atlantic City, Philadelphia, Bethlehem, Port Jervis and Newburgh. While the roads in New Jersey were in good shape, those in Pennsylvania were bad, the grades were heavy and full of short water breaks. The daily runs by the two cars varied between a minimum of 54 miles and a maximum of 94 miles, in every case on a single charge. The total mileage was 489. [illegible] to attempt the ideal tour of approximately 1000 miles, a route familiar to many automobilists over roads along Long Island Sound, through Massachusetts into Vermont and New Hampshire, thence to the Maine coast, down through Boston and return to New York. The paper gave full details of this trip, which was undertaken by two cars. One car showed a total mileage of 1017.99 miles at an average speed of 11.77 miles, and the other car a total of 1017.75 miles, with an average speed of 11.35 miles per hour.

THE OBLIGATIONS OF THE CENTRAL STATION.

A paper by Mr. Louis A. Ferguson, of the Commonwealth Edison Company, entitled "Relation of the Central Station to the Electric Vehicle Industry" was then read by its author, who commented on the slowness of central-station managers to recognize their relations to the electric automobile industry. He said it was unjust to the customer and bad business practice for central-station managers to advise the use of electric vehicles for certain purposes and after they have been placed in service to give no further attention to the matter other than to collect the bills for electricity consumed. He maintained that the central-station company is one of three interested partners, the other two being the vehicle manufacturer and the user. Progressiveness on the part of the builder should be met with tolerance on the part of the purchaser, and the central station should not only supply energy at a reasonable rate, but should also assume that it is to a large degree responsible for the efficient operation of the vehicles. The author dwelt on the responsibility of the central station in the premises and maintained that an expert battery engineer should be employed who should investigate all cases where more energy is being used than seems warrantable. This gratuitous service is certain to be rewarded by greatly increased revenues to be derived from the sale of energy to electric vehicle owners. Moreover, the central-station company owes it to itself and to its customers to set an example and establish proof in its own locality that the electric vehicle is serviceable, reliable and economical when considered from the viewpoint of the user. Investigations made in Chicago show actual costs of operation, including electrical energy at 4 cents per kw-hour, supplies, tires, battery and all other repairs, but exclusive of fixed charges and antiquation, of 6 cents per mile when averaging thirty miles a day. It is unusual for the 1½-ton wagons to use more than 3 amp-hours per mile while running under average conditions. These figures, Mr. Ferguson maintained, demonstrate that the electric commercial truck is capable of meeting practically all requirements of the average user and in addition furnishes him with more economical, cleaner and all around better service than can be obtained from either of its competitors. The author showed that from statistics of his company the average monthly income from a 3000-lb. electric trucks is $12, from a 5-ton truck $20, from freight elevators $20 and from passenger elevators $40. He pointed out that central-station managers would be keen to get an elevator load, whereas actual experience shows that the electric truck gives as great an income and a better load-factor. Battery questions need no longer frighten the buyer, and the mileage range of a vehicle is sufficient for all city demands. The indisputable facts regarding the electric vehicle should be taken by central-station managers to those who ought to use the vehicle, because the day is past when no economy can be shown. Mr. Ferguson concluded with the statement that central-station customers expect the central-station manager to furnish them with reliable data as to cost of operation and maintenance of electric vehicles and unless he can supply this information first hand his statements do not carry sufficient weight to interest a prospective purchaser to the point of buying an electric vehicle. It is essential that its friends do something to pave the way, because there is no surer way to retard the growth of electric vehicle business in a city than for the company itself to fail to make use of them. Merchants cannot be blamed for being skeptical under such conditions.

USES OF ELECTRIC VEHICLES.

Mr. Day Baker, of Boston, then presented an illustrated

paper showing various applications of electric vehicles. Various vehicle manufacturers were invited to send pictures of installations, and as a result a very great number of slides were shown embracing every field of endeavor. Mr. Baker gave short descriptions of each installation and while giving credit to the various manufacturers whose cars were illustrated by stereopticon studiously refrained from mentioning the name of his own company when its product was illustrated. The author felt that the pictures would leave a better and more lasting impression on the minds of those present than the mere recital of the uses to which the vehicles were put. Mr. Baker's paper was followed by the final paper of the morning session, that of Mr. J. T. Hutchings, of the Rochester Railway & Light Company.

THE ELECTRIC TRUCK.

Mr. Hutchings in his paper, which was entitled "The Electric Vehicle in Heavy Trucking Service," stated that there are in operation to-day something over 600 3½-ton to 5-ton electric vehicles in certain mentioned lines of trucking, a considerable number of which have been in use from eight to ten years and are still giving satisfactory service. After discussing the best speed for heavy trucks, the conclusion was arrived at that it is a fallacy to drive them faster than eight miles an hour under our conditions of poor pavements, congested traffic and with the tire problem as it now stands. The possibility of handling trucks of larger capacity than 5 tons is merely a question of tire maintenance and the making of a vehicle which can be safely handled in our crowded streets. Mr. Hutchings states that the present cost of the up-keep of rubber tires on 7½-ton to 10-ton vehicles is so high that lighter trucks would undoubtedly prove less expensive in the total cost of the delivery of merchandise. The question of batteries in connection with heavy trucking is not a serious one. It is no longer difficult to get a man of sufficient experience and ability to take care of batteries in a satisfactory and sane way. Mr. Hutchings believes that it is directly up to the battery manufacturer to supply battery engineers to the users of vehicles. The cost of electric energy for the charging of storage batteries is a very small item, as a 5-ton truck will seldom cost more than $1 per day for electricity at the rate of 4 cents per kw-hour. Taking up the viewpoint of the central station, it is stated that a 5-ton electric truck is equivalent in earning capacity to twenty-one commercial arc lamps or 1000 incandescent lamps or 179 flatirons. With a product which is satisfactory to the user, manufacturer and central station, Mr. Hutchings sees no reason why the future of the electric truck in the transportation of heavy merchandise and material is not assured.

Following the presentation of Mr. Hutchings' paper in abstract, announcement was made that the New York Edison Company had invited the entire assemblage to lunch in the restaurant in the Garden below, and also had provided tickets of admission to the Electrical Show for all those who cared to inspect it after the convention had adjourned. Covers were spread for over 250 and a most enjoyable repast was served.

A complete account of the afternoon session, together with the discussions which took place at that session, for all discussion was reserved for the afternoon session, will appear in the next issue.

Increasing Importance of the Electric Vehicle.

In the course of an address before the Electric Club of Chicago, on Oct. 12, Mr. [illegible] the Woods Motor Vehicle Company, said that he believed the time is not very far distant when there will be as many electric automobiles as gas cars made and sold.

It is true that the gasoline automobile has the touring field pretty nearly to itself. Here the electric vehicle is not a dangerous competitor, and possibly never will be. But in 90 per cent of the work for which all automobiles are used the electric car can, on the whole, give more satisfactory service than its rival.

Central-station managers will observe that the electric vehicle is an off-peak proposition. It is true that there are many isolated plants in garages, but as the number of electric automobiles increases, and as a more careful study is made of the subject of supplying electric energy for them by owners, garage proprietors and central-station men, there will be an increased load of this description taken by the central stations.

Mr. Newman believes that the high standard of electrical appliances has been brought about to a very large extent by the specialty manufacturer. The latter might well give his attention to devising an apparatus that would find a wide field of usefulness in the electric automobile industry. This is an instrument which would reveal, more nearly than is practicable at the present time, the available amount of electrical energy in the battery at all times. A voltmeter, with the aid of a thermometer, tells something, but in the speaker's opinion the amp-hour meter is of little use without the aid of a hydrometer In the case of the hydrometer, again, it is difficult to obtain readings from it in actual practice in operating cars. Therefore, there is an opportunity for the specialty manufacturer to devise an apparatus combining in one appliance all the good qualities of the instruments mentioned without their drawbacks.

The electric automobile industry makes business for the manufacturers of rectifiers and switchboard apparatus and the contractors who install them. Motors, wire brushes and other electrical parts are also required. Mr. Newman said that there is a tendency in the manufacture of sockets to adopt the bayonet type rather than the screw type, as the latter has some tendency to allow the lamp to jar loose. This is especially the case in relation to incandescent lamps used in automobiles.

Brief reference was made to the Edison storage battery, which the speaker thinks still remains to be proved. It was predicted that the manufacturers of lead storage batteries will make great strides in the next few years. The principal drawback of the lead storage battery is its life, or rate of depreciation. Improvement in this respect will give better weight efficiency, which is especially desired for batteries used on vehicles.

Answering a question in relation to the use of the electric car in touring Mr. Newman said that high mileage in automobile operation depends to a great extent on low speeds, thereby reducing wind resistance, which varies as the square of the speed. Big motors and batteries are needed to obtain high speed with electric vehicles, and speed is of importance in touring.

In relation to the comparative cost of operation of electric and gasoline cars Mr. Newman referred to a recent commercial-vehicle run in Philadelphia, where gas and electric vehicles, both delivery cars and trucks, were tested under comparative conditions. In this case more prizes were awarded to electric vehicles for economy in hauling live weight than to the gasoline machines. The recent decision of Gimbel Brothers, of New York, to employ nearly all electric delivery wagons for their large retail store was also mentioned.

Among those who took part in a brief discussion, which brought out some of the foregoing points, were Messrs. O. B. Duncan and James H. Delany. Mr. A. A. Gray gave some account of his observations on a recent trip to the Pacific Coast, and Messrs. F. P. Vose, Max Zabel, T. G. Grier and Mr. McCullough, of the Great Northern Power Company, of Duluth, also spoke briefly. A vote of thanks was tendered the speaker.

Ontario Receives Niagara Power.

To Berlin, Ont., belongs the distinction of being the first city in the world to receive electric energy transmitted over 100 miles at a potential of 110,000 volts. The official turning on of Niagara power received over the lines of the Hydro-electric Power Commission of Ontario took place at Berlin on Oct. 11 and was followed by a three days' celebration in

which the completion of the first section of the greatest public [illegible] fittingly signalized.

Myriads of incandescent lamps were strung along the main thoroughfares, and together with electric arches and signs, transformed Berlin for the time being into an electric city. In Auditorium Rink a fine display of the most modern electrical devices, including power supplies, cooking and heating apparatus, was made by prominent Canadian and American manufacturers. This building was chiefly lighted with tungsten lamps and showed to advantage when the official button was pressed by the Premier of Ontario, Sir James Whitney, and the Hon. Adam Beck, chairman of the commission.

In the evening a banquet was given in honor of the occasion and was largely attended by electrical men from all parts of the province. A distinctive and pleasing feature of this affair was the use of electric cooking in the preparation of the different courses of the menu.

Speaking at the opening ceremonies the Hon. Adam Beck, chairman of the commission, reviewed the progress of the cheap power movement in Ontario which had led to the government undertaking the project on behalf of the people. Referring to the actual engineering and construction work, he warmly praised Chief Engineer P. W. Sothman and his staff of assistant engineers, whose services he felt had been particularly efficient. Identified with Mr. Sothman in this enterprise were the following engineers: Messrs. F. A. Gaby, chief assistant engineer; H. G. Acres, assistant engineer in charge of hydraulic and transmission line work; E. T. J. Brandon, assistant engineer in charge of substation work; A. E. Davidson, in charge of substation construction; F. B. Manshendell, insulator expert; P. B. Yates, J. A. Brundidge and F. T. Stocking. Mr. R. A. Ross, of Messrs. Ross & Holgate, Montreal, was consulting engineer to the commission.

With a view to investigating the possibilities of obtaining cheaper electrical power a movement was started by a number of prominent manufacturers in Western Ontario and from the interest created the Hydroelectric Power Commission of Ontario came into existence. In 1905 it was incorporated by the Legislature and power was given to construct works for the transmission and supply of electrical energy.

March, 1908, saw the completion of an agreement between the commission and the Ontario Power Company, of Niagara Falls, which latter company agreed to supply up to 100,000 hp

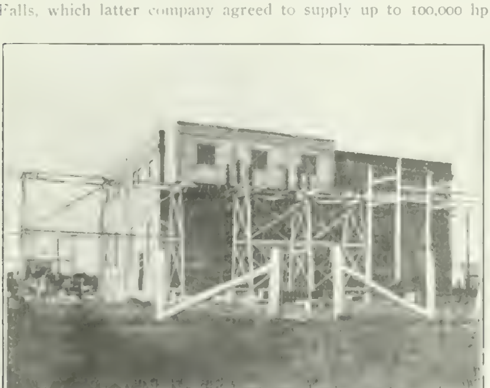


Fig. 1—110,000-Volt Substation at Berlin, Ont., Can.

at 12,000 volts, to be paid for at the rate of \$9.40 per annual horse-power for the first 25,000 hp and \$9 thereafter.

Preliminary surveys were made for a transmission line taking in the cities and towns of Western Ontario which had contracted with the commission for a supply of power. It was at first the intention of the engineers to transmit the power from Niagara Falls at 60,000 volts, three-phase, and with a frequency of 25 cycles, but subsequently it was decided to raise the voltage to 110,000. In all twelve stations were constructed as follows: Step-up transformer station at Niagara Falls; step-down station at Toronto; main interswitching station at Dundas and interswitching and transformer stations at Guelph, London, Preston, Berlin, Stratford, St. Mary's, Paris and Woodstock.

On the line between Niagara and Dundas No. 4-0 stranded aluminum cable was used and No. 3-0 on the rest of the line. At Dundas the line divides into two circuits and is so arranged that in case of accident to the line at any point current can be

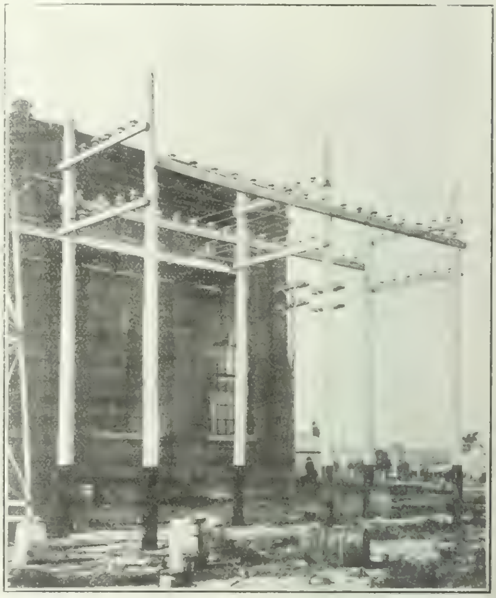


Fig. 2—110,000-Volt Substation at Berlin, Ont., Can.—Outgoing Lines.

fed around the loop in the opposite direction and the service continued without interruption. In conjunction with the power lines, which are practically double-circuited throughout, a telephone system has been installed paralleling the transmission line. The telephone line also carries a protective relay system which in the event of any lines becoming broken, grounded or short-circuited automatically cuts off the high-voltage circuit. This is effected by a balanced system of currents which become disturbed, causing a current to flow when trouble of any nature strikes the line, instantaneously disconnecting each end of the dangerous section.

In laying out their lines the engineers have paralleled the roadways as much as possible and all crossings are protected by mesh construction. The towers used in this work are of light yet substantial design and were tested thoroughly before being finally adopted by the commission. The normal span between towers on the level is 550 ft. The whole tower line is about 276 miles in length and approximately 3000 towers were required for the work of construction. At the end of the Toronto line difficulty was met in obtaining a right-of-way into the city, and as a result the engineers were forced to erect twenty towers along the waterfront and these were placed on massive concrete piers.

Providing insulators for the 110,000-volt line was no small task. Tenders were called for and manufacturers were asked to meet the most rigid specifications. The suspension type of insulator was adopted and these were required to withstand a dry potential test of 330,000 volts and a wet test of 220,000 volts, with ½ in. of rain per minute at 45 deg. angle toward

the insulator. The strain insulators, used on all angles, transpositions and long spans, were compelled to withstand 10,000 lb. without breaking. The first contract for insulators was placed with the Ohio Brass Company, but some of the later insulators were purchased in Germany.

The contract for the construction and erection of the high-tension line was awarded to the F. H. McGuigan Construction Company, which was the lowest tenderer and which agreed to build the line according to specifications and to supply all the materials except insulators. The contract price was $1,270,000 and called for the execution of the work not later than July, 1910. Unfortunately there have been delays in supply of materials and on questions of right-of-way which have made impossible the completion of the line by the date set.

The contracts for the electrical equipment for the different stations were let early in 1909. On account of the pioneer nature of the work it was deemed advisable to consult with several of the prominent power transmission engineers before awarding contracts, and the services of Messrs. R. A. Ross, V. G. Converse and Ralph D. Mershon were accordingly obtained. Visits were made to the works of the companies tendering for the supply of equipment, and contracts were finally made with the Canadian General Electric Company for the supply and installation of the necessary equipment for the stations at Toronto, London, Guelph, Preston, Berlin, Stratford, St. Mary's, Woodstock and St. Thomas, with the exception of the 110,000-volt line switches, which were supplied by the Canadian Westinghouse Company in the above-mentioned stations. This company also supplied the complete equipment of the Niagara and Dundas stations, and installed the protective relay system to cut out automatically defective portions of the line without disconnecting the supply of power at any distributing point of the system.

During the summer of 1909 Chief Engineer Sothman and one of his assistant engineers visited Europe for the purpose of collecting data and latest information on European practice in construction and equipment of high-tension power transmission lines. They also studied the conditions abroad pertaining to the general use of electric power appliances and machinery which eventually could be introduced to further the more general adoption of electric power in the Province. On this trip information of a most valuable character was collected and tabulated.

In conclusion, it may be pointed out that the work of the Hydroelectric Power Commission of Ontario extends over a wide area. The completion of the lines in Western Ontario will soon be an accomplished fact. Other parts of the Province are, however, clamoring for the commission's supervision of [illegible] mated the water-power resources of the Province, storage [illegible] have been surveyed and reported on, and in the case of Dog Lake, situated in the northern part of the Province, plans for increased storage capacity have been drawn for the Department of Public Works [illegible] way. In the east, Ottawa, the Canadian capital, is securing a power supply at a comparatively low rate through the interests of the commission, while many other towns are making application for a similar service.

McCall Ferry Plant Begins Operation.

The large hydroelectric plant which the Pennsylvania Water & Power Company has been building for a number of years at Holtwood, Pa., better known as McCall Ferry, was placed in operation on Oct. 14 and electrical energy was transmitted over its lines to Baltimore, Md. At the station the lines cross the Susquehanna River by a span over 2000 ft. long on towers 120 ft. high, and just east of Baltimore the lines cross the tracks of the Baltimore & Ohio Railroad on 120-ft. towers. At present two wheels are in operation and all of the energy is

Fig. 1—Down-Stream Side of Power House.

being transmitted to the Consolidated Gas, Electric Light & Power Company of Baltimore. The contract with the latter company calls for the delivery of a maximum of 15,000 hp the first year, and this amount will be increased yearly during the life of the contract.

The hydroelectric development of the Pennsylvania Water & Power Company is located on the Susquehanna River about 10 miles northwest of the boundary line between Pennsylvania and Maryland, and about 20 miles from the tidewater of Chesapeake Bay. There are steep banks on either side of the river at McCall Ferry with an island in midstream, and a narrow gorge between the eastern bank and a chain of islands form a natural tail race. A fall in the river due to a series of rapids above the site makes available for hydraulic purposes a total head of about 63 ft. The dam across the river is approximately half a mile in length and is said to be the second longest dam in the world. It is built of solid concrete [illegible] ft. The down-stream face is provided with the usual curve, and to allow for expansion and contraction layers of compressible material are introduced at intervals of 40 ft.

The power house, which is also built of solid concrete and [illegible]

Fig. 2—Forebay of the Pennsylvania Water & Power Company's McCall Ferry Station.

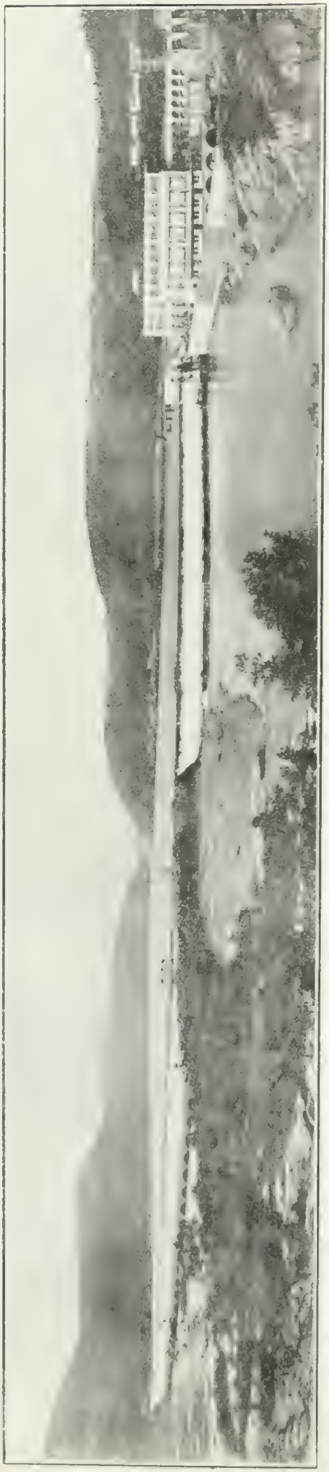


Fig. 3—Panoramic View of the Hydroelectric Development of the Pennsylvania Water & Power Company on the Susquehanna River at McCall Ferry, Pa.

tions have been taken. The normal flow of the Susquehanna River is westward, thus carrying most of the ice away from the power house. In addition a wing dam, having three submerged arches through which the water enters the forebay, is built at right angles to the main dam, between which and a rock fill above floating booms are provided so as to divert such ice as is carried to the east over the spillway. Any ice which enters the forebay despite these safeguards, as well as ice which may form there, is diverted through three ice chutes built into the power house. Some conception of the massiveness of the structures which characterize the plant is conveyed in the accompanying illustrations.

The water wheels are of the vertical type, each capable of developing 13,500-hp when operated at 53 ft. head and with 80 per cent gate opening. Two wheels are mounted on a single shaft of forged steel, and the entire weight is carried on a roller bearing supported by a casting set into the masonry. The arrangement for operating the gates consists of a vertical shaft made of pipe carried on a step and held at the top by a bearing attached to the wall. The maximum velocity of flow of the concrete openings is 6 ft. per second, and all changes of direc-

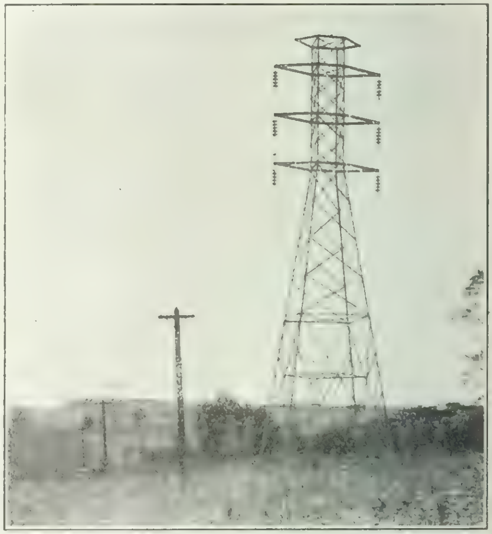


Fig. 4—Transmission Line to Baltimore, Md.

tion of flow have been made as gradual as possible so as to conserve the head. The draft tubes of the upper and lower wheels come out together below the level of the standing tail water, so that it is possible to get at the upper turbine by closing the head gates. When the lower turbine requires attention, stop logs may be used to cut off the tail race and the draft tubes drained by electric pumps. The water wheels were built by the I. P. Morris Company, of Philadelphia. Each wheel is coupled to a 7500-kw. three-phase, 25-cycle General Electric generator operating at 94 r.p.m. The design is such that with the available head reduced to the possible minimum during extreme floods the generators are capable of giving their rated output with 100 per cent gate opening.

The hydraulic plant is now completed for an initial installation of 50,000-hp and an ultimate installation of 100,000-hp. The power house, gate house and transformer house are finished for six units, including rheostat and switchboard galleries, compartments for transformers and other apparatus. At the head works foundations, etc., are completed, the only work required to prepare the power house for the full installation of 100,000-hp being the completion of the superstructure. As stated above, two units are already in operation, and

three other units will be installed as rapidly as they are received from the manufacturer.

Transmission line No. 1 is complete and ready for service. There are 500 steel towers, ranging in height from 40 to 60 ft., carrying two 70,000-volt circuits each of three aluminum cables. The company owns title to a right-of-way 100 ft. wide and 40 miles long, extending from the Susquehanna River to the City of Baltimore, and a private telephone line is installed the entire length of the transmission system. The substation at Baltimore has been ready for operation for several weeks, and the transformer and auxiliary apparatus installed is sufficient to handle 40,000 hp. The station is designed and equipped to receive, transform and distribute energy most economically, and provision is made for additional apparatus, so that the output may be doubled when the demand for energy justifies the installation of additional apparatus. The equipment in the Baltimore substation was supplied by the Westinghouse Electric & Manufacturing Company.

As the result of damming the Susquehanna River a great body of water has been impounded, which forms a lake above the dam about eight miles in length. To protect the company against claims on account of flooding property along the river, it was necessary for it to acquire large tracts of land on both sides of the Susquehanna. This property adjoins the lake which has been formed, and it is the purpose of the company to dispose of it for commercial or other purposes, the Pennsylvania Water & Power Company merely reserving enough real estate to protect its rights.

The contractor for the installation was the Empire Engineering Corporation, which worked under the supervision of Mr. John A. Walls, chief engineer of the Pennsylvania Water & Power Company.

McCall Ferry Power at Baltimore.

On Friday of last week Mayor Mahool, of Baltimore, turned on the power generated by the Susquehanna River at McCall's Ferry in the presence of a party composed of financiers from Baltimore, New York, Philadelphia and elsewhere. Electrical energy at 70,000 volts was received at the receiving plant of the Pennsylvania Water & Power Company, at Highlandtown, whence the energy will be distributed to Baltimore industries. Before the moment of introducing the current into Baltimore arrived the visitors inspected the plant and J. E. Aldred, president of the Pennsylvania Company, explained the work of constructing the buildings and dams and the installation of the machinery. The visitors were then escorted to a house on a hill a short distance away, where luncheon was served. Upon their return to Baltimore they visited the transformer house at Highlandtown. President Aldred, in a speech after the visitors had inspected the plant, said that while all of the investors expected to reap a profit from their investments, yet he believed that the introduction of this new power into Baltimore meant more for the Monumental City than it did for the moneyed men who were interested in the giant enterprise. He concluded his speech by saying that the profit referred to is that profit which comes from making two blades of grass grow where one grew before; that the company does not pretend to be made up of philanthropists or guardians of the people, its principles being plain and simple—to do business, and more of it, with a firm belief that the best way to bring this about is to give the consumer the best goods at the lowest possible price. The United Railways of Baltimore is also expected to contract for a portion of the McCall Ferry output, but as yet no such arrangements have been definitely made.

New York Commission News.

Commissioner Maltbie, of the Public Service Commission of the First District of New York, held a hearing last week on the complaints of consumers in the Far Rockaway section against the rates charged for gas and electricity by the Queens Borough Gas & Electric Company. The attorney representing the complainants was Mr. C. A. Brodek, while Mr. Eugene D. Hawkins represented the company. Two complaints were filed last spring, one concerning gas, the other electricity, each being signed by 100 consumers. An effort to reach a compromise with the consumers failed and the company was then given several months' time in which to go over its books and prepare a statement concerning the cost of manufacture and operation in order that the commission might have proper data upon which to base its decision as to reasonable rates. Mr. Carleton Macy, president and general manager of the company, testified that these statistics had been prepared in regard to gas, but that the investigation of the electrical accounts had not yet been commenced. Mr. Francis Blossom, of the firm of Sanderson & Porter, testified that his firm acted as operating engineers of the plant and that he had made a thorough examination of the operating cost of the gas plant, which he figured at 77 cents per 1000 cu. ft. The average annual consumption per meter is about 25,000 cu. ft. The hearing was adjourned until Oct. 19.

The practice of gas and electrical corporations in requiring deposits of consumers as security for the payment of bills is to be regulated by the Public Service Commission, Second District. A notice has gone out to all the companies of a hearing to be held in Albany on Nov. 1 at which will be discussed the rules and regulations proposed to be adopted.

The proposed order in its more important requirements provides that interest at the rate of 6 per cent per annum shall be allowed on all deposits and shall be paid annually; it provides the specific manner in which the companies shall keep a record of each deposit; it prescribes the form of receipt that shall be used, upon the reverse side of which is to be printed for the information of the consumer the terms and conditions upon which the deposit is exacted and may be withdrawn, and it requires each company not only to use these receipts hereafter, but to substitute them for the receipts now outstanding.

This action of the commission is the result of an extended investigation into the practice. The investigation disclosed that many of the companies allowed depositors less than the legal rate of interest and not a few paid no interest whatsoever upon deposits; that in many instances no explanation was made to consumers as to why security was demanded and no information given as to their rights; and that proper records of deposits were not kept. The purpose of the proposed order is to remedy these and other conditions and to put the methods of all the companies upon a uniform basis.

The right to exact deposits from consumers is given gas and electrical corporations in section 63 of the Transportation Corporation Law, and many of the companies avail themselves of the privilege in order to secure doubtful accounts. Outside of New York City upward of 50,000 consumers, in order to secure gas or electrical service, have been obliged to advance security varying in amounts from several dollars to several hundred dollars. The deposit funds in the possession of the companies now approximate half a million dollars.

The commission has received an application from the Hudson River & Eastern Traction Company for authority to issue $50,000 of additional common stock and $850,000 additional first-mortgage bonds. The company is now engaged in operating an electric railroad in the town of Ossining and intends to complete the construction of its line from its present terminus in the Camp Woods in the town of Ossining to the village of White Plains, a distance of approximately fourteen miles, exclusive of sidings. It is stated that this will require an expenditure of $621,000.

The commission has received a complaint from the Lycoming & New Haven Telephone Company against the New York Telephone Company. The former company owns and operates a telephone line from Lycoming, in the town of Scriba, to Dempster, in the town of New Haven, in the county of Oswego. The line in question is about six miles in length. It is alleged that the New York Telephone Company has neglected and refused to allow patrons and subscribers of the complainant's line to use the lines of the New York Telephone

plainant at Lycoming, although requested to do so. It is stated that the New York company refuses to grant the service unless the complainant company will pay to the New York Telephone Company the sum of $3 per subscriber in addition to the tolls exacted by the New York Telephone Company, and in addition demands that the complainant shall buy the stock of certain dissatisfied stockholders.

The Huntington Light & Power Company has been authorized to execute a mortgage for the sum of $250,000 and to issue bonds to the amount of $98,000 and additional capital stock to the amount of $2,000. The proceeds are to be used for the discharge of outstanding obligations to the amount of $86,000; the improvement of plan and distributing system, $14,000; and $42,000 to purchase the outstanding bonds of Huntington Gas Company at a price not to exceed 70.

Wisconsin Commission News.

In deciding the case of the Beloit Water, Gas & Electric Company vs. the City of Beloit the commission has issued an order which, while having an immediate bearing upon the water department of the utility, is of importance inasmuch as it represents the attitude of the commission toward extensions in all branches of the public utility service.

The petitioners allege that an ordinance of the City of Beloit ordering an extension of water mains is unreasonable, one reason being that the number of prospective consumers is not large enough to make such an extension reasonably remunerative. The commission held that, taking into consideration the expense of construction and the revenue to be derived from such an extension, the ordinance is not unreasonable; that a public utility cannot be required to make extensions indiscriminately, without reference to cost and revenues, but that a utility may well be expected to incur expense in order to serve citizens whom it cannot now serve if there is a reasonable prospect of an increase in revenues sufficient to warrant the expense.

The La Crosse Gas & Electric Company has petitioned the commission for authority to increase its rates. This is the second time the company has applied for an increase in rates, the first application resulting in the first rate decision issued by the commission and therefore being more or less of a tentative nature. The hearing before the commission in the case of the City of De Pere against the Green Bay Traction Company, involving the sale of six tickets for a quarter, has been indefinitely postponed, no date having been fixed.

The commission has authorized the Chippewa Valley Railway, Light & Power Company to issue $100,000 par value of first-mortgage, twenty-year gold bonds of the denomination of $1,000 each, bearing interest at the rate of 5 per cent per annum, to be issued in accordance with the terms of a deed of trust to the Harris Trust and Savings Bank and Andrew Cooke, of the City of Chicago, trustees. The bonds are to be issued and sold for the purpose of supplying the company with funds (a) to complete a concrete dam and power house now being constructed across the Red Cedar River, at Cedar Falls, Dunn County, Wis.; (b) to acquire certain additional riparian rights above the dam made necessary by the erection thereof and which are necessary for the use of said dam when completed; (c) to pay for additions to its property, including the transmission line from Eau Claire to Chippewa Falls; (d) to pay the floating indebtedness incurred by reason of extensions and additions to its property. These bonds are to be issued for money only and for not less than 75 per cent of the par value.

The commission has authorized the Milwaukee Western Electric Railway Company to issue stock and bonds as follows: (1) Ten thousand shares of common stock, of the par value of $100 each, being an issue of $1,000,000, said stock to be issued for money only and at not less than par value. (2) Two and one-half million dollars par value of first mortgage, 5 per cent gold bonds, of the tenor and under the conditions to be set [illegible] executed by said company. The bonds are to be sold for money only and for not less than 75 per cent of the par value thereof.

The stock and bonds are to be issued and sold in order to supply the company with funds for the following purposes (1) To pay for the construction of a line of electric railway extending from the City of Milwaukee to the village of Fox Lake, Dodge County, Wis., with a branch line running from the village of Sussex to the City of Waukesha, Waukesha County, Wis. (2) To pay for the equipment, including the building of power houses, transmission lines, depots, etc., the purchase of rolling stock, machinery of all kinds, right of way and real estate, and everything necessary to carry on the business of the company. (3) To purchase all property of any kind and any claim or right necessary for the purposes of the company.

Maryland Commission News.

The Maryland Public Service Commission last week announced its first important decision, when it dismissed the application of a number of residents of Ellicott City to compel the United Railways and Electric Company to reduce its fare from 15 cents to 10 cents one way from Baltimore to Ellicott City. The case has been under consideration for several months, during which time a number of hearings have been held. In their complaint the people of Ellicott City alleged that they were discriminated against by the fact that the company sold commutation tickets at reduced rates to residents along the Catonsville line. In concluding its decision the commission stated that any material reduction of the fare would jeopardize the interest on the bonds of the company, and, under the provisions of section 30 of the Public Service Commission law, it would require a clear case to warrant any action on the part of the commission that would tend to "disturb the value of any bonds of any of said corporations issued prior to the passage of this act." The decision states that the complainants themselves appear to consider the present charge reasonable and proper for all persons who are not residents of the section traversed by the Ellicott City line, and ask an order "compelling the said United Railways to correct said unjust discrimination and unjust charge on said line by issuing commutation tickets to residents of Ellicott City and intermediate points." The commission considers it altogether beyond its power to order one rate of fare for residents, when for precisely the same service at the same time, and under the same conditions, a higher rate is applied to the general public. That, it said, would be a gross form of the unjust discrimination which the law creating the commission expressly forbids. If it were true that it is the custom of the defendants to issue such "resident tickets" on other suburban lines, it might not be proper for the commission to order a discontinuance of such custom without giving the parties interested an opportunity to be heard in its defence, and the counsel of the body would be directed to take whatever steps might be necessary for that end.

Canadian Hydroelectric Commission News.

When the contract under which the Toronto Electric Light Company lights the Toronto city streets expires, on Dec. 31 next, the municipal power department will be ready to supply energy to 600 of the new street lamps in the residential district from the Niagara hydroelectric plant. There are 600 concrete poles now being erected on the streets at the rate of a mile of streets per day. In addition, five-light cluster lamps will be erected on the business streets downtown.

During the week Premier Sir James Whitney, who has returned from Europe, in speaking of the litigation going on between the city and the Toronto Electric Light Company over the erection of the former's poles on the streets, gave out an interview in which he hinted that unless the differences were adjusted the Ontario Legislature might take action. Subsequently the company wrote to Mayor Geary stating its wi-

ingness to adopt the suggestions of the trial judge and the Premier looking toward a settlement, and further announced that the company would be willing to consider the purchase of its plant and equipment at the present time.

The London Electric Company is also reported as being about to make a new offer to the London City Corporation looking to the purchase of its plant by the municipality. The last offer was made by the company at $400,000 for the entire system, which offer was not accepted by the corporation.

CURRENT NEWS AND NOTES.

Calgary 19,500-hp Hydroelectric Plant.—During the coming winter the Calgary Power Company, Limited, will complete its 19,500-hp plant on the Bow River, 50 miles west of Calgary, where a head of 75 ft. has been developed. The transmission will be at 55,000 volts.

Columbia Electrical Society.—The first fall meeting of the Electrical Engineering Society of Columbia University will be held on Oct. 21, at which time Prof. F. B. Crocker will deliver an address on "Electrical Engineering in the Far East." The meeting, which will be open to the public, will begin at 8:15 p. m.

Sixty-six Thousand-hp Oregon Hydroelectric Plant.—The Mount Hood Railway & Power Company, of Portland, Ore., will complete rapidly the first of its three hydroelectric plants aggregating 64,000 hp. The initial plant will supply 16,000 hp and commence delivery of electrical energy to Portland by August of next year.

Special Pittsfield-Schenectady Meeting of the A. I. E. E.—Arrangements are being made for holding a joint meeting of the Pittsfield and Schenectady sections of the American Institute of Electrical Engineers during February, 1911. The meeting will be of the same general character as those held at Charlotte, N. C., and San Francisco, Cal., last spring.

Steel for Boilers.—At the recent Chicago convention of the American Boiler Manufacturers' Association a change was noted in the "Uniform American Boiler Specifications" by which it is recommended that the content of sulphur in flange or boiler steel be not over 0.03 per cent instead of 0.04 per cent, and that the content of phosphorus be not over 0.04 per cent instead of 0.06 per cent.

Electrical Communication and Signaling on Illinois Central.—An interesting item in the annual report of the Illinois Central Railroad Company for the year ended June 30, 1910, shows that the expense of operating the telegraphs and signals of the company for that year was $275,492.43. During the year the value of additions and betterments made to telegraph and telephone lines on this railroad system amounted to $16,092.11. The system operated by the Illinois Central comprises 4550 miles of railroad.

A. I. E. E. Boston Meetings.—During the present society year there will be three joint meetings in Boston of the Boston Section of the American Institute of Electrical Engineers, American Society of Mechanical Engineers and the Boston Society of Civil Engineers, and in January there will be a joint dinner of the three societies. In addition there will be eight regular and three special meetings of the A. I. E. E. section, the latter to be held respectively at Harvard, Tufts and the Massachusetts Institute of Technology. Mr. Harry M. Hope, 147 Milk Street, is secretary of the section.

Pennsylvania Electric Trains Under the Hudson.—According to the latest official announcement, the Pennsylvania Railroad's Hudson River tubes will be opened for traffic on Nov. 27, which is the first day of the fall train schedule. The new section extends from the station at Seventh Avenue and Thirty-third Street to Harrison, N. J., where it meets the old main line. The tunnels between the New York station and Queens have been in operation since Sept. 8. When the Harrison extension is opened, the entire electrical installation, except the New Haven railroad connection, will be in operation.

Gifts to the University of Illinois.—The General Electric Company has presented to the University of Illinois a recording steam meter, a device used as a means of determining the quantity of steam passing any pipe to which it may be attached. The gift was transmitted on behalf of the company by its sales manager, Mr. F. G. Vaughen, to Prof. Ernst J. Berg, in charge of the department of electrical engineering. This is the second significant gift that the General Electric Company has made the University of Illinois within a year, the first consisting of a 100-kw Curtis steam turbo-generator, which now constitutes a part of the equipment of the department of electrical engineering.

Fuel from Peat.—The results of a further examination into the peat resources of Canada, and particularly Ontario, made during the season 1909-1910 are contained in a report just issued by the mines branch of the Department of Mines at Ottawa. The bogs examined, their situation and extent are as follows: Brunner bog, 8 miles west of Stratford, 2288 acres; Komoka bog, 12 miles from London, 900 acres; Brockville bog, 3 miles from Brockville, 1400 acres; Rondeau bog, on shore of Lake Erie, 6 miles from Blenheim, 1571 acres. All these bogs can be worked at a profit, according to the report. A separate report is also made on the government peat bog at Alfred, while the plants at Dorchester and Farnham, Province of Quebec, are referred to favorably. Dr. Eugene Haanel is Superintendent of Mines at Ottawa, as well as being president of the Canadian Peat Society.

Los Angeles License Tax Valid.—The city license ordinance of Los Angeles, Cal., adopted by referendum vote of June 30, has been declared valid, in so far as the provisions relate to the taxes upon gas and electric corporations according to an opinion recently handed down by Judge Conroy, of the Supreme Court. The Los Angeles Gas & Electric Corporation and the Southern California Edison Company attacked the ordinance as void, and asked permanent injunctions to prevent the enforcement of its provisions. Judge Conroy denied the injunctions asked. The court disposes of the objections to the reasonableness and definiteness of the ordinance by declaring the provisions are not uncertain. Several banks which originally joined in the fight against the ordinance withdrew their objections several weeks ago. The tax against which the lighting companies fought was one-third of 1 per cent on the gross receipts for the sale of electricity and gas, the tax to be payable quarterly.

Proposed Railroad Terminal Electrification in Chicago.—No active steps are being taken toward the desired electrification of steam-railroad terminals in Chicago, but the newspapers keep up the fight energetically. In a recent editorial the Chicago *Daily News* remarked: "Of course, the opinion of engineering and financial experts must to a large degree control in matters of this kind. But these experts should be employed, in part, at least, by the public authorities to make disinterested reports. The railroads should not be allowed to decide by themselves that the cost is prohibitive." The Chicago *Daily Tribune*, after stating that as soon as details can be agreed upon with the authorities of New York City, the entire freight line of the New York Central on the west side of Manhattan Island is to be electrified, points out that the managers of that railroad have resolved to do something which the Chicago roads say would involve intolerable expense and constant danger. The *Tribune* calls again for a railroad-electrification [illegible]

Denver City Lighting.—Denver has [illegible] cp lamps in use on the streets and boulevards. In addition there are 132 arcs in the parks and more than 100 50-cp incandescents. The Welcome Arch contains 1294 4-cp lamps and costs $75 per month to maintain. The total cost of city lighting, exclusive of parks, was $13,499.41 for the month of September.

Proposed Electric Club in Cedar Rapids.—Electrical men in Cedar Rapids, Ia., are discussing the possibility of organizing an electric club. It is believed that a membership of from fifty to sixty could be secured, and the idea is being received with favor. Mr. J. C. Young, superintendent of the lighting department of the Cedar Rapids & Iowa City Railway & Light Company, and Mr. E. H. Ball, of E. H. Ball & Company, electrical contractors, have shown particular interest in the project.

Oil Fuel.—Tests recently made at the Las Cascadas air-compressor plant, Panama Canal Zone, on California crude oil burned under boilers gave an equivalent evaporation of 14.40 lb. of water from and at 212 deg. Fahr. per pound of oil, and 14.63 lb. of water per pound of combustible. The tests were made on six return fire-tube boilers, there being two trials of seven and one-half and nine hours, respectively. A similar test was made at the Mount Hope pumping station on a locomotive-type boiler, which gave 13.11 lb. of water from and at 212 deg. Fahr. per pound of oil, and 13.40 lb. per pound of combustible.

Railroad Electrification and Switching Operations.—In discussing Mr. B. E. Sunny's paper on "The Engineering of Chicago" at a recent meeting of the Western Society of Engineers, Mr. W. E. Symons said that undoubtedly the electrification of steam-railroad terminals will be adopted in all large cities at some time in the future. Probably the system of establishing an electric zone will be employed. Such electrification is not out of the experimental stage as yet, declared Mr. Symons, so far as it is applied to switching operations on a large scale, although it is quite satisfactory for the operation of made-up trains.

Boiler Supplymen's Association.—During the annual convention of the American Boiler Manufacturers' Association in Chicago, on Oct. 13, the allied Supplymen's Association held its annual meeting also. The business transacted was not of general interest, except the election of these officers: President, Mr. W. O. Duntley, Chicago; vice-president, Mr. J. T. Corbett, Chicago; secretary, W. H. S. Bateman, Philadelphia; treasurer, H. B. Hare, Cleveland; executive committee, D. J. Champion, of Cleveland; Thomas Aldcorn, of New York; F. B. Slocum, of New York; C. M. Chamberlain, of Chicago, and R. S. Groves, of Philadelphia.

Pittsburgh A. I. E. E. Meeting.—The October meeting of the Pittsburgh section of the American Institute of Electrical Engineers was devoted to a discussion of the New York paper of Messrs. Stott and Pigott on a "15,000 kw Steam-Engine-Turbine Plant." Among the points brought out is the improvement of economy by adding a low-pressure turbine to a condensing engine, it being generally thought that the place for the low-pressure turbine is as an addition to a non-condensing plant. Messrs. E. D. Dreyfus and W. B. Flanders, of the Westinghouse Machine Company, called attention to the comparatively low efficiency of a turbine in per cent of Rankine cycle efficiency as compared to the efficiency of the high-pressure reciprocating unit. It was shown that there is considerable room for improvement, and it was stated that there is a probability of such improvement. Messrs. W. L. Waters and F. W. Harris, of the Westinghouse Electric & Manufacturing Company, discussed the electrical phase of the situation. It was shown how the induction generator is especially adapted for use in this type of plant, due to the large charging current of the underground cables, and especially desirable in so large a plant on account of the low short-circuit current of these machines. It was stated that oil switches of the present type are capable of opening very heavy short-circuits, but, in case of very heavy plant capacity, at the cost of the destruction of the switch. It was stated that switches of a new type will be available in the very near future, such that the allowable plant capacity will not be limited by the oil switches.

New York I. E. S. Section.—At the October meeting of the New York section of the Illuminating Engineering Society Mr. W. H. Gardiner was elected manager to succeed Mr. S. G. Rhodes, who resigned during the summer. Papers were presented by Messrs. P. S. Millar, H. S. Whiting and A. J. Marshall. Abstracts of these papers and the discussions are given elsewhere in this issue. At the November meeting papers on theoretical and practical subjects will be presented by Prof. E. L. Nichols and Mr. Bassett Jones, Jr.

Wireless on African Lines.—According to Vice-Consul Alexander W. Weddell, at Zanzibar, the Deutsche Ost Afrika Linie, with headquarters in Hamburg, whose ships, in connection with those of the Woermann Line, encircle the African continent, is installing a wireless telegraph system on its nine main-line vessels; a tenth boat, now under construction, and which will be finished by the end of the year, will be similarly equipped. The Telefunken system is used; wave length, 600 meters, but wave lengths of 300 and 400 meters can be also used; radius, 250 miles (though communication has been established at 370 miles); power, 2½ kw; code, Morse. Messages for these vessels are accepted by the Zanzibar government offices at Zanzibar and Pemba, the range of which is about 200 miles; the charge is 2 annas (4 cents) per word, with a minimum charge of 1 rupee (32 1/3 cents) per message.

Nickel-in-the-Slot Street Lighting.—Basing its suggestion on an editorial in the *Electrical World* of Sept. 29 on "Street Lighting Economy," which it quotes in full, the Albert Lea (Minn.) *Evening Tribune* suggests, apparently in a sarcastic vein, that the idea of a slot machine for public lighting might be adopted in that city. "With such a contrivance," says the *Tribune*, "the patriotic citizen who is entertaining a visitor on a moonlight night might bring him down town, drop a quarter in the slot, put the light on for a minute or two and 'show' him rather than tell him what a beautiful and modern lighting system we have. If the city cannot afford to light the streets every night, why not let the citizens help out a bit?" The point of the satire is that Albert Lea has a fine modern electric lighting system and that it is false economy to fail to use it when the moon is shining, or, worse still, when it is supposed to shine but does not penetrate the clouds.

Kansas City an Electrical Pioneer.—In a paper presented before the recent meeting of the Kansas Gas, Water, Electric Light and Street Railway Association, Mr. Edwin R. Weeks, past-president of the National Electric Light Association, stated that in Kansas City was established the first central station using the Thomson-Houston system of electric lighting, and also one of the first stations employing the Edison system. In Kansas City was also established one of the first, if not the very first, commercial electric street railway using the overhead trolley. The rolling stock consisted of two cars, each equipped with a 7½-hp, 250-volt, direct-current motor. There were two overhead trolley wires 10 in. apart, and two pairs of trolley wheels held by springs in lateral contact with each wire, the trolley wheels being all mounted on a single carriage and connected with the motors by flexible duplex cables. Mr. Weeks said that he served as court appraiser some twenty odd years ago on the remains of this road, which paid its creditors 8 cents on the dollar.

OIL AND GAS FUEL STATION AT WICHITA, KAN

A Modern Generating Plant Especially Noteworthy for Compactness and Economy of Operation.

In Wichita, Kan., the Kansas Gas & Electric Company is engaged in the erection of a new generating station that has a number of interesting features. The station is being built for an output of 8750 kw, and it will be a gas-burning or oil-burning station, although the design is such that additions permitting the burning of coal as fuel can be made readily. The plant will be run condensing, using the water of the Arkansas River for that purpose. Its output will be used for commercial lighting and motor service, electric railway service and street lighting. The plant is designed especially with the idea of reducing the cost of operation to the minimum.

As shown in Fig. 1, which is a map of the site of the new station, the building fronts on Third Street, and is near the

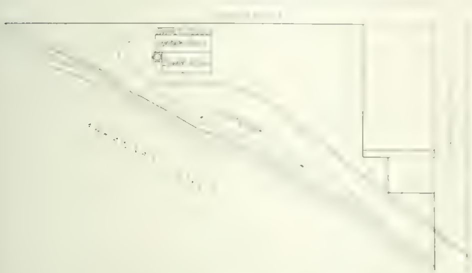


Fig. 1—Map of Site of New Station

Arkansas River at the point where the Little Arkansas flows into it. The site is triangular in shape, the property fronting about 850 ft. on Third Street and about 1200 ft. on the river. The building itself is 135 ft. wide on Third Street and about 110 ft. deep. It consists essentially of three parts—a boiler-room, a steam turbine-room and a switch house. The last-named consists of three stories, as shown in Fig. 2, which is a general cross-section of the power house. The general arrangement plan, Fig. 3, shows the layout. The building is of steel skeleton construction with brick walls

BOILER ROOM EQUIPMENT.

In the boiler-room, as shown in Fig. 3, four boilers will be installed with room for two more. Each of these boilers will be of the Babcock & Wilcox type and have 5680 sq. ft. of heating surface. The boiler-room is over 30 ft. high, and beneath it is a 12-ft. basement. The level of this basement floor is the same as that of the floor of the turbine-room and switch house. There are large openings in the wall between the turbine-room and the boiler-room, so that for operating purposes there is practically only one room. The boiler furnaces are equipped with both oil burners and gas burners. As shown in Fig. 2, they have a very large combustion chamber and are of unusual size. They are fired from under the rear of the boiler on the side facing the turbine-room, so that the turbine-room attendant may also care for the boilers, if necessary. The arrangement is such that there is practically one central operating space for both the turbine-room and the boiler-room, all operating parts being near at hand and very accessible.

There will be a steel stack 14 ft. in diameter and 199 ft. 6 in. in height above the boiler-room floor. The breeching is placed in the base of the stack in such a manner that it would not be necessary to disturb it in case the station is later equipped for burning coal. As will be noticed in Figs. 2 and 3, there is ample room to install automatic stokers, should they be desired later, while the structure and roof of the boiler-room are designed with special reference to supporting coal and ash-handling machinery if desirable later on.

GENERATING UNITS.

In the turbine-room there are three main generating units and the steam piping is so arranged as to be particularly compact and so as not to interfere with the future installation of coal-burning and coal-handling apparatus. Indeed, the changes necessary for the use of coal as fuel could be made without seriously interfering with the operation of the station. The piping layout is also unusual. The arrangement is such that three boilers are drawn upon to supply steam to a main header, which is run directly to each of the 4000-kw steam turbines. There are two of these main headers, and they are cross-connected with a loop which also serves as an auxiliary header for supplying steam to pumps and condensers. The 750-kw turbine is supplied with steam from the header leading to the 4000-kw unit adjacent to it.

Three turbo-generators will be installed in the turbine-room. The one shown at the right in Fig. 3—that is, at the eastern end of the turbine-room—is a 4000-kw horizontal Curtis turbine turning at 1800 r.p.m., the electrical end of the unit being a General Electric alternator. To the west of this, with centrifugal pumps and various steam auxiliaries between, is another 4000-kw unit. This also consists of a horizontal Curtis turbine and a General Electric alternator, but in this case the speed is 1200 r.p.m. These two machines are new. In the western end of the room is a 750-kw vertical unit from the same manufacturer. This, however is an older machine which will be taken from the existing station of the Kansas Gas & Electric Company. All of the generators are wound for three-phase alternating current at 2300 volts and 60 cycles.

CONDENSERS AND AUXILIARIES.

There is a separate surface condenser for each generating unit. These condensers have 11,000 sq. ft. of area in the case

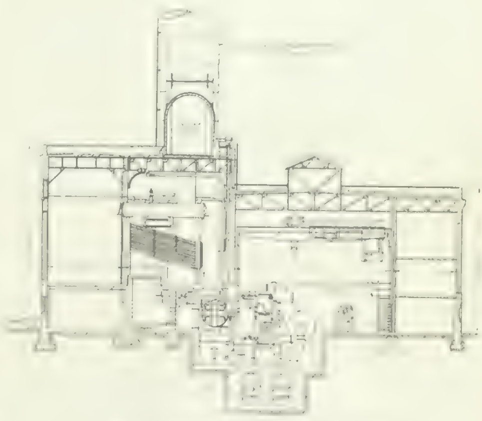


Fig 2—Cross-Section of Power House.

of the 4000-kw units and 3000 sq. ft. for the 750-kw unit. A combined circulating and dry-vacuum pump is provided for each of the 4000-kw units. This is driven by a steam engine, the circulating pump having a rating of 11,000 gal. a minute. For the smaller generating unit there is a motor-driven circulating pump rated at 3000 gal. a minute. For this generating unit an independent steam-driven dry-vacuum pump is provided. There is an independent hot-well pump, steam-driven, for each unit. A group, consisting of one feed-water heater and two vertical steam boiler-feed pumps, centrally located, as shown in Fig. 3, supplies feed water for the whole station. A 35-ton electric overhead traveling crane spans the turbine-room.

Water for condensation is obtained from an intake crib located about 330 ft. west of the station at the junction of the Little Arkansas and Arkansas Rivers. This point was selected because the water of the Little Arkansas River is much purer

than that of the larger stream. From the intake crib an intake tunnel 5 ft. in diameter leads to a well just outside the building. From this point, as shown in Fig. 2, the intake tunnel, which is 5 ft. wide and 8 ft. high, is rectangular in section. The discharge tunnel is of the same dimensions as the intake tunnel, but turns almost directly south after leaving the building and empties into the Arkansas River at the nearest point being about 105 ft. long. These two tunnels are placed side by side under the turbine-room, as shown in Fig. 2. The circulating pumps are placed on the intake tunnel side of the room, and the condensers are so arranged on the other side that the discharge from them passes to the discharge tunnel with the minimum amount of large piping. The arrangement is notably compact; the condensers, as shown in Fig. 2, are placed in a rather unusual position right back of the boilers to save space.

THE OUTPUT OF THE STATION.

The electrical equipment in the turbine-room, in addition to the three generating units already mentioned, consists of four 500-kw motor generators and two 100-kw exciters, placed as indicated in Fig. 3. The four motor generators consist of 700-kw synchronous motors driving 500-kw generators, the latter designed with liberal allowance for overload. Two of these sets provide 275-550-volt direct current for the three-wire system and two provide 550-volt direct current for railway purposes. The arrangement is such that the three-wire machines can be operated on either the three-wire busbars or the railway busbars.

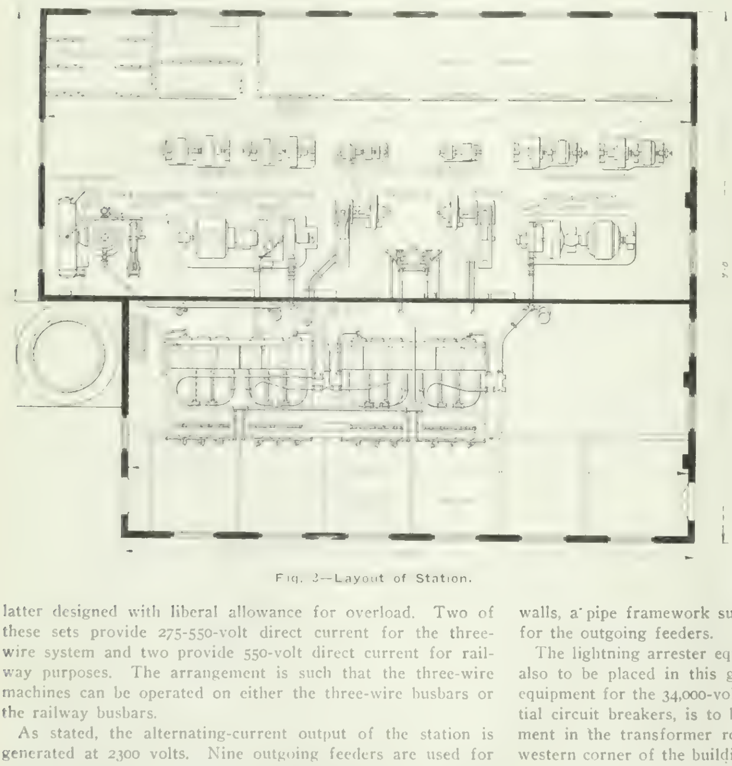


Fig. 3—Layout of Station.

As stated, the alternating-current output of the station is generated at 2300 volts. Nine outgoing feeders are used for commercial lighting and motor service and are supplied with alternating current at the machine voltage. In addition, provision is made for a 34,000-volt (or possibly 60,000-volt) transmission line to be supplied with energy from this station through step-up transformers located in the building. This transmission line will deliver energy to substations, which will convert the high-tension 60-cycle electrical energy by step-down transformers and motor-generator sets into direct current for the operation of an interurban electric railway. Alternating current is also supplied for eight series arc circuits, each designed for seventy-five lamps used for street lighting in Wichita. Four of these circuits are equipped with enclosed arc lamps, and four are equipped with magnetite arc lamps.

The direct-current load is carried by two 275-550 three-wire feeders for motors and ten 550-volt railway feeders. By means of the latter electrical energy is transmitted directly to the system of the local electric railway company the total consumption being measured in the station. Provision is made so that all feeders, except the 34,000-volt transmission line, may be taken out of the station either overhead or underground.

GENERAL ARRANGEMENT OF SWITCHING EQUIPMENT.

In all there will be twenty-one motor-operated oil switches ranging from 300 amp to 800 amp in rating for the control of the turbo-generators and the synchronous motors of the motor-generator sets, one being reserved for the control of the smaller motors and auxiliary apparatus in the station. Starting switches for synchronous and induction motors are of the solenoid-operated type, and are mounted on pipe framework. The motor-operated and solenoid-operated oil switches are electrically interlocked, insuring proper sequence of operation when starting up motors. The motor-operated oil switches are located on the first gallery floor of the switch house, and are placed in fireproof cells. The solenoid-operated switches are placed on the main floor of the switch house, back of the switchboards, which are on the dividing line between the turbine-room and the switch house.

Busbar Chamber.—Both main buses and auxiliary and starting buses are supported on porcelain insulators, which in turn are mounted on pipe framework. The latter will be erected on the switch-house floor back of the switchboards. On account of the comparatively low e.m.f., 2300 volts, no fireproof busbar structure has been found necessary.

All disconnecting switches, shunt and series instrument transformers will also be installed on suitable pipe framework on the switch-house floor in the busbar chamber.

Second Gallery Equipment of Switch House.—The floor space in the second gallery of the switch house (Fig. 2) is devoted to the feeder regulators used to keep the potential constant on those feeders which supply lighting service exclusively. In addition, there will be installed in this gallery, on the floor and walls, a pipe framework supporting the disconnecting switches for the outgoing feeders.

The lightning arrester equipment for the 2300-volt feeders is also to be placed in this gallery, while the lightning arrester equipment for the 34,000-volt line, together with the high potential circuit breakers, is to be installed in a fireproof compartment in the transformer room, the latter being in the northwestern corner of the building, as shown in Fig. 3.

EXCITATION.

There are provided for the excitation of the generators and synchronous motors a 100-kw generator driven by a steam turbine and another unit of similar size driven by an induction motor. Each synchronous motor of the motor-generator set has been provided with an individual exciter, the armature of which is keyed to the main shaft.

The plan of excitation is as follows: Under normal operating conditions the motor-driven exciter provides for the turbo-generators and the individual exciters provide for the excitation of their respective synchronous motors in the motor generator sets. The 100-kw turbine-driven exciter is used as reserve. Two sets of excitation buses have been provided, the

arrangement being such that either the steam-driven exciter or the motor-driven exciter may supply any pair of these buses. In case of the breakdown of an exciter supplying electricity for the synchronous motors the latter may be excited from the second set of excitation buses mentioned above.

SWITCHBOARDS.

There are to be six switchboards in all in this power house. The location of five of these boards is shown on Fig. 3. As indicated, they are on the dividing line between the turbine-room and the switch house, each occupying the space between building columns supporting the wall separating these two divisions of the power house. Beginning at the eastern side of the building, as indicated in Fig. 3, the switchboards in order are: No. 1, controlling generators and exciters; No. 2, three-phase feeders; No. 3, motor-generators and three-wire feeders; No. 4, railway feeders; No. 5, station lighting and motor apparatus; No. 6, arc circuits.

The switchboards are made with blue Vermont marble panels on pipe framework, and one interesting feature is the arrangement used to distinguish the various classes of instruments. All voltmeters are nickel-finished, all polyphase indicating wattmeters have oxidized copper finish, and all other instruments are dull black. Thus the eye of the attendant will be at once arrested by the particular kind of instrument which he is seeking to consult. This is another of the labor-saving ideas emphasized in the design of this station.

STATION LIGHTING AND MOTOR LOAD.

The lighting of the station building itself includes arc lamps in the turbine-room and boiler-room for general illumination and incandescent lamps for specific or local illumination. The arcs will be of the intensified type, operated on 110-volt, 60-cycle, alternating-current circuits. The incandescent lamps will be normally operated on 110-volt, alternating-current circuits, provision being made to operate them, in case of emergency, from the excitation buses. In case both the excitation circuits and the 110-volt alternating-current circuits should fail, a double-pole switch on the distribution panel of the station lighting switchboard is closed, and about fifty emergency lamps will be thrown in circuit with a storage battery. These emergency lamps are placed with a view to having light in the more important parts of the station in case the normal source of lighting should fail.

The incandescent lighting circuits in the station have been arranged so that three-lamp incandescent clusters, located on building columns, will be controlled directly from cut-out cabinets, of which there are three—two in the turbine-room and one in the boiler-room. Where it was found necessary the shorter circuits have been provided with three-way switches, with a view of obtaining control from two different points.

The station motor equipment includes the supplying of electrical energy for operating the turbine-room crane, the circulating pump for the 750-kw generating unit, and two centrifugal bilge pumps located in the basement. The crane motors are three in number and are supplied with 500-volt direct current from the three-wire bus. The circulating pump motor is a three-phase induction machine operated at 2300 volts and 60 cycles. The centrifugal pump motors are single-phase repulsion-induction machines, to be supplied with 60-cycle energy at 220 volts. Provision has also been made to run cables for the motors of a future coal-handling equipment using 500 volts direct current.

STORAGE BATTERY.

A storage battery, to have a rating of 80 amp at the one-hour rate, is to be installed in the first gallery floor of the switch house, where an acid-proof compartment will be provided. The primary purpose of this battery is to supply the motor-operated and solenoid-operated switches with direct current at 110 volts. In addition, the storage battery will be connected to the emergency lighting system as previously stated. The battery is charged from the three-wire buses, the so-called "bleeder system" being installed, so that the charging is practically automatically accomplished.

MISCELLANEOUS.

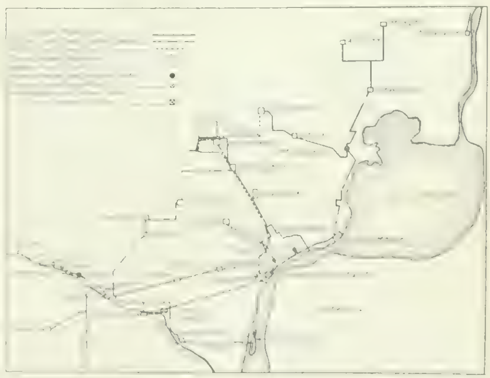
All rheostats for the main generators will be electrically controlled. The rheostats for the synchronous motors of the motor-generator sets are to be of the combination type, chain-operated, the rheostat for the synchronous motor and the motor exciter to be designed as one unit. The rheostats for the railway generators are to be chain-operated also. All rheostats, whether operated electrically or chain-operated, will be placed on pipe framework on the first gallery floor of the switch house.

There will be a system of signals to enable the switchboard attendant and the turbine-room engineer to exchange signals in relation to starting machines, the division of load, etc.

This interesting station was designed by Sargent & Lundy, engineers, Chicago.

INTERCONNECTED HYDROELECTRIC TRANSMISSION SYSTEM IN EASTERN MICHIGAN.

The suburban territory centering about Detroit, Mich., within a radius of fifty miles, is served with electrical energy by the Eastern Michigan Edison Company, whose interests are identified with those of the Edison Illuminating Company of Detroit. The Eastern Michigan Company operates several small low-head water-power generating stations on the Huron River, in the vicinity of Ann Arbor, supplementing the output from these stations with that from steam plants at Geddes and Mount Clemens, and from the Delray stations of the Detroit Edison Company. The stations just enumerated and the various communities served by the Eastern Michigan Company



Map of Hydroelectric Transmission System in Eastern Michigan.

are tied together by 22,000-volt transmission lines, as shown by the accompanying map of the system. This 22,000-volt system is at present chiefly radial from the important centers, but plans have been made for connecting together the outer extremities of these transmission lines, creating a network over which any point on the system can be reached from one of several lines.

The operation of the Eastern Michigan Edison Company is divided into the St. Clair, Washtenaw and Oakland divisions. The St. Clair Division serves the towns of Mount Clemens, Amada, New Haven, Memphis, and Marysville, aggregating 9300 inhabitants, among whom it has 1200 customers. The Washtenaw Division territory comprises Ann Arbor, Ypsilanti, Saline, Wayne, Trenton, Dearborn, Farmington and Northville. Ann Arbor has a population of 14,600, and Ypsilanti is about half this size. Wayne, Trenton and Northville are towns of about 1000 population. The total population served by the Washtenaw Division is about 28,000, out of which the company has over 3000 consumers. In the Oakland territory are Birmingham, Bloomfield Hills, Pontiac, Rochester, Royal Oak and

Utica, with an aggregate population of 27,000 and 600 electrical consumers. The Eastern Michigan Edison Company thus serves a total population of 64,000 and has nearly 5000 customers.

The Mount Clemens steam-driven generating station of the St. Clair Division contains 550 kw in alternating-current generating equipment, which supplies energy to a total connected load of 1575 hp.

The Geddes station of the Washtenaw Division is a combination plant, containing 780 kw in steam-driven and 400 kw in waterwheel-driven alternators. The Superior hydroelectric station (described on page 61 of the *Electrical World*, Sept. 15, 1910) contains a 450-kw alternator, and the Argo plant has a 200-kw waterwheel-driven machine. Thus, of the 1800 kw available capacity of the three plants of the Washtenaw Division, more than 1000 kw is water-power. The total connected load of this division is nearly 4000 kw. Of the average monthly output of the Oakland Division, 50,000 kw-hours, the largest part is supplied for electric railway purposes. The average monthly output of the St. Clair Division is 90,000 kw-hours, and of the Washtenaw Division 320,000 kw-hours.

The officers of the Eastern Michigan Edison Company are: President, Hoyt Post; vice-president, Alex. Dow; secretary, J. V. Oxtoby, and treasurer, K. A. McIntyre. Mr. E. F. Phillips, of Detroit, is general manager; Mr. R. W. Hemphill, of Ann Arbor, is manager of the Washtenaw Division, and Mr. J. C. Hoetger, of Mount Clemens, is superintendent of the St. Clair Division.

COST OF WATER-POWER AND COAL.

By Alton D. Adams.

Great hydroelectric systems are not here considered, but only moderate water-powers such as are often used with steam plants to operate central stations. Such water-powers are fairly represented by the figures for the eight plants given below, which are all located in the East. In rated capacities of water-wheels these plants vary from 339 hp to 3175 hp, and at five of the plants the wheel capacity is above 1000 hp. The falls or normal operating heads of water on the wheels run from 10 ft. to 37 ft. and at five plants the heads are 20 ft. and less. Five plants pay a rental for the use of water, and three own the water-power. Only a part of the flow of the river can be used by the electric plants in three instances, and the total discharge of water is available at each of the others. In no case was the water sufficient to develop all of the required electrical energy, and so both the pounds of coal burned and the number of kw-hours generated are given for each plant.

The figures represent the operations of one year and are arranged in the order of the wheel-powers. At the smallest of the eight stations the wheel capacity was 339 hp, and the annual rental, with the land required for the development, the dam and a station building, was $2,500, or $7.37 per rated horse-power of wheel capacity. The river structures were provided by the lessor; but the electric company furnished the wheels. The lease covered the flow of the river with a fall of 10 ft. and a probable minimum of less than 200 cu. ft. of water per second, so that the annual rental amounted to $250 per foot of fall.

OPERATIONS OF HYDROELECTRIC PLANTS.

H. P. [illegible]	Head [illegible] Feet	[illegible]	Coal Burned in [illegible]
[illegible]	10	[illegible]	[illegible]
384	16	273,725	304,640
[illegible]	16.6	2,448,207	[illegible]
1,120	20	6,127,660	[illegible]
1,200	[illegible]	2,918,150	[illegible]
About [illegible]	[illegible]		
2,835	[illegible]	16,583,186	27,552,000
[illegible]	28	4,312,122	8,365,814

With the wheel capacity of 384 hp the electric company had the entire flow of a small river, and the output was largely devoted to lighting. The average load at this hydroelectric plant was only 41.6 electrical hp during the 8760 hours of the year, and the small ratio of this average to the wheel capacity probably accounts for the fact that only 1.1 lb. of coal were burned per kw-hour generated by water-power and steam-power combined.

An electric company that owned a water-power with the total flow of a river had wheels of 735 hp, and delivered the greater part of its output for electric traction besides supplying a lighting load. The average load at the generating station during the year was 372 electrical hp, which was developed in large part by steam as shown by the consumption of 3.3 lb. of coal per kw-hour.

The hydroelectric plant that had wheels of 1120 rated horse-power on a 20-ft. fall paid a rental of $13,790.40, amounting to $12.31 per horse-power for the water delivered from a canal to its wheels, and the supply was under the control of the water-power company. Besides this water-power the electric plant consumed more than 17,000,000 lb. of coal, amounting to 2.8 lb. per kw-hour generated by both steam and water. This plant sold fully 50 per cent more energy for stationary motors than for all forms of lighting combined, and its average load during all the hours of the year was 932 electrical hp. The rental for the water-power in this instance amounted to $689 per foot of fall, and to 0.22 cent per kw-hour generated by steam and water-power combined. To this must be added the cost of the 2.8 lb. of coal to obtain the average expense of water-power and fuel per kw-hour generated.

Water wheels of 1200 rated horse-power capacity were used on a 37-ft. fall with the entire flow of a small river by a hydroelectric system that had an average load on both steam-driven and water-driven generators of 448 electrical hp. Besides this, energy purchased from a much larger water-power represented an average load of 250 kw, so that the average on the system was 698 kw for the year. More than five times as much energy was sold for motors and traction purposes as for lighting. Under these conditions the coal burned amounted to only 0.39 lb. per kw-hour generated by both water-power and steam-power. It is probable in this instance that the purchase of energy from the large water-power plant kept down the average amount of coal burned per kw-hour generated.

For the two water-powers with wheel capacities of 2835 and about 1565 hp respectively a hydroelectric system paid an annual rental of $34,600 total, or $7.85 per rated horse-power of the wheels. These two water-powers are on the same river only a few miles apart and their combined head is 50 ft., so that the total annual rental amounts to $692 per foot of fall in the river. At one of the plants the electric company installed the wheels and generators and took water from a canal, and at the other plant the water-power company installed the complete equipment and delivered the output to the lines of the electric company. On the basis of its entire output from both steam-power and water-power the above rental paid by the electric company amounted to 0.21 cent per kw-hour generated, and on the same basis the coal burned was 1.6 lb. Though this electric system had a large motor load, its energy output for lighting was a little more than double the amount for motors, and the total average load on both the steam-power and water-power stations was 2524 electrical hp during the year, or about three-fifths of the water-wheel capacity.

The largest hydroelectric plant here considered had a water-wheel capacity of 3175 hp, and paid $19,779.69 as the annual rental of the water from a canal to operate these wheels under the head of 28 ft. Per horse-power of wheel capacity this rental is $6.23, and per foot of fall it is $706 for the water. In this instance the electric company installed the wheels and generators. The connected load of lamps was greater than that of motors, and the average load of the steam-driven and water-driven generators was 656 electrical hp for the entire year. On the basis of the total generated output from both

steam-power and water-power the rental of the water-power amounted to 0.46 cent per kw-hour, and the coal burned was 1.9 lb. per kw-hour on the same basis. This electric company used the water-power in common with a number of manufacturing plants.

ANALYSIS [illegible]

H. P. Water Wheels	Rental Annually per Wheel H.P. Dollars	Rental Annually per Foot of Fall. Dollars	[illegible]	Lbs. Coal [illegible] Hour Generated	Cts. Coal and Water Power Rental
[illegible]	7.37	250			
384				[illegible]	
735					
1,120	12.31	[illegible]	[illegible]	[illegible]	[illegible]
1,200				[illegible]	
Ab't 1,560	7.85	[illegible]	[illegible]	[illegible]	[illegible]
2,835					
3,175	6.23	706	[illegible]	[illegible]	[illegible]

Comparing the results of the above analysis, three of the four rentals show fairly close agreement per horse-power and three show very close agreement per foot of fall. In cost per kw-hour generated with both steam-power and water-power one of the rentals is more than double either of the other two, due in part at least to the low average load. The pounds of coal burned per kw-hour generated vary from 0.39 to 3.3, depending in part on the relative use of water-power. Assuming the cost of soft coal at $4.48 per long ton, or 0.2 cent per pound, the approximate price at the above plants, the combined cost of coal-power and water-power per kw-hour is obtained for three of the plants that rented water. Where 2.8 lb. of coal were burned per kw-hour generated the combined cost of coal and water amounts to 0.78 cent, and where 1.6 lb. of coal were burned the combined cost was 0.53 cent per kw-hour. The water rental of 0.46 cent per kw-hour made a total of 0.84 cent for coal and water. Only one of the three plants that rented water-power appears to have saved anything over the probable cost of coal alone, and in this instance the cost of 0.53 cent for both coal and water was obtained with the total flow of the river at one fall and a great part of the flow at the other.

The following instances illustrate the prices sometimes paid for conveniently located water-power sites to operate electric systems: In one instance the fall of a small river at the purchased site was 10 ft. with normal rate of flow, and the price paid for both banks of the stream with the right to the total discharge was $50,000, or $5,000 per foot of fall. This price included about 1.2 acres of land on both sides of and in the bed of the river, a wooden crib dam of uncertain age and condition, and several old mill buildings, one of which serves as the generating station. On the spillway the length of this dam is about 110 ft., the stored water behind it extends some four miles upstream, and the ponds of other developments on the river add to the constancy of the available power. The discharge of the river at the site in question is unknown, but this site is about 30 miles from its source in a chain of lakes, and at a point 31 miles further down stream the minimum discharge was 130 cu. ft. per second and the mean discharge 1480 cu. ft. in 1908. During that year the least mean discharge for any month was 290 cu. ft. per second. The valley of this river remains of about the same width between the points in question, and perhaps one-half of the above discharge may be available at the purchased power site. At the fall of 10 ft. each 100 cu. ft. of water per second develops 113 gross water hp. The present installed capacity of electric generators at this water-power is only 220 kw, but a higher development is probably warranted. With this 220 kw the price of $50,000 paid for the site and the old hydraulic structures amounts to $227 per kilowatt.

In another instance a site where an old dam gave a fall of 16 ft. was sold for $29,000, including the entire flow of the stream; but the situation was such that the construction of a contemplated new dam would give a fall of 20 ft. The new dam had a spillway 200 ft. long and the pond behind it is 320 ft. wide. Based on the new head of 20 ft. the price of $29,000 amounts to $1,450 per foot of fall. This power site included two acres of land on both sides of a small river at a point above which the drainage area is about 360 sq. miles. At a point several miles further down stream the mean of a large number of discharge measurements taken during a week of October, 1908, was 73 cu. ft. per second. At that time the river was low, and the discharge of 73 cu. ft. per second at the head of 20 ft. developed 165 gross water hp. Before this power site was sold the generators at the old dam where the head was 16 ft. were rated at 250 kw, but it is the purpose to install a much larger capacity at the new dam. On the basis of 250 kw the price of $29,000 for the site amounts to $116 per kilowatt.

In a third instance a water-power site with land on both sides of a river and flowage rights and the entire discharge at a fall of 14 ft. was sold for $37,400, or $2,529 per foot of fall. This is an exceptionally good power, because the flow of water is well maintained in dry seasons. At this fall generators of 800 kw total capacity were installed for operation, with the entire flow of the river, so that the $37,400 paid for the site amounted to $47 per kilowatt of generator capacity. Subsequent operation has proved that the installation of 800 kw on this 14-ft. fall was warranted by the flow of the river, for during several years the generated output of this plant has represented a load factor of not less than 47 per cent annually, based on its rated capacity during 8760 hours, and in one year this load factor was over 60 per cent. This last-named plant illustrates the strong points of even small water-powers where natural or artificial storage gives a large low-water flow.

The above figures for the costs of water-power sites are tabulated below:

Fall at Site. Ft.	Generators Installed. Kw.	Cost Power Site. Dollars	Cost of Site Per Ft. Fall. Dollars	Cost of Site Per Kw. Dollars
10	220	50,000	5,000	227
14	800	37,400	2,529	47
20	250	29,000	1,450	116

In considering the figures that relate to generator capacity it is to be remembered that the 220 kw and 250 kw are for the old equipment and are subject to increase, while the 800 kw was new plant selected for the situation.

INVESTIGATION OF ENERGY TRANSMISSION IN MASSACHUSETTS.

The Massachusetts Gas and Electric Light Commission gave a continued hearing at Boston on Sept. 15 upon Resolve 55 of the Legislature of 1910, requiring the board to investigate the transmission of electricity in bulk in the State and to report to the Legislature of 1911 its conclusion regarding the necessity of any legislation upon the general subject. The full board was in attendance, Chairman Barker presiding. As in the previous hearing of July 14, the discussion centered upon the question of granting the right of eminent domain to electric supply companies, including both central station and transmission organizations.

As a result of several conferences with electric service interests Mr. W. Rodman Peabody, of Boston, counsel for the Amherst Power Company, submitted a tentative bill granting the right of eminent domain to transmission companies, electric light companies and gas companies doing an electrical business. The bill provides that the directors of such a company may apply to the Gas and Electric Light Commission for a certificate of exigency, which shall state that the construction of a specified line for the transmission of electricity in the different municipalities named in the application is consistent with

the public interest. With the application the directors are required to file a map of the proposed line and an estimate showing in reasonable detail the cost of construction. The company is also required to file with the board various data regarding its stock and bonds outstanding, balance sheet within three months of the application, and certain details regarding its officers and directors and their annual salaries. The company is further required to publish a copy of its application in the local press, to send a copy of the application to municipal clerks, and to appear at a public hearing upon the question of exigency. After the hearing the board shall, if in its opinion the construction of the line is consistent with the public interest, grant a certificate to that effect, and a copy of the decision is to be sent to the clerk of each municipality through which the line passes, setting forth the route appropriately. The bill provides that if the board refuses to issue the certificate no further proceedings may be had within one year.

In case the board grants the certificate, the procedure is similar to that followed in the exercise of the right of eminent domain by electric railroads under the law of 1906. Within sixty days the directors of the company may make application to the municipal authorities of each town or city through which the line is to pass for a detailed location, with a suitable map, and after due notice and public hearing the municipal authorities may fix the route, or with the written agreement of the directors may fix a different route to be submitted to the commission for its approval. In case no route is fixed by the mayor and aldermen, or the selectmen, within 60 days of the filing of the company's application with them, the directors may appeal to the commission to fix the route, and the latter is authorized to fix the route except that it may not be longitudinally upon any public way or place without the written consent of the aldermen or selectmen. A certified copy of the commission's decree is then to be sent to each municipal clerk concerned. In fixing the route locally the municipal authorities are permitted to specify where all poles, towers, etc., in the public streets or places shall be placed, the kind of poles, towers and other structures, and the height at which and the places where the wires shall run.

The most important section of the bill is that providing for the exercise of the right of eminent domain. A company which has obtained authority to construct a transmission line under the provisions of the proposed act may lay out its route not more than 100 ft. wide, and if it is unable to obtain such land or such rights or easements therein as are necessary for the construction of its line by agreement with the owner, may take any land within the limits of its location in fee, or may take such rights or easements therein as are proper for the construction and maintenance of such poles, towers, wires and other structures as may be reasonably necessary from time to time for the conduct of its business. The company is required to pay all damages caused by the laying out, construction or maintenance of the transmission line or by the taking of land or of any rights or easements in land, and such damages upon application of either party are to be estimated by the county commissioners in the manner provided for the laying out of highways. The right of the company becomes null and void unless the line is constructed over the route fixed within two years after the location is determined, but the commission may extend the time if it deems it consistent with the public interest. The bill provides that the company shall not sell electricity in any municipality through which it passes unless it has been or is particularly authorized to do so by the municipal authorities. Any corporation, company, or person aggrieved by the action of the municipal authorities may appeal to the commission for adjudication of the matter. After a hearing the board may affirm, amend, alter or add to the terms imposed by the municipal authorities, as the public interest may require. Upon the petition of any party interested, the board may also make such orders regarding the construction and maintenance of lines or the characteristics of electrical [illegible] it may make such orders as to its maintenance overhead or underground as it may deem necessary.

Mr. Peabody said that his clients feel that the provisions of eminent domain as incorporated in the bill are constitutional, and that the time is soon coming when small companies which generate electricity by coal and deliver over small areas will be doomed, so far as manufacturing is concerned, and that they will mainly be distributing agencies. The tendency is in that direction, notably in Germany, England and the West. The right of eminent domain is in the public interest for the reason that persons in the communities served are now paying more for the service of the energy companies than would be the case if the additional cost of lines due to attempts to extort exorbitant prices were eliminated.

Gen. Schaff, of the commission, said that the exigency must be reflected in the act which gives it relief, and questioned the wisdom of opening the door so widely, particularly in regard to central-station organizations. Mr. Peabody then stated that if the right of eminent domain is withheld from central stations and given to transmission companies the tendency will be for the former to organize transmission companies for the extension of their service into larger areas. It is felt that the power given to the board to supervise the granting of a certificate obviates any opportunity for the entrance of abuses.

Mr. Frederick M. Ives, for the Massachusetts Electric Lighting Association, said that if central stations could obtain locations in spite of obstructive tactics on the part of municipal authorities, they would not urge the eminent domain grant He said that if the State waits for an exigency to arise the damage will have been done and the public will have to pay more for its service than would be the case if excessive charges had not been made for line locations. If a municipality should try to revoke the locations already granted to a private company, assuming that a municipal plant was voted for, how could the central station get its locations for energy transmission? He related difficulties which the Boston Edison Company had suffered in locating suburban high-tension lines, and urged the desirability of legislative authority to set aside obstructive policies in local centers.

Mr. Peabody then said that in the recent construction of a high-tension line to deliver hydroelectric energy from Turner's Falls in Easthampton and Amherst many difficulties were encountered, and there was no question that the line was more costly than if the right of eminent domain could have been exercised. It would be necessary to act under an eminent domain law if the service were to be extended to Springfield or Holyoke from Mount Tom, for example. Gen. Schaff said that he had no idea of embarrassing the healthy growth of the industry, but he was somewhat anxious lest the power of eminent domain be abused if granted. He thought it a good deal of a problem to know where to draw the line, and noted that the term "electricity in bulk" was not concretely defined by the resolution under which the commission is conducting the investigation. He asked why a gas company should not be given the right to transmit gas over private land under right of eminent domain, and Mr. Peabody replied that the gas company can serve the public in the highways, whereas the transmission company cannot safely do so. Mr. Peabody emphatically stated that the commission ought not to take a single step toward recommending the grant of eminent domain rights unless on the ground that lower rates would be afforded by the reduced investment. The right must be for the benefit of the ultimate consumer. Companies are to-day prohibited from extending lines in many cases to sell electricity at a low price by the obstructive charges of landowners. It will not do to send energy at high voltage along the highways on account of the danger. He did not fear the expansion of municipal plants under an eminent domain law, for these are almost always local in scope.

Commissioner Weed raised the point of the companies running lines through houses, barns, etc., under eminent domain, and Mr. Peabody answered that in his opinion the citi

zen is amply safeguarded by the bill, which provides for close supervision by the municipal authorities and the commission. The right of appeal is most valuable in this case. He further contended that a transmission line can seek a particular alignment more easily than a railroad, which would obviate many of the troubles encountered in the exercise of eminent domain by transportation companies.

Gen. Schaff asked about the belief that a transmission company sells to individuals locally, and Mr. Peabody stated that the best plan is for the local company to buy and distribute energy from the trunk line. Mr. Alton D. Adams, for the town of Leominster, raised the point that it would be unconstitutional for the right of eminent domain to be granted to private persons except on condition of public use of the service. He contended that the restriction of certain electrical companies to a limit of supply, as in the Fitchburg and Worcester cases against the Connecticut River Transmission Company, rendered it unconstitutional to grant the right of eminent domain for the sole purpose of reaching a selected group of customers. Private property can be taken only for public use, and if a man's land is taken and he cannot then turn around and demand a supply of the service, the taking is in violation of the State and federal constitutions.

Chairman Barker called attention to the definition of supply of electricity in bulk given in the English Electric Lighting Act of 1909, as a concrete expression of the term in mind in the resolution, covering the supply of electricity to any locally authorized company or person authorized to distribute it, or to anyone authorized to contract for it for the lighting of streets, bridges and public places.

Mr. S. H. Pillsbury, counsel for the Connecticut River Transmission Company, contended that the companies have leaned over backward in their willingness to submit to regulation. The proposed bill does not even allow an appeal from the action of local authorities in connection with a line passing longitudinally through the streets. Nothing is asked which in any way cuts into the power of local authorities, and the constitutionality of the bill did not seem questionable to him He understood that the local authorities could absolutely refuse permission for a line to go through the town. The exigency must be met by cheaper rates.

Mr. Henry I. Harriman, president of the Connecticut River Transmission Company, outlined the special fields of service applying to his organization. He thought that more consideration should be given to the ratio of distribution to manufacturing cost. His company had no desire to enter the purely lighting field, on account of the relatively high cost of such service compared with the generating cost in the hydroelectric station. He thought it would be worth while to make studies of the average cost of serving groups of customers, since in most towns the industrial districts are rather closely related, following a railroad or a river. Manufacturing follows certain general axes. The eminent domain bill is justified by the fact that it is impossible to run a high-tension line over a deflected route except at very great cost. In one noteworthy case the line had to be terminated several miles from the urban center on account of the obstructive tactics of landowners, and consequently the distribution in that city is faulty from the engineering standpoint. Mr. A. D. Adams, resuming, said that he did not oppose the granting of eminent domain for any public purpose, but that he opposed its private application.

Mr. M. B. Jones, for the New England Telephone & Telegraph Company, urged that there is no difference in principle between the transmission of electricity in bulk and for conducting intelligence. The right of eminent domain is needed by telephone companies, under all proper restrictions. Anything which tends to cut down the line investment tends to afford a basis for lower cost of service. In closing, Mr. Jones said that in Vermont the existence of eminent domain rights is of great assistance to the company in making purchases of real estate in connection with the reconstruction of its main toll lines. The hearing was then continued by the board to Sept. 27.

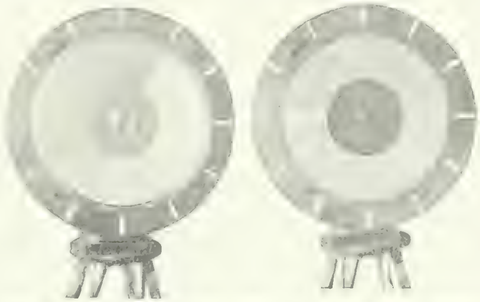
A VARIABLE CONTRAST TESTING DEVICE.

By [illegible]

In the course of tests of street illumination conducted for the lamp committee of the Association of Edison Illuminating Companies need was felt for a means of determining how well one could see with the light provided in the street and measured by means of a photometer.

Consideration of processes of discernment led to the conclusion that practically all seeing in the street at night is a matter of discernment of contrasts. The intensity of illumination is generally so low and objects to be seen are usually of such low light-reflecting power that distinction of detail and perception of most colors is impossible, so that practically all vision is reduced to a basis of contrast discernment.

Ability to see, whether involving visual acuity, color discrimination or shade perception, is so variable, depending not only upon conditions external to the observer, but also upon the observer's condition, that no attempt to measure perception can be successful in establishing precise and definite values. Most of the methods of study which are applicable involve more or less difficulty, due to influences of memory upon judgment or to a tendency on the part of observers to think that objects are seen when they are not seen.



Figs. 1 and 2—Testing Device with Dial Exposed and Equipped for Use.

These considerations were in mind when it was determined to devise some means of measuring the ability to see objects in the streets at night. Three basic conditions were at once established which should be met in the design of a device to accomplish the purpose: (1) The device should test the observer's ability to discern contrasts; (2) it should be so constructed that it may be located in the street and may be observed from some such distance as that at which the objects in the street are most usually observed; (3) it should be free from difficulties of visualization.

After considerable thought, and with the aid of associates at the Electrical Testing Laboratories,[1] a device was evolved which seems to satisfy the requirements fairly well. This device is illustrated in Figs. 1 and 2. It consists of a circular dial on the peripheral portion of which twelve marks are placed to correspond with the hour marks of a clock. The central portion is a surface which is shaded gradually from black, through the grays to white. This part of the construction is illustrated in Fig. 1. The shaded surface of the dial is covered by a disk of dark-gray paper of fairly good diffusive quality. The disk is provided with a slit of variable width corresponding to the hand of a clock. The disk revolves, exposing to view, through the slit, any desired portion of the shaded surface, giving a [illegible] presented to view. As the construction is such that the shaded dial also may be revolved upon its center, any desired degree of contrast may be secured either by revolving the shaded dial with the slit stationary or by revolving the slitted disk with the dial stationary.

[1] [illegible]

The contrasts which are afforded will depend upon the character of the cover disk used. This may be white, when the point of no contrast will be obtained with the slit over the white portion of the dial, or it may be black, when the region of no contrast will be found with the slit over the black portion of the dial, or it may be any desired shade of gray. In most of the work done so far with this device, dark-gray paper has been used, giving the point of no contrast about 70 deg. from the darkest portion of the dial. When thus equipped the calibration of the device is as shown in Fig. 3, with illumination intensities as abscissas and with per cent contrasts as ordinates. The contrasts are very great, as may be expected when one remembers that the intensity is low and the distances are relatively great as experienced in practice. In addition, the object discerned is small, the diameter of the entire device as used in these tests being 15 in., while the slit in the cover disk is only 4 in. long.

For higher intensities, larger objects and near vision, as in interiors, one's ability to discern contrasts is believed to follow Fechner's "law of sensation," according to which one perceives a fixed percentage of contrast irrespective of the absolute intensity of illumination within wide limits. It is known that this law does not hold for very low intensities. The

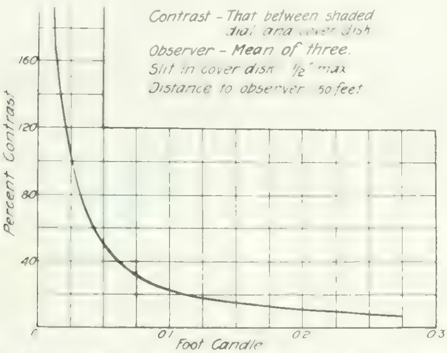


Fig. 3—Calibration of Testing Device Minimum Illumination with Which a Given Contrast May Be Perceived.

calibration of this device follows another law; namely: *The [illegible] tion intensity.*

The device is by no means an instrument of precision, but by averaging a sufficient number of observations a fairly definite result is obtained. After a little practice most observers make fairly consistent settings.

A number of possible procedures in the use of this device will suggest themselves. That usually followed in tests of street illumination is as follows: The shaded dial is adjusted to a condition of no contrast, and the slit is held stationary at some point on the dial. The shaded dial is revolved slowly by an attendant, the contrast being gradually increased until the observer at some distance, say, 100 ft., can just discern the contrast. The observer demonstrates his ability to discern the contrast by designating the time indicated on the clock device by the slit in the cover disk. The dial is then revolved by the attendant until the point of no control is reached and the operation is repeated. If steps had not been taken to guard against such contingencies, the observer in preparing for a second setting would know the portion of the dial upon which his second setting would fall and he would know the appearance which the slit would present when seen. He would, therefore, be liable to think that he saw it before it became visible. To obviate this difficulty, the attendant at the device, in preparing for a second setting, turns the shaded dial through a part of a revolution after having brought the disk slit to the point of no contrast. Having arranged that the degree of contrast obtained in the first trial will in the second be obtained upon a different portion of the dial, he gradually increases the contrast until the position of the slit is located by the observer, who again designates the time indicated by the slit, thereby giving proof of his ability to see it. That this precaution is necessary is attested by the fact that after using the device for some time, always working with the minimum intensity with which a given contrast can be discerned, an observer often imagines that he sees more than one slit on the dial and very frequently thinks that he sees the slit when he does not see it. Indeed, no observer who worked upon the device for any considerable length of time proved free from this difficulty; each one at times indicated that he could discern the contrast when the fact that he was looking at the wrong portion of the dial proved that he did not discern it. The value of this feature lies chiefly in assisting the observer to fix and maintain a definite criterion of discernment, and in pointing out unreliable values in the test results.

In street tests of glare, the contrast device just described was placed in the street at the position where the extent of the glare effect was to be measured and an observer was stationed at a distance usually of 100 ft. Determinations were made of the minimum contrast which could be observed; first, without modifying the conditions; second, with all lamps shielded from the eyes of the observer. This was effected by erecting immediately behind the contrast device a large black cloth screen to obscure all distant lamps from the observer's view and by shielding the observer's eyes locally from the direct light of nearby lamps. Under this condition the contrast device received the same illumination as before, but was observed under conditions of no glare except that which might be due to nearby illuminated surfaces, such as the street. In each test a number of observers were employed and a photometer was placed alongside the contrast device in order to measure the intensity of illumination on the dial. By this means it was in each case either ascertained that the intensity was substantially the same for the glare and no-glare observations, or in the event that the intensity varied the results were corrected for such variations by reference to calibration curves such as that shown in Fig. 3. If the illumination intensity was so low, or the glare was so marked, that with the maximum contrast the position of the slit could not be determined, the slit was widened or the distance between the observer and the contrast device was decreased. It was found, however, that the range illustrated in Fig. 3 would meet nearly all conditions.

Visual acuity instruments which involve discrimination of fine detail, a rather large contrast being presupposed, are employed in tests of illumination. A well-known application is sometimes in the form of reading-distance instruments where the test is the ability to read print of various sizes. Other applications will be recalled by those who have followed the subject.[2]

The variable-contrast testing device here described differs from the visual acuity test objects in a number of important particulars. First, it tests ability to perceive contrasts, which is the more common process of seeing in the streets at night, rather than ability to discriminate fine detail, which is more likely to be involved in a process of seeing in interiors where much higher intensities of illumination prevail. Second, it is free from visualization effects.[3] Third, it presents to view an object which is always of the same size and appearance. Fourth, it is continuously variable throughout a great range.[3]

This variable-contrast device has been found very useful in studying the effect of glare, as encountered in street lighting. It aids a determination of the reduction in power to see objects in the street with the aid of light incident upon them.

As compared with visual acuity test objects this device is believed to be applicable to a somewhat different field of study. Where it may be used in the same field it may be found useful in that it affords a different method of study, and as

[2] [illegible] devised by Sweet and [illegible] Franklin Institute [illegible] that of Ives described [illegible] Vol. IX, Page [illegible]

[3] [illegible] to the Ives test object.

compared with most visual acuity test objects it should be useful because it is much more direct and convenient. As a means of studying the peculiarities [illegible] also appear worthy of trial because of its convenience, simplicity and continuous fine variation throughout the entire range of adjustment.

Central Station
Management, Policies and Commercial Methods

ELECTRIC WIRING CONSIDERED AS AN INVESTMENT.

In a new-business campaign now being carried on among unwired houses in a Western city effective use is being made of the "investment" argument for electric wiring. After pointing out that a six-room house may be equipped with fixtures and wired complete from basement to attic for $59 the letter received by the prospective customer shows how $60 spent in wiring a house often means, in the real-estate man's opinion, an immediate jump in the value of the property of $100 or more. This aspect of electric wiring as an investment for doubling one's money often appeals to the canny landlord or householder with an argument more pointed than all the other ideas of mere convenience, modernness or superior safety incident to electric lighting of his property.

INTERESTING CENTRAL-STATION MEN IN COMPANY AFFAIRS.

One of the benefits resulting from the organization of company branches of the National Electric Light Association is the publication of magazines by these various local societies in the larger cities designed to interest the members in the advancement of the company and leading to a wider knowledge of, and a deeper insight into, the workings of the various departments and their correlation. To this end it is desirable to make these little magazines bright and readable, and this purpose has been accomplished admirably in the case of *The Edison Round Table*, published in Chicago by the Commonwealth Edison Branch of the N. E. L. A. This publication is handsomely printed on fine paper, is illustrated and forms a creditable example of high-class magazine work. Its contents are varied and interesting, relating to the varied activities of the Commonwealth Edison Company, and the editor, Mr. Ernest A. Edkins, and his associates add just the touch of sprightliness which gives zest to the whole and does much to make each issue eagerly awaited. Clever and amusing cartoons are also a help in this direction. It is safe to say that every number is read from cover to cover by nearly everybody in the company's organization, and thus a solidarity of fellowship and effort is attained which it would be difficult to secure in any other way.

FLAT-RATE COMMERCIAL AND RESIDENCE LIGHTING IN INDIANAPOLIS.

For the past month the Merchants Heat & Light Company of Indianapolis, Ind., has been conducting a controlled flat-rate new-business campaign among the business houses and residences reached by its lines. To these new consumers the company offers a flat rate of 1 cent per month for each watt of demand contracted for. The minimum bill under this arrangement is $1 per month, and all accounts are payable in advance. The 1-cent rate applies to residences, apartments and short-hour business places which close before 8 o'clock in the evening. To those requiring long-hour service, until 12 o'clock midnight, 2 cents per watt is charged, and all-night consumers are required to pay 3 cents per watt demand. Flat-rate controllers of the Excess Indicator type are used, which notify the consumer when he is exceeding his demand, but no limitation is placed on the number of lamps which may be connected to the circuit. Any tendency to waste energy by useless long-hour burning on the part of the consumer is controlled by having the customers buy their own lamps—tungstens being chiefly used—which the company sells at cost. The reception given this new rate by customers has been very satisfactory, reports Mr. E. Darrow, general manager of the company. The average demand contracted for varies from 100 watts to 175 watts per month. To permit the use of electric heating and cooking appliances by consumers whose short-hour demand would probably make the monthly bill prohibitive the company provides special flat-rate service taken off its lines behind the flat-rate controller, and charges 60 cents a month for the privilege of using a flatiron, and 25 cents a month for a toaster or percolator.

ELECTRIC VEHICLE CHARGING IN DETROIT.

Detroit is a beautiful city of splendidly paved streets where everybody rides in automobiles because the city is practically the capital of the gasoline-vehicle industry in this country; but probably the greatest stimulating factor in the use of the many electric automobiles seen there has been the low cost of storage-battery charging energy as sold by the Detroit Edison Illuminating Company.

To the private garage owner this company offers a special rate of 4 cents per kw-hour for energy used to charge automobile storage batteries when registered by a separate meter from other services. The only limitation placed on the customer is that he shall not use energy during the hours from 3 p. m. to 7 p. m. in the months from October to March inclusive. His total bill is subject to 10 per cent discount for prompt payment, and in any case he is charged a minimum amount of $1 per month.

To the public-garage owner the company holds out still greater inducements, offering the choice between a special garage rate and the low regular "energy" rate, which latter is the term very properly applied to motor service by the Detroit company instead of the technically inaccurate "power" designation which has wide usage in this country. The public garage rate is 3 cents per kw-hour, and under this agreement the garage owner accepts the same hourly limitations as given in the preceding paragraph. On bills of less than $50 10 per cent discount is allowed for prompt payment. The regular "energy" rate which the garage owner may select if he chooses employs a base rate of $4.50 per month for each kilowatt of demand, to which is added 1 cent per kw-hour for all energy consumed. Under certain conditions of especially satisfactory demand this base rate is reduced to $3 per month per kilowatt of demand. As a result the average cost of energy to the public-garage owner is as low as from 2 1/3 cents to 2 2/3 cents per kw-hour.

There are now about 400 electric pleasure vehicles in use on the streets of Detroit and about twenty-five electric trucks. There are nearly 200 private garages in the city, the majority [illegible] of business, with the result that the average cost of energy for charging a private machine is about $6 per month. A number of owners purchase their battery-charging energy along with their house service, through the same meter, and so no record is kept of the automobile operating costs under these conditions. The public garages charge $30 a month for charging, cleaning and delivering a private automobile.

While in Detroit no especial means have been employed to

encourage the use of electric automobiles the low rate for battery charging offered has, as in the case of the well-known large small-residence lighting business in that city, tended to popularize the electric vehicle and to build up the present satisfactory charging load.

UNUSUAL INSTALLATION OF MOTOR-DRIVEN PUMP IN DEEP SALT MINE.

An unusual installation of a motor-driven pump is that recently added to the lines of the Detroit Edison Illuminating Company, for freeing one of the salt mines of the Detroit Salt Company from ground water which finds its way into the workings. The silurian rocks underlying a wide area in the vicinity of the city contain large deposits of rock salt at a depth of about 750 ft. to 1000 ft. below the surface. The usual method of recovering the salt from these beds is to pump water down into wells leading to underground caverns in the rock salt, producing brine by solution, which returns to the surface, where it is run out into evaporating beds to concentrate and precipitate under the action of the sun. In the installation referred to, however, the rock salt is mined directly in its crystal form. The original shaft was sunk with much difficulty, as a result of encountering several underground streams, and after the actual mining operations were begun it soon proved to be impossible for the workmen to stay in the chambers for more than half an hour at a time on account of the sulphurous fumes liberated from the mine water, by the heat from the steam-driven pump, which had to be operated continuously to keep the shaft free of water. As the pump was at the 750-ft. level the large condensation in the steam line also made operation unsatisfactory in point of expense. A compressed-air lift was next considered, but this idea was abandoned on account of the inefficient performance of such an installation. Accordingly electric pumping was resorted to, and duplicate equipment installed as reserve against possible breakdown. These pumping units comprise 225-hp, 440-volt squirrel-cage induction motors, direct-connected to six-stage centrifugal pumps delivering 750 gal. per minute against the head of 750 ft. As this installation runs at a comparatively low temperature, the former dissociation of the sulphur gases dissolved in the mine water is avoided, and the workmen now remain in the shaft throughout their shifts without sign of discomfort. On account of the destructive action of the sulphur and salt-laden moisture everywhere in the mine, special precautions had to be taken to enclose the motors and protect all wiring in lead-covered cable. Special weatherproof sockets are used in the lighting of the underground passages. The fully loaded pump takes 208 kw., and as this is a twenty-four-hour load almost within the city limits the service is an especially satisfactory one from the central-station viewpoint. This installation obtains a rate of less than 1 cent per kw-hour for the energy it consumes.

ELECTRIC VEHICLES IN TOLEDO, OHIO.

Toledo's level and well-paved streets and large colony of well-to-do residents, among whom the electric vehicle has become almost a fad, have combined to cause the unusual proportion of 700 electric vehicles found in this little city of 170,000 by the last census. Besides the pleasure vehicles above referred to there are at least twenty-five electric trucks in commercial use.

The number of private garages equipped for charging electric automobiles is estimated by Mr. T. D. Buckwell, contract agent of the Toledo Railway & Light Company, which supplies [illegible] owners obtain a special rate of 5 cents per kw-hour for all energy used to charge their storage batteries when measured by separate meters. For this service the minimum monthly bill is $3. The majority of the private-garage customers have installed mercury-vapor rectifiers, as the distribution lines are alternating current, although a small remaining territory is served with 220-volt direct current in the residence section.

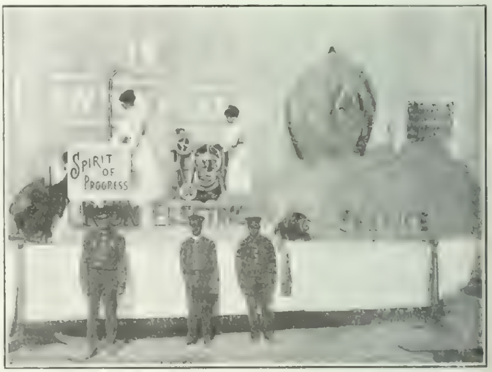
There are two large garages in Toledo which make a specialty of caring for electric vehicles, and each of which has live-storage quarters for more than 100 machines. These charging stations purchase energy at an equivalent rate of from 2.5 cents to 3.0 cents per kw-hour, on the same basis as the "power" or motor-service rate. The cost of "boarding" an electric machine in these places is from $20 to $22.50 a month, which includes charging and care of battery, washing and delivering. There are also several smaller charging stations in which even a lower monthly rate is charged. These garages also offer a special rate of 50 cents per charge for an ordinary electric automobile, which has proved an attractive inducement to many owners who have unwired stables where they can garage their cars, running them out to the charging station to be replenished when necessary.

A distinctive feature of the Toledo electric automobile situation is the large variety of types of machines in use. All of the representative manufacturers have agents in Toledo, and the cars in use there include, besides the customary runabouts and enclosed coupés, many double-seated surreys and limousine patterns. The average income to the central station from the private garages under the 5-cent rate is from $5 to $9 a month

CENTRAL-STATION FLOAT FOR DAYLIGHT PARADE.

One of the interesting features of the industrial parade given under the auspices of the Million Population Club in St. Louis on Oct. 6 was the float of the Union Electric Light & Power Company. It was a daylight parade, and so the electric-service company was unable to utilize the effects of electric lighting, as it might have done in a celebration conducted after dark. However, the float was a striking one, as may be judged by the accompanying illustration.

A conspicuous feature was a large papier-mâché model made to represent an incandescent lamp bulb. This was 8 ft. high,



Daylight Parade Float.

and in front of it was stationed a man in costume representing the figure of "St. Louis." In front of this man (who is not shown in the picture) was a woman operator busily at work at an electric washing machine, which was shown in operation. The clothes thus washed were passed to another woman operator who ironed them with electric flatirons. On each side of the float was a 5-hp electric motor with the end of the pulley painted to indicate the direction of rotation. These motors were supplied with electrical energy from a storage battery on the truck, which was an electric truck transformed for the occasion. Four of the company's colored porters were stationed at the corners of the truck and walked along with it in the parade as an escort.

SOME ASPECTS OF ELECTRIC GARAGE MANAGEMENT.

The patron of a public garag[illegible] his own charging outfit for his electric automobile and compares the cost of home charging with the amount previously paid to the garage management will be difficult to convince that there is a real basis for the higher rate of the public establishment for handling the same automobile. The most important factor in this actual difference in the energy consumption of a car in a public garage and the same vehicle under private supervision is the familiar element of human nature expressed in the saying: "Get your money's worth." As a result of this a car in a public garage is used much more freely, and even needlessly, by its owner than when his mileage is paid for in terms of kw-hours on the electric company's meter. The electric vehicle for whose maintenance a fixed charge of $20 or $30 a month is paid, without regard to mileage, is often run 40 miles or 50 miles a day, if only in half-hearted pleasure seeking, until the battery voltage shows the cells to be nearly exhausted. Then the garage man is summoned to return the car and finds perhaps barely enough remaining "charge" to get the machine back to the charging station. The wear and tear on the battery and the rapid deterioration of the plates under such conditions can be surmised. Another factor in the increased charge demanded by the car in the public garage is the distance of delivery and return from the owner's residence or place of business, which must be added to the regular mileage made by the car. Where this distance is great, or the car is called for daily, the delivery mileage mounts surprisingly.

Realizing that the daily runs of the private electric vehicles in his garage varied considerably, although the practice was to put all of these machines on charge each evening when they came in, the proprietor of a large station hit upon the plan of advising all of his customers to purchase cyclometers for their machines, as a means of "determining the life of their batteries." After succeeding, through continued suggestion, in getting the counters on most of his automobiles the night men were then instructed to read the dials each evening, recording the daily trip totals in a book for the purpose. From these records it was possible to tell how far each automobile had traveled daily, and if this distance did not exceed ten or fifteen miles the car was charged only at two-day or three-day intervals, no one being the wiser except the canny garage owner, who was thus able to slice a good percentage from his electric bills.

Nor is the outlay of the garage proprietor only for electrical energy, labor and store rent. Two of the most important of the shifting factors that determine the margin between profit and loss in this business are the risks of personal injury and property damage which may be done by some employee through carelessness or ignorance in handling a machine in the garage or on the street. Injury to pedestrians or persons in the garage building and collisions or accidents to customers' property or other vehicles are the real ghosts which haunt the proprietor. A damage suit from a serious accident may wipe out his business, or the destruction of a customer's car will absorb a year's profits. Added to this is the constant nagging in regard to minor injuries, thefts, etc., that go on in the semi-public place of the average garage, where the labor employed is sometimes of a very irresponsible class. Custodian of thousands of dollars' worth of valuable equipment, any damage done on or inflicted by any of these machines when in charge of one of his employees returns upon the responsible proprietor. This aspect of garage management has not received proper consideration.

An example of the peculiar accidents which may happen in even a well ordered gar[illegible] curred in a Western charging station while an electric vehicle, just off the road, was being washed up. During the process water collected in some part of the motor, which happened to be so wired that only this bridging path was needed to complete the circuit and energize both field and armature, and the m[illegible] started [illegible] back was turned. He looked around just in time to see it cross the floor at a good rate and collide violently with two other cars, shattering the windows and lamps of all three and doing severe damage to the woodwork and sheet-metal bodies.

The cost of this accident, of course, like that of others while cars are in the hands of garage employees, must be charged against profit and loss. So distressing has this subject become in some instances that a garage owner will welcome and even advise the removal of customers' cars to their own private garages, feeling that no equitable boarding charge which he can make will cover the cost of risk with the machine. No other type of automobile adapts itself so well to private care as does the electric, with its absence of mechanical complication. Any woman can handle the charging appliances, and with a little occasional expert supervision of the battery good service will be secured. The average intelligence of manipulation in the private stable is probably equal to that the car will receive in a public garage, and certainly better care will be accorded the machine as far as operating use is concerned. The tendency to run the battery clear down and the delivery mileage are both eliminated.

The private-garage load is an especially satisfactory one for the central station and can frequently be encouraged with the assistance of the garage proprietors themselves, especially when the latter act as selling agents for machines and supplies. This merchandising, the garage man is often willing to admit, is really the profitable side of his business.

Wiring and Illumination

ADVERTISING A CITY BY ITS LIGHTS.

Toledo, Ohio, is lighted by 2500 magnetite arc lamps, a large number of which are employed in the closely spaced ornamental lighting of the downtown district. This installation, which was one of the first to utilize the new magnetite lamp,

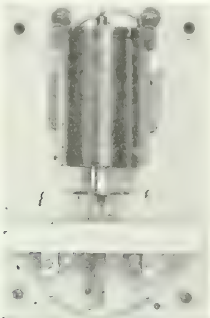
Advertising a Well Illuminated City

[illegible] in the City Council directing the ornamental lighting of additional streets. Fifteen per cent of the cost of operation is borne by the city government, the remaining 85 per cent being collected in a special city tax from the abutting property owners in the proportion in which they are benefited. The energy for these lamps is supplied by the Toledo Railways & Light Company, [illegible] a post card [illegible] town, and well calculated to impress upon the lay mind what

ample electric lighting can do to make a city distinctive. On the reverse or address side of the mailing card is a map of the downtown district showing the disposition of the double-lamp poles, at 80 ft. intervals throughout the business section. The area now thus brilliantly illuminated is five squares long and four squares wide. The operation of these lamps is reported to be extremely satisfactory, outages of less than 0.002 of 1 per cent of the total burning hours being reported from month to month.

CONTROLLING MULTIPLE LAMPS FROM SERIES ARC CIRCUIT.

[illegible] Ohio, are lighted by tungsten and Nernst incandescent units under the same hours-burning agreement as the regular city series magnetite arc lighting. As in each instance the incandescent units are supplied with energy from the neighboring 110-volt and 220-volt multiple secondary lines of the Toledo



Solenoid Switch for Controlling Multiple Lamps

[illegible] lighting, it was formerly necessary to send a patrolman around to each one of the multiple installations both night and morning to turn on and off the lamps.

However, this expense and trouble has now been avoided by devising a solenoid switch, the winding of which is inserted in series with the nearest arc circuit and has its contacts controlling the multiple-lamp circuit. Thus when the series-arc circuits are started up the switch automatically closes, turning on the multiple lamps, which remain burning as long as the arc lamps are operated. All of the street and public lighting is thus under the control of the power-station operator, and the annoyance of sending men to outlying districts simply to turn on and off a few lamps is avoided.

The switch shown in the accompanying illustration was constructed for this purpose by Mr. W. E. Richards, superintendent of power and lighting for the company, and has proven especially satisfactory during the three years since the first one was installed. Meanwhile a number of others have been used to advantage in Toledo, and not a single outage has been reported from the multiple lamps thus controlled.

The switch as constructed in the company's shop consists of [illegible] as shown in the illustration. The winding comprises 320 turns of No. 13 double cotton-covered wire, and has each layer painted with insulating compound and the whole coil wrapped with cotton tape. The coil is wound on a cylinder of 18-gage brass in which the 11/16-in. iron core moves freely. This iron core is extended by a 5/16-in. square fiber rod, 4½ in. long, which passes through a fiber bushing in a supporting shelf of slate, and carries at its lower end the laminated contact pieces which complete the multiple-lamp circuit between two brass contact blocks. [illegible] of the iron core and fiber extension prevents the switch pieces from dropping further open than desired when the coil is not energized.

This solenoid switch will pick up at 3 amp flowing through the winding, which is so proportioned as to carry safely four or five times this current without serious heating. The contacts are designed to carry up to 25 amp.

DISCERNMENT BY SILHOUETTING IN STREET ILLUMINATION.

At a meeting of the New York section of the Illuminating Engineering Society held on Oct. 13 Mr. Preston S. Millar presented a paper entitled "An Unrecognized Aspect of Street Illumination," in which attention was called to the important part played by silhouetting in street illumination. The author remarked that the perception of small objects on the surface of the street and the detection of irregularities in the street surface are purposes which must be served by any effective street-lighting installation, but any estimation of the effectiveness of an installation is likely to fall short of correctness if these are the only factors considered. The discernment of larger objects on the street, such as pedestrians and vehicles, is of at least equal importance, and in the discernment of such objects other factors than those already discussed must be considered.

The light incident upon the near surface of a large body, such as a pedestrian, is either sufficient or too feeble to render him visible. If sufficient, the pedestrian can, of course, be seen; if too feeble to make him visible, it does not follow that he cannot be seen, because in most street-lighting installations the incidental light does not form an adequate criterion of the conditions of discernment of large objects. It may even occur that with decreased intensity of light upon the object it may be discerned more clearly, and, conversely, that with increased intensity of light upon the object it may be discerned less clearly. For example, in a particular instance a pedestrian wearing clothes of substantially the same light-reflecting power as the street surface is seen by reason of the light falling upon him when he is near a lamp; but he is barely discernible when, in walking along the street, he reaches a locality in which the light reflected from his clothing is about the same as the light reflected from the street which serves as a background against [illegible] the street away from

Vehicle in Silhouette by Street Light.

the observer and from the nearest lamp, the light falling upon him becomes less intense, and he would be less easily discernible if dependence were placed alone upon incident light. As a matter of fact, the pedestrian is more easily perceived than when near the lamp, because, as less light is reflected from him to the observer, he becomes more darkly *silhouetted against the background*, which is chiefly the street at a distance. In street lighting, as a rule, large objects on the street are seen as silhouettes.

In the accompanying illustration [illegible] example of such a discernment. The automobile shown was 300 ft. from the camera and nearly 200 ft. from the intermediate lamp. If one had to rely upon the light falling upon the automobile, discernment would be out of the question, but the relatively bright street surface which serves as a background makes it easily visible even with the small flux of light there available. In the photograph one detects the presence of an object because portions of the brightly lighted street surface and trees are obscured. The outline of the obscuring object is recognized as that of an automobile. The presence of the automobile is apparent not because one sees it, but because one fails to see the lighted background within the outline of the object. The phenomenon is simply an eclipse. The author expressed the opinion that this process of discernment is the most usual and the most important in street illumination. It depends upon a contrast between the object to be discerned and the background, which is usually a street surface, at a distance of from one-sixteenth mile to one-quarter mile. Naturally the only factor which is here under control is the brightness of the background. As most objects to be discerned are dark either by reason of low light-reflecting power or low intensity of light falling upon them, it follows that most objects of this nature may be discerned more readily as the background is made brighter.

It is important to remember that it is the distant lamps which determine the brightness of the background. Put out the distant lamps, which affect the illumination in the observer's vicinity inappreciably, and immediately discernment of nearby objects on the street is rendered more difficult.

A fact which has great influence upon street illumination is that within wide limits the apparent brightness of a surface is independent of the distance between that surface and the observer. Other things being equal, the street surface a quarter of a mile from the observer appears substantially as bright as it would if observed from a distance of a sixteenth of a mile and from the same angle. It is very important to consider this fact when studying the influence of distant parts of the street upon the discernment of nearby objects. In order to see a vehicle or pedestrian in the street it is necessary only to provide a substantially bright street, and the distance of the street surface background from an observer is immaterial, within wide limits.

Imagine a street which ends abruptly at a distance of one-fourth mile at the edge of a field. One way to make large objects on that street discernible when looking toward the end of the street would be to erect a board fence across the end of the street, paint the fence white and illuminate it brightly. In the ordinary street the distant surface is the equivalent of such a fence.

From the above-discussed facts the author concludes that the perception of large objects in the street is accomplished by the aid of light falling upon the objects when they are in the immediate vicinity of a lamp, and elsewhere when for some reason or other there is no bright background against which they may be contrasted. Most frequently, however, they appear silhouetted against a lighted background. As the discernment of large objects is in some cases the most important, and in all cases an important, purpose to be achieved, this is one of the essential elements of the problem of street lighting. Having failed to receive due recognition, it affords a new viewpoint from which to consider the whole subject.

SPECIAL STREET LIGHTING IN WASHINGTON.

Mr. A. J. Marshall presented before the New York Section of the Illuminating Engineering [illegible] dealing with a new street-lighting installation in Washington designed by Mr. Walter C. Allen, electrical engineer of the District of Columbia, and installed by the Potomac Electric Power Company.

The lighting of Sixteenth Street, one of the most prominent in the residence section of the District of Columbia, has recently been greatly improved in connection with the extension of that thoroughfare and the opening of the new Piney Branch Bridge, which carries it across a deep run. This broad highway leads directly north from Lafayette Park in front of the White House to and along the eastern boundary of Rock Creek Park, and is adorned by the homes of statesmen and embassies of several foreign countries. It is 160 ft. wide between

Fig. 1—Details of Lamp.

buildings, with a central 50-ft. roadway and a 15-ft. sidewalk and a 40-ft. parking space on each side. For a portion of the distance there are four rows of trees, one at each curb and one at the inner line of each sidewalk.

The old form of lighting consisted of mantle gas lamps, spaced from 150 ft. to 200 ft. apart. These lamps have been abandoned and replaced by tungsten street series lamps, with

Fig. 2—Lamp and Post in Position.

especially designed posts spaced, on the average, 60 ft. apart, measured on the axis of the street.

The lamps are suspended tip downward in a 15-in. ground-glass globe, the center of which is 10 ft. 3 in. from the sidewalk. [illegible] socket is turned toward the houses. The method adopted in the installation of the tungsten lamps in Riverside Drive, New York, has been followed in this instance. Where there are no conduits of the electric lighting company already constructed, a

steel-armored cable was laid on the inner side of the granite curb, where the projecting concrete base would protect it from damage. At the street crossings the cable is carried under the roadway in a terra-cotta conduit.

The total distance covered by this improved lighting is 2.5 miles. Over the first mile, where the foliage is extremely dense and the travel heavy, 80-cp lamps are used, while over the remaining portion, less traveled at night and with only one row of trees on each side of the street, 40-cp, 50-watt lamps are installed, the spacing of the posts being the same in each case.

Use is made of two styles of posts, one on the street corners having a square, open frame to hold the street signs, which are of ruby glass with white letters; the other for the intermediate lamps. The ground-glass globe so diffuses the light that the inner surface of the street signs is illuminated, making it easy to read the names at night. For the designation of the

Fig. 3—Lamp Post on Piney Ridge Bridge.

streets and avenues intersecting at Scott Circle, where the angles are not right angles, it is proposed to use cast-iron plates with cast raised letters, the latter outlined with gold leaf, similar to those now in the Union Station Plaza in Washington.

The new Piney Ridge Bridge, the northern terminus of the present lighting, is a beautiful concrete structure with a single span of 125 ft., a height of 62 ft. above the stream on the center line of the arch and a total length of 272 ft. It is illuminated at present by twelve 80-cp, 100-watt tungsten lamps, three to each of the ornate cast-iron posts. The center globe is 24 in. and the smaller globes 17 in. in diameter, the center of the former being 20 ft. above the pavement. The posts are 160 ft. apart. Each post cost $482, not including erection.

RECENT TELEPHONE PATENTS.

COMBINED TELEPHONE AND TELAUTOGRAPH SYSTEM.

There have probably been very few instances where the telautograph has been combined with a telephone system, and where this has been done the system has been a small one, such as a hotel or private exchange system with the telautograph apparatus confined to the switchboard and a few special stations. Mr. F. Ritchie, of Acton, England, has, however, conceived of a system of much larger proportions, where the telautograph instruments are to be located at subscribers' stations and telephone conversations at once confirmed in writing.

He conceives the telephone stations, i.e., subscriber stations, equipped with storage batteries charged continuously from a central charging outfit. The charging current passes through the switchboard drop, but this is arranged so that a steady energization does not permit the shutter to fall. As all lines are similarly poled and all substation storage batteries likewise, no interline direct currents flow even when two lines are connected together for talking. When, however, it is desired to communicate by telautograph, one subscriber reverses his battery, which allows both local batteries to act together and through the recording apparatus of both

CALL METER SYSTEM.

Mr. C. W. Greenslitt, of Cleveland, Ohio, has patented a call measuring device by which a line may be retained for several successive call periods, but each of which is registered as a separate call. A timing device is set in motion at the central office with the beginning of the call by the act of the calling party registering upon his counter. At the end of the stated initial period a clicking notifies the calling party of the expiration of a unit, and simultaneously cuts out his transmitter. He must then register a second call and thereby automatically restore the timer in order to restore his station for conversation on that connection.

PEG COUNTER SYSTEM.

The peg count is now considered essential to all comprehensive telephone exchange systems. Most counts are made manually upon specified days. It is the idea of Mr. C. H. North, of Cleveland, Ohio, to do this automatically by associating his counting device with all the cord pairs of an operator's position. Extra contacts are provided at the supervisory relays. One contact swings between two others. These latter are connected together so that if the circuit be carried through these contacts it is broken only during the period of swing of the middle contact. This momentary break causes the count It is not brought out why an erroneous count is not made, due to flashing of the subscribers upon recall. The patent is assigned to the North Electric Company.

ANTISEPTIC ATTACHMENT.

An antiseptic attachment of the sheet-of-paper type has been patented by Mr. W. H. Waldron, of San Francisco, and Mr. L. R. Krumm, of Columbus, Ohio. In a square of paper of a size to cover, with a slight margin, the standard mouthpiece are cut three short slits. One of these parallels the bottom and two the two sides, respectively, and they so intersect the lip of the mouthpiece that the margins may be pressed down over the lip to form three clamping joints. From the top of the square two tongues of paper project back and are clamped by being inserted between the mouthpiece and the transmitter face.

IMPROVED RELAY.

With telephone exchange systems of the common-battery type there are two functions to be performed by the subscriber's line relays: first, the closing of the line-lamp circuit, and, second, the removal of this upon the response of the operator. Ordinarily these functions have been performed by two separate and distinct relays. It will, however, be appreciated that, since each line equipment requires its particular relays, a considerable saving can be effected if the two relays can be combined in one. It is apparently with this end in view that Mr. H. Pöser, of Hermsdorf, Germany, has designed a relay, the patent for which is assigned to the Western Electric Company. The relay takes the conventional form with a return pole piece, L-shaped armatures being used, in this case there being two of them. The armatures are carried upon the same pivot, one having its middle portion all cut away so that the other may swing freely in the opening. The relay has three pairs of springs and two windings. The outer pair are normally closed contacts, which the larger or cut-away armature breaks by lifting the top springs. It also simultaneously lifts the middle top spring. The middle contact is normally open, but the small armature may lift the lower spring to close it, whereupon it may again be opened by the lifting of the top spring. The use of the contacts will now be understood. An energization of one winding of the relay will pull the middle armature and close the middle or line-lamp contacts. The response of the operator strongly energizes the second winding, the loop armature responds, cutting off the first or line coil and opening the line-lamp circuit by lifting its top contact.

COMBINED ALARM AND TELEPHONE SYSTEMS.

A patent recently granted to Mr. W. W. Dean and assigned to the Consolidated Fire Alarm Company describes a combined alarm and telephone system. A recording device is arranged to receive the alarm, and its windings may be arranged differentially to the telephone line or a locking device may be put in one side of the line and the recorder in the other so that the recorder is locked save when current exists in its side of the line only.

Another such system, assigned to the International Electric Protection Company and invented by Mr. A. Goldstein, of New York City, provides a dual alarm. One of the alarm-receiving devices is associated with the regular telephone switchboard apparatus and a lamp is lighted whenever the circuit is either opened or short-circuited. For special protection a switch may be thrown at the central office which cuts off the telephone switchboard and connects a special signal for detector purposes.

LETTER TO THE EDITOR.

Compounding of Alternators.

To the Editor of Electrical World:

SIR:—I am indebted to Mr. T. J. Johnston for courteously directing attention, in your issue of Sept. 1, to the letters patent taken out in 1897 by Mr. E. W. Rice.

Mr. Johnston says: "Mr. Rice did not employ a separate winding on the armature of the exciter as does Professor Blondel, but passed into the armature a portion of the main alternating current, regulating the e.m.f. and power-factor by its effect upon the m.m.f. of the armature in substantially the way proposed by Professor Blondel." But, in fact, exactly this same method was described by myself at the Electrical Congress at Geneva, in September, 1896, and published at the time in electrical journals (see *L'Eclairage Electrique*, 1896) before any publication by patent or otherwise was made by Mr. Rice, to my knowledge. Without wishing in any way to lessen the high merit of Mr. Rice, I consequently feel entitled to state that my invention was absolutely independent of his own; moreover, I had it worked in Europe without any patents of Mr. Rice being opposed thereto.

Experience has shown me, moreover, that the separate field winding is, in fact, of great importance with some types of turbo-alternators, and gives the most convenient means for controlling the range of voltage and the amount of compounding at any moment. I do not believe that this double winding of the exciter was tried by others before me for the purpose of compounding.

The complication of the machines, as well as the cost of the separate windings system, has been found practically insignificant by manufacturers, and a number of these machines have operated for some years with good results and no little economy.

Paris. A. BLONDEL.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Windings for Polyphase Generators.—M. SEIDNER.—Modern alternating-current generators are generally built with two, three or four slots per pole per phase. However, in the design of a special machine, for which available sheet-iron stampings are to be used, it may happen to be advantageous to use a fractional number of slots, for instance, 2.5 slots per pole per phase. The windings in such cases do not always yield symmetry, but such windings are often decidedly advantageous. The author discusses various cases in detail with the aid of diagrams.—*Elek. u. Masch.* (Vienna), Sept. 18.

Bare Aluminum Wire for Field Coils of Motors.—At the annual meeting of the Verein Deutscher Strassenbahn-und Kleinmahn-Verwaltungen Mr. Paulsmeier, chief engineer of the Hamburg tramway system, stated that there are some thirty motors on the Hamburg tramcars with field coils made of bare aluminum wire, and that fifty-two further coils have been ordered. The absence of insulating covering and the use of wire of square section resulted in the aluminum coil taking up the same space as a copper coil in spite of the larger wire required. By their use the weight of a tramway motor of normal size was reduced by about 100 lb. This and the fact that the coils are not so easily ruined by overheating and vibration as copper coils appear to be the chief advantages. It appears that eleven other tramway undertakings in Germany are experimenting with aluminum coils, and report favorably. Most of the coils employed have asbestos, paper or linen insulation between the separate layers.—Lond. *Elec. Eng'ing*, Sept. 29.

Lamps and Lighting.

Automobile Lighting.—An illustrated description of a new system of electric lighting for automobiles devised by C. A. Vandervell & Company. The feature of the system is that the output of the generator is maintained constant by the magnetic reaction of the armature and field magnets. Two shunt wound poles N S and two unwound poles N_1 S_1 are provided, as shown in Fig. 1. Commutation takes place under N S, as indicated by the block dots for the conductors—the brushes being in a position at right angles to the conductors. The effect of this is to cause the armature to have a demagnetizing reaction on N S, and thus the current does not rise above a certain value, and a constant current can be maintained at different speeds. At first sight it is difficult to see how satisfactory commutation can take place, but it is thought that this is rendered

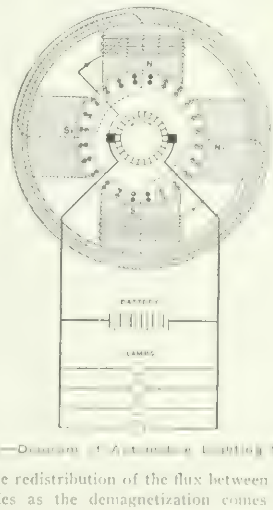


Fig. 1—Diagram of Automobile Lighting System

possible by the redistribution of the flux between the wound and unwound poles as the demagnetization comes into play. A typical output curve of one of these generators, showing the exceptional steadiness of the current over a wide range of speed, is shown in Fig. 2. While any standard winding may be used for the armature, in the present case use is made of a

special winding in which the coils cover an arc of 120 deg. instead of the usual 180 deg. in a two-pole machine. The generators are made to give an e.m.f. of from 6 volts to 12 volts, and a fixed output of 5 amp, the generators of smaller output being intended for taxicabs. From the output curve of the generator it will be noticed that the generator begins to charge the battery at a speed of 600 r.p.m., and at all speeds above 1800 r.p.m. it gives a practically constant output. This machine is

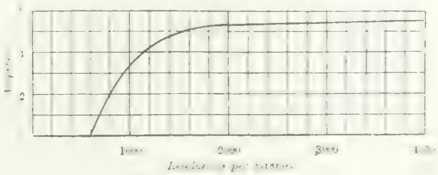


Fig. 2—Output Curve

intended to be geared so as to run at from 1.5 to 2.0 times the speed of the engine.—Lond. *Electrician,* Sept. 23.

Enclosed Arc Lamp.—A note on a recent British patent (13,728, Sept. 15, 1910) of F. W. Schuer. All the parts of the lamp in communication with the inner globe are hermetically sealed, with the exception of a long, narrow outlet of 1/16-in. bore for the release of the generated gases. Entrance of oxygen into the globe is prevented and the combustion of the electrodes is reduced.—Lond. *Elec. Eng'ing,* Sept. 22.

Support for Metallic-Filament Lamp.—A note on a recent British patent (6397, Sept. 22, 1910) of the Wolfram Lampen A.-G. A spring support allowing for vibration in all directions consists of a carbon-filament fixed at one end to the central stem, and provided with a hook or loop for holding the metal filament at the other end. A large loop or coil in the center of the arm gives the desired elasticity.—Lond. *Elec. Eng'ing,* Sept. 29.

Generation, Transmission and Distribution.

Water-Power in Sweden.—An abstract of a recent report of the Swedish water-power committee. The total water-power in Sweden is estimated to amount to 10,000,000 hp capable of being utilized for from six to nine months in the year and 2,500,000 hp which can also be used during the period of low level of the water. Out of the total quantity 75 per cent is to be found in north Sweden, 15 per cent in the Province of Svealand and 10 per cent in Goetaland. The total which will be in use in the near future will be 600,000 hp, of which 340,000 hp will be for the production of electric energy. At present the State is considered to own 880,000 hp, of which 670,000 hp can be employed without any previous regulation of the waterfalls concerned, but the State now utilizes only 63,000 hp, of which 40,000 hp is in the station at the Trollhattan Falls, although work is in progress there for the use of an additional 40,000 hp. It is proposed to erect a 50,000-hp generating station at the Porjus Falls, in north Sweden, capable of being extended to twice this size, while the State also contemplates large generating stations near Akarleby, in Dalarne, and in other localities. Being exceptionally interested in the use of water-power the State has pursued a systematic waterfall policy since the adoption of the law concerning the Trollhattan Falls, although great difficulties have to be contended with owing to the antiquated laws respecting the right of disposal of water-powers. It is probable, however, that a new law on modern principles will be proposed in the near future, and the water-power commission has already prepared a scheme for this purpose. The State has comprehensive projects now under consideration. Preparations are now being made for the regulation of the large Wanern Lake and the Siljan Lake, but, above all, plans are being considered for the utilization of the water-powers of the middle and southern portions of the country in connection with the electrical operation of railways, and the State has acquired waterfalls in these districts for the sum of over $1,250,000. In case the electric frontier railway in the north meets expectations, it is said that the other State railways will eventually be converted to electric traction.—Lond. *Elec. Review,* Sept. 30.

Electric Driving in Textile Mills.—L. Crouch.—The conclusion of his illustrated paper, the chief results of which are as follows: The chief advantages of the electrical driving of textile machinery are: (1) some 20 per cent diminution in breakages, owing to the smoother driving torque; (2) 10 per cent to 20 per cent increase in output per hp-hour with an improved quality of output (at least 5 per cent increase in value); (3) superior efficiency. If the millwriting involved by mechanical drive is straightforward, the initial efficiency is about equal to that of the equivalent electrical drive, but if many changes of direction (and hence bevel gears, etc.) are involved the electrical system has the advantage from the first. Owing to the ease with which power measurements may be made, and to the reduced number of bearings and length of shafting, the efficiency of electrically driven mills can be permanently maintained at practically maximum efficiency, whereas a mechanical system inevitably soon deteriorates considerably. Electrical driving benefits from many years' experience of millwrighting and a ready selection can be made of the best. Only the best must be used, and the whole plant must be kept in perfect order to reap the full benefits of electrical operation. Reciprocally, only the latter enables such maintenance to be carried out. Electrical driving has involved several slight changes in textile millwrighting and machinery design, the most noticeable of which are: (1) The speeding up of line shafting to suit it for direct coupling to standard electric motors; (2) the speeding up of the machine shafts (for example, the tin roller shaft of ring-doubling frames) for the same reason. This naturally involves a greater speed reduction in the machine itself, though, owing to steadier driving, a slightly greater running speed is permissible at the work if electric driving be adopted. The finer the "count" handled and the higher the quality of the material the greater and more desirable are such abstract advantages of electrical operation as the enhanced cleanliness due to the absence of most of the ropes and belts otherwise required, and the freedom from the dust created and stirred by the same.—Lond. *Elec. Review,* Sept. 30.

French Water-Works Plant.—A. Turpain.—A detailed and profusely illustrated description of the Tuiliere water-power plant in the southwest of France. It has a total rating of 24,000 kw, of which 18,000 kw is derived from water-power and 6000 kw from steam. The steam plant is used chiefly as reserve. The generating voltage is 1500 and the transmission voltage partly 13,500 and partly 50,000.—*La Revue Elec.,* Sept. 15 and 30.

Electric Haulage in Mines.—An article illustrated by diagrams describing the different systems of hauling in coal mines and pointing out the advantages of electric hauling. Whether three-phase or direct current is to be used will in general depend on the electric system available; but when a new installation is to be put down direct current is preferable.—Lond. *Elec. Review,* Sept. 30.

Traction.

Frequency for Alternating-Current Traction.—W. Wittek.—The author gives a review of the evolution of single-phase traction for main railroads and thinks that it is due to some unnatural phases of this evolution that the frequency of twenty-five, which was originally favored, has come into disfavor, so that a frequency of fifteen is now often preferred. The author thinks that this is wrong and that the matter should be taken up systematically, and that an endeavor should be made to standardize also the maximum voltage on the trolley wire. The increase of the latter from the usual 10,000 volts to 15,000 volts certainly seems quite feasible.—*Elek. u. Masch.* (Vienna), Sept. 18.

Brake Shoes.—J. W. Dawson.—A paper read before the (British) Municipal Tramways Conference in which the author described investigations which had been undertaken with the object of ascertaining the comparative durability of the various grades of brake shoes used on tramcars in England, together

with their wearing effect upon steel tires. Twenty different grades of shoes were tested. Figures were given of the wearing properties of shoes and tires run under ordinary service conditions, and the results showed that the individual shoes of each group vary considerably in durability. The rate of wear of soft gray-iron shoes is more uniform than that of other groups, and the most excessive wear is obtained with white iron. Similar large variations were found in the wearing effect upon tires. The author advocated a microscopical analysis, in addition to chemical analysis and physical tests, so that the particular structures producing the different characteristics of the shoes might be indicated and a standard specification drawn up. In the author's opinion, it matters little from the point of view of cost which suffers most, the shoe or the tire. When it is desirable to economize energy for brake application and to reduce mechanical stress upon brake gear to a minimum, it is best to use a shoe with a high coefficient of friction. In the discussion which followed the possibility of evolving a standard specification for brake shoes was questioned.—The paper in full in Lond. *Electrician*, Sept. 30; abstracted in Lond. *Elec. Eng'ing*, Sept. 29.

[illegible] abstract of a paper presented before the (British) Municipal Tramways Conference. The paper was a plea for the construction of roads sufficiently wide to carry a double line of tramways in the center and roadways for ordinary traffic on either side. It was suggested that, instead of developing tramways outward from the center of the city, property several miles out should be "town planned," and the roads built toward the big city. With such roadways the author would considerably cheapen the cost of tramway construction, either by the use of macadam paving, which would be worn out by ordinary traffic, or by leaving the space between the rails filled in with turf. Incidentally, the paper condemned the trolley omnibus system, the author believing it the best policy to lay down tramways in the first place, and if necessary face a loss for a year or two. The paper was severely criticised by a large number of speakers, principally on the cost of land mentioned by Mr. Baker and his condemnation of the trackless trolley system.—The paper in full in Lond. *Electrician*, Sept. 30; abstracted in Lond. *Elec. Eng'ing*, Sept. 29.

Lubrication of Car Bearings.—An abstract of a report presented to the (British) Municipal Tramways Conference prepared by E. Cross, R. L. Acland, P. J. Pringle and T. R. Smith. The committee have found that oil is most in favor, and that out of fifty-six tramway undertakings only seven use grease. From replies received from all the tramway undertakings in the United Kingdom it is found that the cost of oil varies from 11 cents to 50 cents per gallon, and, indeed, this large variation has manifested itself throughout. So startling are these variations that the committee is unable to account for them. At Rotherham the motors are run 51,000 miles for 1/16-in. wear on the armature bearings, while at Bournemouth the corresponding figure is 3000 miles, and at Aberdeen and Blackpool about 5000; at Belfast the suspension bearings last for 27,000 miles, while at Burton-on-Trent they lasted only 5300; at Lincoln the axle bearings have run 106,500 miles, at Darwen 350,000, at Liverpool 5000 and Manchester 3600. It is recommended that a system of ring lubrication or its equivalent should be insisted upon in all new motors, as excellent experience has been obtained in a few undertakings that have had these motors installed for a sufficient time to give a decided opinion. With the ring system the waste of oil is practically nil, and, consequently, a higher grade of oil can be used without excessive cost. A better supervision of the work of the "greaser" than is generally the case was insisted upon.—The report in full in Lond. *Electrician*, Sept. 30; abstracted in Lond. *Elec. Eng'ing*, Sept. 29.

Municipal Tramways in Great [illegible] paper read before the (British) Municipal Tramways Association on the first ten years of municipal tramway working in Great Britain. At the present time there are in Great Britain 176 tramways owned by municipalities, only eighty-four of which, however, are worked by the same authority that owns them. Concerning the latter, the following information is given:

[illegible]	[illegible]	[illegible]
No. of undertakings . . .	6	[illegible]
Miles of track	52	2,422
[illegible]	[illegible]	7,986
[illegible]	[illegible]	197,938,433
[illegible]	[illegible]	[illegible]933,118,206

The invested capital was $3,486,350 in 1899 and $202,181,750 in 1909. In nearly all the towns which show a deficit either the energy cost is high or they have a small population. Towns with separate generating stations show better results than those with combined stations, that is, where tramway committees have to buy their energy.—Lond. *Electrician*, Sept. 23.

Mountain Railway.—F. Niethammer.—An illustrated description of the Bernina Railway, which is the highest adhesion railway in Europe, and connects St. Maurice (1778 m. or 5832 ft., above sea level), in Switzerland, with Tirano (429 m. or 1407 ft., above sea level), where connection is made with the Veltellina three-phase railway. Energy is supplied to the Bernina Railway from the Brusio hydroelectric works, the first plant of which contains twelve generating sets of 3000 kva, while a second plant is soon to be started. The Bernina Railway is operated by direct current at 750 volts on the trolley wire, the alternating current being transformed to direct current in four substations.—*Elek. u. Masch.* (Vienna), Sept. 4 and 11.

Paris.—C. Jacquin.—An article, with a map and diagrams, on the Metropolitan Railway of Paris describing especially lines opened in recent years and giving a review of the different substations which convert the three-phase currents received from the generating plants into direct current at 1550 volts for supply to the third rail.—*La Revue Elec.*, Sept. 30.

Installations, Systems and Appliances.

Graphical Methods for Calculating the Cost of Operation.—H. Giesi.—The energy consumed by any machine is partly consumed in making up the losses and partly in producing the useful work. A diagram may be plotted with the useful work as abscissa and the consumed energy as ordinate; the curves of this diagram are in general straight lines for all kinds of machines, for instance, the Diesel engine, and for the steam turbine. In the latter case there is found $y = ax + b$, where y is the consumption of steam in kilograms per hour, x the load in kilowatts, a a figure which depends on the steam pressure and the superheat, while b is the steam consumption at no load, including excitation in kilograms per kw-hour. The total cost of operation is the sum of fixed charges and variable charges. Of the variable charges a part is proportional to the useful work produced, while the balance (due to the losses) is proportional to the time of operation. If diagrams are plotted with the total cost of operation per unit of useful work as ordinate and with the yearly energy quantities as abscissas, the curves obtained are hyperbolas. The diagram is simplified when the reciprocal values of the yearly quantities of energy are used as ordinates, the curves then being straight lines.—*Zeit. d. Ver. Deutsch. Ing.*, vol. 53, No. 48, page 1968; abstracted in *Elek. Zeit.*, Sept. 22.

Wires, Wiring and Conduits.

Calculation of Transmission Lines.—J. Bartok.—The calculation of the electrical conditions in long transmission lines leads to complicated formulas containing trigonometric and exponential functions. The author starts from the formulas given in a book of Roesslear and shows how the complicated functions can be developed into series. In this way he arrives at simpler approximate formulas which are sufficiently accurate for practical requirements so as to find directly the voltage and current at the end of the line and also to determine the cross-section. The article is illustrated by diagrams and by numerical examples.—*Elek. u. Masch.* (Vienna), Sept. 25.

Cable Work.—An illustrated description of Rickard's cable works at Derby, giving some details of the method of rubber covering of wires and the braiding machines.—Lond. *Elec. Eng'ing*, Sept. 29.

Electrophysics and Magnetism.

[illegible] J. J. Thomson.—A [illegible] the British Association giving a further account of his experiments on "positive rays" in discharge tubes. In these continued studies he had found that the investigations became simpler and more definite when he worked with very large tubes or bulbs. For when the vacuum tube was small the negative dark space near the cathode extended up to the wall, and the discharge might crack the glass. With large tubes the pressure of the gas in the bulb could be reduced much lower, and the dark space could attain large dimensions before reaching the glass wall. He had used bulbs holding 11 liters, but had found tubes of 2 liters, such as applied in boiling-point determinations, sufficiently large, as a rule. A fine tube extended backward from the cathode, through which the rays (positive or canal) passed on to the willemite screen. The screen which formed the one end of the bulb was flat and circular, and the general arrangement was as in his previous experiments, the positive rays passing through an electric field and through one or two electromagnetic fields on to the screen. The potential difference between the electrodes and the gas pressure was varied, and the bulb was charged with different gases. When neither field was excited the positive rays would produce a bright spot in the center of the screen. The electric field would deflect and draw out the spot into a horizontal band, while the magnetic field would draw it into a vertical band; when both fields were turned on together, an inclined band of positive rays would be seen, and sometimes also a backward continuation of this band due to negative rays. The inclination of the band would indicate the velocity of the particles. By altering the order of the fields and their strengths and lengths, sharp-angled or curved bands were obtained. In very large tubes, at high exhaustion, the positive band would become faint, and would be replaced by bright spots, which occupied different positions in different gases. The position of these spots would change with the potential difference, and when several gases were in the bulb the different patches were arranged in the same vertical. The patches were not really circular, but parabolical arcs curved upward. Negative bands corresponded to some of these patches, but not to all, and in the case of hydrogen two spots were noticed, one near the origin, in the same vertical as the others, the other further out. In explanation of these phenomena Sir J. J. Thomson suggested that the following types of radiation could be distinguished: (1) Rays not deflected either by electric or magnetic force. (2) Secondary rays produced by rays (1); these were deflected by electric and magnetic forces, and had a constant velocity of about 2×10^8 cm per second, the velocity being independent of the potential difference (varied between 3000 volts and 30,000 volts) and of the gas pressure; the ratio $e \div m$ also had the constant value 10^4. This value had been supposed to be greater than the normal—namely, 1.5×10^4; that point should be investigated in every possible way. (3) Rays characteristic of the gases in the bulb and conspicuous only at low gas pressure. Their velocity depended on the potential difference, and when several gases were present (hydrogen, helium, air, for example), the maximum kinetic energy of the rays corresponding to each of the gases was the same, and seemed to be that due to a fall through the potential difference between the negative glow and the cathode. The values of $e \div m$ for the different gases were inversely proportional to the atomic weights. Thus these rays were probably atoms of the gas carrying unit charges, and in the case of hydrogen there seemed to be rays corresponding both to the atom and to the molecule. In the cases of mercury-vapor, air and the hydrogen atom, the negative bands were also visible; in the cases of the hydrogen molecule and the atoms of helium, carbon and neon the negative constituent had not been detected. There was a considerable range in the velocities of the rays from the same gas, but at low gas pressure most of the particles seemed to move at nearly the maximum velocity. The rays corresponding to the different atoms could be separated by deflecting them with the aid of the magnetic and electric fields. Each kind of ray produced a kind of spectrum under the simultaneous action of the two fields. (4) The fourth type of rays was the one he had formerly called "retrograde" rays. They traveled from the cathode in the same direction as the cathode rays. They had negative constituents, and seemed to be of types (1) and (2); rays (3) had not, so far, been detected among them.—Lond. *Engineering*, Sept. 23.

Number of Electrons in an Atom.—J. A. Crowther.—A paper read before the British Association on experiments made with beta rays to determine the number of electrons in an atom. The chief conclusions are that the positive electrification in an atom occupies a volume comparable with that of the atom, and that the number of electrons in the atom is three times the atomic weight of the substance.—Lond. *Eng'ing*, Sept. 23.

Magnetic Properties of Iron Alloys.—The Reichsantalt investigations have been continued on the chemical composition and treatment of iron alloys and their effect on the magnetic and electric properties. When the last traces of hydrogen were removed from electrolytic iron by heating in vacuo it was possible to reduce the originally high coercive force to such a degree that it has become more feasible to produce iron absolutely free from hysteresis. With one and the same sample of very pure iron it was possible to produce at will any form of hysteresis curve by varying the treatment of the sample (probably meaning the heat treatment). Permeability and remanence of the same sample of iron could be changed at will to a certain degree.—*Elek. Zeit.*, Sept. 22.

Electrochemistry and Batteries.

Electric Steel Plant.—J. W. Richards.—A profusely illustrated description of the Lindenberg steel works in Remscheid, in Germany, where Héroult electric furnaces have been in operation for several years with good success. The steel supplied to the electric furnace is taken from an open-hearth furnace. Two electric furnaces are used, one of 1.8-ton and the other of 3.6-ton rating. The power used by the 1.8-ton furnace is 250 kw and the specific energy consumption 385 kw-hours per ton of fluid metal treated; the 3-ton furnace takes power of 350 kw and as low a value of energy as 235 kw-hours per ton of steel treated. Of the 350 kw it requires 250 to keep the furnace up to a constant temperature, while the other 100 kw (about 30 per cent) is used in melting the fluxes which are added and in raising the temperature of the bath. The electric refining process is described in detail. The manufacturers state, on the basis of five years' experience, that the electric steel is more nearly of the desired composition, more uniform in composition, and can be made from far cheaper raw materials; that the cost is far less for the smelting operation, far less for labor; that the labor required is much easier and safer, the output per given sized plant is greater, the steel is more free from blow-holes, develops fewer edge-cracks or surface faults, and for a greater ductility will carry more carbon and, therefore, show higher strength.—*Met. and Chem. Eng'ing*, October.

Rubbing Powders for Nickel and Zinc Plating.—A description of a new plating process of A. Rosenberg. A wet rag is dipped into the plating powder mixture and then rubbed on the surface to be coated. The principle is that if this surface is metallic, or at least electrically conducting, electrolytic action is set up in the wet mixture which is rubbed on and the desired metal is deposited on the surface. A suitable powder mixture for nickel plating contains 60 parts of nickel ammonium sulphate, 3 parts of metallic magnesium, 30 parts of chalk, 7 parts of talc powder. For plating zinc on iron or copper a powder of the following composition may be used: 45 parts commercial zinc dust, 15 ammonium sulphate, 3 magnesium, 30 chalk and 7 talc powder. The magnesium particles are coated with a very thin wax layer to protect them against oxidation.—*Met. and Chem. Eng'ing*, October.

Electrolytic Chlorine.—B. du Faur.—A paper on the plant for producing chlorine by electrolysis of brine at Mount Morgan Queensland, Australia. Use is made of a diaphragm cell with a diaphragm of asbestos cloth. The method of purifying the electrolyte before supplying it to the cell is described in great detail and the evil effects of the presence of caustic soda in anode liquor are discussed and data are given on salt con-

sumption, energy consumption at [illegible] *[illegible] Chem. Eng'ing*, October.

Electric Laboratory Furnace.—D. F. CALHANE.—An illustrated description of a convenient and quite inexpensive electric laboratory furnace for very high temperatures. It is a resistance furnace with a carbon resistor.—*Met. and Chem. Eng'ing*, October.

Units, Measurements and Instruments.

Standard Cells.—E. COHEN.—A paper read before the German Bunsen Society. The Weston cadmium cell without an excess of solid crystals of cadmium sulphate is not considered to be a standard cell in the proper sense, since deviations of the e.m.f. from the standard value are then possible, even if the cadmium amalgam fulfils all the requirements, as stated below. Cadmium amalgam containing 12.5 per cent by weight is unsuitable for standard cells which are to be used in the temperature interval from 0 deg. C. to 40 deg. C. But a 12.5 per cent amalgam would be suitable in the interval from 14 deg. C. to 60 deg. C. An 8 per cent cadmium amalgam is suitable for cadmium standard cells in the interval between -4 deg. C. to $+40$ deg. C. An exact temperature formula for the e.m.f. of the cadmium cell has not yet been given. The formula proposed by the International Conference on Electric Units and Standards in 1908 does not represent the facts and should be replaced by another formula based on measurements of standard cells containing an 8 per cent amalgam. The previous history of the cadmium amalgam used in the standard cell has a decided influence on the e.m.f. With an 8 per cent amalgam it is possible to construct a portable standard cell.—*Phys. Zeit.*, Oct. 1.

Flat-Coil Galvanometer.—E. F. NORTHRUP.—A Franklin Institute paper in which he first makes a few general remarks upon galvanometer design, then describes a basis upon which the merits of different galvanometers may be compared in certain of their prominent features. ([illegible] / $T^2 . R$) is the usual expression for the figure of merit of any galvanometer where $S_m =$ sensibility, $T =$ period and $R =$ coil resistance. In comparing galvanometers by it the supposition is made that thickness of insulation is neglected and that the galvanometers compared are wound with wire of the same specific resistance. The specifi-

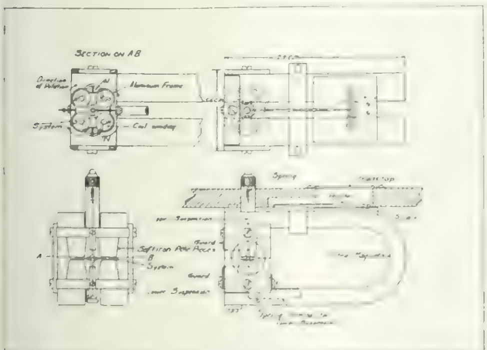


Fig. 3—Diagram of Flat Coil Galvanometer

cation which the author adopts to define S_m is as follows: With the scale at [illegible] mirror galvanometer, the sensibility S_m is the number of megohms which must be in the galvanometer circuit so that with an e.m.f. of 1 volt in the circuit there will result a deflection of one scale division. F is the figure of merit and the unit of it is called a D'Arson. A galvanometer would have, then, a unit figure of merit if its time of a complete oscillation is one second (or, which is practically the same thing, if its time of aperiodic return to the zero within one-twentieth per cent of its previous deflection is one second) and the resistance of its winding is 1 ohm and also [illegible] volt in circuit, its deflection on a scale one-thousand scale-divisions from its mirror is one division. Every consideration shows that in starting out to design a galvanometer of any type which is to have a large number of D'Arsons one should begin by carefully considering the selection of the mirror, pointer or other contrivance essential to reading the deflections, so that this contrivance may have the least possible moment of inertia; for it is the mass of these "dead parts" which ultimately sets a limit to the maximum figure of merit obtainable. In the second part of the paper the author describes a flat-coil galvanometer which is a radical modification of the D'Arsonval type of moving-coil galvanometer. The construction of a pointer-portable instrument of this type is shown in Fig. 3, which is self-explanatory. The following are the main advantages of the construction. When current energizes the four disk-like coils they all contribute to produce rotation in the same direction. A reversal of the direction of the current reverses the direction of rotation, the deflections, with equal current, being the same to either side of the zero. As the galvanometer has no iron core, there are only two air-gaps, one above and one below the coil, instead of four as required by the D'Arsonval galvanometer with an iron core. In the second place all of the magnetic field is active at all times in producing a turning moment regardless of the angular position of the system. Thirdly, the aluminum form in which the four coils are held serves admirably as a magnetic damper. Further, if the instrument is to serve as a ballistic galvanometer its moment of inertia can be made very great out of material which is active in producing a turning moment, and for such service the construction is ideal. Some rules are given of the best proportioning of the parts of this instrument, and finally a table is added giving comparisons between sixteen galvanometers of different kinds and by different makers.—*Jour. Franklin Inst.*, October.

Electric Measurement of High Mechanical Pressures.—At the Reichsanstalt an electric method of measuring high pressures has been investigated. It is based on the fact that the resistance of a wire wound on a tube is increased after the tube is acted upon by a high pressure from the inside so as to expand it radially. The measurement of the resistance must be very exact while the accuracy with which the pressure is found is only moderate. The practical value of the method is, therefore, doubtful.—*Elek. Zeit.*, Sept. 22.

Meters.—In the report of the Reichsanstalt a review is given of progress made in meter construction. It is pointed out that the weight and the price of meters is now only from one-fourth to one-half of what it was ten years ago, but it is thought that further progress can be made by more carefully designing the counting devices.—*Elek. Zeit.*, Sept. 22.

Telegraphy, Telephony and Signals.

[illegible] AND A. J. MAKOWER.—The Telefunken Gesellschaft claims to reach in a normal plant an efficiency of 75 per cent, and the Lepel Wireless Syndicate claims to get higher than 60 per cent. The authors have found with an apparatus which was not precisely the same as that of these two firms, but was rather of an intermediate nature, an efficiency of less than 50 per cent. This efficiency is that of transference of oscillatory energy from the circuit containing the discharge-gap to the aerial wires. The authors have studied the method used by the Telefunken company in their efficiency measurements, which is indirect and rests upon one that is widely applied in the determination of the logarithmic decrements of vibratory circuits. The present authors show experimentally that the method is not exact and may lead to values of the efficiency which are too large. It seems that the proportional waste in the gap increases as the aerial resistance decreases.—Lond. *Electrician*, Sept. 30.

Wireless Telegraphy.—A note on a recent British patent (20,230, Sept. 22, 1910) of G. Marconi and the Marconi Wireless Telegraph Company, Limited. Aerials are made directive by arranging the antennae horizontally in a vertical plane passing through the stations. The antenna is brought very close to the ground, and to avoid the loss in efficiency due to the high resistance of the surface of the ground underneath wires are [illegible]—*Lond. Elec. Eng'ing*, Sept. 29.

Book Reviews

[illegible]
Price, $2.

Many faults supposed to be inherent in laboratory manuals are conspicuous by their absence in the present treatise. Professor Bedell has evidently chosen his experiments for their real instructive and practical value rather than for the purpose of utilizing a given laboratory equipment. Not only are the tests well chosen, but the method of presenting them is excellent. The tests are not described in detail, to do which would usually merely fill up space with things that all who use the book would know; but the purpose of the test, the reasons for using certain methods, the value and limitations of various methods, etc., are discussed, thereby encouraging the reader to think and work intelligently instead of blindly as is usually the case with students working from a laboratory manual. A general idea of the scope of the work may be had from the following outline: Direct-current generators; direct-current motors; synchronous generators; single-phase currents; transformers; polyphase currents; phase changers; potential regulators, etc.

The Design and Construction of Induction Coils. By A. [illegible] pages, 155 illus. Price, $3.

The induction coil is no longer confined to laboratory work, but is designed and built to do definite work under specified conditions. The design of induction coils has been almost entirely empirical because of the number of variables which occur in each individual case. Mr. Collins has treated the design in a purely empirical fashion. He gives directions in detail for building a style of coil suited to wireless and laboratory service. The explanation of the theory of operation of an induction coil is comparatively simple, yet the reader will find himself more confused than enlightened after perusing the theoretical part of this book. To illustrate the author's rather peculiar way of saying things, the following statements are quoted: ". . . An electric current flowing in a conductor is partially changed into magnetic lines . . . "; " . the expansion and contraction of the magnetic lines will cause the lines of force to impinge upon the turns of the coil itself and in this way accentuate the e.m.f. of the current flowing through it"; "a current can only flow when there is an e.m.f. sufficient to overcome the resistance of the circuit." The unfortunate part of the whole thing is that these loose statements occur in the theoretical portion of the book. If the student is to get a clear grasp of the subject it must be clearly and truthfully stated and extreme attention paid to the correct use of terms. There are many important statements made which, if not erroneous, are at least very misleading. For instance, the statement is made that increasing the iron-core section will allow the magnetizing force to build up faster. This might easily be construed to mean that the current growth or decay in a circuit is accelerated by increasing the inductance. This "mix-up" is probably due to a loose usage of magnetizing force for flux, and is sure to tangle a student and make it hard for him to follow the discussion.

In several places the author emphasizes the fact that the secondary voltage depends upon the ratio of the primary to secondary turns. Practice and theory will show that there is no fundamental relation between voltage ratio and turns ratio as in transformers. In the induction coil the secondary voltage depends upon the number of secondary turns, the flux in the core when the primary circuit is broken and the speed at which the flux disappears. The flux depends on the primary amp-turns and the speed of flux decrease is determined by the interruption, the capacity across the break and the constants of the primary circuit. The time appears ripe for a thoroughgoing treatise on the design of induction coils.

Steam Tables: Tables and Diagrams of the Thermal Properties of Superheated Steam. By L. S. Marks and H. N. Davis. New York: Longmans, Green & Company. 106 pages Price, $1.

In these days of steam turbines, supreheated steam locomobile units and gas turbines a modern book of superheated steam data, such as the above, is a most useful contribution to engineering literature. As is well known, the tables which have appeared up to the present have been based upon the classic investigations of Regnault of more than half a century ago. During recent times the work of scientific investigators has yielded new values of the total heat of dry steam, both above and below atmospheric pressure, determined with an accuracy hardly possible in Regnault's day. It is upon these later determinations that the present tables have been based.

Table I gives the pressure, specific volume, density, latent heat, total heat, internal energy and entropy of saturated steam for every degree Fahrenheit from 32 deg. up to 400 deg. and thence by tens up to 689 deg., the critical temperature. Table II gives pressures of saturated steam from 1 lb. absolute up to 600 lb. Table III gives the properties of superheated steam, advancing by 10 deg. from 10 deg. superheat up to 200 deg., and by 50 deg. from 200 deg. up to 600 deg.; and for pressures from 1 lb. up to 250 lb., then in 5-lb. steps up to 400 lb., and thence to 600 lb. in 50-lb. steps. The properties given are for water and saturated steam, temperature in degrees Fahrenheit, specific volume in cubic feet per pound, total heat units from water at 32 deg. and entropy from water at 32 deg. As the highest working temperatures at present necessary in compound engines with double superheat range about 587 deg. Fahr., this table amply covers the practical range, running as it does up to 1086 deg. total temperature of the steam. For special investigations Table IV gives the increase in total heat and in entropy for steam superheated above 600 deg. plus the temperature of the saturated steam—as it may well become in gas turbines. It covers pressures up to 600 lb. and superheat at these pressures up to 2000 deg. Fahr.

Part II of the book is devoted to two graphical diagrams and an explanation of their use. Diagram I is a total heat entropy diagram, known as the "Mollier diagram," for saturated and superheated steam, and is primarily for use in the solution of problems involving adiabatic expansion, throttling and the flow of steam. Diagram II is a total heat-pressure diagram for saturated and superheated steam, showing specific volumes, superheats and properties, and is primarily for use in problems involving ratios of expansion. Both diagrams are large and clear, about 18 in. x 24 in., and contained in a separate pocket in the book and may be mounted on cardboard for handy use on the draughting table.

Part III of the book contains a discussion of the sources from which the tables were derived, a matter which would be naturally inquired into by serious investigators before accepting the tables as a basis for their work.

The Life Story of Sir Charles Tilston Bright. By Charles Bright, F. R. S. E. Revised and abridged. London: Archibald Constable & Company. 478 pages, 68 illus. Price, $4.50.

This volume is an abridgment and revision of a larger work with the same title written by the author and his uncle, which was reviewed in these columns in the issue dated Sept. 9, 1899; and it shows in every page the appreciation of an affectionate son for the achievements of a distinguished father.

That Charles Bright was among the leading engineers of his country and day is seen from the confidence placed in him by capitalists, from the inventions which he patented and from the [illegible] way in which were [illegible] the new and formidable difficulties that arose in the memorable enterprise of uniting telegraphically the Old World with the New.

Though Bright was not a graduate of a technical institution, nor even an ex-apprentice to an engineering firm, he was chosen at the early age of twenty-four to fill the place of engineer-in-chief to the first expedition (1857) that undertook to lay [illegible] the Atlantic. It was fortunate for the

electrical side of the enterprise [illegible] connected with it; for in Professor Thomson (Lord Kelvin), though only in his thirty-third year, the official electricians had a resourceful adviser, while the board of directors of the Atlantic Telegraph Company had a "tower of scientific strength."

The difficulties encountered in the expeditions of 1857 and 1858 in the cable tanks, at the paying-out machinery and in the electrical testing room; the anxieties of exasperating frequency; the mishaps that occurred and the warring of the elements are all told in 135 pages in a manner that makes exciting and instructive reading even at the present day.

The congratulatory message of Queen Victoria to President Buchanan is given on page 157, and if it had been added that the 100 words there printed took 16½ hours in transmission and only 67 minutes in retransmission for verification, the reader would have realized at once the unsatisfactory character of the Whitehouse receiving apparatus at Newfoundland compared with the reliable, fast-working mirror galvanometer of Thomson which was used at Valentia.

The dogged conservatism of Mr. Whitehouse which led him —the company's chief electrician—to retain the unsuitable apparatus at the American end of the line ultimately proved fatal to the cable. To overcome the growing difficulty of signaling across, Mr. Whitehouse gradually increased the battery power at Valentia until the number of Daniell cells used was nearly 500; and when this proved insufficient, the unwise official had recourse to the great penetrative energy of induction coils, which gave the ill-fated cable its *coup de grâce* after barely a month's existence.

Mr. Cromwell Varley, who succeeded Mr. Whitehouse (retired), admitted that the faulty condition of the cable "was no doubt due to the employment of induction coils;" and Professor Hughes declared that the cable "was injured by the induction coils and that the intense currents developed by them were strong enough to burst through gutta percha." On the other hand, Professor Thomson said that "with a properly adjusted mirror galvanometer at each end twenty cells of Daniell's battery would have done the work required."

In this connection it may be recalled that Latimer Clark, using a silver thimble, a pencil of zinc and a few drops of dilute sulphuric acid, was able to send clear signals from Valentia through the two cables of 1865 and 1866 joined together at Newfoundland, a distance of 2700 miles. Mr. Bright relates this interesting fact on page 193, but does not add that signals were sent from Newfoundland to Valentia with a smaller cell consisting of a *gun-cap*, a needle of zinc and a drop of dilute acid. This was also a noteworthy telegraphic feat. Though the author makes thirteen allusions to Mr. Cyrus W. Field, he nowhere waxes warm over the man or his achievements. He does say in the text on page 38 that Mr. Field was "a man of sanguine temperament and intense business energy," and in a footnote on the same page he adds that Sir Charles Bright described Mr. Field as "rapid in thinking and acting, and endowed with courage and perseverance under difficulties."

It is only fair to say that to the above personal qualities there are many who would add that throughout the enterprise Mr. Field was the guiding spirit of the company. The following resolution of the board of directors shows no ordinary degree of appreciation:

"*Resolved*, that the warm and hearty thanks of the company be tendered to Mr. Cyrus W. Field, of New York, for the great services he has rendered to the Atlantic Telegraph Company by his untiring zeal, energy and devotedness from its first formation and for the great personal talent which he has ever displayed and exerted to the utmost in the advancement of its interests."

Hon. John Mullaly, of New York—the historian of the enterprise—is referred to three [illegible] of the book, "The Ocean Telegraph" (320 pages), from which the quotations are taken is not given, nor is it said that Mr. Mullaly was on the *Niagara* in 1857 as secretary to Professor Morse and in 1858 as secretary to Mr. Field, and that on both occasions he was the correspondent of the *New York Herald*. This might have been stated, inasmuch as considerable prominence is given to Mr. Nicholas Wood, who was on the *Agamemnon* as reporter for the London *Times*.

Scant justice—to say the least—is done Mr. W. E. Everett, chief engineer in the United States Navy, whose services were secured for the company from our government by Mr. Field; for, if we read page 77 rightly, the paying-out machinery that *laid* the cable was "devised, adopted and constructed" while Everett was in America. It should be said that Everett was on the *Niagara* in 1857 as chief engineer and that after the unsuccessful attempt of that year he returned home for a while, but was back in London in 1858 for the purpose of making the necessary preparations for his share in the submergence of the cable in the following summer.

The claim made on page 77 is anything but confirmed by the following letter, under date of April 24, 1858, from Mr. George Saward, secretary of the company, to Mr. Everett:

"As you have now reported to the managing committee that the paying-out machinery for H. M. Ship *Agamemnon* is completed and that it has been working satisfactorily during the last three days and that you do not consider any alterations necessary to increase its efficiency, and as another set is required for the United States frigate *Niagara*, the managing committee have authorized and instructed me to request that you will immediately give directions to Messrs. Easton & Amor to put another set in hand for that ship; and I am further to request that you will continue your supervision over the construction of the machinery and also undertake to superintend and direct its being properly fixed and fitted on board the *Niagara*.

"I am further instructed to request that you will take charge of the operation of experimenting upon and subsequently of paying out the cable from that ship, in doing which you will have the co-operation of Messrs. Woodhouse, Follansbee and of such assistant engineers as you may consider it requisite to appropriate to such service. You are also authorized to make such preparations and arrangements as are necessary to enable you to carry out the foregoing instructions."

Besides making it evident that the paying-out machinery for both ships was constructed under the superintendence of Mr. Everett, it also shows that he was not simply the ship's engineer, as our author says, but that he was in the full sense of the term "chief engineer" on board the *Niagara* when the cable was laid in 1858.

Other chapters of this interesting book give the history of the great "telegraph to India" line, which was completed in 1864 by the cable from Fao, at the head of the Persian Gulf, to Karachee, the sea terminus of existing lines; the deep-sea Malta-Alexandria cable, 1868, and the West India network, 1870.

These and similar expeditions, which made great demands on the mental activities of Sir Charles Bright, kept him so much away from home that there was but little leisure left for the domestic circle or for social life. The strain of professional duties and the effects and exposure to malignant climatic influences told severely on a system that was never over-strong, and, at the age of fifty-six, brought a life so bright with promise and so full of achievement to a close on May 3, 1888.

Bright's closeness to work is shown by his motto, *Nulla dies sine linea*. Like his lifelong friend, Lord Kelvin, he always carried with him a notebook to jot down thoughts as they occurred, to sketch pieces of apparatus or to solve problems connected with work in hand.

The chapter on "Home Life and Recreations" contains fifteen pages; we regret that there are not many more, for it is in unprofessional hours and when the cares of the day are over that are best exhibited the qualities of mind, heart and will which go to make up the true man.

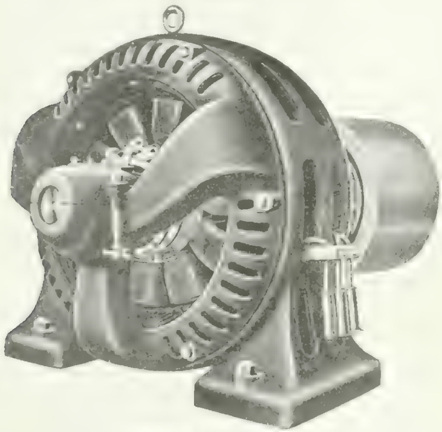
To all connected with ocean telegraphy in its various aspects the life of Sir Charles Bright contains valuable information; to the general reader it will prove an inspiration, showing how difficulties can be overcome and triumphs achieved by energy and perseverance.

New Apparatus and Appliances

REVOLVING FIELD ALTERNATOR.

In a line of revolving-field type alternators recently placed on the market by the Triumph Electric Company, Cincinnati, Ohio, special attention has been paid to the ventilation of all parts.

The usual standard ratings at 35 deg. C. and 40 deg. C. temperature rise have been adopted, the machine being furnished for either rating according to the duty it has to perform. Generally speaking, a 40 deg. C. temperature rise is considered better for machines which have to carry a non-inductive load, while a machine which has to carry an inductive load, such as arc lamps or induction motors, would be better when rated on the 35 deg. C. basis.



Revolving Field Alternator.

The regulation of the alternators is said to be in accordance with the best engineering practice, and varies from 6 per cent on a machine with a 35 deg. C. rise to 8 per cent on a machine rated at 40 deg. C. temperature rise. The use of a relatively large amount of copper in both the rotor and stator windings has kept the copper loss low. Moreover, the core losses are comparatively low, and it is claimed that the machines have exceedingly high efficiencies.

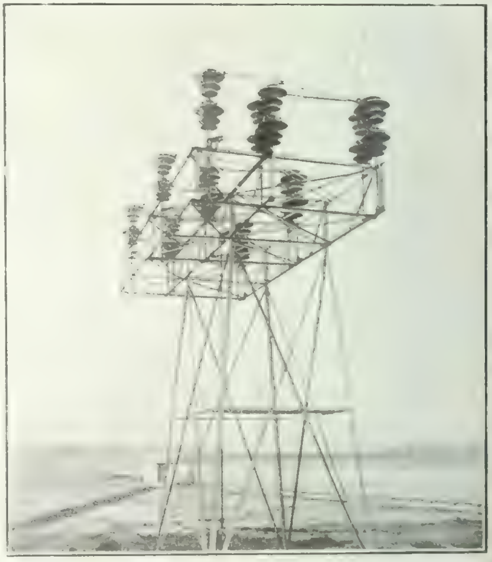
TEST OF A 104,000-VOLT SWITCH.

At the Bay Shore substation of the Sierra & San Francisco Power Company is installed a "Kilarc" type L switch, built by the Bowie Switch Company, through which passes one of the incoming lines of the Stanislaus Power Company, which supplies the United Railroads of San Francisco with power. The system is operated at 104,000 volts, the highest pressure at present in commercial use. This switch was built to handle at least 10,000 kw and to open under load. The operating parts for breaking the load are similar in principle to those of the standard type K switch built by the same company. By the direction of motion of the blade the arc is first drawn upward, away from the insulators, thereby avoiding any possibility of the heat of the arc affecting the insulators.

This switch has been in service for over the last three months, and is situated in a location particularly severe on insulators owing to the salt fogs, high winds and dust, and the insulators have not been cleaned since it was installed.

To determine the ability of the switch to open under load a test was recently made by loading the line with an inductive load of 52 amp on the high-tension side, or over 9000 kva. The switch handled the load without the slightest difficulty, and opened without causing any voltage disturbance to the system, other than would occur from the change of current. There was practically no surge on the line, and the pressure at the power house was raised only 3500 volts, or about 3 per cent maximum when the switch was opened. This demonstrated conclusively that no material rise of voltage accompanies the opening of this type of horn switch.

This is a subject which has caused considerable discussion by engineers, as some have maintained that the opening of air switches would set up serious oscillations in the line. This opinion is without doubt due to the use of air switches of improper design, where the break in the arc occurs in an arc which is ascending in nearly a vertical direction, and where the rupture of the arc will occur in such a manner that the ascending column of heated air will cause the arc to re-form. It is claimed that in horn switches of the type shown it is a practical impossibility for the arc to break in such a manner, since the tendency for the arc to rise is so strong that with proper inclination of the horns the break will be substantially horizontal, and in such a manner that there is no possibility of the arc re-forming, and hence there will be no surging. The result of extended experience with these switches is stated to have shown that they will operate without causing material disturbance of voltage, and in this respect are considerably superior to oil switches, owing to the high resistance of the long arc, which greatly weakens the current before the final break.



104,000-Volt, 10,000-Kw Switch.

This test was particularly severe owing to the highly inductive load, which tended strongly to maintain the arc and to have the stored magnetic energy kick back on the line. Judging by the manner in which the switch operated, without doubt its actual capacity is far in excess of the rating. The photograph shows a view of the switch, which is mounted on a structural steel framework, thoroughly braced, and mounted on a steel tower.

PORTABLE MOTOR-DRIVEN VACUUM CLEANER.

The B. F. Sturtevant Company, of Hyde Park, Mass., has applied its experience in the manufacture of air-moving machinery to the vacuum-cleaner problem and has designed a special fan for which, after two years of experiment and observation, it now claims many distinct advantages. The fan operates at 3400 r.p.m. and is said to give a vacuum that draws in a very large volume of air at a pressure insufficient to injure the fabric of the carpet or other material being cleaned. The air is drawn in at a high velocity, so that the machine takes up large

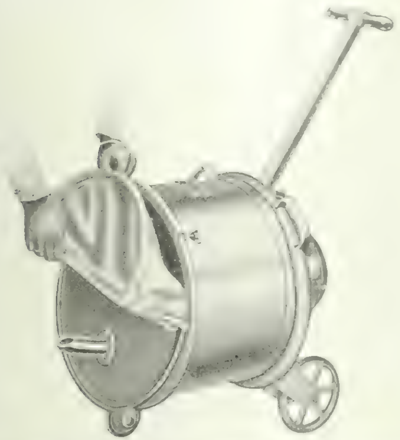


Fig. 1—Portable Motor-Driven Vacuum Cleaner, Showing Dust Receptacle.

particles of matter. The cleaner has no valves, diaphragms, pistons, connecting rods or eccentrics, the apparatus consisting simply of a case containing the fan, which is mounted directly on the armature shaft. The motor is of standard design and

Fig. 2—Portable Cleaner and Cleaning Tools.

is provided with ball bearings packed in lubricant. Direct-current, alternating-current or universal motors are obtainable, and there are only two wiring connections, a snap switch controlling the motor. A dust bag of unusually ample proportions is introduced in front of the fan, the large screen area preventing undue reduction of air velocity. The cleaner is mounted on three rubber-covered wheels, and provided with a detachable handle. It weighs 50 lb. and requires a space 2 ft. by 2 ft. A full complement of [illegible] each machine, many of these being of new design developed by the company, and all of them having been tested in service under various conditions.

THE FIELD ELECTRIC OMNIBUS.

After years of development work Mr. C. J. Field, who in years past has been prominently identified with the Edison central-station interests and the building of electric railways in a number of the large Eastern cities, including Buffalo, Philadelphia, Worcester, Bridgeport, Newark and other places, has completed and tried out at the Edison Works in Orange, N. J., his first electric omnibus operated with the Edison storage batteries.

During the past few months this publication has given several accounts of the results being secured with the Edison battery and the wide commercial development which is taking place with this battery for trolley car work, truck work and pleasure automobiles. The latest application of the battery is to large omnibuses for use by public-service companies.

The Field omnibus, seating thirty passengers, is built to operate on public roads without tracks, and will have a radius of travel on one charge of half a day's service, equal to fifty to seventy-five miles, depending on roads, grades, service, etc. This car, as shown by the illustration, is 22 ft. long over all, by 7 ft. 4 in. wide, and has a wheel base of 13 ft. 6 in. The body without platforms is 17 ft. in length, has cross seats of regulation length of 33 in., with 19-in. wire spring, rattan seats and backs. The total weight of the car is under 8000 lb., of which

Fig. 1—Electric Omnibus—City Type.

20 per cent is in Edison storage batteries. The motor equipment consists of two motors of 7 hp each, trolley car rating. The drive from the motors is direct with Morse silent chains to sprockets on the rear wheels in the ratio of 15 to 71, with 0.9-in. pitch. The front and rear wheels are 34 in. to 36 in. diameter, equipped with a 4-in. single and 4-in. dual solid rubber tires respectively, with Timken roller bearings for city type, and floating bronze bushings for interurban type. The wheel construction is amply strong to meet all requirements for severe service. The axles are imported nickel chrome steel forgings having a tensile strength of 130,000 lb. per sq. in. The springs, made by Lemoine of France, of the very finest mangano silicon steel, are half elliptic with nine leaves in the [illegible] under load. Two-thirds of the load above the springs is carried by the rear and one-third by the front springs.

The frame of the chassis is of ash strips 1¼ in. by 5 in. faced inside and out with ¼-in. by 5-in. cold-rolled strip steel, the cross members being rolled channels. The fittings for the springs are all riveted to this frame, to which the body is directly attached.

The Electric Omnibus & Truck Company, 135 Broadway, New York City, and Passaic, N. J., is building the buses, the city type being shown in the photograph. Interurban type buses to operate without a conductor have the same carrying capacity, and smaller type buses will be built later. There is no experimental feature in connection with these cars, every part or feature in connection with them having been proved and tried under service conditions. The omnibuses were designed by C. J. Field and Raymond Cilley, engineers of the company, with the additional benefit of Mr. Edison's inspection and suggestions. There is a wide field for the application of vehicles of the type shown.

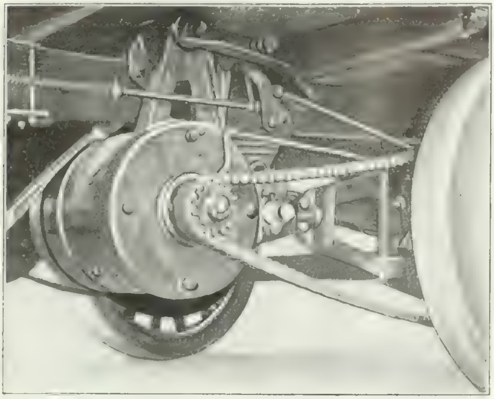


Fig. 2—Electric Omnibus—Details of Motor Drive.

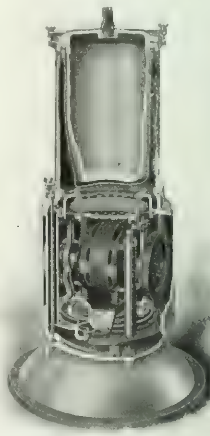
INTERIOR ILLUMINATED ELECTRIC SIGN.

The Flexlume Sign Company, Limited, of St. Catharines, Ontario, Canada, and Buffalo, N. Y., manufactures an interior illuminated electric sign which makes an excellent appearance by day or by night. The letters are of prismatic glass in bold relief. The prisms on the under side of the glass are said to represent so many mirrors and to sparkle in the reflected sunlight. Each letter is illuminated by one lamp, and carefully designed reflectors give a powerful and even distribution of the light through the raised glass characters. The letters are so arranged that they can be swung out from the face of the sign so as to provide access to the lamps, reflectors, etc. The signs are made entirely of metal, and all of the wiring, lamps, etc., are completely protected from the weather. The signs are outlined with raised rope moldings and ornaments finished in gold leaf, and the letters are trimmed with gold. At present the letters are manufactured in different sizes, ranging from 6 in. to 24 in. inclusive. The signs are adapted for all classes of work, and are particularly effective for interiors. The letters are quite legible and are easily read from sharp angles. The sign, as shown in the accompanying engraving, does not possess the earmarks of the ordinary electric sign.

Interior Illuminated Electric Sign.

STATIONARY DUPLEX VACUUM CLEANER.

The Keller Manufacturing Company, of Philadelphia, Pa., has brought out a one-sweeper duplex stationary vacuum cleaner, a sectional view of which is shown herewith. There are but five moving parts in the device. Gears, cranks, levers and chains are dispensed with, straight-line construction being provided. The machine weighs 180 lb., has a base 23 in. in diameter and stands 40 in. high. It is equipped with a 1/4-hp motor, and is said to exhaust 40 cu. ft. of air and to yield a vacuum ranging from 8 in. to 9 in. at an expenditure of power not exceeding 325 watts. The motor is supported midway between the operating parts and in a straight line with them, and owing to the peculiar construction of the machine, whereby the load is balanced, the wear on the motor bearings is said to be uniform, being as much on the top as on the bottom surface of the bearings. Large oil cups using special grease are provided, so that operation can go on for several months without any attention being given to the machine. The special pump units are the same as those employed in the familiar "Santo" portable electric vacuum cleaner. A 1½-in. inlet connects the machine through a hose with the house piping, and the lid or cover of the dust chamber is held in place by two thumbscrews. Solid-rubber gaskets set in grooves in the lid and ring around the top of the dust chamber casing minimize leakage, and the ring supporting the dust bag rests between these two rubber gaskets. The dust bag is made of special closely woven cotton drilling, and an emergency bag made of heavy felt completely surrounds the dust bag and prevents dust or dirt getting into the operating parts should the operator carelessly put the lid on without placing the dust bag in its receptacle. A perforated steel plate covers the pump chamber and supports the dust bags. A rubber gasket forms a seal between the bottom ring of the dust chamber and the upper pump casting. The motor and pump compartments are surrounded by galvanized-steel casing and an upper aluminum connecting link is attached to the eccentric on the motor shaft and the moving portion of the upper pump. Two flywheels are fitted to the motor shaft and a cast-iron straddle bracket supports the motor midway between the upper and lower pumps. The machine is almost noiseless in operation, and it is claimed will operate without attention for long periods under conditions encountered in ordinary household work.



Stationary Duplex Vacuum Cleaner.

ELECTROLYTIC LIGHTNING ARRESTERS.

Many devices have been pla[illegible] market for the protection of electric equipment from abnormal voltage on the line, but the electrolytic lightning arrester, which consists of nested aluminum trays filled with electroyte and submerged in oil, has ideal characteristics for this purpose, in fact, resembles in action a relief or safety valve. The horn-gaps which are between the arresters and the line break down on over-voltage. and if this voltage amounts to over approximately 330 volts per tray a free passage through the film from tray to tray and thence to the ground is provided. When the voltage drops to normal, which is below the critical voltage of the tray, the apparent resistance of the film reasserts itself and the flow of the current is cut down so that the horn-gaps disrupt the arc and all further flow of current ceases.

The nested trays are placed in oil-filled, welded-steel tanks, which for 22,000 volts and above are built with cast covers and outdoor terminals, so that the entire arrester can be placed outdoors. The complete arrester consists of four tanks mounted on an insulated platform for ungrounded neutral service, and three tanks grounded for grounded neutral service. For 13,200 volts and under the arrester is arranged for indoor service only, as the horn-gap setting is so small that much more effective service is obtained when the arrester is housed. For the lower voltages the general arrangement of trays is the same, but a smaller number of tanks is used.

Since when the electrolytic type of arrester is allowed to stand without current passing through it the film on the plates dissolves, it is necessary periodically to pass current through the arrester in order to keep the film in the best condition.

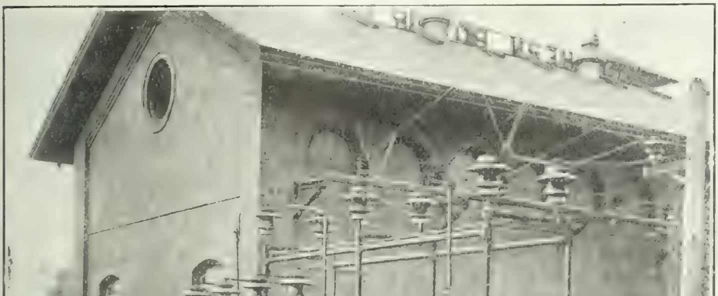


Fig. 1—Electrolytic Lightning Arresters at Entrance to Station

This prevents an abnormal rush of current when the arrester discharges after a long period of idleness.

The rate of dissolution of the film depends upon the kind of electrolyte used and the temperature. There are two kinds of electrolyte made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., one which requires that the horns be bridged daily to pass current through the arresters, and the other that the horns be bridged only every seventh day The latter electrolyte has been known to stand without current for very long periods during cold weather, and when the horns were bridged no undue rush of current followed. However, in order to keep the films well built up it is recommended that current be passed through this electrolyte every seventh day;

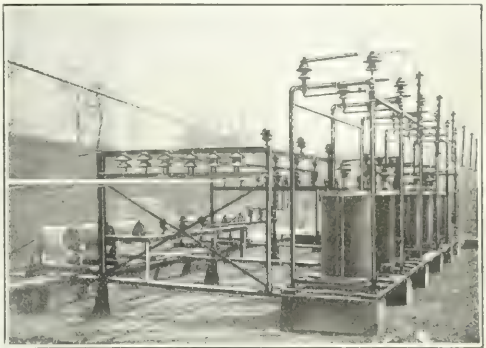


Fig. 2—Two Sets of Electrolytic Lightning Arresters. Showing Choke Coils and Line Connections.

this offers no inconvenience, as apparatus in general should be inspected at least this often.

When arresters are bridged at normal voltage a bluish, crackling static arc indicates the normal condition of the arrester. If the arc is reddish and fluffy, and rises high on the horns, it is evident that the bridging of the horns has been deferred too long a time, and it will take a short period before the arc comes down to normal.

The horn-gaps and bridging device are mounted on a 2-in. pipe frame, to which is also attached the transfer switch used for interchanging a ground and phase tank on underground neutral arresters. The bridging device is very simple and can be operated from either end.

As the voltage increases the number of trays in the arrester also increases. Hence, for a higher voltage, if the trays were all built in a continuous structure, it would be very awkward to handle and require considerable overhead room when installed indoors. For this reason, on all arresters above 13,200 volts, the Westinghouse tray structure is built up into sections containing not over fifty trays, which slide into place, one above the other, between guides supported by a base casting fitting closely to the bottom of the tank. Each section when filled with electrolyte can be easily handled without danger of upsetting it. The electrolyte is poured into the trays by means of a measuring cup, which contains the correct amount of liquid for each tray. When a section of trays is filled the electrolyte is plainly visible so that each tray can be checked.

All parts of the supporting frame directly in contact with the trays are made of the best grade of porcelain; hence, any danger due to [illegible] supports which is likely to be present in case wood is used, is entirely eliminated.

If, when the horn-gaps are set to get the maximum protection from the arrester, a ground on one phase occurs, the horn-gaps connected to the other phases will discharge until the line is cleared, or if thus subjected to a continuous discharge that may last a long time, the Westinghouse arresters are designed with large tanks holding sufficient oil to absorb the heat of a continuous discharge lasting over a considerable period. The tanks are built large enough on the diameter so that the clearance between the top tray and tank where the maximum voltage exists provides a good insulation factor of safety.

VARIABLE-FIELD SPEED-CONTROLLING SYSTEM FOR DRIVING NEWSPAPER PRESSES.

There was placed on the market recently an electric motor installation for driving printing presses for which numerous advantages are claimed by the makers.

A prominent feature of the system is the special arrangement of control stations. There are press-buttons performing three different functions; these buttons may be designated as "A," "B" and "C." The "A" button is a device for starting the motor and increasing its speed. It is equipped with a safety device for locking the press against any further increase in speed until released at the station at which it was applied, but allowing it to be slowed down to 10 r.p.m. of the cylinders or to be stopped from any station while the press is at "safety." The "B" button is for decreasing the speed of the press from maximum to 10 r.p.m. of the cylinders. The "C" button is for stopping and locking the press simultaneously and holding it locked until the locking device has been released at the station at which it was applied.

In the event of any disarrangement of the wires of the press control station the equipment may be operated either from the head pressman's control station or by hand. An emergency button is provided on the board for rapid stopping in connection with the hand control.

The system is said to be "foolproof." Should more than one pressman push the "slow-down" button the equipment would slow down. Should one pressman push the speed button while another simultaneously pushed the "slow-down" button the press would slow down at once. Pressing the "stop" button not only stops the press, but locks it at every station until the automatic catch on the stop button is released at the station where it was applied; thus it is safe for any pressman, by merely stopping the press, to go under it without danger.

The motor used with the equipment is of the commutating-pole type designed especially for printing-press work and hence developing heavy torque at starting. The motor and its two pedestal bearings are mounted on a substantial bedplate which is machined for the alignment required with gear drives.

The equipment described above has been placed on the market by the Garwood Electric Company, Garwood, N. J.

SNAKING AND FISHING MACHINE.

The Conduit Machine Company, 225 Fifth Avenue, New York, has brought out a snaking and fishing machine intended to reduce the labor of fishing and wire pulling to a fraction of its present cost. The machine shown in Fig. 1 is designed for fishing ½-in. conduits and can be used for large loft or office-building work. It weighs 50 lb., and in operation is conveniently placed at any outlet. The snake is coiled on the lower reel and from there is led into a conduit box, where it is held between two wheels which bite about 2½ in. of the snake. Before the fishing wire starts these wheels are clamped together and the snake is forced through the conduit into a small flexible shaft. The flexible shaft is usually about 12 ft. long, and 2 ft. or 3 ft. of it can be threaded into the outlet. The speed at which the snake can be forced through the conduit depends entirely upon the operator. When obstructions or hard bends are met with the fish wire is grasped near the outlet and rammed back and forth until the bend is passed. It is seldom, however, that ramming will be called for, since the motion of the snake is continuous and the momentum forces it around any bends which are fished with difficulty by hand. For instance, in hand-fishing when a hard bend is reached the operator must work against the friction of the snake on the side of the conduit

Fig. 1—Snaking and Fishing Machine for Conduits in Buildings.

throughout its entire length, and also overcome the inertia of the snake throughout its length before he can apply the full force at its head. With the machine shown when the end of the snake appears at the outlet it is only necessary to attach the duplex wire, unclamp the wheels, place the crank lever on the lower wheel and by cranking draw the wire through the outlet into the conduit. The manufacturer claims that it is a very easy matter to pass two or three boxes where the snake comes through direct, and to cut the duplex wire after it has gone

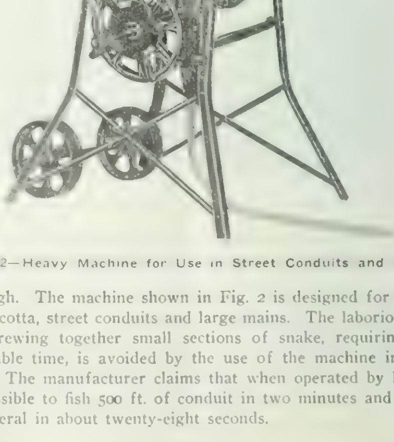


Fig. 2—Heavy Machine for Use in Street Conduits and Mains.

through. The machine shown in Fig. 2 is designed for fishing terra-cotta, street conduits and large mains. The laborious task of screwing together small sections of snake, requiring considerable time, is avoided by the use of the machine in question. The manufacturer claims that when operated by hand it is possible to fish 500 ft. of conduit in two minutes and 100 ft. of lateral in about twenty-eight seconds.

Industrial and Commercial News

THE WEEK IN TRADE

WHILE commercial authorities profess to discern a better feeling or undertone to the condition of trade during the past week, there is little evidence of any increase in actual business. The widespread tendency toward conservatism in purchases is still to be noted and the policy of placing small and frequent orders rather than risking any large buying seems to be the prevailing one among the retailers. The most encouraging feature of the week was the confirmation by government statistical authorities of the optimistic trade estimates of the principal crop yields. Both the corn and oat crops will be bumpers and the wheat yield will be larger than had at first been calculated. There continues to be evidence that stocks of cotton and woolen goods in retailers' hands are very light, but high and uncertain prices are serving to contract purchases. The unusually high price for raw cotton is also doing much to embarrass the manufacturers. In the iron and steel industry the volume of orders being placed is unusually light. The report of the United States Steel Corporation, showing the amount of orders on hand at the end of September to be almost the lightest in the history of the organization, reflects also the condition of the independent mills. The demand for structural material has been greatly reduced with the advance of the fall season and there is practically no buying by the railroads for bridge construction. The car works, too, are remaining out of the market, and appear to be hopeful of securing better prices. The agricultural sections of the country give much more evidence of prosperity than those dependent upon the industries, and in these collections are far better than they have been at any time during the year. Failures for the week ended Oct. 13, as reported by *Bradstreet's*, were 223 as compared with 192 the previous week, 220 in the same week of 1909, 244 in 1908, [illegible]

THE COPPER MARKET.

VERY much more life was exhibited in the copper market last week than during any similar period since last spring. Foreign buyers were in the market to a considerable extent, and according to the reports made by the selling agencies purchases for export were very liberal. One authority has made public the estimate that within two days 75,000,000 lb. of copper were sold to domestic consumers and foreign dealers. Handlers abroad seem more anxious to buy than the melters at home. The result of this movement was an

Standard Copper.	Bid.	Asked.	[illegible] Price.
Spot	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]
January	[illegible]	[illegible]	[illegible]

[illegible]

	Noon.	Closing.
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest.	Lowest.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

advance in the selling price of all grades of copper by the producers, which in turn, of course, had a checking effect upon the buying enthusiasm. The majority of the transactions recorded last week were for November-December delivery, and quite a number of them extended into next year. As far as deliveries for the month of October are concerned it is not at all unlikely that they will show a decline. As deliveries, both domestic and foreign, represent the buying of from thirty to sixty days in advance the present movement will not affect the monthly statistics. It is believed, however, that the steps taken two months ago to curtail production will be reflected in the next report, and that therefore the surplus stocks on hand will show a marked decrease. During the past week lake copper was sold in this market at 12.87½, and electrolytic sold as high as 12.77½. It [illegible] the week these prices were slightly shaded, but the bulk of the trading was done around the top figures. Imports of copper [illegible] during the past week. Exports, as stated above, are not running as heavy as during September. For the month up to and including Oct. 17, exports were 10,157 tons. The daily call on the Metal Exchange Oct. 17 quoted standard copper as per accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

American Power & Light Company.—At a recent meeting of the stockholders of the Hanford Irrigation & Power Company, control of which has passed into the hands of the American Power & Light Company, as published in our issue of Sept. 22, a new board of directors was elected, and the following officers were subsequently chosen: Michael Earles, president; Judge C. H. Hanford and H. M. Walthew, vice-presidents, and G. F. Nevins, secretary and treasurer. The board of directors includes Guy W. Talbot, of Portland, Ore., vice-president and manager of the Pacific Power & Light Company, a subsidiary of the American Power & Light Company; William Jones, of Tacoma, Wash.; Henry Carstens, of Seattle; Gerald Frink and E. S. McCord. At the office of the American Power & Light Company it is stated that the reports published in the West concerning the organization of a large holding company which would engineer extensive developments at Priest Rapids on the Columbia River probably refer to the organization some months ago of the Pacific Power & Light Company. It is estimated that it is possible to develop at this point 300,000 hp. Only a small portion of these water rights are now controlled by the American Power & Light Company, and for the present only a moderate improvement of the Hanford plant is contemplated. Almost the entire business of this company is pumping water for irrigation purposes, although it also serves one or two small towns with energy for lighting.

Westinghouse Electric & Manufacturing Company.—It was stated last week that the New York, New Haven & Hartford Railroad Company had made a contract with the Westinghouse Electric & Manufacturing Company for the electrification of the Hoosac Tunnel, plans for which were referred to in the issue of Sept. 22. It is announced that the work will be started at once, and it is expected to have the road in readiness for operation in the early spring. The general plans of electrification are uniform with those adopted for the main line of the New Haven road. The length of the electrification work is about seven miles, including the four and three-quarters mile tunnel with the approaches. The contract involves about $1,000,000. The Westinghouse company reports at the present time that it is well supplied with orders, and is employing about 19,000 workmen. This is an increase of 9000 over the number employed one year ago. The present rate of orders is running about $3,000,000 a month, or about 50 per cent increase over October, 1909.

Mt. Hood Railway & Power Company.—The Mt. Hood Railway & Power Company, Portland Ore., which did considerable construction work some two years ago, has made necessary arrangements for rapid completion of the construction. The complete project involves three power plants of a combined capacity of 66,000 hp and 25 miles of electric suburban railway. The construction now under way includes the railway running eastward from Portland and the first power development of 16,000 hp. It is expected to deliver power in Portland next August, as a considerable amount of construction and machinery manufacturing has already been done. The engineers for the company, Smith, Kerry & Chace, have assembled at Portland a designing staff from their various offices, W. P. Brereton being in charge of designing, and J. B. Goodwin, formerly of the Niagara Falls Power Company and McCall [illegible]

Westinghouse Turbines for Brazil.—The Rio de Janeiro [illegible] equipment of Le Blanc condensers, circulating pumps, etc. The [illegible] de Janeiro to work in connection with the company's hydraulic plant forty-five miles distant.

Calgary (Alberta) Power Company.—The Calgary Power Company, Ltd., has had under construction in the last year a plant of 19,500-hp capacity on the Bow River, 50 miles west of Calgary. The works consist of a concrete dam 70 ft. high and 400 ft. long, hydraulically operated steel sluice gates for flood control, four penstocks of 250 ft. length, two being 9 ft. 6 in. in diameter and 2 12 ft. in diameter. The operating head will be about 75 ft. Three units are now being installed, two of 2500 kw each, furnished by the Canadian General Electric Company, and two turbines of 3750 hp each, furnished by the Canadian Brown-Boveri Company. The third and fourth machines are of 4000 kw each, with turbines of 6000 hp capacity. One of these units has been ordered, the generator being furnished by the Canadian General Electric Company, the turbine by the Wellman-Seaver-Morgan Company. Energy will be generated at 12,000 volts and transmitted at 55,000 volts. The complete transforming and switching equipment for generating station and Calgary terminal station is being furnished by the Canadian Westinghouse Company, the transformers being three-phase units of 3000 kw each, three being installed in each station. Additional to this there are a 12,000-volt, double-circuit transmission line and a substation of 3000 hp capacity to supply the Exshaw Cement Company with power. The power company also has contracts to supply the Canada Cement Company's mill at Calgary, and the City of Calgary is taking a block of 4000 hp for the operation of the street railway, commercial lighting and general power business. It is expected that the plant will be in operation during the coming winter. The engineers for the company are Smith, Kerry & Chace, and the officers are H. S. Holt, Montreal, president; R. B. Bennett, Calgary, vice-president; C. B. Smith, Toronto and Calgary, managing director.

I. P. Frink.—The reflector manufacturing firm of I. P. Frink has moved into its new factory and offices at 239-243 Tenth Avenue, New York. The concern purchased the property on the corner of Tenth Avenue and Twenty-fourth Street, remodeled the building and has now a first-class plant equal to its needs. The business of the firm had outgrown its rather contracted quarters on Pearl Street, where it had been in operation for more than 50 years. In the new quarters it will be provided with elaborate showrooms for its lighting effects and dark rooms for testing lamps. The firm has recently taken quite a number of large contracts for installing lighting systems, among which are those for the new High School at Wilkes-Barre, Pa.; the Automobile Club of America building, of New York City; American National Bank, of Richmond, Va.; Duquesne National Bank, Pittsburgh, Pa.; Bloomingdales' department store, New York City, in which entirely new fixtures have been installed; Brill Brothers' new store on Broadway, which is being advertised as the best-lighted store in the metropolis; Buckley, Newhall & Company's department store on 125th Street; St. Alphonsus' Church and the new Union Theological Seminary, both in New York.

Colorado & Wyoming Telegraph Company.—The Mountain Telegraph Company, of Denver, which operated about 1300 miles of lines jointly in the interests of the Colorado Fuel & Iron Company and the Victor-American Fuel Company, has been reorganized. The Mountain Telegraph Company will retain about 350 miles of these lines along the Colorado & Southern Railroad, which will be managed as an independent organization, J. R. Waltz having been appointed superintendent to succeed E. E. McClintock, who went to the Western Union Telegraph Company on Oct. 1. The Colorado & Wyoming Telegraph Company has been organized to take over the rest of these lines, and R. E. Fisher has been appointed superintendent. The new company will operate about 1000 miles of line, extending from Southern Colorado to the northern part of Wyoming, and to various mining camps and properties belonging to the Colorado Fuel & Iron Company.

Reliance Operating Company.—The Reliance Engineering Company, of Cincinnati, Ohio, which is general manager of the Spencer Light, Power, Heat & Water Company and the Indiana Electric Transmission Company, and which designs and builds complete industrial establishments, electric power plants and interurban traction roads, has formed a company called the "Reliance Operating Company," which will handle supplies of all kinds used by central stations. The company will be glad to receive from manufacturers catalogs and discounts.

Western Union Telegraph Meeting.—The annual meeting of the stockholders of the Western Union Telegraph Company was held last week, and all of the old board of directors were re-elected. The financial report of the company for the year which ended June 30, 1910, was published in our last issue. In his annual report President Robert C. Clowry said that, while the business of the company has shown a very satisfactory increase and the financial condition was now very encouraging, it had been thought best to continue the annual dividend at 3 per cent, because the directors considered that no change should be made until such reorganizations and improvements in the property shall be made as will enable better and extended facilities to be offered to the public. "To meet the growing demands of the plant and traffic," said Mr. Clowry, "the general superintendent of the first division, Belvidere Brooks, was appointed general manager, and the number of general divisions was increased from four to six. Greater authority has been given both to general and district superintendents, and many changes have been made which will increase the efficiency of the organization and promote the welfare of employees. It has not in the past been possible for this company to keep a large proportion of its offices open both day and night, Sundays and holidays, but under the arrangements which are now in operation in some sections of the country, and which will soon extend to all, it is expected that we will be able to maintain continuous telegraph and cable service twenty-four hours a day and every day in the year." Mr. Clowry said that the response of the public to the new night-letter service, which was introduced during the past year, had been very gratifying.

Western Electric Company.—The prospects now are that the Western Electric Company will be able to live up to its previous estimate of a gross business for the year of $61,000,000. September was a very satisfactory month, the total sales being an increase of 40 per cent over those of September, 1909. October, which is usually one of the largest fall months, has so far been well up to expectations, and will show a proportionate increase. The business is well distributed among the various departments of the company and is also well distributed territorially. There are now 24,000 employees on the company's pay roll, which is the largest number since 1906. The company's fiscal year ends Nov. 30. At a special meeting of the directors in Chicago last week an expenditure of $900,000 was authorized for the expansion of the Hawthorne plant. It is given out that this increase in capacity is needed to take care of the growing business.

General Electric Company Sales.—While the sales of the General Electric Company fell off slightly in September as compared with both August and July, they were still sufficiently large to warrant the belief that the year's business will amount to between $70,000,000 and $71,000,000. The July orders were approximately $6,000,000; those of August about $5,700,000, and those of September $5,600,000. A gratifying feature of the company's business during the current year has been the extremely narrow range within which the monthly records have fluctuated. Early in January the officials were inclined to estimate that the gross business for the year would reach $80,000,000. In the late spring this estimate was modified, as orders did not keep at the rate at which they started early in the year.

Monorail Railroad Approved.—The Public Service Commission of the First District of New York has granted permission to the Pelham Park Railway Company and the City Island Railroad Company to put into operation the newly constructed monorail line between Bartow Station, on the New York, New Haven & Hartford Railroad, and City Island. The permission is contingent upon making some minor track changes and rewinding the car motors as suggested by the commission's engineers. The commission also limits the speed of the cars to 15 miles an hour for the present. Severe tests were made in the presence of the commission's engineers and the road was pronounced safe.

MacGovern, Archer & Company.—MacGovern, Archer & Company have bought out the apparatus of several stations of the Edison Electric Illuminating Company of Boston. These stations are located at Alston, at which 4000-hp generators were installed; at Brookline, at Waltham and at Woburn. The lighting company will have substations using transformers at these points hereafter.

Sale of Western Electric Real Estate in Chicago.—The Pennsylvania Railroad Company has purchased from the Western Electric Company about five acres of land lying south of Polk Street and between the South Branch of the Chicago River and Stewart Avenue, in Chicago. It is said that the deal represents $1,800,000, the price of the land being $8 a square foot. The property will be used for an extension of the Pennsylvania's freight terminal. It has a frontage of 400 ft. on the Chicago River, and was used as the Polk Street works of the Western Electric Company, before the manufacturing operations of the company in Chicago were concentrated at the large Hawthorne plant.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Pittsburgh, Pa.; Annapolis, Md.; Paintsville, Ky.; Lakefield, Minn.; Bethany, W. Va.; Birmingham, Ala.; Libby, Mont.; Sandpoint, Idaho; Joliet, Ill.; Manhattan, Kan.; Interlochen, Mich.; Irwin, Pa.; Palisade, Col.; Cananea, Sonora, Mex.; Montreal, Que., Can.; Nashville, Tenn.; West Allis, Wis.; Prairie du Sac, Wis.; Newport, Ky.; Greenville, Tex.; Lewiston, Maine; Seattle, Wash.; Albia, N. Y.; Shelbyville, Tenn., and Clarion, Pa.

Columbia Gas & Electric Company.—The Columbia Gas & Electric Company, of Huntington, W. Va., has negotiated a deal whereby it will purchase the entire production of the Continental Oil & Gas Company, amounting to 15,000,000 cu. ft. daily. It is believed that this will eventually lead to the Continental company buying the output of all of the independent natural gas companies in the Guyandotte district.

U. S. Naval Academy Power Plant.—Supplementary specifications have been issued for the power-plant equipment of the U. S. Naval Academy, which introduce considerable changes in the original specifications, dated Aug. 17, 1910. A copy of the "Addenda" may be procured by application to the superintendent of the Naval Academy, Annapolis, Md., upon the deposit of $10. Bids are to be opened Nov. 12.

Westinghouse Turbo-Generators for Perth Amboy.—The Westinghouse Electric & Manufacturing Company has recently received an order from the Public Service Corporation, of New Jersey, for two 5000-kw, 13,200-volt, three-phase, 60-cycle, 1800-r.p.m. turbo-generators. These will be installed in the new power house of the Public Service Corporation at Perth Amboy, N. J.

Financial.

The Week in Wall Street.

OPINIONS are practically unanimous that last week was the most encouraging that Wall Street has experienced in the past five months. This is not due so much to the actual upward movement of prices—although this in itself was satisfactory—as to the general improvement in tone, the reawakening of interest and the birth of a sentiment akin to positive optimism with regard to the future. Although for the past three weeks there has been an evident buoyancy in the market, it was mainly demonstrated in the stubbornness with which prices refused to recede under the depressing tactics of the manipulators rather than by the definite advance of prices. It now seems that the market has been pretty thoroughly liquidated, and is in a condition where free buying may be expected. The selling had been in a measure overdone, and good dividend-paying stocks were quoted at prices much below their investment value. With the money market in the easy position it has maintained for many months, this could have been explained only by the far-extending lack of confidence. If the present upward movement means that confidence is being restored, we shall shortly have activity of trading and a fair bond market. As far as business is concerned, the latter is more to be desired than the former. Scores of industrial and transportation improvements are already planned, and are simply waiting for a favorable security market to be put into execution. When this time comes and the wheels begin to turn it will mean increased commercial business for the entire country. Every outside influence at the present time is in favor of an improvement in Wall Street. The political situation, while interesting, is in nowise disturbing; the financial condition is easy and business troubles are remarkably few, and the final returns from the crops are far better than had been anticipated earlier in the season. While there has been a slight advance in the rates charged by the banks for call money, terms are still very cheap. Quotations Oct. 17 were: Call, 2¾@3½; ninety days, 4¾@5 per cent. The quotations in the table are those of the close Oct. 17.

NEW YORK.

	Oct. 10.	Oct. 17.	Shares sold.		Oct. 10.	Oct. 17.	Shares sold.
All.-Ch.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All. Ch., pfd.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Amal. Cop...	[illegible]	[illegible]	82,500	Mackay C.,pf.	78¾	[illegible]	[illegible]
Am. D. T..	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Am. Loc.....	[illegible]	[illegible]	3,900	Met. St. Ry..	15*	[illegible]	[illegible]
Am. Loco., pfd.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am.Tel. & C.	85	[illegible]	1,500	Steel, com....	70⅝	[illegible]	[illegible]
Am. T. & T..	137⅝	[illegible]	[illegible]	Steel, pfd.	[illegible]	[illegible]	[illegible]
B. R. T.	[illegible]	[illegible]	21,750	W. U. T....	74½	[illegible]	[illegible]
Gen. Elec.	[illegible]	[illegible]	4,700	West'h, com..	70	72	[illegible]
Int.-Met.	[illegible]	[illegible]	33,300	West'h. pfd...	125*	124*	[illegible]

PHILADELPHIA.

	Oct. 10.	Oct. 17.		Oct. 10.	Oct. 17.
Am. Rys.	[illegible]	[illegible]	Phila. Elec.	[illegible]	[illegible]
Elec. Co. of A....	[illegible]	[illegible]	P. R. T.	[illegible]	[illegible]
Elec. St. B'ty	49	51	Phila. Trac.........	83	[illegible]
E. S. B'ty, pfd.....	30*	[illegible]	[illegible]	[illegible]	[illegible]

CHICAGO.

	Oct. 10.	Oct. 17.		Oct. 10.	Oct. 17.
Chi. City Ry...	[illegible]	180*	Chi. Tel. Co........	120	[illegible]
Chi. Rs., Ser. 1 ..	[illegible]	[illegible]	Met. El. Com.	[illegible]	[illegible]
Chi. Rs., Ser. 2 ..	[illegible]	17⅝	Met. El., pfd.......	61*	[illegible]
Com. Edison...	[illegible]	[illegible]	Nat'l Carbon	[illegible]	[illegible]
Chi. Subways	[illegible]	[illegible]	Nat'l Car., pfd.....	119½	[illegible]

BOSTON

	Oct. 10.	Oct. 17.		Oct. 10.	Oct. 17.
Am. T. & T........	138	[illegible]	Mex. Tel.	[illegible]	[illegible]
Cum. Tel..	[illegible]	[illegible]	Mex. Tel., pfd. ..	[illegible]	7*
Edison E., Ill......	270	266	N. E. Tel.	[illegible]	[illegible]
Gen. Elec..........	151	[illegible]	W. T. & T.	[illegible]	19*
Mass. E. Ry	[illegible]	[illegible]	W. T. & T., pfd....	90*	[illegible]
Mass. E. Ry., pfd...	84*	[illegible]			

*Last price quoted.
†Shares sold for week Oct. [illegible] to Oct. [illegible]

Financial Notes

Edison Electric Illuminating Company of Boston.—At the annual meeting of the stockholders of the Edison Electric Illuminating Company of Boston Robert Saltonstall, who was elected in September to succeed the late George Dexter, was reelected, as were the other retiring directors. Thomas K. Cummins was elected a member of the executive committee to succeed Mr. Dexter. The gross earnings for the year which ended June 30 were $4,709,466, an increase of about $600,000. The total net earnings were $2,602,228. After paying fixed charges, dividends and taxes, there was a surplus left of $413,548. The number of incandescent lamps connected at the close of the fiscal year (of 16-cp equivalent) was 1,432,407; the number of arc lamps, 10,919; motors, horse-power, 57,093. President Charles L. Edgar in his report said that the acquisition of the electric properties, taken over Sept. 1, 1909, had resulted in a very material increase in the earnings of the company, and that, carrying out the policy of the company to share increased earnings both with customers and stockholders, a reduction in the price of energy from 12 to 11 cents per kw-hour was made on Jan. 1, 1910, and an increase in the regular dividend from 2½ per cent to 3 per cent quarterly was made in May, 1910. The condensed balance sheet showed total assets of $28,887,130.

Chicago Consolidation Ordinance Passed.—The City Council of Chicago has passed the Consolidated Traction ordinance, clearing the way for the merging of the Consolidated Traction Company properties with that of the Chicago Railways Company. There is every reason to believe that the ordinance will be approved by the Mayor and be accepted by the Chicago Railways Company, in which case the latter company takes over the control of the Consolidated properties. The work of rebuilding the line will be started without delay. Some of the main lines may be rehabilitated this fall. The Chicago Railways Company has been making preparations to rush the work as soon as the ordinance is approved. Under the new ordinance the company must at once order 215 new cars.

Receivers for Chicago & Southern Traction Company.—Joseph E. Otis, president of the Western Trust & Savings Bank, of Chicago, and Matthew Slush have been appointed receivers of the property of the Chicago & Southern Traction Company, which operates an electric interurban railway between the southern portion of Chicago and Kankakee, Ill. The receivers were appointed on the application of the Western Trust & Savings Bank and the majority of the bondholders. The complaint filed in the Circuit Court set forth that the company had defaulted in bond interest for the last two years. The company operates 80 miles of track. Mr. Slush has been its president.

Mexican Power Plants Projected.—It is said that plans have been completed to finance in Denver $500,000 worth of securities of the Mayo River Power & Land Company, which is the beginning of a project for the construction of three large power plants on the west coast of Mexico. The company, it is said, has secured the perpetual water rights from the Mexican government on the Rio Mayo, Rio Humaya and Rio Santiago, together with 115,000 acres of agricultural, mineral and timber land. The estimated cost of the three developments is $5,682,000. Among the Denver men interested are Thomas Keely, vice-president of the First National Bank; J. B. Andrews, assistant to the president of the Denver & Rio Grande Railroad; F. F. Struby and L. T. Durbin, of the Denver Tramway Company; John T. Foster, I. B. Perkins and W. O. Temple. The combined dams and systems when completed, it is estimated, will develop 300,000 hp, and will furnish energy for railroads, factories and towns for 12,000 miles along the west coast of Mexico. It is also stated that a tentative contract has been made to furnish the Harriman lines in Mexico with energy.

Washington, D. C., Electric Lines to Merge.—It is stated that at a meeting of the stockholders of the Washington, Alexandria & Mt. Vernon; Washington, Arlington & Falls Church and Washington-Virginia Electric Railway companies last week a plan to merge the three was approved. It is understood that C. P. King, of Philadelphia, president of the first-named company, will be the head of the new corporation, and that the board of directors will include most of the members now acting in the same capacity for the various lines. The general offices of the new company will be in Washington. This consolidation is said to be the first step toward a combination with the companies in which the Goulds are interested, and which are now building electric lines between Washington and Richmond, Va. The Gould road is already in operation between Richmond and Ashland, Va.

Pacific Telephone & Telegraph Company.—While no statement has been given out of the earnings of the Pacific Telephone & Telegraph Company for the past three months, it is well known that they are showing large increases over the same period of 1909. With the increase in gross business comes the announcement that a proportionate increase is being made in the monthly allotment applied to the special maintenance reserve fund. On June 30 there was chargeable to this fund $3,406,743. This was an increase of $744,369 in the first half of the year. This reserve account is provided for from the expense account, and has been approximately $125,000 a month. It is said, however, that during the last three months the rate has been increased to $175,000 a month. It is the plan of the management of the company to increase this fund to $5,000,000.

Telephone Improvement Company.—The Telephone Improvement Company was incorporated at Albany last week, with a $3,000,000 capital, to manufacture and deal in telephone instruments, apparatus and appliances. Of this capital stock, $500,000 is to be 7 per cent cumulative first preferred, $550,000 7 per cent non-cumulative second preferred, and $1,950,000 common. This is the company formed by the consolidation of the Telechronometer Company of Rochester and the North Electric Company of Cleveland, and of which Frederick C. Stevens, formerly State Commissioner of Public Works, is the organizer and president, as detailed in our issue of Sept. 29. The principal offices will be located at Attica, N. Y., and the manufacturing plant at Rochester. The other directors associated with Mr. Stevens are: Charles H. North, James B. Hoge, of Cleveland; Merton E. Lewis and Garrison Babcock, of Rochester; Edward E. Clement, of Washington, and Alfred Stromberg, of Chicago.

Quebec Railway, Light & Power Company.—The earnings of the Quebec Railway, Light & Power Company, according to recent reports, have been substantially better during the current year than they were during 1909. The last report, showing the earnings for August, is gross $129,323, as against $115,136 the previous year. Expenses were $64,030, as against $57,659. The net earnings increased from $57,477 to $65,293. The report shows that the company is in excellent operating condition.

DIVIDENDS.

American District Telephone Company of New Jersey, quarterly, 1 per cent, payable Oct. 29.

Binghamton Light, Heat & Power Company, quarterly, preferred, 1½ per cent, common, ¾ per cent, both payable Oct. 15.

Columbus (Ohio) Railway Company, preferred, quarterly, 1¼ per cent, payable Nov. 1.

Connecticut Railway & Light Company, quarterly, both preferred and common, 1¼ per cent, payable Nov. 15.

Cuyahoga Telephone Company, preferred, quarterly, 1½ per cent, payable Oct. 31.

Edison Electric Illuminating Company of Boston, quarterly, 3 per cent, payable Nov. 1.

Electric Bond & Share Company, quarterly, preferred, 1¼ per cent, payable Nov. 1, common, 2 per cent, payable Oct. 15.

Grand Rapids Railway Company, preferred, quarterly, 1¼ per cent, payable Nov. 1.

Guanajuato Power & Electric Company, preferred, quarterly, 1½ per cent, payable Nov. 1.

Havana Electric Railway Company, quarterly, preferred, 1½ per cent, common, 1½ per cent, both payable Nov. 12.

Michigan State Telephone Company, quarterly, preferred, 1½ per cent, payable Feb. 1, common, 1¾ per cent, payable Dec. 1.

Milwaukee Electric Railway & Light Company, preferred, quarterly, 1½ per cent, payable Oct. 31.

Montreal Street Railway Company, quarterly, 2½ per cent, payable Nov. 2.

Railways Company General, quarterly, 1 per cent, payable Nov. 1.

Sayre Electric Company, preferred, quarterly, 1¾ per cent, payable Oct 15.

Western Electric Company, quarterly, 2 per cent, payable Nov. 1.

REPORTS OF EARINNGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
American Telephone & Telegraph Company:					
[illegible]	[illegible]	[illegible]	[illegible]	$1,249,941	$6,580,259
[illegible]	[illegible]	603,016	7,509,562	1,536,138	[illegible]
[illegible]					
[illegible]	[illegible]	8,761,868	5,416,380	[illegible]	[illegible]
[illegible]	[illegible]	9,488,484	5,005,369	[illegible]	[illegible]
East St. Louis & Suburban Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60,866
[illegible]	[illegible]	[illegible]	89,078	[illegible]	[illegible]
Edison Electric Illuminating Company, of Boston:					
[illegible]	[illegible]	[illegible]	2,602,228	......	[illegible]
[illegible]	4,111,343	[illegible]	2,340,387	......	[illegible]
Electric Light & Power Company, of Abington & Rockland:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Houghton County (Mich.) Electric Light Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	......	172,384	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	305,801	[illegible]
Milford & Uxbridge Street Railway Company:					
[illegible]	[illegible]	16,918	[illegible]	[illegible]	3,684
[illegible]	[illegible]	14,037	[illegible]	[illegible]	[illegible]
[illegible] Light & Power Company:					
[illegible]	[illegible]	......	[illegible]	......	[illegible]
[illegible]	[illegible]	......	227,340	......	98,416
[illegible] Electric Railway Company:					
[illegible]	[illegible]	[illegible]	30,442	......	......
[illegible]	[illegible]	[illegible]	[illegible]	......	......

General News

Construction News.

BIRMINGHAM, ALA.—Plans are being [illegible] Nashville Railroad Company [illegible] road shop at Boyles. which will include construction of power house, car shops, engine houses, etc., and will involve an expenditure of about $750,000.

BIRMINGHAM, ALA.—The Southern Equipment Company, 2601 Twenty-third Avenue, North, Birmingham, Ala., is reported to be in the market for an air compressor direct-connected to an alternating-current, 2-phase, 220-250-volt motor; the compressor to be capable of lifting 1,000,000 gal. of water, 80 ft., every 24 hours.

BIRMINGHAM, ALA.—The special committee appointed to make investigations as to the requirements of the municipal electric light and water works plants at North Birmingham has recommended improvements made to the systems, involving an expenditure of $38,575, of which $2,395 would be required for the electric system and include the installation of generator and switchboard, at $950; arc transformer and switchboard, at $645, and rebuilding of transmission lines, $600.

MOBILE, ALA.—The contract for installing electrical fixtures in the municipal building was awarded to the Mobile Electrical Company, of Mobile, Ala.

MOBILE, ALA.—The Mobile Light & Railway Company has awarded a contract to the Jett Brothers Contracting Company for the construction of an addition to its car barn, at Monroe Park, to cost about $11,000.

MONTEVALLO, ALA.—Plans are being considered by Dr. R. A. Berry for the installation of an electric light and power plant to provide electricity for lighting residences and power for dairy and farm machinery. The proposed plant will be located on the stream on the Berry farm.

PHŒNIX, ARIZ.—The Consolidated Telephone & Electric Company has commenced work on the erection of its long-distance telephone line from Yuma to Tucson.

PRESCOTT, ARIZ.—Preparations are being made by the Arizona Power Company for the erection of a new transmission line from Jerome to Fossil Creek, 163 miles in length. The company has secured contracts from three large irrigating companies along Verde River for energy to pump water from the river to irrigate several hundred acres of land. In the Cherry mining district several operating companies are considering the use of electricity for operating the mines. The United Verde Copper Company has recently started its 400-hp blower, utilizing electricity for operating the same. The company is also preparing to start up a 300-hp compressor, which will make a total of 2300 hp furnished by the Arizona Power Company. The cost of the transmission line is estimated at $100,000.

TUCSON, ARIZ.—Preparations are being made by the Great Western Power Company for the construction of a reservoir and power development in Sabino Canyon. The work will include the construction of a tunnel to divert the water of the canyon to permit the construction of the dam. The cost of the work is estimated at about $1,000,000. W. B. Alexander is consulting engineer.

ARKANSAS CITY, ARK.—Preparations are being made by the Southwestern Interurban Railway Company for the construction of an electric power plant in Arkansas City.

ALAMEDA, CAL.—The proposed contract between the City of Alameda and the Great Western Power Company for supplying electricity in connection with the municipal electric light plant was settled at a meeting of the City Council Oct. 4, when the Council sustained Mayor W. H. Noy's veto of the ordinance, and M. W. Simpson, city attorney, was directed to take necessary steps to have the matter submitted to the voters on referendum vote at the next city election. Opposition to an outside corporation gaining any foothold in Alameda in competition with the municipal plant was the cause of the Mayor's veto and the decision to pass the question up to the voters.

CARRVILLE, CAL.—The Trinity Gold Mining & Reduction Company is constructing a 200-ton reduction mill and electric power plant near Carrville. It is expected to have the plant in operation early in November.

INDEPENDENCE, CAL.—The Town of Independence has entered into a contract with the Board of Public Works of Los Angeles for electrical service to be furnished from the Owens River plant when completed. Under the terms of the contract the town will pay a bonus of $500, which the Board of Public Works of Los Angeles demanded toward the cost of installing the system. The cost of the lines and the transformers at Citrus Road is estimated at $1,250, and the erection of the distributing system in Independence at $500 additional. The contract is for a period of three years, under the terms of which electricity will be supplied at the following rates: Up to 8 kw, $1 per month; 8 to 50 kw, 12 cents per kw-hour; [illegible] 10 cents, 200 to 300 kw, 9 cents; 3[illegible] more, 7 cents. The price for street lamps is fixed at $60 each per year and $10 per lamp per year for incandescent lamps of 32 cp.

LOS ANGELES, CAL.—Sealed bids will be received by the High School Board of the Los Angeles City High School District until Oct. 27 for furnishing and installing electric light fixtures in the annex to the Polytechnic High School Building.

OAKLAND, CAL.—Work has commenced on the construction of a new subsidiary power plant in the West Oakland yards of the Southern Pacific company, which will be used in connection with the project of equipping its Oakland and Alameda local lines for electrical operation. Electricity for operating the system will be transmitted from the Fruitvale power plant. The plant, complete, with equipment, will cost about $100,000.

OCEAN PARK, CAL.—The Edison Electric Company, it is reported, is constructing a new boiler house at its plant in Ocean Park.

OROVILLE, CAL.—With the settlement of the suit brought by the Great Western Power Company against the various Maack estates in this county, the power company has practically secured its rights of way for a second tower line of high-tension transmission lines from Oroville to Oakland, Cal.

PALO ALTO, CAL.—The Board of Public Works has adopted specifications for transformers for the municipal electric light plant and has authorized bids to be called for same.

PORTERVILLE, CAL.—The Porterville Interurban Electric Railroad Company is reported to have purchased a 10-acre tract in the Girder Ranch on which it proposes to erect a power plant to supply electricity to operate its proposed electric railway. The system will radiate from Porterville, extending east to the foothills apple and timber country, west to the Poplar and Woodville districts and north and east through Frazier Valley to Lindsay and Exeter, penetrating the Porterville orange districts.

RED BLUFF, CAL.—The Tehama County Telephone Company has been granted a franchise to construct a telephone system in Tehama County under the terms of which work must begin on erection of the line within sixty days. Joseph P. Tait is president of the company and H. P. Andrews is secretary.

REDWOOD CITY, CAL.—The residents of Menlo Park and Fairs Oaks, near Redwood City, have organized a lighting district and will establish an electric lighting system.

SACRAMENTO, CAL.—Notice of appropriation of 10,000 in. of water in Mill Creek, to be used for power purposes, has been filed by T. H. Ramsey.

SANTA BARBARA, CAL.—Preparations are being made by the Santa Barbara Gas & Electric Company for the construction of a transmission line, carrying 10,000 volts, from its power station on Castillo Street to the substation in Montecito, at an approximate cost of $10,000. Work will commence on construction of the substation as soon as the site is selected.

SANTA CRUZ, CAL.—The City Council has accepted the proposition of the Coast Counties Light & Power Company to supply power for sewage pumping system at $150 per month, and to install a new street lighting system throughout the city, consisting of 100 arc lamps, and to furnish electricity for same at $4.50 each per month. The municipal electric plant is worn out and would have to be practically rebuilt to meet the demands made upon it. The Council decided that the prices offered by the Coast Counties Power Company for the service were cheaper than the municipal plant could furnish it. S. Waldo Coleman is manager of the Coast Counties Light & Power Company.

PALISADE, COL.—Application has been made to the City Council by the Mutual Light, Power & Telephone Company for a twenty-year franchise to furnish electricity for lamps and motors in Palisade. The company proposes to erect a plant at the Farmer's Mine, east of the town, where cheap fuel can be obtained. It also proposes to supply electricity in Palisade and Clifton and also to the farms and orchards between the two places. The company agrees to turn the plant over to the city at any time after an appraisement has been made and also that the maximum charge for energy for lamps shall not exceed 10 cents per kw-hour. The capital stock of the company is placed at $50,000. The incorporators are: H. H. Younger, H. R. Hough, C. Crew, H. L. Davis and others, all of Palisade.

PUEBLO, COL.—The Pueblo & Suburban Traction & Lighting Company is contemplating the construction of an interurban electric railway from Pueblo to La Junta, for which surveys are being made. John F. Vail is general manager.

WASHINGTON, D. C.—Bids will be received at the office of the [illegible] War Department, Washington, D. C., until Oct. 26 [illegible] conductor field wire. Captain A. S. Cowan is chief signal officer.

WASHINGTON, D. C.—The Commissioners of the District of Columbia are considering the question of restoring the lamps on the suburban

roads. Recently 347 lamps were discontinued on the ground that the cost of maintenance could be better applied to the illumination of other sections of the districts.

WEST PALM BEACH, FLA.—The plant and holdings of the West Palm Beach Telephone Company have been purchased by M. E. Gruber and others, of West Palm Beach. The new owners will make improvements and extensions to the system, work on which will begin at once.

ATLANTA, GA.—The Georgia Power Company, successor to the North Georgia Electric Company, has filed with the city clerk its acceptance of the terms of the franchise offered by the Atlanta City Council, and a bond of $25,000 has been deposited by the power company with the city. The company has been granted a fifty-year franchise, under the terms of which the company is given the right to sell electricity for lamps, heat and motors, paying the city to begin with one per cent of its gross income, to be increased eventually to 3 per cent. The company will furnish the service from its large hydroelectric power plant, located near Gainesville, Ga.

BRUNSWICK, GA.—The City & Suburban Railway Company has applied to the State Railroad Commission for permission to issue $100,000 in capital stock and $200,000 in first mortgage bonds.

DALTON, GA.—The Oconee Power Company, of Cleveland, Tenn., has applied to the City Council for a franchise to furnish electricity in Dalton, Ga.

DALTON, GA.—Bonds to the amount of $125,000 have been sold by the City of Dalton, the proceeds to be used for improvements to the municipal electric light plant and other purposes. H. S. Jaudon, of Savannah, Ga., is consulting engineer.

DUBLIN, GA.—At an election to be held in December the proposition to issue $25,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant and water works system, will be submitted to a vote.

FAIRBURN, GA.—The State Railroad Commission has granted the Fairburn & Atlanta Railway & Electric Company permission to issue $75,000 in capital stock and $50,000 in first mortgage bonds. The company is building an electric railway from Fairburn to College Park.

GRIFFIN, GA.—The Spalding Cotton Mills Company has awarded the Central Georgia Power Company, of Macon, Ga., a contract to supply electricity to operate its mills, consisting of 12,000 spindles and a large number of looms. The power company has nearly completed its distributing station at Griffin, Ga.

MACON, GA.—It is reported that the Massaa & Felton Lumber Company will equip its plant for electrical operation. The company, it is stated, has contracted for electricity.

MILLEDGEVILLE, GA.—Improvements are being made to the local street lighting system, including the installation of many new arc lamps and rearrangement of old lamps. An all-night service has recently been established. The electrical service is supplied by the electrical department of the Oconee River Mills.

NICHOLLS, GA.—The Nicholls Telephone Company has awarded the contract for the installation of an exchange in Nicholls to D. H. Peterson, of Peterson & Hughes, of Douglas, Ga.

THOMASVILLE, GA.—A new engine is being installed in the municipal electric light station. This will double the output of the plant.

HONOLULU, HAWAII.—The local telephone company at Hilo is contemplating the construction of a new telephone exchange, to cost not less than $25,000.

BURKE, IDAHO.—The Marsh Mining Company is building a machine shop on its property in Burke, which, it is said, will be equipped for electric motor drive.

LEWISTON, IDAHO.—It is reported that the Independent Telephone Company is planning to extend its toll lines from Spokane to Lewiston, connecting here with the Nez Perce co-operative system.

LEWISTON, IDAHO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 22, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States post office building at Lewiston, Idaho, in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Lewiston, Idaho, or at the above office. James Knox Taylor is supervising architect.

LUCILE, IDAHO.—Plans are being considered by the United Placer Mines Company for the installation of a 5000-hp hydroelectric plant in Lucile. Walter Hovey is consulting engineer.

SANDPOINT, IDAHO.—It is reported that the Idaho Power & Concentrating Company will soon award a contract for the construction of a flume 7150 ft. in length, and other improvements to its plant at Trestle Creek, which will involve an expenditure of from $30,000 to [illegible].

BELVIDERE, ILL.—The City Council is considering the question of [illegible] Belvidere.

CHICAGO, ILL.—Preparations are being made by the Chicago City Railway Company to extend its railway from the Sixty-third Street line through the Stickney tract, to connect with the Chicago & Joliet Electric Railway, near the Corn Products plant.

JOLIET, ILL.—Work has commenced on the construction of the new power plant of the Illinois Steel Company in Joliet. The plans call for [illegible] the equipment to include three 3000-kw gas generating units. The new plant will replace the present steam engines and steam-driven pumps, and the entire works will be equipped for electrical operation. Waste gas from coke ovens will be utilized for fuel. The cost of the plant complete is estimated at about $1,000,000.

STREATOR, ILL.—The plant and holdings of the D. Heenan Lighting Company are reported to have been purchased by the W. H. Schott Company, of Chicago, Ill. It is understood that the new owners will extend the heat and lighting systems throughout the city.

INDIANAPOLIS, IND.—The Washington Hydraulic Company, recently incorporated with a capital stock of $25,000, is planning several power developments along the Tippecanoe River. The company proposes to construct a series of dams across the Tippecanoe River to create backwater at points from the mouth of the river north to Jefferson Township and Carroll Township, a distance of 16 miles. The power will be utilized to generate electricity. The directors are Harry Wade, A. J. Hammond, Daniel E. Storms, A. E. Wade and James E. Watson. The headquarters of the company are located at 308 K. of P. Building, Indianapolis, Ind.

PORTLAND, IND.—The Jay County Commissioners have granted a franchise to S. B. Smith, representing a syndicate formed to supply electricity for lamps and motors in several towns and cities in eastern Indiana.

PRINCETON, IND.—The machine shop and power plant of the Southern Railway Company, at Princeton, Ind., was damaged by fire on Oct. 8, causing a loss of $200,000. The other departments were badly crippled owing to the destruction of the electric generators and air compressors. The plant will be rebuilt at once.

ALBIA, IA.—The Oskaloosa Home Telephone Company has purchased the controlling interest in the Albia Telephone Company, which operates an exchange of about 1000 connections. It is understood that plans are being considered for rebuilding the exchange and installing the central battery system. J. S. Moon will be retained as president and John Renz as manager of the company.

HOSPERS, IA.—William Stovers has submitted a proposition to the Commercial Club offering to install an electric light plant in Hospers provided that sufficient number of residents subscribe for electrical service.

MAGNOLIA, IA.—At an election held Oct. 11 the citizens voted in favor of the proposition to grant the Bullock Public Service Company, of Omaha, a franchise to construct and operate an electric light plant in Magnolia. E. A. Bullock, of Omaha, Neb., is president of the company.

OTTUMWA, IA.—The Ottumwa Railway & Light Company is erecting a new power plant on South Jefferson Street in Ottumwa. The power house will be 112 ft. x 34 ft. of brick and concrete construction.

ATCHISON, KAN.—The stockholders of the Atchison Railway, Light & Power Company have authorized an increase in capital stock of the company from $900,000 to $1,500,000, the proceeds to be used for improvements and extensions to its system. The property of the Atchison company was recently purchased by the McKinley syndicate. Announcement has been made that the McKinley syndicate will extend the railway to St. Joseph, Topeka and Kansas City.

CANTON, KAN.—The Motor Grand Traction Company, which was formed about a year ago, has been reorganized with the following officers: M. M. Bremen, of Roxbury, president; S. M. Law, of Canton, vice-president; S. A. Blue, of Canton, secretary; C. M. Gray, of Canton, treasurer, and B. F. Dole, of Doles Park, general manager. The company proposes to construct and operate an electric railway from Canton to Roxbury.

COUNCIL GROVE, KAN.—The local electric light plant is reported to have been purchased by the R. J. Rhodes Lumber Company at a receiver's sale. The new owners, it is said, will continue to operate the plant and propose to reconstruct the plant and install new machinery as soon as possible. J. J. Rhodes is manager of the lumber company.

HOPE, KAN.—Contracts have been awarded for material and equipment for the municipal electric plant as follows: For switchboard, instruments, regulators, transformers, etc., to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for $1,424, and for material for pole line, etc., to the Western Electric Company, of New York, N. Y., at $6,399. D. L. Stromquist, superintendent of the Herrington Water and Light Department, has charge of the work.

MANHATTAN, KAN.—The Rocky Ford Milling & Power Company, which operates a power plant on the Blue River, four miles north of Manhattan, has been reorganized under the name of the Blue River Power Company. Plans are being made to increase the output of the power house to 1000 hp, machinery for which has already been purchased. The plant furnishes electricity for operating the Rocky Ford mill and also to the City of Manhattan. The company will supply energy to operate the pumping station in Manhattan.

NATIONAL MILITARY HOME, KAN.—Sealed bids will be received at the office of the treasurer of the Western Branch, National Home Disabled Volunteer Soldiers, National Military Home, Kan., until Oct. 22 for furnishing and installing an electric elevator in the general mess hall building. Plans may be seen at the office of the quartermaster and specifications and blank proposals and other information may be obtained upon application to Major W. W. Martin, treasurer.

PRETTY PRAIRIE, KAN.—The Town Board has granted a franchise

to J. J. Siebert to establish an ... The franchise provides for a maximum ...

COVINGTON, KY.—The ... Railroad Company has applied to the City ... franchise to extend its railway in the lower section of Covington. The company is planning to construct a railway to connect ... in length. M. J. Crouch is interested ...

NEWPORT, KY.—It is reported that the Newport Rolling Mill Company is in the market for an ... kw, 200-volt, direct-current generator, direct connected to an automatic non-condensing engine, complete, with switchboard and instruments.

PAINTSVILLE, KY.—Plans are being prepared for the construction of an electric light plant and water-works system in Paintsville, Ky. Stuart H. Bowman and H. H. Hughes, of Huntington, W. Va., are reported to be interested in the project.

LEWISTON, MAINE.—Preliminary plans are being made by the Union Electric Company, of Lewiston, Maine, for the construction of a hydroelectric development at Clarks Rips, Lewiston. The proposed plant will develop about 20,000 hp, which will be transmitted to Lewiston and Auburn, a distance of about ten miles, to be utilized for industrial purposes. The old Googin dam, located about a mile below the site of the proposed dam, is to be repaired and used to generate power to operate the machinery during the process of construction.

ANNAPOLIS, MD.—All proposals received Oct. 1 for power plant equipment to be delivered at the Naval Academy, Annapolis, Md., have been rejected and the work will be readvertised at an early date on amended specifications.

ANNAPOLIS, MD.—The contract for addition to the power plant and distributing system at the Naval Hospital, bids for which were opened Sept. 10, has been awarded to the Noel Construction Company, of Baltimore, Md., at $19,...

ANNAPOLIS, MD.—Bids will be received at the Navy Department, Washington, D. C., until Nov. 12 for completing power plant at the United States Naval Academy, Annapolis, Md. Plans and specifications can be obtained on application to the superintendent of the Naval Academy, Annapolis, Md., for which a deposit of $10 will be required to insure return of same. Beekman Winthrop is acting secretary.

HAGERSTOWN, MD.—It is reported that negotiations are under way with the Hagerstown Street Railway Company to extend its railway from Williamsport across the Potomac River into Berkeley County to North Mountain, Tomahawk, Glengary and other points.

BOSTON, MASS.—Preparations are being made by the Boston & Maine Railroad Company for the construction of locomotive and repair shops, which will involve an expenditure of about $2,500,000, work on which will commence immediately. It is understood that the shops will be located in the vicinity of Boston.

BOSTON, MASS.—Sealed proposals will be received at the office of Fred H. Seavey, county sheriff, until Oct. 31, for installation of electric wires, fixtures and appurtenances for the male portion of the Suffolk County jail and the residence of the sheriff of Suffolk County, adjacent to the jail, in accordance with plans and specifications, which may be secured at the above office.

CLINTON, MASS.—It is reported that a deal has been closed between the Connecticut River Power Company and the Metropolitan Water Board whereby the Connecticut company will purchase all the energy generated at the Wachusett Reservoir dam, at Clinton, Mass. The additional power will be used in connection with its system, which supplies electricity to Worcester and Fitchburg, Mass., and other cities and towns. An appropriation of $125,000 has been made by the State of Massachusetts for establishing a power station at the dam to develop from 2500 hp to 3000 hp. The reservoir supplies water to the City of Boston and surrounding cities and towns. The contract is for a period of five years.

FITCHBURG, MASS.—The Boston & Maine Railroad Company is reported to be contemplating equipping its repair shops in East Fitchburg for electric-motor drive, electricity for which will be purchased from a local company.

FITCHBURG, MASS.—The ... Railroad Company has awarded the contract for equipping the Hoosac tunnel for electrical operation to the Westinghouse Electric & Manufacturing Company. The contract includes complete equipment of the tunnel and erection of power plant capable of generating sufficient power to handle all trains at that point. The cost of the work is estimated at about $1,000,000, work on which will begin at once. The tunnel is nearly 5 miles in length.

HOLYOKE, MASS.—The Board of Public Works is contemplating the installation of tungsten lamps for street lighting. It is expected that tungsten lamps will be placed on many of the streets, eventually replacing the arc lamps now in use.

MARION, MASS.—The Marion Gas & Electric Company is contemplating extending its system to Bourne. The company now supplies electrical service as far as Onset.

BAY CITY, MICH.—The State Railroad Commission has granted the Bay City Power Company permission to issue bonds to the amount of $500,000, the proceeds to be used for extensions to its system, including the purchase of additional machinery.

DETROIT, MICH.—The Edwin ... Mich., is reported to be securing estimates for power plant equipment for its new tannery.

DETROIT, MICH.—Edmunds & Jones, 404 Moffat Building, Detroit, Mich., it is reported, are having plans prepared for an addition to their automobile factory, 67 ft. x 200 ft., three stories high, also a power plant.

GRAND RAPIDS, MICH.—Contingent upon the reorganization of the Grand Rapids-Muskegon Power Company, which will probably be effected within ninety days, extensive improvements are contemplated. Plans are being prepared for extension of transmission lines to North Park, Mill Creek, Spring Lake, and from the Kent City substation to Casnovia, Sparta and along the lake front at Muskegon. The cost of the work is estimated at $200,000.

HILLMAN, MICH.—It is reported that interests connected with the Hillman Electric Light & Water Company are contemplating the installation of another hydroelectric power plant in this vicinity.

INTERLOCHEN, MICH.—Plans are being prepared by Harlin Brown for the construction of a hydroelectric power plant in Interlochen for the purpose of supplying electricity for lamps and motors in the towns of Mesick, Buckley, Wexford, Glengarry, Harrietta, Interlochen and Traverse City and surrounding districts.

SIDNAW, MICH.—A company, composed of local business men, is reported to have purchased the electric light plant which was damaged by fire some time ago.

AUSTIN, MINN.—The Electric Light and Water Board has awarded a contract to the Allis-Chalmers Company, of Milwaukee, Wis., for a 750-kw generator, for $17,600.

COLERAINE, MINN.—The Oliver Iron Mining Company is planning to supply electricity for industrial purposes in Coleraine and to surrounding towns.

HIBBING, MINN.—Preparations are being made for the installation of a new street lighting system. Fifty-six magnetite arc lamps and constant-current transformer will be installed, contract for which has already been placed.

LAKEFIELD, MINN.—Plans are being considered by the Village of Lakefield to enlarge the municipal electric light plant. The installation of a new generator is under consideration.

ST. PAUL, MINN.—The St. Paul Promotion Company, recently incorporated, is planning to begin work on the construction of its proposed system of interurban railways, radiating from St. Paul to Farmington, Northfield, Faribault, Mankato and other southern Minnesota cities. Philip W. Herzog is president of the company.

BAY ST. LOUIS, MISS.—The question of calling an election to vote on the proposition to issue $75,000 in bonds, the proceeds to be used for the construction of an electric light plant, street work, etc., is under consideration by the City Council.

ROLLA, MO.—It is reported that the City Council is contemplating extending the municipal electric lighting system into the territory recently taken over by the city.

ST. LOUIS, MO.—The West End Light & Power Company is reported to be making preparations for the construction of its proposed electric plant.

AVON, MONT.—The Avon Local Home Telephone Company, recently organized with a capital stock of $10,000, is planning to install a telephone system in Avon, work on which will begin at once.

CLINTON, MONT.—Arrangements are being made by the Triangle Mining & Development Company, of Missoula, Mont., for the installation of machinery for a 100-ton concentrating plant on its property in Clinton in the near future. All the machinery will be equipped for electric motor drive. Electricity for operating the plant will be secured from the Bonner plant of the Missoula Light & Water Company.

HELENA, MONT.—It is reported that the City Council is contemplating replacing the present arc-lamp system with tungsten lamps.

LIBBY, MONT.—Plans are being considered for the installation of an electric light plant, water works and telephone systems in Libby, at a cost of about $100,000.

SACO, MONT.—Plans are being prepared by the Moore Telephone Company for the erection of a new exchange. A new switchboard will be installed.

OMAHA, NEB.—All proposals for installing electric wires and conduits for power and light wires and also for telephone conduits for the Douglas County court house, bids for which were opened Oct. 10, were rejected. J. W. Bedford is county commissioner.

SILVER CREEK, NEB.—The Village Board is reported to have granted a franchise to Messrs. Ives and Brown Brothers to install and operate an electric light plant.

BERNARDSVILLE, N. J.—The Bernardsville Water Company has ... tric incandescent lamps of 30 cp instead of 25-cp lamps at the rate of $15 each per year, instead of $12 per lamp as under the present contract. The company also agrees to keep fixtures and lines in repair and to renew lamps without charge.

NEWARK, N. J.—The Common Council has adopted a resolution calling for the extension of the City Hall lighting plant. It is proposed to use the excess power to light the Center Market and such fire houses and ...

[illegible] a contract to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for two 5000-kva, 13,200-volt, three-phase, 60-cycle, 1800 r.p.m. turbo-generators, to be installed in the new power house at Perth Amboy, N. J.

ALBIA, N. Y.—Preparations are being made by William C. Geer for the construction of a hydroelectric power plant. The plant will be located on the Burden Pond and will develop about 300 hp. A company has been organized under the name of the Geer Hydro-Electric Power Company to operate the plant and will supply electricity to operate the mills of the Troy Knitting Company and the Albia Box & Paper Company, of Albia. Surveys are now being made and it is expected to have the plant completed by spring.

BOLTON LANDING, N. Y.—It is reported that the taxpayers of Bolton Landing have signed a petition asking the Town Board to enter into a contract with the Bolton Light & Power Company to supply electricity for lighting the streets and municipal buildings for a term of ten years.

NEW YORK, N. Y.—Notice has been given by the supervising architect, Treasury Department, Washington, D. C., that the date for receiving bids for electric elevator equipment, pneumatic door operating system and construction of the new post office building at New York, N. Y., has been extended from Nov. 3 to Dec. 1, 1910. James Knox Taylor is supervising architect.

OSSINING, N. Y.—The Hudson River & Eastern Traction Company has applied to the Public Service Commission for authority to issue $50,000 additional capital stock and $850,000 in bonds. The company operates an electric railway in Ossining and is contemplating extending its railway from the present terminus in Ossining to White Plains, a distance of about 14 miles, at a cost of about $621,000.

UTICA, N. Y.—The Utica Gas & Electric Company has placed a contract with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for two 1000-kva, self-cooled, new tubular type transformers.

WILLIAMSTON, N. C.—The contract for lighting the town by electricity has been awarded to the Virginia-Carolina Peanut Company, of Williamston.

ADDYSTON, OHIO.—Bids will be received until Oct. 25 by Benjamin Fangman, village clerk, for lighting the streets, alleys and public places in the village, the bidders to state the cost per lamp.

ASHTABULA, OHIO.—The American Fork & Hoe Company is reported to be preparing plans to double the output of its power plant.

CINCINNATI, OHIO.—The Board of Hospital Commissioners will receive bids until Oct. 25 for light figures for the contagious hospital group. Samuel Hannaford & Sons, Sixth Avenue & Vine Streets, Cincinnati, Ohio, are architects.

CLEVELAND, OHIO.—The Cleveland, Barberton, Coshocton & Zanesville Railway Company is reported to have awarded the contract for the construction of its proposed railway to connect Cleveland and Zanesville to the Canadian Construction Company, of Quebec, Que., Can. J. J. Breittinger is president of the railway company.

COLUMBUS, OHIO.—It is reported that plans are being prepared for the construction of a new factory for the Felber Biscuit Company, of Columbus, Ohio. The building will be equipped for electrical operation, sprinkler system, etc.

COLUMBUS, OHIO.—It is reported that the Public Securities Company, recently incorporated with a capital stock of $160,000, will take over the gas and electric plants in Hyomea, Spencer and Coal Mont, Ind., and reorganize the properties. Carl J. Kiefer, G. B. Gilbert, Jackson Keifer, E. M. Gilligan and Henry Kiefer are interested in the company.

DAYTON, OHIO.—The Dayton Motor Car Company is reported to be erecting an addition, 46 ft. x 56 ft., to the power house of plant No. 3.

DAYTON, OHIO.—The C. W. Raymond Company, manufacturer of clay-working machinery, is constructing a large plant at Bolander Street and Broadway, in this city. Several of the buildings have been erected and machinery installed. The plant will be equipped for electric motor drive throughout. Apparatus yet to be provided includes equipment for power plant and some special machinery for the main shop.

LEBANON, OHIO.—Preparations are being made by the Valley Telephone Company for extensive improvements to its local system, including the erection of a new exchange building and the placing of its wires in underground conduits.

FAIRVIEW, OKLA.—The City Council, it is reported, is contemplating making extensions to the municipal electric light system.

TULSA, OKLA.—The capital stock of the Oklahoma Union Traction Company has been increased from $100,000 to $400,000. The company is planning to construct a bridge across the Arkansas River and extend its railway to West Tulsa in the near future. L. Cox is superintendent.

FOREST GROVE, ORE.—Improvements and extensions have been made to the municipal electric light plant, including the installation of a new boiler and engine, at a cost of about $8,000. A day service will be established to furnish electricity for small motors.

LAKEVIEW, ORE.—The Lakeview-New Pine Creek Electric Company is reported to be contemplating the erection of a telephone line from Adel to Bidwell, 32 miles in length.

UNION, ORE.—At an election held recently the proposition to issue bonds for the installation of an electric light plant and for repairs to water works system was carried.

BERLIN, PA.—It is reported that H. G. Kaylor and associates are contemplating the construction of an electric railway to connect Berlin, Somerset and Garrett, for which surveys are being made.

CLARION, PA.—Preparations are being made by the Clarion & East Brady Electric Railway Company for the construction of the first section of its proposed electric railway to Reidsburg, a distance of six miles. The proposed railway will be thirty miles in length and will connect Clarion, Reidsburg, Sligo, Rimersburg and East Brady. The power house will be located in Clarion. It is understood that the company also proposes to furnish electricity for lighting. G. E. Arnold is president.

IRWIN, PA.—Preparations are being made by the Pittsburg, McKeesport & Westmoreland Railway Company for the construction of an electric power plant adjoining its car barn on the Westmoreland line. The proposed plant will furnish electricity for operating its cars and also for lamps and motors to the towns along the State Road, including Circleville, Jacktown, Hahntown, Rillton, Herminie, Irwin and other towns. Contracts for the construction of the buildings and generating machinery have been placed. The equipment will include one 200-hp Buckeye engine, two Babcock & Wilcox boilers, with a rating of 150 hp each, one 150-kw Westinghouse generator with separators, feed water pumps, tanks, etc.; also one 100-hp Buckeye engine and one 75-kw alternating-current generator for lighting service. The cost of the plant is estimated at $30,000. The company now purchases power for operating its system from the West Penn Electric Company. Manning Stires, of McKeesport, Pa., is general superintendent.

McCALL FERRY, PA.—The power plant of the Pennsylvania Water & Power Company was placed in operation Oct. 14. Electricity generated at the plant is now being supplied to the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md. The power company is now negotiating with the United Railways & Electric Company in regard to furnishing the latter with power.

PITTSBURGH, PA.—The West Penn Railways Company is reported to be contemplating extending its railway from Fayette City to Donora.

PITTSBURGH, PA.—The American Locomotive Works is reported to be preparing plans for the construction of a new power plant and special equipment for its works on the lower North Side. It is proposed to equip the plant as far as possible for electric motor drive. The plans contemplated will involve an expenditure of about $500,000.

PITTSBURGH, PA.—The Common Council has approved the ordinance authorizing contracts for electric arc lamps for street lighting for a term of two years at a cost not to exceed $335,000 a year, and for incandescent mantle lamps, the cost not to exceed $105,000. It also has authorized a contract for the construction of a pumping station on the South Side at a cost of $100,000.

WILKES-BARRE, PA.—The Wilkes-Barre Railway Company is reported to be contemplating extensive improvements to its system, including the construction of a new power house and extension of its high-tension wires out of the city.

MOBRIDGE, S. D.—W. W. Seymour, of Philadelphia, Pa., is reported to be contemplating the installation of an electric light plant in Mobridge.

NASHVILLE, TENN.—The Great Falls Power Company, recently organized, proposes to construct a large hydroelectric power plant on the Caney Fork River. Electricity generated at the plant will be transmitted to Nashville to be utilized for industrial purposes. It is expected that work on development of the plant will begin this winter. Fielding H. Yost, Daniel E. McGugin and others are interested in the project.

SHELBYVILLE, TENN.—Preparations are being made for extensive improvements to the local electric light plant, owned by J. F. Boyd, which will include the installation of four new water wheels, a 400-kw generator and construction of new concrete penstock and power house. The cost of the work is estimated at from $20,000 to $30,000. Soloman-Norcross Company, of Atlanta, Ga., has charge of the engineering work.

EL PASO, TEX.—The El Paso Electric Railway Company is reported to be considering the question of extending its railway to Ysleta, a distance of [illegible] miles.

GREENVILLE, TEX.—The City of Greenville, it is reported, has purchased the electric plant owned by H. T. Weathers, of Greenville, for a consideration of $4,000. It is understood that the city will take over the plant Dec. 1 and operate it in connection with the municipal plant. Some changes will be required, as the city plant generates alternating current and the Weathers plant is equipped with direct-current machinery.

GREENVILLE, TEX.—It is reported that the Greenville Railway & Light Company will install machinery in the municipal electric light plant, at a cost of from $8,000 to $10,000, to convert the alternating current generated at the plant into direct current, to be utilized to operate the street railway system, in accordance with an agreement between the company and the City Council, under which the city is to furnish electricity for the street railway and the company to supply and install the equipment.

HEMPSTEAD, TEX.—Work is being pushed rapidly on the new electric light plant in Hempstead. It is expected to have the plant ready for operation by Dec. 1.

KIRBYVILLE, TEX.—The installation of an electric light plant i

Kirbyville is under consideration. W[illegible] interested in the enterprise.

NEW BRAUNFELS, TEX.—The City Council has voted to construct a dam across the Guadalupe River. The proposed dam will furnish about 400 hp, the larger part of which will be utilized by the city. An election will be called to vote on the proposition to issue $75,000 in bonds to build the dam.

PECOS, TEX.—The Pecos Light & Ice Company is reported to be contemplating enlarging its plant.

TEXARKANA, TEX.—The Texarkana Gas & Electric Company is contemplating several extensions to its street car system to the suburban districts.

ROXBURY, UTAH.—The Commercial Club of Roxbury has endorsed a proposition to construct an electric interurban railway from Roxbury to St. Anthony.

HARRISONBURG, VA.—The Town Council has decided to adopt the meter system for furnishing electricity for lamps and will discard the present flat-rate system.

HIGHLAND PARK (P. O. RICHMOND), VA.—The Virginia Railway & Power Company has been granted a franchise by the Town Council to construct and operate an electric light system in Highland Park.

WYTHEVILLE, VA.—It is reported that preparations are being made by the Stone Electric Light & Power Company for improvements to its electric plant. It is understood that a steam plant will be installed at the Wytheville Manufacturing Company's plant in addition to the hydroelectric plant.

ELMA, WASH.—The Chehalis Fir Door Company is reported to be contemplating the erection of a large woodworking plant this fall, which will be equipped for electrical operation.

LOON LAKE, WASH.—The Blue Grouse Tungsten Company, it is said, will require machinery for ore concentration and other purposes in the near future.

MONTESANO, WASH.—Sealed bids will be received by Fred Rosmond, county auditor, until Nov. 7 for furnishing and installing electric fixtures and incandescent lamps in the new court house in Montesano, Wash., in accordance with plans and specifications on file at the office of the county auditor, Montesano, or at the office of Watson Vernon, architect, 447 Finch Building, Aberdeen, Wash.

SEATTLE, WASH.—The Seattle-Tacoma Short Line Company is reported to have awarded a contract for clearing the right of way for its proposed electric railway between Youngstown and Buren Lake. It is expected to have the railway in operation in two years. The engineering offices of the company are located in Seattle. J. B. Murphy is president of the company.

SEATTLE, WASH.—Plans are being considered by the City of Seattle to construct an auxiliary power plant next year, to be located on the shore of Lake Union. Power for operating the plant will be supplied from the Volunteer Park reservoir. The proposed new plant will generate 2000 hp at a small expense, as the waste water from the reservoir will be utilized to operate the plant. From Volunteer Park to the shore of Lake Union there is a drop of 400 ft. A reservoir of about 200,000 cu. ft. capacity will be built. The University of Washington has been asked to join with the city in building the auxiliary plant.

SPOKANE, WASH.—Negotiations are reported to be under way between real estate dealers and the Spokane Traction Company with a view of having the company extend its Corbin Park line northwest and beyond the city limits about two miles. The cost of the work is estimated at about $28,500.

WHITE SALMON, WASH.—The Swan-Hamann Company, which has recently installed an electric generating unit to supply electricity for lighting its plant, it is understood, will later extend the system and equip its mill for electric motor drive.

BETHANY, W. VA.—Extensive improvements are contemplated at the Bethany College, including the erection of a new dormitory, installation of an electric power and heating plants. The electric plant will supply electricity for lighting the Town of Bethany as well as the college.

MORGANTOWN, W. VA.—Surveys are being made by the South Morgantown Traction Company for the proposed extension of its railway to the old Fairmount Fair grounds, a distance of 12 miles. Dudley D. Britt, of Clarksburg, W. Va., is chief engineer.

PARKERSBURG, W. VA.—It is reported that the Parkersburg Electric Light Company is making arrangements to install additional machinery in its power plant, contracts for which have already been awarded. It is proposed to increase the output by 2000 kw. C. H. Shattuck is president of the company.

SWITCHBACK, W. VA.—The Pocahontas Consolidated Company has awarded the contract for the construction of its proposed power house, to cost about $50,000.

BENTON, WIS.—The Minnie Mining Company is reported to be installing a large gasoline engine to operate the hoist and pumps at its mines. The other machinery will be equipped for electric-motor drive, for which electricity will be supplied by the Interstate Power Company, of [illegible], Ill.

CASSVILLE, WIS.—It is reported that contracts have been awarded by the Adams Patent Wheel Company, of Cassville, Wis., for the construction of a new manufacturing plant and power house.

MILWAUKEE, WIS.—The Vilter Manufacturing Company, of Milwaukee, Wis., manufacturer of Corliss engines, ice-making and refrigerating machinery, is making improvements and extensions to its machine shops, including the installation of electrical operating machinery.

NEW HOLSTEIN, WIS.—At an election held recently the proposition to establish a municipal electric light and power plant was defeated. It is understood that the question will be submitted to the voters again.

NEW RICHMOND, WIS.—The New Richmond Roller Mills Company has recently completed the installation of a steam-driven electric power plant, to be used as an auxiliary to its twin water power plants at Huntington, located on the Apple River, five miles from New Richmond. The equipment includes an 800-hp steam turbine and a 525-kw generator. The installation of the steam plant was necessary owing to the low water in the Apple River.

PRAIRIE DU SAC, WIS.—Preparations are reported to be under way by the Wisconsin Power Company for the construction of a large hydroelectric power plant at Prairie du Sac, Wis., on the Wisconsin River. Magnus Swenson, of Madison, Wis., is president of the company.

WEST ALLIS, WIS.—It is reported that bids are being received by Vaughn & Meyer, Majestic Building, Milwaukee, Wis., for motors and other electrical equipment, exclusive of generating units, for the new plant of the Kempsmith Manufacturing Company, at West Allis, Wis. It is understood that the generating machinery has already been purchased.

CALGARY, ALTA., CAN.—Sealed bids will be received by the Commissioners of the City of Calgary until Nov. 12 for furnishing the City of Calgary material and equipment, including rails, cars, overhead material, etc., for extensions to the municipal street railway system. Plans and specifications may be obtained on application to the commissioners. W. D. Spence is city clerk.

ST. BONIFACE, MAN., CAN.—The citizens of St. Boniface are considering the question of asking the provincial government to supply electricity in this territory on a similar plan to that under the control of the Hydroelectric Power Commission in Ontario.

GALT, ONT., CAN.—The Town of Galt is offering debentures to the amount of $66,000, the proceeds to be used for the installation of a municipal plant and distributing system for electricity to be supplied by the Hydroelectric Power Commission in Galt.

LONDON, ONT., CAN.—The London & Northwestern Railway Company has been granted a charter to construct an electric interurban railway between London and Sarnia, 114 miles in length. It is reported that arrangements have been completed and work will begin on construction of the road in the near future. The company is capitalized at $500,000. Daniel A. Stewart is interested in the company.

RENFREW, ONT., CAN.—Debentures to the amount of $117,000 are being offered by the Town of Renfrew, the proceeds to be used for the construction of a municipal plant and distributing system for electricity in connection with the Hydroelectric Power Commission project.

TORONTO, ONT., CAN.—The injunction obtained by the Toronto Electric Company against the City of Toronto, restraining it from erecting poles and wires in the streets of Toronto, has been dismissed, and the city will proceed with the erection of its transmission lines.

MAISONNEUVE, QUE., CAN.—The City Council has awarded the contract for street lighting to the Dominion Light, Heat & Power Company for a period of ten years, under the terms of which the company is to supply arc lamps of 2000 cp at the rate of $80 each per year. The city now pays the Royal Electric Company $115 per lamp per year for 1200-cp lamps. Under the new contract the city will save $35 per year per lamp.

MONTREAL, QUE., CAN.—Preparations are being made by the Shawinigan Water & Power Company for increasing the output of its power plant on the St. Maurice River at Shawinigan Falls. The proposed work will include cutting out a section of the side of the intake canal 1000 ft. long and erecting a concrete and steel bulkhead at an angle of 60 degrees to the present bulkhead. From this extension five steel penstocks, each having a capacity of 15,000 hp, will be carried to the power house to be erected on the lower level, on which there will be a head of 150 ft. The power house equipment will include five units, consisting of turbine water wheels direct-connected to electric generators.

SHERBROOKE, QUE., CAN.—Plans are being prepared by Messrs. Ross and Holgate, of Montreal, Que., Can., for the construction of a new power house on the Magog River. The proposed plant will develop about 3000 hp.

PRINCE ALBERT, SASK., CAN.—The City Council has engaged Charles Mitchell, of Toronto, Ont., Can., electrical engineer, to prepare plans and specifications for the development of water power at Lacelle Falls for the municipality. It is proposed to develop about 10,000 hp, at a cost of about $100,000, beginning with an initial installation of 3000 hp next May.

YORKTON, SASK., CAN.—Contracts have been granted for apparatus for the municipal electric light plant as follows: For meters to the Canadian Westinghouse Company, Ltd., of Winnipeg, Man., for $1,122, and to the Packard Electric Company, of Winnipeg, Man., for transformers, at $814. Contracts for the rest of the equipment will not be awarded at present.

[illegible] generating units with a rating of 3700 kw. A battery of eight large McDougall furnaces is being placed and a new reverberatory plant will be ready for operation within a few months.

New Industrial Companies.

THE CHAPMAN ENGINE & MANUFACTURING COMPANY, of Dundas, Ont., Can., has been granted a charter with a capital stock of $200,000. The company proposes to manufacture engines and machinery.

THE IMPERIAL VALLEY ELECTRIC COMPANY, of El Centro, Cal., has been organized with a capital stock of $10,000 for the purpose of manufacturing electric fixtures and doing a general electrical business. J. W. Frick is president of the company and C. F. Ferguson, secretary.

THE LUCK CEMENT POST MOLD COMPANY, of Aurora, Ill., has been incorporated with a capital stock of $40,000 by John G. Birtness, G. H. Klenze and E. W. Schoede.

THE MOHICAN ELECTRIC ALARM COMPANY, of New York, N. Y., has been chartered with a capital stock of $50,000 to manufacture and deal in electric alarms, signals and supplies. The incorporators are: C. P. Bender, R. T. Ried, of Brooklyn, N. Y., and H. K. Bender, of New York, N. Y.

THE PRISMATIC ELECTRIC SIGN COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $2,000 by David A. Heidman, Julius and Oscar E. Epeneter and others.

THE TELEPHONE IMPROVEMENT COMPANY, of Attica, N. Y., has been incorporated with a capital stock of $3,000,000 for the purpose of manufacturing telephone supplies. The directors are: Frederick C. Stevens, of Attica, N. Y.; Charles H. North and James B. Hoge, of Cleveland, Ohio; Merton E. Lewis and Garrison Babcock, of Rochester, N. Y.; Wilslow M. Mead, of Albany, N. Y., and Alfred Stromberg, of Chicago, Ill.

THE WESTERN CARBON & BATTERY COMPANY, of Seattle, Wash., has been incorporated with a capital stock of $50,000 by James A. Gorman, Ernest H. Stolton and John F. Gorman.

THE WILSON MOTOR CAR COMPANY, of Newark, N. J., has been incorporated by Samuel F. Wilson, John Foley, Jr., of 476 Clinton Avenue, Newark, N. J., and Gustave A. Lutz, of 17 Danforth Avenue, Jersey City, N. J. The company is capitalized at $50,000 and proposes to manufacture and deal in motors, engines, machinery, etc.

New Incorporations.

RED BLUFF, CAL.—The Mission Home Telephone Company has been organized to take over the business of the Pacific States Telephone & Telegraph Company for the Monterey Peninsula. The company will be capitalized at $100,000, and the amount paid to the parent corporation will be $40,000. Thomas J. Field, Arthur G. Metz, E. Cook Smith, Carmel Martin and George S. Gould, Jr., are interested in the new company.

HARRISBURG, PA.—Charters have been granted by the State Department to twelve power and illuminating companies to operate in Northampton, Monroe and adjoining counties as follows: The Washington Power Company, of Washington, Pa.; the Forks Power Company, Forks, Pa.; Palmer Power Company, of Palmer, Pa.; Hamilton Power Company, of Bangor, Pa.; East Stroudsburg Power Company, of East Stroudsburg, Pa.; Lehman Power Company, of Bangor, Pa.; Smithfield Power Company, of Stroudsburg, Pa.; Stroud Power Company, of Stroudsburg, Pa.; the Williamsburg Gas & Electric Company, of Williams, Pa.; the Palmer Gas & Electric Company, of Palmer, Pa., and the Forks Gas & Electric Company, of Forks, Pa. Each company is capitalized at $5,000 and the incorporators are: B. F. Cresson, T. F. McPherson and James W. Fox.

MONTROSE, PA.—The Montrose & State Line Railroad Company has been granted a charter with a capital stock of $150,000 for the purpose of constructing and operating an electric railway from Montrose to the New York and Pennsylvania State line, a distance of fifteen miles. The incorporators are: H. E. Paine, president; F. H. Widmyer, F. W. Ogden, W. J. Douglas, E. C. Randolph, T. P. Hamilton, Howard Fravel, H. J. Paine, of Scranton, Pa., and R. L. Koehler, of Dalton, Pa.

SCENERY HILL, PA.—The Marianna & Scenery Hill Telephone Company has been incorporated with a capital stock of $7,500 by J. W. Shiddler, S. G. Fulton and C. Woonsettler, of Marianna, Pa.

ELGIN, TEX.—The Elgin Telephone Company has been incorporated with a capital stock of $10,000 by L. J. Rivers, W. H. Rivers, Jr., and W. C. Rivers.

GREENVILLE, TEX.—A charter has been granted to the Greenville Railway & Light Company with a capital stock of $300,000 to construct and operate an electric railway, 3 miles in length, in Greenville. The incorporators are: S. A. Price, Albert Emanuel and H. L. Warner.

TACOMA, WASH.—Articles of incorporation have been filed for the Puget Sound, Chelan & Spokane Railway Company with a capital stock of $25,000,000. The company proposes to construct about 1200 miles of electric railway and to develop thirty hydroelectric properties in the State of Washington, aggregating more than 300,000 hp. The W. K. Palmer Company, 717 Dwight Building, Kansas City, Mo., has charge of the engineering work and will supervise the construction work

Personal.

MR. E. H. ROSE, of Los Angeles, has been appointed manager at Martinez, Cal., of the Richmond Light & Power Company.

MR. CARL HERING will present a paper entitled "The Electric Furnace" before the Stevens Engineering Society on Feb. 14.

MR. GEO. E. HULSE, chief engineer of the Safety Car Heating and Lighting Company, will present a paper on "Illuminating Engineering" before the Stevens Engineering Society on April 4.

DR. K. G. FRANK, the American representative of Siemens & Halske, A. G., and Siemens Schuckertwerke, has moved his offices from 50 Church street, to the West Street Building, 90 West street, New York.

MR. W. GODFREY BOYD, JR., formerly with the sales department of the New York office of the Heany Lamp Company, has joined the sales department of the Lamont Corliss Company, 78 Hudson Street, New York.

MR. J. G. SWAIN has resigned as superintendent of light and power of the St. Joseph (Mo.) Railway, Light & Heat Company to become superintendent of motive power of the Cleveland, Painesville and Eastern Railway Company, Willoughby, Ohio.

MR. J. N. WALTON, electrical vehicle expert of the Edison Electric Illuminating Company, of Brooklyn, was married on Oct. 18 to Miss M. McMahan, of Brooklyn. After a honeymoon trip to Niagara Falls, the couple will take up their residence in Brooklyn.

MR. ALFRED W. BEUTTELL, of London, is on another visit to this country, where he will remain for some weeks. Mr. Beuttell will look over the electrical field with a view to arranging for introduction abroad of recently developed electrical apparatus or appliances.

MR. IRVING E. MOULTROP, engineer in charge of construction and installation for the Boston Edison Company, will present a paper entitled "The Design and Construction of a Central Power Station" before the Stevens Engineering Society at its meeting of Nov. 1.

MR. HENRY BOSCH, of the engineering department of the Pacific Gas & Electric Company, of San Francisco, is on a three-months tour of the country to study modern station construction and factory electric power applications. Mr. Bosch was a visitor at the New York Electrical Show.

MR. DANIEL NORRMAN, manager of the De Laval Steam Turbine Company, of Stockholm, Sweden, is visiting this country for rest and recreation. Mr. Norrman has been a visitor to these shores many times, and is incidentally interesting himself in the development of electric heating and cooking devices.

MR. GEORGE BELL has resigned from the Westinghouse Electric & Manufacturing Company to accept the position of general manager of the Shelby County Water, Gas & Electric Company, with headquarters at Shelbyville, Ind. Mr. Bell, who has been connected with the Westinghouse company the past nine years, will assume his new duties on Nov. 1.

MR. C. A. TUPPER, who was for many years in charge of the sales promotion work of Allis-Chalmers Company, and who recently resigned to become manager of the Reliance Engineering & Equipment Company, is making his headquarters at Milwaukee, Wis., 1417-1419 Majestic Building, instead of in San Francisco, as originally contemplated. The change of plans was due to the labor troubles on the Coast.

MR. FRANCIS E. DRAKE, director-general of the Société Anonyme Westinghouse of Paris, has been promoted to the grade of officer in the Legion of Honor. Mr. Drake was in charge of American interests at the Paris Exposition of 1900, at the conclusion of which he received the decoration of Chevalier in the Legion of Honor, and his friends will note with pleasure this renewed mark of distinction on the part of the French government.

MR. E. H. MATHER has become associated with the bond department of Hayden, Stone & Company, bankers and brokers, of New York and Boston, as the expert in street railway, water power, gas and electric light securities. Until recently Mr. Mather has been general manager of the Nassau Light & Power Company, of Mineola, N. Y. He served his engineering apprenticeship with the old Thomson-Houston Company, remaining with the General Electric Company after the consolidation. In 1895 he left that company to become superintendent of the New Haven Street Railway Company. After similar connections with the Central Railway & Light Company, of New Britain, and the Portland Electric Lighting Company, of Portland, Me., he became in 1907 general manager of the Nassau company.

MR. T. R. TALTAVALL, for the past fourteen years associate editor on the staff of the *Electrical World*, has resigned that position to take the editorship of the *Telegraph and Telephone Age*, of which journal he becomes part owner. Mr. Taltavall began his editorial career in 1890 with his brother, Mr. John B. Taltavall, owner of the *Telegraph Age*, which property later was expanded into three journals by the publication from the same office of the *Telegraph Age, Street Railway News* and *Electrical Age*. Mr. Taltavall became editor of the latter journal upon its foundation and remained with it until 1896, when he joined the *Electrical World*. Previous to taking up editorial work, Mr. Taltavall

was one of the prominent telegrap[illegible] and for several years prior to 189[illegible] was supe[illegible] the Associated Press. In later years he has closely followed current advances in telegraphy, which branch he has cared for in these columns. The telegraph field is to be congratulated upon the enlistment of Mr. Taltavall's services, for, in addition to his personal ability and knowledge of the telegraphic art, he brings a broad journalistic experience for application in his new work. This journal will feel deeply the loss of Mr. Taltavall's collaboration, and personally his departure is a matter of keen regret to his associates, which is lightened only by the fact that his new connection will be highly advantageous from the financial standpoint.

Trade Publications.

MULTIPLE UNIT. This syste[illegible] description here, but a new bulletin, No. 4761, just issued by the General Electric Company, should be of interest to railway men.

MILL TYPE MOTORS.—Bulletin No. 4754, issued by the General Electric Company, describes in considerable detail continuous-current and alternating-current motors for use in steel mills and similar places, in connection with cranes, hoists and other apparatus.

MOTORS FOR INDUSTRIAL APPLICATION.—A bulletin (No. 123) recently issued by the Crocker-Wheeler Company, of Ampere, N. J., describes a line of field-weakening, adjustable-speed motors for driving industrial machinery, and points out how economical results are obtained by their use.

BELT-TYPE GENERATORS.—An illustrated pamphlet (Bulletin 122) recently issued by the Crocker-Wheeler Company, of Ampere, N. J., contains much interesting information on the belt-driven generators, including the construction of the magnet frame, armature and commutator, the design and method of application of the field coils, the arrangement of the brush rigging, etc.

ELECTRIC DRIVE.—The Crocker-Wheeler Company, of Ampere, N. J., whose experience in motor drive extends over 23 years, has recently issued a bulletin (No. 120) on its Form I machine, which contains a large amount of useful information on direct-current motor design and is illustrated with half-tone cuts showing varied applications of these motors to machinery.

WESTINGHOUSE PERPETUAL CATALOGUE.—The Westinghouse Electric & Manufacturing Company has just made a distribution of sections for its perpetual catalogue No. 3001. The twenty-four sections in the new distribution cover a wide range of topics. Among the apparatus described are meters, circuit-breakers, arc lamp accessories, static protective apparatus, switchboards, transformers, series tungsten street-lighting systems, etc.

HIGH EFFICIENCY LAMPS.—With this title, the engineering department of the National Electric Lamp Association has reprinted, as Bulletin No. 9B, the paper presented by Mr. S. E. Doane at the St. Louis National Electric Light Convention, in which the effect is discussed of high efficiency lamps on the cost of light to central stations. The bulletin includes in addition reprints of a number of editorials commenting on the paper which appeared in technical journals.

POLYPHASE WATT-HOUR METERS.—The Thomson polyphase watt-hour maters, which are made for the specific purpose of measuring energy in any two-phase, three-phase, or monocycle circuit, are described in Bulletin No. 4762 of the General Electric Company. These meters may be applied to a circuit carrying a mixed load of lamps, motors or other translating devices, and are said to record accurately, irrespective of unbalanced load conditions.

LARGE MOTORS FOR STEEL MILLS.—Bulletin No. 4767, issued by the General Electric Company, illustrates and describes motors designed particularly for use in steel mills. Among them are the 6000-hp, 6600-volt [illegible] Company. The bulletin refers to both alternating and direct-current motors, and contains instructions as to the data which should be furnished when making inquiries in connection with the installation of motors for such purposes.

PORTABLE SUBSTATIONS FOR [illegible]—Bulletin No. 4746, published by the General Electric Company, is described a portable substation for the supply of energy intermittently to electric roads, and to provide for a temporary supply of energy in cases of accidents at substations equipped with only one rotary converter unit. This station consists of a specially arranged car containing a complete substation equipment and may be conveniently moved to any section of the line requiring energy temporarily.

SIGN LAMPS.—The enormous increase in the use of the electric sign is indicative of the increase in competition in connection with all branches of business, and proves that this method of advertising pays. In Bulletin No. 4758, published by the General Electric Company, there is described the highly efficient tungsten lamp, which has contributed and will contribute in still greater degree to the increase in this method of advertising. The bulletin contains a statement of the characteristics of the lamps, wiring diagrams showing the method of changing regular multiple sign wiring to series for sign lamps, and other wiring methods used with these lamps.

AUTO-TRANSFORMERS FOR LOW-VOLTAGE TUNGSTEN LAMPS.—Bulletin No. 4764 of the General Electric Company illustrates and describes a line of auto-transformers for low-voltage lamps. Low-voltage lamps may be used to advantage where small units of light are employed, or in connection with gasoline-engine-driven generating sets, and particularly where the lamps are frequently moved about and subjected to jars. They are also used in connection with ornamental street lighting, and when so used are operated on the standard multiple circuit in connection with an auto-transformer, which is installed in the base of the pole. The bulletin contains data relative to the cost of operating these lamps and shows a diagram of connections.

REMEK TRANSFORMERS.—In the Hungarian language Remek means masterpiece. A line of lighting transformers has recently been placed before the public by the Crocker-Wheeler Company, of Ampere, N. J., to which this name has been applied, and which are radically different in design from any others on the market at the present time. In this machine very low average core-loss and high average efficiency are said to have been effectually combined with many other desirable features. These results are obtained largely through new and original features embodied in the design. The descriptive bulletin (No. 125) which the Crocker-Wheeler Company has published on this subject contains much information of special interest to lighting transformer users.

BUSINESS NOTES.

[illegible] BIGGS & COMPANY [illegible]

AMERICAN ELECTRIC FUSE COMPANY.—Mr. Fred B. Bonde has opened temporary offices at 202 Medinah Temple, 185 Jackson Boulevard, Chicago, Ill., where he will represent the American Electric Fuse Company, of Muskegon, Mich. He will have on hand a complete stock of telephone protector apparatus, rheostats, motor starters, controllers, spark coils and enameled wire.

INDUCTION FEEDER REGULATORS.—Among the large orders that the Westinghouse Electric & Manufacturing Company has recently entered for automatic induction feeder regulators is one for 58 from the West Penn Railways Company, and another for six 100-kw and two 200-kw from the Detroit Edison Company. These regulators will be used on power and lighting circuits.

THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, Philadelphia, was an exhibitor at the recent convention of the Association of Railway Electrical Engineers in Chicago. It displayed several types of I-T-E circuit-breakers. Type "W," designed for train lighting and motor use, was demonstrated by C. E. Wise, of the Chicago office. H. F. Darby, Jr., also represented the company.

THE WISCONSIN ENGINE COMPANY has received a contract for three horizontal, cross-compound, condensing Corliss engines for the Tidewater Portland Cement Company, at Union Bridge, Md., to be direct-connected to 925-kw, 3-phase, 60-cycle alternators. These engines will be furnished with the special valve gear, cylinders and governors peculiar to the "higher speed" Corliss engines built by the Wisconsin [illegible]

Weekly Record of Electrical Patents

UNITED STATES PATENTS [illegible]
(Conducted by W. H. Bissing, Patent [illegible])

3,157. LAMP RECEPTACLE; H. W. Lawrence, Denver, Colo. App. filed Aug. 26, 1909. A sheet metal [illegible] porcelain base for use on moldings, including an insulated wall in the body and a terminal plate surrounded by the wall and a threaded shell surrounding the wall.

72,209. SWIVELING ATTACHMENT FOR ELECTRICAL APPARATUS; J. H. Morley, Johnstown, Pa. App. filed June 26, 1909. For suspending incandescent lamp[illegible] U-shaped springs at the end and a metal sleeve abutting the other end and surrounding the plug and contacting with the arc shaped [illegible]

[illegible],210. STORAGE BATTERY CIRCUIT CONTROLLER AND TESTER; H. N. Motsinger, Pendleton, Ind. App. filed Feb. 9, 1909. A generator, storage battery, meter circuit and three terminal switch blocks for testing the voltage of either the generator or storage battery and for connecting the generator so as to charge the battery.

TROLLEY [illegible]

ELECTRIC HEATING RECEPTACLE [illegible] ceptacle.

PIGTAIL CONNECTION FOR CARBON BRUSHES; W. [illegible]

ELECTRIC HEATER FOR OIL WELLS [illegible]

LOCKOUT DEVICE FOR PARTY LINE TELEPHONES [illegible] ments of the relay utilize the current flowing on the line so that the relay at another station is not operated when the telephone hook at the subscriber's station is in operative position.

LAMP SOCKET [illegible] ing member having separate [illegible] each carrying a conductor, the parts fitting into each other to rotate together with large clearances between the branches for insulation.

FIRE ALARM SWITCH; P. W. [illegible] Rutherfordton, N. C. [illegible]

972,362. FUSE SUPPORTING CONNECTION; L. L. Grant, [illegible] N. Y. App. filed Feb. 8, 1910. Metallic lugs screw threaded and yielding supported conductors contacting with the lugs.

ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed [illegible] operating with the flange.

SNAP SWITCH; [illegible] Boston, Mass. [illegible] the aperture and having an enlarged end and a strain receiving annular member of non-yielding material surrounding the shank.

Attachment Device for Electrical Apparatus.

[illegible],399. ATTACHMENT FOR TELEPHONES; I. W. Nilsson, Balfour, North Dakota. App. filed Nov. 16, 1909. An audible signal which gives the alarm when another person on the party line is using the system, including the receiver fork, with means for setting the mechanism upon the depression of the fork and elements arranged to prevent [illegible] depression of the fork until the signaling mechanism has completed its operations.

[illegible],424. ELECTRICAL RELAY; L. A. Williams, [illegible] contact telephone relay [illegible] frame, a lever armature with a rolling or shifting fulcrum.

[illegible],457. ELECTRICALLY PROPELLED VEHICLE; W. Kohler, Bremen, Germany. App. [illegible] pelled from overhead wires [illegible] pivoted to the vehicle and a lever near the driver for swinging the pipe.

[illegible],468. CLOSED SYSTEM OF ELECTRICAL DISTRIBUTION; R. M. [illegible], Cambridge, Mass. App. filed Mar. [illegible] circuit is normally closed and the supply circuit normally open, the latter being used for ringing bells and being connected to the former through a portion of its resistance.

GROUND CLAMP [illegible]

DEVICE FOR BRAKING TRAMCARS AND ELECTRIC RAILWAY VEHICLES [illegible] the shaft is turned.

[illegible]16. ELECTRIC SIGN FLASHER; R. D. DeWolf, Pittsburgh, Pa. [illegible] an opening to retard the [illegible] and electro magnets for tilting the casing.

972,526. ADJUSTABLE CASING FOR LAMP SOCKETS; L. H. Freeman, Trenton, N. J. App. filed July 28, 1910. A cap with [illegible] and a shell with positioning slots and a locking abutment at one end and an inturned [illegible] engaged by one of the lugs as the other lugs enter the positioning slots.

927,536. ELECTRICAL SYSTEM OF DISTRIBUTION [illegible] rheostat of the booster.

[illegible] DEMAND METER [illegible] 97. A watt meter with means for indicating [illegible] demand during the given interval [illegible] the means to initial position and releases the clutch, the pointer being settable so as to impose a penalty for using power in excess.

MERCURY SWITCH; H. Koch, Rahway, N. J. App. filed [illegible] Switch containing mercury with two socket terminals closed by caps that are perforated and receive the switch pins.

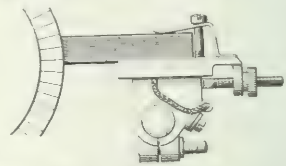
ELECTRICAL FIXTURE; F. E. Seeley, Bridgeport, Conn. App. filed June 17, 1909. Pendent socket with separable members, [illegible] having a projection tending to [illegible] U shape over the projection so as to take the strain.

MOTOR CONTROLLING APPARATUS; S. H. Keefer, [illegible] N. J. App. filed July 28, 1909. Starting and reversing switch [illegible] solenoid with a core and a series of contacts on the core, normally out of engagement with each other, but contacting when the solenoid is energized and a resistance to different points of which the contacts are connected.

CENTRAL TELEPHONE SYSTEM; A. D. T. Lubbey, Elyria, Ohio. App. filed May 28, 1909. Three conductor cord type in which [illegible] independent of the talking conductors with a [illegible] current and a pair of supervisory relays controlling the signal source, one of the relays being connected in the circuit independently of the conversation circuit.

ELECTRICAL RELAY; C. H. North, Cleveland, Ohio. App. filed Nov. 13, 1908. Telephone switch relay with long contact [illegible], an operating lever and a short armature working on a [illegible] air gap so as to multiply the movement produced by the armature.

BRUSH-HOLDER FOR ELECTRIC CONDUCTORS; F. L. [illegible], Columbus, Ohio. App. filed March 8, 1902. A brush



[illegible]—Brush Holder for Electric Conductors.

secured to its support by a resilient clamp which may be adjusted longitudinally of the support.

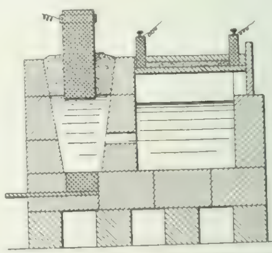
ELECTRICALLY OPERATED BLOCK SIGNAL MECHANISM; R. A. Streeter, Marion, Ia. App. filed June 24, 1908. Upper quadrant signal operated by an electric motor and gearing and [illegible] connection.

APPARATUS FOR LIGHTING MINERS' SAFETY LAMPS; J. C. Boyce, Cardiff, England, and J. H. Phelps, Yokohama, Japan. App. filed July 11, 1908. [illegible]

ELECTRICAL INDICATOR; F. F. Crane, Kansas City, Mo. App. filed June 16, 1909. An electric selector switch with a circular series of contact segments each with a fuse on its end and a rotary switch lever carrying a yielding roller engaging the segments.

TELEPHONE RECEIVING APPARATUS; G. W. Pickard, Amesbury, Mass. App. filed Mar. 11, 1910. For wireless telegraphs and telephones in which a spark terminal is connected with the magnet and pole piece system of a receiver.

[illegible],721. WIRELESS TELEGRAPHY OR WIRELESS TELEPHONY; O. Rochefort, Paris, France. App. filed Nov. 8, 1909. Receiver system consisting in arranging four detectors forming rectifiers so as to arrange between the earth of the bi-polar resonator and the ends of the circuit of the telephone receiver a condenser with three contacts.



972,779.—Electric Furnace for the Continuous Manufacture of Glass.

ELECTRIC FURNACE FOR CONTINUOUS MANUFACTURE OF GLASS; M. Sauvageon, Colombes, France. App. filed [illegible]. Electrodes are immersed in the molten glass at the [illegible] end of the chamber so as to [illegible] the current to the melting [illegible] and refining chamber [illegible] receiving the refined glass.

ELECTRIC FURNACE FOR CONTINUOUS MANUFACTURE OF GLASS; M. Sauvageon, Colombes, France. App. filed Aug. 5, 1909. A [illegible] and refining chamber of small capacity, a lower electrode at the bottom, an upper electrode, the [illegible], a heating resistance, and a working [illegible] chamber to receive the refined glass.

SYSTEM OF ELECTRICAL DISTRIBUTION; J. B. Entz, Philadelphia, Pa. App. filed May 28, 1909. A main battery with pilot cell, the pilot cell first becoming charged with means for [illegible] the main battery and the pilot cell with a switch for interrupting the circuit through the main battery.

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ELECTRIC VEHICLE ASSOCIATION OF AMERICA.

The first convention of the Electric Vehicle Association of America, held in New York last week, clearly disclosed, through its papers and discussions, the need of such an organization, and a most gratifying enthusiasm was displayed by the manufacturing and central-station interests alike in the cooperative movement to place the electric vehicle before the world in its proper light. The program reflected the art as it exists and, considering the newness of the organization and lack of precedents, was excellently prepared. That it by no means sounded all the depths and shoals of the industry was apparent from the very able address of President Blood; for in the enumeration of subjects needing attention he disclosed a veritable mine in which the association can dig with profit for many years to come. The publicity campaign alone is no mean task, and when it comes to standardization, the most aggressive and active work on the part of the association is called for. If the convenience of the user is of any consideration and central stations are to be encouraged to install charging facilities, persistent hammering and blasting at this rock are necessary. A standard charging plug and standard voltage are at present very essential to progress and development in the electric vehicle field, and another important desideratum is the standardization of tires. In the missionary work which inevitably attends all great movements, unanimity in chief essentials is of inestimable worth, and manufacturers might well subjugate competitive interests in these matters for the benefit of the industry as a whole.

Few people appreciate the large number of electric vehicles in operation to-day, the greatest strides having come within the past year or two from improvements in the electric storage battery. In view of the advantages of the electric vehicle, it is, however, astonishing that the public has been so lax in its appreciation. The utilitarian features of the electric vehicle and its superior practicability and economy may have to be proclaimed from the housetops ere much impression is made, and the fund already available for publicity work can be profitably employed in this cause. It is refreshing to note the bright spots presented by those cities where the electrics have established themselves in large numbers through intelligent exploitation of their merits. The examples cited indicate what can be done elsewhere also by similar zealous work on the part of those vitally interested in the sale and upkeep of the vehicles. Battery makers offer encouragement in the shape of improved cells, and the need of lighter electric delivery wagons voiced by central stations will no doubt be heeded by vehicle manufacturers. Taken all in all, the outlook is cheerful. There is much, however, which remains to be taught, but happily there is a growing disposition on the part of prospective users to look into the advantages and economies of the electric vehicle. There is also competition cropping up of no mean proportions in the gasoline field, and it is well for the new organization not to underestimate the strength of the enemy. If the association faithfully adheres to the program already mapped out, its

work will contribute to the stability of the industry and if the enthusiasm displayed at its first convention persists, the electric vehicle is bound to come into its own.

MORE ABOUT THE FIREFLY.

Elsewhere we print two letters which form interesting contributions to a most interesting subject—the light of the firefly. The letter from Professor Thomson is peculiarly instructive, for it is from the large viewpoint of evolution that many details of natural adaptation may be best seen. Certainly if the light of the firefly plays an important part in the life economy of the species, as its mere existence would render probable, then natural selection would certainly be brought to bear to obtain the monochromatic light which seems to characterize it. The question raised by Professor Thomson regarding the small range of wave lengths visible, which apparently would suggest a waste of energy, has a still further physiological answer to complete the case for the wisdom of Nature. The difference of focal plane in the human eye for red and violet rays is nearly 1 mm, and the only thing to which we owe our ability to get sharp focusing at all is the altogether predominant luminosity of a small region in the center of the spectrum. If this region be cut out and an attempt be made to see by the mingled end rays alone, the result is confusion, the muscles of accommodation hunting in vain for a point of distinct vision between the focal planes for red and violet. If we were able to see the infra-red and the ultra-violet with any distinctness, not only would the different resolving power of the two make trouble, as Professor Thomson points out, but there would be no plane in which chromatic aberration would not hopelessly destroy the sharpness of the image. It would be interesting to speculate on the possibility of the evolution through indefinite time of an achromatic eye system instead of the easier course which Nature has taken in providing predominant luminosity in the yellow. Dr. Coblentz in his letter raises further interesting questions along the evolutional line in dealing with the light given by various species of fireflies. If, as seems likely from his note, some species have a more sharply defined luminous band in the spectrum than others, is there histological evidence of a higher specialization in the light-producing organs, or is it in a sense accidental, due perhaps to secondary causes, like different absorption in the tissues of the creature itself? It is to be hoped that Dr. Coblentz will follow up the investigation he has started, since there seems to be considerable evidence in favor of a material diversity in the light given by various species of light-giving insects.

GRAPHIC REPRESENTATION OF THE ELECTROSTATIC CAPACITY OF TRANSMISSION CIRCUITS.

As a means of showing most conveniently the relations between two or more interdependent variables, the graphic method possesses certain decided advantages over the analytical. The most prominent of the advantages is the direct representation of the relative effect upon one variable of a change of chosen magnitude in another variable, which effect is somewhat hidden when the relations are expressed in the form of an equation which must be separately solved for each condition assumed to exist. On the other hand, the graphical method can never give absolutely accurate results, while the analytical is subject only to the errors involved in the initial assumptions, and the results obtained are accurate to the same degree that the assumptions are correct. In many practical problems the constants of the involved equations, and sometimes even the forms of the equations themselves, are known with only a fair degree of accuracy, and in such cases graphical methods can be considered equally accurate with analytical methods for the solution of problems. One of the problems that have generally been considered highly complex when attacked by the usual mathematical methods is that relating to the accurate determination of the electrostatic capacity between the wires of a transmission circuit. The familiar expression of this capacity is in the form of an equation involving the logarithm of the ratio of the distance separating the centers of the wires to the diameter of one of the wires. It has long been known that this equation is only approximate in that it gives impossible values when the diameter is very large as compared with the distance between wires. As was first pointed out by Dr. A. E. Kennelly, an absolutely accurate equation for expressing the capacity is found when use is made of antihyperbolic functions. The equation itself is not complex, but Dr. Kennelly in an article elsewhere in this issue has rendered thoroughly simple the representation of the quantities involved by showing them in graphical form. He has also represented in the simplest possible manner the approximate formula applying over the range where its errors are negligible, the graphs of the formula becoming straight lines when the abscissas are plotted to logarithmic scales and the ordinates to a scale of reciprocals. In conclusion we must tender an apology to Dr. Kennelly for wrongly assigning, in a recent editorial, priority to another for the application of hyperbolic functions to electrotechnics. This application was the subject of an article by Dr. Kennelly printed in these columns in 1894; and furthermore, in a paper presented before the American Philosophical Society in 1909, he showed the application of antihyperbolic functions to the computation of the linear resistances, conductances and capacities between parallel cylindrical conductors or between a cylindrical conductor and a parallel indefinitely extending conducting plane.

WIND AND SLEET IN TRANSMISSION-LINE PROBLEMS.

Few indeed are the problems relating to commercial undertakings that are not affected in some way by the "law of probabilities." The statement just made can be otherwise expressed by saying that in practically all commercial undertakings a certain amount of "risk" is involved. In the erection of transmission lines the law of probabilities is seldom applied, or rather the problems relating to the mechanical features of the lines are usually solved without conscious recognition of any application of the law of probabilities. However, in assigning values to the maximum stresses to which the lines will be subjected the designer is in reality merely assuming that it is probable to a degree beyond the range of recognizable risk that these stresses will not be exceeded. It is evident, therefore, that the designer should have at hand reliable data upon which to base his assumptions as to the maximum stresses.

Of the stresses encountered in transmission-line problems those caused by wind velocities and sleet loads are subject to the most uncertain assumption by reason of the scarcity of reliable data. Our present issue contains an article by Mr. Frank F. Fowle giving a comprehensive review of the data re-

ating to wind and sleet obtained from records of the United States Weather Bureau, with particular reference to the Chicago territory. Observations show that during fifteen years a velocity of 75 miles per hour was reached only once, and 85 miles was not exceeded at any time. During nine years the maximum observed precipitation of sleet was 4.5 in. on one occasion. According to the law of probabilities, the assumption that a wind velocity of 85 miles will never be reached while the sleet is 4.5 in. thick involves a risk that may well be considered negligible. From the curves of probabilities given by the author and from estimates of the cost of constructive material, one could determine just what amount of material to employ in order that the risk assumed should be no greater than the cost of the added material to minimize it still further. However, the error would be on the side of safety if the designer assumed always the existence simultaneously of the maximum known wind velocity and maximum probable load of sleet. The law of probability is receiving sufficient recognition when assigning separately the maximum values to the wind velocity and the sleet load. The article by Mr. Fowle is of much importance in giving valuable data relating to these values. The methods for applying these values in transmission line problems have been discussed fully in articles that have appeared in our columns as follows: Aug. 25, Sept. 29 and Nov. 17, 1906, by Mr. Aug. Bowie, Jr.; Jan. 12 and Sept. 28, 1907, by Dr. Harold Pender; Feb. 29, 1908, by Mr. W. T. Ryan; March 25, 1909, by Mr. . J. Glaubitz, and July 1, 1909, by Mr. H. J. Neall.

STREET SURFACE AND STREET LIGHTING.

The I. E. S. Convention paper of Mr. Preston S. Millar, abstract of which is printed in another column, brings up many interesting points relating to street lighting. The essential thing to which Mr. Millar directs attention is the very great effect of the street surface on the lighting. This evidently must vary immensely with the actual condition of the street surface, and is particularly affected by some of the recent treatments applied to public ways with the view of lessening wear and tear. Of course, the condition on upper Seventh Avenue, New York City, which Mr. Millar cites, is not in the most typical of streets in general, but it is none the less interesting. The situation there found was the polishing of asphalt blocks by automobile traffic until the specular reflection became large, so that the images of distant street lights appeared as points of light on the pavement and hence acted somewhat to increase and render uniform the lighting upon the street. On most streets, save when wet, this phenomenon appears to a very much less degree, and on macadam roads, ...ss treated, hardly at all. Save near grazing incidence the surface of a tarred macadam street is an exceedingly bad reflector, very little if any better than dead black paint on ...d. At grazing incidence under favorable conditions there is enough specular reflection to produce a material increase of radiancy, but roads of this type are such poor reflectors as to be extremely difficult to light as compared with untreated roads or paved streets

We fully agree with Mr. Millar that the reflecting qualities of street surfaces are highly important, particularly in view of the frequency of asphaltic and similar treatment. A normal macadam surface or a pavement more or less dust-covered, ... ordinary blocks, is a very decent reflector, and its effect in brightening the general illumination is very great, particularly when one passes on to it after going along a stretch of asphalted surface on the same street. The latter surface demands from any point of view considerably stronger lighting than the former. Just how much importance should be attached in this connection to the author's theory of silhouetting it is somewhat difficult to say, since while the discernment of objects in general either on the street or anywhere else in a dim light is chiefly due to difference in luminosity between the object and its background, the conditions under which silhouetting from distant lights is of much importance are not altogether common. Large objects may be visible as silhouettes near a distant arc lamp when the street is otherwise in darkness for a considerable distance, but it is not of any particular importance to see objects under this condition. Nobody is much interested in looking at the silhouette of a rapidly departing automobile, and if the car is coming toward him it is by its searchlights and not by its visibility against a bright background that he distinguishes it. When one departs from grazing incidence, the background of an asphalted street is peculiarly bad, and it is often at short range and distant from a light that one has to pick up obstacles in the roadway. The theory of silhouetting therefore furnishes no excuse for bad lighting either near the lamps or far away from them. The more light that reaches the street the better, whether one considers it utilized as a background or as a means of illuminating the objects to be seen.

We are glad to have Mr. Millar directing again vigorous attention to the effect of glare in this connection. A dazzling street lamp is troublesome not only because it produces, as Mr. Millar suggests, a lessened degree of ability to see, due to lessened pupilary aperture, to irradiation, or to too great flooding of the retina with light, but chiefly because the presence of a bright source in the field of view spoils the dark adaptation of the eye which is acquired in moving along a moderately lighted street. The former causes may affect the eye by 10 per cent, 20 per cent or 50 per cent, the latter by many hundred per cent. Even a brief exposure to a powerful and dazzling arc light will put the eye out of condition for seeing faint contrasts in the street beyond for a time much greater than is required for the readjustment of the pupilary aperture. A few seconds at the most suffices for the latter function, while the former will certainly be a matter of many seconds and perhaps minutes. The measurable decrease in ability to see due to the presence of a light source in the field of vision is practically much the least important of the three effects of glare suggested by Mr. Millar. The other effects are not only less transitory but are not avoidable in proportion to the distance of the bright source from the line of vision. One may avoid some of the effects of glare if, as Mr. Millar suggests, there is no lamp within 5 deg. of the object viewed, but a low-hung and dazzling arc will interfere with vision not only when it is well within the field but long after one has passed it. The whole subject is a difficult one since it deals with several totally distinct physiological phenomena in which the absolute amount of light as well as the relative amount plays an important part. Such studies as those of Mr. Millar, however, are of great service in gradually, item by item, bringing to notice details of the theory and practice of lighting which, although they may not have escaped attention, have been overlooked or forgotten by practical men.

Central-Station Statistics.

The summary of central stations published in the October issue of "The McGraw Electrical Directory" gives for the United States, Canada and Mexico a total of 6180 companies, as against 6055 in the April issue. While the increase is thus 125 companies, there are actually 195 new companies given in the October issue, the discrepancy being due to consolidations and mergers, which were larger than usual during the past six months. The total number of companies for the United States is 5669, as against 5550 in the April issue, with 181 new companies added. There are 3578 companies carrying supplies. The number of municipal plants is given by States for the first time, the total number being 1430. There were 1377 in the April issue. The companies using only alternating current number 3760, while there are but 916 using only direct current. An effort is being made to get information for the directory as to the number of plants supplying steam for heating, as well as of those that manufacture ice. The number of plants so far recorded as furnishing steam heat is 226; those manufacturing ice, 105, besides which there are 122 whose names indicate they may be engaged in the manufacture of ice. There are 159 companies doing a purely transmission business and 1220 using water power. There have been 420 new names added to the directory list of electrical dealers and contractors.

International Congress of Inventors.

The annual meeting of the International Congress of Inventors was held at Rochester, N. Y., Oct. 20, at which papers were presented by Messrs. Ludwig Gutmann, St. Louis; Henry L. Doherty, New York; Frank Keiper, Rochester; Fred W. Barnaclo, Utica; L. W. Norcross, Fort Worth; Daniel King, Pinkney, Tenn.; John M. Spellman, Dallas, Tex.; G. E. Callaway, Jonesboro, La.; W. J. Paul, Chicago; William J. Brewer, Troy, N. Y.; M. N. Clark, Los Angeles; W. P. Bryant, Corona, Cal.

Mr. Gutmann in his paper advocated a revision of patent statutes and the institution of a lower patent court and a patent court of appeals. Mr. Keiper, former assistant examiner in the United States Patent Office, advocated the appointment of infringement examiners, who, after a summary hearing on a charge of infringement, could issue an injunction, or recommend that the court issue one. He also advocated the requirement that every patentee shall file annually or biennially a report to the patent office showing operation under his patent; the payment to the patent office of a percentage of the profits from his patent, and the assessment of a tax on issued patents of $5 or $10 every fifth year, the fund thus obtained to be used to protect patents. Resolutions were adopted by the congress endorsing Mr. Keiper's suggestions and authorizing the distribution of his paper, with a view to obtaining further suggestions on the subject. The congress also authorized the framing of a bill based on the paper and suggestions received, for presentation at the next session of the Federal Congress, and pledged the Inventors' Congress to use every honorable endeavor to secure favorable action on the bill.

Decision in Peoria Electric Railway Electrolysis Case.

Judge A. L. Sanborn, of the United States District Court of Madison, Wis., has given a preliminary decision in the Peoria Electric Railway electrolysis case which has been the subject of various court proceedings since 1898, but which actually had its origin in 1894. It was before Judge Grosscup, in Chicago, for some years, then returned to Judge Landis at Madison and finally passed to Judge Sanborn, who in 1907 placed it before a special master for further elucidation. During the course of the suit an immense amount of testimony was taken and many experts pro and con have contributed to the record.

The report of the special master upon which Judge Sanborn acted was that the injury from railway currents to water pipes complained of exists, is permanent and continuing and chargeable to the electric railway company; that the water company can do nothing to prevent the injury; that the railway compan can prevent it by the use of double overhead trolley or by an system which provides a completely insulated metallic circu for the electric current; and that the overhead trolley system though more expensive to install, has been demonstrated to b as safe, economical and satisfactory in its operation as th single-trolley system.

Judge Sanborn in his opinion states that the injury com plained of is localized to the region near the power statio that the damage is decreasing continuously and that the installa tion of the double trolley is unreasonably expensive, its u dangerous and, moreover, it would not entirely prevent th escape of electric current to the ground. After reviewing th several modern methods of rail-return construction, the cou decided that the defendant should be given a reasonable tim to take such measures or put in such improvements to its nega tive return as will substantially prevent injury. The matter o the terms of the decree, as well as the modification of t findings, was deferred for further consideration on applicati for a decree.

Georgia N. E. L. A. Section.

At Atlanta, on Oct. 20 and 21, steps were taken towa the formation of a geographic section of the National Ele tric Light Association, due to the initiative of Mr. John Bleecker, who, with the assistance of Mr. W. R. Collier, h been canvassing the State actively ever since the St. Louis co vention. The meetings were held at the office of the Geor Railway & Light Company, and a constitution adopted wh follows closely the lines of that of the New England Secti It places the voting power in the hands of the operating co panis of the State, while recognizing all the other classes membership now known in the national organization, wh at the present time has in membership in Georgia eleven Cl A members and twenty-five Class B members, as well as a f scattering memberships among representatives of the manuf turing and supply houses. The section thus starts out wit good nucleus, and it is believed that the membership can doubled or even trebled during the coming year.

The following officers were unanimously elected: Presid Mr. John S. Bleecker, Columbus; vice-president, Mr. W. Collier, Atlanta. Executive committee: Messrs. J. J. Cag Macon; R. P. Mayo, Augusta; Burdett Loomis, Jr., Waycro secretary-treasurer, Mr. H. M. Corse, Columbus.

The proceedings of the convention were most agree varied by entertainment on the part of the local electric peo On Thursday a luncheon was given the delegates by the ma facturing and supply concerns, under the auspices of Mr. W. Stearns, of the General Electric Company, and on Fri luncheon was given to the whole convention at the Cap City Club by the Georgia Railway & Light Company, wh officers, President P. S. Arkwright, General Manager G. Brine, and Mr. W. R. Collier, were indefatigable in their tentions and courtesies. During Friday afternoon the pa were also given by the Georgia company an automobile around the city to the various plants and other points of terest.

The National Electric Light Association was represen throughout the convention by Mr. T. C. Martin, secretary, supplied data as to the constitution, methods and practic the other sections already affiliated.

Japanese Officials Inspecting American Electrica Works.

A party of Japanese government officials interested in trical work are on a visit to this country and have inspecte number of electrical plants. The most distinguished visit His Excellency R. Nakakoji, vice-minister of the Depart of Communication of the imperial Japanese government, w has charge of the State-owned railroads, telegraphs and phones of Japan. Accompanying him are two secreta Messrs. H. Suzumura and S. Uchida. These gentlemen are

heir way home from England and arrived in Chicago last week rom Niagara Falls, where they had inspected the hydroelecric plants on Oct. 20. They were met by Mr. J. W. Johnson, nanager, and Mr. James Lyman, engineer of the Chicago office of the General Electric Company, and escorted to the headquarters of the Chicago Telephone Company. Here Mr. B. E. Sunny, president, and Mr. A. S. Hibbard, vice-president of the ompany, took them in charge and showed them through the nain exchange. Later the party visited the main operating uarters of the Western Union Telegraph Company in Chiago and witnessed the complementary operation of the teleraph and telephone.

At luncheon on Oct. 20 the party was entertained at the Jnion League Club, the visitors meeting officers of the companies owning plants visited or to be visited. Mr. J. W. Johnon was the host of the occasion, and in addition to the gentleien already mentioned there were present Mr. K. Yamasaki. apanese consul in Chicago, and Messrs. Ishikawa and Nyshiaki, Japanese electrical engineers temporarily resident in Chicago; also Messrs. Richmond Dean, general manager, and . Dunbar, manager mechanical department, of the Pullman ompany; W. J. Lloyd, assistant general superintendent of the Western Union Telegraph Company; J. G. Wray, chief engieer of the Chicago Telephone Company; G. E. Cullinan, asstant manager in Chicago of the Western Electric Company; ohn F. Gilchrist, assistant to president, and P. Junkersfeld, ssistant to second vice-president, of the Commonwealth Edison ompany.

Following the luncheon the Japanese visitors were taken to e Fisk and Quarry Street generating stations of the Comonwealth Edison Company, later visiting the Hawthorne orks of the Western Electric Company. On Oct. 21 they spected the works of the Allis-Chalmers Company in Milaukee, meeting President Walter H. Whiteside. Returning Chicago, the morning of Oct. 22 was spent in inspecting the ops of the Pullman Company, while in the afternoon the rty witnessed the football game between teams from the niversity of Chicago and Northwestern University. The sitors left for Seattle on the night of Oct. 22.

Automatic Telephone Service for Chicago.

Although the plans of the construction company which is stalling a modern automatic telephone system in Chicago for receivers of the Illinois Tunnel Company are being carried t very quietly, an interesting light on the extent of the terriry that it is desired to cover was given at the meeting of the ty Council on Oct. 17. Alderman Long, of the Sixth Ward. racted attention to the subject by introducing a resolution lling for an investigation into the proposed use for telephone nduits of streets on the South Side at a considerable distance om the central downtown business district which the tunnels the Illinois Tunnel Company underlie.

The resolution was referred to a joint committee composed the three committees on streets and alleys for the North de, South Side and West Side of Chicago. This action was ken because it is said that the automatic people are planning extend their system into the outlying districts of the city all directions, and therefore a large number of aldermen are erested. It is asserted that more than thirty miles of paveent, some of which has been laid only recently, will be torn if the applications of the tunnel company are granted. The uing of the permits will be withheld until the matter can be vestigated.

The matter has a broad aspect, because the Chicago Teleone Company is operating under a recently drawn franchise ing the city close control. The franchise under which the tomatic system of the Illinois Tunnel Company will be opated was granted a number of years ago and is much more neral and generous in its provisions, and many of the alder n seem to think that if there is to be a second general sys n in Chicago, as indicated by these proposed extensions far m the central business district, it should be under the same close municipal control as the existing company. The subject has therefore a greater importance than that of the annoyance of tearing up the streets.

Unusual Suit for Damages.

Mr. Leslie L. Davis, of Buffalo, recently brought an action against the Chautauqua Traction Company, of Jamestown, N. Y., in which he demanded $3,000 damages for an alleged accident of unusual character. The case was tried in Mayville, N. Y., on Oct. 13 and 14. The plaintiff was a passenger in one of the cars of the defendant company in Jamestown on July 29, 1909. The car was standing still at the time of the alleged accident, and another passenger got on with a long piece of galvanized iron pipe. One end of this pipe rested against the car controller. The complainant asserted that the other end of the pipe was off the floor, resting against his left leg at the same time that his left foot was touching the "regulator" (probably part of the motor-driven air compressor) under the seat.

The plaintiff was sitting on the back seat of an open car. He alleged that in some manner a current of electricity escaped from the regulator and gave him a serious shock, injuring his health. The theory of the defense was that, assuming all the plaintiff's preliminary statements to be correct, he could only have received a slight shock, which would not have been at all serious. One witness testified that in a conversation the plaintiff asserted that he received a shock from a 2200-volt current. The defense showed that in no event could the voltage have exceeded 550. Mr. Davis testified that the shock had left him lame and that the left leg has become smaller than the right one. Two doctors testified on the part of the defense that they could find no evidence of any ill health on the part of the plaintiff.

John B. MacDonald, of Buffalo, an engineer of the Westinghouse Electric & Manufacturing Company; Alfred C. Jordan. of the same company; George Kohns, assistant master mechanic of the International Railway Company, of Buffalo; David H. Sperry, of Cleveland, and Frank W. Bullock, superintendent of the Jamestown Lighting & Power Company, Jamestown, N. Y., were called as expert witnesses by the defendant. They all agreed that in the circumstances described by the plaintiff he could have received only a slight shock, if any, whereas if the pipe was resting against the regulator, as was at one time asserted by the plaintiff, he would have received no shock at all. After hearing the testimony the jury retired and returned in ten minutes with a verdict of no cause of action.

Texas Hydroelectric Plants.

The construction of a great reinforced-concrete dam across the Colorado River at a point two miles below Marble Falls and the installation of a hydroelectric plant which will have a capacity of about 30,000 hp are serving to attract attention to the power possibilities of the upper Colorado, the Guadalupe, the San Saba and other rivers that flow through the hilly region of middle western Texas. Already two or three hydroelectric projects similar to that at Marble Falls are being planned and their early consummation is practically assured. One of these is to be located near New Braunfels, on the Guadalupe River, and will be installed and operated by the municipal government of that place. The dam that is to be built across the Colorado River at Austin, thirty miles below Marble Falls, will be of the same type as the one at the latter point of the river.

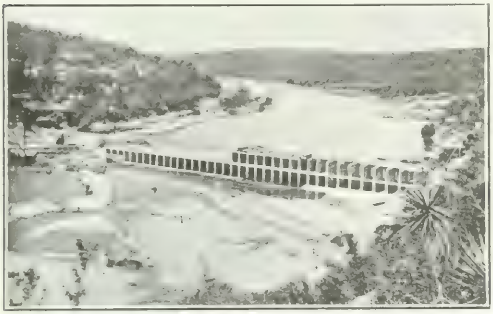
The Marble Falls dam and hydroelectric plant are being erected by Mr. C. H. Alexander, of Dallas, and associates, and the cost of its construction will be about $1,000,000. The reinforced-concrete foundation is embedded in the solid native marble foundation. The superstructure will be four stories in height, making a total height of 65 ft.. Each story is divided into a number of rooms or chambers, separated by 20-in. walls of reinforced concrete. These rooms form a sort of grate work

through which the water may be admitted by means of gates in time of flood in order to relieve the pressure on the dam. The flood gates are of steel.

The base of this dam is 60 ft. wide and the hydroelectric plant will be within the dam. The structure will impound a lake twelve miles long and 1200 ft. to 2000 ft. wide.

The electric energy generated at this plant will be transmitted to a number of towns and cities within a radius of 150 miles, among them being San Antonio, Waco, Austin, Temple, Belton, Georgetown, Llano, San Marcos, Burnet, Taylor, Hutto, Bastrop, Lockhart and Lampasas. It will also be delivered to manufacturing plants and for other purposes in Marble Falls.

Although the dam which is to be constructed across the Colorado River at Austin will be of the same type and size as that at Marble Falls, it will provide for the development of only 6000 hp, all of which will be consumed in Austin. The Austin dam will be constructed by the Hydraulic Properties Company, of New York, which has taken over the contract from the Holmes-Dumont Steel Concrete Company, of Chicago. Under the terms of this contract the city is to pay $1,000,000 for the



Dam at Marble Falls.

construction of the dam and the installation of the hydroelectric plant in semi-annual instalments of $25,000, covering a period of twenty years.

In addition to these two large hydroelectric projects, the early consummation of which is assured, plans are on foot for the erection of other dams and installations of hydroelectric plants, there being a number of available sites along these rivers for enterprises of this kind. In addition to providing electrical generation these proposed dams will store an enormous quantity of water for irrigation purposes.

The construction of an extension of the 'Frisco Railroad from Brady south to Menardville, on the San Saba River, has caused steps to be taken to construct a large dam across that stream with a view of providing water in sufficient quantity to irrigate a large area of valley land, and in connection with the irrigation enterprise a hydroelectric plant will be installed.

Utilization of Proposed Power Development of Los Angeles Aqueduct.

Los Angeles, Cal., is building an aqueduct 240 miles long to supply it with water taken from Owens River. The volume and head of this water will afford an opportunity for creating a hydroelectric development, with an initial development of 30,000 hp or more delivered in Los Angeles. The question has arisen whether the city shall sell this power to consumers itself or shall dispose of it at wholesale rates to the existing electric service companies to be disposed of by them to the actual consumers, utilizing the existing distribution system. This question was discussed at a public hearing held in the council chamber of the City Hall in Los Angeles on Oct. 13.

Mayor Alexander presided at the meeting and there were many other city officials present, as well as representatives of the electric service companies and a number of citizens of [illegible]

President John B. Miller, of the Southern California Edison Company, said the problem before the city was to utilize the proposed supply of electrical energy, making of it an asset with earning power—not a liability or burden upon the city. The problem is not a simple one and is complicated by the existence of the three companies which now give electrical service to the city. These properties represent many millions of investment and employ thousands of men throughout Southern California, and the fate of these investments and of the employment of these men hangs largely upon the city's decision. Mr. Miller expressed his belief in the desire of the people of the city to be fair, and he said that the spirit of his company is one of co-operation and helpfulness. By co-operation it will be possible to obtain an abundance of cheap electricity for the taxpayers without destroying the investments of the companies.

Mr. Walter J. Trask, an attorney, spoke for all three of the companies; that is, the Southern California Edison Company, the Los Angeles Gas & Electric Corporation and the Pacific Light & Power Corporation. He pointed out that the municipal bonds thus far authorized do not include the expense necessary for an electrical distributing plant in the city of Los Angeles or an auxiliary steam plant. To construct these plants would cost from $5,000,000 to $8,000,000. The bonds of the city at present issued and authorized aggregate more than $33,000,000, which is the largest bonded indebtedness incurred by any city of the class of Los Angeles in the United States except Cincinnati.

The speaker also asserted that if the city itself went into the business of distributing and marketing electricity it would have a marked effect on extensions. Los Angeles is growing very rapidly and the extension of electric service to outlying districts has required an expenditure of from $700,000 to $800,000 a year on the part of the companies. If the city should enter the field as a competitor of the companies, the latter would not be justified in extending their systems, but would be compelled to husband their resources and prepare to make the best fight they could to hold the business they now have. This result would be most unfortunate for the development of the city.

The companies have a bonded indebtedness of about $27,000,000, and they pay in city and county taxes more than $1,000 a day. That is more than one-thirtieth of the total amount of such taxes. The companies have expended for distributing systems in the City of Los Angeles about $6,000,000. The city has assumed a moral responsibility toward the companies, and a default on the part of the latter would be a severe blow to Los Angeles, as the companies' securities are held by the leading banks of the city and State, as well as by Eastern banking institutions and the investing public generally.

Mr. Trask suggested the employment of some expert from the East, perhaps from some of the public-utility commissions—a man with practical as well as theoretical knowledge—to act with a board to be appointed to determine what profit the city can make if it constructs a distributing plant, then taking up the subject with the power companies and determining whether a proper adjustment may be made.

Mr. E. F. Scattergood, chief electrical engineer of the bureau of the Los Angeles Aqueduct, was the next speaker. He said that the state of the city's finances must necessarily be considered. It might be wise for the city to endeavor to purchase existing distributing systems at a fair valuation and not proceed to install an independent system unless forced to do so. If the city stands ready to purchase the existing distributing systems at a reasonable price there is no justification in the claim that the electrical energy should be sold to the existing companies.

Mr. Scattergood said that the cost of developing and delivering at a central substation in the city 30,000 hp of electrical energy will not exceed $2,250,000. He remarked that the further cost of a completed distributing system, reaching all consumers within the present city limits and including street lighting, would be about $4,250,000. This system would be capable of taking care of 50 per cent more business than [illegible]

connected to the existing distributing systems. Assuming that the city or any single concern with the investment of $6,500,000 mentioned had all the commercial light and power business and the street lighting, but excluding electrical energy required by railways, Mr. Scattergood said that it could establish a 6-cent base rate for electrical energy sold at a rate of $60 per arc lamp per year for street lighting. After allowing for all operating expenses, interest on the investment at 4½ per cent, a sinking fund of 2½ per cent and "proper depreciation," the excess earnings would be something like $700,000 a year, according to Mr. Scattergood. "These results," said the speaker, "are based on conservative estimates, but could not be accomplished with several different distributing systems and several organizations operating to supply the same service."

There were several other speakers, and it was announced that other hearings would be held later. It is probable that the power companies may submit a general proposition to the city. The Mayor is quoted as saying that the question will be decided ultimately by a two-thirds vote of the citizens.

Mexican Pacific Coast Hydroelectric Plant.

Surveys, estimates and other preliminary arrangements toward the establishment upon the Pacific Coast of Mexico of one of the largest electric power enterprises on the continent have been made. The Mayo River Power & Land Company, composed of Americans, is promoting the big project. According to the authoritative announcement made by the government authorities of the States of Sonora and Sinaloa and the Territory of Tepic, the company has succeeded in financing the enterprise in the United States and the contracts for the construction work will soon be let.

The plans which have been adopted call for the building of three great dams and the installation of that number of hydroelectric plants. These plants will have an aggregate capacity of 300,000 hp, which is about 200,000 hp more than the present capacity of the big hydroelectric plant of the Mexican Light & Power Company near the City of Mexico, although the plans of the latter concern call for the enlargement of its plant to something more than 200,000 hp.

The power-distributing system of the Mayo River Power & Land Company will be very elaborate. It is proposed that the transmission lines shall cover all of the Pacific Slope territory of Mexico, extending from the City of Guaymas on the north to Tepic on the south, a distance of about 700 miles. A number of lines will be built into the mining districts and to the towns and cities, involving all told the construction of about 1200 miles of power transmission lines, it is stated. Tentative contracts have already been entered into by the company with fifteen towns and cities for supplying them with electric light and power. A number of street-railway systems that are now operated by animal traction will be converted into electric transit when the new power is available. One of the most important features of this proposed industrial enterprise is the contract which the company has [illegible] elec-tric power to operate the trains on a portion of the Southern Pacific Railroad of Mexico. It is planned to connect the cities of Guaymas, Culiacan, Mazatlan and Tepic with the hydroelectric plants at the earliest possible time.

The concessions which the Mayo River Power & Land Company has obtained from the State and Federal governments give it the exclusive power rights on the Mayo, the Humaya and the Santiago Rivers. One dam and hydroelectric plant will be constructed upon each of these streams. The surveys that have been made for the proposed dam across the Mayo River in the State of Sonora call for a structure 170 ft. high, 260 ft. long at the top and forming a reservoir of a capacity of 10,280,000,000 cu. ft. of water. The dam across the Humaya River will be 223 ft. high, 708 ft. long at the top and will form a reservoir of a capacity of 11,384,500,000 cu. ft. of water. The dam across the Santiago River will be 215 ft. high, 145 ft. long at the top and will form a reservoir of a capacity of 9,360,000,000 cu. ft. of water.

The hydroelectric plant that the company will install on the Santiago River will furnish power chiefly for the Southern Pacific Railroad of Mexico. Electricity will be used, it is stated, to operate the division of that road which is now being constructed through the Sierra Madres between Tepic and Orendain, the latter place being located on the National Railways of Mexico near Guadalajara.

The Mayo River Power & Land Company has its principal office in Denver, Col., and its representatives have been constantly at work for more than two years locating available power sites and arranging the preliminary details for the project. More than $6,000,000 gold will be invested in the enterprise.

Modern Election Procedure in N. E. L. A. Branch.

The next meeting of the Commonwealth Edison Branch of the National Electric Light Association in Chicago will be held this month at some date after the twentieth, to be determined. This will be the occasion of the annual dinner and election of officers. There are two tickets in the field, and the nominations were made in a manner characterized by fairness and of unusual interest. There was first a "primary" election. Secretary O. R. Hogue prepared a nominating ballot on a blanket sheet containing a list of all the nearly 600 members of the branch, classified under thirty-one departments, as Accounting, Advertising, Contract, Construction, Engineering, Inspection, Meter, Operating, Overhead, Repairs, Stations, Substations, Testing, Underground, and the like. Space was provided at the bottom of the sheet for nominations for each member for chairman, secretary and three members of the executive committee. Members were instructed not to sign these ballots, but to return them to Mr. Hogue before Oct. 1 without marks of identification. As the result of this election two tickets were made up as follows:

For chairman—Mr. J. W. Ferguson, contract department, and Mr. E. F. Smith, substation department.

For vice-chairman—Mr. O. J. Bushnell, meter department, and Mr. W. C. Davis, Fisk Street generating station.

For secretary—Mr. E. J. Doyle, president's office, and A. E. Evans, substation department.

For executive committee (three to be elected)—Mr. A. D. Bailey, Fisk Street station; Mr. N. J. Conrad, testing department; Mr. E. H. Lakeman, construction department; Mr. Guy W. Lunn, Fisk Street station; Mr. W. P. Lyon, contract department, and Mr. A. S. Turnbull, meter department.

For treasurer, Mr. W. A. Fox, of the company, will be reelected without opposition.

The names of these candidates have been printed on an Australian ballot and one ballot sent to each member, who is instructed to mark with a cross the name of the candidates for whom he votes, returning the marked ballot to the secretary by Oct. 20. Both tickets are strong, and the contest is exciting much friendly rivalry between departments. The election is of more than local interest, because it indicates how an event of this character can be treated to arouse a general and healthy interest in every member of a technical or semi-technical society.

Dr. Steinmetz on "Electricity."

Dr. C. P. Steinmetz was the guest of the Electric Club of Chicago on Oct. 20, and he selected as the topic for an after-lucheon talk of twenty minutes the broad subject of "Electricity." He said if he were asked the question, "What is electricity?" he would answer after his questioner told him what gravity is. The latter has been familiar for ages; electrical phenomena have been only much more recently the subject of careful study. Our minds are such, said the speaker, that we really cannot reason out the ultimate nature of things. In trying to do so we get tangled up in contradictions.

Electrical energy is that form of energy that has become familiar to us latest. It is convertible into other forms of en-

ergy. We need energy to do our work; to furnish heat, light, transportation; to prepare our food and make our clothing. Everywhere we are consuming energy. Without a continuous supply of energy civilization could not exist.

Energy is not created, of course. It exists in some place and form and time, and there is need for it perhaps in some other place and form and perhaps at some other time. It is the function of the engineer to bring this supply and this demand together. Of the various forms of energy only two may be conveniently utilized, and these are chemical energy and mechanical energy. Chemical energy is represented by fuel and mechanical energy by water-power.

The transportation of energy is required often to make it available. Chemical energy and electrical energy may be transported, the former as in shipments of coal and the latter over wires as in the transmission of electricity. It is an essential advantage of electrical energy that it can be transmitted from one place to another and this characteristic is utilized in the case of water-power developments. It is interesting to remember that we have practically no use for electrical energy as such. Intrinsically, electrical energy is almost useless; it must be transformed into some other form of energy for use; it is useful simply as an intermediate form of energy.

Chemical energy can be converted easily only into heat. Electrical energy has the great advantage that it may be converted easily into other forms of energy as well. Furthermore, electrical appliances designed for the operation of mechanisms may be and are planned so that they may be used by persons not at all familiar with electricity. Thus the motorman of a trolley car need not be an expert electrician, but the driver of a steam locomotive must have an intelligent understanding of the mechanism under his charge.

When the time element in relation to the utilization of energy is considered electricity is placed at a serious disadvantage. Electricity cannot be stored. In the storage battery it is really chemical energy and not electricity that is stored. Electrical energy must be used when produced and produced as needed. Thus, if the customers of a central station were to use all their requirements in two hours it would cost almost as much to serve them for that two hours as it would to operate the station for twenty-four hours. Therefore, the cost of electricity depends on the degree of uniformity with which it is used; in other words, it depends on the so-called load factor, which is the ratio of average use to maximum use.

It follows that electrical energy has not a fixed cost; the cost is a function of the rate of use; it will be high where the load factor is low and low where there is a uniform use—say of twenty-four hours a day, as in the case of some electrochemical industries. Lighting alone results in a low load factor; factory or industrial requirements give a higher load factor. By combining these two demands a still higher load factor may be obtained, resulting in lowering the cost proportionally by utilizing the total investment to a greater extent. It is apparent from these considerations that there is no real fixed limit in the cost of electrical energy either upward or downward.

Large generating stations are undoubtedly more economical than smaller ones, but there is a limit to the economy which may be secured in this manner. It is to be observed, however, that by increasing the load, which makes necessary a larger station, the load factor becomes higher, and it is this fact that enables the price of electricity to be lowered, rather than the economies obtained by the use of the large generating units. Dr. Steinmetz closed by referring to the economy of supplying many varied utilities from a central source of energy, as has been so successfully done in the case of the central-station company in Chicago.

Mr. W. Clyde Jones, a State senator from one of the Chicago districts and a former electrical man, followed Dr. Steinmetz. He reviewed in an interesting manner the development of electrical applications in the last twenty years and under his own observation. He conjectured that possibly during the next twenty [illegible] somewhat similar develop-ment in the art of aerial navigation and said that perhaps the Wrights, Curtisses and Blériots of to-day are comparable to the Edisons, Brushes and Bells of twenty years ago. Mr Jones spoke of the economic phase of the development of chemical and mechanical energy, otherwise the fuel and water-power resources of the country. The question of property rights in these resources is being studied. Practically all the coal and oil deposits in the United States are monopolized by private owners. Water-powers are now being utilized of necessity and the question of the ownership of undeveloped water-powers has assumed great importance. The word "conservation" has assumed a new meaning. The question has arisen whether the national government or the State governments shall take over these undeveloped natural resources. In Illinois this problem exists in relation to water-power development and a commission of engineers appointed by the national government is now studying it, particularly in relation to the waterway and water-power possibilitiies of the Illinois River. "Dr. Steinmetz," said Senator Jones, in closing, "has exhibited the industrial phases of this great question; men like Roosevelt, Pinchot and Garfield are emphasizing its economic phases."

Mr. H. E. Niesz expressed the appreciation of the Electric Club for the pleasure conferred by Dr. Steinmetz's visit, and a rising vote of thanks was extended to the speaker of the day.

Electricity an Atomic State.

A highly interesting talk on "The Corpuscular Theory of Matter," concluding with a recital of some of the speaker's recent experiments which seem to show that electricity itself exists in ultimate, indivisible atoms or "ions," was delivered by Prof. R. A. Millikan, of the University of Chicago, before the Chicago Section of the American Chemical Society Friday evening, Oct. 21.

After reviewing the basis for the atomic theory as proposed by Dalton, Professor Millikan directed attention to the significance, from the ionic-charge standpoint, of the well-known laws of electrodeposition of metals. For example, it is found that in the transfer of energy through the electrolyte definite weights of the element transported are always associated with definite quantities of electricity passing through the cell, and that these electrochemical equivalents in turn bear a significant relation to the atomic weight and valence of the element involved. Such experiments, familiar for years, should have suggested the indivisible-charge nature of electricity, or, in other words, the latterly proven fact that electrical charges imparted to a body are always in multiple proportion of the ionic charge.

Corroborative data were added to this hypothesis by a study of the phenomena of the Crookes tube, the cathode rays of which, at first thought to be a kind of light wave, were later shown to be actual bombardments of charged particles or corpuscles given off by the cathode plate and moving at such high velocities as actually to give rise to magnetic effects. When it was discovered that these cathode rays might be deflected by traversing a magnetic field all ideas that they were a new kind of mere ether vibration had to be given up, especially as it was later shown that except for proceeding in straight-line paths they were in no sense like light. Precisely similar cathode rays were given off from all kinds of cathodes regardless of their composition, and later it was shown that these same rays could be set up under the action of heat and ultra-violet radiations as well as at the cathode of a vacuum tube. By determining the deflection produced by this corpuscular bombardment traversing a magnetic field it became possible to place the value of the mass of the constituent ions at about 0.0005, that of the hydrogen atom. The ionic charge manifested under conditions of ionization in gases compares exactly with that noted for electrolytes.

Professor Millikan then discussed his recent experiments for measuring the value of the charges of ions by the ingeniously refined method of oil droplets described on page 924 of the *Electrical World* of Oct. 20. The results of many experiments

with the charges acquired by oil droplets of 0.00006 cm to 0.0012 cm diameter, as shown by the speed of movement of these droplets over a fixed distance in an electrostatic field of an intensity of about 6500 volts per centimeter, indicated that the quantity of electricity on the droplet, whether acquired by collision with air ions or by friction in the issuing stream of the atomizer used, was always a multiple of the unit ionic charge, viz., 4.9×10^{-10} c.g.s. electrostatic units, which agrees exactly with the results obtained from atomic considerations.

Electrostatics and Electric Impulse Forces.

At the joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers in Chicago on Oct. 19 Dr. C. P. Steinmetz was the speaker of the evening, and his subject was "Industrial Importance of Electrostatics and Electric Impulse Forces." The main point of the address was to show the comparative simplicity of the electrostatic field if considered in the same manner as Faraday's conception of lines of force in the magnetic field.

The speaker illustrated his remarks, which were of necessity technical in their nature, by simple blackboard diagrams and mathematical equations. He began by saying that the study of electrostatics has become extremely important in the last few years. The first investigations of this subject were made in connection with static machines which give high voltage with low current. Then followed, in the course of electrical development, the so-called galvanism, characterized by moderate amperage and low voltage. When the study of electrical engineering was begun it derived little benefit from the early investigations into the subject of electrostatics. It now became necessary to study the subject of electric power from an engineering point of view and it was found that there was a marked discrepancy between the phenomena of electrostatics as taught in the schools a few years ago and the actual results of electrical engineering experience.

Gradually the transmission of electricity has brought about increasing voltages in commercial practice until now there are underground cables carrying electrical energy at 20,000 volts and overhead lines carrying 100,000 volts or more. The latter figure is higher than the voltage of most electrostatic machines, such as the early writers on this subject had at their disposal. Further, potentials as high as 300,000 volts or 400,000 volts are now used in laboratories, as in the testing of transformers, for instance. These voltages have also very considerable power back of them, which was not the case in the experiments of the early investigators. Thus it became necessary to study electrostatics under new and practical conditions, for problems due to electrostatics are met with on modern high-voltage lines.

It is hard to get a physical conception of the electrostatic field. In the case of the magnetic field an engineering conception of the existing phenomena was given to the world by Faraday and it is the familiar conception of lines of magnetic force. At this point the speaker discussed briefly the complicated magnetic field of the electric generator, where the physical conception of lines of force is of the greatest importance. But when the electrostatic field is reached the trouble begins. Until quite recently this subject was in the same comparatively vague state, so far as human knowledge went, as were magnetic phenomena in the days before the work of Faraday.

Dr. Steinmetz declared that the same conception of lines of force applies to both the magnetic field and the electrostatic field surrounding a conductor. We can conceive an electrostatic field measured by lines of electrostatic force. In an electric circuit electricity is flowing in the conductor, but at the same time something is going on outside of the conductor. A test by an iron needle shows that a magnetic field surrounds the conductor, and it may be represented diagrammatically by concentric circles surrounding the wire. There is also an electrostatic field surrounding the conductor and the lines of electrostatic force may be represented as radiating from the conductor. In the case of parallel conductors these radial lines are modified so that they may be represented as arcs of circles.

What relation have these two fields surrounding the conductor to the flow of energy within the conductor? For one thing, it is known that they are not proportional to the flow of energy in the wire. The magnetic field is proportional to the current in the conductor and the electrostatic field is proportional to the voltage. It follows that resistance, inductance and capacity are factors of every electric circuit. The magnetic field can exert force; it can do work, and the same is true of the static field, which also can do work. Both fields represent stored energy. To produce a magnetic field energy must be supplied to it. Similarly, the electrostatic field represents applied force. The magnetic field is related to voltage, or inductance, and the electrostatic field to current, or capacity.

To deal with the electrostatic field as simply as with the magnetic field there must be a conception of lines of force, and we may consider the number of electrostatic lines of force per square unit of area. Dr. Steinmetz went into this phase of the subject at some length and explained magnetic and electrostatic flux density and also the saturation point of iron in relation to these phenomena.

There is a saturation value in magnetic materials and electrostatic flux density also causes a certain fixed saturation value. When this value is reached there is no appreciable potential gradient across the electrostatic field. The phenomenon is somewhat analogous to magnetic saturation. The dielectric becomes a conductor at a certain critical point. Usually when this point is reached the surrounding medium, if a solid, is destroyed, and if a gas, it becomes luminous. When the surrounding gases become luminous there exists the phenomenon known as the corona. In the case of parallel conductors each has a range of saturation for its electrostatic field and the resulting phenomena are modified accordingly.

When the electrostatic field goes beyond the saturation value the surrounding space becomes conductive and energy is discharged interminably into it. Theoretically there is no difficulty in calculating all the mysterious phenomena of the corona —no more difficulty than in calculating magnetic phenomena, for the static field presents no more inherent difficulties than does the magnetic field.

In practical application, taking a conductor for a high-voltage circuit, say ⅛ in. in diameter, the saturation value of the static field of such a wire is perhaps 70,000 volts or 80,000 volts. Beyond this limit the phenomenon of the corona is witnessed. If two conductors are near together the corona may be found at 20,000 volts or 30,000 volts.

Any change in the electrical circuit must be followed by a readjustment of the stored energy of the two fields outside the conductor—that is, the magnetic field and the electrostatic field. Every change leads to tension in these two fields. The greatest tension, of course, is between open circuit and closed circuit. If a high-voltage circuit is opened suddenly there will be a successive series of transformations of magnetic fields into static fields and vice versa in the form of oscillations. In the event of a lightning stroke another phenomenon is exhibited, in the case of the circuit, and it may be likened to an electrical impulse or wave progressing along the circuit like a wave in water.

In underground cables the capacity is very high and the inductance is very low. If the impulse or wave passing over the circuit has a moderate voltage the current will be large, and vice versa. If the impulse passes from an underground cable to the transformer it may reach a destructive value while harmless in the underground cable itself. Not infrequently sparks jump across the terminals of inductance apparatus that would withstand the impulse in its interior construction. The electric impulses mentioned may result in almost limitless voltages from circuits with limited voltages and amounts of energy. The problem is to dissipate these impulses into the air harmlessly, as is done by the corona.

The discussion that followed Dr. Steinmetz's address was [illegible]

Convention of the Electric Vehicle Association of America.

The second session of the Electric Vehicle Association of America, held in the Concert Hall of Madison Square Garden, New York, in the afternoon of Oct. 18, was as well attended as the morning session, an account of which was published in last week's issue. The first paper of the session was read by Mr. Bruce Ford, of the Electric Storage Battery Company, of Philadelphia. Pa.

THE ELECTRIC VEHICLE BATTERY.

The author divided storage batteries into two classes, according to the nature of their electrolytes, and confined his paper to a comparison of the Edison and the lead cell. The characteristics of the lead-sulphuric-acid battery are stated to be high and uniform individual cell voltage on discharge combined with low internal resistance and high watt-hour efficiency. These, the author claims, render the cell peculiarly adapted to the needs of electric vehicle propulsion where high rates of discharge are required for acceleration, hill climbing and bursts of speed. The nickel-alkali-iron cell has a high capacity per unit of weight, which makes it attractive where an abnormal amount of mileage is required per charge. Mr. Ford maintains, however, that the battery is new in commercial operation and that therefore no definite commercial figures have been obtained as yet to substantiate the claim for long life. High internal resistance and high initial cost are given among the disadvantages of the alkali-iron cell. In the present standard type of lead cell the capacity per pound is varied within certain limits by furnishing plates of different thicknesses. A thicker plate has a longer life in number of cycles of charge and discharge than a thin plate; but its capacity per pound on each discharge is not so great. The author described three thicknesses of plate, one with an initial capacity of about 8 1/3 watt-hours per pound of complete cell which increases to about 10.5 watt-hours in service; another having an initial capacity of about 9.25 watt-hours per pound of complete cell which increases to about 12 watt-hours in service, and still another with an initial capacity of about 10 watt-hours, increasing to about 13.25 watt-hours. Experience has demonstrated that the life in miles of thin plate batteries is about the same as that of thick plate batteries, it being understood that there are more plates per pound of thin plate battery than of thick plate battery. The author states that in both the lead and nickel types of battery the action which governs the life is largely mechanical, the alternate action of charging and discharging causing a molecular disturbance which results in the loss of coherence of the active material. In the lead battery it has been the practice to permit the active material to become gradually disintegrated and washed out from the surface, and to allow a reserve in the quantity of active material sufficient to produce a commercially satisfactory life. To the carrying around of this reserve active material is attributed its great weight per unit of capacity as compared with the alkali battery, whose active material is maintained mechanically to restrict its molecular disintegration. Mr. Ford informed the meeting in closing that his company has purchased the American rights to a French patent covering a method for preventing the disintegration and washing away of the active material of the lead cell, and has been experimenting with the improved battery, which in its present form gives an initial capacity of about 9.5 watt-hours per pound, which increases to over 13 watt-hours in service. Moreover, the life of the battery is claimed to be from two to three times that of the present type of lead battery and during its life the necessity for cleaning the battery of sediment is eliminated. No details of the battery were vouchsafed, the author confining himself to the mere announcement.

Mr. Ford's paper was followed by a very practical paper dealing with the care of the lead cell, prepared by Mr. S. C. Harris, of the battery department of the New York Edison Company. An abstract of this paper appears elsewhere in this issue.

Mr. Frank M. Tait, in a paper entitled "A Central-Station Campaign for Electric Vehicles," considered the subject under the heads of "The Pleasure Vehicle" and "The Commercial Vehicle." It was stated that a net flat charge ranging from $25 to $30 a month for the average coupé or victoria runabout is about the proper rate for a garage charge, but this does not include any tire or general machine repairs. A satisfactory rate for selling electricity to a public garage is 4 cents per kw-hour net, with a minimum service charge averaging $5 per month for each charging rheostat connected. In the case of a private garage a net meter rate of 6¼ cents per kw-hour, with a minimum service charge of $5 net per pleasure vehicle per month, seems to be satisfactory. Taking up the question of the commercial vehicle, he stated that to sell electric trucks a central station must first have a truck or two of its own, an equipment for charging and handling electric trucks, and men in its employ entirely familiar with battery equipment to look after the garage. A plan to interest a possible purchaser is to offer to loan a truck and competent driver to go over the routes now covered by horse deliveries, and allow the deliveryman to check the truck's cost record, as the showing will always be in favor of the electric truck, unless the work to be done involves long and continuous hauls into the country, etc. The paper includes illustrations of a number of commercial vehicles in service in Dayton, Ohio. In the case of a 3000-lb. beer wagon it is stated that the owners have operated it regularly for the past three years on one set of batteries, to which nothing was done except that they were inspected every six months and new plates then inserted if necessary. The batteries were fully charged every night, and the wagon was on the street ten hours every business day, carrying loads ranging from 2500 lb. to 3500 lb. Mr. Tait recommended manufacturers to consider the supply of a small electric wagon of from 500 lb. to 750 lb. capacity, to come between a pleasure vehicle and a 1000-lb. truck, and which could be furnished to the central station for a very much lower price than the latter. He states that there is an eager demand for such a "small service" vehicle. At present the central stations are handicapped by the use of small gasoline delivery wagons of this capacity, as the only electric vehicle now available for the purpose is a 1000-lb. electric wagon, which has a first cost of 65 per cent more than the average small gasoline delivery wagon.

Discussion.

Following Mr. Tait's paper discussion was opened on all of the papers which up to that time had been presented.

Mr. Hayden Eames, of Cleveland, called attention to the fact that the dominating note of all the papers read was the education of the public, the introduction of the electric vehicle depending on that rather than on engineering advance. The foolproofness of the outfit should be emphasized, he said, and the owner advised that the high points of care can be taken up by the central stations. It was just as important in his estimation for one to know how much the battery can be neglected intelligently as it is to know how to care for it scientifically. The vehicle, if it is to be widely adopted, must be convenient; and to be convenient the owner must be relieved of the battery supervision. He cited instances where women charged the battery when they liked and not when the battery should have been charged. The result was that the battery was never overcharged and once a month the garage attendant gave it a full charge so that the battery never suffered.

Mr. Conant, of Washington, D. C., voiced the desirability of a standard charging plug as mentioned in President Blood's address and suggested that a committee be appointed to look after the matter. Mr. Blood said that the charging plug would with other matters be given over to a committee after the convention adjourned.

Mr. R. M. Searle, of Rochester, N. Y., commented on the admission that electric vehicles are not suitable for long hauls and said that it was necessary for central station men to cry down this confession of weakness. He cited instances where by the installation of grade trolley lines for automobiles in New Jersey and in the Westchester district of New York deliveries could be made by New York merchants in territories now im-

possible owing to the hills encountered. The installation of shock absorbers, he said, would also do away with 90 per cent of the chain snap, battery jolt and tire wear; but thus far these devices, so much used in gasoline machines, have not been applied to electric machines. He informed the gathering that from a conversation he had with Dr. Snevin, just returned from Europe, a combination of synthetic rubber and bakelite is destined to solve the rubber tire problem in a short while. Mr. Searle also pointed to the fact that the gasoline car and all its accessories have been placed in schools of technology for the instruction of students, whereas the electric vehicle is unknown in such schools. As a help to those selling electric vehicles, he intimated that if while the vehicle is on trial a number of photographs be taken and presented to the prospective buyer much good will result.

Mr. Sands, of Boston, agreed with Mr. Tait in the necessity of a lighter electric vehicle. He said that Mr. Eames in his St. Louis paper placed the burden of electric vehicle introduction on the shoulders of the central stations. The manufacturers, he maintained, ignored the field for a lighter vehicle, notwithstanding that requests have been made for them time and again. The most potent argument against the commercial use of the electric vehicle of the present type, he said, is the fact that central stations themselves do not use it.

Mr. Lloyd, of Philadelphia, referring to Mr. Ferguson's paper, asked if the energy rate was the same for electric vehicles as for elevators, and if the load factors of the different classes of business were considered. In reply Mr. Ferguson said that he had not gone into the rate question in his paper because it was too complicated. The rate for elevator service in Chicago is about 7.5 cents, while batteries are charged at about 5 cents a kw-hour. The load factor of an elevator installation, however, is about 5 per cent, whereas the load factor of a vehicle installation is from 30 per cent to 35 per cent.

Mr. E. Lunn, of Chicago, gave the reasons for high charges made for washing batteries in garages. In many instances the batteries are not properly assembled and the user is negligent in flushing the battery properly and in washing it at the proper time. Therefore the separators become damaged and considerable charging is necessary to bring the battery back to its proper condition. He contended that there were limitations to the design of light delivery wagons which would make them of doubtful value commercially.

Mr. Farley Osgood, of Newark, N. J., cited some reasons, such as long hauls and steep grades, which made the introduction of electric vehicles in the State of New Jersey on a large scale problematical. He saw aggressive competition on the part of second-hand gasoline cars fitted for light delivery service. These cars can be bought at low prices and remodeled and it would be difficult for an electric to compete, at least as far as first cost is concerned. He had heard that while several electrics were an advantage a single electric truck was not, and wished to be informed on the matter as well as on the merits of solid and pneumatic tires. His impression was that the solid tires were more costly in operation than the pneumatic tires.

Mr. Arthur Williams, of the New York Edison Company, related a conversation he had with Mr. Edison in which the latter maintained that what the butcher and grocer need is a ... vehicle capable of traveling twelve miles a day or at most ... Such a vehicle would have a small motor and small battery and should cost about $750. Mr. Williams pointed out that electric vehicle charging is not a peak load, whereas elevator ... The long-haul problem, he said, was solved in New York by night delivery service to local distributing stations. The ability to deliver goods promptly and creditably is one of the most important features in favor of the electric vehicle. He said that a large department store manager told him that central station men were too modest in their praise of the electric vehicle and that they did not claim anywhere near that degree of excellence in service or efficiency which the vehicle is entitled ... electric vehicles were the only ones which performed their work satisfactorily. The customer selects the roads and not the ... who drives the car, and the electric is the only car which will withstand the strains of general delivery work. One of the experts of a department store delivery service told him that last winter a 2000-lb. wagon averaging thirty-six miles on its route cost 40 cents a day and displaced four horses on the road and four in the stable. Mr. Williams said that a solicitor could make all the claims made for any other type of vehicle for the electric and that the electric would make good in service.

Mr. Ferguson, replying to Mr. Osgood, said that one truck gave as good service as many when properly handled. The trouble, however, is that an individual with only one truck does not employ an expert to look after the battery, whereas a concern with many vehicles gives them expert attention. Central stations could offer some remedy for the trouble, or, better still, battery manufacturers, by building a foolproof battery. As to tires, Mr. Ferguson's experience with his own gasoline touring car is that pneumatic tires cost him 7 cents a mile, while the experience of the Commonwealth Edison Company in Chicago is that solid tires cost it 1.45 cents per mile.

Mr. Lloyd, of the General Vehicle Company, Long Island City, said that small wagons would be produced if there were a market for them. Light-weight cars must be made in quantities to be commercially possible. Pneumatic tires, he maintained, were more expensive than solid rubber tires and a person with a single electric vehicle is much better off than a person with a single gasoline car. He gave the experience of his company in looking after all its vehicles throughout the country.

Mr. Hayden Eames said that the call to-day was not for small but for large electric vehicles, manufacturers finding that they can carry bigger loads. Mr. R. M. Searle, on the other hand, maintained that a small delivery wagon is sorely needed. If the manufacturer of commercial electric vehicles would not meet this need, then the manufacturer of pleasure vehicles could do so by placing a delivery wagon top on a pleasure vehicle chassis.

Mr. Kennedy, speaking on the cost of solid versus pneumatic tires, claimed that the solid tire costs less than 1 cent a mile. The tire cost increases with the square of the speed and by reducing the speed the tire cost is greatly lessened. He also said that there are a large number of single electric vehicles in use which are giving satisfaction. Shock is being minimized by the spring suspension of the battery and by equipping vehicles with larger wheels. Mr. Morgan, of New York, and Mr. Day Baker, of Boston, gave experiences in cleaning batteries and on the tire problem.

Mr. Osgood asked how many miles a day an electric vehicle would have to cover in order to make its operation cheaper than delivery by horse-drawn wagons. Mr. Lloyd, of Long Island City, said when an electric covers fifteen miles it is as cheap in operation as a horse-drawn wagon. Mr. Ferguson said that at twenty-five miles a horse-drawn and an electrically propelled vehicle are comparable, while there is an indirect saving possible with the electric in addition. Mr. Searle said that Mr. Osgood virtually asked how to sell an electric vehicle, and he proceeded to tell the questioner how they were sold in Rochester. The vehicles are put out on 30, 60 and 120 days' trial and the results carefully tabulated. He said that is all that is necessary usually to effect a sale in cases where an electric vehicle is at all applicable.

A paper by Mr. G. M. Graham, of the Philadelphia *North American*, was next presented, followed by an announcement by Mr. Duncan Curry, of the *New York American*. Mr. Graham told of the preliminary work performed by his journal in connection with the first commercial vehicle run ever given in this country, that from Philadelphia to Atlantic City and return, the result of which was published in our Sept. 1 number. Mr. Curry simply stated that his journal would conduct a commercial vehicle test in New York on Oct. 28 and 29.

In a paper entitled "The Largest Modern Electric Garage" Mr. Charles L. Eidlitz described the garage of Gimbel Brothers, the new large New York department store. The building is two stories in height, with a frontage of 150 ft. and 100 ft. in

making it fireproof. The first floor is devoted entirely to charging, there being 595 hp in charging equipment for ninety vehicles. The electricity for charging, lighting and power is furnished by the United Electric Light & Power Company, 220-volt, two-phase current being supplied for power; 120-volt, single-phase current for lighting, and 75-volt and 120-volt direct current for charging. The service board is 10 ft. long and 8 ft. high. The main board is 30 ft. in length and, including rheostats, is 13 ft. in height. It consists of thirteen slabs, having a total of seventy-eight switches controlling circuits which are capable of charging seventy-eight vehicles at one time, thirty-six at 75 volts and forty-two at 120 volts. To charge, the operator first throws a switch to the left, inserts a potential plug, reads the meters, operates his rheostat and then throws the switch to the right. When the battery is fully charged it rings automatically on an annunciator at the board, the switch is opened and an attendant notified by telephone to uncouple. It is pointed out that, whereas the space that would be required for horse stalls would be valued at $150,000, that necessary for the electrical equipment of the garage amounts to only $2,340

Discussion.

Mr. E. S. Mansfield, of Boston, spoke of the need of garages having charging facilities and complained that all of the missionary work connected with the introduction and care of the electric vehicle is put on the central stations of the country.

Mr. F. W. Smith, of New York, said that the garage just described showed what would be considered proper equipment for an installation in a large city. The fact that the garage is used in connection with a New York department store is merely incidental, its size being such as to make it an excellent model for garages intended for general vehicle use.

Mr. P. D. Wagoner, of Long Island City, called attention to the excellence of the garage in question and, replying to Mr. Mansfield's contention that the burden of the missionary movement was on the shoulders of central stations, cited the case of his company, which maintained garages in New York City. He commented on the large number of central stations compared with the small number of electric vehicle manufacturers and spoke of the immense investment that would be necessary for the few electric vehicle manufacturers to establish charging facilities all over the country. Mr. Wagoner gave some figures on electric vehicle performance in New York, where four electrics in their third year of service were compared with four gasoline vehicles.

Mr. Turner, of Cleveland, said that in his city there are from 1500 to 1600 electrics in operation, and that the garages are maintained by the electric vehicle manufacturers.

After hearing the report of the committee on the president's address and passing a vote of thanks to the New York Edison Company for its hospitality, the convention adjourned.

Introduction of the Electric Vehicle.

At a meeting of the Electric Vehicle and Central Station Association held in the Edison Auditorium, Boston, Oct. 17, Mr. Edward S. Mansfield, of the Edison Electric Illuminating Company, of Boston, gave an address, illustrated by stereopticon, entitled "The Electric Vehicle Proposition." The author presented in detail the advantages of the electric vehicle both for pleasure and trucking, and pointed out the various means by which its introduction could be advanced. At least one garage should be established in every city and town where electrics are in use, or where they could be sold if a garage were installed; an efficient inspector should be appointed to see that electric garages give the best of service, to inspect batteries in private charging stations and to educate the caretakers in the simple rules of battery charging. A standard form of charging plug should be adopted, and also an official form of charging sign. An official list of charging stations should be compiled and corrected from time to time, and be available for distribution to electric vehicle owners and prospects. A committee should be appointed by the association for the purpose of standardizing [illegible] and also forms of records for public and private garages. A bureau of information under the publicity department would be valuable in extending business, as a prospect would feel that from such a source he would receive impartial information.

Mr. Mansfield believes that the affairs of the association should not be dominated by the selling interests, but that the electric vehicle owner should be eligible to membership and have a generous representation. Concerning central-station rates, the prospective customer must not take it for granted that such rates for charging are so high that he cannot afford to buy an electric, as a talk with the company's agent may prove to him that the rates, in fact, are particularly attractive: and he must also understand that the cost of current is a small item compared with the greater saving in the use of electric vehicles.

Commercial Electric Vehicles.

In a paper entitled "Commercial Electric Vehicles," read before the Boston Company Section of the National Electri Light Association on Oct. 18, Mr. E. S. Mansfield stated tha in Greater Boston there are 176 pleasure vehicles and 5 electric trucks, with some 30 or 40 private and 25 publi charging stations. The ratio of electric to steam and gaso line vehicles is there 1 to 26. On the other hand, in th City of Cleveland there are 1006 electric pleasure vehicles an 24 electric trucks, with 596 private and 14 public chargin stations, the ratio of electric to steam and gasoline cars bein nearly 1 to 4. The way in which a central station can effectuall build up an electric vehicle business is to establish a competen automobile department to educate the public to the possibilitie of the electric vehicle when properly applied and intelligentl cared for. Until the public becomes educated in the use an care of the battery a system of education and inspection essential to its efficiency and life. Much credit is given to th work of the lead battery in the past, but it is stated that wit the latest Edison battery a new era has been reached, as th battery gives longer life, greater distances on a single charg a reduction in weight of battery and vehicle, and is pro against carelessness never before realized or dreamed of.

Where the same use is made of the gasoline and electr vehicle the latter shows a decided advantage, both in mai tenance and operation. There is a considerable saving in t maintenance of the electric over gasoline vehicles, owing to t better acceleration of the electric. The electric through its ide control gives an appreciable saving of time in congested di tricts, and its life is from two to three times that of t gasoline machine, due to quiet running and lack of vibratio No extra rate of insurance is imposed on the electric, or the building or shed where it is housed, and it is admitted railroad depots and freight yards and on steamboat dock from which the gasoline truck is excluded. An instance w cited of a 1000-lb. electric wagon's operation during a peri of four years, which had a repair account amounting to exact 30 cents, aside from the case of a spring broken in passing ov a bad piece of road.

At the present time there are over 36 central stations in t United States using electric vehicles. The New York Edis station has 72 electrics of various types and sizes in daily oper tion. Results of operation show that in the case of Macy Company, in New York, horse-driven vehicles cost 8 2/5 cer per package for delivery, while electrics cost but 6 2/5 cer per package. The cost per mile with a light electric vehicle w 5.9 cents. A central station company in one of the larger citi has 31 electric vehicles, ranging from 300-lb. to 3½-ton truc and in the month of June made a total run of 42,000 mi with an energy consumption that averaged materially less th ½ kw-hour per mile, the vehicles running from 27 to 50 mil on a single charge. Figures for a period of a year and a h showed a cost per mile, covering all charges excepting admi istration expenses, as follows: 350-lb. capacity, 12 cents p mile; 1000-lb. capacity, 19.6 cents per mile; 2000-lb. capaci 21.5 cents per mile; 4000-lb. capacity, 29 cents per mile; 70

lb. capacity, 40 cents per mile. In the case of a large brewery the cost of transportation with horses was 34 cents per barrel, which was reduced by the use of electric trucks to 27 cents per barrel. This company has ordered a large additional equipment, and states that it expects to save $20,000 a year when deliveries are made entirely with electric trucks. Another large brewery which has twelve electric vehicles in service estimates the cost of operation to be about 14 cents a mile. There are 62 breweries in the United States at the present time using electric trucks.

Coal and Copper Mining in Alaska.

Mr. Alfred H. Brooks, geologist in charge of the Alaskan work of the United States Geological Survey, has recently summarized the coal situation in Alaska in Survey Bulletin No. 442, pointing out the importance of making the high-grade fuels found there available for the use of both Alaska and the Pacific Coast States. While the coal is of first importance to Alaskans, who are attempting to develop the various great resources of the Territory, it is also of scarcely less national importance, inasmuch as these fields can furnish fuel to the industries of the Pacific Coast States and to the Pacific fleet. The development of these fields will conserve the coals of the eastern part of the United States, which are of most value to the nation because they are nearest the center of population. The manufacture of iron on the west coast, for which there is abundant raw material, utilizing Alaskan coal, will not only cheapen the product by overcoming the long railroad haul or the trip around the Horn, but it will diminish the drain on the Eastern iron and coal fields. Every shipload of coal carried around the Horn consumes about one-fifth of its own cargo, while the hauling of iron and coal over the Rocky Mountains results in a still greater fuel waste.

In spite of the low price of copper there has been much activity, Mr. Brooks states, in prospecting for this mineral in Alaska, and seven or eight mines in three districts have continued to make an output. The inland copper districts can only be developed by the construction of railroads, and these depend for their success on the securing of cheap coal.

Northwest Station of the Commonwealth Edison Company.

A visit to the site of the projected Northwest station of the Commonwealth Edison Company shows that work on the elevated switch-track railway, which is to connect the new generating station with the tracks of the Chicago & Northwestern Railway Company, is proceeding steadily. The principal portion of the site extends about 1400 ft. west from the North Branch of the Chicago River, and is bounded on the north by Addison Avenue and on the south by Roscoe Street. It extends as far west as Elston Avenue, and is conveniently reached by the Elston Avenue car line. It is about six miles northwest of the center of the "downtown" business district of Chicago, in an air line.

Plans are under way for the erection of a 120,000-kw generating station on this site, having six turbo-generator units, rated at 20,000 kw each. After the first station is built the present plans contemplate the erection of a second one near the first and duplicating it in design and size. Nothing has been done as yet on the site of these great power houses, which will have the largest electric generating units in existence, beyond the driving of a few piles for testing purposes. Present activities are confined to the building of the elevated railway which will connect the stations to the Chicago & Northwestern tracks. This railway will be electrically operated.

A near neighbor of the great Northwest station will be the existing power house of the Chicago Consolidated Traction Company, at the corner of California Avenue and Roscoe Street.

Telephone Service in America.

At the International Telephone and Telegraph Conference, held in Paris Sept. 4-11, Mr. John J. Carty, chief engineer of the American Telephone & Telegraph Company, presented an interesting paper entitled "Telephone Service in America." The paper was a discussion of the subject of automatic versus manual switchboards, but gave much information concerning recent telephone development in this country, particularly in New York City.

After discussing the main features of the automatic switchboard system, the conclusion arrived at was that this system is not, in fact, automatic but only partly so; that it has been fairly and exhaustively studied and found to be unsuitable for the comprehensive demands of present service, and more and more unsatisfactory when considered with respect to the demands of the future. Some years ago a careful study was made with a view to ascertaining how far the automatic system might be advantageously used in New York City at that time. It was then found that, counting private branch exchange operators and central-office operators, the so-called manual system would require 13,000 operators, while the so-called automatic system, leaving out of account the "mechanician operators," would require 10 000 operators. A thorough study was also made of the telephone system of the State of Connecticut, which showed that, at the time the study was made, if all of the private branch and other operators needed with the manual system were counted, a total of 892 was required. A similar careful study showed that if the automatic system were installed 600 operators would be needed, not counting the "mechanician operators." These illustrations showed that the automatic system, which has so many alluring features about it when its application to simple conditions is considered, becomes more and more unsuitable as the plant grows. Even when the automatic system is applied to the simple case of a single office district, an instance is not to be found in which the total annual charges rendered against it are less than for the manual system.

The paper sketches briefly a semi-automatic system which has been developed and is now being installed in New York for an experimental demonstration. In this system the subscriber's station is identical with that employed in the so-called manual system. The pieces of automatic apparatus needed at the "A" operators' positions in the central office (the "A" operator is the one who answers the subscriber in the first instance) are relatively small in number, while all of the "B" operators (the "B" operator is the one who receives the trunk call from the "A" operator at another office) are eliminated and machines substituted. This semi-automatic system will employ an apparatus operated by keyboards similar to that used on a typewriter, and with such a keyboard it has been experimentally demonstrated that an "A" operator can handle a very much greater number of calls than she could in the so-called manual system, which fact materially reduces even the number of "A" operators. Mr. Carty stated that soon after he returned to America he hoped to be present at the opening of a semi-automatic switchboard, and that if the expectations regarding it are realized, it will be a system more efficient and more economical than either the so-called manual or so-called automatic.

Mr. Carty said that in New York it has been found most economical to make plans for work for a period of twenty years. These plans are not speculative, but are followed in the construction done each year, putting down not only that which is needed for to-day, but that which most careful study represents will be required during a period of twenty years. With such plans for a given city, the probable conditions of the plant are studied at each period of its growth. With such a guide a switchboard or other system, however suitable it might be at the moment, is not installed that will not be capable of growing into that form and to that magnitude which would be required of it by the conditions which must be encountered before its life has expired.

Some idea of these conditions in New York was obtained

from the following data: The fundamental plans for that city, not including the vast outlying suburban regions, provided in 1900 for a system of 51,398 telephone stations, served from forty-three central offices, the population of the city being estimated at 3,437,000. In 1910 the plan provides for 376,000 telephone stations, served from fifty-two central offices with an estimated population of 4,800,000. In 1930 the plan provides for 2,142,000 stations, to be served from 109 central offices, with an estimated population of 8,300,000. Referring to long-distance service Mr. Carty stated that there is an effective long-distance service, through underground cables of the Pupin type, from New York to Philadelphia, ninety miles, and good talking with trunk connections is an everyday matter between New York and Boston, 235 miles. At the present time an underground cable of the Pupin type is being extended from New York to Washington, 225 miles, and surveys and plans are being made for an extension from New York to Boston. By the adoption of phantom-loaded overhead circuits between New York and Chicago, and by similar extensions westward as far as Omaha, and thence to the Rocky Mountains, it is expected by Jan. 1 to extend the long-distance frontier so that conversation may be held between Denver, Col., and New York City, a distance of 2200 miles.

Baltimore Convention of the Illuminating Engineering Society.

With an attendance which overtaxed the meeting room in which it was held, the fourth annual convention of the Illuminating Engineering Society was opened in McCoy Hall at Johns Hopkins University, Baltimore, on Monday, Oct. 24. The convention served the double purpose of bringing together various persons interested to discuss papers on illuminating engineering prepared for the occasion and of forming the introductory exercises connected with a highly noteworthy course of lectures on illuminating engineering offered by Johns Hopkins University in co-operation with the Illuminating Engineering Society. The registration on the first day was 136 members, 24 ladies and 24 guests, or a total of 184.

ADDRESSES OF WELCOME.

The address of welcome to the city was delivered by Hon. J. Barry Mahool, Mayor of Baltimore, who called attention to the effect of illuminating engineering on Baltimore, the lighting of some of the streets of which is excellent. He remarked that much is now being done toward beautifying the city, particularly with reference to the streets, along which all the electric wires are being placed underground.

Dr. Ira Remsen, president of Johns Hopkins, welcomed the society to the university. He stated that among the "first" things for which Baltimore is noted mention should be made of the offering of the first organized course for graduate students, the first requiring the degree of preparation for medical study which is now being adopted by the leading medical schools, and the first offering a course in illuminating engineering. He paid a touching tribute to the memory of Prof. Rowland, whose ashes are now kept in a vault two stories below the surface near the machine upon which was done his work with diffraction gratings.

Following the addresses of welcome, Dr. E. P. Hyde, president of the Illuminating Engineering Society, delivered the annual presidential address, while Past-President Sharp occupied the chair.

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[illegible] illuminating engineering, which, he said, was the attainment of the ideal application of perfect knowledge. He remarked that, judged according to our present conception of ideality, the ideal artificial illuminant, apart from any consideration of its form or magnitude, its polar diagram or its intrinsic brilliancy or any other of its numerous attributes except the quality of the light and efficiency of its production, would transform all the energy supplied to it into luminous radiation of sunlight color. If all of the energy supplied to a lamp were transferred into radiation and all the energy radiated were confined within very narrow limits of wave-length in the yellow-green region of the spectrum, it would be possible, according to the best data available, to produce a luminous flux of about 800 lumens for every watt supplied. However, this monochromatic light would be unnatural and the appearance of natural objects illuminated by it would be uncanny. If, however, the second condition were modified so that all the energy was radiated, not within the narrow wave-length limits of a single color, but throughout the visible spectrum, the distribution of energy in the various colors corresponding to that of average daylight, the resultant light would match daylight in quality and would correspond to an output of about 300 lumens per watt, which is five or six times that of the most efficient artificial source of the present day. Such an efficiency is impossible in the pure temperature radiation of a black body and is scarcely to be sought in the pure temperature radiation of any solid, however selective its radiation may be, for no substance is known which indicates even the possibility of such extreme selectivity.

If an output of several hundred lumens per watt is ever to be attained it should be sought in the radiation of so-called luminescence as exemplified in the flame light of the various luminous and other arcs. A characteristic of such luminescent radiation is a discontinuous spectrum, and even though the desired efficiency might be obtained it is improbable that the bright line spectrum would consist of so many lines and of such relative intensities that the integral quality would be that of sunlight and that the color of natural objects would be true.

Even if it were possible through the development of physical science to produce a light source of the quality of daylight and with the highest possible efficiency consistent with this quality it is very questionable if the results would be perfect. Life upon this earth, as we know it, is dependent on the warming influence of the solar radiation, much of which is beyond the limits of the visible spectrum, and yet one of the conditions of the ideal source precludes any radiation except in the visible spectrum. Many destructive and constructive organic chemical processes are attributed to the ultra-violet radiation in daylight, and yet one of the conditions of the ideal artificial source implies the exclusion of ultra-violet radiation. The demands we have made upon the ideal artificial source render it unnatural and no one knows the bane or blessing involved in those very radiations which one should studiously avoid.

Efficiency signifies in its broadest meaning the most perfect accomplishment of some desired end by the most economical means. It is the ratio of satisfactoriness to cost and not merely the reciprocal of cost. If the aim of a lighting design is a soft yellow tint, a green light would not be efficient, whatever its lumens per watt. It is correct to study the source as a necessary element in illumination, but the emphasis to-day should be placed rather on the study of its application. Although the most efficient source possible as a result of the evolution of scientific research may not yet have been developed, numerous sources are available which have not been utilized to the limit of their possibilities. Until the fundamental auxiliary sciences which underlie the science of illuminating engineering attain to perfection, that science cannot be perfect; the development of the science of illuminating engineering is not even abreast of those auxiliary sciences on which in large part it depends.

Dr. Hyde expressed the opinion that the assumption that a uniform distribution of illumination is to be desired in interior lighting is hardly justified. He stated that our knowledge is relatively meager on the values of high lights and shadows, and of directed and diffused illumination; our knowledge of exact conditions in the case of daylight illumination, which are generally recognized as highly satisfactory, is very deficient and the result must follow that with less satisfactory illuminants and with imperfect knowledge our attempts at artificial reproduction of these daylight standards meet with but a small meas-

ure of success. Illuminating engineering as a distinct science is, indeed, not abreast of those auxiliary sciences on which it in a large part depends. To an even greater degree it may be said that the art of illuminating engineering is not abreast of the development of the material illuminants which it applies. It would seem from the above that we have at the present time very indefinite conceptions of ideality in what might seem to be the simplest and most advanced elements of illuminating engineering.

The goal of illuminating engineering is not the mere computation of foot-candle illumination necessary for vision or the design and application of lamps and reflectors which will give a uniform or non-uniform distribution of illumination, as the exigencies of the case or the whim of the designer may dictate. It is not a cold calculated plan of illumination which keeps within the bounds of physics and does not trespass upon the field implanted by physiological research with the warning sign of "dangerous."

The speaker claimed that the goal of illumination undoubtedly will have been attained when as a result of the concomitant development of its component illuminants it will be possible in every case presented to design a lighting installation which will be efficient, effective, artistic, which will produce an illumination correct in quantity and quality, properly balanced as to high lights and shadows, restful to the eye and harmonious with the form and numerous color schemes involved, which will stand the rigorous test of logical analysis and will appeal to the most highly developed sense of beauty.

REPORTS OF COMMITTEES.

The committee on nomenclature and standards, of which Dr. Alexander C. Humphreys was chairman, did not submit a formal report, but referred to the work of the sub-committee on photometric units, a report from which was read by Dr. Clayton H. Sharp, the chairman. The report contained definitions of the various terms and units, such as light, flux, flux density, intensity, candle-power, lumen, lux, hefner-candle, foot-candle, lumen per square foot, lumen per square meter, etc. The committee strongly recommended the use of the term lumen per square foot rather than its equivalent the foot-candle. The lumen per square meter is the lux when the lumen is based on the international candle; when the hefner-candle is used the lumen per square meter becomes the hefner-lux. The committee recommended the use of the following symbols: I for candle-power, F for flux, E for flux density, Q for lumen hours, e for angle of emission, r for distance from light source, ω for solid angle.

In discussing the report of the committee Dr. E. B. Rosa suggested the report be considered as preliminary, action being deferred for one year so that other countries may be consulted as to preferences for symbols.

Dr. A. S. McAllister expressed the opinion that, unless very important reasons exist for doing so, selection should not be made of the sumbols I and E, which are now the recognized symbols for current and e.m.f.

Mr. F. J. Pearson said that in formulating the photometric units and symbols recognition should be made of the c.g.s. units and other societies should be consulted. Mr. E. L. Elliott remarked that the symbol J could be used for candle-power rathen than I, as is now done in Germany. Mr. H. T. Owens claimed that printed copies of the reports should be submitted to the members before any definite action is taken.

Dr. Sharp contended that no confusion will arise from the use of well-known electrical symbols for photometric quantities. He remarked that since the suggestions contained in the report were based on the terms used by Prof. Blondel the report would receive the endorsement of France and possibly England also. The suggestion of Dr. Rosa was then put in the form of a motion, which was carried.

The committee on the division of membership, of which Mr. E. L. Elliott was chairman, submitted a report suggesting that a division of membership be made at a time and in a manner to be determined by the full membership of the society. The report was discussed by Messrs. A. J. Marshall, H. T. Owens, F. J. Pearson, R. C. Ware, W. H. Gartley, G. H. Keech and C. H. Sharp. A motion to adopt the report having been lost, the committee was discharged, thereby placing the division of membership just where it was before the matter was agitated.

[illegible]

A paper entitled "Central Station Illuminating Engineering Department Work and Methods Applied by the Denver Gas & Electric Company," by Mr. C. F. Oehlman, was read by Mr. Williams. An abstract of this paper is given elsewhere in this issue.

Prof. S. W. Ashe described the education work being carried on by the General Electric Company at the Harrison (N. J.) lamp works. A lecture course in illuminating engineering and salesmanship is given to a corps of college men who are working upon the various processes of lamp manufacture. Certain men are trained in selling lamps by means of instruction in wiring and illumination, and certain men are selected for specialized subjects such as sign lighting, automobile lighting, street lighting, etc. An experimental lecture course is also given to the factory and office employees.

Mr. Norman Macbeth claimed that under present-day conditions it is essential for a lighting salesman to be trained along the lines of illuminating engineering. Mr. A. J. Marshall remarked that, since architects decide what lighting equipment will be used in most buildings, the Illuminating Engineering Society should attempt to co-operate with the architects rather than to antagonize them. In closing the discussion Mr. Williams said that the Denver company had found it advantageous always to supervise the installation of all pipes for gas and wires for electricity in order to ensure good results for the customers. He remarked that good illumination itself is the best advertiser in obtaining new customers.

EFFECT OF LIGHT ON GERM LIFE.

In a highly entertaining lecture Prof. Samuel O. Mast described the effect of light on the movement of lower organisms. Strong light tends to destroy most germ life, but light of a lesser intensity may assist in building up complex out of simple organisms. These complex organisms serve as food for more highly complex organisms by stages until the more advanced organisms, such as small fishes, are reached; these serve as food for larger fishes, etc., so that even the well-developed organisms are dependent largely upon light. Professor Mast described in detail a certain simple form of germ, the movement of which in water is almost wholly dependent upon the density of light to which it is subjected, the germ adjusting its location so as to become parallel to the light rays and in a density of light best suited to its needs.

Dr. P. W. Cobb explained that the operation of the rods and cones in the eye is an example of the effect of light upon living members, quite similar to that on the lower organisms.

ILLUMINATING ENGINEERING CHARTS.

Mr. J. S. Codman presented a paper describing two charts designated as the "angle" sheet and the "distance" sheet, respectively designed to serve as convenient means of recording the results of photometric tests, to facilitate the making of calculations from the test data recorded and to serve as a convenient record of such calculations so that repetition of work done will, to a great extent, be avoided. The charts are sheets showing the tangent, cosine squared, cosine cubed of the angles made with the vertical from 0 deg. to 180 deg., from which by easy steps can be calculated the average illumination over the floor area when the candle-power distribution of the lighting source is known.

The author outlined the advantages of the sheets and stated that they can be readily filled out piecemeal at convenient times, the work being taken up exactly where left off because all work previously done is permanently recorded. Since the sheets contain all the necessary constants they can be filled out with-

out reference to tables or books of any kind. At any stage of the proceedings additional copies of the data and calculations can be obtained by the simple process of blue-printing. He said that the sheets can be used to great advantage in calculations to ascertain what are ideal photometric curves for particular purposes. When definite flux or illumination values are required the corresponding candle-power values can readily be determined by working the sheets backward.

In discussing Mr. Codman's paper Mr. V. R. Lansingh called attention to a simple method for calculating illumination on the horizontal plane devised by Mr. . A. Wohlauer. According to this method the illumination at any point on the plane is found by dividing the indicated candle-power value projected on the vertical by the square of the height of suspension of the lamp.

STREET ILLUMINATION CONSIDERATION.

Mr. P. S. Millar presented a paper in which were outlined certain heretofore neglected considerations pertaining to street illumination. This paper is given in abstract elsewhere in this issue.

Mr. A. J. Sweet claimed that the effect of silhouetting in street lighting had been emphasized too much by Mr. Millar. The effect exists, but it is of relatively minor importance. While a non-symmetrical candle-power distribution was needed with the earlier types of street lighting equipments, the need is not so urgent to-day, when lamps of small candle-power are placed at close intervals to give uniform illumination. Of the highest importance is the elimination of glare, especially the specular glare from the street surface.

Mr. R. C. Ware remarked that when the lamps are widely spaced the intensity of illumination near the lamps is too high and the glare is objectionable. Dr. Sharp said that silhouetting lighting does not involve wide spacing of lamps, but requires merely a bright background formed by the street surface. One can easily solve the problem of lighting a street when no limit is placed on the number of lamps and the amount of watts. The problem becomes quite different when the money to be expended is limited.

Prof. S. W. Ashe stated that some tests made two years ago showed that with a lamp placed 8 deg. from the direct line of vision there was a decrease of 30 per cent in the ability to see, which value agrees closely with the results obtained by Mr. Millar. Mr. G. H. Stickney said that the use of non-symmetrical reflectors does not always give good results by reason of the difficulty in adjusting the reflectors.

On Monday evening a lecture of a popular nature intended for the benefit of the people of Baltimore was given by Mr. V. R. Lansingh. This lecture was followed by a reception and dance at the Hotel Belvedere.

TUESDAY'S SESSION.

At the opening of the session of Tuesday morning the total registration was 218. Much enthusiasm was manifested over the announcement that the registration for the lecture course under the auspices of Johns Hopkins University and the society, which opens on Wednesday, was at that time no less than 212.

PERFORMANCE OF GAS LAMPS.

Many valuable data relating to the operation of gas lamps were given in a paper by Mr. Norman Macbeth entitled "The Relations Between Pressure and Light Output with Various Gas Lamps and Burners." The tests recorded show that reports on the light output and gas consumption of different lamps at different pressures may in no way be considered comparable unless the characteristic of the performance of each lamp is known at the various other pressures. To calculate the probable resultant illumination with any gas lamp it is also necessary not only to have this information, but also that pertaining to the average pressure of supply. There may be a variation in light production of from 100 per cent to 190 per cent depending upon whether the pressure is 1 in. or 8 in. and depending also

The paper by Mr. Macbeth was discussed by Messrs. Bassett Jones, Jr., S. W. Ashe, C. H. Sharp, H. T. Owens, J. H. Sherrerd, Preston S. Millar, W. E. Barrows, R. S. Hale and others. Mr. Macbeth stated that gas companies were formerly asleep and made little headway, while now they are wide-awake and making rapid progress.

HEAT FROM LIGHTING SOURCES.

Messrs. J. G. Felton and E. J. Brady, in a paper entitled "The Temperature Rise Due to the Energy Radiated in the Lower Hemisphere from Different Light Sources," reported the results of tests of the space distribution of light and heat flow in the lower hemisphere from various types of gas and electric lamps. The tests were made with a photometer and with a bolometer used in the same positions as the photometer. Of the electric lamps the carbon and the tantalum give off much more heat per candle-power than does the tungsten lamp. The ratio of the heat to the light in the lower hemisphere from the last-named lamp is greater when the lamp is provided with a prismatic reflector than when used without a reflector. Of the mantle gas lamps, the upright with opal dome and the inverted with a clear cylinder are about equal to the tungsten lamps, while all other gas lamps exhibit a much larger ratio of heat to light in the lower hemisphere.

The paper by Messrs. Felton and Brady was discussed by Drs. H. E. Ives and C. H. Sharp, Norman Macbeth and others.

COMPARISON OF PHOTOMETRIC METHODS.

The paper on the program by Dr. Herbert E. Ives was then presented and its discussion, owing to the approach of lunch hour, was deferred until the opening of the afternoon session.

In this paper, entitled "Some Spherical Luminosity Curves Obtained by Flicker and Equality-of-Brightness Photometers," Dr. Ives reported the results obtained by five observers in comparing the two photometric methods at two different illumination densities expressed in arbitrary values of 10 units and 250 units. Spectral luminosity curves obtained by the observers using the flicker and equality-of-brightness methods did not show exact agreement between the two methods. With different observers the relative positions of the two kinds of curves were different. At low illuminations the equality-of-brightness curves shifted toward the blue, the flicker toward the red. Marked differences in the color sensibility of the five observers exists, as shown by each method. The flicker method was found to possess much greater sensibility than the equality-of-brightness method, the difference being greatest at high illuminations.

The most important fact shown by the investigation is probably that the flicker method and the equality-of-brightness method give nearer the same values at high than at low illuminations. This result was thought probable before the investigation was undertaken, from consideration of the results of other observers. The author remarked that there is some reason for believing the flicker photometer to act chiefly by means of those elements of the retina called the cones in distinction from the rods. The cones are supposed to be responsible for vision at high illuminations, the rods at low. The Purkinje effect is ascribed to the shift from cone to rod action; it becomes very small at high illuminations. Furthermore, the flicker photometer had been found to show little or no Purkinje effect. It, therefore, seemed possible that at high illuminations, using a size of photometric field such that the retinal area used is very largely cone, the two methods might agree.

Dr. Ives' paper was discussed by Messrs. R. C. Ware, F. J. Pearson, George C. Keech and S. W. Ashe. Professor Ashe referred to his work in photometry at Columbia and also to the work of Mr. J. S. Dow on the flicker photometer. Dr. Ives claimed that the eye alone could be used as an instrument to compare candle-power, and that it is best not to compare lamps of different colors, but to refer each lamp to one of its color standardized at the laboratory.

At the afternoon session the remaining papers on the program, abstracts of which follow, were disposed of.

FLAME PH[illegible]

Messrs. E. B. Rosa and E. C. Crittenden reported the results of a study of flame photometric standards made at the Bureau of Standards. The authors found that, when proper account is taken of the humidity, temperature and barometric pressure, pentane lamps form a reliable source of standard candle-power. They found the same light-humidity coefficient for all ranges of humidity, namely, 0.0567 candle for a change in water-vapor of 1 liter per cubic meter. The light-barometric coefficient was about 0.6 per cent for a change of 1 cm in the pressure (mercury).

Three papers outlining the advantages of illuminating engineering to various interests were presented by Messrs. W. J. Serrill, J. F. Gilchrist and V. R. Lansingh.

Mr. Serrill stated that the commercial man is dependent upon the illuminating engineer for the design and development of the electric and gas lamps which he may offer to the public. In order to sell these he must have a comprehensive knowledge of the salient characteristics of each of the units. For this knowledge he is dependent upon the illuminating engineer. Since practical considerations force the application of lighting units to interiors into the hands of the canvasser, he must be able to solve problems relating to the illumination of interiors. The principles needed by the commercial man are relatively simple, and he can easily grasp them if he appreciates their importance and seriously applies himself to them. He should learn how to determine the amount of illumination from the curve of the lighting unit when the units are spaced at any given distance and height, and how to allow for the effects of reflection from walls and ceiling.

Mr. Gilchrist remarked that from the standpoint of their own interests the central stations should foster the development of illuminating engineering and the training of the young men in the industry to a thorough knowledge and appreciation of the fundamental principles of proper illumination. Proper influence should be exerted to ensure that the light produced will be used in the correct, hygienic and economical manner. That is to say, the education of the customer to an appreciation of proper illumination is of great benefit to the central station. Mr. Gilchrist contended that the central-station manager should wake up thoroughly to the fact that in the lighting end of his business what he should sell is an effective and useful illumination, and not merely electricity. He cannot sell the former without the aid of representatives who are thoroughly well educated and up to date in matters of illumination, and in such representatives he has nothing more or less than a corps of illuminating engineers, despite any prejudices he may entertain.

Mr. Lansigh classed the manufacturers who are benefited by illuminating engineering under the heads of makers of artificial illuminants, shades and reflectors, lighting auxiliaries and energy itself. The advantages to each of these were outlined. Mr. Lansingh said that by applying the laws of illuminating engineering the illuminant manufacturers' products are improved. A knowledge of illuminating engineering causes the salesman of a manufacturer to solicit business intelligently and obtain satisfied customers. Present-day shades and reflectors could not be produced without a comprehensive knowledge of illuminating engineering.

Wisconsin Commission News.

The commission has [illegible] the City of Kaukauna vs. the Kaukauna Gas, Electric Light & Power Company, in which the petition of the plaintiff for an approved service has been granted. The petition alleged in the main that the commercial and private lighting service as furnished by the respondent lighting company was grossly inadequate. The evidence and the tests made by the engineers of the commission showed [illegible] plant and distribution system are wholly inadequate to meet the reasonable demands of the city. The distribution system was poorly constructed in the first place and has never been properly maintained since. The power plant is in little better condition, for much of it is obsolete and there are many appliances lacking which are necessary to the rendering of good service.

The respondent attributes the poor condition of affairs to the failure of the City Council to sign certain street-lighting contracts extending over a period of years and calling for an increase in the number of street lamps. The contracts for some time past have been on the month-to-month basis and the company claimed that the uncertainty of the street-lighting business as now conducted did not warrant it in making the improvements necessary to give satisfactory service. And without certain of these needed improvements the commercial lighting service must remain unsatisfactory. Regarding this matter the commission says: "The rules prescribed by the commission concerning the standard of service required of every utility have not been observed, and could not in the situation be observed, until extensive work of repair, reconstruction and extension of the power plant and distribution systems was first performed. Further delay in putting the power plant and distribution system in an efficient operating condition will not be endured. The public is entitled to a reasonably adequate service. Neglect or failure to furnish such service is not excusable on the ground that the municipality refuses to enter into a contract with the company for street lighting."

Regarding the possibility of the city wishing to sign a contract for power at some future time and for an increased amount of power, the commission says: "The company cannot be expected to install units in its power house to meet unusual or exceptional demands. It must from time to time make such extensions to its system as public necessity requires, but it is not required to anticipate any unusual demands for service that may hereafter arise. Whenever any such exigency occurs it must be considered and provision made therefor, but any unnecessary enlargement of the plant to meet every possible demand for service is not justifiable, as it might result in placing an unjustifiable burden upon consumers by requiring them to pay returns upon additional investment as well as for the upkeep, depreciation and operation of property not reasonably necessary for their service." The commission suggests that if the city contemplates increasing the number of street lights it might avoid considerable delay if a contract were signed before the reconstruction, as ordered by the commission, was begun.

The commission has ordered that the respondent company make such additions, alterations and repairs as will render its power plant and distribution system adequate and efficient for the purpose of supplying the City of Kaukauna with reasonably adequate service and that it observe and comply with the standards of service as fixed by the commission. Ninety days is deemed a reasonable time within which to comply with the order and no postponement of the time of taking effect of the order will be granted.

The commission has authorized the Columbia County Electric Light & Power Company to issue $25,000 par value of twenty-year bonds, to bear interest at the rate of 6 per cent. The bonds are to be sold for money only and for not less than 75 per cent of the par value. Also 280 shares of common stock, of the par value of $25 each, to be sold for money only and for not less than par value.

The purposes for which the stock and bonds are to be issued and disposed of are as follows: (a) Bonds of the par value [illegible] and exchanged for the interest and property of what is now known as the Duck Creek Light & Power Company; (b) stock [illegible] pany with funds for making additions and extensions to the property.

Maryland Commission News.

[illegible] Service Commission will begin the latter part of this week hearings on the schedules of rates proposed by the Chesapeake & Potomac Telephone Company as a substitute for the schedule of charges now made by it. Since the matter was first brought up the commission has been gathering data and information from every available quarter in order that it might feel competent to deal with the question when it was brought up. Although the new schedules were filed in the summer, the representatives of the company requested a postponement of the hearing because of the absence of some of its officials. Oct. 24 was fixed by the commission as the time for the first hearing, but it is likely that the real hearings will not be begun until a few days later, awaiting the return of all of the counsel and parties interested from their vacations. While the new rates are proposed as reductions, the flat rate for unlimited service has been eliminated. This feature of the proposed schedules has created dissatisfaction and led to protests being filed with the commission.

The subject of lower rates for gas and electric service asked for by the City of Baltimore will come before the commission in formal complaints which Mayor Mahool and the City Solicitor will file within the next two weeks. During the summer months experts employed by the city have been preparing the city's side of the case. Superintendent Robert J. McCuen, of the Department of Lamps and Lighting, recently reported to the Mayor conclusions which he has reached through the aid of electrical experts as to the cost of electricity for street lighting and service to municipal buildings. Prof. Charles E. Munroe, of the George Washington University, a gas expert, will complete within the next week his report regarding the rates charged in Baltimore for gas. While both the reports of Mr. McCuen and Professor Munroe deal particularly with the rates charged to the city for gas and electricity, yet it is expected that they will be made the basis of a demand by the city for a reduction in general commercial rates.

New York Commission News.

The Public Service Commission, Second District, has made order requiring the New York Telephone Company to file on or before Nov. 1 a schedule showing the number of pay stations operated within the City of New York, together with the gross earnings received therefrom. It is required that the statement show separately by the districts as adopted by the [illegible] and by classification as shown in its schedule of tariffs filed with the commission: the number of pay stations, automatic pay stations and approximate number of each type of automatic pay stations in use in each district; the different classes of locations in which pay stations are now established, together with the relative number in each class, and whether standard pay stations or automatic pay stations.

The commission has also required every telephone corporation under its jurisdiction to file on or before Nov. 15 schedules which will show by each exchange separately those of its patrons or subscribers who are receiving telephone service of any character at rates or charges which vary or differ in any respect from the standard rates adopted and now in force for contracting new business.

The commission has also ordered every telephone corporation under its jurisdiction to file on or before Dec. 1 schedule showing all rates, rentals and charges for services of each and every kind by or over its line or lines between points in New York and between each point upon its line and all points upon every line leased or operated by it and all points upon the line of any other telephone corporation whenever a through service or joint rate shall have been established between any two points.

Such schedules are required to show also all charges and all privileges or facilities granted or allowed and any rules or regulations or forms of contract which may in any wise change, affect or determine any or the aggregate of the rates, rentals or charges for the service rendered.

The commission has received a complaint from Academy Grange No. 62, of Cheshire, Ontario County, directed against the Interlake Telephone Company increasing its rate from $12 to $15 per year. Complaint is also made of the service now rendered the public. Complaint has been served upon the company and an answer required within twenty days.

The commission will give a hearing this week on the application of the Suffolk Gas & Electric Light Company for authority to acquire all of the outstanding capital stock of the East Islip Electric Company and to merge that company; on the complaint of the East Islip Light Company against the Sayville Electric Company alleging that the latter company is unlawfully stringing wires and furnishing electricity at East Islip; on the application of the Islip Light Company for authority to issue $30,000 of common capital stock and $20,000 of bonds; on the application of the Hudson River & Eastern Traction Company, of Ossining, for authority to issue $50,000 additional common capital stock and $850,000 additional first mortgage bonds; on the complaint of the Middleport Gas & Electric Light Company against the A. L. Swett Electric Light & Power Company alleging unlawful operation in construction of lines in the town of Royalton, Niagara County; and on the application of the Middleport Gas & Electric Company for permission to exercise franchises in the town of Royalton.

The commission has authorized Mr. Moritz Mayer, of Syracuse, to transfer and assign the franchises granted by the village of Camillus and town of Camillus to furnish electricity to those communities to the Syracuse Lighting Company, the latter named company to carry out the provisions of the franchises, the municipalities having consented to such transfer. An agreement has been approved of whereby the Hornellsville Electric Railway Company, Hornellsville & Canisteo Railway Company and Canisteo Valley Electric Railway Company are consolidated into one company known as the Hornell Traction Company. The new company is authorized to issue common capital stock to the amount of $120,000, which shall be exchanged for the stock of the consolidated companies.

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission has received a petition from the Plymouth Electric Light Company asking the approval of the board upon a proposed issue of $30,000 worth of additional capital stock, the proceeds of which are to be used in paying off funded debt incurred in making extensions to the company's physical plant. A hearing will be assigned.

The Massachusetts Railroad Commission gave a hearing on Oct. 18 upon the petition of the Selectmen of Abington for the establishment of a 5-cent fare from all parts of the town of Abington to the City of Brockton, on the lines of the Old Colony Street Railway Company. Bentley W. Warren, Esq., Boston, appeared for the company and stated that if the fare should be granted it would be a financial injury to the lines in question and would cause discrimination between Whitman and Abington as regards service between those towns and Brockton. He argued that the present fare affords a rate of only 1 cent per passenger mile, which is too low for profitable operation in New England country districts. The board took the case under advisement.

The board heard the petition of the Mayor and Aldermen of Newburyport on Oct. 19, praying for fare reductions and extensions of transfer privileges on the lines of the Haverhill & Amesbury Citizens' Electric and Boston & Northern Street Railways Companies. City Solicitor Withington, of Newburyport, represented the petitioners, who urged that the board require the three companies to interchange transfers in Newburyport so that a uniform 5-cent fare would prevail in the city, and to reduce the fare from Newburyport to Smithtown, at the New Hampshire state line, from 10 cents to 5 cents. President David A. Belden, of the Haverhill & Amesbury company, submitted figures showing that in the past ten years the company has accumulated a deficit of about [illegible]. The com

pany is a part of the system controlled by the New Hampshire Electric Railways, but Chairman Hall refused to recognize the holding organization, although pressed to do so by the petitioners. He declared in no uncertain tones that the business of the Massachusetts board is with the equity of fares and the financial showing of Massachusetts street railways, rather than with outside corporations with which they may be affiliated. The petitioners endeavored to show that the original franchise granted the Haverhill & Amesbury company called for a 5-cent fare between Smithtown and Newburyport, and contended that the agreement was at least morally binding, although, as Chairman Hall pointed out, the decision of the Massachusetts Supreme Court in the case of Keefe vs. Lexington & Boston Street Railway Company, decided in 1904, stated that a conditional franchise is not legally binding. Chairman Hall asked the petitioners four times if they would declare that such an agreement is morally binding if it can be shown that it is financially impossible, and each time the reply was an evasion. The board closed the hearing and took the case under advisement.

At recent hearings upon Boston transit matters before the joint board consisting of the Massachusetts Railroad and Boston Transit Commissions a strong sentiment has been displayed in favor of relocating the new subway shortly to be built under the Charles River embankment from Park Street to the Charlesgate district. An association of influential merchants in the Back Bay proposes the construction of a four-track subway under Boylston Street and Commonwealth Avenue, with provision for local car service under Washington and Essex Streets to the South Station. A plan has been advanced for the establishment of express service to Park Street by a subway loop from Church Street running under Boston Common, with a station at Church Street for inter-train transferring. It is contended that the completion of the river-bank subway will tend to drive shopping away from the Back Bay, since it will deflect from that district a large part of the traffic which now passes through it by surface cars serving the western suburbs of Boston. Another project to which the joint board has given attention is the proposed West End loop in connection with the Boston terminus of the Cambridge subway. Property owners in the West End emphasize the fact that the district is rapidly deteriorating and that it needs new rapid transit facilities in order to attain a commercial and moral revival. A hearing will be given in the near future at which the Boston Elevated Railway Company will present its views regarding changes in the subway plans now authorized by law. It is probable that the company will adhere, in large measure, to the existing plans, which have been laid out with the transportation welfare of the metropolitan district as a whole in mind. The estimated cost of building a four-track subway under Boylston Street is at least $7,000,000, and it is questionable if the company, committed as it is to huge expenditures for rapid-transit improvements under present construction, would consent to further responsibilities of the kind outlined above. An interesting phase of the situation is the publication in the Boston dailies by the Boston Elevated Railway Company of a series of maps showing the part the company has had in developing rapid transit in the past decade.

A hearing was recently given by Governor Draper at Boston upon the complaint of a committee of subscribers of the New England Telephone & Telegraph Company that the new rate schedule proposed by the Massachusetts Highway Commission will result in larger telephone bills than prevail under the present system. Evidence was introduced by Representative C. A. Dean, of Wakefield; Mr. Benjamin C. Lane, of the United Improvement Association; Mr. William E. McClintock, chairman of the Chelsea Board of Control, and others. Governor Draper pointed out that the authority of the Highway Commission over telephone rates is derived from the Legislature and that his own power is only appointive. He stated that the object of the commission was to reduce telephone rates, after it had gone thoroughly into the matter, and that the actual working out of the problem is most difficult, since many persons have been receiving service at less than its fair cost. The Governor pointed out that State regulation presupposes equality to all as nearly as can be attained. Concluding, he said that he would do everything he could to see that the committee had full opportunity to be heard. Commissioner William D. Sohier then stated that if the committee would ask for a hearing on the new rates the Highway Commission would be glad to give one, and he pointed out that in spite of all the agitation which had arisen the board had not been asked to give such a hearing.

The joint commission on metropolitan improvements, composed of the Massachusetts Railroad, Harbor and Land, Metropolitan Park and Boston Transit Commissions, gave a public hearing at Boston on Oct. 20 upon the proposed tunnel between the North and South Stations. The hearing was given over to arguments in oposition to the tunnel, and among the speakers were Mr. William B. Lawrence, of Medford, Mass.; Mr. Joseph B. Eastman, Boston, secretary of the Public Franchise League; Mr. Charles A. Ufford and Mr. J. W. Ayres, Boston. It was argued that the estimated cost of such a tunnel, equipped for electrical operation, is too great an investment for the results contemplated. The estimate is $16,000,000. Secretary Eastman favored the construction of the tunnel by the Boston Transit Commission, by the railroads, with immediate State ownership, and, as a third alternative, construction and ownership by the Boston Terminal Company, which built and owns the South Station. Chief Engineer Wheeler, of the New York, New Haven & Hartford Railroad Company, stated that the plans for the tunnel had been presented to a sub-committee of the joint board and that the company considered no further statement necessary at present.

CURRENT NEWS AND NOTES.

I. E. S. Lecture Course.—The number of registrations for the lecture course at Johns Hopkins University under the joint auspices of the university and the Illuminating Engineering Society had reached 212 on Tuesday morning of this week.

Next Joint Electrical Meeting in Chicago.—The next joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers will be held at the rooms of the former in the Monadnock Building, Chicago, on the evening of Wednesday, Nov. 23. Dr. E. J. Berg, professor of electrical engineering in the University of Illinois, will address the meeting on "The Surging of Synchronous Machines."

Electrical Workers' Union on the Isthmus.—A meeting was called for Oct. 9, at Ancon, on the Isthmus of Panama, for the purpose of installing a local lodge of the International Brotherhood of Electrical Workers. This lodge was to have jurisdiction over the Canal Zone. It is probable that by this time the union is in regular working form. The notice for the meeting said that all electrical workers were eligible to become charter members, and it is interesting to observe that this notice was published in the official organ of the Isthmian Canal Commission.

"The Big Stick."—On the occasion of the visit of Theodore Roosevelt to Milwaukee last month the Milwaukee Press Club celebrated the occasion by issuing the first, last and only number of *The Big Stick*, a twelve-page, seven-column newspaper published solely in honor of the former president. The paper had many interesting articles, and, with its editorials, illustrations, cartoons, fashion hints, theatrical, market, marine and sporting departments, all cleverly relating in some way to the distinguished guest, was really a notable production. Advertising was carried, and the paper bore every mark of a modern, enterprising and prosperous daily. Electrical men will feel an especial interest in the achievement from the fact that the idea was suggested and its execution actively assisted

by Mr. Charles L. Benjamin, advertising manager of the Cutler-Hammer Manufacturing Company.

Large Attendance at New York Electrical Show.—Although the actual figures are not yet available, those in charge of the New York Electrical Show state that the attendance during the ten days of the show was, in round numbers, 160,000.

The Dangers of Gas.—One of the large gas interests has taken the precaution to supply its plant with a kit for use in case of asphyxiation. This consists of a handled box containing, among other things, effervescing phosphate of ammonia and aromatic spirits of ammonia, with sponge attachment, wooden tongue pliers and wooden jaw blocks. This should make an instructive exhibit for a central-station showroom.

St. Lawrence Power Transmission Company.—Another effort is being made by the St. Lawrence Power Company to obtain the consent of the Dominion government to the development by the company of the Long Sault rapids. A further set of plans was submitted to the government's engineers at Ottawa on Oct. 19, but no conclusion was reached. Mr. F. W. Bowden, chief engineer of the Department of Railways and Canals, will make a tour of inspection of the proposed works.

Meeting of New York Electrical Society.—At the next meeting of the New York Electrical Society, to be held in the Engineering Societies Building, 29 West Thirty-ninth Street, New York, Oct. 28, Mr. Gilbert H. Aymar will lecture on animated photography in natural colors. The lecturer will outline briefly the principles of the art of motion photography and also describe the various steps taken in the development of "kinemacolor," a process by which the actual colors of the objects photographed are reproduced.

A Central Station "Opening" in St. Louis.—On the occasion of the opening of its new West End branch office at 4912 Delmar Avenue, near Euclid Avenue, on Oct. 19 and 20, the Union Electric Light & Power Company, of St. Louis, gave away a number of electric household appliances. These gifts included such conveniences as electric toasters, flatirons, corn poppers, coffee percolators, chafing dishes, waffle irons, curling irons, shaving mugs, etc. The opening was advertised in the daily newspapers and attracted much attention.

Fort Wayne A. I. E. E. Section Excursion.—Twenty-six members of the Fort Wayne (Ind.) section of the American Institute of Electrical Engineers of Fort Wayne made an inspection trip last week in a special car over the Fort Wayne & Wabash Valley Traction line. The start was made from the Fort Wayne Electric Works, and the first stop was at Delphi to inspect the modern substation of the road at that point. The party then proceeded to Lafayette, arriving at 1 o'clock. After dinner they inspected the company's new power house, leaving on the return trip at 6 o'clock.

Denver Electrical Show.—The Colorado Electric Club at its weekly lunch, on Oct. 20, held an informal report meeting to discuss the popular and financial results of the Denver Electrical Show. About 50,000 paid admissions were recorded, and opinion on all sides was favorable to the continuance of annual shows. One hundred per cent dividends and a balance in the neighborhood of $2,500 were also announced. Plans for entertaining the Jovians at next year's annual rejuvenation in Denver will be discussed by the club at a business meeting and smoker Saturday evening, Oct. 29.

Utilization of Dam of Unknown Origin.—Situated in the Animas Valley in New Mexico and extending across the boundary line into Mexico are the remains of a dam 15 miles in length. This dam, which was constructed by people of an unknown civilization, is of semicircular shape, 40 ft. high, 150 ft. wide across its base and 40 ft. wide at the top. It was built of earth mixed with concrete material, and is in an excellent state of preservation. It is reported that the 100-ft. break in the dam will probably be repaired and an enormous reservoir will thus be formed for irrigation and other projects.

Columbia University School of Industrial Arts.—The Teachers' College of Columbia University, New York, has established a School of Industrial Arts, devoted to the technique of fundamental processes in industries and commerce and the study and practice of the educational method of these subjects in the work of instruction in schools of various types and grades. Instruction will also be given in evening technical courses to all qualified students who desire to obtain technical knowledge in trades and professions represented by the courses. Mr. Victor R. Greiff is in charge of the instruction in electricity, which includes a course for wiremen, linemen, dynamo attendants and others working on or handling electrical apparatus, and an advanced course in electrical machinery.

Letters for Four-Party Telephone Calls.—Letters of the alphabet, in addition to numbers, are being used in calling telephone subscribers on four-party lines in the suburban district around Chicago. The letters chosen, after much experimenting to select those best adapted for telephone enunciation, are L, R, J and W. No letters are used in connection with numbers except on the four-party line service. But a subscriber on a four-party line will have a letter added to his present number, as, for instance, 786-R. It is believed that the addition of letters will decrease the likelihood of making mistakes. The introduction of this system is not contemplated in the City of Chicago, but the plan has been carried into effect in Joliet and other near-by places within the territory of the Chicago Telephone Company. The combination of numbers and letters for telephone calls is not new, but it is something of a novelty in Chicago and its vicinity.

Meeting of Cleveland A. I. E. E. Section.—Lamps and illumination were the theme of the program for the regular October meeting of the Cleveland Section of the American Institute of Electrical Engineers, which was held Monday evening, Oct. 17, in the rooms of the Cleveland Engineering Society, 718 Caxton Building. Mr. G. S. Merrill reviewed his paper on "Tungsten-Filament Lamps," which he presented before the Toronto Section and which appeared in the September *Transactions* of the A. I. E. E. Mr. M. D. Cooper discussed the stresses which exist in filaments when lamps are burned in a horizontal position and also described the methods of deriving equations for accurately calculating the performance of various types of filaments. Mr. J. G. Henninger gave a brief résumé showing that there is almost no field of illumination which has not felt the effect of the new high-efficiency lamps. The importance of providing proper light in industrial work was touched upon by Mr. Ward Harrison. The insignificant cost of such lighting when compared with the value of the workman's time, said Mr. Harrison, is quite striking. Assuming on an average a wage of 30 cents an hour by the use of high-efficiency lamps, the saving of twenty-four seconds of the workman's time each day, by reason of the better illumination, would pay the entire cost of his share of illumination for two hours. As it is probable that much more time than this would be saved each day, a good rate of return is, therefore, secured upon the money invested in proper lighting. The proper method of calculating comparative costs of lighting was also discussed by Mr. Harrison, and the necessity of considering the items of depreciation and maintenance and the efficiency of utilization was particularly emphasized. Calculations on this basis show that the present cost of producing the electric light is less than the cost of equivalent lighting with gas, exactly the reverse of the opinion accepted by many.

Mr. J. D. Hoit presented a number of excellent views of industrial illumination with incandescent lamps in various classes of service from steel and textile mills to breakfast-food factories. At the conclusion of this paper a general discussion on the several papers took place.

ELECTRICAL EQUIPMENT OF THE PLYMOUTH ELECTRIC LIGHT COMPANY.

Electrical service in the historic town of Plymouth, Mass., is supplied to the community by the Plymouth Electric Light Company, whose generating plant is located on Leyden Street, the oldest thoroughfare in New England. Central-station distributing circuits to-day occupy a field which less than 300 years ago was often darkened by Indian arrows aimed in vain against advancing civilization. The historic charm of this typical New England seaside community outlasts repeated visits; but its industrial life is so diversified that there is nothing incongruous in the maintenance there of a progressive central-station organization, although in the central shrine of American liberty. The sense of past glories is so keen, however, in Plymouth that one cannot help speculating upon the amazement which even valiant Captain Standish and his devoted followers would display if permitted to witness the transformation of their ancient street which has been effected by the establishment upon it of the most modern electric generating facilities.

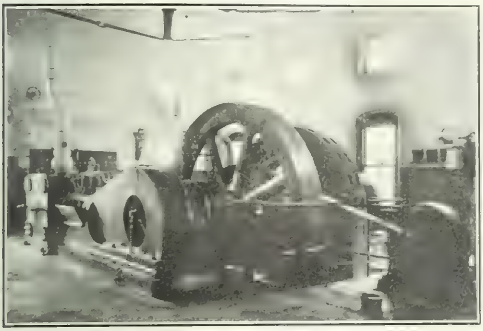


Fig. 1—360-kw Unit Engine Room.

The Plymouth company serves 709 customers in the three Massachusetts Bay towns of Plymouth, Duxbury and Kingston. Its outstanding capitalization on June 30, 1910, was 900 shares of stock of the par value of $90,000. The local industries include the largest cordage factory in the world, woolen, tack and rivet mills, zinc works, foundries and laundries. The population of Plymouth is about 12,000 and the total population tributary to the local central-station service is approximately 15,000. In the past three years the connected motor load has risen from 487 hp to 985 hp; an excellent day load in proportion to the size of the district served has been established; the tungsten lamp has come into general service for street lighting; gross earnings have increased from $36,848 to $50,809, and the total investment in the plant has increased from $174,313 to $222,221.

The generating plant of the company was crippled by a serious fire on April 26, 1909. The equipment of the old station consisted mainly of a 250-hp McIntosh & Seymour engine belted to a 150-kw, three-phase alternator, two multipolar, 90-kw 550-volt, direct-current generators; a 200-hp Ide engine belted to a 120-kw, single-phase alternator and a 90-kw, direct-current generator; a 125-hp Ide engine belted to a 90-kw, single-phase alternator, and a 360-kw, direct-connected alternator driven by a Harris-Corliss horizontal cross-compound engine. The last unit had just been installed when the fire broke out. As soon as the fire occurred General Manager E. P. Rowell made arrangements with the Brockton & Plymouth Street Railway Company for the supply of energy temporarily from its generating plant. A 200-kw, three-phase generator was shipped on a rush order from the Schenectady works of the General Electric Company and belted to an engine in the Brockton & Plymouth station. The entire service of the Plymouth Electric Light Company was restored within fifty hours of the fire, temporary overhead circuits being run to the street railway plant from the Leyden Street station, a distance of about half a mile. The company did not lose a single customer by the fire.

It was immediately decided to rebuild the Leyden Street station along thoroughly modern lines. The 360-kw alternator was found to be capable of service after a complete drying out and a second unit of the same size and type was purchased, both being installed in a 70-ft. x 33-ft. engine room. Each unit consists of a 15-in. x 28-in. x 30-in. Harris-Corliss engine driving a 360-kw, 2300-volt, three-phase, 60-cycle General Electric revolving-field alternator. The station building is a brick structure with an expanded metal roof supported by mill construction. Fig. 1 shows one of the 360-kw units, with its piping, and the general character of the roof construction. Each unit is provided with an 18-kw, 125-volt exciter, belt-driven from the flywheel shaft. The two units are installed with their axes at right angles on account of the limitations of space in the engine room. The normal speed of each unit is 150 r.p.m. The plant is provided with a ten-panel marble switchboard located on the floor of the engine room, shown in Fig. 2. There are one exciter, two machine, two reserve, four feeder and one street-lighting panel, with the usual synchronizing bracket, lamps and indicator. The street-lighting panel carries three circuits, only two of which are as yet in use. Two sets of busbars are provided on the 2300-volt service and duplicate switches of the oil-break type, so that either generating unit can be thrown upon either busbar. The same arrangement applies to the feeder circuits, one switch being provided for one busbar and a second for the other. The feeder is tapped off a common terminal connection of each switch and this arrangement saves space upon the back of the board. Two 125-volt exciter busbars are provided at the rear of the board.

Each generating unit is supplied with live steam from two batteries of three boilers located in a fire room adjoining the engine room. There is one horizontal return-tubular Strothers & Wells 150-hp boiler in the plant and there are two

Fig. 2—Switchboard

Babcock & Wilcox water-tube boilers rated at 200 hp each, the normal steam pressure of the service being 140 lb. The engines are equipped with a gravity-feed oiling system with an elevated tank in the engine room to which the oil is pumped after being stored and filtered. Each engine is of the condensing type, fresh water for boiler feeding being supplied from the old Town Brook. The plant is located practically on tidewater. The piping is so arranged that if the high-pressure cylinder of either unit fails steam can be supplied to the low pressure cylinder through the receiver and a reducing valve, enabling the engine to be operated at reduced load on the low-pressure cylinder. Provision is also made for exhausting into either the condenser or the atmosphere, an automatic valve being provided in the exhaust piping so that if the vacuum becomes broken the engines will discharge steam into the air at the top of the station building. Worthington jet condenser

equipment is installed. The live-steam supply from the boiler room is drawn from an 8-in. main, the engine high-pressure cylinders being served by 5-in. branches.

On account of the limited space in the engine room one belt-driven exciter is installed in the basement below, as shown in Fig. 3. This photograph also shows the arrangement of the outgoing feeders and the series transformers under the switchboard floor level, with the wall opening whence the outgoing lines pass to the street and thence diverge to the various centers of distribution. The field rheostats are also carried on a concrete framing in the engine-room basement The station wiring is carried in conduit throughout. The conduits are in general carried on 1.5-in. pipe racks.

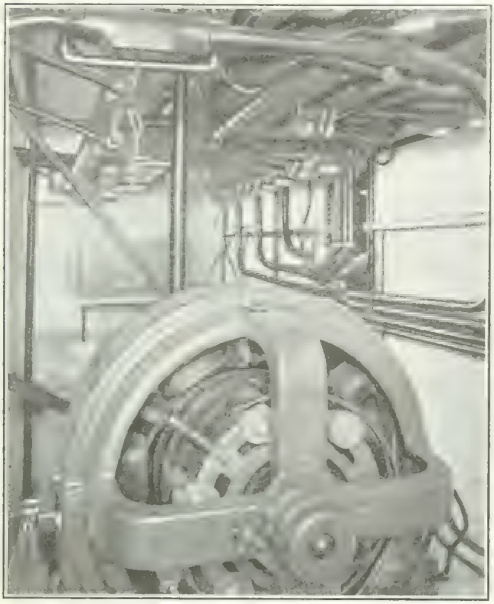


Fig. 3—Engine-Room Basement Wiring Arrangements.

Adjoining the engine room is a motor-generator room 40 ft. x 30 ft. in dimensions. This at present contains a 150-kw, 550-volt, direct-current multipolar generator belt driven by a 200-hp, three-phase General Electric synchronous motor and a 15-kw direct-current generator driven by a belt attached to a 20-hp synchronous motor. A four-panel switchboard is used in measuring and controlling the output of these machines, which in the main supply energy to the company's direct-current system. The motor-generator room is large enough for the installation of a steam turbo unit in case it becomes desirable later. The smaller of the two present sets is used to carry the minimum load late at night or on Sundays and holidays. Fig. 4 shows the motor-generator room and Fig. 5 shows the company's load curve on the day of the maximum peak during the past year. The maximum load attained was 300 kw and the average load throughout the daylight period was about 250 kw. The day's output was 4530 kw-hours.

The company's prices for motor service vary from 10 to 3 cents per kw-hour with discounts of 0 per cent to 70 per cent, according to consumption. A minimum charge of $1 per horsepower per month is made for motors rated between ⅛ hp and 5 hp if not used. The liberal discounts given for large consumptions have been responsible for much of the company's recent success in securing a larger connected motor load.

The lighting rates are divided into two classes, "A" and "B." "A" customers are defined by the company as those who have a large number of lamps installed and use only a few of them, or customers who do not use lighting every night of the week, such as house and store lighting, particularly where the store is closed the majority of nights each week. "B" customers are those who use practically all their lights every night, such as drug stores, restaurants and hotels. In the past it was the custom of the company to allow discounts ranging from 5 per cent to 35 per cent for "A" customers and 10 per cent to 50 per cent for "B" customers. This kind of a rate was found to be inequitable, as there were conditions under which it would have been cheaper for the customer to have used a little more energy. For example, if a customer's bill was $9.90 his bill after a 5 per cent discount would have been $9.41. If, however, he had used $10 worth of energy, he would get a discount under the old plan of 10 per cent, making the bill $9.00 net. In other words, 50 kw-hours were cheaper by 41 cents than 49.5 kw-hours were.

To overcome this difficulty the company arranged a sliding scale, with rates of 18 cents, 13 cents, 11 cents and 10 cents per kw-hour, as follows: For energy used up to 100 kw-hours, 18 cents; for the next 100 kw-hours, 13 cents; for the next 100 kw-hours, 11 cents; for all additional energy, 10 cents.

A minimum charge of $1 net per month is made on all bills. The results of this schedule are: First, an equitable rate to customers; second, a uniform discount for all classes of service; third a reduction in rate of 20 per cent to customers whose bills are less than $5 and a substantial reduction to large users. This rate means a saving of 38 cents net on a bill for 10 kw-hours, 76 cents on 20 kw-hours, $1.12 on 40 kw-hours, $1.26 on 70 kw-hours and 80 cents on 100 kw-hours. A discount of 10 per cent is allowed on bills of "A" customers and 20 per cent on bills of "B" customers. The company's lighting service is a single-phase, 60-cycle, 110-volt alternating supply.

The street-lighting service is given by means of two tub transformers of 6.5 amp rating and 32.5-kw combined rating. There are now eight municipal arc lamps and 365 50-watt tungsten incandescent lamps in street service. During the past year the street lamps were burned 3039 hours. The arc lamps are run upon an all-night moonlight schedule at a rate of $125 per lamp-year and service on a midnight moonlight schedule is charged $85 per lamp year. The incandescent rates run from $20 to $21 per year. The company's connected load in kilowatts is as follows: Municipal arc lamps, 3.6 kw; commercial arc lamps, 3.6 kw; municipal incandescent lamps, 18.2 kw; commercial incandescent lamps, 906.5 kw; Nernst lamps, 8.9 kw; alternating-current motors, 485.0 kw; direct-current motors, 229.0 kw. The total is 1654.8 kw.

Fig. 4—Motor-Generator Room.

The company's system now includes 152 transformers, the most common size being 600 watts, thirty-eight of these being in service. There are 779 meters and the company has 1500 wooden poles and 751,228 ft. of wire in operation. The distribution circuits include 10,576 ft. of arc-lamp circuits, 182,720 ft. of municipal incandescent lamp lines, 329,540 ft. of primary alternating-current wire, 171,192 ft. of alternating-current secondary wire

46,500 ft. of direct-current motor-service lines and 10,700 ft. of alternating-current motor-service primary lines. A 24-hour service is furnished by the company. It does not wire buildings. The output for the year ended June 30, 1910, was as follows: Total kw-hours at switchboard, 1,134,201; kw-hours for street lighting, 67,560; kw-hours for commercial lighting, 301,768; kw-hours for motor service, 361,142; total accounted for, including 10,500 kw-hours used by company, 740,970; total kw-hours unaccounted for, 393,231.

The company's revenue for the year was $50,808.85, the larger items being commercial lighting, $27,534.71, and electric motor service, $15,118.18. The average revenue per kw-hour sold was 7.65 cents and the average income per kw-hour sold for motor service was 4.16 cents. The income from all

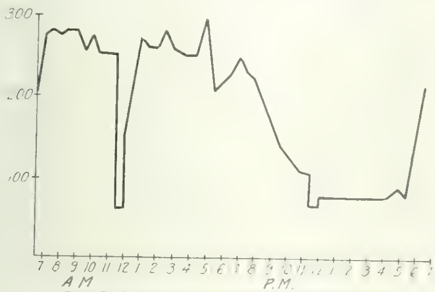


Fig. 5—Load Curve, Showing Highest Peak.

sales per kilowatt of station rating was $59.30. The company's investment on June 30, 1910, was as follows: Lands, $3,964.50; buildings, $18,421.23; steam plant, $57,914.68; electric plant, $63,055.10; overhead lines, $54,912.56; Nernst lamps, $940.69; transformers, $8,527.61; meters, $12,245.33; arc lamps, $2,238.98; total, $222,220.68, or approximately $255 per kilowatt of station equipment.

The net station cost of electrical production at the switchboard for 1910, exclusive of any fixed distribution or administrative charges, was about $11,190, or 1.72 cents per kw-hour manufactured. The company burned 251 tons of Cumberland coal and 766 tons of New River coal during the year, the former costing $4.03 and the latter $3.96 per ton. The total operating expenses were $35,829, or 3.16 cents per kw-hour. The company purchased about 484,000 kw-hours from the local street railway company at an approximate cost of $8,497.

The officers of the company are: President, Arthur C. Bent, Taunton, Mass.; clerk, Arthur Lord, Plymouth, Mass.; treasurer and manager E. P. Rowell, Plymouth, Mass.

NIGHT-SCHOOL SCHOLARSHIPS IN CHICAGO.

President Samuel Insull, of the Commonwealth Edison Company, of Chicago, has issued a letter to the employees of the company in which he says that the results obtained by the award of night-school scholarships last year by that company are so encouraging that the company has decided to award scholarships for additional courses this year to such of last year's students as are worthy of further encouragement in the judgment of the employees' committee. In addition, the company will also issue thirty-two night-school scholarships to worthy employees, which will cover tuition for one course in one school-year at a cost not to exceed $15 in some night school within the city of Chicago. The employee receiving such a scholarship will, subject to the approval of the employees' committee, be allowed to select both the school and the course, but the studies in this course must be such that they will benefit the employee in his work for the company. The conditions under which such scholarships will be awarded are: (a) At least one year's service with good record. (b) Sufficiently good health to undertake night-school work. (c) Studious habits. (d) An observing disposition. Applicants for the scholarship must make their requests through the heads of their departments or sub-departments.

A STUDY OF SLEET LOADS AND WIND VELOCITIES.

By [illegible]

The engineer who is called upon to design pole lines or transmission lines is frequently beset with the difficulty of obtaining reliable data on sleet and wind loads. Sleet storms occur nearly every year throughout large areas of this and other countries. Occasionally they are so severe as to prostrate many lines, especially those of the lighter types of construction, causing much financial loss and interruption to service. The majority of sleet storms occur with some wind, and the combination of wind with sleet, or with wet adhesive snow, is usually the condition which creates the severest loads. An investigation of the stresses which result from this combination reveals the fact that it is most essential to know how much sleet and how much wind will occur simultaneously in given localities. It is impossible, of course, to formulate any general rule or statement in this regard for a country so large as ours, because the climatic conditions range between wide extremes.

The most reliable data now obtainable for the country as a whole are to be found in the records of the United States Weather Bureau. The observatories are so numerous and the observations are now so comprehensive that valuable information can be obtained for practically every locality. The present article deals with an analysis of the Weather Bureau records at Chicago, Ill., made through the courtesy of Mr. Henry J. Cox, in charge of the station. The observations of the Weather Bureau have been amplified from time to time, and while now comprehensive, they were formerly not so much so. It was not possible, therefore, to extend certain portions of the analysis over very long periods, such as twenty years or more. However, the data obtained are believed to furnish the means of drawing valuable conclusions.

Before taking up the analysis in detail the history of the Chicago station will be given, briefly, for the period covered by the study. On June 8, 1873, the station was moved from a former location to the southeast corner of Madison and La Salle Streets, on the Major block, at an altitude of 103 ft. above the street. It remained here until Jan. 1, 1887, and was then moved to the southwest corner of Clark and Washington Streets, on the Chicago Opera House block, at an altitude of 153 ft. above the street. In February, 1890, it was moved to the southwest corner of Wabash Avenue and Congress Street, on the Auditorium, at an altitude of 274 ft. On June 10, 1905, it was moved to its present location on the Federal Building, bounded by Jackson Boulevard, Dearborn, Adams and Clark Streets, at an altitude of 310 ft. above the street. The altitude of the station has increased progressively since 1873, the change in 1890 being very marked.

On account of these changes in altitude it was necessary to divide the study into corresponding periods. The effect of altitude on velocity is very important, although it is only one of several factors that need to be considered. The Weather Bureau observations of wind velocity are made with the familiar cup anemometer, arranged to register the total movement. The observations of maximum velocity are obtained from the difference of two readings for a five-minute interval and are recorded for each hour of the day. The recorded velocities are made on the assumption that the velocity of the cups is one-third the true velocity of the wind, independent of the magnitude of the latter. It is now well known that this assumption is in error, and it has been shown[1] that the true relation is expressed by

[illegible]

where V = true wind velocity,

v = actual velocity of cup centers.

The error in the assumption before stated is not constant, but increases with larger values of velocity. Table I shows the Weather Bureau velocity and the true velocity at ten-mile intervals.

[1] Anemometry, third edition, by C. F. Marvin, Circular D, Instrument [illegible]

A curve can be constructed from Table I to obtain the true velocity for any value of observed velocity. No corrections were applied to the recorded velocities in making the study, which fact should be kept in mind in considering what follows.

TABLE I.—OBSERVED AND CORRECTED WIND VELOCITY IN MILES PER HOUR.

OBSERVED VELOCITY.	TRUE VELOCITY.
10	9.6
20	17.8
30	[illegible]
40	33.3
50	40.8
60	48.0
70	55.2
80	62.2
90	69.2
100	76.2

Before investigating the coincidence of wind and sleet it was thought best to analyze wind velocities independently and establish if possible a law of probability showing how often any given velocity might be expected to occur. This was carried out first on the basis of daily maxima covering a period of five years, from 1905 to 1909, inclusive. During the first five months and ten days of this period the station was situated on the Auditorium at an elevation of 274 ft. above the street, while for the remainder it was situated on the Federal Building at an elevation of 310 ft. This fact is not believed to prejudice the results materially, which may be concluded from the subsequent data and the fact that the major portion of the period comprises 91 per cent of the whole. The daily maxima during this period were classified in the order of their magnitude, as appears in Table II below.

This table exhibits the fact that Chicago's daily maximum winds seldom fall below twelve miles per hour. A calm of twenty-four hours' duration did not occur in the whole five-year period and the lowest maximum was six miles per hour. The velocities of twenty miles, twenty-four miles and thirty miles are especially predominant; this is apparent rather than real and is due probably to the failure to interpolate all readings which fell between the ruled lines of the record sheet. In order to eliminate this defect the observations were grouped in five-mile and ten-mile divisions, as shown in Table III.

TABLE II.—DAILY MAXIMUM WIND VELOCITIES AT CHICAGO, ILL., 1905 TO 1909.

V.	Days.	V.	Days.	V.	Days.	V.	Days.
6	2	22	67	38	41	54	3
7	1	23	68	39	16	55	1
8	2	24	127	40	29	56	2
9	3	25	89	41	12	57	
10	6	26	79	42	16	58	1
11	9	27	43	43	10	59	1
12	18	28	71	44	18	60	2
13	24	29	81	45	5	61	
14	[illegible]	30	101	46	14	62	
15	58	31	45	47	7	63	
16	57	32	53	48	23	64	
17	[illegible]	33	27	49	3	65	
18	61	34	46	50	6	66	
19	[illegible]	35	32	51		67	
20	125	36	83	52	6	68	1
21	48	37	2	53	2		

Table III exhibits a very consistent appearance and shows that the most prominent velocities are between twenty miles and thirty miles per hour, with velocities exceeding fifty miles comparatively infrequent. This information has been employed in the compilation of a probability table showing the probability that any given velocity will occur in a twenty-four-hour period and the probability that the velocity will exceed a certain magnitude during a like period. These probabilities are easily convertible to any other period simply by multiplying them by the number of days in the desired period.

The probable daily maximum velocity is one between twenty-one and twenty-five-miles per hour, and it is equally probable that the maximum will be greater or less than this range. The values of probability in Table IV have been plotted in Fig. 1. Velocities greater than seventy miles per hour will be exceedingly infrequent. A five-year period is inadequate, however, to study these extreme velocities and accordingly a study was made of the monthly maxima from 1873 to 1910. This

TABLE III.—SUMMARY OF DAILY MAXIMUM WIND VELOCITIES AT CHICAGO, ILL., 1905 TO 1909.

V.	DAYS.	DAYS.
0 to 5	0	14
6 " 10	14	
11 " 15	148	501
16 " 20	353	
21 " 25	399	774
26 " 30	375	
31 " 35	203	404
36 " 40	201	
41 " 45	61	114
46 " 50	53	
51 " 55	12	18
56 " 60	6	
61 " 65	0	1
66 " 70	1	
TOTAL	1,826	1,826

study was divided into periods according to the location of the station during that time. The total period was 441 months, from June, 1873, to February, 1910; no observation was recorded for December, 1887, probably because the maximum was less than twenty-five miles.

Table V shows very clearly that the wind velocities increase

TABLE IV.—PROBABLE DAILY MAXIMUM WIND VELOCITIES AT CHICAGO, ILL.

VELOCITY INTERVAL.	AVERAGE VELOCITY.	PROBABILITY That the Velocity Will Occur.	PROBABILITY That the Velocity Will Be Exceeded.
0 to 5	2.5	0.0000	1.000
6 " 10	7.5	.0077	.992
11 " 15	12.5	.0811	.911
16 " 20	17.5	.193	.718
21 " 25	22.5	.219	.500
26 " 30	27.5	.205	.294
31 " 35	32.5	.111	.183
36 " 40	37.5	.110	.0729
41 " 45	42.5	.0334	.0394
46 " 50	47.5	.0290	.0104
51 " 55	52.5	.0066	.00383
56 " 60	57.5	.0033	.00055
61 " 65	62.5	.0000	.00055
66 " 70	67.5	.00055	.00000

with the elevation. But elevation alone is not a criterion, because surrounding objects such as trees and buildings play an important part. The contour of the surrounding country, if uneven or hilly, is also important. It will be noticed that as a whole the velocities on the Federal Building, at 310 ft. elevation, seem to be slightly less than the velocities on the Auditorium, at 274 ft. In this connection Mr. Cox states that the total wind movement observed on the Federal Building is about 10 per cent less than that on the Auditorium, caused by the fact that the former is situated among high buildings which afford some slight protection, while the latter is fully exposed.

The extreme maximum velocity observed in the whole thirty-six-year period was eighty-four miles per hour, in February, 1894. A velocity of seventy-six miles was observed once, in November, 1898, and a velocity of seventy-two miles was observed seven times. The most probable monthly maximum at the present location is one between forty-six miles and fifty miles per hour. Referring to Table IV, it will be seen that the velocity which will probably occur once every thirty days is

between forty-one miles and forty-five miles, which fairly checks the most probable maximum of Table V and is perhaps more reliable. No information is easily obtainable as to the extent to which the observatory was possibly shielded by surrounding buildings at its locations previous to 1890, but it is fairly presumable that such action was not prominent because very high buildings did not exist to any extent before that date. In order to study the effect of altitude it is necessary to prepare a table of probabilities from Table V. It may then be possible to make direct comparisons of equally probable velocities at unequal heights. The probabilities are given in Table VI and are plotted in Fig. 2.

TABLE V.—MONTHLY MAXIM[illegible]AGO, ILL., 187[illegible]

V.	MONTHS. June, 1873, to Dec., 1886. Elevation 103 Feet.	Jan., 1887, to Jan., 1890. Elevation 153 Feet.	Feb., 1890, to May, 1905. [illegible] 274 Feet.	June, 1905, [illegible] Feb., 1910. [illegible] 310 Feet
16 to 20	14			
21 " 25	50	[illegible]		
26 " 30	61	[illegible]		
31 " 35	22	[illegible]	[illegible]	[illegible]
36 " 40	13	14	[illegible]	[illegible]
41 " 45	2	[illegible]	[illegible]	[illegible]
46 " 50	1	1	58	10
51 " 55			39	[illegible]
56 " 60			[illegible]	[illegible]
61 " 65			[illegible]	
66 " 70			[illegible]	[illegible]
71 " 75			[illegible]	
76 " 80			[illegible]	
81 " 85			[illegible]	
TOTAL	16[illegible]	[illegible]	[illegible]	[illegible]

TABLE VI.—PROBABLE MONTHLY MAXIMUM WIND VELOCITIES AT CHICAGO, ILL.

V	PROBABILITY [illegible] Elevation 103 Feet	[illegible] 153 Feet	[illegible] 274 Feet	[illegible] 310 Feet
16 " 20	.086			
21 " 25	.307	[illegible]		
26 " 30	.374	[illegible]		
31 " 35	[illegible]	[illegible]	[illegible]	018
36 " 40	[illegible]	[illegible]	[illegible]	175
41 " 45	[illegible]123	[illegible]	[illegible]	228
46 " 50	[illegible]61	[illegible]	[illegible]	[illegible]
51 " 55			[illegible]	[illegible]
56 " 60			[illegible]	[illegible]
61 " 65			049	
66 " 70			[illegible]	[illegible]
71 " 75			[illegible]	
76 " 80			[illegible]	
81 " 85			[illegible]	

The observations at 103-ft. and 274-ft. elevation are the most numerous and probably the most reliable. The curves in Fig. 2 show the marked difference in velocity at different elevations. In order to study the effect of elevation it will be best to take the velocities which occurred most frequently at each elevation; these are given in Table VII.

The velocities at 310 ft. will be disregarded on account of facts previously stated. The others are plotted in Fig. 3. The two most reliable points on this plot are at 103 ft. and 274 ft. A straight line drawn through them indicates that the corresponding velocity at the ground level would be about thirteen miles per hour. The velocities at 153 ft. fall somewhat below the straight line and a curve passing through all three points would give substantially zero velocity at the ground. There are not sufficient points on the plot to give a wholly reliable curve, but the conclusion that the velocities nearer the ground decrease materially seems to be warranted. The conditions in a built-up city district are not very favorable for a study of the effect of elevation; the presence of buildings of uneven height and contour, with intersecting lanes composed of streets and alleys, causes eddies and counter currents which make unreliable any observations that are not made well above all surrounding objects.

TABLE VII.—PREDOMINANT MAXIMUM VELOCITIES.

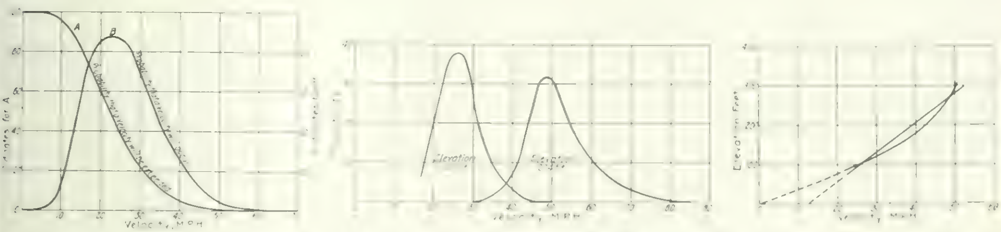
[illegible]	[illegible]
103 [illegible]	[illegible]
153 [illegible]	[illegible]
274 [illegible]	[illegible]
[illegible]	[illegible]

If the straight line of Fig. 3 is accepted, however, as a conservative basis for extrapolating the velocities at elevations below 100 ft., the maxima at several points corresponding to eighty-four miles per hour at 274 ft. and fifty miles at 100 ft. will be as found in Table VIII.

TABLE VIII.—MAXIMUM VELOCITY AT DIFFERENT ELEVATIONS.

ELEVATION	MAXIMUM VELOCITY	
274 feet	84*	
1[illegible] "	[illegible]	50*
[illegible] "	33	[illegible]7
[illegible] "	27	31
	* [illegible]	

Taking into account the conditions in cities it is very probable that the velocities at low elevations in open stretches of country will exceed those given in Table VIII. This amounts to much the same thing as saying that protecting objects are of the greatest importance in estimating maximum wind velocities in given localities. It is possible to compare the Chicago winds with those in a few representative localities from some investigations made by Mr. H. W. Buck.[3] The period covered



Figs. 1, 2 and 3—Probability Curves of Wind Velocity.

[3] [illegible] by H. W. Buck. [illegible] St. Louis, [illegible]

is ten years, from about 1894 to 1903, inclusive, and the comparison appears in Table IX.

The maximum observed at Chicago is as high as that at any other locality except Buffalo, and all of the maxima range be-

[illegible] MAXIMUM OBSERVED WIND VELOCITIES AT [illegible] PLACES, 1894 [illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Eastport, Me.	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Salt Lake City, Utah	[illegible]

tween sixty miles and ninety miles per hour. It will be recalled that these are uncorrected observations for five-minute intervals, or possibly one-minute intervals in some cases. The puffy or gusty character of winds is well known, and it is to be expected that the instantaneous maxima are considerably greater than those given by the Weather Bureau. That this is a fact has been proven by observations made with the Dines pressure tube anemometer. A chart of instantaneous pressures recorded by this apparatus[3] shows that the extreme maximum is about 50 per cent in excess of the average for short periods. The very uneven character of the puffs is clearly shown, but winds differ much in this respect at different times and places.

If the observed velocities are corrected by means of the curve in Fig. 4 and are then increased 50 per cent, the results given in Table VIII will be changed to those shown in Table X.

[illegible] MAXIMUM INSTANTANEOUS VELOCITY AT DIFFERENT ELEVATIONS.

Elevation.	Maximum Velocity.	
274 feet	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Table X shows that where wind pressures alone are to be considered a velocity of forty-seven miles per hour may be assumed in calculations for transmission lines with tower construction and forty miles for ordinary pole lines. In exposed localities where the wind has a wide, free sweep these velocities should be increased somewhat, probably to sixty miles and forty-eight miles, respectively, at least. Mr. Buck concludes from his analysis that at the elevation of ordinary transmission lines the velocity is about 30 per cent less than at altitudes of 100 ft. or more. The Weather Bureau observations are generally taken at elevations of more than 100 ft. It is a fact also that maximum velocities do not generally occur at very low temperatures.

Reviewing this analysis of maximum wind velocities it appears that the data of the Chicago Observatory form a safe basis for most of the country. They are perhaps high if anything, but the error will be on the safe side. Every locality should be investigated by itself, of course, when the safety of important construction is in question, but Table IX indicates that the differences between representative localities are not very great as a whole. The direction of prevailing winds and especially the direction of storms are quite important in relation to transmission lines and pole lines. When the direction of a line lies in the path of prevailing storms it requires less reinforcement than lines transverse to or having some angularity with the storm path. This fact has an important bearing upon the character of storm guys needed, but is almost entirely a local problem.

WIND VELOCITY AND WIND PRESSURE.

There have been numerous experiments to determine the relationship between wind velocities and pressures. Some brief account[4] of the matter is given by the writer in a treatment of the subject of transmission line crossings. Smeaton's formula is:

$$P = 0.005\,V^2. \tag{3}$$

The experiments by Langley gave

$$P = 0.0036\,V^2. \tag{4}$$

The results of the work done by the Weather Bureau are expressed by

$$P = 0.004\left(\frac{B}{30}\right)V^2 \tag{5}$$

where

P = pressure in pounds per square foot on a flat surface normal to the wind,

V = wind velocity in miles per hour,

B = barometer reading in inches.

Borda's experiments with cylindrical surfaces show that the pressure is equal to one-half the pressure on a projected plane surface with the wind normal. Taking the Weather Bureau formula and neglecting the barometer indications, the normal wind pressure on cylindrical smooth wires will be

$$P = 0.002\,V^2 \tag{6}$$

Mr. Buck's experiments with wind pressures on a stranded cable resulted in the formula

$$P = 0.0025\,V^2. \tag{7}$$

Wind pressures do not ordinarily produce severe loads on pole lines or wire spans, except in the case of cyclones or tornadoes, or at very great altitudes. The most severe condition

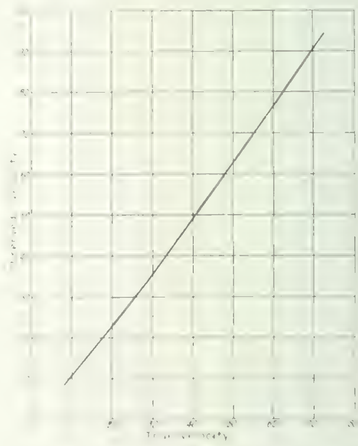


Fig. 4—Observed and True Velocity Curve.

exists when structures and wires are encased in sleet or wet snow. Under such circumstances there is not only the dead load of sleet or snow, but a largely increased wind load caused by the increased surface. The combination of sleet and wind is much the most severe condition encountered where sleet storms occur.

WIND VELOCITY AND SLEET.

There have not been a great many data on the maximum wind velocities during the precipitation of sleet, but such data are manifestly desirable and valuable; without them the factor of safety in many structures or spans is at best an uncertain quantity, or, what is worse, it may not exist at all. It is, therefore, important to collect all the data available on this question. The records of the Chicago Observatory were searched for the period from 1900 to 1909, inclusive, or ten years, to gather such

[3] [illegible] 177, Fig. 61.

[4] [illegible] Line Crossings, by [illegible] New York [illegible]

data. As the results are important and will be discussed in some detail, they are presented in full in Table XI.

TABLE XI.—SLEET STORMS [illegible] 1900 [illegible] 1909.

Date	Character of Sleet Precipitation.	Vel.	[illegible]
Feb 3, 1900	Light	[illegible]	
Feb. 4, 1900	Light	[illegible]	
Mar 5 1900	Nearly 2 inches	[illegible]	
Mar 6 1900	Nearly 2½ inches	[illegible]	
Mar. 14 1900	Moderate	[illegible]	
Nov 17 1900	Considerable	[illegible]	
Jan 9 1901	Moderate	[illegible]	
Nov 3 1901	Trace	[illegible]	
Dec. 13 1901	Moderate	[illegible]	Extreme velocity 57 m.p.h.
Nov. 29 1902	Trace	[illegible]	
Dec. 10 1902	Considerable	[illegible]	
Dec. 11, 1902	Considerable	[illegible]	On Dec. 12 maximum velocity was 54 m.p.h.
Feb. 3, 1903	Heavy	[illegible]	Extreme velocity 54 m.p.h.
Mar. 17, 1904	Moderate	[illegible]	
Mar 20, 1904	Moderate	[illegible]	On Mar. 21 maximum velocity was 42 m.p.h.
Mar. 25, 1904	Light	[illegible]	
Dec 26 1904	Heavy	[illegible]	On Dec. 27 maximum velocity was 72 m.p.h. and extreme velocity was 86 m.p.h. Temperature fell.
Jan 11 1905	Not ver[illegible]	[illegible]	
Jan 19 1906	Moderate	[illegible]	
Jan 22 1906	Heavy	[illegible]	
Nov 19 1906	Light	22	
Jan. 17, 1907	[illegible]	[illegible]	On. Jan. 18 maximum velocity was 18 m.p.h. and on Jan. 19, 52 m.p.h. Warm.
Mar 7 1907	Trace	[illegible]	
Nov. 30, 1907	Moderate	[illegible]	
Dec. 22, 1907	Heavy	[illegible]	On Dec. 23 maximum velocity was 29 m.p.h. and on Dec. 24, 37 m.p.h.
Dec 28, 1907	Trace	[illegible]	
Jan 11 1908	Trace	[illegible]	
Jan 12 1908	Rain and wet snow	[illegible]	
Feb. 5 1908	About ½ inch	[illegible]	
Feb. 14, 1908	About ¼ [illegible]	[illegible]	
Feb. 29 1908	Moderate	[illegible]	
Jan. 28 1909	Trace	[illegible]	
Feb 14 1909	0.8 inch	[illegible]	
Apr 7 1909	Trace	[illegible]	
Apr 28 1909	½ inch	[illegible]	
Nov. 22 1909	Light	[illegible]	
Nov. 24 1909	Light	[illegible]	
Dec 5, 1909	Moderate	[illegible]	
Dec 11, 1909	Heavy	[illegible]	
Dec 12, 1909	Not over 0.4 in.	[illegible]	[illegible] was 36 m.p.h. Temperature fell.

Table XI covers a period of ten years, in which there were thirty-four sleet storms, extending over a period of forty days in the records. The average was 3.4 storms per year. The storms may be classified as follows:

Trace sleet	[illegible]
Light sleet	[illegible]
Moderate sleet	[illegible]
Considerable sleet	6
Heavy sleet	[illegible]
Total	33

Sleet storms of a serious character appear to occur about twice a year and heavy storms not quite once a year. A number of important conclusions can be drawn from Table XI, which are next enumerated:

1. The maximum recorded sleet precipitation was nearly 2.5 in., with an observed maximum wind velocity of fifty-three miles per hour.

2. A sleet precipitation of at least 1 in. may be expected occasionally, and 0.5 in. frequently.

3. The maximum recorded velocity during a sleet storm was sixty miles per hour.

4. In the wake of a sleet storm it may happen that

(*a*) the temperature falls,

(*b*) the wind rises,

(*c*) or both occur.

5. Following a precipitation of sleet there may be a precipitation of wet, adhesive snow.

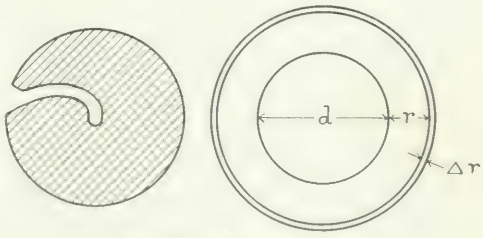
6. An extreme wind velocity of eighty-six miles per hour was observed after one heavy storm, with falling temperature.

It appears from these conclusions that one must reckon with the conditions which follow a storm, as well as the storm itself. Falling temperature and rising wind after a storm may cause the principal damage, for under such conditions the sleet will remain. The extreme velocities noted under remarks in Table XI were presumably taken for one-minute intervals; the ordinary recorded maxima are taken for five-minute intervals. A summary of the observed maxima during the storms is given in Table XII.

TABLE XII.—OBSERVED MAXIMUM [illegible] DURING SLEET STORMS, AT CHICAGO, ILL.

V	DAYS	
11 to 15	[illegible]	[illegible]
16 " 20	1	[illegible]
21 " 25	[illegible]	[illegible]
26 " [illegible]	[illegible]	[illegible]
31 " 35	[illegible]	[illegible]
36 " 40	5	12
41 " 45	[illegible]	[illegible]
46 " 50	[illegible]	[illegible]
51 " 55	[illegible]	[illegible]
56 " 60	[illegible]	1
Total	[illegible]	[illegible]

The most frequently observed velocity was between twenty-six and thirty miles per hour, with a maximum of sixty miles. On one occasion a maximum of seventy-two miles was observed the day following a storm, with an extreme maximum of eighty-six miles and a temperature below 32 deg. Fahr. This observation was taken at an elevation of 274 ft. On a number of other occasions, also, the wind rose on the day after the storm.



Figs. 5 and 6—Sleet on Wire

The general probability that very high winds will occur is exceedingly small, as shown in Figs. 1 and 2. Yet such velocities will occur during or in the wake of sleet storms, at long intervals, and should be taken into account. On the occasion of a severe storm in Chicago, within the writer's experience, sleet accumulated on telephone and telegraph wires to a diameter of about 2 in. and remained several days. When it finally melted sections of it which had fallen from the few wires that remained on the poles presented an interesting fact. The outside diameter of sleet had not apparently diminished very much, although the temperature had risen somewhat, but the wire had melted through the sleet in a curious manner, as shown in Fig. 5.

The curved path made by the wire through the sleet can be explained by the effect of wind, which increasingly deflected the sleet from a position of equilibrium as the wire progressed toward the circumference. Had there been no wind the path would have been straight, along a radius. The general form of sleet accumulations on wires is cylindrical or approximately

so. There are no data bearing upon the relationship between precipitation and the thickness of formations on wires, so far as known. The following theoretical discussion is, therefore, submitted as of general interest.

Assume a cylindrical wire of diameter d, with a uniform concentric sleet load of radial thickness r, as shown in Fig. 6. Assume also that the sleet precipitation is uniform, at the rate p. The amount of sleet which strikes the wire will be equal to that passing through the projected area of the wire, normal to the direction of precipitation.

In the time Δt the volume of precipitation which impounds on the wire in a unit of length will be

$$\Delta V = p\,(d + 2r)\,\Delta t \qquad (8)$$

Assuming that this volume distributes itself uniformly around the wire, the increase in sleet thickness Δr, caused by the precipitation ΔV in the time Δt, will be

$$\Delta r = \frac{p\,(d + 2r)\,\Delta t}{\pi\,(d + 2r)} = \frac{p}{\pi}\,\Delta t \qquad (9)$$

or

$$r = \frac{p\,t}{\pi} \qquad (10)$$

That is, the radial thickness of a uniform sleet deposit resulting from a total precipitation of $p\,t$ inches will be $\frac{p\,t}{\pi}$ inches, regardless of the diameter of the wire. This can be expressed as

$$r = 0.318\,p\,t \qquad (11)$$

or

$$d' = 2r = 0.637\,p\,t \qquad (12)$$

where d' is the diameter of sleet, exclusive of the wire. Approximately, then, the sleet diameter will be 64 per cent of the total precipitation. This result is wholly theoretical and assumes that all the sleet which strikes the wire will stick there. Until some data can be gathered to corroborate it, the constants must be used with caution, but at the same time it is difficult to see any flaw in the reasoning.

Referring to Table XI, the greatest precipitation noted in any storm was 2.5 in., on March 5 and 6, 1900. Assuming that the total of the two days was entirely cumulative, the sleet diameter on wires would have been 2.87 in. So great a diameter is probably very rare, but the writer has observed approximately 2 in., so that the former is not altogether improbable.

It is entirely probable that a coefficient should be inroduced to differentiate between different wire substances, but almost no information on this matter is available. There is a good deal of testimony to the effect that aluminum is practically immune from sleet, owing to the greasy character of its surface oxide. Taking this to be a fact, aluminum has then an important advantage over copper for transmission cables in sleet zones. But whether it is immune alike from sleet and wet snow under all conditions does not yet appear to be established.

There is one more factor to be considered in sleet formations, relating to transmission cables. The temperature range of sleet storms is exceedingly limited, and consequently a small temperature elevation will practically prevent sleet formation. Such a condition exists in overloaded cables; it often occurs in railway feeders and sometimes in transmission lines. The load factor is seldom high enough and the wasted energy is too great to make this a generally dependable protection, but it is undoubtedly effective. The questions whether electrostatic attractions and repulsions come into play on high-tension lines, and whether sleet will form on lines about which there are corona, seem to be open. The energy loss in the corona must be dissipated as heat and it would be reasonable to suppose that sleet formation would therefore be lessened or perhaps prevented. It seems unlikely in any case that sleet would remain long on live cables.

The calculation of loads due to combined wind and sleet is usually made on the assumption that the former is horizontal and normal to the line, and the two forces are combined in the usual manner. This is not correct in strict theory if the sag of the span is relatively great compared to the length, but for ordinary spans it is undoubtedly true for all practical purposes. A steady horizontal wind pressure theoretically deflects the span until the moment due to gravity is equal to the moment due to wind pressure. But the puffy character of the wind usually sets the span into oscillation. Such oscillations in lines carrying numerous wires in short spans are frequently serious and are sometimes the direct cause of pole failures when the spans swing in synchronism. Storm guys must be relied upon to reduce the serious consequences of such effects.

The formula for wind pressure on smooth wires, in pounds per foot of length, is

$$p = \left(\frac{d + 2r}{[illegible]}\right) V^2 \qquad (13)$$

where

d = wire diameter in inches,
r = radial thickness of sleet in inches,
V = wind velocity in miles per hour, corrected.

Assuming the weight of sleet as 57.5 pounds per cubic foot, the formula for sleet load per foot of length is

$$w = 1.254\,r\,(d + r) + w_1 \qquad (14)$$

where w_1 = weight of the wire or cable in pounds per foot.

The combined load in pounds per foot is

$$W = \sqrt{w^2 + p^2} \qquad (15)$$

The effect of sleet in increasing the wind pressure, resulting from increased surface, is quite apparent from (13). The effect is most noticeable with small wires. The most severe imaginable case of loading occurs when the wind pressure is vertically downward, when the wind and sleet loads are directly cumulative. This case rarely occurs and then only in unusual localities, where natural formations make it possible.

In conclusion it may be remarked that this study disposes in part of the numerous doubts which have heretofore existed in regard to combined loads of wind and sleet. It is to be hoped that investigators in other localities will take up the subject as opportunity affords and gather new data.

GRAPHIC REPRESENTATIONS OF THE LINEAR ELECTROSTATIC CAPACITY BETWEEN EQUAL PARALLEL WIRES.

By A. E. Kennelly.

In an article[1] appearing in these columns in the issue of Sept. 22, 1910, Messrs. H. Pender and H. S. Osborne pointed out the errors which existed in certain tables of linear electrostatic capacities of overhead wires, owing to the misapplication of a certain well-known approximate formula to cases where the interaxial distances separating the wires are less than 60 diameters, and especially when they are less than 6 diameters. They demonstrate the interesting new proposition that the surface density of charge on opposed parallel cylinders is represented by an ellipse, with the axis of the cylinder at one focus, and they substituted correct antihyperbolic formulas for the inaccurate approximative formulas in discussing short interaxial distances.

The proposition that the fundamental formula of linear capacity between equal parallel wires involved antihyperbolic functions of the type

$$[illegible]\cosh^{-1} x \quad [illegible] \quad \text{farads per unit length,} \qquad (1)$$

was first published by the writer, in a paper[2] which pointed out

[1] "[illegible] Electrostatic Capacity Between Equal Parallel Wires," by H. Pender and H. S. Osborne. *Electrical World*, Vol. LVI, No. 12, pages 667-670.

[2] "The Linear Resistance Between Parallel Conducting Cylinders in a Medium of Uniform Conductivity," by A. E. Kennelly, *Proceedings* American Philosophical Society, Vol. XLVIII, April 24, 1909, pp. 142-165.

that not only the linear capacity, but also the potentials, resistances, conductances and linear currents between such parallel cylinders, whether equal or unequal, are naturally and simply expressed in antihyperbolic functions. A reference table of 178 entries between the limits of 1.01 and 5000 for x, the ratio of interaxial distance to diameter, was also appended.

A curve sheet is here presented in the accompanying Fig. 1 showing the graphs of $\cosh^{-1} x$, $1/\cosh^{-1} x$, and linear capacities of equal, parallel, round wires in air, for values of x less than 25—that is, for interaxial distances less than 25 diameters. Such graphs have less precision than numerical tables of linear capacity for wires of a given size at stated distances apart, such as appear in the recent paper of Messrs. Pender and Osborne, but graphs have the advantages of presenting the results collectively to the eye and of offering continuous solutions for all intermediate values of the variable x.

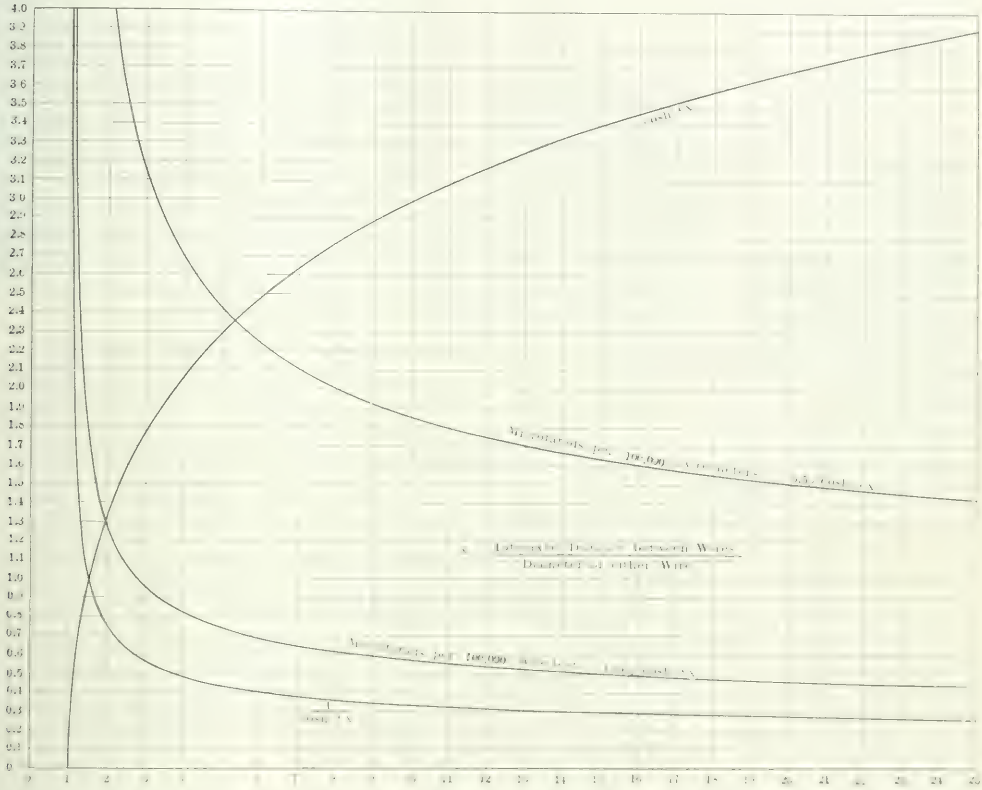


Fig. 1—Linear Capacity per 100,000 Wire-Feet and Wire-Meter.
Graphs of $\cosh^{-1} x$, $1/\cosh^{-1} x$, and linear capacities of bare, equal, parallel, round wires in air for interaxial distances up to 25 diameters.

In dealing with the linear capacity of transmission lines, it is probably easier to consider and discuss capacities per wire-unit-length than capacities per loop-unit-length. In cases of single-phase transmission lines there is not much advantage in favor of one or the other of these quantities, but in cases of polyphase transmission lines, there is distinct advantage in favor of the former. The linear capacity of a wire-kilometer, for instance, may be defined as the capacity of one wire per kilometer of a transmission line, as measured between that wire and the neutral-potential surface. In the case of a symmetrical three-phase line, that surface will be the surface of zero potential or of neutral potential. In the case of a single-phase line, the neutral-potential surface will be the infinite midplane between the wires. In any overhead line the linear capacity per "loop-kilometer," or kilometer of loop, is, therefore, always half the linear capacity per "wire-kilometer," just as reciprocally the inductance per loop-mile is always twice the inductance per wire-mile. The advantage of dealing with the linear capacity of a short three-phase line per wire-kilometer is that if we multiply the impressed star-branch voltage at the generator end of the line by the linear capacity per wire-kilometer, we obtain immediately the charging current per kilometer of line, whereas if we use the linear capacity per loop-kilometer we have to make an additional step in the reasoning and computation.

In Fig. 1 the linear capacity is given in microfarads per 100,000 wire-meters and in microfarads per 100,000 wire-feet.

Thus, if we take a pair of No. 4-0 wires (diameter 0.46 in. = 1.168cm) at an interaxial distance of 1 in. (2.54 cm), we have $x = \frac{1}{0.46} = \frac{2.54}{1.168} = 2.174$; and on referring to Fig. 1 we find for $x = 2.174$, $y = 1.2$ microfarads per 100,000 wire-feet, or 3.94 microfarads per 100,000 wire-meters. If we need the linear capacity per loop length, we would take half these values, or 0.6 microfarad per 100,000 loop-feet and 1.97 microfarads per 100 loop-km. That is, two such parallel wires, each 100 km long, and forming between them a loop 100 km long, would offer a condenser capacity of 1.97 microfarads when tested against each other with other conductors remote. This result agrees with that given in the corrected table of the Pender and Osborne paper above mentioned.

[illegible] are given for interaxial distances between 25 diameters and 10,000 diameters—that is, for cases in which $\cosh^{-1} x$ does not appreciably differ from $\log_e(2x)$; so that the ordinary approximate formulas are applicable. By using abscissas to logarithmic scale and ordinates to a scale of reciprocals, these graphs become converted into straight lines. There are advantages in the use of straight-line graphs that are probably worth securing at the expense of non-uniformity of gradation along the coordinate axes.

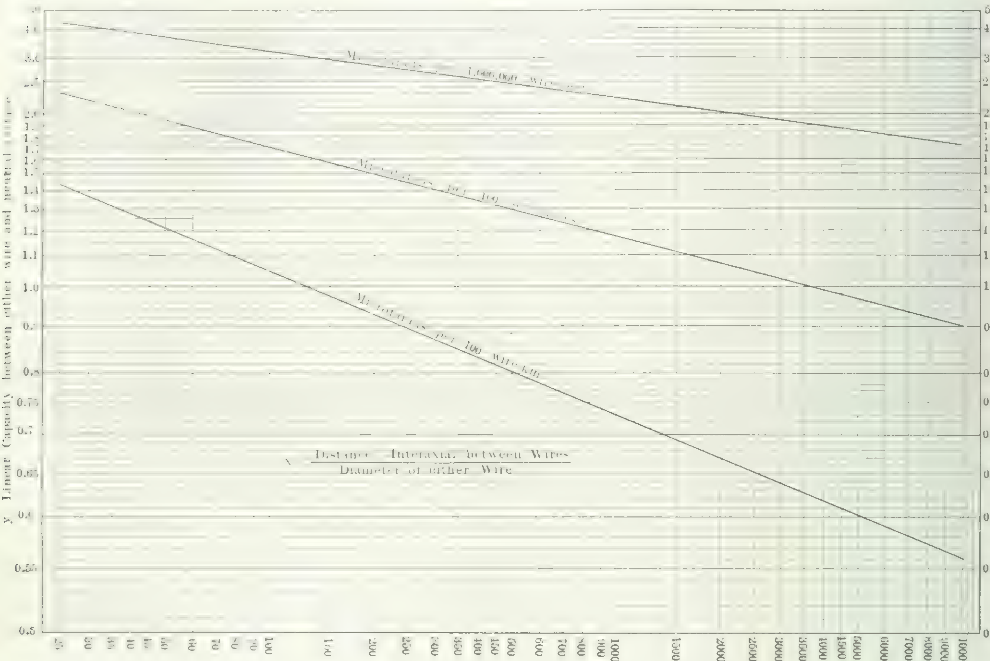


Fig. 2——Linear Capacity for Different Interaxial Distances.

Graphs of linear capacity of bare, equal, parallel, round wires in air for interaxial distances from 25 to 10,000 diameters. In microfarads per 1,000,000 "wire-feet," per 100 "wire-miles" and per 100 "wire-kilometers"; $y = \frac{16.93}{\cosh^{-1} x}$ mf. per 1,000,000 wire-feet; $y = \frac{8.941}{\cosh^{-1} x}$ mf. per 100 wire-miles; $y = \frac{5.555}{\cosh^{-1} x}$ mf. per 100 wire-kilometers.

As an example, if we consider a pair of No. 4-0 wires as before, but suspended at an interaxial distance of 72 in. (182.8 cm), we have $x = \frac{72}{0.46} = \frac{182.8}{1.168} = 156.5$. By reference to Fig. 2, with this value of x, we find $y = 0.97\,\mu f$ per 100 wire-km, $1.56\,\mu f$ per 100 wire-miles and $2.94\,\mu f$ per 1,000,000 wire-feet. That is, 1 wire-km would offer 0.0097 microfarad, 1 wire-mile 0.0156 microfarad, and 1000 wire-feet 0.00294 microfarad, all as measured between one wire of the system and the neutral or zero-potential surface. The linear loop capacities would be the halves of these values respectively.

The precision of such a graph is necessarily limited on a small-scale diagram, but in practice the linear capacity of wires is not only difficult to measure experimentally with precision, but various disturbing factors introduce deviations from the computed values[2] and always in the positive direction, or direction of excess—that is, the presence of neighboring conductors and the electrostatic capacities of the insulators—so that the graphs are likely to be of sufficient precision for practical purposes.

[illegible]

THE TRACKLESS TROLLEY AT LOS ANGELES.

By R. W. Shoemaker.

The first commercial trackless trolley in America has lately been installed in Laurel Canyon, near Los Angeles, Cal., for the purpose of handling passengers from the lines of the Los Angeles Pacific Railroad Company to "Bungalow Land," a real-estate subdivision in the hills northwest of the city.

The road traversed is mostly curves, there being only 1000 ft. of tangent in the mile and a half, the grade ranging from 5 to 12 per cent, and not especially even; in fact, the course is what might be called an ordinary country road, and hence is a road well suited to test the practicability of the system.

Transportation previous to the installation of the trolley system was by means of automobiles, but these proved too uncertain, while, owing to the grades, the maintenance was excessive; moreover, such a transportation system lacks the substantiality necessary to an enterprise of this character. The expense of constructing a track and overhead work for a regular traction system would have been excessive, as the road is in a pass in the hills and would be ruined for automobiles, which pass over the route in considerable numbers, and the scenery would also have been marred to a considerable extent. For these reasons the trackless trolley seemed to be the logical solution, combining simplicity, reliability, economy in first cost and low operating charges.

The old gasoline motor buses, two in number, were stripped of the original motive power and fitted with two especially designed and constructed motors of 15-hp rating, 500 volts, each motor driving one rear wheel by chain, thus eliminating the differential. The control is by means of a series-parallel controller mounted on the dash to the left of the steering wheel, the reverse switch being separate under the driver's seat and operated by a handle to the right of the wheel. The usual ex-

panding and contracting brakes are fitted as in a regular automobile.

The trolleys are mounted forward on the roof of the bus, approximately 24 in. back of the front axle and spaced 48 in. apart, which is also the spacing of the trolley wires. The poles themselves are of wood 15 ft. long and carry a special swiveled form of collector at the end, which is arranged to slip off without damage in case the pole should leave the wire and the collector catch on the overhead. This collector consists of an aluminum shoe supported on a light spring and having a vertical movement of [illegible] in. in a [illegible] enables the

Fig. 1—View of Car.

Fig. 2—Junction with the Los Angeles Pacific Railway.

shoe to keep the proper position on the wire regardless of the horizontal angle the trolley pole happens to be making with the trolley wire.

The trolley system allows a total variation of 11 ft. each side of the center of the roadway, and at slow speed will operate when the trolley poles have an angle of 75 deg.; it also allows the car to be completely reversed in direction under the wires without change, although it is, of course, necessary to turn the poles after the car has turned and before it can proceed, as the poles are crossed and project forward of the car.

The trolley wires are No. 3-0 copper conductors suspended from pipe arm brackets fastened to telephone poles along the roadway, these being sometimes on the right and sometimes on the left-hand side of the road; the cars, however, always obey the rule of the road and pass to the right of approaching vehicles regardless of the location of the trolley wires. On some of the sharp turns two [illegible] from the poles, thus making an even curve on the trolley wire where otherwise there would be a sharp angle. A speed of twenty-five miles per hour is possible on a straightaway course, but ten miles per hour is all that is desired or used on the curved portions of the line.

From the success attained with this road, both from a financial and an engineering standpoint, it is certain that there are numerous cases in the country where like roads could be profitably constructed. For wherever there are two places between which a certain amount of travel could be expected and yet not enough to warrant the purchase of a right-of-way, etc., necessary for a railway, it would be only necessary to string two wires along the highway on the telephone poles that in almost all cases exist on the main roads between towns and operate a trackless trolley. As the investment is small, a very moderate amount of travel is all that is required to pay good returns.

A further application that promises to be of greater importance is the use of the trackless trolley in transporting freight to mining camps remote from a railroad, which, owing to various causes, cannot be reached by a railroad and have to depend on freight teams for supplies.

A trackless trolley would have no difficulty whatever in traversing any road over which it is possible to drive freighting teams and at a much greater speed and with less expense.

The system in Laurel Canyon is owned by the Laurel Canyon Utilities Company, of Los Angeles, Mr. Charles S. Mann, president, and the line and electrical apparatus were designed and furnished by the writer.

Central Station
Management, Policies and Commercial Methods

CENTRAL-STATION SERVICE GROWTH IN TOLEDO, OHIO.

The increasing industrial importance of Toledo has found the local central-station company, the Toledo Railways & Light Company, which also operates the street-car system and gas-supply business, almost unable to keep pace with the demand for motor and lighting service in spite of the additions of new machinery. During the past year the railway load on the company's generating station increased 29 per cent, the Edison direct-current load 36 per cent and the motor load 62 per cent. To meet this increased demand a 6000-kw, 4000-volt, 25-cycle Allis-Chalmers turbine-generator set is being installed, bringing the generating station's total rating up to 20,000 kw. This [illegible] service generated and transmitted, including 25-cycle and 60-cycle three-phase alternating current at several voltages, 110-220-volt direct-current service, 550-volt electric railway service and rectified current for the city magnetite arc lamps. The company is now erecting a substation in East Toledo at a point on the bank of the Maumee River just opposite the generating station, with which it is connected by a submarine 4000-volt cable. This substation will supply 2000 kw for railway pur- [illegible] will be transmitted through the station to a transmission line. The Toledo company has 12,000 connected electrical customers out of the city's population of 170,000. Mr. W. E. Richards is [illegible]

N. E. L. A. COMMERCIAL SECTION.

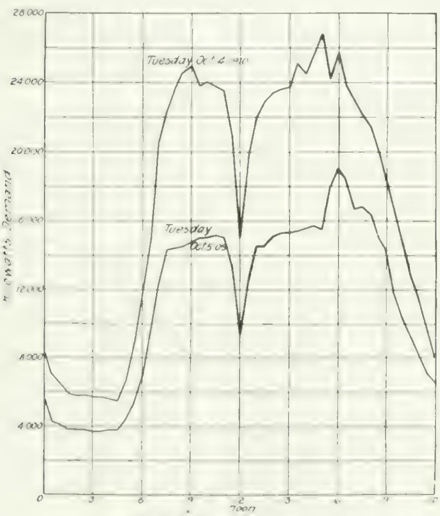
At the St. Louis convention the National Electric Light Association appointed a committee as follows on the organization of a Commercial Section of the association: Messrs. George Williams, chairman; J. E. Becker, E. L. Callahan, F. H. Gale, J. R. Crouse, L. D. Gibbs, H. J. Gille, V. A. Henderson, T. I. Jones, C. W. Lee, E. W. Lloyd, H. C. Mohr, M. C. Rypinski, C. N. Stannard; Frank B. Rae, Jr., secretary.

The first meeting of this committee was held in the rooms of the association, New York City, on Oct. 17 at 11 a. m., the sessions continuing until evening. A plan of organization with constitution and by-laws was presented by Chairman Williams and was unanimously adopted. This plan provides for the formation of a commercial committee with chairman and secretary as officers. Each member of the commercial committee is in turn chairman of a sub-committee appointed to investigate and report upon a specific department of central-station commercial work. Through this plan of organization it is hoped that the association will have each year very complete and authoritative reports of commercial progress instead of papers by individual authors as in the past.

The first meeting of the committee was given over largely to discussion of the plan of organization and selection of subjects to be taken up by the sub-committees. At the conclusion of the session it was determined to call a second meeting on Nov. 10 at Pittsburgh, where nominations for the various committees would be made and their work outlined in full.

DETROIT EDISON COMPANY'S OUTPUT INCREASED 52 PER CENT LAST YEAR.

Aside from the well-known progressive policy of the local company, for several years Detroit has had a reputation among central-station men on account of its large number of residences served with electric light. In fact, with a city population



Detroit Load Curves.

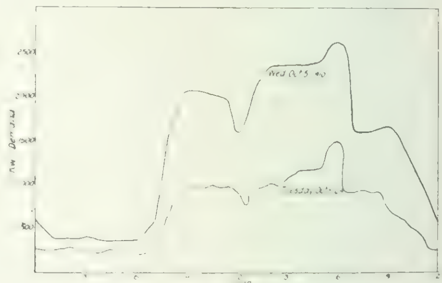
of 466,000, as shown by the 1910 census, to which may be added another 100,000 to account for the adjacent suburban territory, the Edison Illuminating Company of Detroit now has nearly 22,000 residence customers. In the past eighteen months the selling organization of the company, headed by Miss Sheridan, has turned its attention as well to the securing of large power business, with the result shown by the accompanying load curves, in which the hourly demands are shown for the same day in 1909 and in 1910. These indicate an increase in demand, continuing throughout almost all the hours of the day, of nearly 10,000 kw. The monthly output increased from 7,181,430 kw-hours in September, 1909, to 10,932,000 kw-hours in September, 1910—a gain of 51.6 per cent. Of both these amounts about 2,000,000 kw-hours were sold to the local railways company. During the year 11,194 hp in connected motors were added to the lines of the company, indicating, from the increased demand of 10,000 kw as shown by the load curves, that the already existing installations were being worked at an increased load factor.

Meanwhile the accession of new business in the various other departments of the service was not being neglected. Of the even 1000 new customers obtained during last month 66 per cent were residence installations, 24 per cent were commercial-lighting customers and 10 per cent were motor-service installations.

An increase of over 50 per cent within one year's time in the demand and the delivered output of a large central-station system like that of the Detroit Edison Company is unusual, and the accompanying contrast of load curves is interesting in showing the substantial, healthy character of the growth recorded.

CORLISS ENGINE FOR BIG TURBINE STATION AT INDIANAPOLIS.

To serve its increasing electric light and motor service and steam-heating business the Merchants' Heat & Light Company, of Indianapolis, is installing a 10,000-hp Allis-Chalmers engine-



Indianapolis Load Curves.

driven generator in one of its local power plants, where 10,000 kw in turbo-generating apparatus is already in operation.

The motor-service business, to which this company chiefly confines itself, has increased 66 per cent during the past year. The accompanying load curves show the demand on one of the stations of the Merchants' company for two typical days—Oct. 5, 1909, and Oct. 5, 1910. The total demand of the company's service is divided evenly between the Pearl Street and West Washington Street stations, so that these curves provide an index of the growth that has occurred. The taking on of motor business has been accompanied by the replacement of many isolated plants, one of the largest of these being the 250-kw steam turbine and auxiliary plant of the Sanitary Can Company, at Indianapolis, for which motor drive was substituted.

CENTRAL-STATION ILLUMINATING ENGINEERING AT DENVER.

In a paper presented at the Baltimore convention of the Illuminating Engineering Society on Oct. 24 Mr. C. F. Oehlmann described the work of the illuminating engineering department of the Denver Gas & Electric Company. The author said that the central-station illuminating engineer, after having studied the science of illuminating engineering work, learns

that his work is to "hold the business." The result is that the illuminating engineering department finds that it must sell to the same consumer light for as many hours out of the twenty-four as possible in order to widen the peak load, and that to the same consumer light must be sold for as many years as possible. Thus the peak should be widened until there is no peak and the station investment, covering mains, services, meters, etc., should be kept in actual use during the approximate life of the station installation. It is well known that the ideal load curve is one that shows no peak—it is also well known that such a load curve is almost an impossibility; there is sure to be a peak, one slope of which occurs between dusk and dawn. The study of the load curve is of great interest to the illuminating engineering department.

Business.—There are several classes of business to be sought, and even fought, for. One of the best is the street-lighting contract, which usually covers both the maximum hours between dusk and dawn and also covers a majority of years of the life of the plant. Another is the all-night service for advertising purposes, such as window lighting, sign lighting and billboard illumination. Another is for light over the safe in the rear of stores, etc. Another is for small lamps at the base of show windows in winter months, for the purpose of preventing the formation of frost and moisture on the windows. Another is for porch lighting on an all-night arrangement. For those customers who will not accept the all-night rate one can usually establish a 2 o'clock rate. Then there is the popular midnight lighting rate, frequently used to good advantage. There is the arc lamp for all-night use at livery-stable entrances, garage entrances, dairy stables, hospitals and any place where wagons or other vehicles leave and approach at various hours of the night. Park lighting is another good business to secure. There are also other uses for illumination at all hours of the night to which some thought might be given.

Complaints.—Seventy per cent of the work of the central-station illuminating engineering department is the settling of complaints of some kind or another, usually high bills. These complaints come from all departments of the company. When a complaint comes to the illuminating engineering department the illuminating engineer tags it, "Hold the business." It is the complaining consumer that is the encouraging prospective consumer for the gasoline salesman. Not many gasoline lamps would be in service to-day if all gas or electric consumers had always been pleased with and enthusiastic over the results of using either gas or electric light. The person complaining may be what is sometimes called a chronic kicker and by some departments considered incurable, but there are few chronic kickers in the Denver territory. The complaining person is usually one who complains about a high bill or poor service, or both. The first step taken is to ascertain what amount the consumer has been paying during the past year. This information is marked on the complaint memorandum for future reference; the person who turned in the complaint for the consumer is then consulted and much useful information is thus obtained. A call is then made on the consumer by a member of the illuminating engineering department, who discusses with him the reasons for his complaint. He is offered the services of the illuminating engineering department free of cost. It is explained to him that if he accepts the services of the department his place of business will be measured and a drawing of his store for illustrating a suggestion or a new system of illumination will be made.

When the consumer consents to have the illuminating engineering department measure his store and make suggestions for better illumination a drawing is made showing all of the walls, windows, doors, hallways, show windows, etc. Then if the consumer contemplates any changes in the rooms or building a note is made of them and often they are arranged for on the drawings if the changes are to be made immediately. In case there is sufficient time the openings for the lamps are so arranged that when the building is changed the proper system will be in readiness. The openings that are made in contemplation of changes are plugged and no fixtures are installed. The fixtures are specially designed or selected and specifications are drawn. The drawings and specifications are submitted to the consumer and if the plans are accepted bids are asked on the work and taken to the consumer, and the contractor is thus selected. The work of installation is superintended by the illuminating engineering department until completed and accepted by the consumer.

When the new lighting system is placed in operation the central station reaps the harvest of the work of the illuminating engineering department. No matter how bitter he may have been in his complaints, almost invariably a consumer will become very enthusiastic over the improved appearance of his store; he can then easily be induced to step outside of his store and compare the outside with the improved interior. He does not wait to be coaxed, but usually says, "What can we do about those windows and that sign?" It is not the actual amount of money the consumer pays that interests him, but how much he gets for his money. When the illuminating engineering department by a rearrangement or a new system gives him three times as much illumination as before the consumer is glad to pay the bill; the illuminating engineering department has held the business and the consumer becomes immediately a prospective consumer for better window lighting and sign advertising.

A record is kept of the work by taking a small Kodak picture of the drawing and pasting it to a reference card, which is filed for future use. The means used for keeping this record is a cabinet card showing the date, name, address, nature of business or building, installation made, style of glassware, ceiling height, color, decorations, size of room, watts per square feet, density, reasons for changing, previous installation and remarks.

A photo of the original accepted drawing is placed on this card and filed for future reference. This card is cheap and convenient to refer to later and takes little room. The consumer often wants the original drawing for other structural work, and if he so desires it is given to him, the company being released from responsibility if errors in measurements are made from the drawing, such as structural iron being short, millwork and metal ceilings not fitting, etc.

Cards are also used in keeping a record of new buildings. A record is kept of all building permits. Cards are sent to new owners, architects and contractors offering services of the illuminating engineering department.

To all representatives an opportunity is given to join an illuminating engineering class during the fall of each year, and those who join are given a series of lectures and instruction along illuminating engineering lines. They are taught to read drawings and are instructed in a few principles of fixture designing. The object of this course is to teach the commercial men the principles of illuminating engineering in order that they may correct small mistakes as they proceed in their work each day when small additions and alterations are being made. They also receive information and data regarding new shades, lamps, etc., and the uses to which they can be put.

PRACTICAL CARE OF LEAD BATTERIES FOR VEHICLES.

Mr. S. C. Harris, of the battery department of the New York Edison Company, presented an interesting paper on the proper and practical care of vehicle batteries before the Electric Vehicle Association of America at its first convention, held in Madison Square Garden Concert Hall, New York, Oct. 18. The paper was devoted entirely to the lead cell, and before launching into his subject the author described a properly constructed battery of this type, taking up in detail the tray, manner of arranging the cells in the tray, insulation between the rows of cells, kind of contact used, quality of rubber jars, manner of assembling the cell and the style of strap used.

For sectional batteries the construction of the tray is simple

being made of wood sufficiently strong and in a size convenient to handle. For single-tray batteries stronger construction is necessary and iron must be used. There are two ways to construct these trays; one in which the iron is used to brace the heavy wooden parts and one in which the tray is made completely of iron and light wood packing is used between the cells and the tray. In the sectional batteries the cells are placed in short rows; the voltage between consecutive rows varies with the size of battery and the number of trays, but is much less than in single-tray batteries. In single-tray batteries the arrangement of cells varies with the shape of the tray. The arrangement should be such that the voltage between rows will be a minimum so as to prevent as much as possible the burning of jars if the trays and packing become acid-soaked, or if any foreign material lodges on top of the cells and becomes a good conductor through spraying or slopping of the electrolyte. The wood of the tray should not come within 1 in. of the top of the cells.

The space allowed in the tray for the cells should be enough to permit at least ¼ in. between rows. The packing between the rows should be paraffined wood and should not come within 1 in. of the tops of the cells. With the exception of the warm summer months glass sheets extending above the cells are much better than the wood packing. Glass, being a bad conductor of heat, allows the cells to become too warm in warm weather. The packing between the jars should be tight enough to prevent any movement of the jars in the tray.

Single-tray batteries have contacts on the side of the tray which engage with similar contacts on the vehicle. These contacts have not been satisfactory in many cases and have been discarded and the wires from the battery are connected to the controller wires by ordinary wire connectors. In sectional batteries this method of connection is less troublesome than that in which the contacts are placed on the trays, especially when the wood of the trays becomes acid-soaked.

Rubber jars should be of the best quality so that the troubles due to leaking jars will be reduced to a minimum. Where the conditions of operation are such that the wooden separators will have as long a life as the plates the jars should have enough sediment space to receive the sediment thrown down during the life of the positive plate.

In assembling a cell the jar should be just large enough to receive the element, which should fit so that there can be no movement of the element in the jar. The wooden separators between the plates of the element should be thick enough to prevent any movement of the plates, and should be wide enough so that they will protect the edges of the plates from any material that may lodge between and short-circuit them. The spacing between plates should be wide enough to allow sufficient acid for a complete discharge of the plate. The surfaces of the positive plate should be protected by perforated hard-rubber sheets, and the smooth side of the wooden separator should be placed against the negative plate. Strips of wood or hard rubber should be placed across the tops of the separators and securely fastened to prevent them from being misplaced. The separators should extend above the tops of the plates. The pillar strap should be used and burned low to allow considerable space between the top of the cover and the top of the jar for the slopping of acid where cells are not sealed.

With a battery constructed as above described the proper care consists in the following method of operation: Fill the cells with electrolyte of 1200 specific gravity and pass a charging current through them at a rate of 1 amp per positive plate for the M. V. size. If it is desired to complete the formation quickly a higher rate can be used if care is taken to prevent the temperature from rising beyond 100 deg. Fahr. This forming charge should be continued until the specific gravity of the electrolyte has reached its maximum and has continued at its maximum of ten hours. One cell in the battery should be used as a pilot cell on which readings are taken at regular intervals near the end of the formation. This pilot cell should have its electrolyte kept at a constant level by adding a small amount of water at frequent intervals to make up for the loss by evaporation, otherwise the readings of specific gravity will not be comparable. The specific gravity readings should also be corrected for temperature.

After the forming charge has been completed one or two discharges are taken to determine the capacity. If full capacity is not obtained it is usually due to the excessive hardness of the positive plates, in which case considerable discharging and overcharging are necessary if full capacity is desired before putting the battery in service. After the battery is put into service the following points should be carefully considered: proper charging; no over-discharging; filling cells with water of approved quality, and examining battery for leaking jars; keeping the tops of the cells free from dirt or any substance that will contaminate the electrolyte, and inspection of the battery for determining the state of charge of the individual cells.

The instructions given by the manufacturer are that the battery be charged at the normal rate until the maximum voltage is reached and then to charge at the low rate (half normal) until the same voltage is again reached. These instructions are no doubt very good if followed, but they require considerable more attention to the switchboard than is likely to be given. It is often puzzling for the attendant to know just when the maximum has been reached where several batteries of different ages are being charged at the same time. The author doubts whether the degree of accuracy in charging required for the best life of plates is obtained where this method of charging is practised.

The charging of batteries by the amp-hour meter has been tried by a number of garages with good results. By this method a certain percentage more charge is given than the discharge indicated on the dial of the amp-hour meter. The indicator o[f] the meter is pushed forward in the direction of discharge unti[l] the meter reads the amount of charge to be put into the battery (10 per cent to 15 per cent more charge than discharge, a[s] conditions require). The charge is then put on and the han[d] travels toward zero, where there is a contact which automatically opens the charging circuit when the required amp-hour[s] have been put into the battery.

This method of charging requires much less attention at th[e] switchboard and is more accurate than the voltage method. A[s] a check on both the voltage and amp-hour-meter method o[f] charging a pilot cell reading of specific gravity at the end o[f] charge should be taken each week and when the specific gravit[y] falls below the maximum an extended overcharge at a lo[w] rate should be given to restore the electrolyte to its maximu[m] gravity.

The water used for filling the cells should be distilled unle[ss] it is found by examination that the water from the faucet con[-]tains no injurious impurities. When water from iron pipes [is] used it should be allowed to run a few minutes before using [to] prevent any iron scale that may be in the pipes from gettin[g] into the battery. Care should be used to avoid putting mor[e] water in each cell than is required to cover the plates about [½] in. This advice should be closely followed, as it has been foun[d] in many instances that excessive slopping has been due to ove[r-]filling with the result that the wooden trays and packing b[e-]come soaked with acid, and, therefore, good conductors, cau[s-]ing burning of jars.

The cleaning of the tops of the cells is very important, as t[he] dust from the street and material that is hauled in the vehic[le] is sometimes found in considerable quantity on the top of t[he] battery, which, becoming saturated with acid, is another cau[se] of burning jars. The battery compartment of the vehic[le] should be arranged to prevent this collection of dirt as mu[ch] as possible.

The inspection of the individual cells of a battery for t[he] purpose of determining their state of charge consists in taki[ng] voltage, specific gravity and temperature readings at regular i[n-]tervals over the entire battery. The frequency with which su[ch] inspections should be made is a matter of opinion and does n[ot] affect the life of the plates materially as long as the prop[er]

methods of operation are followed. The author said he knew of batteries that had been in service in vehicles that had not been inspected as to their state of charge for a period of four months and were found to be up to full capacity when tested. The life obtained from these plates was as good as the life obtained from plates where the voltage and gravity readings were taken weekly. A simpler and equally effective method of inspection is to observe the gassing of each cell at the end of charge once a week.

The pilot-cell readings are an indication of the condition of the whole battery and any cell that is in a sufficiently low condition to require special attention can be readily detected by slight gassing or the absence of gas at the end of charge. When the pilot cell indicates that the battery needs an overcharge to bring the specific gravity to a maximum, then voltage, specific gravity and temperature readings should be taken on all the cells.

The kind of care used in operating the vehicle has much to do with the results obtained from the battery. The route traveled by the vehicle should not be such as to require a complete discharge daily and an overdischarge should be a rare occurrence. The speed should be cut down going over rough roads to prevent the breaking of rubber jars. There is a considerable reduction in the cost per mile for running vehicles where the driver is held responsible for the condition of his vehicle and severely disciplined for carelessness in its operation.

Wiring and Illumination

COLORADO TOWN STREET LIGHTING.

At Fort Morgan, Col., use is made of a street-lighting scheme involving the installation of 12-ft. iron posts along the curb spaced 80 ft. apart. Each post is provided with a heavy bracket supporting two 200-watt tungsten lamps without shades at a height of about 10 ft. above the sidewalk. It is said that the effect is very pleasing, and the street is more attractive by night than by day.

NEGLECTED CONSIDERATIONS PERTAINING TO STREET ILLUMINATION.

In a paper presented at the Baltimore convention of the Illuminating Engineering Society on Oct. 24 Mr. Preston S. Millar outlined the results of certain street-lighting tests conducted for the lamp committee of the Association of Edison Illuminating Companies and submitted some conclusions relative to the desirable features of street illumination which seem hitherto to have been overlooked.

Attention was directed to the fact that a considerable portion of the light from any lamp giving a symmetrical distribution of candle-power is lost by being directed against trees, buildings, etc. The proportion of light from various lamps effective in illuminating the street surface is about as follows:

Lamp	Per Cent. Light Applied 70 ft. Street.
9.6-ampere open arc	[illegible]
4.0-ampere [illegible]	[illegible]
6.6-ampere [illegible]	[illegible]
6.6-ampere [illegible]	[illegible]

A symmetrical candle-power distribution is suitable for illuminating a circular area, but not for illuminating a narrow area, such as a street. To what extent it is desirable to restrict the light from the street lamps to the street surface depends upon local conditions. It may be said, however, that in general it is practicable to do much more in this direction than has been attempted without bringing about effects which are otherwise objectionable.

In discussing the uniformity of illumination over the street surface, the author described some observations made along upper Seventh Avenue, New York City. This street appears to be uniformly lighted, and yet the incident light varies largely. A test of effective brightness of the street surface showed a high degree of uniformity, thereby confirming the impression of observers. For an explanation of this remarkable state of affairs one must look to the street pavement. Examination shows that the asphalt blocks which constitute the pavement have become polished in all high spots as a result of the automobile traffic. These small polished areas reflect specularly, while the low spots of the surface which are not so polished diffuse the light more or less well. In driving through the street one sees reflected in the numerous small polished areas images or part images of distant arc lamps. The street is long, straight and lighted by arc lamps arranged in three rows. At a distance these appear to converge. The consequence is that when looking at the street surface in almost any direction required in driving a person is likely to find some one of the distant arc lamps imaged in one of the small bright areas. These are so generally distributed over the surface of the drive, and notwithstanding the rather wide spacing there are so many arc lamps which may be effective in this way, that the entire drive seems to be very uniformly illuminated.

Now, it is to be remembered that a portion of the street surface which receives the most intense light from a nearby arc lamp will reflect to the eye practically none of this light from the small brightly polished areas which reflect specularly. These appear bright only by reason of lamps located at a distance of one-fourth mile, one-half mile, or even farther away. The portions of the street surface which are not polished will reflect light more or less diffusely, and these are capable of reflecting a considerable proportion of the light toward the approaching driver. They, however, are the little valleys between the polished high spots and in many cases the high spots obstruct light which would be reflected in the direction of the approaching driver. The consequence is that in driving through Seventh Avenue, when one looks at the street surface 200 ft. or more away, he finds it bright because of the polished surfaces and the distant lamps, while when he looks downward at the nearby surface he finds it bright by reason of the diffused light when near a lamp and much less bright by reason of the same reflecting process when midway between lamps.

The author expressed the opinion that, in general, the reflecting qualities of street surface are at least as important in street lighting as are the reflecting qualities of ceiling and walls in interior illumination.

Glare has been talked of more or less in connection with street lighting for years. Recently it has come to the fore in such discussions and in consequence it seems probable that in the very near future the subject of glare will be more generally investigated than in the past. The author mentioned three effects of glare in street lighting: (1) a measurable decrease in ability to see, due to the presence of a light source in the field of vision; (2) a lessened chance of seeing a barely discernible object when viewed carelessly, even though when a careful examination of the street is made the object may be discerned just as well in spite of the glare; (3) a condition of transitory glare, due to a temporarily dazzling effect when one looks directly at a light source for moments and then looks elsewhere and finds it impossible to see well. The two last effects are difficult to measure or even to detect. The first effect may be studied without difficulty. Tests of glare in the streets as well as general observation have indicated that the distant lamps which are near the center of the field of vision are the lamps which are most harmful from the glare standpoint. Nearby lamps which are not near the center of the field of vision do relatively little damage. When the observed object is within [illegible] such as a distant arc lamp, it usually is not discernible unless in the immediate region of a lamp, so that the intensity of illumina-

[illegible] is high. Thus, [illegible] approaching automobile in a thoroughfare like Fifth Avenue, New York, it is a common experience to be able to discern the vehicle readily without being able to see the heads and shoulders of the occupants. The distant arc lamps are absolutely prohibitive to seeing objects which are removed from them by an angle of no more than 1 deg., but the glare effect falls off so rapidly and the vision is assisted so markedly by the brightly lighted street surface that the lower portions of the vehicle may be discerned without difficulty.

There are two ways to diminish the effect of glare sufficiently to avoid harmful effects. These are: (1) Permit no exposed lamps to be located near the center of the field of vision. The author expressed the belief that satisfactory results will be achieved if no lamps can be seen within 5 deg. of the object viewed. (2) Make the effective brightness of the street high. No study of glare in the streets can lead to correct final conclusions unless it takes into account the effect upon an observer's ability to see objects when silhouetted against a lighted background.

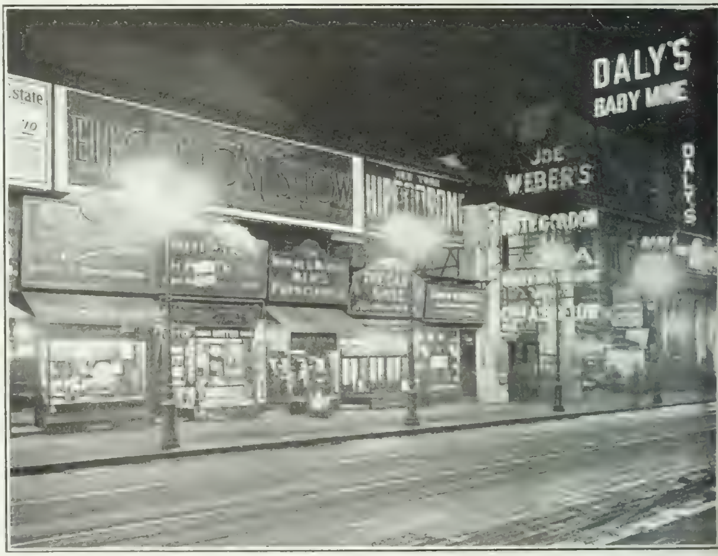
The author called attention to the outline-against-light-background method of discernment, as described in our issue for Oct. 20, and said that objects in streets at night are discerned most usually as silhouettes against a lighted background. The first requirement of good street lighting is for a well-lighted street surface to serve as a background. It is the effective brightness of street surface, or the brightness as seen when viewing the street longitudinally at an angle of from 2 deg. to 3 deg., which determines the value of the surface as a lighted background. The effective brightness may be increased by providing a greater number of more powerful lamps or by repaving the street with material having more favorable light-reflecting qualities. The light-distribution characteristics of all commercial illuminants being unsuitable for street lighting, it would appear feasible to increase the effective brightness of streets by directing a larger proportion of the light upon the street surface. With a given intensity of incident light the effective brightness of a street is greatest when the lamps are mounted over the driveway. Non-uniformity of illumination, while undesirable, is not so objectionable as has been asserted, because (1) the effective brightness of street surface does not vary as much as does the intensity of incident light, and (2) the bright street surfaces near lamps assist in discernment of large objects in the dimly lighted regions.

Glare must not be neglected. Its effect becomes harmful when the glaring source is very near (less than 5 deg. removed from) the object to be seen or when there is no lighted background against which to view objects. In ordinary city installations the glare from street lamps may dazzle temporarily after one looks directly at the lamps and may increase the chance of failure to perceive a barely perceptible object in a hasty, careless glance. But otherwise it occasions no material decrease in ability to see objects. It is entirely feasible to design a lighting installation in which there shall be entire absence of objectionable glare while securing high effective brightness of street surface. But usually in practice one must choose between decreased effective brightness [illegible] and some degree of glare on the other. For each such installation there is some compromise which will produce the best results. The proper compromise can be reached best not as a matter of theory or prejudgment, but as a matter of trial in the street, preferably including a determination of ability to see under the various conditions.

In concluding the author remarked that the problem of street illumination is not simple when considered alone as a matter of theory. The additional elements which commercial conditions introduce render it extremely complicated in practice. A number of the factors which enter into the problem might be studied independently with profit. But the application of the results of such studies must always be made with due regard to the importance of other factors. Our tenets of street illumination must be broad-gaged and must give proper weight to all elements of the subject, whether scientific or commercial.

FLAMING-ARC LAMPS IN NEW YORK'S THEATRICAL DISTRICT.

As is probably well known, New York City's "Great White Way" is so well lighted by electric signs, windows, etc., that the arc lamps of the city would not be missed if they were extinguished, so feeble are their rays when compared with the light paid for by private interests. In order to attract attention, therefore, nothing short of flaming-arc lamps will serve in districts already ablaze. Many merchants recognize this fact and have made the Rialto much brighter by the installation of flaming arcs, which in turn necessitated a lavish use of tungstens in windows to counteract the effect of the dimness which obtained there. The accompanying illustration shows a flaming-arc installation on Broadway at Twenty-ninth Street in front of Weber's Theater. Four Mott Iron Works regulation city poles are spaced about 30 ft. apart and support eight Grant flaming-arc lamps. In order to distinguish the poles from those of the city they are finished in bronze. The lamps burn two in series across the 110-volt, direct-current mains of the New York Edison Company, each pair consuming 10 amp. Impregnated electrodes giving a yellow light are used, and the lamps are trimmed after every eighteen hours of burning. Instead of



Installation of Flaming Arcs at Broadway and Twenty-ninth Street, New York.

being arranged at right angles to the street, the lamps are hung parallel to the sidewalk so as to give the maximum amount of light on the sidewalk. In addition to the eight lamps on the posts there are two others hung on either side of the theater entrance. The brilliancy of the lighting is well shown in the engraving, and its effect has been to increase the traffic of promenaders on a street already crowded as much at night as it is during the day.

ILLUMINATION AT THE DENVER ELECTRIC SHOW.

By Joseph A. [illegible]

As published in these columns on Oct. 13, the first annual electric show of the Colorado Electric Club, an organization composed of the electric interests of Colorado, opened in the Auditorium, Denver, on the evening of Oct. 8, and continued through the week to Oct. 15. This exposition, which was in reality a celebration of the progress made in the electrical industry in the West, was characterized by the most spectacular street-lighting features ever seen in Denver. The streets leading to the Auditorium were one profusion of dazzling light, and over 100,000 of the city's population turned out on the opening night to view the monster illuminating features. The congestion of traffic was the worst the police of Denver ever handled. As already published, at 7:30 o'clock on the evening of Oct. 8 Captain Wm. H. Green, accompanied by Governor Shafroth, stepped on the platform erected on the Fourteenth Street side of the Auditorium to push the button that flooded the great hall with light. Simultaneously every whistle, bell and gun in the vicinity was turned loose to send broadcast the message that the first lighting festival of the West had opened in Denver. Inscribed on the button were the words, "And God said: Let there be light."

The street illumination during the week excelled that at the recent Mardi Gras celebration at New Orleans, which was conceded to be a revelation, and was on a par with some of the creations that electrified New York City at the Hudson-Fulton celebration last fall. Champa and Curtis Streets, the thoroughfares leading to the Auditorium, were decorated with a portière and stringer effect. Franklin's kite portrayed in light soared above the highest building on Curtis Street and was considered a remarkable piece, as was the Liberty Bell on Champa Street. Denver's "Great White Way," Sixteenth Street, seemed to grow dim before the luster of the decorations.

Directly after the streets were illuminated there was a rush for the great amphitheater where the show was being held. For hours the entrance was blocked by people waiting to secure tickets. The attendance on opening night was estimated to be in the neighborhood of 15,000, while each day thereafter averaged about 4000.

Demonstrations of electrically operated mining machinery were made to show how the industry has been revolutionized in the last decade. The advent of electric energy into isolated regions where the cost of fuel was a detriment to operations has established a new era in the mining industry. Many properties, some of which have remained idle since the Territorial days of Colorado, have resumed operations through the introduction of electric energy into the districts. These displays proved to [illegible] terested in a low cost of production received sufficient evidence of the value of electricity for their purposes. The Northern Colorado Power Company and the Central Colorado Power Company co-operated with the Hendrie & Bolthoff Manufacturing & Supply Company, of Denver, in giving these demonstrations.

Fig. 1—General View of Denver Electric Show, Showing Spectacular Sunrise Effect in Background

The agricultural industry of Colorado contributes most to its [illegible] out the State, 80,000 acres of which have been reclaimed and put under cultivation through the agency of the electric pump. At one time a dry farming rage was on in the State, but this movement has sunk into comparative oblivion. The culti-

vated area is being rapidly increased by means of electric pumping, which was thoroughly exploited during the show.

The Denver Gas & Electric Company's exhibit of a modern electric home was one of the most interesting. Every conceivable appliance used in curtailing the work of the housewife

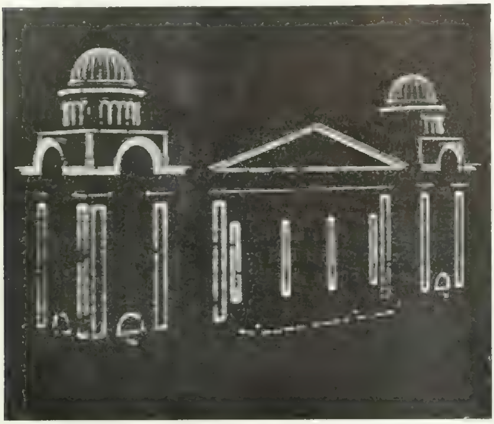


Fig. 2—Illumination of Auditorium Exterior.

in the home was displayed. The small electric disk stove and the elaborate electric piano each had its station. The contrast of the clean, silent and cool electric kitchen with the smoky, mussy and hot one was well set forth.

The Pike's Peak sunrise depiction was the most wonderful production of scenic illumination ever witnessed by Denver people. It was portrayed with a certain amount of realism that attracted and charmed those who viewed it. Three thousand lamps were used, 2500 for the sun, while a sufficient number were employed in bringing out the ray effect.

In the basement of the Auditorium was located the "Chamber of Wonders." Here all the freakish whims of electricity were

Fig. 3—Electric Kite on Curtis Street

displayed. The principal feature was a specially designed apparatus demonstrating interesting high-frequency experiments. This apparatus consisted of an oil-immersed transformer with a primary winding, tapped for 60-cycle current, the secondary being wound for 150,000 volts. This circuit was connected to the primary of a Tesla coil through the medium of large 40-plate glass condensers and multiple spark gap oscillator, which produced, at the secondary terminals of the Tesla coil, upwards of 1,000,000 volts.

The phenomena of high voltage and high frequency were exhibited on various pieces of apparatus, showing the disruptive power, through the piercing of glass plates, brush discharge, climbing arc, illuminating of Geissler tubes and vacuum electrodes, imitation of thunder and lightning, the lighting of incandescent lamps held in the hand without wire connections and the passing of 1,000,000 volts through the body of the operator and various other spectacular demonstrations. These displays were conducted by Mr. W. P. Carstarphen, Jr.

A scholarship prize contest for boys was held in connection

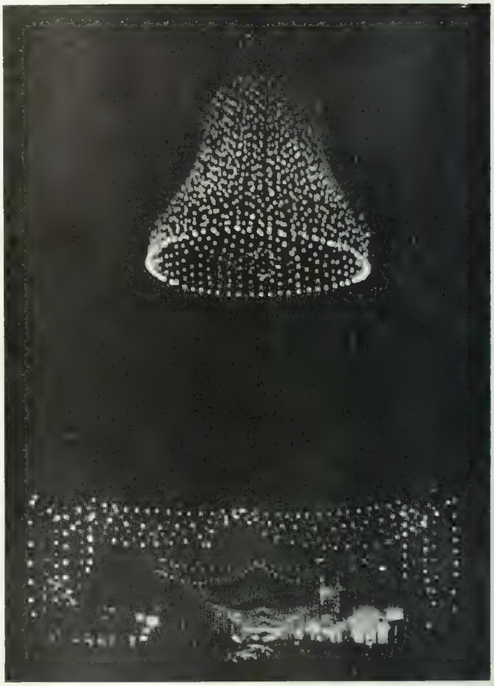


Fig. 4—View of Champa Street During Electric Show.

with the show. About forty young Edisons and Thomsons of Denver were interested in this contest. The equipment entered consisted mostly of wireless telegraph instruments and models of aeroplanes. In the finals five boys were awarded prizes for exhibitions of wireless telegraph instruments and one aeroplane exhibitor was successful in landing a prize.

The Colorado Electric Club has definitely decided to hold electric shows annually in Denver. Next year it is planned to make the street illuminating features even more elaborate, and such effects as the mountain sunrise will be attempted on a broader scale.

RATES FOR ELECTRIC VEHICLE CHARGING IN MILWAUKEE.

Owners of electric vehicles in Milwaukee may take advantage of the favorable "ten-seven" rate offered by the Milwaukee Electric Railway & Light Company, under which the customary demand charge is reduced by three-quarters, making the equivalent rate from 5 cents to 1½ cents per kw-hour, depending upon the quantity used. The taking of energy under this rate is limited to the after-peak hours between 10 p. m. and 7 a. m.

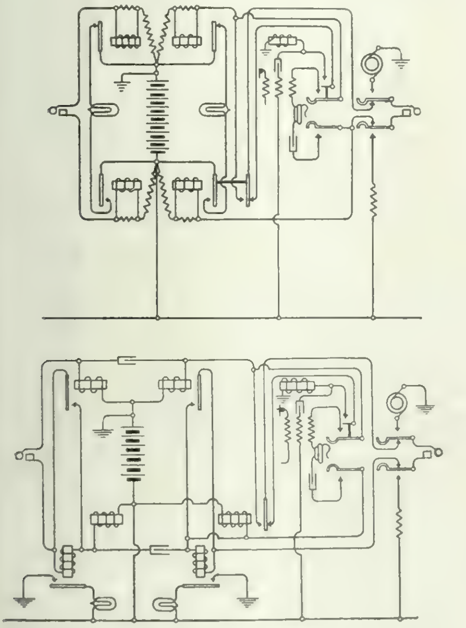
FIVE MILES OF DECORATIVE STREET LIGHTING IN CHICAGO.

From Desplaines Street to Fifty-first Avenue, throughout five miles of its length, West Madison Street, Chicago, was the scene of a street carnival during the week of Oct. 17. The affair was heartily participated in by the merchants whose stores line this great artery of Chicago's West Side, and special events, automobile parades, etc., were held each evening. A feature of the carnival was the electrical decorations, festoons of forty 8-cp lamps, caught up at the center, spanning the street at half-block intervals throughout the entire participating length of the street.

RECENT TELEPHONE PATENTS.

SWITCHBOARD CIRCUITS.

Mr. C. S. Winston, of Chicago, has patented two switchboard-circuit systems of the two-wire, common-battery type, both patents being assigned to the Kellogg Switchboard & Supply Company. The novelty in both cases seems to lie in the cord signaling circuits. In one of the circuits a repeating coil is used with the battery supply cut in at its middle. Two



Switchboard Circuit Systems.

elays are used for each cord, one in each strand. One is a ut-on relay in the strand which feeds the cut-off relay and the ther a cut-on relay in the strand feeding the line directly. The second system uses a retardation coil feed, relays serving he line strand of each cord and retardation coils the other trand. In the cut-off relay strand there are series relays which close the lamp circuit, except when shunted out by the ontacts of the line strand relays, which follow the station ook switch. Fig. 1 shows both cord circuits.

PARTY LINE SYSTEMS.

A lock-out system is described in Mr. H. G. Webster's patent, which party-line system is for use with common-battery ines. A limit relay at each station is shunted out by the transmitter circuit of its own or any other station of the line. To this end, the relay windings, connected across the line are made of high resistance compared with that of the transmitter circuit, also across the line. When the limit relay fails at any station that station is locked off the line. If a second station is desired upon any line, the transmitter bridge at the calling station must be opened by a manual key until the desired station has responded. The patent is assigned to the Kellogg Switchboard & Supply Company.

In a system patented by Mr. W. F. Mikolasek, of Scotland, S. D., the connection of an undesired station to the line during conversation is evidenced by the operation of a buzzer

Mr. C. T. Patterson, of Albany, Ore., has a step-by-step system. Energy is furnished on the main line from a main-line battery. The stepping motor at each station drives an insulating cylinder carrying contact bars. The angular motion of the cylinder about its axis determines the connection of the various stations.

With multi-station lines the habit of listening-in with a consequent running down of the batteries has led Mr. W. E. Burt, of Yuba, Wis., to devise a hook-switch retainer for mounting upon wall sets. This retainer permits the hook-switch lever to rise half way and there stop. The contacts are so arranged that this mid position corresponds to a closure of the receiver circuit, but not to a closure of the battery circuit. For talking connection the stop is pulled back to permit full travel of the switch lever.

NEW APPARATUS.

A hand microphone set forms the subject of a patent granted to Mr. J. N. Wallace, of La Crosse, Wis., and assigned to the Vote-Berger Company. The handle consists of a split tube, the two halves of which, after being abutted, are held by end ferrules and a middle sleeve serving as a hand grip. The receiver and transmitter are secured to their respective ends, but taper bushings are inserted between them and the handle to give the transmitter and receiver a tilt to suit more readily the average head.

A patent granted to Mr. R. J. Barber, of Belmont, Mass., and assigned to the Globe Earphone Company describes a means of adjusting receivers used to assist the deaf to hear. It is necessary to provide an adjustment suitable for unskilled hands. The diaphragm is secured within the earpiece. This latter is threaded and arranged to screw down over the receiver body. A lock nut or ring upon the body ahead of the cap serves to lock the cap where placed. A stop is provided so that the cap may not advance further than the position corresponding to minimum allowable clearance between the diaphragm and pole pieces.

Another patent assigned to the Vote-Berger Company is that issued to Mr. H. S. Mattison, of La Crosse, Wis., for a transmitter. The diaphragm has a peripheral groove which receives a resilient gasket of circular section. This gasket lies only partly in the groove and serves to hold the diaphragm clear of the transmitter casing. A spider-like spring member perforated to receive the microphone button at its middle bears upon the diaphragm to hold it down to the casing.

Mr. W. E. Harkness, of East Orange, N. J., has obtained a reissue of a patent for a telephone transmitter of the inverted, solid-back type. The patent covers the seating of the microphone button casing in a central aperture of the transmitter diaphragm so as to vibrate with the diaphragm. The reissued patent is assigned to the Dean Electric Company.

A patent granted to Mr. O. F. Falk, of Belleville, N. J., describes a special mouthpiece for transmitters as applied to the so-called "Dictograph." The mouthpiece is conical, with its wide end outward. Another cone of sheet metal of lesser altitude is mounted within the first one, with its apex outward. An annular space is left between the base of this cone and the mouthpiece wall. It will be seen that sound impinging on the mouthpiece and cone will be deflected through the annular space and that behind the cone all reflections ultimately turn the sound toward the diaphragm. This patent is assigned to the National Dictograph Company

LETTERS TO THE EDITOR.

The Light of the Firefly.

To the Editor of Electrical World:

SIR:—Your editorial comments on "The Light of the Firefly," page 846 of your issue of Oct. 13, interested me very much. It is certainly gratifying to have the rigid scientific evidence furnished by Ives and Coblentz that the light of the firefly is really light alone, unadulterated by wasteful radiation. This we have long suspected, and some of us have assumed it to be true on the basis of evolution—the survival of those fireflies and their progeny which could give the greatest light output for the least expenditure of energy. The light here referred to is, of course, physiological light, wave lengths which most strongly affect the retina. Incidentally it may be pointed out that the fiber of silk is very much stronger, weight for weight, than any metallic wire; and that the same is true of many animal and vegetable fibers, particularly the former. Again, the greatest perfection will have been reached, in the evolutionary process of elimination of the less fit, in that organism which, other things being the same, has been under stress longest and of which the number of generations has been greatest. Hence, those forms which were on the earth early and which reach maturity quickly have become almost perfectly fitted to their conditions of life. Witness the complete, though from our standpoint undesirable, social system of the ants, the bees and the wasps.

It is probably true, as a result of evolution, that the sensitiveness of retinas of different animal organisms varies much as regards amplitude of what we call light waves, and also in relation to varied wave lengths. That creature which has been under the necessity of distinguishing colors most definitely and acutely will naturally have the sharpest color vision for such wave lengths as concern it the more particularly; and that creature which has the need of the widest range in this respect will probably be man. It is even asserted that some of the lower races of men are devoid of an acute sense of the violet rays of the spectrum, and it is known that even among civilized men wide variations in color sense occur. This may possibly be due to atavistic tendencies, and to an assumed late development of the color sense.

The question has often been asked, Why do we see only such a limited range of wave lengths, when radiation of waves of the character of light may extend far beyond the violet in the ultra-violet, and far below the red in the infra-red? I have never heard or read of an appropriate answer, but I think I can contribute to the solution of the question, and also make it fairly clear why for most seeing animals the visible radiations are within our own visible spectrum range. In the first place, what we know as transparent bodies are more or less opaque to ultra-violet. Prof. R. W. Wood has shown that bodies which reflect or diffuse the rays of ordinary light, and even appear white, may absorb ultra-violet, and would be, so to speak, black if seen by ultra-violet light, supposing we could suddenly acquire a power of vision which would include such light.

Again, the infra-red can penetrate bodies ordinarily black, and a vision including them involves similar contradictory impressions. The sky would be dark, and foliage nearly white, as the photographs of Professor Wood show. From these considerations it is evident that a sense of vision including ultra-violet and infra-red would tend more to obscure than assist visibility of objects illuminated by a wide range of radiation.

Moreover, distinctness of vision or optical resolving power for fine details is an inverse function of wave length. This means that if vision were alone possible with rays far below the red the fine edges of objects would become blurred and indistinct; while, what is more important, if our vision by ordinary light were to have superposed on it vision by such low waves, the result would be, not to sharpen vision, but to confuse the outlines of objects or blur the fine details.

West Lynn, Mass. ELIHU THOMSON.

To the Editor of Electrical World:

SIR:—With reference to the interesting results published by Dr. Ives in your issue of Oct. 13 the following observations on the transparency of various parts of the outer covering of the firefly may be helpful in indicating in what spectral region one may expect to find possible radiations if generated within the body of the firefly and transmitted through the outer integument.

The part examined is the outer integument, called "chitin," which is an amorphous, horny substance varying in color from white (covering over the luminous organs) to a dark brown. The latter color, as will be noticed in the present illustrations, is simply due to a pigment which absorbs heavily in the visible spectrum—see curve *a*, Fig. 1.

The determination of the transmissivity is very difficult on account of the smallness of the specimens and their lack of homogeneity. In the present examination the specimens were mounted upon a thick cardboard with a suitable opening in it and placed over the spectrometer slit. An image of a well-

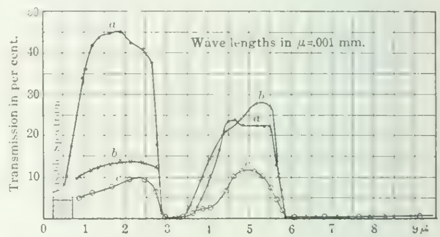


Fig. 1—Transmissivity of Various Members of a Firefly.

seasoned Nernst glower was projected thereon, and its spectral energy curve was observed. Subsequently the specimen was removed from the cardboard and the spectral radiation curve of the glower was obtained. The ratio of the emissivities (bolometer-galvanometer deflections) gives the transmission at any wave length. By operating the glower on a storage battery it was possible to keep its temperature constant to a much higher precision than was required in the experiment.

In Fig. 1 curve *a* gives the transmission through one of the horny abdominal segments of a dried specimen of the Cuban firefly, Pyrophorus noctilucus. This integument is dark brown (in reflected light), which causes a heavy absorption through the visible spectrum to the red, at which point the transmission increases rapidly. In this firefly, it may be recalled, the abdominal light is emitted through a slit between two of the segments, of which the above is a sample. The size of the segment examined was about 1.5 mm x 7 mm. In this same illustration, Fig. 1, curve *b* gives the transmission through one of the eye-like, fenestrate membranes on the thorax of the Cuban firefly, through which is emitted the so-called "thoracic light." The specimen was only 1.5 mm x 2 mm and hence very difficult to examine. After removing all the photogenic cell ligaments which adhered to it this specimen was fairly translucent. In the region from 1 μ to 2 μ ($\mu = 0.001$ mm) the transmissivity is probably higher than observed, the low values being due to scattering of the radiation in passing through the specimen.

Curve *c*, Fig. 1, gives the transmission through the outer integument covering the photogenic cells of Photinus pyralis. The specimen examined was a single dried abdominal segment 1:5 mm x 4 mm, which had been moistened in water and freed from all ligaments and photogenic material. The specimen was not very smooth and it was only semi-translucent. No doubt

a better sample could have been prepared by dissecting a fresh undried insect. In both curves *b* and *c* the opacity at 1 μ to 2 μ and at 5 μ is greatly increased by scattering of the transmitted radiation which did not reach the bolometer. However, as was anticipated in a previous communication, these curves have the characteristic absorption spectrum of complex carbohydrates, in which there is great (and usually complete) opacity from 2.8 μ to 3.8 μ, and beyond 6 μ, with a fairly transparent region at 4.5 μ to 5 μ.

It may be noticed that these specimens were dry. If they had been fresh, then the water would have absorbed most of the radiation at 4 μ to 5 μ, as may be noticed in Fig. 2, curve *b*, which gives the transmissivity of a layer of water only 0.038 mm thick. Curve *c* gives the transmission of a layer of water 0.31 mm in thickness which shows complete opacity beyond 2.5 μ.

Now, the photogenic cells are not directly in contact with the outer integument (at least the most of them are not so situated), so that there can easily be an intervening layer of water molecules equivalent to 0.1 mm in thickness. If we superpose the curves in Figs. 1 and 2 we can see that only an extremely small amount, if any, of the radiation of wave-lengths greater than 2.5 μ (assuming that such radiations are generated within the photogenic cells) can pass out into space. The experiments of Ives bridged the gap from the visible to 1.5 μ. The present data show that but little radiant energy (if generated

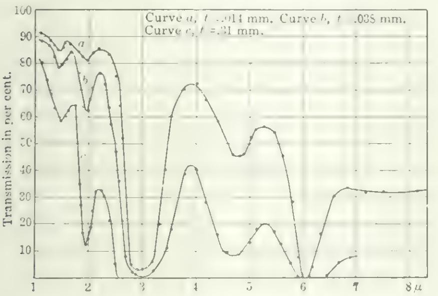


Fig. 2—Transmissivity in Presence of Moisture.

in the photogenic cells) of wave lengths greater than 2.5 μ will get out of the insect's body. That which does get out at 4 μ to 5 μ will be so weak in intensity that it will hardly be distinguishable from the emission spectrum of the "animal heat," radiated from the surface of the body, which has its maximum in the region of 7 μ. By exclusion we have therefore reduced the unexplored region to that part of the spectrum lying between the wave lengths 1.5 μ and 2.5 μ. There are no types of radiators known which would lead one to expect emission bands in this region of the spectrum of the light from the firefly and while it is important to be on the alert for the unexpected it seems just as probable that the explanation will be found in biochemical phenomena not requiring the production of radiations of low frequency in order to produce a given amount of light.

Numerous illustrations have recently been published[1] showing that in incandescent solids and in gases excited in vacuum tubes the production of light is accompanied by a very considerable production of infra-red radiation; that the arc light, especially the "flaming-arc" lamp, is the most efficient because of the absence of an appreciable amount of infra-red radiation, and finally, that in the high-frequency spark nearly all the radiation is in the ultra-violet (and hence useless to man) with but little if any radiation in the infra-red. In this classification the firefly would have to be compared with the flaming arc, which seems absurd.

Finally, it may be added that in determining the *radiant* efficiency of the firefly the assumptions made by Ives and Coblentz, of no appreciable amount of infra-red radiation, seem to be sustained by their subsequent experiments.

The experiments of Ives confirm the results obtained in this laboratory the preceding summer that keeping the insect in the dark, dead or alive, heating or cooling it, or exposing it to ultra-violet light, gives no indication that the light is of a fluorescent nature. These experiments were confirmed again this summer when various species of fireflies were kept in the dark for several days. The receptacles were of such a nature that the health of the insect was not impaired. The main point of interest was that in the dark they kept up their usual flashing, which was immediately stopped when exposed to light.

This test was applied repeatedly in rapid succession with the same results. The propensity of the firefly to flash in the dark is not unlike that of a hen going to roost during a total eclipse of the sun. These tests, of course, are nothing more than have been made by others during the past fifty years, when the insect has been subjected to all sorts of indignities to wrest its secret from it, but all in vain. Perhaps when we learn something about triboluminescence and the phosphorescence in marine animals due to the contraction of the muscular fibers the phenomenon may become clearer. In this connection the time seems opportune for us to discard our old habit of expecting the production of "light" to be accompanied by the production of a very appreciable amount of radiation (especially in the infra-red) not affecting the eye.

The question of the composition of the light emitted by various species of fireflies is of considerable interest. The species Photinus pyralis, studied by Dr. Ives and myself a year ago, emits a rich yellowish light extending well into the red. Another species, Photuris pennsylvanica, emits a much brighter flash of shorter duration and of a much more greenish hue than the longer and more frequent fulmination of the Photinus. The emission band does not seem so broad as in the latter species. Spectral photographs were obtained this summer to determine (1) whether the maximum of the emission band of light from the Photuris lies at the same point as the one found (at 0.57 μ) in the light of the Photinus, the side of the energy curve, toward the red, being simply steeper, due to a deficiency of radiation in the yellow and red; (2) whether the maximum actually lies farther toward the green, as the bluish-green flash seems to indicate, or (3) whether the bluish-green color is simply a matter of comparison with other light. In this connection it may be added, in parentheses, that with both species in a glass vessel for comparison the light from the Photuris appeared the more bluish green when in a perfectly dark room, while there seemed to be no difference in color when these two species emitted light near a carbon-incandescent lamp. Unfortunately, the photographic plates at hand were not sufficiently sensitive and the photographs obtained were never thoroughly examined photometrically. Furthermore, the Photuris came earlier in the season than had been anticipated and in the course of only a few days after starting the work this particular species had entirely disappeared. The work was, therefore, discontinued until next summer. From the data at hand it appears that the light from the Photuris pennsylvanica consists of a narrower and much more intense band than that emitted by the Photinus pyralis, due to a greater deficiency of yellow and red light; i.e., it is more nearly monochromatic. Whether the maximum emission is very different in these two genera is not definitely determined. Until we can get further data it is an interesting speculation whether in the Photuris the apparent loss in breadth of spectrum is compensated by a greater intensity at the point of maximum emission. In other words, what are the relative areas of the spectral energy curves of the light emitted by these two genera of fireflies? In this connection it is to be remembered that in the Photinus pyralis the flash is more frequent and of longer duration than in the Photuris pennsylvanica.

Bureau of Standards, W. W. Coblentz
Washington, D. C.

[1] Coblentz, *Illuminating* [illegible] III [illegible]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Leakage Reactance.—J. REZELMAN.—A mathematical paper in which, from the test results on various machines, the author deduces a method for estimating the mutual induction between the overhanging coils of the different phases of a stator winding. Following this he proceeds to estimate the negative mutual induction between the overhanging coils of the stator and rotor of a non-synchronous motor. The article is illustrated by diagrams, and numerical examples are given.—Lond. *Electrician*, Oct. 7.

Brussels Exposition.—J. REYVAL.—An illustrated description of various exhibits at the Brussels Exposition, especially of dynamo-electric machinery. Among them is a turbo-alternator giving 1500 kw at 10,000 volts and 50 cycles, compounded according to the system of Latour; also a water pump driven by a three-phase commutator motor the speed of which is regulated by displacement of the brushes. The stator and the rotor of the machine are connected in series. This is, however, not the most general case. Often the two windings are connected through a transformer so as to change the voltage. The introduction of an air-gap in this transformer limits the speed of the motor.—*La Lumière Elec.*, Oct. 1.

Vertical Alternators.—L. LEGROS.—An illustrated article on vertical low-speed alternators. Some details of construction of such alternators built by the Oerlikon Company are given with test results.—*Elek. Zeit.*, Oct. 6.

Noise of Electrical Machines.—E. SCHULZ.—A discussion of the different causes of noise made by electrical machines, with special reference to the effect of the form of the slots and the air-gap.—*Elek. Anz.*, Sept. 29.

Lamps and Lighting.

Metallic-Filament Lamps.—B. DUSCHNITZ.—The author gives a review of various new processes for making metallic-filament lamps; in some of these processes use is made of an organic substance as binding material. To produce a very finely divided tungsten powder which is specially suited for the manufacture of filaments E. Ruhstrat uses the following process: Ordinary tungsten powder is dropped through an arc lighted in a hydrogen or nitrogen atmosphere or in a vacuum and the thus superheated powder is then subjected to a sudden cooling by catching it in a cool reservoir or in a liquid. The tungsten particles are thereby rendered very brittle and can be diminuted to an exceedingly fine powder, which almost approaches the colloidal state. The Allge. Elek. Ges. has obtained filaments consisting of a mixture of conductors of the first and second class. Refractory materials like titanium and tungsten are mixed with carbon and silicon and are melted to produce a mixture of titanium or tungsten with silicon carbide. The properties of such a filament depend on the proportion in which the two constituents are present. To get a long life it is important to select such a proportion of the two constituents that the electric resistivity of the finished filament has a positive temperature-resistance coefficient. The best proportion seems to be to mix the two constituents in the ratio of their equivalent weights. Lamps containing such a filament do not need to be evacuated to a very high vacuum with a pump. If a partial vacuum has been produced the globe is closed and the filament is then heated for a short time by the electric current to a very high temperature. A chemical reaction between the residue of gases, such as nitrogen and oxygen, with the metal takes place. Nitrites, etc., are produced and a perfect vacuum is obtained. At the same time it is claimed that the filament, which was formerly dark, is now covered with a very thin layer of high emissivity whereby the efficiency of the lamp is greatly increased.—*Elek. Anz.*, Sept. 22.

Three-Phase Arc Lamp with Four Electrodes.—A. RIGHI.—An abstract of a paper presented before the Italian Electrical Association. The arrangement of electrodes is as follows: The three bottom electrodes, 8 mm in diameter, connected to each phase and adapted for fixing in the ordinary holder of a single-phase lamp, are set vertically, so that they form the edges of a triangular prism, the side of which measures from 14 mm to 15 mm. The fourth electrode, about 25 mm in diameter, is set above them coaxially with the prism, and is suspended in such a manner that it can deviate slightly from the vertical so as to enable it to make simultaneous contact with the three bottom electrodes. In this way three star-connected arcs are formed with the production of six craters, which are the main sources of luminosity in the lamp. Owing to the position of the three top craters the light is in great part thrown downward without the necessity for using reflectors such as single-phase lamps require. The supply pressure can be adjusted either by impedances or by transformers, mesh or star wound. In the latter case the fourth electrode can be connected to the center point of the star. In the regulating mechanism the series coil carries the current of one phase, while the shunt coil may be connected between the fourth electrode and any one phase, or between two phases. When the arcs are started between the three electrodes the fourth electrode, which at first is supported quite clear of them, is gradually lowered until it forms part of the path of the arcs and three craters are then developed in it. During the movement there is not much change in the value of the current or the light emitted, but when the craters are once formed there is a marked diminution of the current, and the light, which, to begin with, was fluctuating and badly distributed, undergoes a substantial increase and gives a distribution which is well suited for illuminating purposes. It is expected frequencies lower even than 17 cycles per second can be used.—Lond. *Electrician*, Oct. 7.

The Eye as an Electric Organ.—W. M. THORNTON.—The author first considers the influence of absorption on vision. The greater part of the incident energy is absorbed before reaching the vitreous humor, but the rate of diminution in the latter is so great that in the case of exposure to very strong light injury is lessened. The chief function of the vitreous humor, from this point of view, is to act as an absorbing screen protecting the retina from possible over-exposure. Although absorption would appear to reduce the sensitiveness of the eye by its presence the structure of the retina can by it be much more delicate without risk of injury. The least electrical current in a nerve fiber which can produce the sensation of light is about 2.87×10^{-14} amp. If this is correct the eye would appear to be able to detect about one-twentieth of the energy required for the least perception of sound. The current, when viewing white clouds in full sunlight with one's back to the sun, is about 7.0×10^{-12} amp in the fibers.—*Phil. Mag.*, October.

Sterilization of Water by Ultra-Violet Light.—V. HENRI, A. HELBRONNER AND M. DE RECKLINGHAUSEN.—A note on a paper presented before the French Academy of Sciences. Systematic tests have shown that the sterilization of large quantities of water by ultra-violet light can be obtained at a maximum expense of 36 watt-hours per cubic meter.—*La Lumière Elec.*, Oct. 1.

Generation, Transmission and Distribution.

Variable Speed Three Phase Motors.—J. J. E. SCHUURMAN.—An Iron and Steel Institute paper on the use of three-phase motors with variable speed in steel mills. After a brief discussion of the wasteful nature of speed regulation of induction motors by inserting resistance in the secondary circuit, and

the disadvantage of this method of regulation that for a once-adjusted slip resistance the speed changes to a very great extent with variations of the load and rises to practically its normal value at no load, the author described the system of regulation of A. Scherbius. In this system, instead of the slip-rings being connected to a variable resistance, they are connected to an auxiliary motor (Fig. 1) of the three-phase commutator type, so that the energy can be utilized. The auxiliary motor is shunt-excited, and, possessing little inductance, can be regarded practically as running like a continuous-current machine. Speed regulation of the main motor is obtained by adjustment of the excitation of the auxiliary motor, and thus controlling the motor voltage. A compound winding on the auxiliary motor can produce a drop of speed of the main

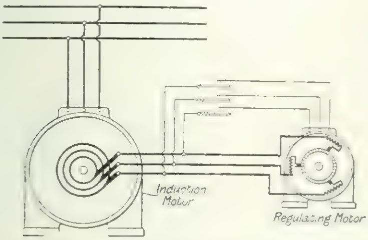


Fig. 1—The Scherbius System of Speed Regulation.

notor, so that the energy of a flywheel may be drawn upon utomatically if required. The auxiliary motor can either e coupled directly to the main motor, so that the slip energy s given back mechanically to the main driving shaft, or it an drive an induction generator and return energy electrically o the line. In general, the former arrangement is the more lesirable, but it is not always possible, as with it the reguating motor must follow the speed fluctuations of the main notor, and on this account becomes too expensive for very ride ranges of regulation. In such cases the regulating set, vhich runs at constant speed, is preferable. Another point

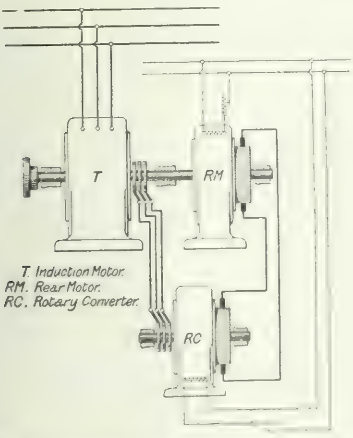


Fig. 2—The Krämer System of Speed Regulation.

bout the Scherbius system is that it can be used to obtain peeds above as well as below synchronous speed. It also ermits of the power-factor compensation. The system due o C. Krämer was then described. In this case (Fig. 2) the lip energy is converted by a rotary converter to continuous urrent, which is fed to the continuous-current motor assisting he main motor, and the speed is regulated by varying the esistance in the shunt-field circuit of the auxiliary motor. When resistance is cut out the armature voltage and the continuous-current voltage of the rotary converter will increase. At the same time the alternating-current voltage at the slip-rings must increase, as the continuous-current and alternating-current voltage of a rotary converter stand in a fixed relation to each other. The speed of the main motor will thus decrease. The system is capable of very wide ranges of regulation, but it is rather more complicated than the Scherbius system; moreover, it cannot be used so easily with existing motors. The Déri single-phase repulsion motor offers a third solution of the problem, particularly in the matter of output. It is shown diagrammatically in Fig. 3. The speed regulation and reversal are effected entirely by alternation of the position of the movable brushes. The motor has a series characteristic or, more exactly, an infinite number of such characteristics, each being for a certain position of the brushes, as shown in the diagram. By moving back the brushes over the zero position during running regenerative control can be obtained. The first advantage of the Déri motor is its simplicity. When the output is small the single-phase Déri motor will hardly affect the distribution of the load on the three phases of a system, especially when there are several such motors which can be divided over the different phases. But when large motor outputs come into question it is better to make use of a double-commutator motor, which electrically consists of two Déri motors mechanically built into one. Examples are mentioned in the paper of motors up to 2000 hp controlled by the Scherbius system. The Krämer system is also used in a few rolling mills. Déri double-commutator motors of 250 hp are

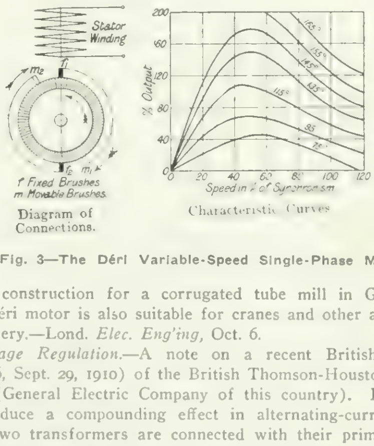


Fig. 3—The Déri Variable-Speed Single-Phase Motor.

under construction for a corrugated tube mill in Germany. The Déri motor is also suitable for cranes and other auxiliary machinery.—Lond. *Elec. Eng'ing,* Oct. 6.

Voltage Regulation.—A note on a recent British patent (23,416, Sept. 29, 1910) of the British Thomson-Houston Company (General Electric Company of this country). In order to produce a compounding effect in alternating-current circuits two transformers are connected with their primaries in series with each other and in shunt to the supply, and their secondaries in series with each other and with the load. One transformer has a saturated and the other an unsaturated core, and the relative connections are reversed so that the secondary voltages are in opposition. At no load the voltages are equal and opposite, but as the load increases the magnetization of the unsaturated transformer is increased. This increases its voltage and thus raises the main voltage.—Lond. *Elec. Eng'ing,* Oct. 6.

Italian Water-Power Station.—J. Collignon.—An illustrated description of the Cervara water-power station in Italy. It contains five three-phase alternators, each of 1900 kw, coupled to 2200-hp water turbines. The plant supplies electricity at 3750 volts (which is the generating voltage) to the City of Terni, and also supplies a large amount to a calcium carbide plant in Narni, the transmission e.m.f. being 27,000 volts.—*La Houille Blanche,* September.

Lifting Magnets.—J. Liska.—A mathematical paper illustrated by diagrams in which the author gives the general formula for the tractive force of alternating-current magnets as a function of the air-gap, taking into account the stray flux

and the ohmic resistance. The heating of the magnets is then discussed, and an example from practice is given.—*Elek. Zeit.*, Sept. 29 and Oct. 6.

Installations, Systems and Appliances.

Present Condition of Electrical Industries in Germany.—G. Dettmar.—A lecture held at the World's Fair in Brussels. There are at present 150,000 working men and employees in the German electrical industries. The value of their products is $250,000,000 and is the highest of all the countries of the world; one-fourth by value of the products is exported. The progress made in machine construction is indicated in the gradual reduction of weight of a 10-hp, 1000-r.p.m., direct-current motor, as shown in Fig. 4. The weight was 900 kg

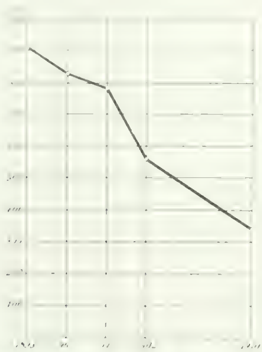


Fig. 4—Diagram Showing Weight of a 10-hp, 1000-r.p.m. D.C. Motor.

(1980 lb.) in 1893 and is only 340 kg (750 lb.) in 1910. The electrical stock companies in Germany paid in the year 1907-8 on the average a dividend of 8 per cent. As to the largest machines built in Germany, there are generators of 12,500 kw, motors of 15,000 hp and transformers of 12,000 kw. The highest e.m.f. produced directly in a generator is 12,000 volts. Reference is made to the use of alloyed steels, to the progress in the construction of turbo-alternators, mercury-vapor rectifiers, high-voltage transformers for testing, etc. Tungsten lamps are now made in candle-powers up to 1000 and down to 0.5. The small 0.5-cp lamps consume 0.15 amp at 3.5 volts. They are used very successfully with portable storage batteries and dry cells. The total rating of motors connected to the German central stations is 1,350,000 hp, while the total rating of all motors in operation in Germany is estimated at 6,500,000 hp. Rapid progress has been made in recent years in the electric equipment of mines and rolling mills. The number of electric stations in Germany is estimated as 50,000 and their rating at 6,500,000 kw, generating per year 7,000,000,000 kw-hours. The number of central stations proper is 2350 in Germany, supplying energy to 6500 cities and towns. The aggregate rating of the central stations is 1,350,000 kw, the number of incandescent lamps connected 15,000,000, that of the arc lamps 300,000, and the rating of cooking and heating apparatus is 50,000 kw. Forty per cent of the energy generated in these stations is used for lighting and 60 per cent for industrial purposes. The paper is to be concluded.—*Elek. Zeit.*, Oct. 6.

Apparatus for Detecting Fire-Damp in Mines.—An illustrated description of an apparatus designed to detect the presence of fire-damp or marsh gas in collieries. Fire-damp is a gaseous mixture which contains a considerable amount of hydrogen, and the apparatus takes advantage of the fact that platinum rises in temperature in the presence of this gas. Fig. 5 shows the arrangement. The detector is formed of two strips of metal, shown at the extreme left of the diagram, each rigidly fixed at one end, and the free ends of which overlap. Under normal conditions these remain out of contact with one another. Each strip consists of two pieces of dissimilar metal, such as steel and brass, having different coefficients of expansion, and any heating of these strips causes them to curve. Below the strips are placed coils of thin wire, that on the left being composed of some metal having no catalytic properties and that on the right being made of platinum; these coils are placed in series in a circuit passing to a lamp or resistance in the cut-out box. As long as no hydrogen is present the amounts of heat evolved by the two coils are equal, and the heat is transmitted to the metal strips above the coils, which curve upward equally and do not come into contact with one another; hence, fluctuations in atmospheric temperature or voltage of supply do not upset the arrangement. If, however, fire-damp is present the temperature of the platinum coil increases, and the strip above it curves to a greater extent and makes contact with the overlapping strip. When this occurs current passes through the circuit *S S* to the magnetic solenoid switch *w*, lifting the core of this switch

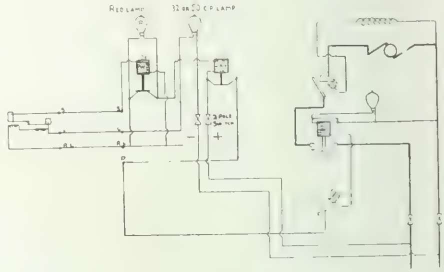


Fig. 5—Connections of Fire-damp Detector.

and breaking circuit on two springs shown. This causes the red lamp *R* to be put in series with the 32-cp or 50-cp lamp shown and the heating coils. The red lamp lights up brilliantly, giving a danger signal, while the current passing through the white lamp and the heating coils is so much reduced that the white lamp goes practically out and the heating coils cool down. By putting this red lamp into series it will be seen also that the current in a second magnetic solenoid switch *x* is also reduced and the core of this second switch falls, breaking connection in a circuit passing to the starting switch of any motor which it is desired to cut off in the presence of fire-damp. In the arrangements shown in the diagram the reduction of current in *x* breaks the circuit of the main solenoid switch controlling the motor, and the switch therefore lies flat in its off position, thus cutting off the supply. If the motor solenoid switch be enclosed in a locked case, an attendant, however foolish, cannot possibly switch current on again under gassy conditions until the solenoid switch *w* has been reset by a person having the key giving him access to the same. The fire-damp cut-out is connected to the supply mains on the supply side of the main double-pole switch controlling the motor circuit which it is desired to protect, so that it is always capable of operation. In this way this protective device is not put out of action at times when the motor switch is off, as, for example, during week-ends; this is important, because the accumulation of gas during such periods is extremely probable, and it is desirable that such an apparatus should prevent the starting of the motor under gassy conditions when work is resumed.—Lond. *Elec. Review*, Oct. 7.

Meter and Method of Charging.—A note on a recent British patent (20,815, Sept. 29, 1910) of Siemens Brothers Dynamo Works and F. Lyndall. A description is given of a meter which records at a rate depending upon the irregularity of the demand. It thus retains the essential feature of the maximum-demand system with the advantage of only one instrument and a direct reading. The system consists in charging at a fixed rate per unit multiplied by a variable factor representing the degree of irregularity. The factor is the ratio of the root mean square value of the current over a long period, such as a

quarter-year, to the average current. The speed of the meter is made proportional to the square of the current, and it records the mean square of the amperes flowing over a predetermined period multiplied by the square of the supply voltage and the square of the number of hours in the period divided by 1,000,000.—Lond. *Elec. Eng'ing*, Oct. 6.

Manchester.—An abstract of last year's report of the municipal electric station of Manchester. The total number of kw-hours sold by the electricity department during the year was 71,557,387, or over 90 kw-hours per head of population. Of this total about two-fifths is accounted for by electric traction, namely, 28,526,468 kw-hours, while private consumers required 42,886,223 kw-hours, public lighting being responsible for only the small amount of 144,696 kw-hours. The generating cost per kw-hour sold was 0.68 cent, the distribution cost 0.22 cent, the management cost 0.08 cent, the capital cost charges 1.06 cents, rents and taxes 0.24 cent; hence, the total cost, including capital charges, etc., was 2.28 cents. At Manchester the municipality owns both the gas department and the electricity department, and this is causing some trouble, as discussed in the separate editorials. It is pointed out that in many ways it would be better for the Manchester electricity department if the gas supply were in the hands of a private company.—Lond. *Electrician*, Oct. 7.

Commercial Organization of Central Stations.—C. Kinzbrunner.—The author thinks that while for the production and sale of electrical machinery a rather perfect commercial organization has been effected, such organization is still lacking in the distribution of electrical energy. Such a commercial organization, however, is necessary in order to make electricity more popular. Of greatest importance is large-scale soliciting carried out systematically from a central bureau, not in competition with gas, but rather in co-operation with gas companies as far as this is possible. Moreover, electricity should be distributed uniformly over the town, even to the poorer districts. The load factor should be increased by encouraging electric cooking, but the use of electricity for motors and heaters should be limited to certain hours, or at least discouraged for lighting hours. A suitable tariff is of greatest importance.—*Elek. Zeit.*, Sept. 29.

Excessive Voltages.—G. Giles and M. Wohlleben.—The conclusion of their very long reply to the criticism of Schrottke. They maintain their position that condensers and valves are superior to horn lightning arresters and spark-gaps. They claim that during the last five years some 5000 condensers and valves have been installed in practice and four-fifths of this number have replaced horn lightning arresters and spark-gaps, and they are proving successful.—*Elek. Zeit.*, Sept. 29.

Transformer Protection.—In providing switchgear for the control of transformers banked in parallel the use of protective devices operating on overloads is accompanied by certain disadvantages. A system of the British Thomson-Houston Company for transformer protection is described which is free from such defects.—Lond. *Elec. Review*, Oct. 7.

Wires, Wiring and Conduits.

Plastic Insulating Materials.—A. Hakansson.—The conclusion of his long article on plastic insulating materials. In the present instalment he discusses the ability to withstand high temperatures and gives curves showing the influence of temperature on mechanical strength. He then discusses the methods of forming insulating materials into shape and of machining them and their various applications. Under the name of hard rubber there are a large number of plastic insulating materials in the market which differ very greatly in their properties. For instance, some kinds of hard rubber do not withstand temperatures higher than 70 deg. C., but have a very high insulating resistance and often high mechanical strength and are little hygroscopic. On the other hand, there are kinds of hard rubber that can withstand very high temperatures, but have a comparatively small insulating resistance. In general, it is not proper to judge insulating material from its name.—*Elek. Zeit.*, Sept. 29.

Thermal and Electric Insulation of Wires.—A. Russell.—A mathematical paper on the convection of heat from a body cooled by a stream of fluid. In discussing the effect on the convection of heat from a cylinder by putting a covering around it, he shows that if the diameter of the cylinder and the thickness of the covering are sufficiently small the insulating material will have the effect of lowering the temperature of the wire. The following simple experiment illustrates this effect: Portions of a piece of thin manganin wire are insulated with glass, the rest being left bare. When placed in a current of air and heated electrically the bare pieces of wire glow brilliantly, but the portions covered by the glass are quite dark and are therefore at a much lower temperature. In very high-tension systems for the electric transmission of energy the overhead wires are sometimes surrounded with corona, which appreciably increases the transmission losses. The author has previously suggested that the losses would be diminished by insulating the overhead wires with a suitable material of high electric strength. The analysis in the present paper indicates, however, that this procedure instead of diminishing the permissible current in the wires would actually, in many cases, allow an appreciably greater current to be transmitted for the same rise of temperature of the wire.—*Phil. Mag.*, October.

Electrophysics and Magnetism.

Ions from Hot Bodies.—O. W. Richardson and E. R. Hulbirt.—One of these authors formerly developed a method of measuring the value of e/m for the ions emitted by hot bodies and applied it to the case of the ions of both signs from platinum and carbon. As was to be expected from the results of earlier investigations, the value of the specific charge for the negative ions was found to correspond to that for the negative electrons, whereas the number obtained for the positive ions pointed to bodies of atomic magnitude. Somewhat contrary to expectations, the value of e/m for the positive ions was found to be identical within the limits of experimental error for both platinum and carbon, despite their wide divergence of atomic weight as well as both chemical and physical properties. The values found were also very close to the value given by Sir J. J. Thomson for the corresponding quantity in the case of iron, which appears to have been the only substance for whose positive ions the value of e/m had been determined. The value of e/m in all these cases was about 380 electromagnetic units, and corresponds to an atomic weight of the carriers of about $m/H = 26$, assuming that they carry the same charge as the hydrogen atom in electrolysis. The authors have now extended this investigation to a greater number of metals and alloys, including platinum, palladium, gold, silver, copper, nickel, iron, osmium, tantalum, tungsten, brass, nichrome and steel. In general, the value of m/H differs from a mean value of 25.3 by not more than the error of observation. This mean value is near the atomic weight of sodium, and the authors think it probable that these positive ions which seem common to so many different substances are due to sodium or its compounds which are present as an impurity.—*Phil. Mag.*, October.

Emission of Ions.—A. E. Garrett.—An account of an investigation of the emission of ions from aluminum phosphate on heating. In this case a very large excess of positive ions is given up. The decay of positive ionization was studied. The value found for the ratio of charge to mass indicates that the smallest positive ions present at the lowest pressures must be of a magnitude comparable with that of the hydrogen atom. The high velocity of the ions at low pressures and also the fact that some escape with great velocity even when no external field is applied lead one to expect that a tube in which some aluminum phosphate is heated might be of use as a rectifier for alternating currents. It can be so used.—*Phil. Mag.*, October.

Photoelectric Fatigue of Metals.—H. S. Allen.—An account of experiments on the diminution of the photoelectric activity of metal surfaces with time. The author concludes that in the case of zinc light is not the primary cause of fatigue, that the

fatigue is practically independent of the electric field, that the fatigue takes place in an atmosphere of hydrogen as in ordinary air, and that the fatigue proceeds more slowly when the plate is kept in a small vessel. To explain the last result one is forced to the conclusion that the fatigue must be due to some substance (ozone, Hallwachs; in the case of zinc, ozone, water, vapor, Ullman) present in small quantities in the atmosphere surrounding the plate. The fatigue must be associated with the condition of the gaseous films on the surface of the plate or with the gas occluded in the metal.—*Phil. Mag.*, October.

Radiation from Electron Orbits.—J. H. Jeans.—A mathematical paper in which an attempt is made to examine the nature of the radiation which would be emitted by electrons describing orbits about various centers of force and in fields

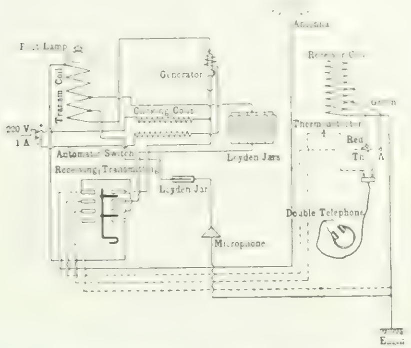


Fig. 6—Circuits for Wireless Telephony.

of force of various kinds, with a view to collecting evidence as to whether black-body radiation can be interpreted as radiation emitted in this way. The author concludes that it is necessary to abandon the hypothesis that the radiation proceeds from electrons describing open orbits. The consideration of closed orbits is reserved for a separate paper.—*Phil. Mag.*, October.

Radiology.—Lenard and Ramsauer.—The first report of the Institute of Radiology of the University of Heidelberg. The first part deals with scientific investigations on cathode rays, the photoelectric effect, the conduction of electricity through gases, phosphorescence, luminescence and radio-activity. The second part deals with new apparatus, among them a new cathode-ray tube, a phosphoroscope for measuring and demonstrating purposes, etc. The third part deals with the application of radio-activity for medical purposes.—*Elek. Zeit.*, Oct. 6.

Telegraphy, Telephony and Signals.

Wireless Telephony.—An illustrated description of an experimental and demonstration apparatus for wireless telephony. By its aid it is possible, with a mast of 5 ft., to transmit music as well as the human voice over a distance of about 50 m. The connections for working in both directions are shown in Fig. 6. By closing the plug connection a 220-volt direct-current circuit is completed through a choking coil to the arc generator, in parallel to which is an oscillation circuit consisting of self-induction (transmitter coil) and a capacity (Leyden jars). From the transmitter coil, which is connected at the upper part with the antenna, a branch connection is made through a Leyden jar and a microphone to earth; the coupling between the generator circuit and the antenna is therefore direct. By reversing a switch (automatic) the receiving circuit is put in. It consists of the receiving coil, the thermo-detector (cell) and a double-head telephone. All three instruments are connected in series. Part of the receiving coil is connected to the antenna; the coupling in this case is also direct.—Lond. *Electrician*, Oct. 7.

Electrochemistry and Batteries.

Electric Steel Refining.—G. Arnou.—A review of various electric furnaces proposed or used for steel making and refining, namely, the resistance furnaces of Gin, the induction furnaces and the combination furnace of Roechling-Rodenhauser, and the arc furnaces of Girod, Strassano, Héroult and Keller. An outline is given of what has actually been accomplished in practice, together with a table of different furnaces in operation.—*La Lumière Elec.*, Oct. 1.

New Apparatus and Appliances

LUMINOUS AND FLAME ARCS VS. OPEN AND ENCLOSED ARCS.

The paper on "Luminous and Flame Arcs versus Open and Enclosed Arcs" presented by Mr. W. D. A. Ryan at the St. Louis Convention of the National Electric Light Association has been reprinted by the General Electric Company with further illustrations, including some in colors. Charts and curves of the types of lamps treated in the article are shown, and in addition complete instructions in reading them are given. This feature gives it a particular interest to all interested in street illumination. In an introduction to the paper mention is made of the importance of illumination charts and curves and the psychological opposition usually met with in their use by uninitiated persons. The following are the types of lamps studied:

The 9.6-amp carbon open arc, commercially rated at 480 watts, equipped with clear globe and no reflector. The 6.6-amp carbon enclosed arc, commercially rated at 480 watts and equipped with light opal inner, clear outer globes and street reflector. The 4-amp luminous arc, commercially rated at 310 watts and equipped with clear outer globe, internal concentric diffuser and magnetic electrode. The 6.6-amp luminous arc, commercially rated at 510 watts and equipped with clear globe, internal concentric diffuser and magnetite electrode. The 6.6-amp vertical-carbon flame arc, commercially rated at 510 watts and equipped with 26-in. concentric diffuser and light opal outer globe.

A polar curve and a hemispherical chart are shown giving the characteristics of the various types, together with instructions in reading them and conclusions to be drawn.

Fig 1—Boston Flame-Arc Lamp and Ornamental Pole in Copley Square, Boston.

After this study of the characteristics of distribution and the relative spherical and hemispherical efficiencies, attention is

turned to the illumination on the street and two foot-candle curves in colors are given. A study of the height of lamps above the street is accompanied by two charts partly in color that furnish a ready means of comparing the relative candle-powers and resulting intensities for different spacings and heights of lamps.

While street arcs are employed largely for linear lighting, that is up and down the street, there are many cases where open squares, parks, etc., must be illuminated, and a chart is shown giving a comparison of the area over which the various lamps will project a given minimum light.

The values of the various types of lamps spaced at 500 ft. and 1250 ft. respectively are illustrated in two sector plates in colors. The relative illuminating power of the various units for distances of 250 ft. and beyond, indicating the number of lamps required of each type if massed at one point to equal one Boston flame arc, is given as follows:

6.6	amp.	Boston flame arc	[illegible] lamp
6.6	"	luminous arc	2 lamps
4	"	luminous arc	[illegible] lamps
6.6	"	enclosed carbon	[illegible] lamps
9.6	"	open carbon	7 lamps

The Boston type of lamp referred to is the vertical-carbon-flame lamp recently placed on the market by the General Electric Company and is termed Boston type because the first fifty were placed in service in that city to light the principal parks and squares.

Fig. 2—Luminous Arcs on Main Street, Salt Lake City.

The chapter entitled "X Values" treats, in an interesting way, the specifications adopted at the 1907 meeting of the National Electric Light Association. The "X value" is explained as indicating the relative strength of the light as compared with a standard 16-cp incandescent lamp at a fraction of the distance. An arc lamp, for example, having an "X value" of 4 gives the same light as a 16-cp incandescent lamp at one-fourth of the distance, all of the measurements being taken in accordance with definite specifications. In this chapter are given the "X values" of the types of lamps dealt with by Mr. Ryan.

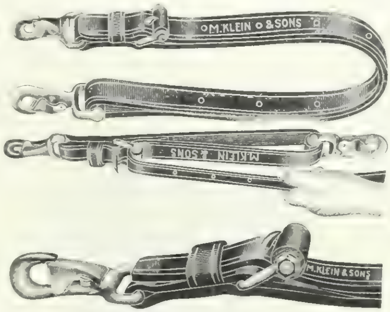
Summarizing, Mr. Ryan says that one of the strongest features of the present conditions of the art of street lighting is that there are now available three high-efficiency units which can be operated in series on the same circuit, as follows:

The 6.6-amp luminous arc for lighting the principal streets; the 6.6-amp Boston flame arc for lighting parks, squares and other places; the 6.6-amp "Mazda" units for residential and incidental lighting.

Photographs are shown of streets in Minneapolis, Detroit, Toledo, St. Louis and Boston, which were made especially for the reprint by the General Electric Company's expert night photographer, Mr. Norris. Two very interesting photographs are those of Park Square, Boston, both taken at the same point, one by daylight, the other at night, the latter illustrating the illumination by the vertical-carbon flame lamps hung there. The accompanying illustrations show a Boston flame-arc lamp and ornamental pole in Copley Square, Boston, and the illumination of Main Street, Salt Lake City, by magnetite luminous arcs.

COMBINED SAFETY AND SLACK STRAP FOR LINEMEN.

Every lineman is now regularly equipped with a safety belt so as to secure himself in his position when it is necessary to work with both hands on the pole. The ordinary safety belt,



Combined Safety and Slack Strap.

of course, serves this purpose satisfactorily; but inasmuch as it frequently happens that the lineman finds it necessary to use comealongs and to pull up slack wires, the combined safety and slack strap illustrated herewith will doubtless be found convenient and useful. The upper illustration shows the strap as used for a safety strap; the center illustration shows the combination roller buckle and the bottom illustration shows the strap as used in pulling slack. The free snap is of the roller type and the free end of the strap is guided over the roller of the combination buckle, making it a powerful double-purchase pulling device. By throwing the tongue of the buckle into any of the holes along the surface of the strap the load can be held in any desired position. The strap is manufactured by Mathias Klein & Sons, Chicago, Ill.

LARGE BASE LAMP SOCKET.

The Benjamin Electric Manufacturing Company, of Chicago, Ill., has brought out one-piece, multiple and two-piece, series, large base lamp sockets, together with one having a galvanized flange tapped for ½-in. iron pipe. These are intended for use with lamps having large screw bases, and are adapted for attaching to the surface or bracket by means of screws passing

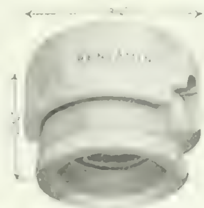


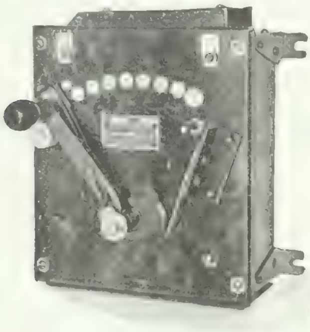
Fig. 1—One-piece Multiple Set. Fig. 2—Two-piece Series Socket.

through the base. The screw holes in the one-piece multiple socket are spaced 1 5/32 in. part, and in the two-piece series socket 1¾ in. apart. The one-piece socket is intended for use on low-voltage circuits not requiring a cut-out or short-circuiting mechanism. It possesses a spring center contact, the wires lead in at the side, and the binding screws are accessible from the central opening. The two-piece, series, cut-out socket has a short-circuiting center contact for high-voltage, street-lighting circuits. It has side connections and will take wires as large as No. 6, and the latter are firmly held by clamping plates.

STARTERS FOR SINGLE-PHASE MOTORS.

Single-phase motors have done much in helping to build up "day loads," but when starting under load the current often reaches four and five times the normal, thereby causing disturbances to the distributing system. To prevent such occurrences and provide a serviceable apparatus for starting the Cutler-Hammer Manufacturing Company, of Milwaukee, has developed a "primary resistance" starter for single-phase, self-starting motors.

This starter, shown in the accompanying illustration, has been specially designed to meet the requirements of alternating-current motors. The resistance is of the ventilated tubular type so arranged as to eliminate the effect of inductance and provide the highest possible power-factor obtainable in starters of this type. The starter is operated by means of a single sliding lever. A hub-spring attachment prevents an operator from leaving the lever on an intermediate contact, and it is held in the running position by a spring pawl which engages



Single-Phase Motor Starter.

a notch in the fan tail of the lever. The standard apparatus is made for 110-volt and 220-volt circuits, 60-cycles and 133-cycles, in sizes up to 35 hp. As the no-voltage release is not as important a feature as with direct-current starters, it is provided only when desired.

TUNGSTEN FIXTURES.

With the development of the tungsten filament lamp street lighting as well as indoor lighting is being revolutionized, and central-station men are confronted with the problem of a substitute for the ordinary enclosed arc-lamp systems of lighting installed previous to the development of the tungsten lamp. To meet this demand the George Cutter Company, South Bend, Ind., is placing on the market a "Tungsten Arc," so called because it is designed to give the service of an arc lamp while producing the same beautiful white light as the tungsten filament lamp at an efficiency of from 1 watt to 1¼ watts per candle-power. While not an arc lamp it has been given the above trade name because of its purpose.

The type shown in the accompanying illustration is used to replace the ordinary alternating-current enclosed arc. In doing this it is only necessary to replace the original arc lamp with the lamp shown, the same supporting devices being used. The only change necessary in the wiring is to connect the original leading-in wires to the binding posts of the new lamp. A transformer may be placed in the casing to step the voltage down, or series-tungsten lamps may be used, in which case the arc lamps are fitted with film sockets.

Fig. 2 shows an outrigger type of this same appliance, the fittings of this lamp being made for ¾-in. pipe. The pipe is fastened to a pole or front of a building and the whole fixture is insulated by a high-voltage porcelain joint fastened directly to the casing. A large 22-in. porcelain enameled reflector is used to give a wide distribution of light.

Other types of these arc lamps are made to meet special requirements, as, for instance, lighting factories, stores and store

Fig. 1—"Tungsten Arc" Lamp.

fronts and for street lighting. For outdoor use they have the special advantage of being heavier than most of the tungsten lighting appliances and hence do not tend to swing in the wind so much as the lighter fixtures. Spring-suspended sockets may

Fig. 2—Tungsten Street Lamp, Outrigger Type.

be used to protect the delicate filaments. The chief advantage claimed for the "Tungsten Arc" over other systems of tungsten lighting is that it facilitates concentration of light and thus reduces the number of outlets, and for certain cases meets conditions that no other appliances can.

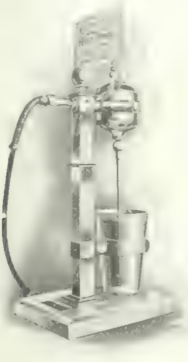
REMOTE-CONTROLLED DIMMERS FOR CATHEDRAL LIGHTING.

All the subtle effects of finely shaded electric lighting will be used, supplementing the best in architecture and music, to impress those in attendance at the new Cathedral of St. John the Divine, which is building on Morningside Heights, New York City. This structure has been in process of erection for the last twenty-five years and another quarter century will probably elapse before the complete plans of the architects are all carried out, but the basement of the building is already in use for services and the nave will shortly be ready for occupancy. A huge dimmer board, which has already been com-

pleted at the works of the Cutler-Hammer Company, Milwaukee, will be operated by individual motors remotely controlled from contact buttons located in various parts of the cathedral so that the effects can be manipulated from several points as may be desired during the services. The resistance units of the dimmers, unlike those used in theater work, where the effects required are of short duration, have been especially designed for continuous use so that their rated currents can be carried indefinitely.

ELECTRIC DRINK MIXER.

To supersede the ordinary hand shaker used in mixing drinks at bars and soda-water fountains the Hamilton-Beach Manufacturing Company, of Racine, Wis., is making the electric drink mixer illustrated herewith. An electric motor of 1/12 hp is attached to a standard and operates a vertical shaft, at the bottom of which is the so-called applicator in the form of



Electric Drink Mixer.

a thick button, ¾ in. in diameter, and of a shape particularly designed to set the contents of the glass in motion. The ingredients of the drink are placed in a mixing glass, which is then adjusted in a holder under the vertical shaft. The operator then presses down the machine until the applicator is about 3 in. from the bottom of the glass, when the motor starts automatically. Raising the machine stops the operation of the motor. The motor is said to have a maximum speed of 10,000 r.p.m., and as it is directly connected to the mixer shaft and applicator the contents of the mixing glass are very quickly and thoroughly agitated, the contents of the glass forming in a funnel shape which stirs everything from the bottom toward the top of the glass. The motion mixes air with the drink, making it light and creamy.

A universal motor designed to operate at from 104 volts to 125 volts on either alternating-current or direct-current circuits is used. If alternating current is used the periodicity must be 60 cycles or less. The motor is especially designed, the pole-faces in particular being somewhat different from other small electric motors. It runs on two ¾-in. nickel-babbitt bearings and consumes ½ amp at 110 volts.

Ordinarily two minutes or more are needed to make a mixed drink in a hand shaker and often the result is not entirely satisfactory. With the electric mixer it is said that the mixing may be done in from ten to twenty seconds and that all flavors are perfectly blended in a light, frothy and pleasing beverage. Another advantage is that the machine is sanitary. It is a simple matter to keep it clean, and in this particular it is a decided improvement over the ordinary hand shaker. The novelty of an electric drink mixer, it is pointed out, is also an attraction at drinking bars.

It is said that with a little care the machine will give no trouble in operation. Difficulty may be experienced by endeavoring to force the applicator into the bottom of the glass when it is full of comparatively large pieces of ice. Shaved ice should be used and it is said that a tablespoonful will be sufficient to cool any drink when mixed by the use of this electric device.

FLAMING-ARC LAMPS FOR ILLUMINATING MACHINE SHOPS.

For some time the Crucible Steel Company of America, at Harrison, N. J., had difficulty in finding a satisfactory means of illuminating its gun and projectile shop. In this shop, which works day and night, turning out guns and projectiles for the United States government, good light is imperative. The guns and projectiles made for the government are built under very rigid specifications, and each shell and gun undergoes very close inspection during the process of construction. It is apparent that without good light much of the work would fail to pass the inspection and thus be rejected.

This shop was formerly lighted by carbon arcs, but these proved unsatisfactory and incandescent lamps were added. These individual incandescent lamps were hung near the various lathes, planers and other machines, and it was thought that this would solve the lighting problem. This combination failed, however, for the men on the night shift were continually having trouble with their eyes. As a last resort flaming arcs were tried and after a thorough test seven Western Electric "Hawthorn" flaming arcs were installed in the main gun shop and three in the adjoining shop. These lamps were run two in series on a 220-volt circuit, and although the voltage is very unsteady, due to the fact that two or three 40-hp or 50-hp induction motors are often started or reversed simultaneously, the lamps are operating very satisfactorily.

After the flaming-arc lamps had been installed for some time it was noted that the increase in the amount of work turned out by the night shift was a little over 10 per cent. In order to determine whether or not this was due wholly to the introduction of the flaming arcs the lamps were taken out for a time and the night work carried on with the old lighting system. It was then found that the amount of work dropped

Flaming-Arc Lamps in a Crucible Steel Gun Shop.

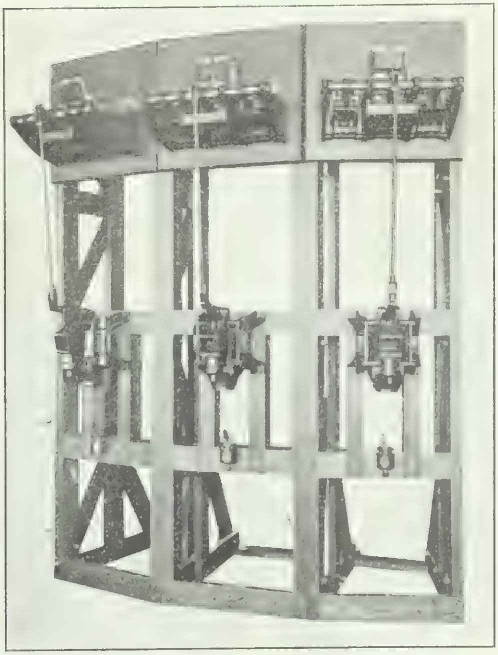
off over 10 per cent and that when the work was again carried on under the flaming-arc lamps the men were able to produce 10 per cent more work.

This increase in production is due not only to the amount of light but to the quality. The golden yellow rays of the flaming-arc lamp are stimulating in character and very easy on the eyes, and since these lamps have been installed night men have found it possible to turn out a greater amount of work with less effort than was possible with the old carbon lamps.

LARGE ALTERNATING-CURRENT CIRCUIT-BREAKER INSTALLATION.

The General Electric Company has installed the largest alternating-current circuit-breaker yet built in the worsted mills of the American Woolen Company at Lawrence, Mass., its function being to protect a 600-volt, 40-cycle turbo-alternator. It is a triple-pole, solenoid-operated breaker with a current-carrying capacity of 12,000 amp continuously without overheating. If a circuit-breaker for use on heavy alternating-current circuits of 6000 amp and over were built on the lines of usual direct-current construction, it would not perform its work satisfactorily and would heat to a dangerous degree in service. To avoid this special construction must be employed.

In the design of the circuit-breaker in question a large amount of radiating surface was provided and uniform distribution of the current throughout the various parts was ensured by subdividing the contact brushes and the studs of each pole into six sections, each section insulated from the others. Each pole of the circuit-breaker is operated by a separate solenoid mechanism so connected that the entire triple-pole breaker is controlled by a single-control switch on the switchboard panel. The open and closed positions of the breaker are indicated by pilot lamps located at the controlling switch.



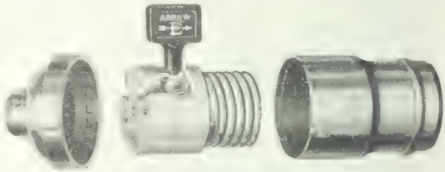
Heavy Alternating-Current Circuit-Breaker.

To obviate the necessity of opening an arc at the control switch the circuit of the closing coils is opened by relays located near the circuit-breaker after the latter closes. The circuit-breaker trip coils are opened by auxiliary switches on it, which open when the breaker itself opens. The device is made automatic by the use of series-transformers and relays. The circuit-breaker, solenoids and control-relays are mounted on specially designed hard-wood supporting framework made to conform to the perimeter of the turbine to which the framework is secured.

Before shipment, after being well tried out for purposes of adjustment and to discover any weak points in construction, the breaker was subjected to thorough mechanical endurance tests under conditions much more severe than it could possibly be expected to endure in actual service. The breaker has now been in service for several months and is operating satisfactorily.

SNAP-SHELL LAMP SOCKET.

The snap-shell socket illustrated herewith and made by the Arrow Electric Company, of Hartford, Conn., is known as "Arrow Forty." The chief feature of its construction lies in the method by which the shell is attached and detached from the cap. As shown in the engraving, there are four lugs on opposite sides near the upper edge of the shell which engage with notches on the interior of the cap. Twenty notches are



Snap-Shell Lamp Socket.

provided and these are so arranged as to give forty points of adjustment. Two of the lugs on either side of the shell prevent the socket and shell from being pulled apart by straight tension, and the other two lugs straddle the metal strips between slots in the rim of the cap and thus prevent the shell and cap turning relative to each other. In assembling the socket the shell is pushed straight into the cap and given a slight twist to right or left. When the shell is locked in position a distinct click is heard so that no doubt need exist in the mind of the wireman, especially in husk work, that the shell is absolutely fastened. The engaging rim in the cap is made of heavy brass to withstand rough usage.

The manufacturer draws attention to the small, and consequently strong, holding lugs, which do not weaken the shell. The engaging ring contained in the cap also clings tightly to the shell so that the point of strain on the lug is close to the shell at the point of the greatest strength and not on the extreme edge where the leverage is greater and where there is danger of ripping the lug loose from the shell. The positive lock resists a direct pull, an angle pull or a twisting strain; in fact, the design of the socket cap is such that the connection between the outlet nozzle and the cap itself will give before the connection between the cap and the shell will disengage. Nevertheless a slight pressure of the fingers on the shell below the lugs releases it. The interior of the socket is so designed that the weakening of the screw shell by cutting away the base has been reduced to a minimum. A solid screw shell strongly reinforced with heavy brass adds greatly to the life of the socket. The cam operating between the two springs eliminates the grating jar against the solid base, which is so disastrous to the life of tungsten lamps. The contact springs, moreover, cannot be forced out of position or out of contact. The center contact, like the springs, is of phosphor bronze with rounded edges and is not long enough to be twisted under the pressure of the lamp to the side of the shell. Ample room is given in the porcelain for wiring, a feature being the straight run with no corners provided for the wires. In the pull sockets the chain carrier is of heavy fiber and insulates the chain, preventing any possible short-circuit with the binding post. The operating mechanism in the pull socket includes an insulating disk of fiber, which, on breaking the circuit, drops down and smothers the arc, insuring an absolute break and eliminating any tendency to sustained arcing. When necessary the chain horn or chain guide can be easily unsnapped from the customary position without the use of tools and readily replaced. The socket is made in key, keyless, pull and wall types. The shell and cap can be separated by using only one hand, a slight pressure of the thumb being all that is necessary to effect the release.

Industrial and Commercial News

The Week in Trade.

There was little advancement in the trade situation during the past week. For this condition the weather is being held responsible by the majority of commercial authorities. Summer temperatures which have prevailed over a great part of the country have largely affected retail trade, and have checked liberal purchases. The wholesale and jobbing business of the week displayed that same conservatism which has been observed for many months. The majority of the buying that was done was of the hand-to-mouth character, although in some of the central markets it is claimed that the volume of trade was greater than that for the corresponding week last year. In the South the cotton crop movement has been freer than heretofore, and this has led to a slight improvement in retail buying and also in collections. It is said that the long-delayed specifications by railroads are being prepared, and there are intimations that a good tonnage of steel rails will shortly be ordered. The pig-iron market is not greatly changed, but it is said that the Southern producers are seeking to deal directly with consumers and are cutting out the jobbers and middlemen. The iron and steel manufacturers are practically living upon the hope that the railways will soon come into the market for all kinds of equipment. Business in finished lines shows a slight gain in some centers, but Pittsburgh advices indicate that there is little improvement in that quarter. The demand for structural material is not up to expectations, but the more optimistic manufacturers still declare that a goodly tonnage is pending. The firmer condition of copper has encouraged that industry, and it is said that electrical companies which are known to be fairly busy are buying rather liberally. Collections were distinctly improved during the week, especially in the South and West. Business failures for the week which ended October 20, as quoted by *Bradstreet's,* were 197, as compared with 233 the previous week: 224 in the same week of 1909; 231 in 1908; 220 in 1907, and 184 in 1906.

The Copper Market.

Advancing the asking price of copper to 12⅞ @ 13 cents for electrolytic has, to some extent, stimulated the desire to buy on the part of domestic consumers. This is one of the reasons that the actual transactions in metal were better last week and it has brought a more cheerful frame of mind to the copper market. Almost all of the sales were for November-December delivery, and as a general thing the purchases individually were for small amounts. Consumers with orders ahead are not willing to be caught short of metal while the market is threatening to go higher. Added to this it may also be said that consumers are putting more faith in the promised curtailment of the producers, and also are beginning to believe that the demand for electrical materials will be enlarged after the election. It is said that at the close of the week the demand for electrolytic was slightly easier and that some of the larger selling agencies, notably the United Metals Selling Company, were inclined to shade prices a trifle. In Europe there was some speculative interest in standard warrants, but the net advance in price for the week was insignificant. In Germany and Holland 36,000,000 lb. were placed in warehouses during the week against which certificates were issued which will be traded in on the new German Exchange. Reports from the British Board of Trade for the first nine months of the year show that about 10,000 tons more copper have gone into consumption in England during that period than in the same months of 1909. Imports, while still liberal, are not up to the high records established during the summer. Exports are heavy as a result of the large sales made in July and August. For the month, including Oct. 24, shipments have been 19,670 tons. The daily call on the Metal Exchange, Oct. 24, quoted standard copper as per accompanying table.

Standard Copper.	Bid.	Asked.	Selling price.
Spot	12.50	12.60	....
October	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]
January	[illegible]	[illegible]	[illegible]

The London [illegible]

	Noon.	Closing.
	[illegible]	[illegible]
Standard Copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations, for this year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
Best selected	[illegible]	[illegible]

Industrial and Commercial Notes.

More Edison Storage Battery Cars for New York City.—The Central Park, North & East River Railroad Company, known as the "Belt Line," which has been operating horse cars in New York City on a number of its lines, has decided to replace this service on West Street with Beach Storage Battery cars, which are equipped with Edison Storage Batteries. The company has practically concluded negotiations for ten of these cars. These cars, if the deal is concluded, will be similar to the No. 1 car now in service on the Twenty-eighth and Twenty-ninth Streets Crosstown Railroad. This car, it is claimed, has proved entirely satisfactory. No application for permission to change the motive power has yet been made to the Public Service Commission. There are at present 100 miles of horse-car lines in the Borough of Manhattan, and it is believed that within a year all of these will be replaced with storage battery cars. The South Shore Traction Company, which runs a line across the Queensboro Bridge, expects to install within a short time a two-truck storage battery car, which is now being completed at the Edison works in Orange. This car will be: Body, 29 ft. long, 7 ft. 6 in. wide; over-all length, 40 ft. 3 in.; two maximum traction trucks, wheels with roller bearings; four 85-volt, 40 amp motors with ball-bearing journals. The seating capacity will be 40 passengers, and the total capacity 100 passengers. It is expected that a single normal battery charge will operate the car 65 miles, and the estimated consumption of energy in kw-hours is 1.3. The total weight will be 16,000 lbs. A certificate was filed last week by the Edison Storage Battery Company showing that it had issued $1,998,200 of additional capital stock. This issue is the outcome of a resolution adopted by the company to increase its capitalization to $3,500,000.

Interstate Power Company.—The report recently circulated in South Carolina that the Interstate Power Company, of Anderson, S. C., had purchased control of the Savannah River Power Company is officially denied by representatives of the former company. The Interstate Power Company was organized last winter, and was authorized to issue $5,000,000 of 5 per cent bonds, of which the Carnegie Trust Company of New York was named as trustee. Reference to this organization was made in our issue of Feb. 17, 1910. These bonds have not yet been placed, and the Interstate Power Company has not yet begun the development of the hydroelectric site which it owns at Middleton Shoals, S. C., in the Savannah River. The Savannah River Power Company is operating a plant at Greggs Shoals. This company supplies power to the municipal plants at Greenwood and Abbeville, S. C. The Interstate company expects to develop the Middleton Shoals proposition as soon as the financial market is such that its bonds can be placed at favorable terms.

New York Electric Lines Company.—The Supreme Court of New York City denied last week the application made by the New York Electric Lines Company for a writ of mandamus to compel the Empire Subway Company to permit it to lay telephone lines within its ducts. The ground of the decision was that the applying company had not fully established its franchise rights, and that this must be done before a mandamus could be granted. The Electric Lines' Company is a wire-leasing company and is owned by the Great Eastern Telephone Company, which is seeking to operate an independent telephone system in New York City. It is claimed that the independent company has already more than one hundred thousand contracts for service. At the office of the Great Eastern company it was stated that the present decision was not considered conclusive and that the matter would be appealed to higher courts.

Telephones on the Louisville & Nashville.—The Louisville & Nashville Railroad Company has just completed the installation of telephone train dispatching and message circuits, supplanting the telegraph on its Knoxville division. These circuits consist of the following equipment: One dispatching circuit from Knoxville, Tenn., to Corbin, Ky., a distance of 105 miles, equipped with nineteen stations; one dispatching circuit from La Follette, Tenn., to Etowah, Tenn., a distance of 114 miles, equipped with sixteen stations, and one message circuit extending from Corbin, Ky., to Etowah, Tenn., a distance of 163 miles, equipped with thirty-six stations. These circuits also connect with the Pine Mountain, Olive Spring and Marysville branches. The lines are equipped with No. 9 B. & S. gage copper metallic circuit. The equipment furnished is a special high-efficiency telephone train dispatching circuit developed by the Western Electric Company. Selectors are employed for calling any station desired without interrupting the service of other stations. The cost of equipping this division amounts to about $36,000. Complete supervision of the work, both of the dispatchers and the men along the line, has been insured by placing telephone equipment at the chief dispatcher's desk and in the superintendent's office, so arranged that by simply taking down a receiver and listening in on the line the dispatcher and the superintendent may at all times be in direct touch and communication with any office on the entire division. The power furnished for operating the selectors and ringing the bells is obtained from motor generator sets. These sets are operated directly from the primary sources of power available, and on alternate days, so that the sets are always in an operative condition. They are arranged so that it is possible to connect all of the offices to either the train wire or message circuit. Test panels are furnished at all stations, making it possible to introduce a portion of the message circuit into the dispatcher's line, in case of trouble on the train wire. The dispatching panels employed in the more complicated stations are of special design, manufactured by the Western Electric Company according to instructions furnished by R. R. Hobbs, who has charge of the telegraph business of the entire Louisville & Nashville Railway system. Work trains and repair trains on this division will be equipped with portable telephone sets, which, used in conjunction with special line poles, make it possible for the employees to get in immediate touch with either the dispatcher or the message operator.

Western Electric Company Improvements.—The enlargements of the Hawthorne plant of the Western Electric Company, which were referred to in our issue of Oct. 20, will be in the nature of telephone and cable shops, and will give 300,000 sq. ft. of additional floor space, increasing the Hawthorne plant capacity by 20 per cent. In 1905 it become evident that future expansion in the plants at Polk and Clinton Streets in Chicago would not be sufficient to meet the demands of the company. At that time the company purchased 150 acres of virgin prairie at Hawthorne, and only about 25 acres of this property are now occupied by shops, so it is apparent that there is plenty of room for future growth. Practically all of the manufacturing of the company will be transferred to Hawthorne, including much of that which has up to this time been carried on at the New York City plant. The New York City office will probably always remain the executive and administrative headquarters, but the main manufacturing center will be at Hawthorne. When the company originally came to New York its plant was established there for the purpose of manufacturing supplies for the Western Union Telegraph Company, but that branch of the business is far overshadowed by the development in the telephone industry. The company has already spent about $20,000,000 on its plants that are now in operation.

Chicago as an Electrical Market.—In endeavoring to further the industrial activities of Chicago, the trade extension committee of the Chicago Association of Commerce is issuing a number of pamphlets designed to exploit the extent and resources of a number of the leading industries of Chicago. One of these is entitled "Chicago, the Electrical Machinery and Supplies Market." It asserts that "Chicago leads all cities of the United States as a market for electrical machinery and electrical supplies. In quality, quantity and variety the stocks carried here have no parallel." It is declared that the Chicago electrical market is equipped to supply the heaviest demands on the shortest notice, and that selling is done, not from catalog, but almost always from stock. The electrical salesrooms of Chicago are said to form one of the sights of the city, and it is contended that for size, arrangement and equipment they surpass those of any other market. They are got together in a comparatively small area and are easily reached. The buyer who comes in person to the Chicago market for electrical goods will find much to repay him for his visit. Appended to the general introductory statement is a list of fifty-five electrical concerns that are members of the Association of Commerce. Brief lists of the goods supplied by each concern are given.

Washington Water Power Company.—Options on about 7000 acres of land on both sides of the Spokane River, in Stevens and Spokane counties, Wash., have recently been acquired by the Washington Water Power Company. This land will be taken over preparatory to an extensive power development which will involve the expenditure of about $1,000,000. With this new property the company will have holdings sufficient to permit it to back up the water for twenty miles. The company has recently purchased the lands and rights of the Big Bend Water Power Company and four power sites owned by H. L. Mordy and associates, of Spokane. On one of these sites at Spalding it is estimated that between 75,000 hp and 80,000 hp can be developed. The plans at this point contemplate the erection of a dam 150 feet high. The Washington Water Power Company is also contemplating, it is said, the erection of a new power plant at Nine Mile Point, on the Spokane River.

Price of Platinum Continues to Advance.—The price of crude platinum has continued to advance during the past six weeks until it is now selling at $37 to $38 per ounce. According to the statement of one of the principal importers in the American market, this increase is entirely due to the increased demand from the jewelers, dental manufacturers and electrical manufacturers in this country. Shipments from Russia have been rather slow and the consumption has been unusually large. No new controlling legislation has been adopted by the Russian government which has affected the market, but ever since the selling price went above $25 per ounce—which was about the figure covering the advances of the Russian banks—there has been less disposition to push sales.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at New Orleans, La.; Norfolk, Va.; Lakeland, Fla.; Washington, D. C.; Perrysburg, N. Y.; Columbia, Mo.; Texas City, Tex.; Osyka, Miss.; Dayton, Ohio; Tacony, Pa.; Grand Rapids, Mich.; Logan, Va.; Houston, Tex.; Lyons, N. Y.; Panama; Wilmington, Del.; Klamath Falls, Ore.; Redmond, Ore.; Keewatin, Minn.; Eldora, Ia.; Charleston, S. C.; Detroit, Mich., and Milltown, N. B., Can.

The Manufacturers' Club.—The annual meeting of the Manufacturers' Club was held at the Hotel Aspinwall, Lenox, Mass., last week and the following officers were elected for the coming year: President, B. M. Downs, Brookfield Glass Company; vice-president, A. H. Pease, Hard & Hegeman Manufacturing Company; treasurer, Herbert Sinclair, Star Porcelain Company, and secretary, Walter Carey, Westinghouse Lamp Company. The membership of the Manufacturers' Club, the headquarters of which are in New York, is composed of representative electrical manufacturers of the Eastern States.

Foreign Agency for American Goods.—A European business firm advises an American consular officer that it desires to represent American manufacturers of incandescent electric lamps with metallic filaments, carbons for arc lamps, insulators, switches and arc lamps. Catalogs, prices, terms, etc., are requested. Correspondence may be in English if desired, and references will be furnished. The name of the firm may be obtained from the Bureau of Manufacturers, Washington, the file number being 5,756.

Costa Rica Hydroelectric Plants.—The Aguacate Mine, Inc., an American corporation, is installing a hydroelectric plant on the Rio Grande River and will construct a transmission line from the plant to its mines, a distance of twenty miles. The plant will have a capacity of 5000 hp. The Abangarez Gold Fields, of which Minor C. Keith, of New York, is president, is installing a 3000-hp hydroelectric plant on the Gaucimal River and will construct a transmission line eleven miles long from the plant to its mines.

Brussels Grand Prize for E. W. Bliss Company.—The E. W. Bliss Company, Brooklyn, has received a grand prize for its exhibit of machinery at the Brussels Exposition, and also the highest awards for individual machines.

Sherbrooke (Que.) Power & Railway Company.—A settlement has been arrived at between J. M. Craig and the Sherbrooke Power & Railway Company over certain water-power rights on the Magog River. The company has purchased from Mr. Craig that portion of his property which it found necessary for its business. The company has now secured a clear title to one of the finest water-powers in the eastern townships district of the Province of Quebec, situated in the center of the City of Sherbrooke. The generating plant is expected to be placed in operation within a few weeks. The control of the Sherbrooke Power & Railway Company was transferred some months ago from ex-Governor P. W. Clement, of Vermont, to a syndicate headed by Clarence J. McCuaig, of Montreal, who is now president of the company. A new franchise was also granted by the municipality in consideration of the company developing the Magog water-power, as well as constructing a large extension of the street railway system.

Wicomico Electric & Power Company.—A charter was obtained at the last session of the Maryland Legislature for a new electric railway in Wicomico County, that State, and a company has just been formed in Baltimore, called the Wicomico Electric & Power Company, to construct and operate the line. The company has organized as follows: M. V. Brewington, president; H. James Messick, vice-president; William M. Cooper, treasurer; Mark Cooper, secretary; Jesse D. Price, Levin W. Dorman, W. Jefferson Staton, George C. Bounds, Whitefield S. Lowe and J. B. Culver, directors, all of Baltimore. The Industrial Engineering Company, of Philadelphia, has its representatives, Frank S. Gibson and J. B. Walters, engineers, now looking over the field and contracting for rights of way from Salisbury to Nanticoke Point.

Chicago Subway Telephones.—The Illinois Tunnel Company is wiring its automatic telephone system and installing its switchboard equipment, in order to begin partial operation by January. It is said that when the installation of telephones begins from 400 to 500 will be placed daily. There will be 30,000 telephones in service, about 10,000 more than the ordinance requires, by June, 1911. The company has made application to the City Council for permission to open various South Side streets for telephone conduits, and this application has been referred to a committee. It is expected to place fifteen miles of conduit on the south side. Officials of the company say that no further issue of receivers' certificates will be necessary for the telephone installation.

Isthmian Canal Proposals.—The general purchasing officer at Washington of the Isthmian Canal in circular No. 611 asks proposals for electrical material, bids for which will be received up to Nov. 14. The schedule includes dynamo brushes, interior conduit and conduit fittings, shades, switches, magneto test sets, lineman's belts and safety straps and tools, trolley wire and fittings, rail bonds, fuses, sockets, globes, insulating tape, arc lamp suspension fittings, copper wire and cables.

Grand Trunk Secures Traction Line.—It was announced at Montreal last week that arrangements were being made whereby the Montreal & Southern Counties Electric Railway will pass formally under the control of the Grand Trunk Railway Company. The company is applying to the Dominion Parliament for authority to acquire the electric railway system.

General Electric Company Equipment.—George W. Lynch, receiver of the Second Avenue Railroad Company, has made a contract with the General Electric Company for the purchase of 100 double motor equipments, No. 216, to replace old motors on cars now in service.

Financial.

The Week in Wall Street

IMPROVEMENT continued to be marked in the [illegible] of Wall Street during the past week [illegible] is fully double that of two months ago. During the week [illegible] advanced for practically every active issue. There [illegible] some evidence that the [illegible] interested in the market, and [illegible] more hopeful than they have [illegible] is all the more [illegible] the financial market has [illegible] Bank of England during the week [illegible] per cent. In Wall Street [illegible] that those stocks known as the [illegible] were particularly buoyant, and this has led to the general belief that this powerful combination of financiers were full of optimism and looked for substantial advances. Among the specific influences for improvement were the more encouraging reports received from the final crop estimates and the distinctly bettered condition of foreign trade as shown by the September statement. The inquiry for bonds has not been quite as active during the past week as earlier in the month, but is still sufficiently good to be encouraging. The increased interest in stocks quite naturally attracts some attention from bonds. The money market has been little affected by the growth of activity and advance in prices, although rates have somewhat advanced. Quotations Oct. 24 were: Call, 3 @ 3¼; ninety days, 4¾ @ 5 per cent. The quotations in the table are those of the close Oct. 24.

NEW YORK.

	Oct. 17.	Oct. 24.	Shares sold.		Oct. 17.	Oct. 24.	Shares sold.
[illegible]				[illegible]			
All. Ch., pfd.	33½*	[illegible]		[illegible]			600
[illegible]				[illegible]			
Am. D. T.	20½*	[illegible]	———	Man. Elev. ..	144	143*	820
[illegible]				[illegible]			—
[illegible]	106*			[illegible]			
Am. Tel. & C	87*	[illegible]	132	Steel, com. ..	76⅞	78⅛	1,188,225
[illegible]			10,813	Steel, pfd. ..	120	[illegible]	
B. R. T.	78⅛	[illegible]		[illegible]			6,170
[illegible]			6,400	West'h, com.	72	73	14,100
Int.-Met. ...	22⅝			[illegible]		24*	

PHILADELPHIA.

	Oct. 17.	Oct. 24.		Oct. 17.	Oct. 24.
[illegible]	[illegible]	43*	Phila. Elec	[illegible]	
[illegible]	[illegible]	11⅝*	Phila. R. T	[illegible]	
[illegible]		[illegible]	[illegible]		[illegible]
E. S. B'ty, pfd.	30*	30*	Union Trac.	44	[illegible]

CHICAGO.

	Oct. 17.	Oct. 24.		Oct. 17.	Oct. 24.
[illegible]			[illegible]		[illegible]
Chi. Rs., Ser. 1	72	[illegible]	[illegible]		[illegible]
Chi. Rs., Ser. 2	17⅝	[illegible]	[illegible]		65*
[illegible]	[illegible]	116	Nat'l Carbon	127*	128
[illegible]		[illegible]	[illegible]		[illegible]

BOSTON.

	Oct. 17.	Oct. 24.		Oct. 17.	Oct. 24.
Am. T. & T.	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		6
Edison E., Ill.	266	266	N. E. Tel.	133½*	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	W. T. & T., pfd.	90*	[illegible]
Mass. E. Ry., pfd. ..	84½	[illegible]			

*Last price quoted.
Shares sold for week Oct. 17 to Oct. [illegible]

Financial Notes.

United Light & Railways Company.—The United Light & Railways Company has been incorporated under the laws of Maine to take over the properties now controlled by Child, Hulswit & Company, of Grand Rapids, Mich. The new company has an authorized capitalization of $30,000,000, divided into $12,500,000 6 per cent cumulative first preferred, $5,000,000 3 per cent cumulative second preferred, and $12,500,000 common. The company will issue no bonds but assumes $2,231,000 underlying 5 per cent bonds and $500,000 stock of constituent companies. At present there will be issued $2,133,000 first preferred, $866,000 second preferred and $800,000 common stock. The remaining stock will only be issued to take over additional properties. The new company takes over the Fort Dodge (Ia.) Light & Power Company; the Citizens Railway & Light Company, of Muscatine, Ia.; the gas and hot water heating system of Laporte, Ind., and the entire gas business of Fort Dodge, Muscatine and Cedar Rapids, Ia.; Cadillac, Mich.; Mattoon, Ill., and Chattanooga, Tenn. The officers of the company are Frank T. Hulswit, president; Richard Schaddelee, first vice-president; Ralph S. Child, second vice-president; B. C. Robinson, secretary and treasurer, and T. J. Weber, consulting engineer.

Fort Worth (Tex.) Electric Lighting Properties Sold.—J. R. Nutt, of Cleveland, Ohio, has bought the properties of the Fort Worth Light & Power Company and the electrical properties of the Fort Worth Gas Company. According to an arrangement with the City Commission, a hydroelectric plant with a capacity of 22,000 hp will be erected on the Trinity River and other large improvements made, calling for a total expenditure of approximately $2,000,000. Besides furnishing power to the Nutt plants, the hydroelectric plant will supply the local electric railway system, the Northern Texas Traction interurban line, and a number of industries in Fort Worth and adjacent territory. Plans for the new work have been prepared by Charles William Ricker. Mr. Nutt is managing director of the Citizens' Savings & Trust Company, of Cleveland.

General Electric Company Stock.—There has been a persistent rumor in Wall Street for the last two or three weeks that the General Electric Company was contemplating the issue of a stock bonus of 33 1/3 per cent. This report is denied at the office of the General Electric Company. It is said that there is no occasion for a distribution of stock at the present time. The assets of the company were reduced from a high valuation soon after the organization in 1892. At that time the amount of stock outstanding was decreased, and later, when earnings warranted it, the capitalization was increased, but it is not believed by the management that it would be good policy to further increase the stock at this time. There is every reason to believe that the earnings of the company will continue to be sufficient to pay the present 8 per cent rate dividend, and at the same time to add a comfortable sum each year to the surplus.

Southern Electric Securities at Auction.—At the auction of securities in New York last week quite a number of securities [illegible] Traction Company stock; $266,000 of Southern Light & Traction Company of Louisiana first mortgage bonds; $60,000 of Jennings (Pa.) Electric Light & Power Company first mortgage bonds; 300 shares of Jennings Light & Power Company stock; $32,000 of Vicksburg Railway & Light Company first mortgage bonds, and 3750 shares of Vicksburg Railway & Light Company stock. The entire lot was sold for $25,000.

Augusta-Aiken (Ga.) Railway & Electric Company.—Redmond & Company and J. G. White & Company, of New York, are at the head of the syndicate which has purchased control of the Augusta-Aiken Railway & Electric Company, of Georgia. [illegible] Franklin Q. Brown, a member of the [illegible] of Redmond & Company, has been elected president of the electric company, and will head the new corporation, which will be known as the Augusta & Columbia Electric Railway.

Chicago Traction Consolidation.—The new consolidation ordinance permitting the Chicago Railways Company to take over the Yerkes properties in Chicago will run for seventeen years and will, therefore, expire at the same time as the present franchise of the Chicago Railways Company. For about $4,000,000 the Railways company will purchase the property and will secure the use of 128 miles of track, 172 cars and three power houses. The rest of the Consolidated Traction Company property, consisting of 187 miles of track and 344 cars, is outside the city limits and is not included in the consolidation ordinance. The rehabilitation of the property will be pushed forward as rapidly as possible under the direction of the Board of Supervising Engineers of the city and any extension must be constructed that the City Council may direct. Several substations will be constructed at once and additions will be made to the transmission lines and car-barn facilities. This consolidation practically unites all of the surface lines on the north and west sides of Chicago and it is believed points to the ultimate union of all the transit lines in Chicago. In the Chicago stock market the passage of the ordinance has had the effect of creating a large buying interest in traction stocks and Series 1 and 2 of Chicago Railways certificates have rapidly advanced in price.

Montreal Power-Street Railway Merger Declared Off.—During the week an announcement was made by President H. S. Holt, of the Montreal Light, Heat & Power Company, that the proposed merger between his company and the Montreal Street Railway Company had been declared off. Mr. Holt stated that the response for proxies had been so half-hearted and the active opposition to the merger so pronounced that he had deemed it advisable to end the negotiations.

Stolz Electrophone Company.—The Stolz Electrophone Company, of Chicago, which makes telephonic appliances for the purpose of assisting the partially deaf to hear, has increased its capital stock from $25,000 to $100,000.

DIVIDENDS.

Cape Breton Electric Company, Ltd., preferred, semi-annual, 3 per cent; common, initial, 1½ per cent, both payable Nov. 1.

Commonwealth Edison Company, quarterly, 1¾ per cent, payable Nov. 1.

Houghton County (Mich.) Electric Light Company, semi-annual, preferred, 1½ per cent; common, 1½ per cent, payable Nov. 1.

Lewiston, Augusta & Waterville Street Railway Company, quarterly, preferred, 1½ per cent, payable Nov. 1.

Montreal Light, Heat & Power Company, quarterly, 1¾ per cent, payable Nov. 15.

Pacific Power & Light Company, preferred, 1¾ per cent, payable Nov. 1.

Sierra Pacific Electric Company, preferred, quarterly, 1½ per cent, payable Nov. 1.

Tampa Electric Company, semi-annual, 4 per cent, payable Nov. 15.

West Penn. Railway Company, Pittsburgh, preferred, quarterly, 1¼ per cent, payable Nov. 1.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus
[illegible] Light and Traction Company:					
[illegible], 1910	[illegible]	[illegible]	[illegible]	......	......
[illegible], 1909	[illegible]	[illegible]	[illegible]	......	......
Aurora, Elgin & Chicago Railroad Company:					
[illegible]	[illegible]	[illegible]	634,121	373,823	331,837
[illegible]	[illegible]	[illegible]	615,453	341,325	329,019
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	288,571	91,777
[illegible]	[illegible]	[illegible]	471,887	[illegible]	175,733
Crosstown Street Railway Company, Buffalo:					
Quarter ended June 30, 1910	224,898	155,861	69,036	46,218	8,623
[illegible]	[illegible]	[illegible]	[illegible]	37,175	[illegible]
Fairmont & Clarksburg Traction Company:					
[illegible]	[illegible]	[illegible]	43,316	13,112	30,204
[illegible]	[illegible]	[illegible]	32,002	12,055	19,947
[illegible]					
Year ended June 30, 1910	630,325	565,226	65,098	36,715	29,109
Year ended June 30, 1909	369,406	310,986	58,416	37,248	[illegible]
[illegible] City Railway & Light Company:					
September, 1910	628,685	365,790	262,895	189,119	73,776
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	88,697
Keystone Telephone Company, Philadelphia:					
September, 1910	94,340	46,594	47,746	24,762	22,984
September, 1909	91,908	45,070	46,838	24,682	22,156
Kings County Electric Light & Power Company:					
September, 1910	352,889	181,942	170,947	109,015	61,932
September, 1909	286,822	155,546	131,276	91,827	39,449
Laclede Gas Light Company:					
Nine months ended Sept. 30, 1910	3,274,766	1,748,194	1,526,571	839,004	537,365
Nine months ended Sept. 30, 1909	2,951,007	1,657,057	1,293,949	844,186	364,982
[illegible]					
[illegible]	[illegible]	[illegible]	73,786	33,390	40,396
[illegible]	[illegible]	[illegible]	71,456	33,024	38,432
New Jersey & New York Railroad Company:					
Quarter ended June 30, 1910	186,481	113,874	72,607	54,040	15,838
Quarter ended June 30, 1909	169,406	105,888	63,518	40,233	18,891
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	128,790	351,228
[illegible]	[illegible]	[illegible]	278,349	107,924	204,277
[illegible]					
[illegible]	[illegible]	[illegible]	90,140	58,602	31,538
[illegible]	[illegible]	[illegible]	71,061	57,555	13,506
[illegible]					
[illegible]	[illegible]	[illegible]	223,275	96,625	145,105
Quarter ended June 30, [illegible]	[illegible]	[illegible]	261,161	107,177	165,220

General News

Construction News.

KINGMAN, ARIZ.—Prepar[illegible] Mining & Power Company to operate the machinery at its mines and mills in the Union Pass district by electricity, which will be secured from a transmission line that is to be extended to that section from the main station at Kingman.

PHOENIX, ARIZ.—Plans have been prepared for the Water Users' Association for equipment for an electric power plant to be established at a point near Tempe, which are now in the hands of a board of consulting engineers. A report has been submitted by L. C. Hill, supervising engineer at this point for the reclamation service, under whose direction the plant will be installed, and for which the association has agreed to advance $900,000 within the next two years, at which time the association begins payment of the $8,000,000 invested by the federal government in the Roosevelt and Granite Reef dams. Extensive changes and enlargements of the distributing canal system are contemplated by the association. A new canal is to be built from Scottsdale to a point opposite Tempe, where the electric power plant is to be located.

PRESCOTT, ARIZ.—The contract for erecting a transmission line in Verde Valley for the Arizona Power Company has been awarded to William Nagle and E. Kurmier. The proposed line will extend from the power plant on Fossil Creek to Jerome, a distance of about forty miles, and will cost about $100,000.

TUCSON, ARIZ.—The City Council is considering the question of increasing the water power at the municipal pumping station up the river. It is proposed to raise the dam and develop sufficient power to meet all the requirements of the city. The present plant supplies 2500 hp. The cost of the proposed work is estimated at from $100,000 to $150,000. The city has appropriated $28,000 for service from the Washington Water Power Company.

WINKELMAN, ARIZ.—F. L. Payne and Henry Mitchell, of Phoenix, Ariz., have been granted a twenty-five-year franchise by the Board of Supervisors for construction of a hydro-electric power plant in the Winkelman district. It is proposed to erect a 100-ft. diversion dam and a 12-in. pipe line to convey the water to Winkelman. It is estimated that several hundred horsepower can be developed.

JONESBORO, ARK.—Arrangements are being made by the Home Telephone Company to extend its system from Jonesboro to Marked Tree.

LITTLE ROCK, ARK.—The contract for the construction of the power house in connection with the proposed municipal electric light plant has been awarded to Loftis Collarmore, of Little Rock, for $7,500. The building will be 42 ft. x 100 ft. Contracts for equipment have been awarded. The plant when completed will provide electricity to maintain 1000 arc lamps. The cost of the plant complete is estimated at $55,000. William L. Rogoski is chairman of electrical committee.

HEROULT, CAL.—Plans are being prepared by the Noble Electric Steel Company for the installation of five additional furnaces at its large smelter at Heroult, at a cost of about $300,000. The company is developing several chrome mines near its smelter. Since the demonstration in July of the electric process the furnace has been closed down, owing to the Northern California Power Company being unable to supply electricity during the dry season to operate the plant.

LOS ANGELES, CAL.—Citizens of the East Hollywood, Colegrove and Melrose districts have petitioned the Board of Public Works for street lamps. The light committee has reported that 167 lamps could be installed at a cost of $6,000, but recommends that only $2,000 be expended this fall for installing lamps.

LOS ANGELES, CAL.—Surveys have been completed by the Pacific Electric Railway Company for the extension of its new La Habra line, two and one-half miles east beyond Yorba Linda. The company has also completed a survey for an electric railway to Burbank, extending from the Glendale line at Verdugo wash and following the valley between the foothills and the river.

PORTERVILLE, CAL.—Surveys have been completed by the Porter-[illegible] eighteen miles in length, along the north bank of the Tule River, in Porterville. It is understood that contracts will soon be awarded for construction of the road. C. S. Freeland, of Porterville, Cal., is chief engineer.

SAN FRANCISCO, CAL.—United States Commissioner Harry M. Wright has recommended that the temporary injunction granted by the United States Circuit Court prohibiting the Hydro Electric Company from proceeding with the building of a pipe line across the Mono forest reserve be sustained. The matter will be again taken before the United States [illegible]uit Court.

SANTA ROSA, CAL.—The Clear Lake Consolidated Telephone & Telegraph Company, recently organized, has just closed a deal whereby it has purchased the properties, rights and franchises of the Clear Lake Telephone & Telegraph Company, the Northwestern Telephone & Telegraph Company, the Gold Ridge Improvement Company and the telephone plant of the Northwestern Electric Company. A. H. Spur is president of the company, and Fred L. Wright secretary and general manager.

NEW HAVEN, CONN.—Bids will be received at the office of the Board of Education, 87 Orange Street, New Haven, Conn., until Oct. 28 for furnishing electric lamps for the New Haven High School building. Plans and specifications can be obtained at the office of the Board of Education. G. T. Hewlett is secretary of the board.

NEW HAVEN, CONN.—Plans have been prepared by the Shore Line Electric Railway Company for the extension of its railway from Guilford and North Branford, through the Totoket and Foxen regions, across the meadows northeast of New Haven, crossing the Quinnipiac River and connecting with the local system of the Connecticut Company at the corner of State and Ferry Streets.

OAKVILLE, CONN.—At a town meeting held recently the citizens voted to form a fire district for lighting purposes. A committee was chosen to take charge of the matter. B. F. Ball is chairman of the committee.

WASHINGTON, D. C.—Sealed proposals will be received until Nov. 9 for furnishing and installing lighting fixtures in the United States buildings at Athens, Ohio; Davenport, Ia.; Houston, Tex.; Lake Charles, La.; Lancaster, Ohio; New Brunswick, N. J.; New London, Conn.; Salisbury, N. C.; Toledo, Ohio, and Statesville, N. C., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

WILMINGTON, DEL.—The Board of Water Commissioners has instructed the chief engineer to look into the cost of installing an electric generating plant to supply electricity for the Water Department. It is proposed to utilize the water power from the Porter Reservoir to the Cool Spring, or to install a steam plant. It now costs about $3,000 per year for lighting the department.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company has submitted a proposition to the occupants of the buildings on Market Street to continue the present decorative lighting system on the street until Dec. 31, as a trial, at a very reasonable cost. It is understood that the cost would be from one-half to three-quarters of a cent per foot per night. The present system is not of a permanent character, but can be maintained for a reasonable length of time.

BRONSON, FLA.—The Florida Power Company has filed a $200,000 mortgage in favor of Augustus S. Peabody, of Chicago, Ill., trustee. The company proposes to construct a dam across the Withlacooche River, in the southern part of Levy County, the power to be utilized to generate electricity, which will be distributed in several cities in Levy and adjoining counties, and also for use in the phosphate industry in those sections.

FORT MEADE, FLA.—The City Council has granted S. T. Rivers a franchise to install an electric light and power plant in Fort Meade.

LAKELAND, FLA.—Bids will be received by the Board of Bond Trustees of the City of Lakeland until Nov. 10 for improvements to water and light plant as follows: Three miles of 10, 6 and 4-in. cast-iron pipe, fittings, hydrants, valves and boxes; compound engine, air compressor, generator, exciter and switchboard; constructing pipe lines, setting hydrants, valves and boxes; constructing power house, machinery foundations, reservoir and installing machinery. Specifications may be obtained from H. L. Swatts, secretary. Plans will be on file and can be seen at the office of William W. Lyon, 305 Duval Building, Jacksonville, Fla., consulting engineer.

MIAMI, FLA.—C. T. McCreminon, of Miami, Fla., is reported to be in the market for equipment for an electric light plant for a $16,000 hotel.

PENSACOLA, FLA.—The Board of County Commissioners has awarded the contract for installing freight and passenger elevators in the new county jail building to the Warner Electric Company, to cost about $5,000.

SANFORD, FLA.—It is reported that the city is contemplating the installation of additional machinery in the municipal electric light plant at a cost of $20,000.

ALBANY, GA.—Application has been made to the City Council by C. W. Rawson, of Albany, and associates, for a franchise to construct and operate a street railway system in Albany. It is understood that a company will be formed by local business men to operate the system.

ATLANTA, GA.—Work has commenced on the installation of an ornamental electric illuminating system in Atlanta, Ga. The system is being installed by the Flour City Ornamental Iron Works, of Minneapolis, Minn. Corinthian standards will be used. It is expected to have [illegible]

[illegible] is reported to be in the market for a complete outfit for an electric plant [illegible] battery, of sufficient rating to supply 50 lamps of 16 cp.

[illegible] Company, of Atlanta, Ga., is making surveys of the Chattanooga River just north of Franklin. It is understood that the company is contemplating the construction of a dam and power plant in this vicinity.

MACON, GA.—The transmission lines of the Central Georgia Power Company have been completed from the power plant at Jackson to Macon, and the substation at the power house of the Macon Railway & Light Company in this city is ready to be put in operation. A substation has also been erected at Forsyth, from which electricity will be supplied for the mills and for lighting the city. It is expected to have the plant [illegible]

MILLEDGEVILLE, GA.—The plants of the Central of Georgia Guano Company and the Baldwin County Fertilizer Company will be operated entirely by electricity, which will be supplied by the Oconee River Mills electric department.

ROME, GA.—The new plant of the Cherokee Hosiery Mills has been completed, which consists of two-story mill building, 60 ft. x 107 ft., and an engine and dye house, 30 ft. x 80 ft. The plant will be operated by electricity furnished by an electric generator driven by a 125-hp steam engine.

CHICAGO, ILL.—Preparations are being made by the Central Manufacturing District, of Chicago, Ill., for the construction of a new factory building for the J. L. Metz Furniture Company, 60 ft. x 160 ft., six stories high. The building will be equipped with two large electric freight elevators and automatic sprinkler system.

CHICAGO, ILL.—Plans are being prepared by I. & S. Lanski, of Chicago, Ill., for a new factory building, 127 ft. x 165 ft., four stories high, to be erected at the corner of Morgan and Twenty-first Streets. The building will be of reinforced concrete and will be equipped with automatic sprinkler system and freight electric elevators.

KEWANEE, ILL.—The Kewanee Boiler Company is installing four electric cranes, manufactured by the Northern Engineering Works, of Detroit, Mich., in connection with the new additions and improvements to its plant. These cranes are of the alternating-current Northern type E design, ranging from 5 to 55 tons and 55-ft. span.

LOWELL, IND.—The capital stock of the Lowell Telephone Company has been increased from $9,000 to $25,000.

MISHAWAKA, IND.—Plans are being considered by the Fostoria Aluminum Manufacturing Company, of Fostoria, Ohio, for the construction of a concrete foundry building 65 ft. x 95 ft. The proposed foundry will be equipped with oil furnaces for melting brass and aluminum, band saws, molding machines, etc. The entire plant will be equipped for electric-motor drive.

MOORESVILLE, IND.—The Public Service Company, which supplies electricity in Mooresville, is reported to have been placed in the hands of a receiver. It is alleged that the company is insolvent, and that the plant is depreciating and expenses exceed the income. Benjamin R. M[illegible]

MT. CARMEL, IND.—Application has been made to the City Council by the Evansville, Mt. Carmel & Olney Electric Railway Company for a franchise to construct its proposed railway through the main street of Mt. Carmel. The railway will be sixty-five miles in length and will connect Mt. Carmel and Olney and intervening towns. E. Q. Lockyear, of Evansville, Ind., is secretary.

SOUTH BEND, IND.—A new warehouse and office building, 38 ft. x [illegible] ft., is being erected by the [illegible] Company, of South Bend, which will be equipped with electric elevators, bundle chutes and heating plant.

TERRE HAUTE, IND.—The Central Union Telephone Company is making extensive improvements to its local telephone system, which will involve an expenditure of about $100,000, and include a large addition to its main exchange and the installation of new cable and new equipment.

ALLERTON, IA.—It is reported that the local municipal electric light plant, recently completed, was destroyed by fire on Oct. 6, causing a loss of about $8,000.

BRADY, IA.—Preparations are being made for improvements and extension to the local telephone system, which will involve an expenditure of about $12,000. J. J. Paxton and C. A. Fancher are interested in the company.

BURLINGTON, IA.—The Rock Island Southern Railroad Company is securing the right of way for an extension of its railway from Monmouth to Burlington, via Macomb and Oquawka. The company will soon apply for a franchise in Burlington, Ia.

ELDORA, IA.—Preparations are being made by the Park Dam Company, of Eldora, Ia., to begin work on the construction of a cement dam across the Iowa River, at Eldora, and erection of power house and electric system in this city. The company was recently granted a franchise to supply electricity in Eldora. Electrical service is now furnished by the Eldora Electric Light Company, owned and operated by Ferris Brothers. E. H. Lundy, George W. Wood and A. H. Latimer, of Mason City, Ia., are interested in the Park Dam Company.

ELLIOTT, IA.—R. O. Prather, of Griswold, Ia., has applied for a franchise to supply electricity in Elliott.

[illegible] Merchants, Mechanics & Farmers' Telephone Company will be submitted [illegible] erect an automatic exchange and telephone system in Marshalltown, at [illegible]

WEBSTER CITY, IA.—It is reported that the construction of a new power station in Webster City, at a cost of about $50,000, is under consideration.

BONNER SPRINGS, KAN.—The Kansas City, Kaw Valley & Western Railway Company, which proposes to construct an interurban railway from Kansas City to Topeka, via Bonner Springs and Lawrence, is reported to have received authority from the State Railroad Commission to issue $1,500,000 in capital stock and $2,500,000 in bonds, the proceeds to be used for the construction of the railway. The company will take over the Bonner Springs Railway, five miles in length, and the eight miles of road which has been graded. The stock issue is limited to $20,000 per mile and bond issue to $35,000 per mile. J. W. Freeborn, of Kansas City, is president of the company.

McPHERSON, KAN.—The City Council has decided to submit the proposition to issue bonds to the amount of $10,000, the proceeds to be used for extensions and improvements to the municipal electric light plant, to a vote at the November election.

NEWTON, KAN.—It is reported that the Electric Light & Power Company is contemplating doubling the present output of its plant. A condensing outfit will also be installed.

SYLVIA, KAN.—Owing to some irregularity in the proceedings the bond election was not held Oct. 7 to vote on the proposition to purchase the electric light plant owned by B. McKeown. The plant was burned some time ago. The town proposes to purchase the plant and to issue $5,000 in bonds to pay for the rehabilitation of the system. At the present time the town is without electrical service.

WETMORE, KAN.—At an election held recently the citizens voted in favor of the proposition to issue $6,000 in bonds, the proceeds to be used to establish a municipal electric light plant.

NEW ORLEANS, LA.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 3, for two 300-hp boilers, piping, economizer, flue, boiler-feed pumps, motor-generator set, wiring, etc., at the United States naval station at New Orleans. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. The cost of the work is estimated at about $35,000. R. C. Hollyday is chief of bureau.

SHREVEPORT, LA.—The Shreveport Traction Company is contemplating extending its Southern-Fairfield Avenue line in Shreveport, for which it will soon apply for a franchise.

BALTIMORE, MD.—It is reported that plans are being prepared by the Monumental Sugar Refining Company for the construction of a plant near Baltimore which will have an output of 2000 barrels a day. The plant will be equipped for electric motor drive. William L. Frantz, Equitable Building, Baltmore, Md., is financial agent.

BALTIMORE, MD.—V. G. Bloede, president of the Patapsco Electric & Manufacturing Company, has submitted a proposition to Robert J. McCuen, superintendent of the Department of Lamps and Lighting, offering to supply electricity for lighting the municipal building within a reasonable radius of the courthouse and city hall at the rate of 2 cents per kw-hour, providing the company is granted a franchise to extend its transmission lines from the present terminus at the old city limits to the court house and city hall. The city now pays the Consolidated Gas & Electric Light Company 3 cents per kw-hour for the service. The Patapsco Electric & Manufacturing Company's plant is located in Ellicott City, Md., and supplies electrical service in Catonsville, Halethrope, Violetsville and West Baltimore.

UNION BRIDGE, MD.—The Tidewater Portland Cement Company is reported to have contracted with the Wisconsin Engine Company, of Corliss, Wis., for three horizontal cross-compound engines, with cylinders 23 in., 43 in. and 48 in. stroke, to be operated condensing; each to be direct connected to a 925-kva, 3-phase, 60-cycle, alternating-current generator.

LEOMINSTER, MASS.—The Leominster Electric Light & Power Company has purchased the lot next to its power station, on which it will erect a large addition to its plant. The new building will be equipped with two 300-hp Manning boilers, to replace some of the boilers now in use, and a 750-hp turbine.

PLYMOUTH, MASS.—The Plymouth Electric Light Company has applied to the Massachusetts Gas and Electric Light Commission for permission to issue $300,000 in additional capital stock, the proceeds to be used for taking up the funded debt incurred in making extensions to its plant.

DETROIT, MICH.—Plans are being prepared by Malcomson & Higginbotham, Moffat Building, Detroit, Mich., for the construction of an auto lamp factory, 67 ft. x 200 ft., three stories high. A power plant will also be erected in connection with the plant.

GRAND RAPIDS, MICH.—Bids will be received by the Board of Public Works until Nov. 3 for two arc generators direct-connected to a motor, with an alternative proposition for six 50-lamp series rectifier systems, complete. Bids will also be received at the same time and place for chain grate stokers for the combination pumping and lighting station for the City of Grand Rapids. Samuel A. Freshney is secretary and general manager of the municipal electric light plant.

MONROE, MICH.—The Raisin River Paper Company is reported to have awarded contracts for the construction of its proposed paper mill to cost about $125,000. The project includes a steam and electric power

plant to cost about $20,000. Machinery and equipment for the works is estimated at about $65,000.

NEGAUNEE, MICH.—It is reported that the Volunteer Ore Company, of Duluth, Minn., is opening up a large mine at Palmer Lake, near Negaunee, for which a large amount of equipment will be required. Compressed air and electricity for operating the machinery will be supplied from the power house of the Volunteer mine for the present. Thomas F. Cole and G. A. Tomilson are interested in the company.

SAGINAW, MICH.—Arrangements are being made by the Jackson & Church Company for the erection of a new plant at Saginaw, Mich., consisting of a pattern shop, foundry, machine shop, finishing shop and several other buildings, including a separate power house. The plant will be equipped for electric motor drive throughout.

CHISHOLM, MINN.—The Mesaba Range Power Company, recently organized with a capital stock of $250,000, will take over the plant and holdings of the Range Power Company, which now supplies electricity in the City of Chisholm. It is understood that the new company proposes to complete the Sturgeon Lake dam project for the development of water power. A. L. Ober, president of the First National Bank, of Chatfield, Minn., is president of the new company, and associated with him are W. W. Boyer, C. L. Thurber, F. G. Stout and M. J. Schermerhorn, of Chatfield, Minn.

KEEWATIN, MINN.—Preparations are being made for the construction of a municipal electric light plant in Keewatin, to cost about $8,000, bids for construction of which have been asked.

ST. PAUL, MINN.—Tentative plans for taking over the power to be developed by the erection of the high dam, near the Soldiers' Home, and its distribution between the Federal government, the University of Minnesota and the Twin Cities are under consideration. The present plan calls for the organization of a company to be composed of the president of the Board of Regents of the university, the dean of the engineering department of the university, the mayors and city engineers of the two cities. This corporation would be authorized by the legislature to raise money for its electric power plant and reserve steam power plant, and to enter into contracts with the two cities and other organizations.

OSYKA, MISS.—Sealed proposals will be received by the Mayor and Board of Aldermen until Nov. 8 for furnishing materials and machinery for an electric light plant and water-works system to cost about $20,000. Plans and specifications can be seen at the office of the Mayor, Osyka, Miss., and at the office of Xavier A. Kramer, engineer, Magnolia, Miss Clinton Thompson is Mayor.

COLUMBIA, MO.—The City Council is reported to have engaged M. E. Fawkes as engineer in charge of improvements to the municipal electric light plant and water-works system. The work includes the erection of a power station and boiler plant, changing the present arc lighting system to magnetite lamps, and rearrangement of present street-lighting system. A 750-kw electric generating plant will be installed, consisting of a 500-kw high-pressure turbo-generator and a 250-kw generating unit. Bonds to the amount of $125,000 were recently voted for the improvements.

ST. LOUIS, MO.—The Gratiot & Lindenwood Improvement Association is considering the question of building an independent street car line from South Broadway to the suburbs of Greenwood and Maplewood. The South Broadway merchants are expected to co-operate with the association. Charles F. Dollas is chairman of the special committee appointed to take up the matter.

CHINOOK, MONT.—S. W. Swenson is reported to have applied for a franchise to install an electric light plant in Chinook.

AINSWORTH, NEB.—The Ainsworth Electric & Power Company is reported to be contemplating the extension of its transmission line to Long Pine, to supply electricity for lighting the railroad yards and business districts in that town.

FRANKLIN, NEB.—It is reported that preparations are being made to build an electric lighting system in Franklin, bonds for which have been voted.

NORFOLK, NEB.—The City of Norfolk, Neb., has engaged the W. K. Palmer Company, engineers, 717-720 Dwight Building, Kansas City, Mo., to prepare plans and specifications for a municipal electric light plant in Norfolk, and for improvements to the city water-works system.

WEST CONCORD, N. H.—Work has commenced on the improvements to the power house of the street railway company at the South End, which include the erection of a new smokestack and the installation of new boilers.

GARFIELD, N. J.—At an election to be held Nov. 1 the proposition to issue bonds to the amount of $25,000 for the installation of a municipal electric light plant will be submitted to a vote. It is proposed to purchase the distributing system of the Public Service Corporation of New Jersey and install a power plant.

ALAMOGORDO, N. M.—It is reported that the Alamogordo Water Power Company is contemplating the installation of an 800-hp hydroelectric power plant in Box Canyon, near Highrolls. Electricity generated at the plant will be transmitted to the Sacramento Valley to operate irrigating pumping plants and for manufacturing purposes.

BALDWINSVILLE, N. Y.—The Village Board has granted the Syracuse, Lake Shore & North[illegible] [illegible] railway through Syracuse Street, [illegible]

BALDWINSVILLE, N. Y.—The contract for the construction of the power house for the Seneca River Power Company, at Baldwinsville, N. Y., has been awarded to D. E. Wadsworth, of Fulton, N. Y. Gaggin & Gaggin, of Syracuse, N. Y., are architects.

BROOKLYN, N. Y.—The contract for installing electric equipment in School 167, Borough of Brooklyn, has been awarded to the Commercial Construction Company, 24 State Street, New York, N. Y., for $10,973. C. B. J. Snyder is Superintendent of Schools.

BUFFALO, N. Y.—Sealed proposals will be received at the office of the Department of Public Works, Room 1, City Hall, Buffalo, N. Y., until Nov. 4 for three steam turbine electric generators for the pumping station, foot of Porter Avenue. Plans and specifications can be seen and forms of proposals obtained on application at the Bureau of Water. Francis G. Ward is commissioner.

HUDSON, N. Y.—Contracts for power house equipment for the New York Training School for Girls, at Hudson, N. Y., have been awarded as follows: For electrical work to the New York Construction Company, of New York, N. Y., for $11,524; for steam apparatus to the R. T. Ford Company, of Rochester, N. Y., at $33,775. G. W. Sullivan, of Hudson, is steward.

HUNTINGTON, N. Y.—The Public Service Commission, Second District, has authorized the Huntington Light & Power Company to execute a mortgage for $250,000 and to issue bonds to the amount of $98,000 and additional capital stock to the amount of $2,000, the proceeds to be used for taking up outstanding obligations to the amount of $86,000; for improvements to plants and distributing system, $14,000, and $42,000 to purchase the outstanding bonds of the Huntington Gas Company at a price not to exceed 70.

LYONS, N. Y.—The Safferson & Weisberg Company, which is building a new factory on Geneva Street, has decided to install a power plant to light and operate its works.

NEW YORK, N. Y.—Bids will be received by William H. Edwards, Commissioner of Street Cleaning, until Nov. 1 for furnishing and installing an electric lighting system in several buildings of the Department of Street Cleaning.

NEW YORK, N. Y.—Sealed bids will be received by C. B. J. Snyder, Superintendent of School Buildings, until Oct. 31 for the installation of electric equipment in addition to and alterations to present equipment in Girls' High School, located on Nostrand Avenue, between Halsey and Macon Streets, Borough of Brooklyn, N. Y.

PERRYSBURG, N. Y.—Plans have been prepared for a power plant to be erected at the J. N. Adam Tuberculosis Hospital to be built by the City of Buffalo at Perrysburg, N. Y. The equipment will consist of three 80-hp water tube boilers, feed pump, compression tank pump, vacuum pump, one 50-kw generator and one 20-kw generator, two 5-hp motors and three 1-hp motors. John H. Coxhead, 938 Ellicott Square, Buffalo, is architect. C. A. Hager, of Holland, N. Y., has the general contract for the buildings.

ROCHESTER, N. Y.—The Commercial Register Company, of Buffalo, N. Y., has been consolidated with the Benjamin Account System Company, recently incorporated with a capital stock of $120,000. It is understood that a new manufacturing plant will be erected in Rochester, which will be equipped with modern woodworking machinery. The proposed plant will be operated by electricity furnished by the Niagara Falls plant.

SYRACUSE, N. Y.—The Public Service Commission, Second District, has authorized the Syracuse Light Company to take over from Mortiz Mayer, of Syracuse, N. Y., franchises for an electric transmission line from Solvay to Camillus. The line has been in operation since June 1, and was erected primarily to supply electricity to the Camillus Cutlery Company, with which Mr. Mayer is connected, which also supplies electrical service in the towns of Geddes and Camillus. The cost of the line, including the distributing system, is estimated at about $12,000.

ROSS, N. D.—The Queen City Telephone Company is planning to erect a telephone line to Power Lake in the near future.

DAYTON, OHIO.—Plans are being considered by the directors of the Oakwood Street Railway Company for enlarging its power plant. Changing the location of the plant is also under consideration.

DELAWARE, OHIO.—The contract for electrical work on the new high school building has been awarded to the Electric Supply Company, of Columbus, Ohio.

TOLEDO, OHIO.—The Toledo Railways & Light Company has awarded the contract for construction of its substation to be located at 408 Front Street, East Side, to A. Bentley & Sons, to cost about $15,-[illegible]

YOUNGSTOWN, OHIO.—The contract for installing a switchboard in the new court house has been awarded to Caldwell & Drake for $4,650. The switchboard will control the lighting system being installed in the building.

CARTER, OKLA.—J. A. Corbell, of Carter, Okla., is reported to be in the market for an electric plant with sufficient output to supply 200 lamps, the equipment to include a gasoline engine, dynamo, switchboard, wire, 16-cp and 32-cp lamps, sockets, wire, etc.

HOBART, OKLA. Plans are being considered for the installation of electrical apparatus in the municipal pumping station, including a large [illegible]

[illegible] for the construction of a street railway in Ponca City, for which a fran- [illegible] Ponca City, are interested in the project.

TULSA, OKLA.—Preparations are being made by the Pioneer Telephone & Telegraph Company for installing an underground conduit system in Tulsa for the purpose of placing its wires underground.

KLAMATH FALLS, ORE.—Preparations are being made by the Klamath Light & Water Company to double the output of the Moore plant. An additional water wheel will be installed this fall and another next spring, increasing the output to 10,000 hp. The company proposes to discard the wooden flume to the power house and substitute iron pipe.

PORTLAND, ORE.—It is reported that the Southern Pacific Company is preparing plans for equipping its railway on the west side from Portland to Corvallis, to be operated by electricity.

REDMOND, ORE.—The Crook County Water, Light & Power Company has purchased the plant and holdings of the Cline Falls Water & Power Company, including 1300 acres of agricultural land, irrigation water rights and its rights to Cline Falls water power, including 150 hp already developed. It is understood that the Crook County Water, Light & Power Company proposes to utilize the power already developed and install additional machinery. The company expects to be ready to distribute electricity in Redmond within six months. C. N. Ehret is a director of the company.

SALEM, ORE.—The City Council has granted the Oregon Electric Railway Company, of Portland, Ore., a franchise to lay its tracks on certain streets in Salem.

SPRINGFIELD, ORE.—Plans are being prepared by the Northwestern Corporation for enlarging its local plant. The new equipment will include a 2000-kw turbo-generator set and two additional boilers.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Nov. 14 for furnishing electrical material, including fittings, fixtures, insulating material, line material, hardware, tools, rubber gloves, wire, electric and steel cable, etc. Blanks and general information relating to this circular (611) may be obtained from the above office, or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 55 National Realty Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officer.

HARRISBURG, PA.—The contract for furnishing and installing pumping machinery in the high-service pumping station has been awarded to the Birdsboro Foundry & Machine Company, of Birdsboro, Pa., for $15,500. The pumps have a capacity of 100,000 gal. each per twenty-four hours, one driven by a Nash gas engine and the other by an electric motor. Charles A. Hague, of New York, N. Y., is consulting engineer.

LAIRDSVILLE, PA.—The Muncy Creek Telephone Company has increased its capital stock from $5,000 to $15,000. U. G. Boyer is secretary of the company.

QUINCY, PA.—It is reported that plans are being prepared by M. I. Kast, 216 Market Street, Harrisburg, Pa., for an electric light plant for the United Brethren Church Orphanage in Quincy, Pa. It is understood that bids for the construction of the plant will be asked for this fall. The cost of the plant is estimated at $12,000. H. J. Kitzmiller is superintendent.

TACONY, PA.—The Holmes, Tacony & Frankford Electric Railway Company is contemplating the construction of an addition to its boiler house in Tacony, contracts for which will be awarded in the near future. Henry Glazier is general superintendent.

WOODLAWN, PA.—The Woodlawn Light & Power Company, a subsidiary of the Interborough Light, Heat & Power Company of Economy, Pa., has been granted a franchise by the Woodlawn Council to supply electricity in this town. Energy for operating the system will be supplied from the power plant of the Interborough Company, at Economy. A permit has been granted the Interborough Light, Heat & Power Company by the War Department to lay a cable across the Ohio River at Economy, work on which has already commenced. Work on the erection of the plant in Woodlawn will soon begin.

CHARLESTON, S. C.—The special committee appointed by the City Council to make investigations in connection with the installation of a municipal electric light plant and water-works system will soon engage an engineer to prepare plans and estimates for same. The City Council recently made an appropriation of $3,000 to pay for same.

DILLON, S. C.—Plans are being considered for the construction of a municipal electric light plant in Dillon to cost about $15,000. J. M. Carmichael is city clerk.

ROCK HILL, S. C.—An appraisement is being made of the electric plant of the Rock Hill Water & Electric Company to secure a valuation of the property with a view of its being purchased by the city. If the price is satisfactory the plant will be taken over and operated by the municipality; if not, the city will proceed at once to erect a municipal plant.

HURON, S. D.—The question of installing a new street lighting system in Huron is reported to be under consideration.

RAPID CITY, S. D.—The Rapid City Electric & Gas Light Company is contemplating the erection of a new power house and extension of its transmission lines.

CAMDEN, TEX.—The W. T. Carter Lumber Company, it is reported, is contemplating the construction of a timber cutting plant, which will be equipped for electric-motor drive. The plans call for the installation of a large steam-driven power plant.

CHAPIN, TEX.—Preparations are being made by the Valley Reservoir & Canal Company for the installation of a large pumping plant, for which contracts for machinery will soon be placed. The plant when completed will supply water for about 200,000 acres in the lower valley of the Rio Grande River.

ELKHART, TEX.—The City Council is reported to be considering the question of issuing bonds, the proceeds to be used for the construction of a municipal electric light plant and water works system.

FORT WORTH, TEX.—J. R. Nutt, of Cleveland, Ohio, has purchased the plant and holdings of the Fort Worth Light & Power Company and the electrical properties of the Fort Worth Gas Company. He will add to the property a 22,000-hp hydroelectric plant on the Trinity River, and other large improvements involving an expenditure of about $2,000,000. Charles William Ricker has prepared plans for the hydroelectric plant and other improvements.

HOUSTON, TEX.—It is reported that an appropriation of $65,000 has been made for the installation of an electric power plant at the William M. Rice Institute, in Houston. It is understood that contracts for construction of same will soon be awarded.

TEXAS CITY, TEX.—The Texas City Transportation Company is reported to have authorized the installation of an additional 500-kw generator in its power plant. H. B. Moore is general manager.

RUTLAND, VT.—The Penryhn Slate Company has placed a contract with the Rutland Railway & Light Company to equip the Scotch Hill mill and quarry, located about three miles north of Fair Haven, for electrical operation. One 25-hp motor, one 10-hp motor, one 15-hp motor and one 35-hp motor will be installed.

LOGAN, VA.—It is understood that the Arcoma Coal Company will require electrical machinery for mining purposes in the near future, including power plant, chain machine, motors, etc. E. B. Hubard, of Logan, Va., is engineer in charge.

NATIONAL SOLDIERS' HOME, VA.—Sealed proposals will be received at the office of the treasurer of the Southern branch of the National Home for Disabled Volunteer Soldiers, Soldiers' Home, Va., until Nov. 15 for furnishing and installing an electric elevator in the quartermaster's storehouse in accordance with plans and specifications, copies of which with blank proposals can be had on application to John T. Hume, treasurer.

NORFOLK, VA.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 3 for coal and ash-handling apparatus for the central power station at the United States Navy Yard, Norfolk, Va. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. The cost of the work is estimated at $24,000. R. C. Hollyday is chief of bureau.

BELLINGHAM, WASH.—Preliminary arrangements have been made by the Nooksack Valley Traction Company, of Bellingham, Wash., for the construction of its proposed electric railway to connect Bellingham and Sumas. Samuel Alsop is interested in the project.

CENTRALIA, WASH.—The Twin City Light & Traction Company is reported to have succeeded in raising $150,000 for the construction of its proposed power plant. It is said that the company may forfeit its franchise in Centralia and a municipal electric light plant may be established.

ELMA, WASH.—It is reported that the Olympic Railway & Light Company, recently organized by M. H. Lynch and D. E. Servis, proposes to construct and operate an electric power plant to supply electricity for manufacturing plants in Elma and vicinity.

OROVILLE, WASH.—A petition is being circulated by the North Washington Power & Reduction Company asking the city to grant the company a franchise to construct and operate electric transmission lines and telephone lines within the city limits.

SEATTLE, WASH.—The machinery in the new machine shop of the Puget Sound Machinery Depot, being built in Seattle, will be equipped for electrical operation. A large traveling crane will also be installed.

SPOKANE, WASH.—The Spokane Traction Company is reported to be preparing to commence work on the extension of its North Howard and Lincoln Heights lines.

SPOKANE, WASH.—The Board of Public Works has engaged W. E. Moore, hydraulic engineer, as consulting engineer, in connection with the establishment of a municipal electric light plant.

SPOKANE, WASH.—The Washington Water Power Company has recently acquired 7000 acres of land, including power sites, on both sides of the Spokane River, in Spokane and Stevens counties, north of Spokane; it is stated that other land will be purchased preparatory to its extensive power development, which will involve an expenditure of $1,000,000. The company now has holdings sufficient to back water over a strip twenty miles in length. The company recently purchased the lands and right of the Big Bend Water Power Company, located about four miles below the Lapray bridge, and the four sites owned by H. [illegible] and associates above the bridge. On the Spalding site it

is estimated that between 75,000 and 80,000 hp can be developed. The plans call for the erection of a dam 150 ft. in height, connecting perpendicular granite walls 300 ft. from base to cap. The company started work in September on a tunnel in the Spokane River, near its plant in Spokane, but abandoned this work recently. Following the outcome of the litigation respecting the overflow lands just below Cœur d'Alene, Idaho, where the Washington Water Power Company has its chief plant, the management is planning to build a large power plant at Nine Mile Point. D. L. Huntington is president of the company.

WATERVILLE, WASH.—The Home Telephone Company has submitted a proposition to the Farmers' Telephone Company offering to erect a telephone line from Wenatchee to Waterville and connect with the Farmers' Telephone Company's line.

PARKERSBURG, W. VA.—It is reported that the city will soon ask for bids for street lighting on one-year and ten-year contracts. The present contract expires January, 1910.

PARKERSBURG, W. VA.—The Parkersburg, Marietta & Interurban Railway Company is reported to have awarded the contract for a 2000-kw generator in its power plant to provide electricity for the commercial lighting circuit in Parkersburg. C. H. Shattuck is president and general manager.

DELAVAN, WIS.—The Board of Supervisors has granted Hamilton Brown, of Delavan, Wis., a franchise to construct and operate an electric railway in Delavan.

KAUKAUNA, WIS.—The Wisconsin Rate Commission has handed down a decision against the Kaukauna Electric Light Company and has ordered the company to make such improvements and extensions to its plant and distributing system as are necessary to provide an adequate and efficient service within ninety days. The report shows the plant to be wholly inadequate to meet the demands made upon it and that it will practically have to be reconstructed.

MADISON, WIS.—The City Council has granted the Chicago & Wisconsin Valley Railway Company a franchise to build an electric railway in Madison. The proposed railway will connect Madison and Wausau. Allen T. Russell, of Chicago, Ill., is general manager.

SUN PRAIRIE, WIS.—The contract for construction of power station at the municipal electric light plant has been awarded to Lissuer & Hasenfus, of Sun Prairie, Wis.

WYOCENA, WIS.—The Wisconsin State Railroad Commission has authorized the Columbia County Electric Light & Power Company to issue $25,000 in bonds, to be sold for not less than 75, and to issue 280 shares of common stock (par value $25), the proceeds to be used as follows: Bonds to the amount of $18,000 and stock to the amount of $6,950 to be issued and exchanged for the rights and property of what is now known as the Duck Creek Light & Power Company; stocks and bonds to be issued and sold to the amount of $7,000 to provide funds for extensions and improvements to the property.

DUNCAN, B. C., CAN.—The electric light by-law recently submitted to the property owners of North Cowichan municipality was carried by a large majority.

MILLTOWN, N. B., CAN.—Preparations are being made for the installation of a 400-hp electric plant at the St. Croix Mill to furnish electricity for operating the new machinery in the dyeing department and for lighting the mill.

LONDON, ONT., CAN.—The London Electric Light Company is reported to have submitted a proposition to the Mayor and Board of Aldermen, offering to sell its plant to the city at a reasonable price. It is understood that the company will sell out for $200,000.

NIAGARA FALLS, ONT., CAN.—Plans are being considered by the Symmes Construction Company for the construction of a power plant in the Porcupine mining district of Northern Ontario. The proposed plant will be located at Sandy Falls, on the Migogoni River, and from 6000 to 8000 hp will be developed.

WESTON, ONT., CAN.—The Council is reported to be contemplating the construction of a substation to utilize the energy furnished by the Hydro-Electric Power Commission in Weston.

CAPULA, HIDALGO, MEX.—The Mexico Light & Power Company is planning to extend its transmission line from Pachua to Capula to supply the mines and mills of the La Cruz Mining Company with electricity. The mining company will install electrical equipment in order to be ready for the service as soon as the transmission line reaches Capula. It is expected that other mines and industrial plants will also utilize the service furnished by this transmission line.

CULIACAN, SINALOA, MEX.—Surveys and other preliminary arrangements have been completed by the Mayo River Power & Land Company, of Denver, Col., for establishing a large electric power project on the Pacific coast of Mexico. The present plans call for the construction of three large dams and installation of three hydroelectric power plants having a total output of about 300,000 hp. The transmission lines extending from Guaymas on the north and to Tepic on the south, a distance of about 700 miles, will cover the entire Pacific slope territory of Mexico. Transmission lines will be extended into the mining districts and to the towns and cities, involving the erection of about 1200 miles of line. It is understood that tentative contracts have been made by the company with fifteen towns and cities for electrical service. The company has also a contract to supply electricity to operate the trains on a portion of the Southern Pacific Railroad of Mexico. The concessions granted the Mayo River Power & Land Company by the State and Federal governments give it exclusive rights on the Mayo, Humaya and Santiago rivers.

DURAZNO, CHIHUAHUA, MEX.—The Sierra Consolidated Mines Company is reported to have placed contracts for machinery for a steam-driven electric plant. It is understood that other improvements are also contemplated.

GUANAJUATO, MEX.—The La Tula Mining Company has recently installed ten additional motors for operating the machinery of its mills and mines in the Guanajuato district. The mining company now uses about 400 hp, which it obtains from the transmission line of Guanajuato Light & Power Company, of Guanajuato.

HOSTOTIPAQUILLO, JALISCO, MEX.—The Amajac Mines Company, of Hostotipaquillo, has contracted with the Chapala Hydro-Electric & Irrigation Company, of Guadalajara, Mex., for electrical power to the amount of 200 hp, to operate its mill, and also has taken an option on 300 hp additional for future needs. The transmission line of the Chapala Hydro-Electric & Irrigation Company will soon be extended to this district.

MEXICO CITY, MEX.—Announcement has been made that F. T. Snyder, of the Metallurgic Engineering Company, of Chicago, Ill., is contemplating the installation of a plant in Mexico for roasting copper ore with electricity generated by water power.

TORREON, COAHUILA, MEX.—A company has been organized to take over the property and holdings of the Chinese Street Car Company in Torreon. The company is to be capitalized at $200,000 and will take over and operate the system, which was built about two years ago.

New Industrial Companies.

THE BURGLAR ALARM & AUTOMOBILE BELL MANUFACTURING COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 to manufacture and sell alarms, signals, etc. The incorporators are: W. A. Boeckel, S. Tekulsky, of New York, N. Y., and J. H. Hopkins, of Paterson, N. J.

THE CROSS-MAGILL MOTOR TRUCK COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 by C. J. Cross, W. F. Magill, P. S. Tilden, of New York, N. Y. The company proposes to manufacture motors, motor vehicles, etc.

THE ELECTRICAL SHOW COMPANY, of Newark, N. J., has filed articles of incorporation with a capital stock of $60,000. The company proposes to operate exhibits promoting use of electrical appliances. The incorporators are: George Tiernan, Frank H. Parcells and Robert G. Redlefsen, all of Newark, N. J.

THE ELECTRIC SUPPLY COMPANY, of Jackson, Miss., has been organized with a capital stock of $10,000, by John Masal, E. W. Strauss and others.

THE HARRIS AUTO COMPANY, of Atlantic City, N. J., has been incorporated by W. B. Loudenslager, I. B. McDeviee, F. C. Muller and A. G. Boettger, of Atlantic City, N. J. The company is capitalized at $60,000, and proposes to manufacture motors, engines, machinery, etc.

THE HYDRO PATENT POWER COMPANY, of Portland, Ore., has been chartered by Norman R. Smith, Frank Becker and C. M. Idleman. The company is capitalized at $1,000,000, and proposes to manufacture and sell machinery for generating power by water. It is understood that the plant is to be erected in Portland, Ore.

THE MACDONALD HYDRAULIC POWER COMPANY, of Paterson, N. J., has been incorporated with a capital stock of $125,000 to deal in hydraulic power systems, plants, machinery, etc. The incorporators are: T. A. Macdonald, of Clifton; I. E. Zimmerman and W. H. Ackerman, of Paterson, N. J.

THE MAGIC DYNAMO COMPANY, of New York, N. Y., has been incorporated by Siegfried Blum and Edouard G. Dupre, 18 East Seventy-fifth Street, New York, N. Y., and Joseph J. Cohn, 139 East Seventy-second Street, New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture dynamos and machinery.

THE MORGAN REGISTER COMPANY, of Anderson, Ind., has been incorporated with a capital stock of $100,000 to manufacture and sell devices for registering fares and for ventilation of cars; also other appliances used in the operation of railways. The company is a successor to the Morgan Fare Register Company. The directors are: Fred A. Morgan, Henry A. Mansfield and H. C. Stillwell.

THE NATIONAL WATER POWER COMPANY has filed articles of incorporation with the Secretary of State, with a capital stock of $500,000, for the purpose of constructing windmills, waterwheels and motors of every description. The incorporators are: Walter H. Fieroe, John W. Fieroe and Melvina Beyer, of Atlantic City, N. J., and Harry W. Davis, of Wilmington, Del.

THE OTTUMWA-MOLINE ENGINE & PUMP COMPANY, of Moline, Ill., has been incorporated with a capital stock of $100,000 by J. M. Johnston, R. A. Clifton and J. U. Barnard. The company proposes to manufacture machinery.

THE VIRDEN EQUIPMENT COMPANY, of Camden, N. J., has been incorporated by A. W. Ward, of Germantown, Philadelphia, Pa.; W. K. Wood, of Sharon Hill, Pa., and E. L. Dudley, of Camden, N. J. The company is capitalized at $50,000, and proposes to manufacture electrical machinery, appliances, supplies, etc.

THE V. V. FITTINGS COMPANY, of Trenton, N. J., has filed [illegible] electrical and mechanical specialties. The incorporators are: J. P. Burns, of Philadelphia, Pa.; W. T. Pringle, of Lansdowne, Pa., and W. Gloeckner, of Trenton, N. J.

New Incorporations.

GLOBE, ARIZ.—The Gila Valley Electric Gas & Water Company has been organized with a capital stock of $100,000. The company proposes to construct a large reservoir and install an electric plant and supply both electricity and water to Layton, Safford and Thatcher. The power plant will be located in Frye Canyon, in the Graham Mountains. The initial installation will provide for 500 hp. A. G. Smith, of Globe, Ariz., is interested in the project.

DOVER, DEL.—The Rector Pittsburgh Lighting & Heating Company has filed articles of incorporation with the Secretary of State, with a capital stock of $125,000. The incorporators are: A. Rector, of New York, N. Y.; J. G. Callanhan, of Otto, Pa., and W. I. N. Lofland, of Dover, Del.

CARNESVILLE, GA.—The Carnesville Railway Company has been granted a charter with a capital stock of $200,000 to construct and operate an electric railway to connect Toccoa, Carnesville, Mize and Red Hill. The incorporators are: W. S. Irwin, J. H. Hicks, E. S. Hunnicull, G. W. Edwards, G. W. Davis, J. C. Andrews, and others.

BOGALUSA, LA.—Articles of incorporation have been filed for the Bogalusa Public Service Corporation with a capital stock of $500,000 by C. W. Goodyear, Jr., N. G. Pearsall, J. K. Breeden and others. The company proposes to construct and operate electric light plants, water works and sewer systems, etc.

HARRISBURG, PA.—Charters have been granted by the State Department to five new companies as follows: The East Bangor Power Company, the Penn Argyle Power Company, the Steckerton Power Company, the Tatamy Power Company and the Wind Gas Company. Each company is capitalized at $5,000, and the directors are the same in all companies: Chesleigh H. Briscoe, 187 Columbia Heights, Brooklyn, N. Y., treasurer; Herbert M. Hagerman, of Bangor, Pa., and Edwin C. Weller, of Portland, Pa.

HARRISBURG, PA.—Charters were issued at the State Department on Oct. 12 to 12 power and illuminating companies to operate in Northampton, Monroe and adjoining counties, the incorporators of all the companies being the same. Each company is capitalized at $5,000, and the titles are as follows: Washington Power Company, of Washington Township; Forks Power Company, of Forks Township; Palmer Power Company, of Palmer Township; all in Northampton County; the Hamilton Power Company, of Hamilton Township, Monroe County, with offices at Bangor, Pa.; East Stroudsburg Power Company, of East Stroudsburg; Lehman Power Company, of Lehman Township, with offices at Bangor; Smithfield Power Company, of Smithfield Township, with offices at Stroudsburg; Middle Smithfield Power Company, of Middle Smithfield Township; Stroud Power Company, of Stroud Township, with offices at Stroudsburg; the Williams Gas & Electric Company, of Williams Township; the Palmer Gas & Electric Company, of Palmer Township and the Forks Gas & Electric Company, of Forks Township, with offices at Easton, Pa.

OTTO, PA.—The Rector Pittsburg Lighting & Heating Company has been granted a charter with a capital stock of $125,000 for the purpose of constructing and operating lighting and heating plants.

PLYMOUTH, PA.—The Forty-Fort Electric Company has been granted a charter with a capital stock of $5,000. The directors are: A. J. Llewellyn, of Plymouth, treasurer; W. C. Anderson, Kingston, Pa., and R. R. Van Horn Ely, of Plymouth, Pa.

Personal.

MR. D. McF. MOORE will read a paper on vacuum-tube lighting before the Baltimore Section of the American Institute of Electrical Engineers on Friday, Oct. 28.

MR. J. S. PECK, of the British Westinghouse Company and formerly at East Pittsburgh, has been elected chairman of the Manchester local section of the British Institution of Electrical Engineers.

M. A. L. SEARLES, electrical engineer of the Fort Wayne Electric Works, formerly located at Grand Rapids, Mich., is now manager of the rock drill department of that company, with headquarters in Madison, Wis.

MR. PETER SPANG MILLER, sales manager of the Franklin Electric Manufacturing Company, was married Oct. 19 at Hartford, Conn., to Miss Daisy Elizabeth Miner, daughter of Mrs. Caroline A. Miner, of that city.

MR. CHARLES F. UNMACH, formerly with R. Williamson & Com [illegible] at 21 Lake Street, Chicago.

MR. WILLIAM H. WISSING, vice-president and general manager of the Central Station Development Company, Cleveland, was married in that city on Oct. 19, to Mrs. Mary Frances Lamb. The happy couple will return from their wedding trip about Nov. 1.

MR. W. S. BOYD, secretary of the Western Association of Electrical Inspectors, is making an inspection tour to compare Colorado interior wiring conditions and ordinances with those of Eastern territories. Denver, Colorado Springs and Pueblo are the principal points to be examined.

MR. FRANK J. SPRAGUE in a letter to the New York *Sun* of Saturday, Oct. 22, criticises the Public Service Commission for not having a representative at the A. I. E. E. meeting on Monday, Oct. 17, to defend the tri-borough plans of the commission, which were the subject of an Institute paper and discussion.

MR. BELA GATI, engineer-in-chief and manager of the Royal Hungarian Telegraph & Telephone Experiment Station in Budapest, has arrived in this country for a short visit. Mr. Gáti comes direct from the second Telegraph and Telephone Conference, held in Paris last month, where he presented six papers on telephone subjects. While here he will make a study of long-distance telephony, rapid cable telegraphy and the wireless situation.

DR. C. P. STEINMETZ, who spent parts of Oct. 19 and 20 in Chicago, delivered two addresses to electrical men, made some visits of inspection and met a number of the local electrical men socially. On the evening of Oct. 19 Dr. Steinmetz lectured at Fullerton Memorial Hall, Art Institute, before a representative audience of about 300 men on "Industrial Importance of Electrostatics and Electric Impulse Forces." The meeting was the first of the season's joint meetings given by the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers. Mr. J. W. Alvord, president of the Western Society of Engineers, occupied the chair, and Dr. Steinmetz's address, which was of a technical nature, was listened to with closest attention. After the lecture the distinguished visitor and a number of Chicago gentlemen were entertained at the University Club by Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company. Dr. Steinmetz made his headquarters at the University Club while in Chicago. In addition to Mr. Abbott, Mr. J. G. Wray, chief engineer of the Chicago Telephone Company, and Mr. James Lyman, Western district engineer for the General Electric Company, were conspicuous in the local arrangements for Dr. Steinmetz's visit. On the morning of Oct. 20 Dr. Steinmetz, in company with some of his Chicago friends, visited the Ryerson Physical Laboratory of the University of Chicago, where he met Prof. Albert A. Michelson and Prof. R. A. Millikan, of the physics department, and was enabled to see some of the experimental work being carried on at the university, notably the beautiful spectroscopic gratings of Prof. Michelson and the means which he has devised for making them; also the phenomena exhibited by extremely small globules of oil when subjected to the action of an electrostatic field, as opposed to gravity. The latter experiments are being carried out under the direction of Prof. Millikan. At luncheon on Oct. 20 Dr. Steinmetz was the guest of the Electric Club of Chicago, which he addressed on the broad subject of "Electricity." Dr. Steinmetz was received with the utmost enthusiasm by the electrical men present, numbering about 100, and was unanimously elected an honorary member of the club. After a call at the headquarters of the Commonwealth Edison Company, the visitor later in the day departed for his home in Schenectady. His sojourn in Chicago was appreciated by the electrical men of the city and left a pleasant impression.

Obituary.

GENERAL T. T. ECKERT, former president of the Western Union Telegraph Company, died at West End, Long Branch, Oct. 20, after an illness of some duration. Thomas Thompson Eckert was born in Clairsville, Ohio, April 28, 1825. He learned telegraphy at an early age and at the age of twenty-seven in 1852 supervised the construction and became superintendent of a telegraph line from Pittsburgh to Chicago, with which line he remained until it became merged with another company in 1859, when he resigned his position to become superintendent of a gold-mining company in North Carolina. At the outbreak of the civil war he offered his services to the federal government, and was sent to Cincinnati as superintendent of military telegraphs for the Department of the Potomac with the rank of captain. He later became general superintendent of the military telegraph and received the brevet titles of lieutenant-colonel and then colonel. In 1865 he was brevetted brigadier-general of volunteers for meritorious and distinguished service. From July 27, 1866, to February 28, 1867, he was acting Secretary of War. Upon leaving the government service he became general superintendent of the Western Union Telegraph Company, which position he held until 1875, when he became president of the Atlantic & Pacific Telegraph Company until 1881, when he was chosen vice-president and general manager of the Western Union Telegraph Company. In 1893 he was made president of that company, which position he held until [illegible]

Trade Publications.

THERMIT RAIL WELDING.—With this title the Goldschmidt Ther- [illegible]

Thermit to rail welding. Excellent half-tones show the process of welding in practical operation.

HAND-OPERATED STARTING COMPENSATORS FOR ALTERNATING CURRENT MOTORS.—Bulletin No. 4771, entitled "Hand-Operated Starting Compensators for Alternating Current Motors," has recently been issued by the General Electric Company, superseding previous bulletins on this subject.

ENGINE-TYPE DIRECT-CURRENT GENERATORS.—A bulletin has recently been issued by the General Electric Company, entitled "Engine-Type Continuous-Current Generators, Forms RB and RBO for Lighting and Power." The bulletin illustrates and describes direct-current generators for two and three wire systems [illegible] voltages.

WESCO SUPPLY CATALOGUE.—The Wesco Supply Company, St. Louis, has issued a catalog, No. 150, which contains about 1400 pages, and covers every department of [illegible] supplies, electrical novelties and ignition apparatus and supplies, a complete line of street railway material—in fact, everything that pertains to the application of electricity.

PACKARD TRANSFORMERS.—The Packard Electric Company has issued Catalog No. 10, having for a subject transformers for all purposes ranging from 200 kw to 1/10 kw, and including lines for welding work, switchboards and testing. For sign and house lighting with high-efficiency metallic-filament lamps there is a line for secondary voltages from 10 to 55 and with capacities ranging from 1½ watts to 1/10 watt. A useful addition to the catalogue is a section giving instructions for the testing of transformers.

BENJAMIN LIGHTING SPECIALTIES.—The Benjamin Electric Manufacturing Company, Chicago, has issued, with the title "Benjamin Wireless Clusters and Lighting Specialties," an 80-page pamphlet (B-19) illustrating and describing the many lines of Benjamin electric lighting appliances. The catalog has four divisions, covering respectively wireless clusters and cluster fixtures, special fixtures, lighting specialties, and fixture accessories. A feature of the publication is the inclusion of illumination in the section on special fixtures.

ELECTRIC AUTOMOBILE APPLIANCES.—Bulletin No. 4772, entitled "Electric Automobile Appliances," issued by the General Electric Company, supersedes a previous bulletin on this subject, and will be of interest to all owners or users of electric automobiles for either pleasure or business. The bulletin illustrates and describes an outfit for charging the storage batteries, as well as a combination ammeter and voltmeter for automobiles. It illustrates tungsten lamps for head light, side light and tail light, and also a lamp for limousine illumination. Automobile motors, controllers and air compressor outfits are illustrated and described.

ELECTRIC WIRES AND CABLES.—The American Steel & Wire Company, Chicago and New York, has issued a catalog-handbook presenting in serviceable form information interesting to customers, engineers and students. All types of bare and insulated wires and cables now in common use are fully described. In addition, there is a considerable amount of engineering data and descriptive matter, including an abridged dictionary of electrical terms, which have been introduced for the purpose of making the book a fairly complete treatise on electrical conductors. The book is divided into nine sections. The first contains general data on copper, iron and aluminum conductors; the next seven constitute the catalog portion of the book, and the final section comprises the electrical dictionary. The book, which contains 234 pages, concludes with a very complete index, having conveniently arranged cross references to materials used in electric lighting, telegraph and telephone work.

MAGNETO NON-MULTIPLE SWITCHBOARDS.—Bulletin No. 020, describing magneto non-multiple switchboards of the sectional unit type, has just been published by the Western Electric Company. It is pointed out that the flexibility of operation and ease of increase in size of these switchboards, which are designed somewhat along the idea of the sectional unit bookcase, make them especially adaptable for small but rapidly growing telephone systems. The bulletin, which is illustrated with many photographs, contains a detailed description of the line circuit apparatus, paying attention both to combined jacks and signals and the line drops. A list of the apparatus required, with different varieties of cord circuits, is given. Other sections are devoted to a description of the operator's telephone circuit and its apparatus, the ringing and night alarm circuit and apparatus, wiring and cabling and line terminal arrangement. The switchboard units are described, as well as methods of assembling these units.

NATIONAL ELECTRIC LAMP ASSOCIATION BULLETINS.—The engineering department of the National Electric Lamp Association has just issued two bulletins, one entitled "Mazda Multiple Lamps" (No. 13), and the other, "Hylo-Economical Turn-Down Electric Lamps" (No. 14). The first mentioned contains twenty pages of practical information and technical data on "Mazda" multiple lamps for use on 100-125 volts and 200-250 volts, three tables and fourteen cuts being included. It is stated that "Mazda" multiple lamps for use on central-station circuits are now available in twenty types, thirteen being designed for 100-125 volts and seven for 200-225 volts, the range in consumption being from 25 watts to 500 watts. Twelve of the twenty types have pear-shaped bulbs, while the remainder have round or meridian bulbs, the former being in seven sizes and the latter in five sizes. Bulletin No. 14 contains twelve pages and describes a new type of turn-down lamp, the principles of which are fully explained and illustrated by means of diagrams. One table and twelve cuts are included in the bulletin.

BUSINESS NOTES.

THE ELKHART DRY BATTERY & SIGNAL COMPANY, of Elkhart, Ind., has filed a notice with the Secretary of State showing a change in name to the Elkhart Electric-Carno Company.

MESSRS. VAUGHN AND MAYER, consulting electrical engineers, Milwaukee, have been appointed engineers and power-plant experts to the State Board of Control of the State of Wisconsin, which has charge of the various educational, charitable, penal and reform institutions of the State, twelve in number.

THE WESCO SUPPLY COMPANY, ST. LOUIS, is erecting a building on the corner of Eighth Street and Clark Avenue, which will be an exact duplicate of its present building on Seventh Street and Clark Avenue. The company will occupy both structures, which will give practically twice the present floor space, thus allowing increased facilities for quick service, and at the same time a large increase in stock carried.

THE IDEAL ELECTRIC & MANUFACTURING COMPANY, of Mansfield, Ohio, announces that the Machinery & Supply Company, of 61 Fremont Street, San Francisco, Cal., has been appointed its Western agent. The Machinery & Supply Company now carries a full line of "Ideal" apparatus, including alternating and direct-current generators, induction motors, both of the slip-ring and squirrel-cage types, special elevator motors and also a complete line of direct-current motors.

JAMES A. GRAHAM has leased the premises at 137 Liberty Street, this city, where he will carry a stock of new and second-hand motors and generators for direct and alternating current for sale or rental, and also electrical instruments, switchboards and other lighting and power accessories. No installation work will be done and no repairs, except to machinery purchased for resale. Mr. Graham has had twenty years' practical experience in the purchase, sale and repairs of electrical machinery.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED [illegible]

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

[illegible]. BRUSH HOLDER FOR DYNAMO ELECTRIC MACHINES; [illegible] and guided by guide rods with lugs to receive the guide rods.

[illegible]. CIGAR LIGHTER; [illegible] switch, gravity operated, after a predetermined interval.

[illegible]. ELECTRICAL RELAY; J. F. Cadell, Baltimore, Md. App. filed October 29, [illegible] armature and an L-shaped return bar for the magnetism, the latter [illegible]

972,838. ELECTRIC-WELDING MACHINE; S. Z. De Ferranti, Grindleford Bridge, near Sheffield, [illegible] attaching turbine blades, including a magazine, with means for transferring a blade from the magazine to holding means, together with means including the holding means for attaching the blade to the carrying element.

[illegible]. TELEPHONE ATTACHMENT; [illegible] ized listening in by telegraphing the call to the parties conversing by means of a device which is connected to the receiver hook for interrupting the circuit and providing means for preventing the telephone circuit from being opened until the interrupting device is operated.

972,840. FIRE ALARM; J. E. Fogal, A. M. Crichton and A. C. Mowry, Quincy, Ill. App. filed Feb. 18, 1909. An electric signal system with a circuit controller normally closed and biased open and then to close the circuit with a signal released by opening the circuit and causing signals on reclosing the circuit.

972,850. ROTARY FIELD MEMBER OF DYNAMO ELECTRIC MACHINES; A. M. Gray, Milwaukee, Wis. App. filed May 13, 1909. For ventilating and cooling by means of fans on the frame with field magnets having radial ventilating passages and field coils spaced from the poles so as to form air spaces communicating therewith.

972,874. SELF-ACTING TELEPHONIC LINE CONNECTING SYSTEM; B. Kugelmann, Bad Kissengen, Germany. App. filed June 12, 1907. The subscribers' lines are divided into groups and a number of selectors are provided for each group, each having a traveling contact moved into two directions, in one direction making contact with the common line and each selector contacting with the subscribers' line.

[illegible] R. W. Meyer [illegible] 1908. Alternating current rectifier, including a balanced chemical rectifier and an alternating circuit in which the fluctuations are [illegible] the direct-current leads of the chemical rectifier.

972,929. DYNAMO ELECTRIC MACHINE; C. E. Search, Milwaukee, Wis. App. filed March 27, 1909. A turbo generator with an enclosing housing, including a yoke having an annular portion supporting the end cover and clamping devices holding the end cover against [illegible] angle.

972,947. ELECTROLYTIC DECOMPOSITION OF SOLUTIONS; C. P. Townsend, Washington, D. C. App. filed April 12, 1902. Passes an electric current through the solution and a diaphragm to an electrode and recovers a product by means of a non-saponifying oil.

972,950. COIL; A. Voegtle, H. C. Lea and R. H. Voegtle, Sharpsburg, Pa. App. filed June 17, 1909. Inductive resistance arc coil, consisting of a magnetic core with sectional coils wound around the limbs of the core. Details.

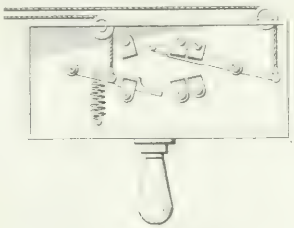
972,956. TERMINAL PLUG RECEPTACLE; J. E. Ward, New York, N. Y. App. filed July 9, 1909. For charging storage batteries on railway cars in yards by means of a yard plug, including a casing pivoted to a bracket, so as to swing parallel with the car-bearing surface of the bracket a block having one or more electrodes supported within the casing.

972,962. SERVICE METER SYSTEM; A. H. Weiss, Chicago, Ill. App. filed Nov. 29, 1907. Central-energy, three-conductor telephone system with service meters at the central office to register calls made by a subscriber. Includes a cut-off relay, a service meter, an auxiliary resistance normally in series with the relay, but shunted by actuating the service meter, a cord circuit and voltages to actuate the meter or to connect it with the line.

972,963. ELECTRICAL FUSE; A. West, Westminster, London, Eng. App. filed Dec. 4, 1909. A fuse carrier with insulating side lugs in one piece, with a contact sheet between and a spring pressing the sheet outward.

972,964. THERMIC CIRCUIT CLOSER FOR ELECTRO-MAGNETIC APPARATUS; G. White, Chapel Hill, Tenn. App. filed Sept. 2, 1909. An opened top gas tube containing mercury having a line which absorbs moisture, in which the terminals are located.

972,986. PLURAL LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed March 27, 1907. A pair of plates conduct current to the terminals of the lamp-receiving socket, the plates being secured to bases and holding the sockets in the casing.



973,154.—Signal System.

972,987. PLURAL LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed April 11, 1907. An insulating block with an inner casing, a center contact for each lamp holder and also an outer contact for each, the outer contact being carried on the casing with a conductor on the block with which the outer contacts engage.

972,988. INDICATING MEANS FOR PARTY LINE TELEPHONES; J. H. Blythe, Denver, Colo. App. filed June 24, 1907. An indicating member with a disk having a recess on the periphery of its inner face for actuating the indicator, the disk being actuated through electro-magnetic means to show the condition on the line.

972,994. INSULATOR; J. H. Campbell, Ripley, O. App. filed Nov. 23, 1904. For stringing telegraph and telephone wires, the insulator having a head to which the wire is secured and a pin for attaching it to a support with a groove in the head and a bead cross-arm extending into the groove, over which bead the head fits.

972,999. ELECTRIC REVERSING SWITCH; J. F. Cavanaugh, Providence, R. I. App. filed Nov. 5, 1908. Reversing switch for spark coil to change the direction of current to the contact point each time the connection is made by means of a switch, a pivoted arm swinging between the contacts with means for shifting them on the arm to reverse the current passing through the contacts.

973,[illegible] RESISTANCE GRID; H. W. Cheney, Milwaukee, Wis. App. filed Dec. 26, 1908. A zig-zag resistance spring with free end turns and a single bar, which braces the end turns.

973,030. AUTOMATIC GAS IGNITER AND SAFETY DEVICE; E. E. Gerald, Baltimore, Md. App. filed Jan. 22, 1910. Burner, gas supply pipe, valve and buttons on the stem of the valve, the valve closing an electric circuit with a resistance above the burner in the path of the escaping gas, and a rod which when heated by the flame controls the valve so as to automatically relight the gas when extinguished by the wind.

973,037. ROTOR FOR HIGH-FREQUENCY ALTERNATING-CURRENT MACHINES; A. E. Guy, Trenton, N. J. App. filed April 10, 1909. A disk with teeth of magnetic material, certain of which bridge the spaces between the teeth and filling pieces between the teeth.

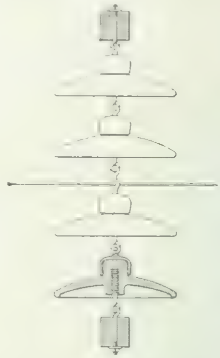
973,089. ELECTRIC HEATER; H. C. Walter, Wilkinsburg, Pa. App. filed Oct. 11, 1909. For the window of an electric railway car to keep the window pane from sleeting, consisting of a sheet of mica and a resistance coil, which can be attached to the window

973,096. PLUG SWITCH; F. B. Adam, St. Louis, Mo. App. filed Dec. 20, 1909. Single-pole plug switch, including movable arms having at their outer ends semi-circular portions forming a cylindrical sleeve for receiving the cylindrical contacts.

973,152. ELECTRICAL MEASURING INSTRUMENT; M. J. Wohl New York, and H. Hertzberg, Brooklyn, N. Y. App. filed Nov. 26, 1907. Includes a metallic wire or ribbon, which, when heated, moves a pointer and provides an automatic slack take-up, including a torsion spring for the ribbon.

973,154. SIGNAL SYSTEM; R. S. Woods, Los Angeles, Cal. App. filed [illegible] For controlling a train of two or more cars in giving [illegible] signal to the motorman and the stop signal by means of switches on the car [illegible] controlled by cords pulled by a conductor, [illegible] in series and a bell and battery arranged to be thrown in series therewith [illegible] shunted around the same.

[illegible],171. PROCESS OF TREATING BARIUM CHLORID AND STRONTIUM CHLORID FOR PRODUCING CHLORIN AND HYDROXID OF THE SAID METALS; A. Clemm, Mannheim, Germany. App. filed March 11, 1910. Subjects a solution of a chlorid of an alkaline earth to electrolysis until the chlorid solution is nearly saturated with the hydroxide.



973,204.—High-Potential Insulator.

973,198. TELEPHONE RECEIVER HOLDER; J. F. Hines, Pittsburg, Pa. App. filed Nov. 18, 1909. For desk telephones in which a pair of clamps connected to the pedestal carry the support for the telephone receiver when removed from the hook.

973,199. CLUSTER SOCKET; D. Holden, Upper Montclair, New Jersey. App. filed March 16, 1908. A rigid metallic ring to which is bolted a plurality of insulators and threaded shells, the bolts forming center contacts.

973,204. INSULATING SYSTEM FOR HIGH-POTENTIAL ELECTRIC CONDUCTORS; F. M. Locke, Victor, N. Y. App. filed Aug. 27, 1908. A series of insulators in sequence and separated and supported at opposite sides. The insulators may turn with respect to the supports.

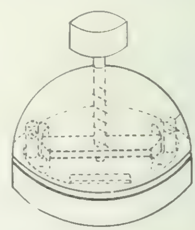
973,216. ELECTROMECHANICAL DEVICE; G. H. Rowe, Berwyn, Ill. App. filed Oct. 17, 1908. A riveter having a plunger partly magnetic and partly non-magnetic, the latter forming the striking portion, with a field coil surrounding the plunger and a motor within the casing for reciprocating the field core.

973,250. ELECTRIC FUSE; I. E. Barricklow, Antioch, Cal. App. filed Feb. 10, 1910. A retainer for the fuse cover which slides on the casing and covers the joint between the cover and the casing.

973,257. INDICATING-SWITCH; R. C. Browne, Salem, Mass. App. filed Nov. 19, 1906. An indicating rotary snap switch, having a bell-shaped cover and hammer for ringing the bell.

973,322. THROW-OUT SWITCH; W. H. Tucker and W. F. Waddell, New York, N. Y. App. filed March 10, 1909. For cold storage in which fans circulate the air, the fan being stopped in the present instance when a fire breaks out, by means of a cut-out switch and latch, the latch being controlled by a fuse and gravity device.

973,336. METHOD OF PRODUCING METAL SALTS AND METALS; J. Woods Beckman, Niagara Falls, Ont., Canada. App. filed May 7, 1910. Electrolizes a calcium salt of a metal in a fused condition as by heating an oxide of the metal with calcium oxide in an electric furnace and then electrolizing the bath in a state of fusion.



973,257.—Indicating Switch.

973,340. RINGING MACHINE; J. E. Burge, Lincoln, Neb. App. filed Dec. 6, 1907. Rotary pole changer, including a motor and circuit-maker and breaker upon the armature shaft, bell circuit and brushes controlled by the circuit-maker.

973,362. ELECTRIC SWITCH; E. K. Mackintosh and E. A. Smith, Washington, D. C. App. filed Dec. 16, 1909. For indicating the level of water by means of a shaft and wheel controlled by a float and controlling contacts.

973,409. INSULATED HANGER; E. Crabbe, Seattle, Wash. App. filed Feb. 19, 1910. A block with a groove for the wire, the groove spanned by a yoke which is hooked to a screw eye.

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ILLUMINATING ENGINEERING CONVENTION AND LECTURES.

The Illuminating Engineering Society is again to be congratulated on its well-directed activity, as most recently exemplified by the success of its Baltimore convention and the remarkable enrolment for the Johns Hopkins University lectures on illuminating engineering, which course was established through the initiative of the society. A noteworthy feature of the Baltimore convention papers was the direct application of the material presented to general illuminating engineering rather than merely to gas lighting or electric lighting. Of the twelve papers and addresses, only two were of limited applicability, one dealing solely with gas lamps and the other with the electric lighting business, while even these contained much matter of general rather than specific interest. To the broadening effect of papers such as those presented at the convention can be attributed a portion of the widening influence of the society as a national organization. In many respects the semi-public exercises connected with the convention and lecture course can be regarded as affording convincing proof that the cause for which the society stands is beginning to receive in general the recognition which it merits. However circumscribed the original field of the society may have been held to be, it now appears to be reaching out on the one side to co-operate with the ophthalmologist, and on the other to render assistance to the architect and contractor. Doubtless the ultimate detrimental effect of improper illumination upon the health and happiness of the masses will hereafter be equally considered with the economical advantages of proper illumination to the person who initially pays for the installation and provides money for its operation. Any idea that the illuminating engineer of the future will be merely a gas-lighting or electric-lighting expert was dispelled by the very atmosphere of the convention.

Just what knowledge a person should possess in order to be classed as an illuminating engineer has not yet been formulated, but it can safely be stated that the lighting expert of the past must acquire much additional information before he can be ranked as an illuminating engineer in the future. Some idea of the requisite information can be gained from the lectures on illuminating engineering now being given at Johns Hopkins University. These lectures cover not only lamps and lighting, but the physical, physiological, psychological, architectural, decorative and commercial aspects of illumination. To the society and to the profession these thirty-six lectures, given by twenty-four lecturers, each a recognized master of the subjects which he presents, are of the highest importance. No more carefully selected list of lectures and lecturers was ever presented in a course of university instruction in an engineering subject, and probably no better list has ever been offered at any time in any single subject of any nature. That the lecture course is being duly appreciated is shown by the registration, which far exceeded the hoped-for 100 and reached the total of 250 on the opening day of the two weeks' course. The influence of the course will be widely felt, because those fortunate enough to attend will in many cases become the teachers of others, and

the lecture outline will set the example for courses in illuminating engineering to be given at other universities.

Without doubt the remarkable success with which this young society has met is largely due to the character of its organization, which precludes domination of any one locality in the government of the body. The result of this democratic system is that each section feels a direct responsibility in forwarding the objects of the society, and credit for achievements reflects on all alike. Equally important with the federal organization is the system of selection of officers by a board of nominators, consisting of past-presidents and past-vice-presidents, who, through experience, know best the work of the society and the qualifications desirable in those who are to carry it on. Moreover, since the vice-presidents on the board correspond in number and in residence to the several sections, at least two sections are represented in the choice of any nominee, thus rendering improbable any combination whereby one locality would secure undue advantages. The broad spirit which has characterized the career of the Illuminating Engineering Society and the keen interest taken in its work by the membership regardless of location appear, in short, to be ascribable to the truly national form of organization of that body, and to be sustained by a system of nomination which places at its head unquestioned leaders in the art and science represented, and in the other offices men selected intelligently with relation to their fitness for planning and carrying on the work of an active and progressive engineering body.

THE RAILWAY ELECTROLYSIS QUESTION.

Managers of electric-railway properties will breathe more freely, perhaps, now that Judge Sanborn, of the United States Circuit Court for the Northern District of Illinois, has handed down his decision in the famous "Peoria electrolysis case." This action has been in the courts for twelve years, while the controversy which caused it dates back to 1894. The complainant, the Peoria Water Works Company, asked an injunction against the Peoria Railway Company, alleging injury to its buried water pipes by electrolytic action caused by electricity escaping from the ground return of the electric railway of the defendant. In his decision the judge says that an injunction should be granted, but he declares that the railway company shall receive a reasonable time to "take such measures or put in such improvements to its negative return as will substantially prevent injury"; and the declaration for an injunction is made on the condition that the complainant co-operate with the defendant, so far as is reasonable and proper, in aiding the latter to prevent or lessen the escape of electricity from its rails, or in preventing the escape of electricity from the water pipes in such manner as to cause injury to the pipes. In effect, if a layman may venture to interpret the decision, the judge seems to say to the litigants: "Gentlemen, this is a serious matter, but the case is by no means desperate. It is altogether probable that means may be devised to prevent injury from the escape of electricity from the ground return of electric railways. It would seem to be a matter for co-operation and mutual helpfulness. Try to get together and solve this problem, in which you are both so deeply interested." And as a possible remedy the judge seems favorably impressed with the "quadrilateral" or constant-potential system of connecting the ground returns to prevent differences of potential and consequent escape of electricity. The whole opinion is characterized by moderation, in contrast with the views of the special master in chancery, who made it clear that he was convinced that the arguments of the water-works company should prevail.

The decision is an important one both to electric-railway companies and to the owners of buried metallic structures in city streets that may be affected by stray currents from the ground returns of the practically universal single-trolley type of railway construction. Complaints of damage due to electrolytic action have been frequent in American cities, and so the outcome of this long-drawn-out case was awaited with great interest. The master in chancery, in his reports, came out strongly in favor of the double-trolley system. According to the defendant's statement, cited in the judge's opinion, there are about 1600 single-trolley electric-railway systems in the United States and only one or two double-trolley equipments. The effect on the electric-railway industry if the master's conclusions were upheld may therefore be imagined. But the judge was not convinced that the situation needed this desperate and revolutionary remedy. He found that, on the whole, the damage done to water pipes in Peoria by electrolysis was lessening, and, moreover, that it is incorrect to assume that wherever a current of electricity leaves a buried pipe injury naturally follows, as electrolysis has a relation to surrounding conditions. The court intimated that the damage to the water-works system is not so serious as reported by the master, and seemed to believe, or at least to hope, that it may be rendered negligible by some plan of improving the rail-return system, perhaps by the adoption of the so-called "quadrilateral" or constant-potential system. Finally, the judge says that damage does exist and should be stopped, but reasonable time must be given to the defendant to effect improvements in its rail return to accomplish this, and the complainant must co-operate with the defendant in so doing. The exact terms of the arrangement to carry out the judge's decision are to be fixed when the final decree is applied for. Apparently the attorneys in the case wish ample time to digest the long and important decision of Judge Sanborn before applying for the decree—an act which in this case will be more than a mere formality.

RATES AND ACCOUNTING AT THE ILLINOIS CONVENTION.

The Illinois State Electric Association got together 149 central-station men at its convention at Rock Island last week, thus making a record in attendance. One of the most significant and gratifying features of the papers and discussions was the general attitude on the subject of rates and uniform accounting. For years past the discussions at state conventions on the subject of rates have shown that while a few managers appreciated the fundamental principles which should underlie any equitable system of rates, the great majority either failed to recognize or have failed to put in practice these principles, and have in actual use systems which not only hamper electric lighting in competition with other illuminants, but are often unjust to the consumer. At the recent Illinois convention it became evident that there is now a much better agreement than in the past among central-station men as to the principles which must be followed in formulating a system of rates. These principles were embodied in a report of the committee on rates, which advocated what it called the differential rate. This rate involves two factors, that of a fixed charge independent of output but dependent on demand, and a variable charge based on kw-hours output. In view of the fact that the Hopkinson or so-

called differential or multiple-rate or readiness-to-serve system has been recognized by state commissions and courts as equitable and just in principle, and is advocated by practically all students of the subject of rates, and in view of the further fact that bodies like the Illinois Association are now recommending such a system, it looks as if the time were not far distant when all companies not restricted by franchises or not absolutely blind to businesslike methods would adopt a rational rate system. Another gratifying feature of the convention was the announcement of the adoption by a number of companies of the standard system of accounting recommended by the National Electric Light Association, which system was by a vote urged by the association upon its members.

ALTERNATING-CURRENT MEASUREMENTS BY SUPERPOSING E.M.FS IN QUADRATURE.

When a telephone is used in a Wheatstone bridge in the place of the usual galvanometer, and the bridge is operated with alternating current, it is well known that there is great difficulty in making any adjustments that will bring about silence in the telephone. A large part of the difficulty is attributable to the fact that although the terminals of the telephone may be brought to the same effective value of alternating potential as might be determined by independent voltmeters, yet, because these potentials are not in the same phase, relatively strong currents may pass through the telephone. Another obstacle is that it is difficult to secure pure sine waves of alternating testing current, so that such current usually contains considerable traces of harmonic frequencies, each of which is a law unto itself. Finally, if the frequencies are of the telephonic order, small condenser capacities, such as that of an instrument and the observer's body, may give rise to appreciable disturbing currents. A simple form of laboratory testing apparatus for producing any desired phase displacement, as well as magnitude, of alternating e.m.f. is described by Prof. Absalon Larsen in a recent number of the *Elektrotechnische Zeitschrift,* as noted in the Digest. An alternating current, of as nearly constant frequency and pure sine form as possible, is passed through a slide-wire resistance and the primary winding of an air-core transformer in series. The secondary winding of this transformer will have an e.m.f. induced in it that must be in quadrature with the *IR* drop in the slide wire. Adjustable proportions of the secondary and *IR*-drop e.m.fs. may readily be compounded in series into a single resultant e.m.f. of any desired phase. The magnitude of the resultant can also be changed without changing the phase by changing the strength of the testing current. In this way any unknown e.m.f. can be annulled and measured by connecting a telephone in its circuit with the *IR*-drop and secondary voltage compensator. For weak currents generally, and for telephonic currents particularly, the above method of testing has many advantages and deserves to be remembered.

TEMPERATURE RISE DUE TO THE ENERGY RADIATED IN THE LOWER HEMISPHERE FROM DIFFERENT LIGHT SOURCES.

It is ordinarily assumed that when the zonal curve of luminous intensity for a given light source is correctly drawn, the same curve represents, to another scale, the distribution of total radiant intensity. That is, the assumption is usually made that if in any given direction the luminous intensity bears a certain ratio to the total radiation intensity, then this ratio will be maintained in all directions. This assumption has even been made the basis of photometric tests, as our columns have occasionally made known. Since the Ulbricht sphere supplies only a measurement of the mean spherical candle-power of a source, and obviously cannot give a measurement of the candle-power in the various directions required for a zonal distribution curve, it has been proposed to ascertain the zonal distribution, when required, by radiant energy measurements, thus eliminating the photometer. The plan has been to measure either bolometrically or with a thermopile the distribution of radiant power in a vertical plane through the light source, and to record the successive galvanometer deflections at successive angles, so that the graph of these deflections might be taken as the graph of luminous intensities, to some particular scale.

A paper read at the Baltimore convention of the Illuminating Engineering Society, by Messrs. J. G. Felton and E. J. Brady, demonstrates experimentally the danger of the above line of reasoning. If the color of the light in all directions is the same, and if there are no areas of non-uniform radiation giving out heat and light differently, the reasoning appears to be sound and the assumption justifiable. Cases may arise, however, in which great color differences or radiation differences occur. Thus, when an incandescent lamp was used, either alone or in a simple globe, the zonal curves of bolometrically observed total radiation intensity and of photometrically observed luminous intensity agreed very satisfactorily. But when a gas incandescent-mantle lamp was used with a green glass shade, there was a marked discrepancy between the two curves in the zones above and below the shade. Manifestly, the radiant heat would pass through the green glass shade with relatively little loss, but the luminous rays in the bundle would be largely absorbed. Again, a plain glass lamp chimney surrounding a gas burner in its upper portions gives off no light, but a very appreciable amount of heat, so that the zonal heat curve differs appreciably from the zonal light curve. Incidentally the paper illustrates the extent to which shades may cut down the total useful luminous output of a lamp.

ELECTRICITY AND YELLOW JOURNALISM.

The persistence with which the scare headline writer has followed the bad habits of earlier years in dealing with matters electrical is a constant source of wonder to us. One would suppose that after twenty years or so of peaceful development in the electrical field, the sensational press would have learned to take electric lighting and power as a matter of course. At the beginning there was the keenest kind of rivalry between gas and electric lighting, and indeed between electrical systems exploited by various interests, resulting in turning the searchlight upon every alleged accident or failure which gossip might suggest. Time was when it seemed to be the popular idea that the "deadly current" was in the habit of jumping across the street to set fire to buildings which had never been wired, and when a short-circuit and a dynamite explosion were placed in the same category. Even now it is curious to see the unanimity with which fires of absolutely unknown origin are charged up to electric circuits, when there are any in the vicinity, without considering the innumerable curious possibilities which have proved to be responsible for fire losses in the past.

If a fire is not plainly incendiary or known on direct evidence

to have been produced by some particular accident, the chances are that it will be credited to defective wiring if there is any current in the building, sometimes justifiably, more often on the merest surmise or in the absence of any proof to the contrary. It seems to be a case of assuming electric conductors to be guilty unless by chance they are proved to be innocent. Now, with all the care that is being taken at the present time and with the rigorous inspection of the underwriters, both in materials and actual construction, the inference ought to be rather against an electrical cause than for it. Fires may have curious origins never suspected by the ordinary man or indeed generally thought of by the expert unless after long investigation. For instance, the fact that an ordinary steam pipe may ignite dust even at its usual moderate temperature is a thing which, while known to the skilled investigators of the underwriters, would be considered quite impossible by the average householder. Spontaneous ignition of refuse, sometimes with almost explosive violence, may take place in quite unexpected fashion, or a dangerous fire among dry leaves has been produced by so seemingly impossible a cause as a spark struck by a scythe in use for mowing down the weeds. Yet it is a safe gamble that if a barn had been set on fire in the way just mentioned and there had been a transmission line across the field that line would have been charged with the crime.

In a similar way the old traditions of early and hard fighting days in the electrical art have persisted with respect to accidents to persons. Only the other day we saw heralded for perhaps the hundredth time a broken trolley wire sputtering in the street under the scare headline of "Death Menace to Hundreds." Now, in point of fact a sputtering trolley wire is about the least likely of all electrical conductors to menace the public with destruction, for the simple reason that everybody instinctively gives it a wide berth. The really dangerous thing is a supposedly dead wire. It is like the gun that isn't loaded. If a lineman is accidentally killed by a fall from a pole the chances are that accident will figure in some of the yellow journals under some such cheerful caption as "Roasted by 50,000 Volts," when he may have been working on a 110-volt circuit and missed his footing. Even when there really is a fatal accident from contact with the conductor it seems hardly necessary in these days to treat it with more sensational accompaniments than when an unfortunate carpenter falls off the roof of a house. There is certainly need for a change in the too common customs of some sensational dailies. Old habits are hard to break and we realize the traditions of the newspaper business, which came down from the time when direct current, alternating current and gas were engaged in a three-cornered fight for supremacy. That fight is now over, however, and there seems to be no reason for continuing the acerbity of treatment which was only too familiar twenty years ago. The times have changed and the manners of the headline writer ought to change with them.

ELECTRICAL WORK OF THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT DURING 1909.

An abstract of the work of the national German laboratories at Charlottenburg, as accomplished and in course of conduct during 1909, has recently been published in the *Elektrotechnische Zeitschrift*. The Reichsanstalt carries on researches in many fields, so that the electrical work is only one portion, although an important portion, of the whole work conducted. In the department of standards the check measurements of manganin standard-ohm resistances have been continued. No change in these has been detected during the last sixteen years outside of the limits of instrumental and observational error. The chief difficulties in such measurements lie in measuring the temperatures of the standard resistances with the required degree of precision. According to definition, the standard ohm is the resistance of a column of mercury, in a glass tube, of definite cross-section and mass at the temperature of melting ice. Five such mercury standards have been in regular service. It has recently been found possible to make tubes of quartz, and two mercury standards in quartz tubes have been installed.

The silver coulometer is the adopted standard apparatus for determining the ampere. Much discussion has appeared in recent years over its international precision. Everyone admits that in a given laboratory one and the same observer or group of observers trained to a definite technical process in the use of the silver coulometer can repeat and reproduce their results with a high degree of precision, say, of the fifth order, or one part in 100,000. But it has been claimed that differently trained observers in different laboratories, not using identical technique may be able to secure only a comparative agreement, of, say, the fourth order, so that as an international apparatus, in the absence of a rigidly universal technique, the precision of the coulometer has been criticised adversely. Some of the earlier determinations of the silver electrochemical equivalent had been made with the silver anode surrounded by a raw silk cover, while in others no such cover had been used. Recently instituted tests at Charlottenburg are stated to have shown no appreciable difference with these two conditions of measurement. In the second section of the Reichsanstalt a number of electrical researches are mentioned, such as measurements of feeble alternating currents, the production of constant frequency of alternation, and the measurement of the stray magnetic field of transformers. A research of especial practical interest to electric lighting engineers is that on the aging of fuses. It has been noticed that, after a certain duration of active service, a fuse may run hotter or even melt with normal current strength. Tests have indicated that a fuse wire steadily operated at a fairly high temperature may undergo a gradual increase of resistance, amounting in all to 20 per cent, accompanying a change in its substance. It seems to be suggested that such changes are not likely to occur at nearly normal temperatures.

It is pointed out in connection with optical measurements that the efforts which are being made by England, France and America to introduce a new unit of luminous intensity under the name of the "international candle" cannot be supported at present in Germany owing to objections against the definition of that unit. Consequently, protest must be entered upon the part of Germany against the name "international candle." Our German confrères do not seem to have taken the same standpoint regarding this matter as those countries entering into the candle agreement. No one disputes that a reliable, scientific, reproducible and practicable primary light source is a desirable thing. At present the best primary light source we have is the hefner, and it is far from meeting all our needs. Meanwhile, England, France and America tried to maintain their respective national candles on a primary flame basis, each for its own. Flame standards are subject to such irregularities

that no satisfactory permanence or reproducibility yet exists for them. Properly seasoned incandescent lamps, however, possess the property of maintaining and reproducing an arbitrarily chosen standard of luminous intensity with a satisfactory degree of precision. The three countries, therefore, agreed virtually to sink their primary flame standards to a subordinate position and to maintain a certain mean or compromise luminous intensity as representing the candle, with the aid of mutually interchanged incandescent lamps. In a few years we may expect that a "candle" will have no other meaning than this co-operatively maintained standard of luminous intensity, which incidentally is decimally related to the hefner, because the hefner is nine-tenths of this candle. Germany's protest against the term "international" candle must, of course, be respected. No standard can be international in the same sense as the volt, ohm or ampere until it is adopted by all civilized countries. Nevertheless, the three contracting countries have by their action aided German photometry as well as their own, because they have swept out of competition confusing and supernumerary standards. There remain only the compromise candle and the hefner, instead of three different candles and the hefner.

TEMPERATURE-COEFFICIENT OF RESISTANCE OF COPPER.

There is hardly any thermal constant of a metal more important to the electrical engineer than the temperature-coefficient of resistivity in copper. Upon the magnitude of this constant depends the change in resistance that a copper wire will offer when subjected to change of temperature, the change in joulean power that a given current will develop in that resistance as I^2R watts, and, reciprocally, the change of temperature which a certain thermal change of resistance betokens. If different engineers employ different temperature-coefficients, they will differ correspondingly in their determinations of temperature-elevation of dynamo field-coils and similar apparatus, as computed from thermal increase in resistance. It is, therefore, important to know with precision how great this coefficient is, and how it varies in different samples of copper. It is also important that all engineers should come to an international agreement upon the value to be adopted. At the present time there is a very appreciable range of variation in the values that are used in different countries. There are two fundamental electrical constants for a metallic conducting substance, namely (1) the resistivity, or specific resistance, at a standard temperature, and (2) the temperature-coefficient of that resistivity. Resistivity is expressed either in ohms to the cubic centimeter (ohm-cm) or in ohms to the meter-gram. In the former we refer to the resistance offered by 1 cu. cm of the substance at the standard temperature, between any pair of opposed faces. In the latter we refer to the resistance offered by a uniform wire or prism of the substance at the standard temperature, 1 meter long and weighing just 1 gram. The two expressions are definitely connected through the specific gravity of the substance. In practice, however, measurements are easier and more precisely made with reference to the meter-gram than to the centimeter cube.

The resistivity of copper is now generally admitted to follow a straight-line law between the temperatures of 0 deg. C. and 100 deg. C., the most important range to the electrical engineer. Beyond these limits the shape of the resistance-temperature curve is in some doubt. But for all practical purposes relating to this useful range [illegible] arbitrary assumption that the straight line continues steadily as the temperature is lowered. This means that there is a certain definite low temperature at which the resistivity of copper would be nil, which inferred temperature may be called the inferred absolute zero of copper-resistivity. This corresponds by analogy to the inferred absolute zero of volume for gases. Thus, at 0 deg. C. the temperature-coefficient of expansion of gases is usually taken as 0.00366. Hence the inferred absolute zero of volume of gas, assuming the continuance downward of this straight-line law, is $-1/0.00366 = -273$ deg. C. Similarly, if copper be taken to have a straight-line resistivity coefficient of 0.004 at, say, 15 deg. C., then the inferred absolute zero of resistivity is $-1/0.004 = -250 + 15 = -235$ deg. C., or the copper-resistivity behaves between 0 deg. C. and 100 deg. C. as though it started from zero at -235 deg. C. Thus premised, all resistivities are proportional to the absolute temperature of the substance, counting 100 deg. C. as 335 deg. abs., 30 deg. C. as 265 deg. abs., and so on. Consequently, copper is completely defined electrically when we give its meter-gram resistance at a standard temperature and its inferred absolute temperature of zero resistivity.

The *Journal* of the Franklin Institute has recently published an interesting abstract, by Mr. J. H. Dellinger, of a paper shortly to appear in the *Bulletin* of the Bureau of Standards. A large number of samples of good commercial copper from different manufacturers were tested at the bureau both for resistivity and for the temperature-coefficient of the same. The remarkable deduction is drawn from these measurements that between the limits of variation presented in practice for resistivity the temperature-coefficient varies inversely as the resistivity i.e., directly as the conductivity. Thus, the bureau has selected a meter-gram of soft copper at 20 deg. C. as having 0.153022 international ohm. This may be called a definition of 100 per cent conductivity on an arbitrary scale corresponding to "Matthiessen's standard." This quality of copper has a temperature-coefficient of 0.00394 at 20 deg. C., or an absolute temperature of $-1/0.00394 = -253.8 + 20 = -233.8$ deg. C. The temperature-coefficient at 0 deg. C. is thus $1/233.8 = 0.004277$. If now some other sample of wire, hard drawn or otherwise slightly imperfect, has 2 per cent greater resistivity than this standard, its absolute temperature below zero will be 2 per cent greater than -233.8, or -238.5. Or, if the conductivity of the new sample is 2 per cent less than the normal, the temperature-coefficient will be 2 per cent less than 0.00394 at 20 deg. C.

The outcome of the research at the Bureau of Standards is, therefore, that between the conductivity range of 97 and 102 per cent there is only one essential electrical definition of copper—either the resistivity or its temperature-coefficient; because if one of these is known the other may be deduced immediately. The temperature-coefficient adopted by the American Institute of Electrical Engineers is 0.0042 from and at 0 deg. C., corresponding to an inferred absolute resistivity zero temperature of -238.1 deg. C. That adopted by the Institution of Electrical Engineers in England is 0.00428, or -233.6 deg. C. The value taken by the Verband Deutscher Elektrotechniker is 0.00426 or -234.7 deg. C., and that generally used in France is 0.004, or -250 deg. C. Excepting the last named, it would appear that the values obtained lie close together, and that there should be little difficulty in reaching an international agreement. It is to be hoped that this matter may be brought to the attention of the International Electrotechnical Commis- [illegible]

Illuminating Engineering Lecture and Laboratory Course.

If attendance and enthusiasm can be taken as criteria of success, then the course of lectures and laboratory demonstrations relating to illuminating engineering being given by the Johns Hopkins University in co-operation with the Illuminating Engineering Society is successful far beyond expectations. When the plan was first formulated an attendance of 100 was hoped for. The advance registration reached 150, while more than 200 had registered before the opening exercises. Before the lectures began the registration totaled 230, which was the maximum number that could be accommodated without altering the arrangements. Additional facilities were provided so as to accommodate the 250 who finally applied for admission to the course.

The exercises connected with the inauguration of the lecture course were held on the afternoon of Tuesday, Oct. 25, in McCoy Hall at the university. Dr. Ira Remsen, president of the university, in the opening address, expressed his gratification that Johns Hopkins had been selected for the highly important work of providing the most noteworthy series of lectures ever offered to students in the beginning of a course of study of an engineering nature.

Dr. E. P. Hyde, as president of the Illuminating Engineering Society, outlined the three objects of the lecture course, namely, to indicate the proper co-ordination of those arts and sciences which constitute illuminating engineering; to furnish a condensed outline of study suitable for elaboration into an undergraduate course for introduction into the curricula of under- [illegible] opportunity to obtain a conception of the science of illuminating engineering as a whole. He called particular attention to the high standing of the lecturers, who were invited by the university upon the advice of the society.

Mr. Herbert A. Wagner, on behalf of the president of the Association of Edison Illuminating Companies, stated that the interest of the association in the work of the society is vital, and remarked that only within the past few years has the importance of illuminating engineering been appreciated.

Mr. W. W. Freeman, president of the National Electric Light Association, said that the inauguration of the lecture course was an event of much interest to all, and the work of the society has proved to be of great value to the lighting industry.

Mr. W. C. Morris, vice-president of the American Gas Institute, claimed that the need for instruction in illuminating engineering had become urgent, because the public must be educated in the proper use of lamps and lighting fixtures.

Dr. J. B. Whitehead, acting for the president of the American Institute of Electrical Engineers, commented upon the close relation between the advancement in the knowledge of illumination and the improvement in the efficiency of electric lamps. He congratulated both the society and the university upon the lecture course on illuminating engineering.

[illegible] logical Society, expressed his great interest in the work of the Illuminating Engineering Society, especially along the lines of protection to the eyes by the use of proper shades and reflectors to eliminate or reduce glare. He claimed that no light from the lamp should be allowed to reach the eye directly, but all light should be directed toward the objects to be viewed.

Dr. Wendell Reber, president of the Academy of Ophthalmology and Oto-Laryngology, stated that the eyes should always be protected from the harmful invisible rays, for which purpose yellow-green glass is quite satisfastory. It will be to the advantage of all for those interested in the eyes to co-operate with those interested in light, and steps should be taken by the proper societies to ensure such co-operation.

Mr. J. R. Sloan, president of the Association of Railway Electrical Engineers, said that much valuable assistance has been rendered by the Illuminating Engineering Society in formulating the laws of illumination so that they may be applied in the practical problems that arise. The effects are to be noted in railway-car lighting, where the improvements seen are attributable not only to the use of better lamps, but to the employment of better illuminating arrangements.

In addition to the connecting link between the convention of the Illuminating Engineering Society and the lecture course at Johns Hopkins University formed by the above-mentioned opening exercises, a noteworthy event was the banquet held at the Hotel Belvedere on Tuesday evening, which was much enjoyed by those present. Almost all of those in attendance being college graduates, the college spirit was let loose and good-fellowship became the keynote of the evening. Gen. George H. Harries acted as toastmaster. Toasts were responded to by Mayor Mahool, Dr. Remsen, Dr. Hyde and Hon. Ferdinand C. Latrobe.

Montreal Lighting Controversy.

The Montreal Light, Heat & Power Company and the City of Montreal finally settled their differences with regard to the charges for a lighting service furnished the city during the preceding twenty-two months by the company's accepting the price of $72.70 per year per arc lamp, the city assuming in addition all the costs of the case. The amount paid over by the city aggregates something over $240,000 for lighting service in addition to the cost. The price of $72.70 agreed upon in settlement is the same figure as tendered by the Montreal Light, Heat & Power Company and accepted by the city in the award of a ten years' lighting contract made a few weeks ago. The price for which the company had brought suit was about $90 per lamp per year.

It will be recalled that the merits of the value of the service rendered by the company in lighting the city were being determined by a board of arbitrators consisting of Prof. L. A. Herdt, Mr. R. G. Black and Mr. A. A. Dion. Although hearings had continued throughout the summer, the cross-examination of only the second witness called by the plaintiff, its superintendent, Mr. R. M. Wilson, had not yet been completed and the company's other experts, Mr. Henry Floy, of New York, and Mr. R. S. Kelsch, of Montreal, had not yet been called. From the progress made it became evident to both sides of the controversy that the hearings would be indefinitely prolonged and the expense amount to more than either the company or the city could hope to gain by a decision through the board of arbitration.

With this situation in mind, the city authorities concluded it wise to agree to pay somewhat more than had been thought a fair price by them, and at the same time the company yielded somewhat in the price claimed by it as the value of the service in order to meet the city and wipe out the unpleasant relations that have existed for the last two or three years between the city and the company.

New York Electrical Society Meeting.

An entertaining and instructive lecture on motion pictures in natural colors was delivered before the New York Electrical Society on Oct. 28 by Mr. Gilbert H. Aymar. The speaker described and demonstrated the process of Urban and Smith, according to which the views are shown alternately by red and green light. The views, which resemble the ordinary photographic black and white, possess just the requisite amount of red and green so that when combined by the "persistence of vision" they appear in the colors supplied by nature. A remarkable feature was the fact that even the blue and violet colors were properly represented on the screen, and all colors seemed true to nature. Only in the case of rapid motion was a defect noticeable, when the "green" view of a moving object failed to be superposed in space upon the corresponding "red" view of the same object, the result being distinct separate red and green views of the same object in progression across the screen. The views are shown at the rate of thirty-two impressions per second, which is just double the rate used with the ordi-

nary motion picture. Use is made of an electric motor for driving the film and synchronized red-and-green screen mechanisms, while an arc lamp with carbon electrodes is used for supplying the light, which is filtered through color screens to obtain the proper alternate red and green rays.

The Metric System and Export Trade with European Continental Countries.

Dr. Gino Dompieri, of Trieste, president of the South Austrian Engineers' Society, in a communication to this journal points out the handicap to the extension of American trade on the Continent of Europe due to the English system of weights and measures. This applies particularly to the case of exports like machinery, metal goods, material used in the construction of buildings, bridges, etc. When plans for an engineering work are undertaken, and designs and specifications are being prepared, the American system of weights and measures is found annoying to deal with, as the equivalents in metric figures have either to be calculated or reference made to tables of equivalents. Furthermore, an engineer using Continental material is able to select his material readily by recourse to a French or German "Ready Reckoner," which gives formulas, tables, etc., corresponding with commercial standards of weights, dimensions, etc. All of these tables, however, refer to the metric system, as at present screws are the only article manufactured on the Continent of Europe that does not conform to this system. A new metric screw standard has, however, been recently adopted by the Association of German Engineers, which will supplant the Whitworth screw standard as the old screw-cutting machines wear out. In the case of American publications, trade circulars, etc., the metric equivalents of engineering material are very rarely given, and an engineer thus does not know, without laborious calculation, the equivalent of the English dimensions in the metric system.

Dr. Dompieri refers to the German publication "Hutte" as a thorough vade mecum of general engineering, which is translated into the principal European languages and a new edition issued biennially. This book, which contains formulas, tables, etc., in every branch of engineering, is edited by a committee of engineers, and is accepted as an engineering rather than as a commercial publication. The Continental engineer, who goes much more into detail than the American engineer, will, for instance, in designing a bridge or other similar structure refer to this book in the selection of girders, etc., as in it he will find all of the data, including dimensions, weights, moments of inertia, etc. If he had in mind obtaining proposals for American girders, angles, etc., he would be embarrassed to ascertain whether the calculated size could be procured; as, however, he does know that all of the sizes given in the "Hutte" are made by Continental iron workers, he will be apt to consider only Continental contractors. The same is true in the case of manufacturers of machinery, whose technical staffs use exclusively the "Hutte" or a similar handbook. The "Hutte" even goes so far as to insert, in the case of special material, the name of the German firm from which it may be secured. Handbooks of this kind are inclining Continental engineers and purchasers more and more to the exclusive use of material listed therein. Dr. Dompieri states that he has designed many plants for installation in the principal industrial centers of Europe and also directed the installation of many works, and has come to the conclusion that very frequently American materials are not specified owing to the fact that they are not represented in engineers' handbooks of the above-mentioned kind, and he has also found that Continental architects and engineers practically ignore the use of American material for that reason.

In conclusion Dr. Dompieri says that if American industrial firms wish to secure a footing in the Continental market they must make their products known there through engineers' handbooks and in quoting the goods must use the metric system. He suggests that American manufacturers might co-operate and compile a handbook of general [illegible] similar to the "Hutte," not printing it, however, as a trade publication, but placing the matter with a regular publisher of engineering books. Such a book, while on the same general lines as the "Hutte," could with benefit be made more extensive with regard to mechanics, electrotechnics, machine tools, etc. Besides an edition in English the book should be translated into French and published simultaneously in both countries. The book should be sold at cost, the aim being solely to facilitate the sale of American goods on the Continent of Europe and in countries elsewhere using the metric system.

Electrical Protective League of Chicago.

The Electrical Protective League of Chicago was incorporated under the laws of Illinois on Oct. 8. It consists of about forty-five manufacturers, jobbers and dealers in electrical appliances in Chicago. In a number of cases electrical dealers have suffered loss by allowing goods to be taken away on "fake" orders, received, perhaps, over the telephone. Orders have come in, apparently placed in good faith and in the regular way, by some reputable concern, and later a wagon would appear to secure the goods, which would be turned over to the teamster without suspicion. When the bill was presented to the supposed customer, however, it would transpire that the latter was totally ignorant of the transaction, the dealer simply being the victim of a confidence game. This practice, or dishonest methods akin to it, has become too frequent, and the new Electrical Protective League has been incorporated for the mutual protection of its members against the loss of goods by dishonest practices. One of the best lawyers in Chicago has been retained as the counsel for the league, and in the future all cases of this kind in which any member of the new organization is the sufferer will be prosecuted to the limit by the organization and not by the individual who has suffered loss. The officers of the league are: President, Louis A. Schwab, Monarch Electric & Wire Company; treasurer, N. G. Harvey, Illinois Electric Company; directors, Mr. Schwab, Mr. Harvey and F. M. Pierce, of the Manhattan Electrical Supply Company; F. Overbagh, of Overbagh & Ayres Manufacturing Company, and James Wolff, of the New York Insulated Wire Company. The office of the league will be at 411 South Clinton Street.

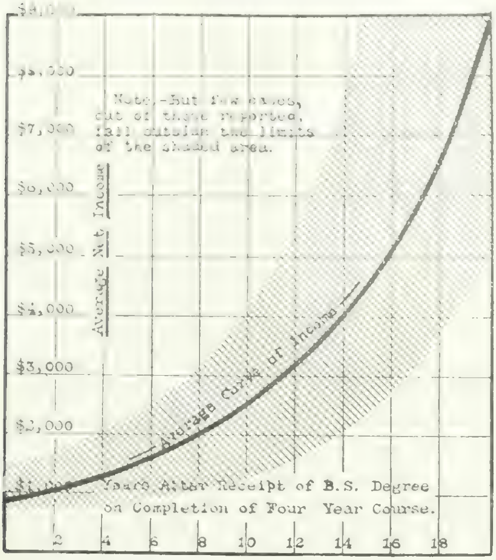
Electrical Developments in China.

Contracts were let last year for electric light plants at Chungking, Chengtu, Changsha, Nanking and Ningpo, China, and for more or less important extensions at Shanghai (settlements and native city), Hankow, Peking, Swatow, Mukden and other places. Negotiations were proceeding at the beginning of 1910 for a large installation at Hanchow and for installations in several cities in Manchuria. There is said to be an electric lighting project in every city in China, although at Pakhoi the project is stated to have been abandoned in view of the successful introduction of incandescent gas mantles; the only difficulty is to find funds for carrying such projects into execution. An electric tramway scheme for Canton is under contemplation, a considerable extension of the telephone system in that city has recently been carried out, and preparations are being made for inaugurating telephone services at Chengtu, at Wuhu and in the provinces of Giangsi and Chekiang.

A British commercial attaché states that the conditions with respect to selling to such plants are such that British manufacturers are at a great disadvantage in competition. Almost all contracts require to be financed by the contractors, and British firms, finding British manufacturers unwilling to supply plant except for cash down, have sometimes co-operated with German firms, the latter arranging the finances in return for being allowed to participate. Thus several recent contracts are for British engines and boilers and German dynamos. Payment is generally spread over a period of two or three years on proper security being given.

Average Income of Technical Graduates.

The Worcester Polytechnic Institute has published in diagrammatic form the results of a canvass made by Prof. H. B. Smith of the electrical engineering alumni of the institute in



order to determine the present average annual income. A reproduction of the diagram is given herewith, which, it will be seen, indicates a material prosperity of the graduates that probably prevails in few, if any, other professions.

Conservation Without Development.

At the recent meeting of the Kansas Gas, Water, Electric Light and Street Railway Association Mr. Edwin R. Weeks, past-president of the National Electric Light Association, presented a paper which included a review of the James River Dam case, with which Mr. Weeks was professionally connected. The petitioners for legislative action for hydraulic development on the James River owned all the land on both sides of the river; that is to say, the full title was vested in them, and neither the State nor the United States nor any private person could either develop or acquire these rights without their consent or without giving an adequate consideration. It was necessary, however, for the owners, the petitioners in the case, to borrow funds with which to construct the plant, and the bankers to whom they applied said they would furnish the money if Congress would pass a resolution declaring the river unnavigable, which it was well known to be, as fully established by surveys. It was also shown by the surveys that, with a moderate investment, power could be distributed to a wide area at about one-half its present cost.

After the resolution had been introduced into Congress and had passed the House, President Roosevelt called a conference of the Governors of the several States to consider the question of conservation. Mr. Weeks advised his clients, the principals in the James River enterprise, to withdraw the resolution and let the whole matter rest until a more propitious time. It was decided, however, that the particular case could be easily differentiated from others wherein the State owned all the riparian rights, and the measure was put up to President Roosevelt. The result is that the water-power is still being "conserved," the people interested are bearing the burden of heavy expenses incurred, and the water is still wearing away the rocks.

In conclusion Mr. Weeks said that this question has been handled not only unjustly, but with far too little practical economic sense. While he believes in the doctrine of conservation of natural resources and considers that their waste has long been a national sin, he nevertheless thinks that there is no proper conservation without development in cases where there is an economic necessity for such development. In such cases if the State withholds from private interests the necessary grant it becomes the duty of the State to make the development. The best conservation of any resource, he added, is its economic use.

The Patents of Thomas Alva Edison.

By Joseph J. O'Brien.

While a great deal has been written about Edison and his inventions, there seems to be general confusion as to the scope of his activity and the fields in which he has worked. In the June number of the *Cosmopolitan Magazine* the statement is made that Edison is credited with over 500 patents, and the "Encyclopedia Americana" makes a similar error in its article on Edison. With the view of correcting existing errors and of establishing a better conception of the importance of Edison's work, and of defining some of its limits, the following review is offered. First, however, it seems desirable that some figures of the total number of patents issued by the United States Patent Office and the number issued in important classes, including the electrical classes, should be given.

From 1790, when the patent system was founded, to July 4, 1836, before the reorganization of the system, a total of 10,048 patents were issued. Most of the records of these patents were destroyed in a fire and but 2236 records were restored. Since the reorganization, which followed a Congressional investigation and which resulted in the establishment of the examination system, a total of 956,506 patents have been issued. The total of all patents issued before 1836 and after is 966,554, up to and including the issue of April 26, 1910.

The total number of electrical patents issued up to May 13, 1910, is about 58,057, or approximately one-sixteenth of all United States patents. The accompanying table gives the distribution of the patents by classes and sub-classes, excepting a number estimated at 5000, which are not distinctively classified.

Table I.—Electrical Patents in Classes and Sub-Classes [illegible]

Class	No. of Class	Patents	Total
Electricity, Generation	171	6,626	
Motive Power	172	4,241	
Conductors	173	2,956	
Medical and Surgical	174	823	
General Appliances	175	4,473	
Electric Lighting	176	5,422	
Electric Signaling	177	2,078	
Telegraphy	178	5,468	
Telephony	179	4,490	
Electrochemistry	204	5,389	
Electric Heaters	219	1,774	
[illegible]	247	1,824	45,564
[illegible] 12 [illegible] 105, 104, 73, 58, 234, 161, 246, 236, 89, 83, 197, 189, 84, 46, 21, 235		7,493	
Estimate of other electrical patents in other [illegible]		[illegible]	[illegible]

Edison secured his first patent on June [illegible] 1869, on an electrographic vote recorder for use in Congress to secure quick vote counting, its number being 90,646. Mr. Carroll D. Wright, who later became Commissioner of Labor, and who wrote the excellent book "Industrial Evolution," was Edison's first attorney. Since June 1, 1869, Edison has had issued to him a total of 905 patents. These patents may be classified under seventeen heads, as shown in Table II.

About 190 of Edison's patents may be considered as mechanical or may be excluded from the list of patents which are electrical in nature or in application, leaving a total of 713 patents which may be regarded as electrical. This total is about 1/63 of the number of patents in the electrical classes, or about 1/81 of the number in these classes and in the subclasses.

The proportion of Edison's patents in the art of electrical communication, which includes telegraphy, telephony and signaling, is 1/78, there being 184 patents to his credit in this art out of a total of 14,504 patents issued in the art. The proportion of Edison's patents in the art of electrical illumination is 1/28, there being 190 patents to Edison's credit in this art and 5422 patents issued in the art. There are 939 patents issued on phonographs, and of these 109 belong to Edison, thus representing 1/9 of the total number in the art. There are 1292 patents issued on secondary batteries, classed under Electrochemistry, No. 204. Edison has seventy-eight patents in this art, which is 1/17 of the total number.

[illegible] S. PATENTS [illegible]

Art	Patents by years, 1869–1910 (legible figures, in printed order)	Totals.
1. Electrical communication	3 .. 6 [illegible] 19 8 7 [illegible] 2 2 4 5 5 8 1 3 1 12 [illegible] 1 1 [illegible] 1	[illegible]
2. Electrical illumination	[illegible] 2 [illegible] 5 11 16 8 12 [illegible] 2 6 [illegible] 1 1	190
3. Electrical power [illegible] ery	9 38 24 9 1 2 4 1 7 3 [illegible] 1 1 .... 1 1	113
4. Electrical batteries	3 [illegible] 5 [illegible] 14 [illegible] 1	81
5. Distribution of electricity	11 . 2 1 [illegible] 1 [illegible] 1 [illegible] 2 1 2 ..	59
6. Measurement of electricity	1 1 [illegible] 1 2 1 2 [illegible] 1	22
7. Electric traction	2 [illegible] 2 2 11 2 .. 1 2 [illegible] 1	[illegible]
8. Electrochemistry	1 1 [illegible] 2 1 2 1	10
9. Ore, cement and milling	1 2 3 2 10 2 1 2 3 1 5 13 2 1 [illegible] 1 [illegible] 4 1	[illegible]
10. Phonographs	3 [illegible] 17 19 14 11 7 5 2 2 1 4 1 [illegible] 2 2 1 [illegible] 1	109
11. Photography	2 1 1	[illegible]
12. Office appliances	1 [illegible] 1 [illegible] 2 [illegible] 1	[illegible]
13. Journal bearings and gearing	1 [illegible] 1 [illegible] 1 1 1 1	10
14. Compressed air	2 1	3
15. Wire drawing	2 1	[illegible]
16. Glass	2	2
17. Fruit preserving	1	1
Totals	1 [illegible] 20 12 19 [illegible] 13 14 69 75 65 26 12 18 21 [illegible] 37 65 32 [illegible] 20 9 1 [illegible] 3 2 [illegible] 3 15 23 [illegible] 10 17 7 19 23 12 22 8	905
Patents assigned before issue	2 1 [illegible] 15 15 [illegible] 16 8 [illegible] 11 2 1 42 36 25 8 [illegible] 6 [illegible] 11 10 15 10 17 5 3 [illegible] 1 8 2 6 [illegible] 14 [illegible] 11 14 4	355
Joint patents	2 [illegible] 2 [illegible] 1 [illegible]	17
Reissue patents	2 .. 2 [illegible] 1 [illegible] 1 [illegible] 2 [illegible] 2 1 1	13

By examining Table II it will be noted that Edison's work has moved in waves. His work in telegraphy began with his career as an operator, or rather preceded this, beginning with his association with operators. From 1869 to 1894, with the exception of two years, 1870 and 1884, one or more patents were issued to Edison in the art, or rather arts, of electrical communication. From telegraphy he went into the telephonic field. After 1894 but one patent was issued to him in any of the arts of electrical communication.

[illegible] III.—[illegible] U. S. PATENT ISSUES BY YEARS.

1869	[illegible]	1880	14	1891	32	[illegible]	[illegible]
1870	1	[illegible]	69	1892	65	1903	10
[illegible]	7	[illegible]	75	1893	20	1904	[illegible]
1872	[illegible]	[illegible]	65	1894	9	1905	7
[illegible]	[illegible]	[illegible]	26	1895	10	1906	[illegible]
[illegible]	12	[illegible]	12	1896	3	[illegible]	
1875	[illegible]	1886	18	[illegible]	[illegible]	[illegible]	12
[illegible]	[illegible]	1887	21	1898	8	1909	22
1877	8	1888	35	[illegible]	[illegible]	[illegible]	8
1878	[illegible]	1889	37	[illegible]			
[illegible]	1	[illegible]	65	[illegible]	[illegible]	41 years	905

From Table II it is seen that Edison has had a ready market at practically all times for his patents, and that a considerable number of his patents were assigned before issue. This factor is an important one in considering the elements of Edison's success. In practically all of that portion of his work which has been placed under patent protection Edison has, without reasonable doubt, followed the demands of the market. That part of his work which anticipated the market has been withheld, and that part which possessed purely scientific value was denied to the world. What Edison might have done in the fields of discovery had he been free to carry out such plans as have formed in his mind, along the lines of original scientific work is very hard to estimate.

In 1879 Edison secured five patents in the art of electrical illumination and these patents really marked the beginning of his more important inventive successes, such as led up to the organization of the numerous Edison companies all over the United States. Telegraphic work led to the vote recorder, to the stencil pen, which in turn opened the field of office appliances, and which led directly to the speaking telegraph, as the telephone was first called. From the diaphragm of the telephone came the phonograph. Without the knowledge and insight which extensive work with electromagnets gave the magnetic ore separator would not have been created. After the carbon filament was produced a demand was felt for improved generators, distributing systems, meters, regulators and manufacturing processes in order that an economic system of electric lighting could be produced.

From the records of the Patent Office we are able to compute the number of patents issued to Edison, but these records are silent as to the number of applications pending, the number of applications filed and not brought to issue and the number of inventions now being prepared for patent. It is reasonable to conclude that Edison abandoned many inventions in the art of communication after his unhappy experience with the telegraph companies. It is also reasonable to conclude that he never brought to the application stage many inventions to which he could not devote time or expense to project, and that this number is very large.

The process of shaping an invention for the Patent Office and then for the market is a long and tedious one, and the limits of one's energies and resources would naturally restrict the number of inventions that can be projected into the market. In every large orchard there is a large quantity of fruit that is never brought to the market. The process of pruning is used by inventors as well as by farmers. There is a difference, however, as inventors are often compelled to prune, or suppress and withhold, inventions of the greatest value in order that they may not be swamped economically in their promotion.

A liberal estimate of all Edison's inventions would bring the grand total up to near 2000. This conclusion is based on the assumption that the number of unissued cases in the Patent Office is considerably over 200; that he has at least 100 inventions in the preliminary stage, and that he has produced a large number of inventions which could not be developed by experiments or projected by patents and manufacture, equal to, or nearly equal to, the number actually patented.

Grounding in Mines.

The Bureau of Standards in its recent circular (No. 23) on the subject of standardization of electrical practice in mines, which received notice in our issue of last week, discusses grounding in mines in a note explanatory of a rule requiring the grounding of circuits, machine frames, etc.

Referring to the rule requiring that the frames and bedplates of generators, motors and transformers and the metallic coverings of cables, switches, etc., shall be grounded, it is stated that four objections are usually brought against grounding as thus required, as follows:

(1) It produces greater strain on the insulation. (2) A single fault in the insulation requires the shutting down of the machine or cable. (3) Such a fault may develop a short-circuit and the flash which results may ignite gas, should the latter be present. (4) Difficulty is often experienced in making a good ground, especially for coal-cutter motors.

The first of these objections can, it is stated, be justified only on the ground of economy in the initial installation. It is true that a somewhat cheaper machine can be built where the insulation strains can be kept low, but in the case of low-voltage or medium-voltage machines for mining work the severe mechanical strains that are put on the insulation due to severe overloads, mechanical shocks, etc., require that the insulation be of such strength and quality that the additional voltage strain that would be caused by grounding the frame would be of relatively small consequence. The difference in cost would, therefore, be of such slight importance that it would be hardly worthy of consideration in comparison with the much more important question of safety.

As regards the second objection, that a single fault in the insulation makes it necessary to shut down the machine, it must be said that this is true only in case one point of the electric circuit is grounded, and even then it can hardly be regarded as a disadvantage. A machine which has developed a fault in its insulation should never be continued in operation in a mine even though such operation may be possible. Any machine that has developed a fault in its insulation is obviously more likely to develop another than one in which trouble has never occurred, because the appearance of the first fault often indicates a bad condition of the insulation as a whole. Hence it is more dangerous to operate a machine that is grounded through defective insulation than to operate one in which the frame is intentionally connected to earth. Moreover, either through overlooking the defect, or owing to the inevitable tendency of the operator to keep the machine in operation, even after the first defect is discovered, this condition of greater danger would frequently arise.

The third objection mentioned carries practically no weight for the reason that the rules prohibit the operation of electric machines where gas in explosive quantities is present, and the possibility of a short-circuit developing during the interval between the appearance of gas and the shutting down of the machine is very remote.

The last objection is not serious since the ground wire need not be of large current-carrying capacity, hence a small flexible wire can be run to any convenient ground plate or other suitable ground, either back along the trailing cable or separately as the case may require. Since this wire is not alive its presence cannot be regarded as materially objectionable and the question of insulation does not arise at all.

On the other hand, we have the unquestionable fact, supported by numerous authentic records, that persons have frequently been killed by coming in contact with the ungrounded frame of a motor or coal cutter which had accidentally become alive even from a lower-stage circuit; whereas such accidents are rendered absolutely impossible by the thorough grounding of the frames of such machines.

It would seem, therefore, that the doubtful advantage of ungrounded machine frames can hardly be regarded as comparable with the positive safety from shock assured by the thorough grounding of such machines.

Grounding of machine frames, cable sheaths, etc., is required by law in Great Britain, the Cape of Good Hope and New South Wales.

Taking up another section of the same rule, the note says that the grounding of three-wire direct-current systems and all alternating-current systems of low voltage or medium voltage is deemed of great importance as a measure of safety. The large number of deaths from electric shock from low-voltage and medium-voltage circuits has proven beyond a doubt that the danger even from low-voltage circuits is serious and should be guarded against wherever possible. Three-wire systems are rarely installed in mines for lower than medium voltages, and since the grounding of the neutral of such a system reduces the normal working pressure between either line and ground to one-half what it would if one side were grounded it is desirable that the neutral point be grounded wherever possible.

In alternating-current systems the danger from shock arises from two sources, viz., from the normal working pressure of the circuit and in the case of secondary circuits from the high pressure of the primary circuit due to accidental contact between primary and secondary system. Danger from the latter source is eliminated by grounding any point of the secondary system. If one side of the secondary be grounded, however, there would still remain the danger of shock from the normal working pressure of the secondary circuit, while if the neutral or middle point of the secondary winding of the transformer be grounded a person standing on the ground and touching either wire would receive only half of the normal working pressure between lines in the case of a single-phase system. Here, again, therefore, the neutral should be grounded wherever possible. Most of the companies are now prepared to supply standard types of transformers in which the neutral can readily be grounded when working at pressures of 220 volts or 440 volts, so that this presents no difficulty. In three-phase systems two cases have to be considered, viz., the delta and the star-connected secondaries. In the latter the common connection of the three phases is commonly called the neutral, and this point should always be grounded, since by so doing the voltage between any line and ground is reduced to about 58 per cent of what it would be if one line were grounded. In case the secondary is connected in delta there is no neutral point as in the case of the star connection. In this case the neutral point of one phase, and one only, should always be grounded, as in this case the pressure between two of the lines and the ground is reduced to one-half of the normal working pressure between lines, and that between the third line and ground is reduced to about 86 per cent of the normal line voltage. It is apparent, therefore, that grounding a proper neutral point on any system greatly reduces the danger of shock. It may be noted that the delta-connected system gives a somewhat less satisfactory condition in this respect, but inasmuch as this connection is sometimes preferable in practical operation it does not seem desirable to prohibit its use

Hunting of Synchronous Apparatus.

At the recent meeting of the Illinois State Electric Association Dr. Ernst J. Berg, professor of electrical engineering at the University of Illinois, presented a paper in which were related some of the author's early experiences relating to the parallel operation of synchronous generators and motors. In one case cited, where two 125-kw alternators were driven by belts from a common line shaft, when the two machines were connected in parallel, the belts would slip and buckle for a few seconds, the ammeters would show an enormous pulsation of current and finally the belts would fly off. An investigation showed that the driving pulleys differed in diameter by 1/16 in. When the pulleys were turned to equal diameters the machines operated satisfactorily.

In another case certain synchronous converters in railway service refused to operate without hunting. After some experimenting it was found that, if the converters could be supplied with energy over lines having very little potential drop, they would work satisfactorily; the more copper connecting the generators with the converters, and the more copper between the converters, the greater was the stability. This relation was

very important theoretically, but could not well be taken advantage of, since the cable system had been planned for duties other than that of keeping converters in step. Fortunately, among the large number of rotaries there were one or two which seemed to be more stable than the others, whether they were running alone from the generators or in pairs. A very careful study was made of these, which were built from the same drawings as all the rest, and it was found that their pole-pieces were slightly warmer than those on the others. This was a very important clew. It took little theorizing to see the reason in this case. The eddies in the poles must constitute a damping brake and, therefore, act to diminish any tendency to pulsation.

The poles of one rotary were "shimmed" and the result was as expected; they became very much hotter, but the rotary was stable. An unexpected situation arose in this connection; it seemed that any of the other rotaries could be run satisfactorily with this one even without "shimming" the other. Shimming seemed to be the solution and the poles of all were shimmed. In connection with this some difficulties were met with, however. It was found that on the rotaries that had the greatest line drop the pole-pieces had to be shimmed to an extent to make the pole-faces almost red hot, which hardly could be considered practical and certainly greatly impaired the efficiency. It was but a short step to find other and better means to obtain the required braking effect. Copper bridges were installed between the poles, and as a later evolution a regular squirrel-cage winding is being inserted in the polefaces. The observation about the effect of line resistance was turned to good advantage in later installations. At the present time it is not expected that satisfactory parallel operation of synchronous machines can be accomplished unless the line resistance is moderate.

It was felt that by using the above remedies the synchronous converter situation was well in hand and that no more difficulties could arise. It was but a very short time later, however, when a whole new set of difficulties arose, and these were in connection with the parallel operation of slow-speed, directly connected alternators. In these cases, as in the cases of synchronous converters, difficulties were encountered almost with the first installation. The conditions furthermore were almost in every case the same. The generators, while at times running perfectly well, would, seemingly without any provocation, begin to see-saw until the cross currents became so large as to cause them to fall out of step. During the hunting energy was transferred periodically from one machine to the other, as was shown by the movements of the electrical instruments and the opening and closing of the steam valves. It was found that by operating the throttle by hand the machines would stay in step, showing that the dashpots of the governors were at fault. The air dashpots were replaced by oil dashpots, thereby impairing the speed regulation, but stopping the hunting. In later constructions the dashpots were provided with by-paths so that they would prevent any sudden small tendencies to speed variation and at the same time be sufficiently sensitive to prevent the speed from getting too high in case the load was suddenly removed.

The oil dashpots cured practically all cases, but they did not solve every case. By systematic investigation still another important remedy was found in eliminating "play" in the various connecting rods between the governor and the steam valves. With a total "play" of only 0.02 in. or 0.03 in. operation would be impossible in many cases. This feature accounts for many erratic hunting tendencies found to-day. In 99 out of 100 cases the generators could be made to operate satisfactorily with these simple modifications of the engines.

With the introduction of turbo-generators it was felt that no difficulties could well occur, since these have very high inertia and always run at uniform speed. Nevertheless, difficulties have been experienced in some rare cases, and it is not unusual to find a slight pulsation of current between two turbo-alternators. These cases have occurred when two or more generators are running in parallel in different stations connected by cables of considerable resistance. At the time these difficulties first arose previous experience and theories very quickly suggested the installation of reactive coils between the individual machines or stations and such coils did check the tendency to hunt.

The author told of two characteristic extreme cases of hunting, one in connection with synchronous converters and the other with synchronous motors. It was found that, although all apparatus of a certain system had been running satisfactorily for years, with the addition of some new water-wheel-driven generators hunting began. When this difficulty arose sufficient was known of the theory of hunting to suspect that the "natural period" of the new machines might be the same as that of some of the old machines, and therefore hunting was likely to occur. The periods were determined and found to be the same. The difficulties were removed by adding a small flywheel to the new machines.

In the other case the natural period of the generators was the same as the number of revolutions of the engines. The trouble could have been remedied by the addition of a small flywheel, or by shimming of the poles, but the central-station man did not want to increase the weight on the bearings nor did he permit shimming, since this would slightly affect the voltage regulation; in fact, he wanted turbo-generators—which he got.

The author remarked that hunting is always associated with pulsation in speed. If the speeds of two synchronous machines at every instant are the same hunting cannot take place. With belt-driven machines such variation may be due to the condition of the belt. With directly connected, slow-speed engine units there is always a slight pulsation in speed during each revolution. With a fairy-wheel capacity there should be little difficulty on this score. When the flywheel is of sufficient size to limit the pulsation in speed to 2.5 electrical space degrees hunting will not take place.

Illinois State Electric Association Convention.

The 1910 convention of the Illinois State Electric Association was held at Rock Island, Ill., Oct. 26 and 27, 1910. Central-station men arriving early were entertained with a smoker and vaudeville at the Harper House on the evening of Oct. 25. Mr J. H. Delaney, of the Cosmopolitan Electric Company, Chicago, acted as master of ceremonies on this occasion.

Wednesday morning the convention opened on the sixth floor of an office building, the main floor of which is occupied by the offices and display-room of the People's Power Company, of Davenport, Moline and Rock Island. Most of the sixth floor of this building was given over to exhibits and to a large room where the sessions were held. An excellent array of exhibits was provided by the manufacturers. The registration at the convention was 149.

The first session was called to order at 10 a. m. Wednesday by President E. W. Smith, of Kewanee. The first business was the presentation of the membership committee's report by Mr D. McAfee, of Galesburg, who offered the applications of eighteen central-station companies for membership in the association, which companies were duly elected to membership. On motion of Mr. E. L. Brown it was then voted that the president appoint a committee on resolutions. He mentioned especially for remembrance by the committee the death of a former president of the association, Mr. W. E. McCullough, of Beardstown.

The first paper was one by Mr. W. E. Osborn, advertising manager of the Rockford Electric Company, on "Signs and Window Lighting." In opening the discussion on this paper President Smith called attention to the fact that the convention was opening with the best attendance the association ever had at one of its conventions, and that the opportunities for discussion were unusually good. In the discussion Mr. John G. Learned, of the North Shore Electric Company, Chicago; Mr. T. W. Gregory, of East St. Louis; Prof. E. J. Berg, of Urbana; Mr. R. S. Wallace, of Peoria; Mr. N. M. Argabrite, of

Belvidere, and President Smith told of successful methods they had used to increase revenue from sign and window lighting.

Mr. J. S. Maltman, new business manager of the Kankakee Gas & Electric Company, read a paper entitled "The Radical Tendency in Rates." In it he objected to imposing a large fixed readiness-to-serve charge upon the consumer, and also urged simplicity in rate systems. This stirred up considerable discussion, an account of which is given elsewhere in this issue. The general sentiment was in favor of a recognition of the principle in rate-making that higher rates must be made to consumers with a low load-factor than to those with a high load-factor. Mr. Maltman explained that his paper did not intend to attack this principle, but his objection was raised to its application of a high readiness-to-serve charge which would scare away customers.

"Electric Shows in Small Cities" was the title of a paper in which Mr. J. E. Johnson, general superintendent of the Danville Railway & Light Company, told of the experience of his company in putting through an electric show. Mr. E. W. Smith related an experiment of his along the same line two years ago, and he was followed by Messrs. A. G. Mosier; Bass, of Bloomington; Gregory, of East St. Louis; Bell, of Granite City, and others. The president then announced the appointment of a committee on resolutions as follows: Mr. F. M. Sinsabaugh, of Carrollton; E. L. Brown, of Elmwood, and Mr. F. J. Baker, of Chicago.

The Wednesday afternoon session was opened with a paper by Mr. T. P. Pinckard, new business manager of the Peoria Gas & Electric Company, on "Promoting New Business." This was immediately followed with a paper by Mr. Max Heiliger, assistant manager of the Rockford Electric Company, on "How to Get New Business." These two papers were discussed together. The discussion hinged mainly about Mr. Pinckard's contention that extensive free trials of devices and spectacular methods of selling articles below cost were not good, sound business for a substantial organization like an electric light company.

The chairman of the rate committee, Mr. R. S. Wallace, presented the first report of that committee, which was a summary of the various rate systems in use, containing an appendix giving an example of the working out of a rate and references to various articles recently appearing on the subject of rates and commission decisions, the majority of references being to articles in the *Electrical World*. The report recommended a differential rate which consists of two elements—the element of fixed charges and the element of variable or operating charges. It gave examples of determining fixed and variable charges. The general principle of the differential rate only was advocated without recommending details as to methods of applying it. The committee consisted of representative men from large and small plants in the State. Its membership was as follows: Mr. R. S. Wallace, of Peoria, chairman; Mr. J. J. Frey, of Hillsboro; Mr. Geo. W. Burton, of Danville; Mr. E. L. Brown, of Elmwood; Mr. S. B. Cushing, of Chicago. After the reading of the report the committee was continued for two years. The discussion which followed was on the importance of uniform accounting in order to determine rates and also on the general principle of the differential rate, with which most of the speakers were in accord. An abstract of this discussion appears elsewhere in this issue.

The president then introduced Mr. L. D. Mathes, of Dubuque, Ia., as ex-president of the Iowa Electrical Association. Mr. Mathes made a few pleasant remarks in his very original way about the relations between the central-station men of the two neighboring States, and then discussed some of the new-business ideas advanced in Mr. Pinckard's paper.

Mr. P. B. Sawyer, manager of the Des Moines Electric Company, another visiting Iowa central-station man, was also introduced. Mr. E. L. Brown spoke briefly on the importance of adopting a standard system of accounts. Secretary H. E. Chubbuck then requested Mr. J. R. Cravath, of Chicago, to give the association a short talk on the indirect system of illumination, of which he said he had seen some very fine examples recently in Chicago. Following Mr. Cravath's remarks the president announced that the registration to date was 133 central-station men, which announcement was received with much applause.

A paper on "New-Business Ideas," by Mr. O. C. Macey, superintendent of the Alton Gas & Electric Company, was then read. After some further discussion of new-business topics the nominating committee was appointed by the president as follows: Messrs. E. L. Brown, of Elmwood; John G. Learned, Chicago, and N. M. Argabrite, of Belvidere.

The Thursday morning session was opened with a paper by Mr. P. B. Sawyer, general manager of the Des Moines Electric Company, on the Des Moines plan of meter reading. This described how the meter reading and billing are carried on continuously throughout the month. This aroused considerable discussion on meter and billing methods. Among those who told of their methods were Messrs. Frank J. Baker, of the North Shore Electric Company, Chicago; E. McDonald, of Lincoln; John F. Gilchrist, of the Commonwealth Edison Company, Chicago; E. L. Brown, of Elmwood; J. J. Frey, of Hillsboro and Collinsville; R. S. Wallace, of Peoria; N. M. Argabrite, of Belvidere; E. W. Smith, of Kewanee, and C. W. King, of Lewistown.

Dr. E. J. Berg, professor of electrical engineering at the University of Illinois, Urbana, gave an interesting account of his experiences in curing the hunting of synchronous apparatus at various times during his connection with the General Electric Company, an abstract of which appears elsewhere in this issue.

Mr. C. W. Lee, of New York, then presented a paper on "Publicity and Public Policy," urging that public service companies give more publicity to some of the essential facts concerning their business in order to prevent the agitation which sometimes arises because of the mystery surrounding the business. He was followed by Mr. John F. Gilchrist, of Chicago, and Mr. Thomas Crawford, president of the Iowa Electrical Association. Mr. L. D. Mathes, of Dubuque, Ia., urged that companies be reasonably right with the public before asking for favors. This friendship must be cultivated in advance and not worked up temporarily when the company has its hand out asking for favors.

The association then went into executive session for the transaction of the remaining business of the convention. In this session the following officers were elected for the ensuing year: President, Mr. W. G. Austin, of Effingham; first vice-president, Mr. H. A. Foster, of Fairbury; second vice-president, Mr. J. J. Frey, Hillsboro; third vice-president, Mr. F. H. Golding, Rockford; fourth vice-president, Mr. E. MacDonald, Lincoln; secretary, Mr. H. E. Chubbuck, Peoria; assistant secretary, Mr. C. A. Willoughby, Peoria; treasurer, Mr. F. Reimert, Rock Island. Executive committee: Messrs. W. B. McKinley, Champaign; R. S. Wallace, Peoria; Frank J. Baker, Chicago; F. M. Sinsabaugh, Carrollton, and E. W. Smith, Kewanee. A motion was also passed recommending the N. E. L. A. standard accounting system to member companies.

The supply men entertained the convention at the smoker and vaudeville Tuesday evening, and there was a theater party Wednesday evening, the latter, however, proving somewhat of a disappointment to those giving it on account of the quality of the play presented.

Thursday afternoon the convention was taken in hand by the People's Power Company, of Rock Island, of which Mr. J. F. Porter is president, and was royally entertained, first by a trip through the Rock Island arsenal, and then across the dam to the plant of the People's Power Company in Moline. After that special cars were provided to take the party out to the historical resort on the bluffs of the Rock River known as "Blackhawk's Watch Tower." A fine banquet was there spread, and this was followed by toasts in which both the local and convention talent participated.

The Rate and Accounting Questions at the Illinois Convention.

At the convention of the Illinois State Electric Association at Rock Island, Ill., Oct. 26 and 27, a general account of which appears elsewhere, considerable discussion was engendered on the subject of rates. The first paper on this subject was entitled "The Radical Tendency in Rates," by Mr. J. S. Maltman, new business manager of the Kankakee Electric Light Company. Mr. Maltman made a plea for simplicity in rates and claimed that we cannot get down to the exact cost of service to each consumer and cannot ever approximate it, as the diversity factor plays too important a part. He questioned the policy of adopting an elaborate rate based on cost of service plus cost of energy, for even if just and equitable the public would not understand it. For example, if a house were wired for electricity and piped for gas, and a man should have to pay $2 for electric service plus a small rate for energy, would not a large number of prospects have only the gas connected? Mr. Maltman considered that lamps of 0.1 watt per candle which have been suggested lately would be the greatest revenue producers the central station ever got hold of. He said that he did not know of a consumer in his city who had reduced his bill through the use of tungsten lamps, and there are as many tungstens in proportion to population as in any city of the country.

If the consumer's bill is greater than he expects to pay he kicks, and if it goes under he uses light more liberally. One large consumer, and a chronic kicker on the amount of the bills, changed over to tungsten lamps, and, though the bills gradually increased until they were materially larger than before, the consumer said he was perfectly satisfied, as he felt he is now getting his money's worth, whereas before he did not.

In the discussion of the paper Mr. J. R. Cravath, of Chicago, said that we could not get away from the fact that electrical energy under certain conditions costs a certain amount delivered, and that unless our methods of selling vary according to cost of production and delivery some electrical energy will be sold below cost. The system of charging involving a fixed readiness-to-serve charge, plus a variable operating charge, had never to his knowledge been extensively and successfully used in residence lighting business. The consumer objects to the high fixed charge. On the other hand, in commercial lighting it had been the means of building up business and meeting competition in many places.

Mr. Linn, of Bloomington, said that his company had since Jan. 1 a two-rate system in effect. Part of the energy is charged at a high primary rate and part at a low secondary rate. They are now trying to educate merchants to the fact that the secondary rate is low and that they can get more for their money by using electricity more hours per day. The rate in the business district is 10 cents per kw-hour up to an equivalent of three hours per day of the connected load, and 5 cents for electricity in excess of that.

Mr. Frank J. Baker, of the North Shore Electric Company, Chicago, said that the method of having a maximum-demand meter for each consumer involved too great an investment. His company takes a certain percentage of the connected load as the estimated maximum demand, but does not count heating and other day-load appliances. This percentage is based on actual experience from the measurement of several thousand customers in Chicago. In making this estimate no account is taken of the heating appliances connected, which thus usually get the low secondary portion of the rate and this makes them economical to the householder. He thought it important that the association should agree, not on the rates themselves, but on the principles and systems of charging to be employed.

Mr. N. M. Argabrite said that his company in applying the two-rate system did not count heating appliances. The connected load is invoiced once each year. Mr. E. W. Osborn, of the Rockford Electric Company, said that his company had a two-rate system of 13.3 cents and 6.6 cents in use in the business district in Rockford, while in the residence district the rate is a uniform meter rate. Mr. Baker objected to this practice, because he said that it discouraged the use of flatirons, vacuum cleaners and other profitable day-load devices, by forcing them on a high rate. He further said that his company so thoroughly believes in the flatiron business that it now exchanges flatirons on the same basis that it exchanges lamps; that is, if the consumer brings back a defective iron he will be given a good one in its place.

Mr. John G. Learned, of Chicago, thought that companies not having a primary and secondary rate were losing by it, because the secondary rate encourages off-peak use of electricity. Among 16,000 customers his company has placed 5000 flatirons. The argument that one can use these flatirons at the low rate is a strong one. Mr. E. McDonald, of Lincoln, said that he had trouble in getting the maximum load of various customers because of changes from time to time, especially among merchants the few weeks before the holidays. Mr. Argabrite thought that there should be no trouble with this. If a merchant has his store properly lighted there is no reason why he should change his lighting during the holidays.

Mr. Thompson, of Peoria, told of an experiment made at San Antonio, Tex., to determine a basis of estimating maximum demand according to the number of rooms in a house. By taking all the houses in a certain district, they worked out an average of one 16-cp lamp for each room or hall, without regard to size or number of lamps on the chandelier. Mr. T. W. Gregory, of East St. Louis, also thought that central-station companies not using a primary and secondary rate are losing much good business. Mr. Maltman explained that he did not in his paper intend to criticise the differential or maximum-demand rate with a primary and a secondary portion, as his company employs such a rate. What he objected to was a high fixed charge independent of the kw-hours consumed.

Mr. Monroe, of Streator, told of a rapid new-business campaign carried on in that town, which last spring had only eighty residences connected for 20,000 population, and where business had been increased 140 per cent since June 1. It was simply a question of educating the public. He touched on the importance of teaching consumers the necessity of washing shades and reflectors, having them learn to figure bills and keep their own meter readings in order to obviate complaints. Consumers would gladly pay a high rate if only educated up to the convenience and importance of the service.

Mr. H. R. Kingman, of Mount Vernon, said that the question of the actual rate is not of so much importance as whether all consumers are getting the same rates. A man does not object to paying a fairly high rate if he knows that every one else is paying the same thing. It is the discrimination that makes trouble. He advised companies to get ready for the establishment of a commission in Illinois.

The report of the committee on rates was followed by a lengthy discussion. The report pointed out that the problem is to determine the general principles that applied to a concrete case will result in a schedule of rates that is equitable practical and legal. After describing briefly the flat rate, uniform rate, sliding-scale meter rate, step-scale meter rate and pyramid-scale meter rate, it finally took up the differential rate, which in general is the form it advocated. This rate it defined as one in which the price per unit of electricity used varies with the consumer's monthly or yearly load factor. Schedules of this type are the results of attempts to devise a rate which will divide equitably among the users of electricity the cost incident to serving them. It is the unanimous conclusion of all who have studied the subject of rate making that rates if equitable must bear a definite relation to load factor. One method of applying the differential rate is to charge the consumer with a portion of the electricity used at a high or primary rate and the balance at a lower rate or rates. The number of units for which the consumer is charged at the high rate may be determined by, first, a maximum demand indicator, or second, the amount of the consumer's connected load, or third, his estimated maximum demand. In the readiness-to-serve rate the consumer is charged with a fixed amount, which consists of [illegible] proportional to the size of his

installation and a consumer charge, which is the same for all consumers. In addition to this fixed charge there is an additional charge for electricity used at a relatively low price per unit. A percentage of the connected load is used by some in determining the estimated maximum demand. Still others use the number of rooms regardless of the number of lamps installed; some do not include heating devices; others use the floor area lighted as the basis of demand.

The committee realized that rates adopted as a result of its recommendation might later be subjected to the scrutiny of a commission or the courts. The basis of a system of rates must be such that the resulting rate schedule will bear proper relation to the cost of service, so that each user of service shall pay the cost incident to his requirement and in addition thereto a reasonable profit. It is impracticable to devise a schedule which will assess to each consumer the exact cost of the service rendered him, but a system of rates which approaches this condition is preferable to one in which there is no intent that the rate shall bear any definite relation to the cost.

It concludes that a system in which the cost of service is recognized, which has been successfully defended in the courts and which has been declared correct in principle by public bodies exercising regulatory powers can be safely adopted. The committee recommended therefore the differential rate system, fully believing that after a careful analysis of cost and segregation of consumers' accounts a schedule of differential rates can be devised for any company that will prove equitable, practicable, expedient and legal. The exact form of differential rate, whether to Wright maximum demand, multiple rate or readiness-to-serve, must be decided with due regard to local conditions. The committee gave as an appendix to its report a list of rates prepared by the secretary during the past year. There are but three differential rates in the list of twenty, from which it would appear that many rates have been arbitrarily fixed without regard to any factor except expediency and perhaps necessity.

The basis of the differential rate is in the fact that electricity cannot be stored, and there is, therefore, one class of expenses that is independent of output and another class that is dependent upon output. The former may be named fixed cost and the latter variable cost. The usual items of expense may be grouped under two headings as follows: Under fixed cost, interest, taxes, insurance and depreciation. Under variable cost, fuel, labor, supplies, repairs and maintenance, distribution expense, general expense. Each of the variable costs has a fixed element in it. For instance, the fuel consumption may be one-third as much at no load as at full load. The labor may be nearly as much whether one generator or all are operating.

As an illustration of one method of determining a differential rate, the committee gave figures for a station having a capacity of 400 kw located in a town of 10,000 inhabitants. Interest was figured at 6 per cent on the whole investment. Insurance and taxes were figured as 1 per cent on land, 1.5 per cent on buildings, 1 per cent on mechanical plant, 1 per cent on electrical plant and 0.5 per cent on pole lines. Depreciation was figured as 2.5 per cent on buildings, 6 per cent on mechanical plants, 6 per cent on electrical plant and 4.5 per cent on lines.

The total station investment was figured at $60,000, or $150 per kilowatt of capacity. The fixed charges per year would amount to $6,600 on the station investment. The investment for the distribution system was assumed as $118,350, or $296 per kilowatt. The total operating cost was assumed to be $25,975. Of this 63.5 per cent does not change with the output and 36.5 does so change. In other words, two-thirds of the variable cost is caused by being ready to serve the customer without notice. Adding the fixed operating cost to the other fixed charges, such as interest and depreciation, gives a total annual cost of $35,667.50 for the fixed portion and $9,468 for the variable portion of the cost. Analyzing this cost further, the conclusion is reached that a rate of 6 cents per kw-hour for street lighting and 11 cents per kw-hour for business and residential lighting would yield the station a net profit of 10 per cent.

However, a rate of 11 cents per kw-hour is not fair to all, unless each customer uses his maximum demand the same number of hours per day and the load on the station is kept constant throughout the twenty-four hours. For the business and residence lighting the maximum station load is 300 kw, and the kw-hours sold by the consumers' meters is 345,452. This makes the load factor for the year for this class of business 13.2 per cent, or 3.2 hours' use per day of the maximum demand. From this it is deduced that the total revenue from business and residence lighting, $36,517.25, is made up of two elements, one being the fixed revenue of $29,638.95, which, divided by the output, gives 9 cents per kw-hour. The other element is a variable, which is $6,878.30, which, divided by the output, gives 2 cents per kw-hour. The rates, if adjusted so as to give 11 cents for three hours' use per day of the maximum demand, might be arranged as follows: First hour, 15 cents; second hour, 9 cents; third hour, 9 cents. Total three hours, 33 cents; average, 11 cents.

In the discussion on the committee's report Mr. Frank J. Baker, general manager of the North Shore Electric Company, Chicago, urged the necessity of the adoption of uniform systems of accounting in order to determine rates. He announced that his company had decided to adopt the standard system recommended by the National Electric Light Association. This association has recently printed books for its members giving its standard classification of accounts. The Commonwealth Edison Company, of Chicago, is also seriously considering changing its extensive system of accounting to conform to the N. E. L. A. standard.

Mr. E. J. Condon, president of the central-station company at Harvard, Ill., did not favor the association taking any action on a standard accounting system at present, because of the possibility that a state commission, if established, might change or require a change in such system. In reply Mr. Baker said that if the companies of the State to a considerable number now adopt the system adopted by the National Electric Light Association a commission would probably accept the system rather than formulate something new. If, however, the companies of the State have not agreed on anything, the probability would be much greater that the commission would formulate a system of its own. The N. E. L. A. system has been the result of several years' work by some of the best electric light accountants of the country working close to the commissions of the State of New York. The form adopted is very similar to that required in New York and Wisconsin. The system as it would be adopted by small companies using only the main headings would be very simple. Mr. N. M. Argabrite, of Belvidere, announced that his company had just changed to the N. E. L. A. system. The only expense had been that for a few forms. The system is easy to follow. He considered it safe to say that no better brains would be put into devising an accounting system in Illinois than had already been put into this National Electric Light Association system.

In a later session the question of standard accounting was again brought up, and a resolution was passed recommending that the companies of the State adopt the N. E. L. A. system as far as possible. A number of companies reported having either adopted the system or having decided to adopt it at the beginning of the next fiscal year. It was pointed out that only eight general headings of operating expense accounts are required by the N. E. L. A. system, and three of these are not for items with which the smaller companies are concerned, so that practically only five headings would have to be kept in the majority of cases.

Discussion on Rate Schedules at Empire State Meeting.

A paper on the subject of rate schedules was read by Mr. James T. Hutchings, general manager, Rochester Railway & Light Company, at the annual meeting of the Empire State Gas and Electric Association, New York, on Oct. 5.

Mr. Hutchings said that in many respects the sale and price

of electricity for light, heat and power are governed by the same conditions as the sale of any other commodity: First, by the cost; second, by competition or the price at which a similar article can be purchased; third, by the fact that the lower the price to a certain extent, the greater would be the amount of sales.

It must be remembered that electricity in all of its various fields has keen competition. In the case of the small customer electric light has the competition of kerosene oil, illuminating gas and various types of gasoline-lighting systems. In the larger plants there is the competition of illuminating gas and the private power plant. The same condition holds true in the power field for both the large and small customer.

Mr. Hutchings desired to bring out only a few of the many points which must have consideration in any rate scheme. In the inception of any enterprise the price asked for the product is based upon the demand, what has been previously charged for the product which is replaced, and the cost of production. But after the early stages have been passed the question to be confronted is, Upon what system is the charge now based? Following are a few systems in effect at the present time:

First—A flat charge of $—— per month per kilowatt of maximum demand or connected load.

Second—A flat charge of —— cents per kw-hour.

Third—A flat charge of —— cents per kw-hour, subject to varying rates of discount for quantity.

Fourth—A charge of $—— per kilowatt of maximum demand, plus a flat charge of —— cents per kw-hour.

Fifth—A customer charge plus demand plus flat charge per kw-hour.

Sixth—Making use of the fourth and fifth methods, and, in addition, a discount for quantity.

Lastly—Innumerable combinations of the foregoing.

All of these different schemes are used with varying unit prices for both lamps and motors. Mr. Hutchings then considered the advantages to be obtained by each system outlined in the foregoing:

First—This is very satisfactory to the customer if the flat price is low enough and his use long enough. It is also very satisfactory to the company if the price is high enough and the customer's use is short. Should all of any company's business, however, be sold upon this basis at a profit, the company would be losing money on all of its long-hour business and the price would be so high that the company would be unable to supply short-hour business. This scheme of charge has been most advantageous to companies generating their electricity hydraulically, as in this case a very large proportion of the cost of delivering energy depends entirely upon the capacity of the plant; it makes little or no difference whether the load is carried one or twenty-four hours per day. Where generation is by steam, if a flat price is charged sufficiently high to make a customer using energy twenty-four hours per day profitable, this price is too high to obtain the business of a short-hour customer.

Second—This scheme of charge has been made very popular with many of the lighting companies, most of the older companies having passed from the flat-rate scheme to the meter rate upon the development of a satisfactory electric meter. A company, however, selling energy upon this basis only will be unable to make a price which will return a profit upon the short-hour customer and obtain the business of the long-hour customer; in other words, a company selling energy upon this basis would have a very poor load-factor and would have only the extremely short-hour customer. This scheme has, however, the advantage of being easily understood by the customer and is very easily billed by the company.

Third—This scheme is [illegible] foregoing, and, if carried out, will have a tendency to load up the central station with a very large plant investment and a poor load-factor, as it does not take into consideration the fact that it is much cheaper to sell 1000 kw-hours to the customer having 1 kw of capacity or [illegible] equal sale of 1000 kw-hours with a maximum demand or capacity of 10 kw. It, however, has the advantage over the preceding systems of being very simple and appealing to the customer.

Fourth—This scheme is quite satisfactory, although somewhat more complicated. If properly explained to the customer it is possible to improve very materially the load-factor of the station and to enable the customer to earn a very low rate per kw-hour of energy used. This system of charge, if properly worked out, will bring to the company all of the long-hour business; in other words, all of the business which is most profitable to the company. In competition with the private plant it must be remembered that the cost of central-station power house and distribution system per kilowatt of maximum demand will generally be twice that of a private plant of the same capacity, so that the fixed charge, which holds whether the plant is operated or not, would be twice as much for the central station as for the isolated plant. For this reason the central station is somewhat handicapped on the very short-hour business, whereas owing to its lower operating costs and diversity factor it has a considerable advantage in bidding for the long-hour business. This scheme, however, does not take into consideration the fact that there is a distinct cost per customer regardless of the amount of business done.

Fifth—This system takes into consideration the cost of serving a customer as a customer, also the cost of serving per maximum demand, and the cost of producing energy per kw-hour. It is somewhat more complicated than the preceding one, but is in theory more equitable.

Sixth—The use of a discount for quantity in connection with the foregoing systems of charge (fourth and fifth) is justifiable, first, because there is a difference in cost between delivering a large and small amount of energy to any particular point other than the pure customer cost. But the main reason is to secure the business. How far this discount should go is determined very largely by competition. Mr. Hutchings believes, however, that the central station should make a profit on all of its business; that is, it should take no business at a price so low as to incur loss, after taking into consideration everything which enters into the cost of delivering energy to the particular customer. In determining what is the lowest price at which energy can be sold under any particular load factor, total average costs, as shown by the company's books, are absolutely unreliable. Mr. Hutchings took as an illustration a community of 10,000 people supplied by a central station having a contract with the city for street lighting and doing a general commercial business. There is located in this city one very large manufacturing industry upon which the prosperity of the community very largely depends. The energy required to operate this one industry is equal in kw-hours to the total business now being furnished—the load-factor of this industry being 40 per cent, whereas the present load-factor of the central station is about 30 per cent. The question comes home to the central station: "Why can we not obtain this business, and how far shall we go in making the price for this industry lower than that quoted to our present business?"

Before entering into negotiations the cost to the present industry to generate its own electricity should be ascertained, if possible. A very careful estimate should then be made of how much additional plant would be required on the part of the central station to supply this load, and how much more is would cost to operate this plant after taking on the larger customer. Any profit which can be made after payment of the additional operating expense and the additional fixed charge of interest on the capital invested, depreciation and taxes is pure profit, and if there is no profit shown between company cost and the customer's cost the business should not be taken. If, however, there is a profit the system of charge for this large business should be made on a basis which will return as close a price as possible to the cost to the private plant, taking into consideration such improvements as the company engineers may know could be made therein. In other words, the price quoted should be such as to hold the business permanently, as one cannot afford to take this business over unless there is a good guaran-

tee that it will be held for a number of years. In justification of this method it is known that every time output has been doubled there has been a reduction in unit cost, both per kilowatt of maximum demand and kw-hour.

The question of rates is so complicated that Mr. Hutchings feels this subject should receive a great deal of thought and investigation. Central station costs should be analyzed to the minutest detail, having regard to their relation to the cost of carrying the maximum peak load and the cost of delivering per kw-hour.

Mr. Hutchings feels that any company that has not a complete published schedule of rates is in a very unfortunate condition, and that whatever the rate system is it should be possible for the customer to obtain as good results by negotiating with the office boy as with the general manager, and the office boy should have just as much latitude and no more than the general manager.

Discussion.

The presentation of the paper of Mr. Hutchings was followed by a joint discussion by Mr. John C. Parker, mechanical and electrical engineer, and Mr. H. C. Deffenbaugh, of the Rochester company.

Messrs. Parker and Deffenbaugh had found that the existing rate schedule of their company, consisting of a sliding scale with a progressive discount for large customers, contained certain anomalies and did not automatically favor that class of business which is the cheapest to supply, namely, the off-peak business.

It was their feeling that it is inequitable to favor such business by making class rates, whereunder storage-battery charging at night may receive an exceptionally good rate, which is not received by some other business using the service in an identical manner, but not falling under the same nominal classification.

They therefore attempted to formulate a schedule of rates whereunder the charge should be based entirely upon the way in which the service is utilized, rather than upon the use to which it is put. To do this they studied the costs of production and the competitive cost of isolated-plant energy, with a view to determining the way in which the various component items should be arrived at. The cost of service and the competitive cost were found to consist of three items:

First—A customer charge, "A," independent of the size of the customer.

Second—A demand charge, "B," per kilowatt over and above the customer charge and irrespective of the amount of energy used.

Third—An energy charge, "C," per kw-hour over and above the "A" and "B" charges and dependent only upon the energy consumption.

As the "B" charge is largely dependent upon the apparatus which has to be installed to meet the maximum demand for service, and as this demand is occasioned by the "peak" customers during the winter months, and as the apparatus provided therefor is idle during the non-peak or summer months, the "B" charge should be a graded one—heaviest during the winter months, lightest during the summer months—the sum of such graded charges being equal to the annual "B" charge, which is determined upon as being a fair one per kilowatt of demand.

In this way a strong incentive will be created to the use of motors during the summer months for such purposes as refrigeration, brewery use, etc., and a strong deterrent will discourage use during the peak or will, at least, compel it to bear its proper share of the expense.

Remittance of a part of the "B" charge is contemplated during off-peak hours in the various months in cases where the customers are willing to pay a nominal sum, covering the cost of metering.

This would encourage those classes of business that can advantageously keep off the peak, and would, if applied to domestic service, constitute a strong and logical inducement to the use of electric flatirons, vacuum cleaners, cooking devices, etc., without necessitating the making of one class rate for cooking, another for flatirons, another for lighting etc.

By this means one of the chief objections to the "A," "B," "C" system could be met and encouragement given to profitable residence business, since, in view of the fact that the energy charge is only a small portion of the total service charge, additional use of devices will cost but little, and it will, therefore, be readily possible for customers to double or triple the amount of satisfaction they can receive from central-station service, and this in a degree much greater than the slight increase in their bills which will be necessary in order to render the service profitable.

Messrs. Parker and Deffenbaugh do not believe that it is right that any class of service should be supplied at a loss. The fact that the company is at present constrained so to do with its residence consumers is, after all, only an expression of the fundamental note of socialism, "To every man according to his needs; from every man according to his ability." The energy charge under an A, B, C system could be cut nearly in two if the company were freed from the losses resultant from its short-hour business. The fact that the long-hour customers are compelled to pay for the cheap service secured by the residence customers would not be so bad, if it resulted only in a redistribution of the wealth of the community—in a saving to the householder at the expense of the industrial consumer—but the fact is that the burden which the industrial consumer is compelled to carry for the benefit of the losing business, represented by the householder, deters not a few of them from utilizing central-station service and compels them to install isolated plants, thereby rendering impossible a conservation by the community of its total wealth and working an economic wrong to the community.

As an illustration of the simplicity of the A, B, C system, as suggested, a tentative model bill was shown, as follows:

Customer charge	$——
— kilowatts demand at $—	——
— kw-hours of energy at — cents..........	——
Total service charge....................	$——

This is much more direct and simple for the clerical force than are any of the present sliding schedules and is more readily comprehensible by the public.

In arriving at the service cost each of the account numbers specified by the Public Service Commission was analyzed to determine what part of it was occasioned by the customer charge, what part by the demand and what part by the energy used.

For example, most of the coal consumption is dependent on the kw-hours used, but a part of it, namely, the stand-by and banking coal, is dependent on the size of the plant; that is, on the total demand. Therefore, the coal burned per month was plotted against the kw-hours generated per month. From this there was obtained a shotgun curve and a line was dropped in, passing fairly through all the points. By notation of the pounds of coal per month corresponding to a "zero" kw-hour generation it was determined how much of the coal should enter into the "B" element of the cost and how much into the "C" element.

Similarly, the other items of expense were determined. Power-house equipment, storage batteries, general supervision of these details, etc., would be almost, if not entirely, demand expenses. A large part of the meter cost is a customer expense. The distributing system consists entirely of customer and demand expense, the customer expense being that part which would be occasioned by serving each customer with the minimum size of wire mechanically practical, but delivering no energy over this wire. All the rest of the distribution expense would appear as "B" cost, and its aggregate divided by the aggregate demand is the distribution expense per kilowatt of demand.

Of course, due weight must be given to the diversity factor in deciding how much cost attaches to each customer-kilowatt. It must also be recognized that conditions would be radically

different in different towns, so that a distribution that would work out fairly well in Rochester, where there is a combination of hydraulic generation, steam generation and energy purchased under a demand schedule, would be absolutely inequitable in a city where the generation was purely hydraulic, or, again, in a city where nothing but steam supply was to be found.

Certain items of expense, such as commercial and advertising costs, are indeterminate in their distribution among the three items of charge. They should, therefore, be thrown into that item, or those items, which can best bear them under competition.

Bond interest and preferred-stock dividends, being a function of the size of the plant, should be accounted as demand or "B" costs. Common-stock dividends, representing in part, at least, the "velvet" of the concern, should be distributed proportionately over all three items of the charge, or should be thrown on to that part of the business best capable of bearing the addition, always provided that part of the charge will return enough to constitute an attractive profit to the stockholders.

Before instituting such a rate system, especially with reference to the graded "B" charges, due weight should be given to their reactive effect on the company's business; that is, the "B" charge should not be made so low in the summer, for example, as to create a summer peak and a winter "valley." Sound commercial judgment will dictate just how much of an inducement will attract the customers to the off-peak periods, and the inducement should not, in the nature of things, be made any greater than this; otherwise a very undesirable result will ensue.

Discussion.

The general discussion which followed was participated in by the following: Messrs. Lawrent Heaton, Orange County Lighting Company; A. E. Forstall, New York City; F. B. H. Paine, Niagara, Lockport & Ontario Power Company; T. R. Beal, Poughkeepsie Light, Heat & Power Company; Percy Thomas; John T. Smith, Southern Dutchess Gas & Electric Company; A. S. Ives, Poughkeepsie Light, Heat & Power Company; E. H. Palmer, Interurban Gas Company; R. M. Searle Rochester Railway & Light Company, and George L. Colgate, Canandaigua Gas Light Company.

Some of those who discussed the subject did not agree with all the conclusions reached by Mr. Hutchings and expressed the opinion that their own methods of rate-making were more satisfactory.

New York Commission News.

The Public Service Commission, Second District, has granted its first permission for capitalization in connection with the telephone companies under its jurisdiction. The commission has consented and approved of the issue of consolidated first mortgage 5 per cent gold bonds of the Auburn Telephone Company in the amount of $200,000, divided into two denominations of $100 and $1,000 respectively. Provision is made that the holders of the bonds of the denomination of $1,000 be given an opportunity to exchange their bonds for those of the denomination of $100. Bonds are to be issued to retire outstanding bonds, it being provided that exchange of bonds must be par for par in the aggregate amount.

The Syracuse Lighting Company has made a complaint to the Public Service Commission, Second District, directed against the Union Rental Company, of Syracuse, alleging that the company has constructed an electric light plant and is engaged in the business of manufacturing and selling electricity for lighting purposes in the City of Syracuse and not exclusively for its own use or the use of its tenants, and as such is an electrical corporation within the definition of the Public Service Commission's law, and that the company secured a franchise from the City of Syracuse on March 8, 1909, whereby it has laid its wires in a subway under one of the public streets. The complainant alleges that the company is unlawfully exercising its franchise, not having received the approval of the Public Service Commission for the exercise of the franchise. The complaint has been served upon the Union Rental Company and an order made to show cause why the commission should not proceed to procure a judgment of the Supreme Court restraining the defendant from exercising the franchise and from performing any and all other acts as an electrical corporation without the consent or permission of the commission.

Mr. M. W. Gregory, of Morristown, St. Lawrence County, has been authorized to begin construction of an electric light plant in that village and to exercise a franchise granted him.

Maryland Commission News.

The Maryland Public Service Commission spent last week in the discussion of the new schedule of rates proposed by the Chesapeake & Potomac Telephone Company for its subscribers in Baltimore and the surrounding suburbs, which reduces the rate for restricted calls, but does away entirely with the unlimited service in the business district. A number of citizens appeared before the commission during the past week and numerous complaints by letter have been made against the proposed schedule. Messrs. Joseph L. Downes and Laurence M. Miller, general agents for the Northwestern Mutual Life Insurance Company, asked that the commission shall not take action until after it has investigated the technical conditions of the telephone business, the cost of operation, etc. Mr. Francis I. Mooney, an attorney, recommends that the company shall not be permitted to charge more than 5 cents a call. He says that he now pays $2.50 a month for thirty calls, the amount being a little more than 8 cents a call. The proposed rate for the same telephone is not quite 7 cents a call. When complaint was made Mr. Mooney says he was informed that he was only paying 5 cents a call, the extra $1 a month being for the use of the service. Mr. Enoch Harlan, a member of the bar, states to the commission in a letter that he is the author of the bill introduced at the last session of the Legislature by Senator Linthicum designed to regulate telephone rates in Baltimore City; that while the bill was pending he had several interviews with the officials of the telephone company and their counsel, and believes that the measure embodies features which should guide the commission in reaching a conclusion upon the matter of properly regulating the telephone charges. Mr. Harlan believes that the company should grant unlimited service until it perfects such a device as would register each call in the subscriber's home or office, and that if subscribers do not get the party called a charge of not over 1 cent shall be made. He further believes that the price per call after the maintenance charge of $12 per year is provided for shall be the same to the subscriber who uses fifty calls as to the one who uses 5000 per year. In his letter he also makes the statement that the telephone company put a stenographer on his telephone after his bill had been introduced who listened and reported his conversations concerning the bill to the company. She also kept an accurate account of the number of calls he made and the length of time that he talked. A record kept by the stenographer was appended to his letter.

The Coach Owners and Undertakers' Association, of Baltimore, also sent a long letter to the Public Service Commission protesting against the proposal of the Chesapeake & Potomac Telephone Company to discontinue its unlimited service. The association has fifty members representing a combined capital of something like $1,000,000. The letter states that the proposed rates are highly excessive, and urges that the commission shall place the cost of tolls at no more than 2 cents each. Mr. John F. Frazer, Jr., with offices in the American Building, called the attention of the commission to the fact that in addition to paying high rates for telephone service he is also charged for the wire, or a portion of it, that runs along Bellona Avenue, near Charles Street, where he lives.

Massachusetts Commission News.

Governor Draper has issued a statement regarding the tendering of his good offices to the Massachusetts Railroad Commission in connection with the Boston & Eastern Electric Railroad Company's petition for a certificate of exigency from the board. He stated that he has conferred with the majority of the Railroad Commission, Messrs. Bishop and White, and urged them to give an immediate decision, if possible, upon the case in hand. The two commissioners still feel that a present decision would be improper in the face of investigations now going forward, and refuse to take any action in the case. It is doubtful if any action of the board within recent years has aroused so much hostile criticism, and in some quarters an effort is being made to make political capital out of the situation. The Boston & Eastern company has been endeavoring for over four years to gain an entrance into Boston in order to furnish high-speed electric service to and from the densely populated communities of the North Shore, and the feeling is general that the matter ought to be decided one way or the other without further delay.

The Railroad Commission expected to give a hearing on Nov. 1 upon the various Boston rapid transit matters before it, in connection with the Boston Transit Commission, sitting with it. The Boston Elevated Railway Company's side of the case was planned for presentation at this hearing.

The Massachusetts Gas and Electric Light Commission has issued a pamphlet containing the General Laws of Massachusetts relating to the manufacture and sale of gas and electricity, revised to July, 1910. The compilation requires 225 pages of closely printed text, and has been prepared for the convenience of parties interested and with special reference to the jurisdiction and duties of the board. In the absence of a codification of the laws in question the text is made up primarily of certain chapters of the Revised Laws. The act of 1910 relative to the abatement of smoke in Boston, Brookline, Cambridge, Chelsea, Everett and Somerville imposes the duty of administering it upon the board, and is therefore printed in full. As a matter of convenience and interest a table of all special laws relating to the manufacture and sale of gas and electricity has been added, including special laws enacted in 1910. A valuable feature of the compilation is the enclosure in brackets of sections of the law which have been repealed and words which have been stricken out, while new or substituted sections and words are printed in italics. The special laws are arranged chronologically and the compilation is provided with an excellent index. The board has also published its annual tabulation of new laws relating to gas and electric light companies and municipalities owning electric or gas lighting plants.

The Massachusetts Railroad Commission has approved the consolidation of the Union and the Dartmouth & Westport Street Railway Companies, and the increase in the capital stock of the Union Street Railway Company for this purpose by not exceeding 5000 shares, amounting at par value to $500,000. The shares of the two companies are to be exchanged on an even basis, the certificates of the Dartmouth & Westport company to be upon exchange surrendered and canceled.

Among the pending cases before the Massachusetts Gas & Electric Light Commission is the petition of the Selectmen of Plymouth for a reduction in the price of street lights furnished the town by the Plymouth Electric Light Company. At the public hearing in Plymouth on this case the company was represented by its counsel, Mr. Arthur Lord, of Boston, and its general manager, Mr. E. P. Rowell. The petitioners held that the price per kw-hour for street lighting averaged more in Plymouth than in other towns of similar size in the State, and the counsel for the petitioners, Mr. C. S. Davis, argued for a reduction on the ground that the town is not buying light but electrical energy, although it was shown that by the substitution of tungsten lamps for carbon lamps of lower candle-power the town is receiving more light than before for a given expenditure. Mr. Lord pointed out that the price of the company for 40-cp tungsten lamps burned all night is $21 per year each, which he considered reasonable. The old price paid by the town for 25-cp lamps of the carbon type was $20 per year on a 12 o'clock midnight, moonlight schedule. The company's new offer, which is disputed by the Selectmen, thus means a slight increase in the price per lamp-year, but it also means an increase of 60 per cent in candle-power and a 60 per cent longer service than formerly. The town authorities did not seem to appreciate that they are getting a much better quality and a larger volume of illumination under the new plan. The evidence indicated that the company is obtaining a relatively low income per kw-hour for its residential and commercial lighting service. Mr. Lord contended that in the twenty-five years of the company's history it has paid in one year a dividend of 2 per cent and in another a dividend of 1 per cent, so that, measured by the receipts at least, the community has had the use of its capital stock and a substantial part of its bonds with merely nominal return to the investors. Since the fire of April, 1909, the company has rebuilt its plant, and it is now in a better condition than ever to serve the public, but a larger debt presses it down, and the present is an unfortunate time for the town to ask for a reduction in the cost of street lighting.

The company also maintained that it is paying heavy taxes and is facing a demand for certain of its lines to be placed underground, while the cost of maintenance of its lines in the wind-swept territory along the coast which it serves is probably 25 per cent greater than the cost of maintaining inland distribution lines. The street-lighting circuits are carried about fifteen miles along the coast. There are about 350 incandescent lamps involved in the case. The petitioners came to the board for its recommendation as to a proper price upon which to frame a contract. Mr. Lord said that the only fair comparison with the prices in force in other municipalities must take into account the volume and hours of illumination furnished, and that, measured by candle-power hours, the Plymouth service costs the public less rather than more than elsewhere, and the basis of grievance disappears.

AMERICAN ELECTRICAL ENGINEERS.

G. W. Pickard.

Greenleaf Whittier Pickard was born Feb. 14, 1877 in Portland, Maine, where he attended the public schools, and subsequently his student life was spent at the Westbrook Seminary, Woodfords, Maine; the Lawrence Scientific School, Harvard University, and the Massachusetts Institute of Technology.

Having taken up the study of wireless telegraphy in May, 1899, he was placed in responsible charge, under Dr. A. L. Rotch, at the Blue Hill Observatory, Milton, Mass., for the Smithsonian Institution, of experimenal work in wireless telegraphy, and, in particular, the investigation of very high antennæ. Some account of this work appears in a paper read by Mr. Pickard at the meeting of the Maine Academy of Medicine and Science Nov. 13, 1899, and printed in the *Journal of Medicine and Science* of September, 1900.

In June, 1901, Mr. Pickard became associate engineer of the American Wireless Telephone & Telegraph Company, of Philadelphia, and later chief engineer of the Federal Wireless Telegraph & Telephone Company of the same place. During these engagements he was in full charge of the design of several complete wireless telegraph plants, including stations at Galilee, N. J.; Baltimore and Washington. In July, 1902, he joined the engineering staff of the American Telephone & Telegraph Company at Boston, Mass., in which service he had entire charge of the investigation of wireless telephony. During this period he developed an original system of wireless telephony that was successfully tried in September, 1902. He also had responsible charge of the development of a system and apparatus for the protection of telephone circuits from lightning and high-tension circuits, and a system and apparatus for simultaneous telegraphy and telephony over telegraph wires. Other work consisted of numerous original researches and investigations in

electrical science bearing upon high-frequency oscillations and electrical wave propagation, wireless detectors, telephone relays or repeaters, improvements in telephone receivers and in the measurement of feeble alternating and oscillatory currents. He also acted as chief expert in a number of suits involving wireless telegraph patents.

In June, 1906, Mr. Pickard became consulting and electrical engineer of the Huff Electrostatic Separation Company of Boston, and the Wireless Specialty Apparatus Company, of New York, and also started general practice as a consulting engineer and expert in patent litigation. During this latter period Mr. Pickard has made a number of original investigations, some of which have had a practical development. Among the latter are a simple method of measuring the sensitiveness of wireless detectors; a method of measuring the

G. W. Pickard.

received energy at wireless stations, which for the first time permitted of measurements in absolute units of the received energy in long-distance wireless communication; an investigation of solid rectifiers or asymmetric conductors, and of their adaptation to wireless communication; a method of receiving wireless signals by the use of an underground closed loop of wire, which has permitted the determination of the direction and absolute intensity of the magnetic component of the gliding electrical waves employed in wireless communication, and also enabled important investigations to be made as to the structure of such waves at great distances from their sources. This form of receiving circuit was later applied by Bellini and Tosi in their radio-goniometer, and at present is used in a number of important wireless stations. Accounts of these various methods have appeared in the technical press. Perhaps the most important contribution by Mr. Pickard to the art of wireless communication is the solid rectifier above mentioned. Certain forms of this, notably the "Perikon detector," are now standard in the United States Navy, and it is with this type of detector that practically all the long-distance records of the past two years have been made. To Mr. Pickard have been granted over forty United States and foreign patents, chiefly bearing upon wireless communication. At his home at Amesbury, Mass., he has a wireless station and laboratory entirely devoted to research and development work in wireless communication.

Mr. Pickard is a member of the American Institute of Electrical Engineers, the Society of Chemical Industry, London, and the Wireless Institute, New York, of which latter body he is the vice-president.

CURRENT NEWS AND NOTES.

Tests of Electric Meters.—Of 6293 tests of watt-hour meters made by the Public Service Commission of the Second District of New York in August, 1910, 462, or 7.34 per cent, were fast; 4546, or 72.24 per cent, were accurate, and 1285, or 20.42 per cent, were slow.

N. E. L. A. Membership.—The membership of the National Electric Light Association is approaching the 6000 mark, the membership on Oct. 13 having been 5905, of which 897 are class A or central-station company members. The net gain during the summer months was over 400.

Federal Drift of N. E. L. A. Government.—The recent organization of N. E. L. A. geographical sections in Georgia and Nebraska indicates that before long the government of that body as conducted by the executive committee may pass to the presidents of state and other geographic sections. According to the constitution of that body each president of a geographic section becomes a member of the executive committee, and such members will be in a majority when they exceed in number the fixed number of members who are elected at the annual convention.

N. E. L. A. Committee on Rate Research.—The following committee on rate research has been apointed by the National Electric Light Association: Mr. John F. Gilchrist, Commonwealth Edison Company, chairman, Messrs. R. A. Phillips, of Stone & Webster; A. S. Huey, of H. M. Byllesby & Company; L. H. Conklin, of J. G. White & Company; W. H. Winslow, of Superior Water, Light & Power Company, Superior, Wis.; R. S. Hale, of Boston Edison Company, Boston, and S. E. Doane, of the National Electric Lamp Association, of Cleveland, thus completing the committee of seven.

Electricity in Palestine.—According to United States Consul Thomas R. Wallace, at Jerusalem, nothing more modern than an ordinary oil lamp was used for lighting in Palestine until about four years ago, when the first electric plant was installed. The first building to be thus lighted was the French Convent of Notre Dame de France. The second lighting plant was put up about three years ago in the "Fast" Hotel. The third was in the new German sanatorium opened during the past summer by Prince Eitel. The fourth is now under construction in the Grand New Hotel. These installations consist of a storage battery and generator run by a gasoline engine. All the materials, even to the distilled water, are brought directly from Germany.

Lighting Concession in Russia.—United States Consul-General John H. Snodgrass, of Moscow, has forwarded to the Bureau of Manufactures a comprehensive report in relation to a concession for an electric railway and lighting plant for the Russian City of Peasa. He gives this as an illustration of the numerous opportunities open in Russia for American capitalists and manufacturers. All the cities of any size in that country are introducing modern methods in lighting, sewerage and transportation facilities, and capital is required from foreign countries, from which also most of the supplies necessary for such purposes must be purchased. Pensa has 80,000 population and is the trade center of a populous region. It is the junction of three railways, has thirty-six manufactories, forty-two schools and colleges and is the location of barracks filled with 10,000 soldiers. The concession runs for forty years, includes the payment by the city of a fixed sum of $7,210 per annum, payment for 100 street arc lamps, and many other favorable inducements.

Telephones in Turkey.— [illegible] partment of Telegraphy intends to install telephone systems in all of the cities of Turkey.

Cleveland Electrical League.—A smoker will be given to the Cleveland Electrical League the evening of Nov. 19 in the Auditorium of the National Electric Lamp Association.

Telegraph and Telephones in Sweden.—According to United States Consul General E. D. Winslow, at Stockholm, Sweden's government-owned telegraph and telephone systems netted the country \$192,000 during 1909. The receipts amounted to \$458,000, while the cost of operation was \$266,000.

Lecture by Mr. Peter Cooper Hewitt.—At a meeting of the Electrical Engineering Society of Columbia University to be held in the Engineering Societies Building, 39 West Thirty-ninth Street, Friday evening, Nov. 4, at 8:15 o'clock, Mr. Peter Cooper Hewitt will deliver a lecture on the mercury-vapor rectifier.

Gas Inquiry in Chicago.—A complete appraisal of all the properties of the People's Gas Light & Coke Company, of Chicago, will be made by experts acting for the City Council committee on gas, oil and electric light. The present rate for gas in Chicago is 85 cents, but the ordinance fixing the price will expire on Feb. 25, 1911, and the committee is endeavoring to determine before that time whether the company can afford to make a lower rate.

California Hydroelectric Development.—The extent to which the available water-power sites in California have been taken up is indicated by a recent investigation in Los Angeles which brought out the information that at every available point of the Tule River, both forks, and on the Kern River clear to the ice limits almost at Kern Lakes, every site has been filed upon by agents of hydroelectric companies. The titles to these sites are owned by either the Edison or the Huntington interests.

Jerusalem to Be Modernized.—It is said that the people of Jerusalem are fast becoming modernized, largely owing to the influx of tourists. David Yellin, who is reported to be a member of the municipality of the Holy City, is quoted in the *Jewish Chronicle* of London as saying that sanitary improvements are proceeding and that European firms have been asked to bid on electric street lighting and street railway installations, as well as a system of water works. These utilities are to be operated by private enterprise, although the municipality reserves the right to take them over after a term of years.

Nitrate Fertilizer in Japan.—A nitrate fertilizer company in Japan has two factories, one at Minamata, where calcium cyanide is made, and the other in Osaka, where sulphite of ammonia is made from the calcium carbide received from the former. The company will soon double its capital and start another factory in north Japan. The calcium carbide sold by the Jananese company always contains 17 per cent or more of nitrogen. An analysis is made at the Minamata factory, and that containing the foregoing percentage remaining unsold is sent to the Osaka factory to be converted into sulphate of [illegible] to the percentage of nitrogen contained therein, are as follows per ton: 17 per cent, \$50; 18 per cent, \$52; 19 per cent, \$55; 20 per cent, \$57.

St. Louis Section of N. E. L. A.—The St. Louis local section of the National Electric Light Association, composed of employees of the Union Electric Light & Power Company of that city, held a meeting at the headquarters of the company [illegible] department, read a paper on "Engines." This paper is preliminary to another one which will be read at a later meeting covering the most modern types of engines. Mr. T. C. Hawkins, of the Holophane Company, read a paper on "Distribution of Artificial Illumination." About 150 members were present, and after the technical program had been concluded the entertainment committee amused those present by presenting a number of moving pictures. At the next meeting it is expected that Mr. E. C. Freeze will read a paper on "Conduits and Cables."

Proposed Mississippi Waterway.—On the occasion of a recent visit to St. Louis, members of the government commission of engineers investigating the feasibility of the proposed deep waterway in the Illinois and Mississippi Rivers discussed the proposed dams in the Mississippi at Jefferson Barracks and Commerce, Mo. The former place is about eight miles south of the center of St. Louis and the latter about 140 miles south. By the construction of these dams it is believed that a 14-foot waterway could be maintained between the mouth of the Illinois and the mouth of the Ohio. Each dam would be provided with locks, of course, and the river would be operated, for navigation, like a canal. Incidentally a large water-power would be created for electrical development. The commission is investigating the character of foundations that would be necessary at the proposed dams.

Water-Power Agreement.—The Secretary of Agriculture has recently approved a new agreement allowing the development of water-power within the national forests. Provision is made for the issuance of temporary permits during a period of two years to persons wishing to develop water-power, which will protect such persons during the time necessary for making accurate surveys of the project and for collecting the data on which the final agreement will be based. The general provisions of the permanent agreement contemplate the full development of each water-power site and granting permission to use it for a period of fifty years. Clauses permit a revision of the factors on which the charge for the use of the land is based at the end of every ten years, if the passing of lands into private ownership or changes in the boundaries of the forests require it. A renewal of the agreement may be granted by application to the Secretary of Agriculture not less than two years nor more than four years before the expiration of the old agreement. Some of the leading water-power engineers and attorneys of the United States were consulted in the preparation of the new form of agreement.

Wireless Directory.—In the directory of wireless telegraph stations issued by the Bureau of Steam Engineering of the United States Navy 1520 stations are listed. The number includes shore stations and ships, but does not take into consideration the warships of foreign governments, nor are there listed the hundreds of stations equipped and operated by amateurs, which are the cause of considerable annoyance to the regular stations. There are given first the wireless telegraph shore stations throughout the entire world, according to country, giving call letters, wave length, power, range and character of station. There are about 700 of these shore stations scattered about the globe. Of this number 88 are on the Atlantic and Gulf Coasts of the United States, 3 in the interior, 48 on the Great Lakes, 51 on the Pacific Coast and 16 in Alaska. A separate list shows the 47 shore stations of the United States Navy and another the 344 ships of the navy. The stations of the United States Army are listed separately, showing 30 land stations and 16 stations aboard vessels of that service. In the list of merchant vessels, such as steamships, tugs, yachts, etc., 821 stations are listed. The vessels' call letters and owners, and the apparatus' wave length, power and range in miles are noted. These vessels are scattered over the entire world. As an index, the final list contains the call letters of every station, arranged alphabetically. From this operators can distinguish the name of ship or station calling.

Chicago Convention of the Illuminating Engineering Society.—The Chicago Chamber of Commerce has extended to the Illuminating Engineering Society an invitation to hold its annual convention in that city in 1911.

Denver Club Meeting.—Before 128 members Mr. Wilton Lackaye gave a talk at the weekly lunch of the Colorado Electric Club on Oct. 27. His subject was "Electrical Properties of the Solar System," and was so entertaining that most of the members decided to see "The Battle" during Mr. Lackaye's Denver engagement.

Iron and Steel Electrical Engineers.—The Association of Iron and Steel Electrical Engineers has elected the following officers: President, Mr. L. Palmer, Pittsburgh; first vice-president, Mr. B. R. Shover, Youngstown, Ohio; second vice-president, Mr. C. W. Parkhurst, Johnstown, Pa.; treasurer, Mr. E. W. Yearsley, Philadelphia; secretary, Mr. John Farrington, Steubenville, Ohio.

Everything by Electricity.—Mr. M. Klein, of Denver, is planning a new residence area near the Country Club to have its own heating and artesian water plant, and to purchase electrical energy wholesale from the Denver Gas & Electric Company. It is planned to equip all residences in the district with special electrical circuits, to be utilized for light, cooking, water heating, vacuum cleaning, ventilation, refrigeration and the like. The details are being worked out in conjunction with the engineers of the Denver Gas & Electric Company and of the Rocky Mountain Fire Underwriters' Association.

Union Electric of St. Louis to Remove Its Headquarters.—About Dec. 1 the Union Electric Light & Power Company, of St. Louis, will remove its general offices from the building now occupied at Tenth and St. Charles Streets, which has been outgrown, to the building now under construction at the southwest corner of Twelfth and Locust Streets, which will be known as the "Union Electric Building." Here there will be a handsome display-room in addition to the offices of President Miller and his associates. An interesting feature will be a rest-room, adjoining the Shubert Theater, where patrons of the theater may lounge at their ease and at the same time inspect the most modern electrical appliances.

I. E. S. Banquet.—At the banquet of the Illuminating Engineering Society held at Hotel Belvedere, Baltimore, on Oct. 25, in connection with the annual convention of the society and the inauguration of a lecture course in illuminating engineering at the Johns Hopkins University, a prominent feature was the good-natured rivalry in college enthusiasm among the large number of graduates of the various universities. Combined with the songs and "yells" of the colleges were special references to the individuals who have contributed to the success of the society, the Cornell contingent claiming as its own three of the four past-presidents, with Johns Hopkins laying claim to the fourth past-president and the present president.

Electrical Students at Lewis Institute Night School.—The second ten-week semester of the twelfth year of Lewis Institute (Chicago) night school began Oct. 2, and by the 22d of the month a total of 1712 night students, among whom nearly 500 are taking electrical engineering, had registered. The three-year course is given in three semesters of ten weeks each in each year, students attending two or three nights each week. Besides the 507 engineering students, 365 are taking drawing and shop work, 169 mathematics and 57 chemistry. The majority of the students are of mature age and exhibit determination in their school work; and in the advanced classes many technical and college graduates are found. The night-school work is in charge of Prof. P. B. Woodworth, of the department of electrical engineering.

Meetings of the New York Electrical Society.—The New York Electrical Society has arranged for a visiting meeting to Llewellyn Park, on a date not yet set, to inspect the laboratory of Mr. Thomas A. Edison and see the Edison storage battery in process of construction. Among the lectures announced for this season, which represents the fortieth year of its existence, are the following: *The Effect of the Telephone on Modern Industrial and Social Life*, by Mr. Herbert N. Casson; *The Catskill Water Supply*, by Hon. Chas. N. Chadwick; *Electricity and the Panama Canal*, by Mr. David B. Rushmore; *Hydroelectric Development in Mexico*, by Mr. F. O. Blackwell; *The Rapid Transit Problem of New York City*, by Mr. H. St. Clair Putnam; *Wave Motion by Electricity and Other Energy*, by Dr. C. P. Steinmetz; *The Physics of Light Sources*, by Dr. E. P. Hyde; *The Relation of the Modern Incandescent Lamp to the Central Station*, by Mr. S. E. Doane.

Waterway and Water Power Agitation in Illinois.—At a political meeting in Jacksonville, Ill., on Oct. 22 Gov. Deneen placed himself on record as in favor of the immediate purchase by the State of Illinois of the available water-power sites along the route of the proposed deep waterway to be made by deepening the Des Plaines River from Lockport, Ill., to its junction with the Kankakee River to form the Illinois River, and from that point in the Illinois River to Utica, Ill. The purchase price, according to the Governor's program, is to come from the sale of bonds out of the $20,000,000 issue already approved by the people of the State. The estimated cost at the present time of the purchase of five water-power sites between Lockport and Utica is figured by the Governor's engineering advisers as something over $350,000. The Governor asserted that private interests are endeavoring to secure these water-power sites, and that the State should act promptly to obtain control.

St. Louis League of Electrical Interests.—The League of Electrical Interests of St. Louis gave a smoker on Oct. 21 at the assembly hall of the United Railways Company, on the corner of Grand and Vista Avenues. This hall is an ideal place for entertainments, being approximately 125 ft. square and having a stage, dressing-rooms, etc. It was attractively decorated with flags and bunting, and over the entrance was an electric sign, "L. of E. I.," flashed in white and red lamps. There were 150 members present, and the United Railways Company's band of fifty pieces gave a number of selections, one being the "Anvil Chorus" with spectacular electrical effects. Mr. Charles W. Brainerd, a tenor singer, pleased the audience greatly by his rendition of several songs. There were cigars, pipes and tobacco for all, and after the musical program there were a number of impromptu speeches and stories. This was followed by a buffet luncheon. The occasion was greatly enjoyed by all present, and the league has plans for several other meetings of this kind during the coming winter.

Removal of Elevated Railway Pillars for Chicago Through Street Railway Routes.—After negotiations lasting for some time the surface street-railway companies and the Northwestern Elevated Railroad Company, of Chicago, the latter owning the Union Loop, have reached an agreement, after the intervention of Mayor Busse, in relation to the removal of certain pillars supporting the elevated structure. It is desired to remove about twenty of these supports in order to permit the laying of surface tracks with suitable curves to provide for the through routes and large cars contemplated by the street-railway rehabilitation ordinances. The work will be done by the Northwestern Elevated Railroad Company, and the cost will be borne by the Chicago City Railway Company and the Chicago Railways Company, which operate the surface lines. It is estimated that the cost of removing each pillar and substituting other supports will be about $10,000, making the total expense about $200,000. The work will be done under the supervision of the Board of Supervising Engineers, Chicago Traction.

Nine-Year-Old Electric Truck.—Among the entries for the New York commercial truck run, Oct. 28 and 29, is that of a nine-year old electric truck by the Central Brewing Company, of New York. The owners state that the working record of the truck is 2600 days, with relatively small cost for repairs.

Lessons from Electrical Accidents.—In the article entitled "Lessons from Electrical Accidents," appearing on pages 797 and 798 of the issue of Oct. 6, credit for the information contained should have been accorded to Mr. Michael Longridge, chief engineer of the British Boiler & Electrical Insurance Company, Manchester, England.

Fuel from Peat.—A peat fuel plant is projected for Winnipeg (Manitoba) having a capacity of 100,000 tons per annum. Mr. L. B. Lincoln, manager of the Canada Fertilizer Company, of Montreal, has been in Winnipeg for the purpose of investigating, surveying and examining the peat deposits in that vicinity with a view to the proposed location of a plant there. The plant, if erected, will most likely be of the same type as the company has outside of Montreal, where the peat is automatically excavated from the bog, then run through a mecerating machine and finally delivered on top of the bog in the shape of pulp.

Iowa Electrical Association Convention.—During the recent Illinois State Electric Association convention at Rock Island several members of the executive committee of the Iowa State Electrical Association met and decided upon the dates and preliminary arrangements for the next convention of the Iowa Electrical Association. This is to be held at Davenport April 19, 20 and 21, 1911. Arrangements have been made for the use of the Davenport Coliseum, which has a large floor space, 90 ft. x 120 ft., free from obstructing columns, which will be used for exhibits. A sound-proof room elsewhere in the Coliseum will be available for the convention sessions. Mr. W. N. Keiser, of the Union Electric Company, Dubuque, Iowa, is secretary.

Newspaper Technics.—The battery-charging installation used by the Pennsylvania Railroad at Altoona in connection with its passenger car lighting service was described recently in one of the daily papers as follows: "The current has been transformed from alternating to direct before being stored in the batteries, and as a matter of economy in time and expense a mercury system is now used with success, and has been for several months. The transformer is a large glass case, over which glows an arc through which the current passes. It then goes through the transformer, which is filled with mercury, the metal taking up one pole of the electricity, and it comes out on the feeding wires as direct current. It is then fed to the storage batteries of the cars, which in a few hours are ready for the road."

Philadelphia N. E. L. A. Meeting.—The first meeting of the season of the Philadelphia Electric Company Section of the National Electric Light Association was held on Monday evening, Oct. 17, 1910, in the assembly room of the main office of the Philadelphia Electric Company, with 114 members and guests in attendance. Mr. Joseph D. Israel, section chairman, opened the meeting with an address in which he outlined all the work which it is hoped to accomplish during the ensuing season, particular mention being made of the work of the membership committee, which, it is hoped, will double the membership this season. Strenuous efforts are being made to encourage all company employees to become members of the association, and judging from the results thus far the prospect is very bright. The chairman then introduced the speaker of [illegible] mercial Engineering," the subject embracing every department of the company. After a brief review of the many trials of the solicitor in securing large contracts, particularly motor installations, in which all the arguments used were presented, and also the probable questions of the prospective consumer, a few concrete cases were cited in which the actual figures, showing the estimated income and the results obtained, were given; also the effect of these new installations on the station load curve. The lecture was illustrated with numerous lantern slides.

Telautographs for Automatic Telephone System.—A telautograph system will be used for transmitting and recording trouble reports from the trouble desk at the central office to the maintenance men at the various substations of the new automatic telephone system now being installed for the Illinois Tunnel Company in Chicago. Subscribers will be instructed to call a certain telephone number in case of trouble, and the clerk receiving these calls will be provided with a telautograph transmitter communicating with a receiver at each of the six automatic substations where the switching apparatus is installed. In this way the trouble reports will be received and transmitted promptly and a record left at both the central office and substation, largely eliminating the human element, which is the aim of the automatic apparatus.

Boston 1912 Electrical Exposition.—The Edison Electric Illuminating Company of Boston has leased the entire Mechanics Building, on Huntington Avenue, Boston, for the holding of a large electrical exposition during the month of October, 1912. The company plans to make the exposition the largest ever held by a central station, and has arranged for the installation of exhibits during the entire month of September, 1912, and has also provided for ample time following the conclusion of the show in October for the removal of the displays. Mr. L. D. Gibbs, superintendent of advertising, has begun to catalog for reference purposes descriptions of every appliance that uses or in any way promotes the use of electricity, together with the names of manufacturers, the points where such apparatus can be obtained, the retail price and power consumption. The company is desirous of obtaining descriptive matter covering the foregoing points, addressed to its main offices at 39 Boylston Street, Boston, in the care of the advertising department.

The A. I. E. E. Edison Medal.—The Edison Medal Association, formed by the friends and admirers of Mr. T. A. Edison to found a gold medal in the American Institute of Electrical Engineers celebrating the invention of the incandescent lamp and twenty-five years of its successful use, has just closed up its accounts. The association began its work five years ago and raised a fund of somewhat over $7,600 for the purpose. Of this account $5,000 was placed in the hands of the institute for the medal award fund. The contract for the design of the medal was made with Mr. James Earle Frazer, the well-known sculptor, who, owing to the change in the deed of gift, was called upon to make two separate designs and who received about $1,500 for his work. The medal was at first to be awarded to the best thesis submitted by students of electrical engineering, but this plan proved a failure and only one award was made to a student competing, the amount being $150 without a medal, but with a special certificate. A new deed of gift was then drawn up by which the medal is awarded for meritorious achievement in electricity, and this year Prof. Elihu Thomson was the first recipient. The other principal sums from the fund were $544 for the reduction of the medal design, for the steel dies and for a small number of bronze replicas presented to institutes and to those interested in the work. A further amount of $207 was paid for the design and reproduction of the certificate accompanying the medal, and the remainder of the fund was used up in stationery, postage and petty cash expenditures. The $5,000 fund since it was placed in the hands of the institute has grown considerably. The officers of the Edison Medal Association engaging in carrying out this work on behalf of the subscribers and representing them with the institute and with the institute Edison Medal Committee have been: Mr. Samuel Insull, president of the association; Mr. Frank S. Hastings, treasurer, and Mr. T. C. Martin, secretary, by whom the accounts have been balanced and verified.

INTERCONNECTED MASSACHUSETTS GENERATING PLANTS.

System and Operating Features of the Greenfield Electric Light & Power Company.

A SUGGESTIVE example of the co-ordination of water-power and steam-power in central-station service is afforded by the system of the Greenfield Electric Light & Power Company, of Greenfield, Mass. Although the communities supplied with energy by the company are of moderate

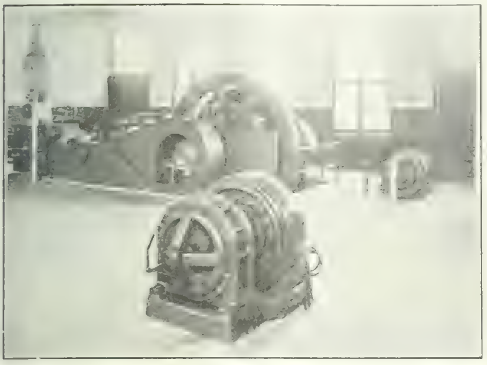


Fig. 1—500-kw Engine-Driven Generator and Exciters.

population, the area of the territory served and the location of generating and distributing installations combine to form an engineering situation of considerable interest. The demands upon the company embrace the supply of electricity for traction purposes in addition to the usual lighting and motor service in residential and industrial fields. The sphere of influence of the company is of more than local extent, and the combination of a progressive commercial policy with a skilful technical administration has established the business upon a thoroughly satisfactory basis.

The company now serves the towns of Greenfield, Shelburne Falls, Old Deerfield, including East Deerfield and Buckland; the total population of its territory being about 15,000 persons. Within the past year the company has purchased the plant and business of the Shelburne Falls Electric Light & Power Company, and it is now engaged in co-ordinating the equipment into a single effective generating and distributing system. Greenfield and Shelburne Falls are prosperous manufacturing communities, and the company is keenly alive to the advantages of establishing an electric power load in all parts of its

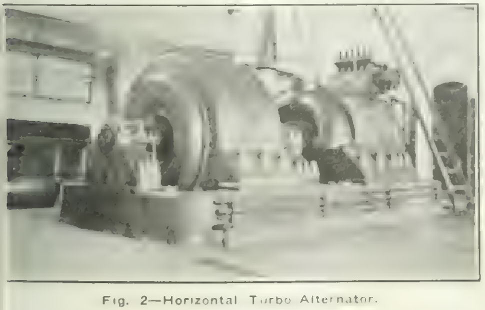


Fig. 2—Horizontal Turbo Alternator.

territory. Motors are in operation in machine, carpenter, woodworking, pocketbook, underwear, cutlery, box, pattern and tool shops, in stone-crushing plants, laundries, brick yards, grinding plants, pumping and many other industries which have an integrated energy [illegible] load factor of the generating equipment, and which provide about one-half the company's total annual income.

The operating headquarters of the system are at Greenfield, where the company maintains an auxiliary steam plant and a transformer substation for local distribution in the lighting, industrial and railway fields. From the Greenfield station three 10,000-volt transmission lines are run respectively to Turners Falls, Shelburne Falls and Hadley. The generating capacity of the auxiliary steam plant at Greenfield is about 2000 kw. At Turners Falls the company utilizes generators rated at a total of 1000 kw, and at Shelburne Falls an 800-kw installation is available. The power derived from Turners Falls and Shelburne Falls is hydroelectric, and the company utilizes this as far as possible without running its steam plant at Greenfield.

The three-phase transmission lines between Greenfield and the above points are independent of one another. The Shelburne Falls line is eight miles in length and is of No. 1 copper. The Turners Falls line is of No. 3 copper, and is 3.5 miles long. The line to Hadley is 19.5 miles long, and is a No. 4 copper circuit, being used exclusively for the supply of energy to a 480-kw motor-generator substation of the Connecticut Valley Street Railway Company. Electric railway distribution in the Greenfield district is from a rotary converter substation established in the Greenfield generating station. A storage-battery installation is also in service at Greenfield for the purpose of regulating the supply of energy to the railway. The total generating capacity of the company is approximately 4000 kw, including water-driven and steam-driven machinery.

On account of recent improvements in its equipment and arrangement the auxiliary steam plant at Greenfield is in con-

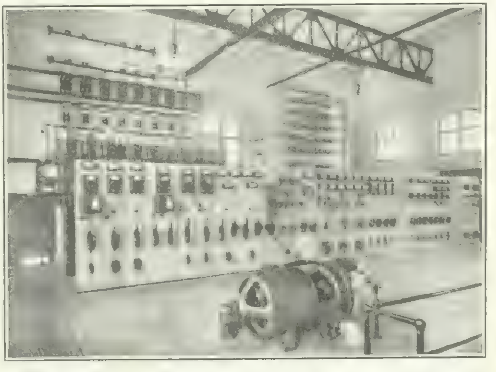


Fig. 3—High and Low-Tension Switchboard.

dition to meet any anticipated emergency demands upon the system. This station now contains two direct-connected and two belted generating units, and a modernized boiler plant with an economical coal-handling installation. The coal supply is received by rail, the plant being located below the Fitchburg division tracks of the Boston & Maine Railroad near the center of the town. Formerly all the fuel was carted to the station at a cost of about 40 cents per ton. By the installation of a coal trestle about 200 ft. long and a conveyor equipment driven by a 7.5-hp, 220-volt induction motor the fuel is now delivered at the boiler-room door at a cost of less than 5 cents per ton. The company burned last year about 760 tons of bituminous coal, the average cost of fuel being about $4.68. The supply of water at the hydroelectric plants is sufficient to enable the Greenfield steam-generating machinery to be shut down about eight months per year.

The steam-generating equipment at Greenfield consists of one 600-hp Stirling and three 250-hp Hazleton boilers, hand-fired. The present boiler house was erected during the past summer on the site of the old installation, the latter having reached a stage of dilapidation. A run of back water per-

[illegible] generating point of view. The new boiler house is built of brick, and is of heavy mill construction, with a concrete roof. Space has been left for the installation of two additional 400-hp boiler units, and one of these will probably be installed before next spring. During the period of reconstruction one boiler was kept in readiness for service at all times. When the [illegible]

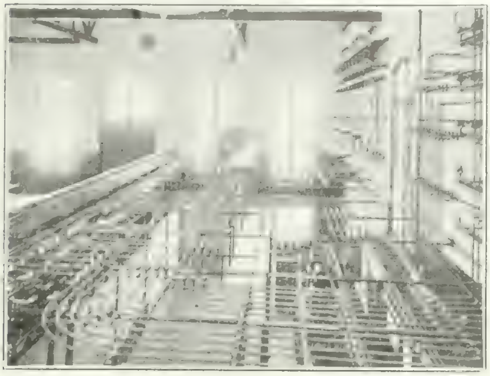


Fig. 4—Rear of Switchboard, Showing Outgoing and Incoming Lines.

naces and a system of fixed pipes and nozzles for soot blowing. The emission of black smoke has been almost entirely eliminated. Each boiler is provided with an individual stack, that on the Stirling unit being 133 ft. high and 5 ft. in diameter, and the other three are each 62 ft. high and 3 ft. 6 in. in diameter. Steam is delivered to the prime movers at 130 lb. pressure, condensing water being supplied from a small pond located at the sides of the station and having a capacity of about 1,500,000 gal.

The station now contains a 500-kw, three-phase General Electric alternator of the revolving field type, wound for 2300 volts, and direct-driven by an 18-in x 36-in. x 36-in. horizontal cross-compound McIntosh & Seymour engine; a 937-kva horizontal Curtis turbo-alternator wound for 2300 volts, and two 400-kw alternators, belt-driven, in an older section of the station, by Harris and Russell engines. One of the 400-kw machines is run as a synchronous motor a large part of the time for its effect on the station power-factor. The latter can be raised from 60 per cent to practically unity by the absorption of about 35 kw in the synchronous condenser. All the engines in the plant are of the condensing type, and the turbine is equipped with an Alberger jet condenser.

The energy supply from Shelburne Falls is furnished by two 400-kw, 10,000-volt, waterwheel-driven generators, running upon a head of 37 ft. provided by the Deerfield River. The old Shelburne Falls company operated a 90-kw installation within that town, an 1100-volt service being supplied. This old station will give way to the modernized service from the Greenfield company's system as soon as possible. At Turners Falls the water supply is controlled by the Turners Falls Power Company, which there utilizes the flow of the Connecticut River for hydroelectric transmission to Greenfield, Northampton, Easthampton and Amherst.

The 10,000-volt service received from the hydroelectric plants [illegible] transformers, one bank consisting of three single-phase, oil-cooled units of 250-kw rating, and the other of three 300-kw, air-blast, single-phase outfits, all the service being delivered and utilized at a frequency of 60 cycles. The air-blast transformers are cooled by two blower sets, each consisting of a 2-hp, 220 volt, three-phase fan motor, either being capable of supplying air to three transformers. A convenience for charging the sparking batteries of automobiles has been provided by belting a 12-volt, 30-amp, direct-current generator to one of the blower motors. The cost of operating this charging generator under such circumstances is practically nil.

The station wiring is arranged so that the Turners Falls and Shelburne Falls lines can be operated in multiple if desired or run on separate sections of the 10,000-volt station buses. Energy is supplied to the Hadley substation line without potential transformation or phase-alteration. Tirrill regulators are in-[illegible] station, and at the Turners Falls end of the line a three-phase, 2300-volt induction regulator is installed, the range being 10 per cent up or down, and this regulator automatically compensates for line drop and maintains the potential at the receiving end of the line within 2 per cent of normal. The 2300-volt busbars in the Greenfield station are divided into two sections, and either alternator or set of step-down transformers can be run on either bus section. Double-throw oil switches provide for these changes as needed.

The 2300-volt outgoing feeder lines at Greenfield are carried on insulators supported on wrought-iron pipe framework behind the switchboard, which is of the usual type, with twenty-four panels installed on the engine-room floor facing the generating units. The outgoing feeders are carried through the station wall from insulators supported on angle-iron horizontals, the feeder lightning arresters being mounted on the walls just below where the lines leave the building. The 10,000-volt incoming lines are equipped with lightning arresters on the opposite end of the wall behind the switchboard, and the regularity of the wiring and freedom of access available are unusual. From the lightning arresters the 10,000-volt lines are carried to oil switch cells behind the panels through appropriate conduit and potheads. The transformer installation is located in the basement directly below the switching area. In the station are installed five automatic motor-driven General Electric feeder regulators for controlling the lighting-circuit potential. The range is 10 per cent above and below normal, and these regulators maintain the voltage at a selected point on the distribution system within 2 per cent of normal. Each lighting circuit is provided with a compensated voltmeter connection and Bristol recorders are used to follow the potential which is maintained on the distribution system. Charts from

Fig. 5—Transformers, Rectifiers and Regulators.

these are taken daily and after examination by the superintendent are filed at the station. These regulators are all installed at the rear of the switchboard near the oil switch cells. When the steam plant is shut down the regulators at the hydroelectric stations maintain the desired steadiness of voltage at Greenfield.

In addition to the railway supply the station at Greenfield delivers for service 2300-volt, single-phase and three-phase current for general lighting and industrial uses. Each circuit is equipped with an indicating wattmeter and a watt-hour meter. The local street lighting requires eighty magnetite arc lamps of the 4-amp size, these being the first installed in Massachu-

setts. There are also about 100 60-cp tungstens in service. Direct current for the use of the magnetite arcs is obtained by the installation of mercury rectifiers in circuit with constant-current transformers.

An unusual feature of the Greenfield service is the use of a storage-battery and booster equipment to control the effects of railway load fluctuations on the alternating-current side of the system, in order to enable the lighting company to handle this service more efficiently and economically. The battery is housed in a small wooden building outside the main station, and 288

Fig. 6—Oil Switches and Feeder-Wire Framework.

cells are provided, the Electric Storage Battery Company, of Philadelphia, having supplied the installation, including a carbon regulator. The battery is connected across the direct-current busbars of the railway system, and is controlled by the regulating apparatus, which in turn is operated through a series transformer placed in the railway alternating-current line. In case a momentary demand for energy in large quantity falls upon the Hadley substation, it is supplied by the battery in the following manner: the effective voltage of the battery is increased automatically by the regulating apparatus until the rotary installation at Greenfield inverts, and thus furnishes the Hadley transmission line with an extra volume of alternating current, instead of allowing the whole demand to fall upon a water-power plant of the railway company located at Millers Falls. Under these conditions the local direct-current load at Greenfield for railway service is supplied by the battery. The inversion of the rotary at Greenfield, however, is relatively infrequent, because ordinarily the taking up of a portion of the direct-current load at Greenfield by the storage battery is sufficient to compensate for the increase in the load at the Hadley substation. In case the load at Hadley falls off the battery helps to maintain a normal demand on the power station by absorbing a charge equal to the falling off in load. The carbon regulator controls the field coils of a small motor-generator set which in turn excites the field coils of the booster. The booster consists of a direct-current machine driven by an induction motor, and is so connected that it receives through its armature all the current which passes in or out of the storage battery.

The normal method of operating the station is to parallel the two 10,000-volt lines at the Greenfield bus, and when occasion demands to run one or more steam-plant units in parallel with either or both the 10,000-volt lines. The average load on the station for a twelve-hour day, including the railway, is from 100 kw to 1200 kw, and for a twenty-four-hour day it is from [illegible] to 800 k[illegible] [illegible] 00 kw. The momentary peaks on the combined loads are normally from 1500 kw to 1600 kw, with an occasional rise to 1800 kw in case of a sudden storm or rush of holiday traffic. The total losses on all the lines amount to between 10 per cent and 15 per cent. The company has expended considerable money in providing the [illegible] town with lightning arresters, and the results have been very satisfactory. All the company's power plants operate [illegible] eight-hour shifts. The railway load averages from 500 kw to 750 kw normally.

The company's connected load on June 30, 1910, was:

[illegible]	
[illegible]	22 [illegible]
[illegible]	1[illegible] 01
[illegible]	[illegible] 69
[illegible]	[illegible] 10
Commercial incandescents, tungstens	310.48
Total connected lighting load	1113.30 kw
Motor load, connected, commercial motors (336)	1312.59
Motor load, street railway apparatus	980.00
Total connected load	3405.89 kw

The company's total output at the switchboard for the year ended June 30, 1910, was 5,242,224 kw-hours. The company sold for street lighting during the year 141,448 kw-hours; for lighting by meter service, 311,781 kw-hours; for contract lighting, 15,592 kw-hours, estimated; for industrial motors, 962,862 kw-hours, and to street railway consumers, 2,811,630 kw-hours. The company used 39,790 kw-hours in its auxiliary and own lighting service, and the total energy accounted for amounted to 4,283,103 kw-hours, leaving 959,121 kw-hours unaccounted for. The maximum station load during that period was 1400 kw, occurring Dec. 13, 1909, at 6 p. m., and the maximum load on the day of least output was 590 kw, the date being May 8, 1910, at 8 p. m. The energy sold to the Connecticut Valley Street Railway Company was measured and delivered at the Greenfield station. From the Turners Falls company the Greenfield company purchased 1,795,145 kw-hours, at a cost of $8,975.73, measured at the hydroelectric station. The Greenfield company bears in addition the line losses and the annual charges upon the transmission system, including maintenance.

The company's return to the State shows that its total income for the year was $111,893.75, the larger items being: Sale of energy to railways, $39,385.08; energy for industrial purposes, $23,994.17; commercial arc and incandescent lighting, $38,373.06.

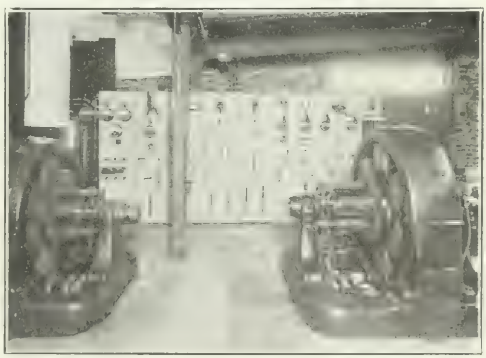


Fig. 7—Railway Switchboard and Rotary Converters

including service charges. The operating expenses for the [illegible] were:

[illegible]	[illegible] 10
Purchased electricity @ 0.5 cent per kw-hour	[illegible]
[illegible]	[illegible]
[illegible]	8,461 [illegible]
[illegible]	[illegible]
[illegible] legal claims, etc	[illegible]
[illegible]	[illegible]

The company declared dividends of 6 per cent on its capital, the amount disbursed being $19,500. An allowance of $18,000 was made for depreciation, $6,536.65 being assigned to the steam plant and $11,436.35 to the electric plant. The total investment in the physical plant on June 30 last was $463,083.22, or about $163 per kilowatt of generating capacity owned by the company June 30, 1910, the latter being then 2850 kw. The

larger items were: Water-power plant, $154,463; steam plant, $83,382; overhead lines, $79,950, and electric plant, $60,111.

The company's 10,000-volt lines are carried on 35-ft. chestnut poles. Its distribution system includes 1,195,444 ft. of wire, subdivided as follows: Municipal arcs, 133,800 ft.; municipal incandescents, 22,645 ft.; commercial primaries, 226,732 ft.; commercial secondaries, 226,215 ft.; transmission lines, 325,659 ft.; power primaries, 235,510 ft.; power secondaries, 24,882 ft. There are 2467 poles in service. The transformer equipment on the distribution system includes 286 outfits, the most common size being 1 kw. The number of meters now in use is 1119. The street-lighting service averaged 3898 hours burning last year, and the company used 1446 electrodes. The rate for street-lighting service is $78 per arc lamp per year, and for 60-cp lamps at Greenfield, $24 per lamp-year.

The company's prices for electric energy for lamp circuits vary from 15 cents to 8 cents per kw-hour, according to the consumption, with a discount of 10 per cent for a ten-day cash payment on all bills in excess of $1.65 per month. For amounts under 75 kw-hours per month the rate is 15 cents, and over 600 kw-hours, 8 cents. For motor circuits the rates range from 6 cents per kw-hour, with a monthly total of less than 100 kw-hours, to 1.8 cents for over 10,000 kw-hours per month. The minimum monthly bill on the motor service is $1.50 up

Fig. 8—Factory Transformer House.

to and including 3 hp, and on installations of more than 3 hp the minimum is 50 cents per horse-power connected per month. Electric sign and window lighting are handled on the following flat-rate basis: 60-watt tungsten lamp, 60 cents per lamp per month; 100-watt tungsten lamp, 90 cents per lamp per month; 5-watt, 11-volt sign lamp, tungsten, 7 cents to 7.5 cents per lamp per month. These lamps are extinguished at 10:30 p. m., and are not burned on Sundays. The company reduced its prices for arc-lamp service from $87.50 to $78 during the year, and the rate on public incandescents was changed from $29 for 40-cp units to $24 for 60-cp lamps. Carbon and graphitized filament lamps are renewed free by the company, the customer paying for initial and renewal installations of tungstens.

The company maintains an attractive office and display room on Federal Street, Greenfield, and has been successful in introducing appliances of diverse types. Occasionally some current-consuming article is placed in the window and a card attached stating that the price will be reduced daily until the device is sold. Popular interest is keen in this policy. Electric signs are purchased by customers and installed free by the company. The company wires buildings at cost, and practically all the mercantile windows in town are equipped with tungsten lamp advertising. Besides supplying energy for lamps and motors the company has over 300 electric flatirons on its lines, as well as glue-pots, water-heaters and cooking apparatus, including one 40-gal. water-heating tank and a 20-kw drying oven for drying japan on metal work. An electric oil-tempering bath, consuming 3000 watts, is in service at the regular motor rate. Two houses are completely equipped for electric cooking. The company's earnings have been nearly doubled in the past three years, and close personal relations are maintained with customers in order to keep the service at the highest possible standard. The company has constantly striven to give good regulation on its lines, and has expended money liberally to this end, so that the results are excellent in spite of the variations in the load and its diverse character.

In connection with the purchase of the Shelburne Falls property the company is planning to reconstruct the entire distributing system in the towns of Shelburne Falls and Buckland, spending about $46,000 on improvements. The Shelburne Falls company was owned by the partnership of Messrs E. J. Halligan and C. H. Wilcox, and the Greenfield company acquired the system on Sept. 1. The Shelburne Falls company earned about $7,300 a year, and had ninety-five customers in Shelburne Falls and twenty-five in Buckland. When taking over the property the Greenfield company issued a statement to the people of the Shelburne Falls district pointing out that the new management would supply twenty-four-hour service and the Greenfield rates were to apply throughout the entire district. An illuminating engineer has been sent into the territory by the company to facilitate modernized house and store lighting, and special efforts are being made to secure residence customers. Out of 1941 residences in the town of Greenfield there are approximately 675 wired and using electricity. A display room will be opened in Shelburne Falls in the near future for the special sale of appliances.

DATA OF PLANT OPERATION, GREENFIELD, 1910

Kw-hours delivered at bus-bars	5,242,223
sold, total	4,101,865
Percentage of output sold	78.3
Kw-hours sold, electric railway service	2,811,630
industrial motor service	962,862
commercial lighting	327,373
municipal lighting	141,448
Total income	$111,893.75
Earnings from electric railway energy sales	$39,385.08
industrial energy sales	$23,994.17
commercial lighting	$38,373.06
street lighting	$8,824.26
Total cost of physical plant	$463,083.22
Cost of overhead lines	$79,949.78
transformer	$19,620.05
meter	$16,077.03
Kw rating of generating equipments, June 30	2,850
Operating expenses (incl. legal, taxes, mfg., distribution)	$60,709.59
Connected load in kw	3,406
Total number of residences	1,941
Number of residences wired	675
Average total earnings per kw-hour sold, cents	2.72
Average earnings per kw-hour sales for motor uses, cents	1.68
" " " " " to electric railway, cents	1.4
" " " " " for industrial motors, cents	2.5
" " " " " for commercial lighting, cents	11.7
" " " " " for street lighting, cents	6.3
Total cost of plant per kw of station generating capacity	$163.00
Average income per kw of industrial motor load connected per year	$18.20
Population served (census of 1905)	11,268
Total liabilities per kw station capacity	$176.00
Gross yearly income per kw station capacity	$39.20
Per cent of gross yearly income expended for operation	64.5
Yearly operating expenses per $100 liabilities	$12.1
Average income per consumer (897 customers)	$124.5
Total connected load in kw per kw station capacity	1.2
all motors (kw) per kw station capacity	0.4
Kw-hours sold per 100 kw-hours generated and delivered at bus	78.5
Yearly load factor (average load divided by maximum), per cent	42.8
Gross yearly income per capita	$9.90
Investment per capita	$41.30
Watts station capacity per capita	253.00
Number consumers per 100 of population	8.00

A noteworthy feature of the company's motor service is the installation of concrete transformer houses. A typical house is located on the premises of the Goodell-Pratt Company, a prominent maker of mechanics' tools. This establishment has thirty-three motors in service, and the transformers for the service are placed in a 10-ft. x 10-ft. x 14-ft. house, with 7-in. walls and good drainage, the cost of the house being about $200. Pipe framing 1¼ in. in diameter is used to support the interior oil switch equipment, and there are one 15-kw and three 30-kw transformers in the building. This arrangement adds much to the safety and convenience of the service, as fuses can be replaced with little loss of time, and the locking of the building and use of iron conduit in the factory, with a separate concrete meter and switch room for departmental subdivision of energy costs, leave no room for the usual possibilities of interference and accident. The foundry of the foregoing establishment is one of the most complete in Central New England, and all the tools are driven by direct-connected

motors, including a stack blower, heating fan, core sand mixer, mills, dust exhausters and grinders. The foundry proper is effectively lighted by a single 500-watt regenerative flame-arc lamp, the dimensions of the pouring room being 120 ft. x 40 ft., with the lamp 35 ft. above the floor.

A summary of recent data bearing upon the company's operations is given in the table on the preeding page.

The officers of the company are: President, Mr. Joseph W. Stevens; clerk, Mr. Charles H. Keith; treasurer and superintendent, Mr. George W. Lawrence, all of Greenfield. The directors are: Messrs. Joseph W. Stevens, Charles C. Dyer, Frank O. Wells and William B. Allen, Greenfield; and Philip Cabot, Boston; Winthrop Coffin, Brookline, and John J. Mackintosh, Holyoke, Mass.

LOW-HEAD WATER POWER AT MANHATTAN, KAN

On July 8 last the Rocky Ford Milling & Power Company started up its 800-kw hydroelectric generating station, utilizing a 13-ft. fall in the Blue River, in north-central Kansas, and transmitting electrical energy into the City of Manhattan, three miles distant. At the Rocky Ford, where the new plant is located, a government gaging station has demonstrated that the stream flow during a number of years has never diminished beyond a minimum of 535 cu. ft. per second. For forty-three years an old four-story stone mill structure occupied this site, and when demolished to make way for the present development furnished a large part of the material which went into the new power house. The station building is of concrete, and has a floor area of 21 ft. x 54 ft.

The former wooden dam has been replaced by one of concrete, extending 283 ft. across the stream and having an arch of 12 ft. upstream. The dam is 14 ft. 4 in. high, and is carried on a 14-ft. base seated on bed-rock. The stratum runs thin just below the dam, however, and to guard against wear of this rock by the discharged water, a [illegible] ft. thick has been added to break the falling force of the spill. Along the crest of the dam, at [illegible] intervals, vertical pieces of 2-in. pipe, 15 in. in length, have been cast flush with the concrete. By inserting suitable flash-board standards in the dockets formed by these pipes, a simple and effective method is provided for supporting boards used to raise the effective level of the dam.

Fig. 1—Tail Gate and Spillway of Rocky Ford Hydroelectric Plant.

Protecting the entrance to the head race, 60 ft. wide, which leads 140 ft. downstream to the power house, is a floating timber log-boom which can be adjusted to the height of the water level at the dam, with varying floods. The trash racks are of ¼-in. steel section, 3½ in. wide, and 18 ft. long, and are separated by distances of 2 in. These rocks are mounted at an angle of 45 deg., so that all entrained material is effectively floated to the surface. For controlling the amount of water entering the penstocks, planks can be inserted between the rack-bars, entirely closing the inlet if desired.

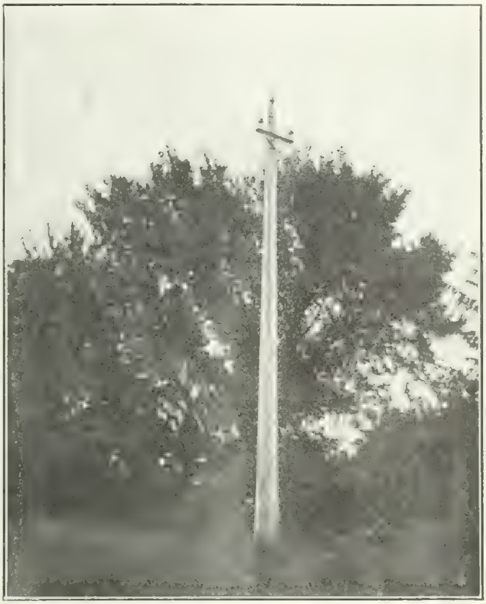


Fig. 2—Reinforced Concrete Pole for Transmission Lines.

The generating equipment compries two 400-kw, three-phase, 60-cycle, 6600-volt Allis-Chalmers alternators, driven by Leffel pressure turbines. The speed is controlled by a Woodward mechanical governor, and the voltage is automatically adjusted by a Tirrill regulator. Westinghouse electrolytic lightning arresters are used. The output of the station is transmitted at generator pressure, 6600 volts, over three miles of concrete-pole transmission line on leased right of way, to the City of Manhattan, where it is purchased by the local electric company for re-sale among its customers.

The concrete poles used in this transmission are 35 ft. in height, tapering from 15 in. in diameter at the base to 6 in. at the top. They are reinforced by four ¾-in. twisted steel rods running through the entire length of the pole, besides an 18-ft. boiler-tube inserted from the base of each pole for additional stiffening. The cross-arms are 4 x 4-in. angle-irons with ⅛-in. webs, each weighing 35 lb., which are braced to the pole by 1¼ x 1¼-in. angle sections. The poles are set at intervals of 260 ft., and carry three No. 1 copper conductors on 13,000-volt insulators.

The Manhattan Light, Ice & Power Company, which is the local distributor of electricity among the 1100 customers in the town of 7000, maintains its steam-generating station for use as an auxiliary in case of high water or accident to the hydro-electric plant. The equipment at the steam station comprises

one 300-kw Westinghouse steam turbine set and one 200-kw and one 100-kw Corliss engine-driven alternator.

The generating company does not sell outright its output to the distributing company, but accepts as its payment for producing the energy a fixed proportion of the amount paid by the consumer, at his prevailing rate. By this arrangement the distributing company pays all the charges for distributing, selling, metering, billing and other local expenses, while the generating company merely produces the energy and delivers it to the Manhattan substation.

The prevailing rate at which electrical energy is sold is about 12½ cents per kw-hour, with discounts for prompt payment. Among the industrial installations served with electricity are two grist mills, having 150 and 130 hp of motors installed, respectively; a cold storage plant with 60 hp, an alfalfa mill with 75 hp, and a planing mill with 40 hp.

About $85,000 has been expended in the construction and equipment of the water-power plant by the Rocky Ford Milling and Power Company. Dr. C. K. Raber is president of the company, and Mr. H. Pierce is secretary and treasurer. The design and construction of the dam and power house were carried out by the officers of the company without professional engineering assistance.

THE BOILERLESS STEAM CENTRAL STATION AT KENOSHA, WIS.

Several useful suggestions for the supply of twenty-four-hour service by central-station companies in towns where factory power plants are located may be gained from the experience of the Kenosha Electric Railway Company, which, from its modern, but boilerless, generating station, supplies energy for lighting and railway purposes at Kenosha, Wis.

The plant of this company obtains its steam from the nearby boiler house of the Simmons Manufacturing Company, operating its turbine generating equipment during fourteen hours of the day and night, and purchases electrical energy from the Simmons plant for distribution to its customers during the remaining ten hours of the working day.

The interests controlling the electric company and the manufacturing concern are entirely independent, and this arrangement of co-operation between the factory power plant and the electric company's new generating station was instituted only

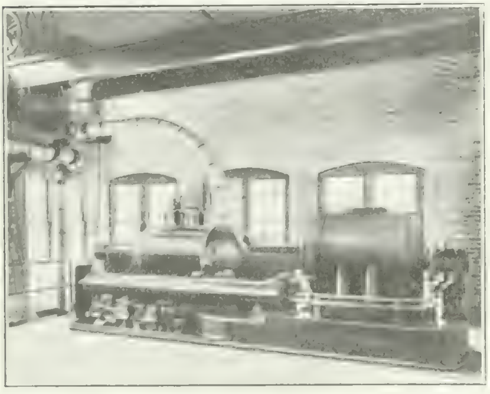


Fig. 1—Turbine Generator in Kenosha Power House.

to take advantage of the unused steam and electrical generating capacity of the factory plant, at the same time providing a most flexible means of interchanging service which is very satisfactory to both parties. When it is necessary to operate one or two departments of the factory overtime the Simmons company purchases energy from the electric company, without being put to the trouble and expense of keeping its own large units running; and it also has at all times the benefit of the lighting and standby service supplied by the central station.

The Simmons Manufacturing Company is one of the largest makers of brass bedsteads in this country, and in its great Kenosha factory employs about 6000 people. Motor drive is used throughout the plant, and one of the interesting uses of electricity is that of baking the lacquer on the polished tube

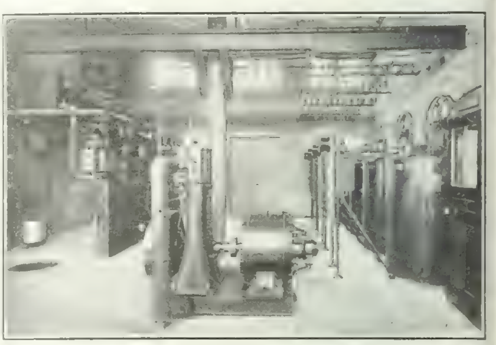


Fig. 2—Switchboard, Exciter and City Arc Rectifier in Kenosha Power Plant.

parts by traversing them with low-voltage current from the secondary terminals of a step-down transformer.

The main generating unit in the Simmons plant is a 1000-kw, 480-volt, three-phase, 60-cycle alternator, driven by a Corliss cross-compound engine. Besides the induction-motor lines to various parts of the factory one circuit of three No. 2-0 wires is led out of the Simmons plant, and across the 40 ft. of intervening space to a bank of three 200-kw, single-phase transformers in the Kenosha Electric Railway Company's station. As shown in the accompanying diagram, 370-volt taps are taken off from the primary side of these transformers for operating the 200-kw, 60-cycle Westinghouse rotary converter which delivers 600-volt, direct-current energy for the local street car lines, operating nine single-truck, two-motor cars. From the 2300-volt side of the transformers the station buses are connected through oil-switches to the turbine-generator armature, the commercial lighting and motor circuits, and rectifier outfits for the 190 Westinghouse metallic-flame arc lamps with which the streets of Kenosha are lighted. The 300-kw turbine-alternator is of the Allis-Chalmers-Parsons type, and runs at 3600 r.p.m., delivering 2300-volt, 60-cycle, three-phase energy into the station buses during about fourteen hours of the twenty-four, when energy is not being received from the Simmons plant. Excitation is furnished by a 10-kw Allis-Chalmers direct-current generator driven by an American Blower Company engine. Both the turbine and the exciter set receive steam at 125 lb. per square inch from the Simmons boilers through a 10-in. header, covered, where it crosses the 40-ft. court between the boiler house and generator station, by a 3-in. layer of asbestos, which is protected by metal sheeting, so that condensation is reduced to a minimum. The turbine exhausts into a 12-in. Tomlinson barometric condenser.

The control of the transformer, switches, turbine-generator leads, service lines and the four Westinghouse constant-current arc-rectifying outfits is centered in a six-panel marble switchboard at the west end of the generator room. This board comprises two 2300-volt panels, one exciter panel, one rotary-converter panel and the two series arc panels, besides a Tirrill regulator mounted on a swinging bracket at the left of the board. Besides the usual complement of indicating instruments, recording watt-hour meters are inserted in the station bus lines as shown at *A*, *B* and *C* in the accompanying sketch. The meter at *A* is of the regular station type, but is equipped with a ratchet inserted between its moving element and the registering train, so that only rotation of the armature corresponding to a flow of energy out of the station and into

the Simmons plant is recorded, as indicated by the arrow. By arrangement with the Simmons company the central station pays for its steam on a kw-hour basis, measuring the output of its own generator and adding this to the quantity actually delivered as electrical energy by the engine-driven factory plant. Meters *C* and *B* are of the ordinary type, one measuring the 660-volt railway output and the other the 2300-volt lighting output. The sum of their two readings thus gives the number of kw-hours on which the purchase of steam and electrical energy is figured, and against this is credited the reading from meter *A*, which represents the energy supplied by the electric company to the factory.

As commonly operated the factory engine-driven plant is running during the ten hours of the working day. The turbine-

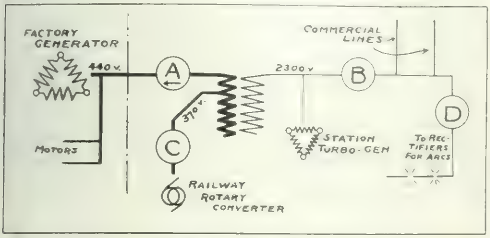


Fig. 3—Arrangement of Meters and Apparatus in System of Kenosha Electric Railway Company.

generator is started up in ample time to take the evening peak of the combined lighting and railway load and ordinarily runs throughout the night until the engine is again running. This arrangement is extremely flexible, as each station enjoys the auxiliary assistance of the other, and in case of light loads or overtime the factory plant need not be run under inefficient conditions. Only one man is required to handle the electric company's generating station, two being employed on twelve-hour shifts, and all the annoyances of a boiler plant are avoided.

The generating station building is of yellow brick, one story high, with a reinforced concrete roof. A five-ton hand-operated crane serves the various pieces of generating and converting machinery. This station was started in operation in August, 1909, the plans being formulated, contracts drawn, building erected, and machines installed complete in sixty days. Mr. S. A. Loughridge is general manager of the Kenosha Electric Railway Company, and Mr. L. A. Pease is electrical engineer.

OFFICE BUILDING POWER PLANT.

The sub-basement power plant of the new McCormick office building, Chicago, exemplifies how proper space allowances can be made in building plans for the important functions which the electrical, steam, hydraulic and compressed-air equipment must discharge in an isolated station of this kind. The building, recently constructed, is a 20-story structure fronting 101 ft. on Michigan Avenue and running back 172 ft. on Van Buren Street. The engine-room, 64 x 80 ft., with a 15-ft. ceiling, occupies the central part of the second basement, two stories below the street level. Behind the engine-room and on the third sub-story level is the boiler-room, whose 28-ft. ceiling is on a level with that of the engine-room.

Coal discharged from wagons in the alley behind the building is delivered by gravity chutes to the concrete-and-steel bunkers, which have a capacity of 260 tons. From these bunkers the coal is again discharged by gravity onto the McKenzie chain stokers serving the three 250-hp Heine boilers, so that in its course from wagons to fire-grates the fuel is delivered without other means of conveyance than gravity. Each chain-grate is individually driven by a ½-hp, 110-volt motor, arranged with a throw-over switch, so that when necessary to speed up the operation of the [illegible] be accelerated by connecting it [illegible]. The motor guarantee provides for successful operation under this rigorous treatment, and the grates are sometimes operated at high speed for several hours in succession. The boiler-feed pumps and auxiliaries are all steam-driven. Steam from the boilers is delivered to a 12-in. main header, from which 6-in. and 8-in. lines lead to the various engines and pumps on the engine-room floor.

The mechanical equipment of the engine-room has been divided into two sections, all the electrical generators being

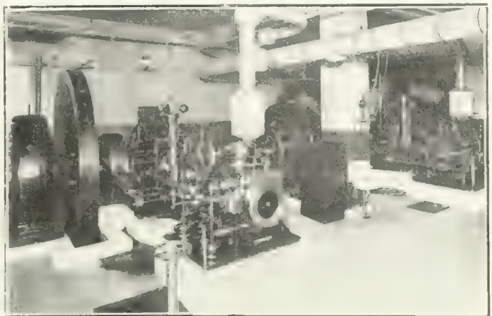


Fig. 1—Generating Units.

installed in the south half of the room, while the elevator pumps, house pumps, air compressors and auxiliary machinery occupy the north half. At the east end of the broad aisle running between the two groups of machinery is the electrical switchboard, while at the opposite end are the various pressure gages.

The three engine-driven, direct-current, generating units, of 250, 175 and 100 kw each, respectively, are composed of Filer & Stowell heavy-duty Corliss engines driving Crocker-Wheeler 220-volt direct-current generators. By this choice of capacities of the generating apparatus, units are provided of one-third

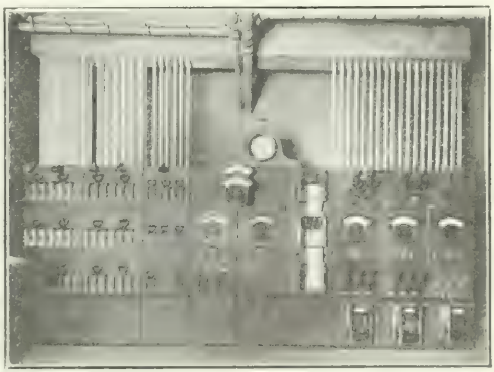


Fig. 2—Switchboard.

and two-thirds the full-load demand in the station, making one set always available for operation under most favorable conditions of load and efficiency. The switchboard, constructed by Kohler Brothers, Chicago, comprises the three generator panels, complete with circuit-breakers, ammeters and watthour meters; a recording meter panel containing a Westinghouse graphic voltmeter and Westinghouse graphic ammeters on the lighting and power circuits; two compensating panels, and three lighting panels. The indicating voltmeters are mounted on swinging brackets. To the right of the switchboard are installed the two Crocker-Wheeler compensators, one 50-amp and one 100-amp set.

For supplying compressed air to the thermostat valves used to control the room temperatures automatically two 4-hp motor-driven compressors are installed. Compressed air for the use of tenants and for various purposes throughout the building is furnished by a 12-hp motor-driven pump.

The advisability of installing a vacuum cleaning system throughout the building, exhausted by pumps in the basement, was studied carefully before the building was erected. It appeared, however, that the present equipment of three large, portable Duntley cleaners, driven by individual ¾-hp motors, might be expected to perform the work more satisfactorily, flexibly and economically than the vacuum piping system. The portable arrangement avoids the necessity for drawing and maintaining a vacuum on all or part of the entire piping system, in order to clean one or more rooms. The various apartments are cleaned at different regular intervals, as meets their individual requirements, and if a house vacuum system were installed during much of the time the entire exhausting capacity would be kept in operation to maintain the proper vacuum for a relatively disproportional result.

Three 6-hp ventilating fans are in operation for supplying fresh air—on the twentieth floor, basement and sub-basement.

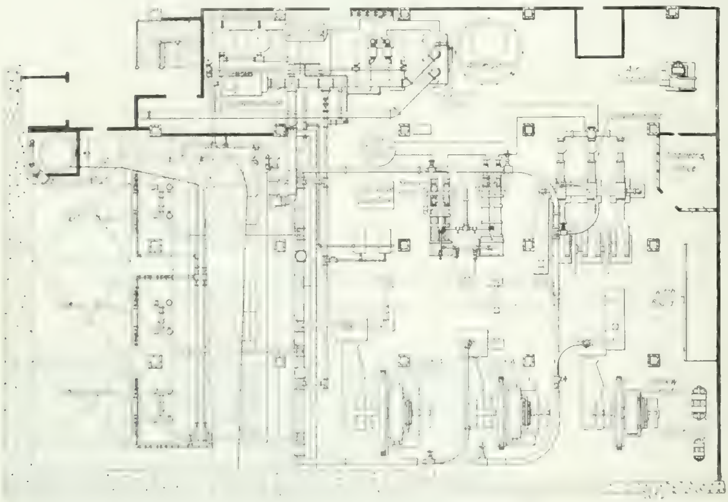


Fig. 3—Plan of Engine and Boiler Room, McCormick Building, Chicago.

All drainage from the building and engine-room is collected in a sump beneath the sub-basement, the sump level being 40 ft. below the level of Lake Michigan. This sump is arranged to be emptied by two Yeoman ejector motor-driven pumps, in addition to which an emergency steam ejector is supplied.

The main floor of the building is occupied by a leading firm of jewelers, whose workshop is in the twentieth story. Connecting this floor with the basement is a Roundtree dumbwaiter, driven by a 10-hp motor, which is used for conveying goods between the store and work rooms. The nine passenger and two freight elevators are hydraulic-operated.

The various fixtures in the office rooms contain 7500 outlets. This service is measured by more than 500 Sangamo mercury-type meters, varying in capacity from 100 amp to 5 amp. Distribution throughout the building is accomplished by two wire shafts, each containing three sets of 110-220-volt, three-wire risers. For wiring purposes, each floor is divided in half, and six half-floors are served by each riser. About 75 hp in motors is installed in the building and power plant.

Holabird & Roche were architects for the building. Mr. M. T. Kimman is chief engineer of the building.

A LARGE ELECTRIC VEHICLE GARAGE AT TOLEDO, OHIO.

"The largest garage in Ohio" the claim reads, and in point of ground covered probably one of the largest in the United States; the institution best known locally in Toledo, Ohio, as the Twenty-first Street Garage deserves other distinctions for its progressive management and up-to-date service than those of mere size.

The Twenty-first Street Garage has comfortable accommodations for more than 175 machines, both gasoline and electric, and is usually well stocked with "boarding cars" in spite of the fact that in Toledo, to an extent seen nowhere else, automobile owners have their own private garages. A ride through the better-class residence streets of the city discloses a garage building behind almost every house, and frequently the home of the machine approximates in size and architecture that of its owner. Besides the innumerable small private garages everywhere, a few neighborhood co-operative affairs are in operation, where a small group of automobile owners club together and build a six-car or eight-car garage to house their machines, employing a man to do the washing and delivering. Toledo is also unique in the large proportion of electric vehicles among the automobiles of the city. There are probably more than 500 of these cars—exceeding in number any city twice Toledo's size. The electric vehicle fad has grown healthily there on account of the city's level, well-paved streets and perhaps also as a result of its large well-to-do population. Electric vehicles are also found cheaper to maintain than gasoline cars, while their pleasant, dignified operation seems better suited to the needs of many of the community.

The floor space of the Twenty-first Street Garage is divided into two large rooms, one of which, 60 ft. x 220 ft., is used entirely for electric vehicles. This room has accommodations for more than 100 cars, and provides equipment for charging thirty cars simultaneously. The electric vehicle section is separated from the gasoline-car room by a brick fire wall pierced at front and rear by wide openings protected by steel fire doors. The one street entrance, in the gasoline-car section, is used by all the automobiles in the garage, as shown in the accompanying plan of the building. The purpose of this arrangement was to institute a system of checking so that those in the glass-windowed office in the front could know of all car movements. Next to the office is the drivers' waiting-room at the left of the entrance. From here the garage chauffeurs can be easily summoned from the street, as electric customers frequently stop by the building on their way home to pick up a driver, who returns the car to the garage. At the other side of the office is a large show space for new cars, for which the garage acts as agent.

At the rear of both the electric and gasoline-car areas are the respective repair shops. The gasoline workroom communicates by elevator with a varnish and paint shop on the second floor. Just outside the electric workshop is the rectifying and charging switchboard.

Alternating-current energy is received at 110 volts, 220 volts and 440 volts, 60 cycles, from secondary taps in a transformer of the Toledo Railways & Light Company, which supplies the local lighting and motor service. The charging equipment comprises five General Electric mercury-vapor rectifier outfits as-

sembled in a switchboard of [illegible] switching panels, which provide for charging thirty cars simultaneously. These panels are so arranged that 110-volt, 220-volt or 440-volt energy can be drawn upon to secure the most efficient conditions, dependent on the number of cars to be charged, the outlets being arranged for connection in series as needed. From the switchboard sixty No. 12 copper wires composing the thirty charging circuits are carried straight down the room in porce-

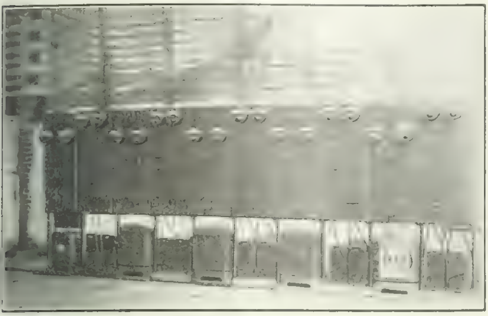


Fig. 1—Charging Switchboard.

lain cleats on blocks mounted on the steel roof trusses. At each of these trusses, which are at 8-ft. distances, two charging circuits are carried to the adjacent wall, as shown, and down to knife switches to the lower clips of which are attached the charging cords ending in the machine plugs. With the exception of one pair of lines all of the charging outlets are on the center-wall side of the room. Along the walls behind the rows of vehicles an auxiliary lighting circuit is carried with sockets for plug connection every 16 ft., used for inspecting cars and batteries. Below this are the heating coils of the hot-water system, and at the floor is a wide concrete step 4 in. high and with a 2-ft. top. This step prevents the cars from being backed into the wall and injuring their upper parts and also provides a clear passageway along the wall behind the row of vehicles. The floor is of concrete and drains [illegible] the center.

The entire floor space is without pillars of any kind, the roof being carried on steel arch trusses with 6-ft. rise placed at [illegible] intervals. At the center of the arch the roof is broken by an 8-ft. skylight which extends the length of the building and provides a flood of daylight for the garage interior. The artificial lighting is furnished by three rows of seven 32-cp lamps suspended from the roof trusses.

The workroom is equipped with a lathe, drill press and other machine tools which are driven by a 5-hp, 220-volt induction motor. This motor also drives an air compressor used to fill a tank from which tires are inflated. Rain water from the nearly 35,000 sq. ft. of roof surface of the two buildings is collected and passed through a barrel filter at the ceiling level, where it traverses a 1-ft. layer of gravel and several feet thickness of charcoal. From the filter it is led through rub-

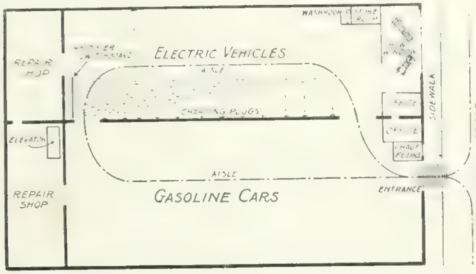


Fig. 2—Plan of Twenty-first Street Garage, Toledo, Ohio.

ber hose and wooden valves and fittings to the battery-room, where it is used in place of distilled water to replenish the evaporation in the cells.

A system of recording, for the garage men's use, all necessary information about each car is provided by a blackboard tablet mounted at the front of the room. This tablet has spaces for the name of the owner of the car, its tag number and make, and the hour at which it is regularly ordered daily. Three other columns show "In," "Call For" and "Delivered," a marker on a hook over each space showing the last disposition of the car.

Careful records are kept of the battery condition each day of all cars in the garage and a card is filled out showing the voltage and amperes flowing during each hour of the charging operation. Where an odometer is installed on the car this reading is also taken. These cards are preserved and show exactly what amount of charging was given any car during any period, information which is valuable to both the owner and the garage operator.

From records kept in this way for one month recently when 738 separate charging operations were completed it was shown

Fig. 3—Interior View of Toledo Garage.

[illegible] Taking an average battery pressure of 75 volts this represents about 8 kw-hours consumption per day, or 240 kw-hours per month for each machine.

Regular inspections are made of customers' batteries and a loose-leaf record filled out, a copy of which is mailed to the owner of the car. This record form shows the date, name of owner, name and number of car, number of cells, condition of positive plates, condition of negative plates, amount of sediment in jar, specific gravity of acid and work recommended. It is the aim to place this latter information in the hands of the owner at least two weeks before the trouble may become annoying or serious so that convenient arrangements can be made for withdrawing the car from service while it is being repaired. Date lines to be filled out when the work recommended has been done complete the record.

For "boarding" an electric automobile the garage receives $22.50 per month, which includes charging and supervision of battery, washing and delivering and calling for the car. A rate of $27.50 a month has also been offered, in return for which it is agreed to keep the machine in repair at all times,

THE TOLEDO AUTO & GARAGE CO.

CHARGING CARD

Date 191

Owner

Address

Make and Type of Car

No. of Cells *Odometer Reading*

P. M.			A. M.		
Hour	VOLTS	AMP.	Hour	VOLTS	AMP.
1			1		
2			2		

11			11		
12			12		

REMARKS

CHARGED BY —

Fig. 1—Record Form.

assuming all the minor replacement and repair costs and guaranteeing frequent mechanical inspections of the car to anticipate trouble. The latter rate has not met with the appreciation among owners which it seems to deserve, the average owner preferring the minimum "boarding" charge, by which he probably thinks to save.

The Toledo Auto & Garage Company operates the garage above described. Mr. A. U. Campbell is manager of the com-

ELECTRICAL ENERGY IN STEEL WORKS CONSTRUCTION.

[illegible] the new steel works of the Minnesota Steel Company, at New Duluth, near Duluth, Minn. The works will represent an investment of $10,000,000 or more, and construction work has been under way for some time. A temporary steam-driven electric generating plant, rated at about 500 hp, has been installed, and a cement plant, hoists, derricks, conveyors, etc., are operated by motors supplied with electricity by temporary circuits. The company is itself doing the construction work.

CONSTRUCTION OF FOUNDATIONS FOR ELECTRICAL MACHINERY.

By Bruce H. Page

As a rule, concrete machine foundations as designed in drafting rooms and engineering offices are needlessly intricate. The actual contour of a masonry foundation may be almost any reasonable one that a designer selects without increasing the cost of the foundation much, because with masonry foundations forms are not required. Forms, which are in a majority of cases required in the construction of concrete foundations, are relatively expensive to construct. Hence, the design of a foundation should be such that they will be as simple as possible.

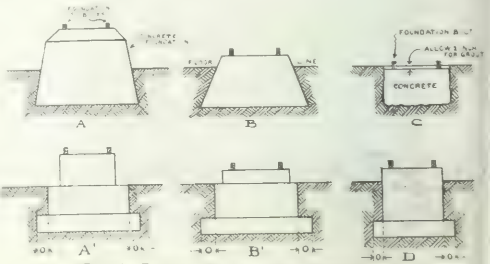


Fig. 1—Designs for Concrete Foundations.

The type of machine foundation shown at *A*, Fig. 1, is a favorite with draftsmen, but for what reason the writer does not know. A form for such a foundation, because of the inclined sides, which necessitate beveled corners, is difficult and expensive to construct. In certain cases such a large area of base may be required for a machine foundation to prevent its sinking into the supporting soil that its bottom should be much

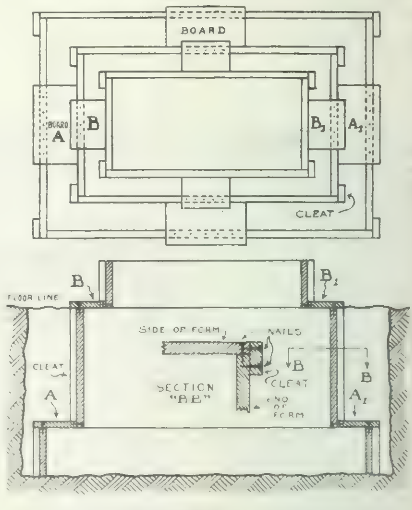


Fig. 2—A Complicated Form for a Concrete Foundation.

larger than the top. In such cases the form for a foundation constructed as shown at *A'*, Fig. 1, will be cheaper than that shown at *A*, although both have the same area of base. A form for the foundation *A'* is shown in Fig. 2. All of its sides are vertical and all of its angles right angles. However, such a form is expensive and should not be used if a simple foundation and form such as shown in Fig. 3 will do.

The form of Fig. 2 consists essentially of three boxes of dif[illegible] without tops or bottoms. In erecting, the lower box is first placed in the excavation and braced with blocks wedged between it and the sides of the excavation. The box is then

mped full of concrete. Next the box above is arranged in oper position on the green concrete and held in position by e pieces of board A and A_1, shown in Fig. 2. It is filled with ncrete and the third box located, blocked in position with the eces B and B_1 and filled. The corners for this or any other nilar form should be made as shown at *Section BB*, Fig. 2, that the boards will not be forced apart by the concrete-mming process.

Where this type of a "sectional" form is used it is necessary support the foundation bolt templet on a frame, inasmuch it is impossible to support it on the form. A form can be ed for a templet support when the form is of the plain de-

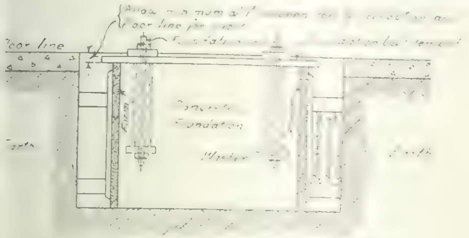


Fig. 3—A Simple and Sens... Form ... P...

n shown in Fig. 3. B' (Fig. 1) shows how the foundation wn at B can be modified into one having an equal area of e that can be built with easily constructed forms. At D hown another design. In this case a certain area of founda-1 base was necessary to support the load. A smaller area top was sufficient to include the foundation bolts and pro-e a rest for the machine. The foundation was erected as wn. It could have been made with vertical sides, its top ing the same area as its base, but the value of the concrete ed through the use of the extended footing was much more n sufficient to pay the cost of the additional form construc-: involved.

n designing foundations such as those indicated at A', B' D (Fig. 1) care must be taken that the "offset"—the dis-ce o, Fig. 1—be not so great that the footing will crack off ndicated in Fig. 4. Rules are given by which the safe "off-distance for commonly used masonry construction mate-s may be determined.

requently concrete foundations can be built, as shown at C, . 1, without any form at all where the soil is firm enough to port itself. The excavation can be made, the foundation templet located and supported by a frame and the mixture ped directly into the hole. Obviously this procedure is only

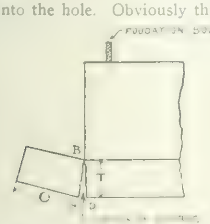


Fig. 4—A F...

ticable where the foundation is of simple shape. In the mple shown at C (Fig. 1) 1 in. is allowed for grout at the of the foundation, so that the bottom of the base of the hine to be supported will lie flush with the floor line.

ets for plain foundations like that delineated in Fig. 3 pported directly on the top of the form and attached

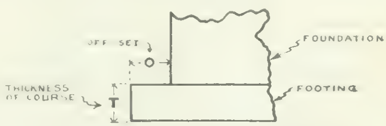
possible contour. The forms for it can be easily and nade. This construction can be profitably followed in a it majority of cases where small machines are involved. It be usually found that the area of base will be ample to ent sinking if it be made the same as the area of top. The area of top is determined by the dimensions of the machine to be carried. The top must be big enough to include all of the foundation bolts and to carry the base of the machine. Whether or not a certain area is sufficiently large can be ascertained by referring to the table giving the bearing power of soils in the August number.

As suggested above, there is a tendency for the projecting part of a footing to break off along the line BD, Fig. 4. This projecting portion may be treated as a cantilever beam. The section represented by BD offers resistance to bending. The load causing the tendency to break is the reactive pressure of the soil upon which the footing rests. It is evident that there is, for any given material, pressure against the soil and thickness (T, Fig. 4), a safe distance O, which should not be exceeded. This distance may be computed with sufficient accuracy for all practical purposes by the equation:

$$O = \frac{1}{2} T \sqrt{\frac{R}{Pf}}$$

in which O = the greatest possible safe offset or projection of the footing course in inches; T = the thickness of the footing course in inches; R = the modulus of rupture of the material (given in Fig. 5) of which the footing is composed, in pounds per square inch; P = the pressure, in tons per square foot, at the bottom of the footing course under consideration; f = the factor of safety. This equation and the table in Fig. 5 were compiled from matter in *Masonry Construction*, by Baker. The reader who wishes to study the subject of footing proportions further is advised to consult this work.

Obviously there is a relation with a given material and foun-



[illegible]	Modulus of Rupture in Pounds per Sq. Inch.	O in terms of T for a pressure, in tons per square foot, on the bottom of the course, 0.5	1.0	2.0
STONE				
[illegible]	5,026	[illegible]	3.2	2.3
[illegible]	1,849	2.7	1.9	1.4
[illegible]	1,377	2.4	1.7	1.2
[illegible]	1,378	2.4	1.7	1.2
BRICK-WORK				
Good building brick in poor 1:2 natural-[illegible]	120	0.7	[illegible]	0.3
Under-burned building brick in 1:3 Portland cement mortar, age 76 days....	706	1.7	1.2	0.8
Vitrified building brick in 1:3 Portland cement mortar, age 76 days........	3,506	4.3	2.7	1.9
CONCRETE				
1:2:4 Portland cement at 1 month......	300	1.1	0.8	0.5
1:2:4 Portland cement at 6 month	400	1.4	0.9	0.6

Fig. 5—Safe Offsets for Masonry Footing Courses, Factor of Safety = 10.

dation pressure between the thickness of T (Fig. 4) and a safe projecting distance O. For reference the table, Fig. 5, is given, which shows safe offset distances for materials and loads ordinarily encountered in foundation work. A factor of safety of 10, which is about right for average conditions, was employed in computing the table. Where masonry or brickwork is involved the values given in the table (Fig. 5) are not true unless the stones or bricks are well bedded, have a thickness equal to the thickness of the course and project not more than half of their length. For concrete the ratio of O in terms of T varies from about 0.5 to 1. Inasmuch as foundations are frequently quite green when machines are mounted on them, it is not unusual to use the ratio 0.5; assuming a pressure against the soil of ½ ton per square foot. A footing, for example, of the proportions indicated in Fig. 6 would result from this as-

sumption. A three-step footing like the one shown would only be justified where the machine carried was excessively heavy and a large area of base is imperative.

A three-step footing is shown merely for an illustration of the principle. Obviously the dimensions of 8 in. and 16 in.

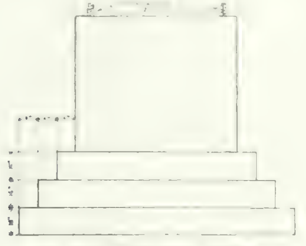


Fig. 6—A Three-Step Footing.

would hold true if the footing had only one step or had two steps.

In general, no concrete footing should be less than 8 in. in thickness; thinner ones are too delicate. The constructor is urged to avoid footings altogether where he economically can do so and to build foundations of ample base area with plain, vertical sides. In each doubtful case it is a question of form cost versus concrete cost.

MOST ECONOMICAL METHODS OF CARRYING PEAK LOADS.

A discussion of the most economical methods of carrying peak loads, with special consideration of fixed charges, written by Mr. H. G. Stott, of New York, forms part of the committee report on power generation presented before the recent meeting of the American Street and Interurban Engineering Association. The author devoted the major portion of his discussion to the question of economical production of energy, which he fears is not so clearly understood as might be wished, especially as regards peak loads. The curve printed herewith shows the total maintenance and operating costs per kw-hour for various percentages of load-factor below the horizontal axis, while the curve above this axis shows the fixed charges per kw-hour for various load-factors. The sum of the ordinates above and below the axis gives the total cost of energy under the conditions which have been assumed.

From a consideration of these curves it will be seen that for peak loads having an annual load factor of from 5 per cent to 15 per cent the operating and maintenance charges are relatively unimportant and the fixed or capital charges are of the greatest importance. The various sources to be considered for peak loads are given as follows: Storage batteries, purchased energy, hydroelectric energy, gas engines and steam turbines. The author then makes the following analysis:

A storage battery would seem at first sight to be an ideal means of carrying peak loads, as obviously it would not call for any additional plant capacity, but if the double curves are applied to it, it will be found that the fixed charges, on a battery capable of discharging at its maximum rate for two hours at a time, are so high as to leave it out of the question.

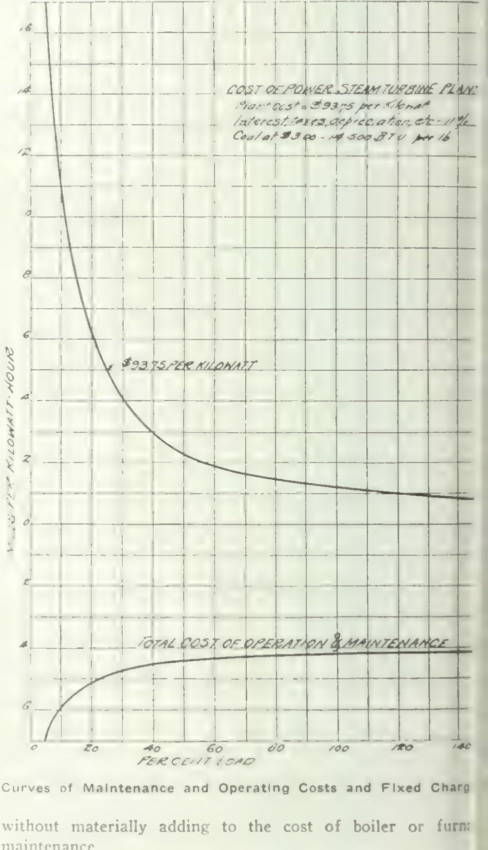
Purchased energy almost invariably carries a heavy fixed charge per kilowatt of maximum demand, varying from $15 to $25 per kilowatt per annum, with a further charge per kw-hour actually used. The first charge should be treated as a fixed charge and so plotted above the axis. This will in all probability show an extremely high cost per kw-hour of peak load.

Hydroelectric energy if transmitted more than a few miles will inevitably show very high fixed charges, owing to the large investment in the power plant, hydraulic development, transmission lines, etc.

Gas engines, while attractive from the point of view of smal cost for fuel during the period the plant is idle, are inadmissibl from the point of view of high fixed charges due to the larg investment per kilowatt.

Steam turbines are at present the most satisfactory type o prime mover in the market for the peak-load problem, owing t their low first cost. If a reciprocating-engine plant in goo condition is available, then the addition of low-pressure tur bines will result in the development of a kilowatt at an invest ment of about $25, provided there is enough room available i the engine-room and if the boilers can be forced sufficiently t carry the extra load.

In the boiler-room the investment can be kept down by add ing grate surface instead of more boilers, and by the use c forced draft the old rating of 10 sq. ft. of heating surface pe boiler horse-power can safely be reduced to 4 sq. ft. or 5 sq. f



Curves of Maintenance and Operating Costs and Fixed Charg

without materially adding to the cost of boiler or furn maintenance.

While the over-all boiler efficiency will begin to fall gradually beyond 175 per cent or 200 per cent rating, the sm loss thus entailed is insignificant compared to the saving fixed charges as shown in the curves.

According to Mr. Stott, the solution of the problem of car ing peak load economically is, therefore, to be found in red ing the investment per kilowatt to a minimum, and this can best accomplished at present by the use of steam turbines a by the use of large grate area, such as a ratio of 30 sq. ft. 40 sq. ft. of heating surface to each foot of grate area, inste of the present ratio of 55 or 60 to 1. Forced draft may be e ployed with advantage with any grate area and will in alm any case result in increased economy as well as in increas capacity.

LETTERS ON PRACTICAL SUBJECTS

A METHOD OF RAISING INVERTED MOTORS.

There are many methods of raising an inverted motor to a cation on a ceiling. The one outlined herein will be found ccellent under certain conditions. Fig. 1 shows how the ckle is arranged and Fig. 2 illustrates a plan view at the sec- ıd floor. In the method described here the inverted motor raised with two ropes. Each passes through a foundation- ›lt hole in the bed-plate, is arranged around the motor frame ıd is made fast in the eyebolt at what is normally the top of e motor. The two holes in the bed-plate through which the ›isting ropes pass are located at diagonally opposite corners. ıe hoisting ropes, after being made fast to the motor, are readed through two of the four holes which have been bored accommodate the bolts in the stringer pieces which will sup- ›rt the motor. Then the ropes are carried through two accu- tely located holes in the floor above. On this floor rests a ›rse which supports the two sets of blocks with which the otor is raised. As indicated in Fig. 2, the horse is arranged agonally so that it is directly over the two holes in the floor rough which the hoisting ropes pass. Sometimes instead of ing a horse to support the tackle, it is best to arrange tempo- ry eye-bolts in the floor of the story next above as shown *A* and *A*. They can be readily removed when the motor has

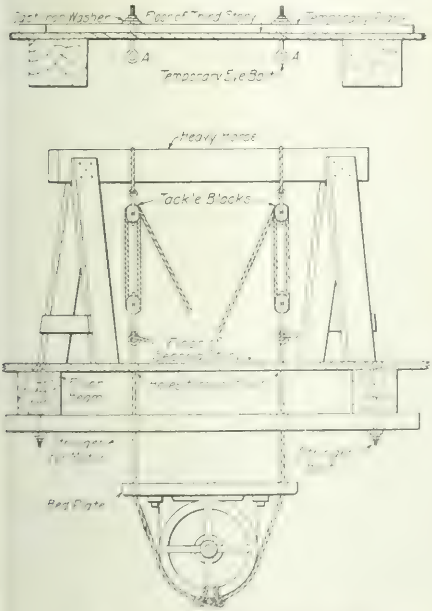


Fig. 1—Side Elevation of Hoisting Outfit

:n raised, but can be quickly replaced when the motor must replaced or taken down. After a motor has been raised to position on the stringer planks two bolts are inserted ·ough the open holes and set up tightly. Then the hoisting ›es are pulled out and the other two bolts are inserted. It ›uld be noted that with this method it is not necessary to cut y large holes in floors. The stringer pieces having been lted to the beams, the four holes, two in each stringer, for four motor-supporting bolts are located and bored in them. ıese holes should be at least ⅛ in. greater in diameter than the diameter of the supporting bolts. Then the two holes for the ropes are bored through the floor above. If a bit long enough is available this is easily done by using the holes in the stringers as guides and boring with the lower end of the bit

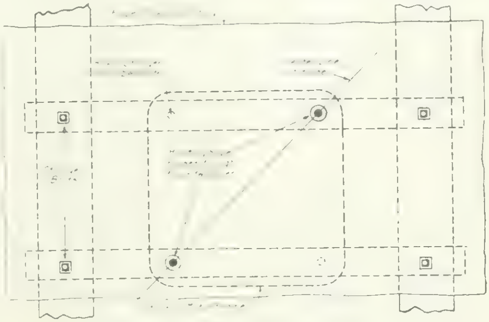


Fig. 2—Plan View on Second Floor.

through one of them. If no long bit is at hand the locations of the floor holes can be accurately determined with a plumb-bob, as shown in Fig. 3. The floor holes should be generously large so that they will not bind the hoisting rope. When buying a motor for inverted ceiling mounting or for mounting in any

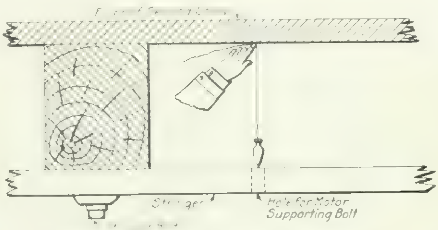


Fig. 3—Method of Locating Bolt Holes.

position, one should be selected which has a single bed-plate instead of two slide-rails. It is much more difficult and tedious, therefore expensive, to line up and level two slide-rails than one bed-plate. Furthermore, the slide-rails will require at least twice as many supporting bolts as will the bed-plate.

Pittsburgh, Pa. H. T. BOYNTON.

CARE AND LUBRICATION OF BEARINGS.

Bearings run hot or excessively warm from one or more of the following causes: When the tension of the belt is excessive, when too much load is imposed on the bearing, when the boxes are not properly fitted for the journal, when there is an improper distribution of the oil over the entire surface of the journal, and when the boxes are pressed too tightly against the journal. These are the five principal causes of hot bearings. When an excessive load is imposed on the journal by reason of the belt being pulled too tightly, the belt will usually indicate the trouble by waving on the pulling side. If the oiler or attendant is not aware of this fact he will tighten the belt more in order to stop its waving, thus increasing the difficulty and the liability of a hot bearing. When the belt waves on the pulling side the oiler should feel the bearing; if the bearing is cool the belt can be tightened, but if there is an indication of a rise in temperature then the belt must be run slack. This is one great cause of hot bearings, because it imposes an excessive load on the journal. When a bearing runs hot from an improper distribution of oil the oil may supply only one end of the journal, thus causing the opposite end to

run dry or without a sufficient quantity to insure lubrication. This particular cause is often associated with hot bearings and is difficult to detect because the cap of the bearing would have to be removed in order to discover the trouble. After the cap is removed it will be easily found owing to the difference in color of both ends of the journal. The oil will not be distributed evenly over the journal surface when the boxes impinge on some particular part of it. The box may be fitted badly to the journal, permitting an edge of the box to act as a wiper or scraper; the edge being so close against the journal that it is impossible for oil to find its way between the box and journal. The box may also be without oil grooves. If one stands facing the journal and rotation is toward the right, then the upper edge of the right-hand box parallel with the journal should be cut away, otherwise the oil will flow over the box and not between the box and journal where it is needed. Bearings will run hot from a stoppage of the oiling rings, if ring oilers are used, or if chain oilers are employed the chain may kink, which will surely prevent it from traveling, and thus a hot bearing is the result. When ring oilers are used the ends of the rings should be soldered evenly together and no burr should be allowed to protrude on their surface so as to catch in like projections that might be on the surface of the ring ways cut in each bearing. If an oil cup is used to feed the bearings with oil the cup may become clogged, which, of course, could be easily detected before any serious heat developed, especially if the drop or stream of oil is compelled to pass by some opening in the shank of the cup. The opening or view-hole should be protected from air currents by either a glass or mica tube, because if the drop is exposed to strong air currents it is liable to be blown out of line of the oil pipe and forced to drop away from the place where it is needed. If no glass or mica tubes are obtainable the oiler can readily aid matters by making a tube out of a thin sheet of mica and substituting it for the regular tube. When bearings are oiled by the gravity system a pump is usually employed to return the [illegible] the [illegible] which it flows to the different bearings through brass or iron piping, the flow of oil to each bearing being controlled by a cock or valve situated in a handy position. If the oil is passed through a filter before it is deposited in the gravity tank a considerable amount of deleterious matter which combined with the oil during its passage through the bearings will be removed. The oil should not be taken from the bottom of the gravity tank, but should be taken some distance above the bottom, because doing so eliminates all chances of water flowing into the oiling system. The gravity tank is in nearly all cases fitted with a gage glass, which enables the oiler to see at a glance the height of the oil in the tank, and if any water is present it will appear at the base of the glass, in which case it can be run off by means of a valve located in the bottom of the tank. The glass will also indicate when a fresh supply of oil is needed, hence a continuous flow of oil through the oiling [illegible] air pressure, and in numerous cases oil is pumped directly through the bearings. When oil is pumped directly through the bearings the oil pump may be independently operated by means of a variable-speed motor or else the pump may be driven direct from some rocker shaft on the engine. When the variable-speed motor is used no by-pass is needed because the speed regulator has sufficient resistance to compel the motor to run at a low speed. If the oil supply is not enough the motor can be speeded up, thus increasing the quantity of oil on the bearings.. When the oil pump is driven by the engine its speed cannot be changed, and in this case a by-pass is needed to regulate the flow of oil. (Of course, a by-pass can also be attached to the motor-driven pump if required.) There is one great danger attached to the above system of oiling. When such a system is in use the returning oil from the different bearings will contain water to a greater or less degree, caused by the condensation of any steam that happens to blow through the stuffing boxes into the interior of the engine bed, the steam striking against the cold metal condensing and falling to the bottom or lowest part of the engine framework, where [it] mingles with the returning oil and eventually arrives in t[he] vessel from which the pump takes its supply. As soon as t[he] water has risen high enough it will prevent the pump from r[e]ceiving oil, and water will be discharged on the different bea[r]ings, increasing the liability of heat. The remedy is to run [off] the water and pour into the oil vessel a fresh supply of cle[an] oil. At first when the water begins to mingle with the oil [it] will change the oil to a whitish color; the amber color of t[he] oil will no longer be present and this indication should cau[se] immediate attention to be given to the oiling system. If the vessel is fitted with a gage glass an incandescent lamp shou[ld] be placed in a position which would give the oiler or attenda[nt] a good view of the glass and show water as soon as it [has] taken the place of the oil. When oil is circulated by air pre[s]sure the same trouble will arise as in the previous-mention[ed] case. When oil is circulated by water pressure no water c[an] be forced through the bearings, because the oil is compelled [to] issue from the upper portion of the pressure oil tank and, [of] course, any water in the oil must fall to the lowest point. [B]ut when air pressure is used the oil is forced from the bott[om] of the tank and any water present will surely find its way i[nto] the oiling system. Where plants are equipped with any of [the] above oiling systems there is no need of running the beari[ngs] too near the danger line for the sake of economizing oil, [be]cause with any of the above systems the same oil is used o[ver] and over again. The only precautions necessary are to fil[ter] and clean the oil and to see that the bearings receive a su[ffi]cient quantity at all times to maintain them cool. After [a] bearing runs hot, necessitating shut-down, the boxes should [be] taken out, all roughness removed from both the boxes a[nd] journal, the oilways cleaned and the boxes put back in po[si]tion. When a box is put back the screws which hold it agai[nst] the journal may first be made hand-tight, then after runnin[g a] while they should be tightened a little more, and in this w[ay] the correct amount of pressure be placed on the boxes. An [ex]pert in such a case would require only one or two trials to [ad]just the boxes properly, but those who are not expert sh[ould] tighten up the bearings gradually. Should the temperature [of] a bearing rise there is no need of becoming unduly frighte[ned]. The engineer should see that the bearing is receiving oil, and [if] the temperature continues to rise, try to locate the difficu[lty]. The heat may be caused by excessive tension on the belt, [in] which case the belt should be slackened. If this cannot [be] done, the bolts that hold the boxes against the journal sh[ould] be loosened and the quantity of oil increased. At the p[lant] with which the writer is connected some of the bearings [occa]sionally run up to a temperature which would prohibit a per[son] feeling them with the hand in the ordinary manner, but [so long] as they can be touched with the tip of the finger they are all[owed] to run in that condition because the machines cannot we[ll be] shut down when heat develops.

[illegible] William K[illegible]

THE TROUBLESOME BLOW-OFF PIPE.

[illegible] the neighboring light p[lant] he always makes it a point to get around behind the boi[ler] room and take a look at the boiler blow-off pipes. Very f[re]quently he finds here leaky blow-off valves which are the cau[se] of waste equal to the revenue of a half dozen good consume[rs]. A blow-off pipe is a most troublesome detail. It will per[sist] in leaking unless looked after carefully. One at the wri[ter's] own plant was a continual source of annoyance. Some[times] on investigating it was barely running a stream. At ot[her] times it was fairly pouring. Each time the boiler was cle[aned] the valve received attention and occasionally a new one [was] substituted. Finally he saw an advertisement of a Y-valve ma[de] particularly for blow-offs. One was obtained and installed a[nd] the blow-off pipe has remained dry ever since. As a prec[au]tionary measure, an ordinary disk valve was placed between t[he] new one and the boiler in order that the Y-valve might ha[ve] attention without emptying the boiler.

[illegible] Ind. Carl B. Gough

RECONSTRUCTING A CENTRAL STATION.

The August number contained photographs and a description of some contemplated changes in the central station of the Indiana & Michigan Electric Company, at South Bend, Ind. The changes in question comprise the erection of a new steel structure in and around the old building, which is filled with electrical machinery which must be kept in operation at all

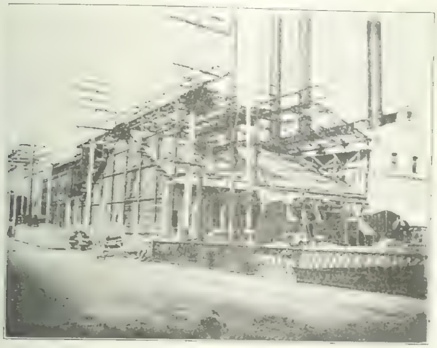


Fig. 1—Side and End Elevation of Power House.

times. New foundations were put in for the new building and this work occupied more than a year. In fact, nearly two years elapsed from the time operations were commenced until the first visible piece of structural steel appeared through the roof of the old station. The half-tones herewith show the progress which had been made up to Aug. 21, at which time the roof framing presented an appearance not unlike an immense flying machine. As the front wall of the new building was to fill practically the position occupied by the front wall of the old building, it was found necessary to take down the brickwork and close the end of the old building with scantling, rough boards and tarred paper. Then the permanent steel framing of the building was put in place, as shown by the engraving. The false front will be removed little by little as the construction of the new walls proceeds. The manner of joining the steel timbering to the wing of the building already erected was

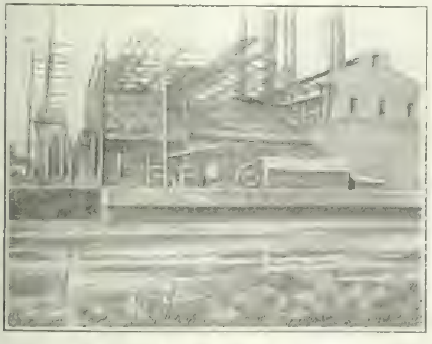


Fig. 2—End View of Power House.

very simple indeed. All that was done was to knock out a few bricks wherever a timber would enter the wall. Holes 2 ft. or 3 ft. square were driven through the wall and the new timbers inserted, fully leveled and aligned and then bricked firmly into the old wall, good, strong cement mortar being used for this work.

Fig. 1 shows the building as seen from the street and gives the side and end elevation of the structure, and also shows plainly the manner in which the structural steel was carried up through the old building. The high-tension receiving poles are shown at the extreme left of this illustration. Fig. 2 is an end view taken from across the canal and shows the manner in which the building is divided into two sections or bents, one of which is much wider than the other. To keep the old building water-tight while the work is going on has proved quite a task, but it has been successfully accomplished. Other problems equally serious are sure to arise when the time comes to demolish the old structure, and a good deal of expert engineering will be required to remove successfully all the material in the present building without dropping any matter whatever into the generating machinery, which is constantly in operation a few feet below the roof.

South Bend, Ind. James F. Hobart.

METHODS OF STARTING A ROTARY CONVERTER.

There are two general ways of starting a rotary converter, each one having its advantages as well as disadvantages; so perhaps a few words on the relative merits of each will be beneficial to those interested in the operation of these machines. One method of starting is by driving the machine as a shunt-wound direct-current motor and bringing it into synchronism with the alternating-current circuit; the other method is by starting it from the alternating-current side as an induction motor. Under the first method there are two sub-methods. The most common way of starting is as follows: The machine is brought up to speed from the direct-current side as an ordinary direct-current motor. This is done by first closing the field switch, giving the machine a full field from the direct-current bus in the station. Next one terminal of the armature is connected to, say, the positive side of the bus and the other terminal, through a starting box, to the negative bus. The rotary will then turn over and, as the resistance of the starting box is cut out, the machine, of course, comes up to speed. When the rotary is running on full voltage it is ready to be synchronized. It will be seen that it is running "inverted," generating, or, rather, converting, direct current into alternating current and sending this into the secondary of the transformer. This in turn induces a high-voltage current in the primary. Now a synchronoscope is connected across the corresponding phases of the incoming machine and the line from the generating station. This indicates when the rotary and the generator are running in synchronism—that is, at the same speed pole for pole. The speed of the rotary is varied by means of the field excitation until synchronism is attained and at that instant the oil switch connecting the rotary to the line has to be closed. It can readily be seen that if this switch is closed too soon or too late the two currents will "buck" one another, with the result that the rotary's relay will trip the oil switch, and if they are very much out of synchronism the chances are that it will "knock" the generator off, too. In any event, the machine has to be started over again. In the second method of synchronizing, a small induction motor is mounted on the end of the shaft of the rotary. The machine is run by this up to speed. The field switch of the rotary is closed and all of the resistance cut in so that there is hardly any "drag" on the machine. The resistance is then cut out gradually until the rotary slows down and the synchronoscope indicates that they are in synchronism. After the rotary is put on the alternating-current circuit the induction motor is cut out and left to run free on the shaft.

The method of starting from alternating-current side is as follows: Three taps are taken from the secondary of the transformer, giving one-third, two-thirds and full voltage, and are connected to starting switches. After seeing that all the machine switches are open, the high-tension oil switch is closed. Then the first starting switch is closed and the rotary should turn over, running on one-third of its normal voltage. As the machine gathers speed, a voltmeter connected across the direct-current side will oscillate back and forth and finally come to rest in either a reverse or positive position. The field switch (which is a double-throw one) is closed in the normal position if the voltmeter indicates that the machine is generating cur-

rent in the right direction. If, however, it shows that the polarity of the rotary is reversed the field switch is closed in the other position. This reverses the current through the field coils. The polarity of the machine will be reversed and the field switch is pulled out and closed in the normal position. Then the other two starting switches are closed successively, allowing time between the closing of each for the rotary to pick up speed, and when the last one is closed the rotary is running on full voltage and in synchronism and is ready for service.

Now, as to the advantages and disadvantages of these methods. To start by the first method it is, in the first place, essential that there be a storage battery or other source of direct current in the station when the station is shut down. Secondly, it takes time to synchronize and time is of the utmost value when a machine is wanted in a hurry, and it is always when one is in a hurry after a "shut-down" or other trouble that it takes the longest to synchronize a machine, due to low and fluctuating line voltage. The writer has been half an hour trying to synchronize a machine that ordinarily took from one to three minutes. The oldest and most experienced men run the risk of throwing a machine on when it is out of synchronism, through no fault of their own, but because the voltage would vary as they throw the switch, with the result that they have it all to do over again. On the other hand, the rotary starts more smoothly without taking such a rush of current from the generating station. By starting from the induction motor on the shaft there is the advantage of not having to have direct current in the station, regardless of whether or not the station is running, but there is the cost of the motor, and there are still the other disadvantages connected with having to synchronize. By starting from the alternating-current side as an induction motor there is no necessity of having an external source of direct current; the danger of knocking machines off the line by "going-in" out of synchronism is eliminated, and it is much quicker, saving time in an emergency. However, the initial cost of the transformers is slightly more and the machines take a large momentary starting current. In the writer's opinion, the last method is by far the best in the long run, but it is a subject open to debate, as proved by the fact that some large companies stick to the former while others use the latter in all their new stations.

Brooklyn, N. Y. W. R. Sherwood.

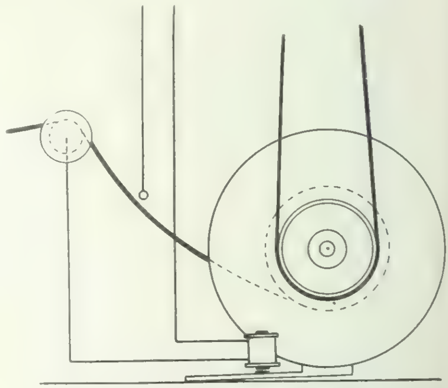
TESTING BLASTING CIRCUITS WITH A FIELD GALVANOMETER.

In preparing to fire large electrically ignited blasts it is important for the powderman to know whether his circuits are closed and in good condition or whether there may be leakage across bare conductors or some of the fuses may have become disconnected. Obviously a blasting circuit all ready to touch off several thousand pounds of powder or dynamite can not be experimented with under actual working conditions without detonating the whole charge. On the other hand, after all preparations have been made for a blast, the workmen withdrawn and the field cleared, the delay is a serious and often dangerous one if the charge cannot be set off promptly, because if there is tinkering with the circuits, while this is going on some of the workmen, either ignorant or forgetful of their peril, may return to the site of the blast. A large powder-manufacturing concern has recently developed a field type of galvanometer for powdermen's use which can be employed to make sure that all electrical circuits are in good condition and closed before attempting to fire the blast. This outfit employs a source of small current strength which is measured by a sensitive galvanometer arranged to read in ohms the resistance of the circuit traversed. By sending this small current through the blasting circuit, noting the reading of the galvanometer and [illegible] of line wires, fuses, etc., the powderman can easily ascertain if the total reading checks with the number and character of fuses he has set. If so, he can be reasonably sure that the circuit is closed and the lines are in good condition. For example, if the operator has set thirty holes in each of which is an 8-ft. fuse, the resistance reading should be about 33 ohms, and if this is the case he can assure himself that the circuit is complete. If one of the line wires becomes broken or disconnected in tamping the hole, there will be no movement of the galvanometer needle, but the blaster may then, before the blast warning is given, "open-circuit" the series and, taking his galvanometer from hole to hole, readily ascertain the open fuse by testing across the ground terminals. Where possible the separate holes should be independently tested for open wires directly each is tamped in.

Scranton, Pa. John Davis.

WINDING AT UNIFORM TENSION ON A REEL OF VARYING DIAMETER

In the process of making wire mattresses at the factory of the Simmons Manufacturing Company, Kenosha, Wis., the wire links are first made up into the form of a chain which is reeled up and transported to another machine, which cuts this chain into suitable lengths, interconnecting these with cross-links. At the point where the chain is formed, in the first operation, and wound upon wooden reels, similar to those on which electrical wire is shipped, it became a problem to wind the chain properly on the varying circumference of the reels, which continually increased as more chain was wound. The chain was produced at a constant speed in the machine, but, as the diameter of the reel grew, the same reel speed of rotation which



Electromagnetically Controlled Brake.

was proper in the beginning became too fast with the larger circumferences and trouble was caused. To correct this difficulty Mr. W. W. Vincent, general superintendent of the company, arranged the electromagnetically controlled brake shown in the accompanying sketch, which is used in conjunction with a friction-drive clutch on the belt wheel. The pulley speed is adjusted so as to drive the reel, through the friction clutch, at a speed just a little higher than that necessary to reel up the output of the machine on the bare spool. If the chain becomes tightened beyond the slack allowed, contact is made with a metal ring above the chain and a circuit is completed through the electromagnet applying the brake to the reel and allowing the driving pulley to slip a partial revolution until the chain machine catches up and supplies the slack required. The actual rotation of the spool is thus at a varying speed, decreasing as the reel diameter increases and so adjusted at all times that the chain is wound at a constant tension. The principle involved is one that can be applied to advantage in many other forms of reeling operations where it is necessary to wind at even tension a product that is being delivered at a constant rate of production.

[illegible] George Taylor

QUESTIONS AND ANSWERS

I have a [illegible] but the rotor does not run hot [illegible] sign. The bars of the faulty rotor are properly connected to the rings, the rotor does not strike the pole pieces, the field coils show no defect and although new bearings have been inserted and the rotor centered, the trouble still continues. What should cause this? G. H. P.

The fact that the fan motor operates without heating when driving a certain fan, although it heats considerably when driving a different fan, shows at once that the heating is due to the fan, rather than to any defect in the motor itself. It is extremely probable that when the motor overheats it is driving a fan designed for a very much lower rotative speed than that at which the motor operates.

Is there any possible danger of fire in running high-tension wires through switchboard marble in a stone pump house and placing the transformer on a brick shelf within the structure? It is desired to make such an installation in rough country subject to terrific ice storms in winter and excessive heat in summer. J. W. H.

It is perfectly proper to place the transformers for a pump motor on a brick shelf erected within the pump house. The high-tension wires could well be brought through switch marble, and if proper precautions are taken to keep the high-tension wires separated at about the same distance as is used on the external transmission line, the arrangement should give thoroughly satisfactory results. No trouble whatsoever should be expected from fire.

Where half a dozen 220-volt grounded circuits cross the white plastered ceiling of a comparatively new building, I recently noticed that the static dust mark along one of the wires is several times darker than the marking under the other wires of the same polarity. These circuits are all under potential continuously, as the switches are at the other ends of the runs, near the lamps or motors they control. Upon tracing out the excessively blackened circuit, I found it to lead to a motor, which is controlled, however, from a switch on the same side of the marked ceiling. Of course, the current taken by the motor is greater than that of the lighting circuits, but, assuming that the potential and the time during which the wires are charged are the same for all the circuits, which is the case, I cannot understand why all the dust markings should not be similar, for the marks are presumably static effects and so bear no relation to the currents flowing. K. D. L.

If, as you say, all the wires are charged at the same potential during equal periods daily, the darker marking under the underground wire of the motor circuit is doubtless due to the heating effect of the larger current flowing in this circuit. The heat thus produced might cause convection currents in the air, and also increase the adhesiveness of the wall coating, in either case affecting the amount of dust deposited on the wall over this particular wire.

Will you kindly inform me whether, in commercial practice, telephone cables are laid under water in contact with electric transmission cables carrying 2000 volts or more? R. C. M.

Presuming that you refer to incorporating the telephone wires inside the transmission cable in a way similar to that in which pressure wires are sometimes brought back from distribution points, this has sometimes been done. We call to mind an installation on the Pacific Coast where a submarine cable was used some years ago for supplying energy to a motor-driven dredge and through which communication was maintained with the shore. In this case there was no interference or inductive effect. The objection to such an arrangement would be the possible breaking down of the insulation, whereby the higher voltage would be impressed on the telephone line. Any danger to life, however, could be prevented by the use of the insulated telephonic transformer or repeating coil which has been brought out within a year or so. Such a transformer could be inserted in the telephone line between the cable and the telephone user and would protect against shock. With such a highly insulated repeating coil it is probable that the practice of inserting telephone wires in transmission cables will be followed to a greater extent than in the past. Formerly it was the practice to wrap telephone pairs in a separate cable, with steel wires to take the tensional stresses, and to place the cable thus formed alongside the transmission cable. There is, of course, no objection to placing power and telephone cables very close together under water which provides a good ground, as in some of the large cities the distribution companies have their own telephone service installed in the same ducts as the high-tension lines.

I desire to construct a dimmer for theatrical purposes and to employ a choke coil for this purpose. Could you advise me what size of wire, number of turns, length and amount of iron are needed to produce this effect. One dimmer is required to control twenty 16-cp lamps and another to control 140 16-cp lamps, the lamps being rated at 3.5 watts per candle, the circuit potential being 110 volts, and the frequency 60 cycles. It is also desired to construct an auto-transformer giving about 45 amp for a hand-controlled arc lamp using the same circuit. C. H. G.

An auto-transformer designed for operating at an e.m.f. of 110 volts at 60 cycles should have such a sized core and such a number of turns of wire that the product of the core area in square inches and the number of turns of wire in series equals 1100. An auto-transformer of this kind intended to deliver 45 amp at, say, 55 volts should be wound with No. 7 copper wire. All of the turns on this auto-transformer should be connected in series as though to make a single coil, and this single coil should be tapped at its center. However, the two halves of the coil should be placed as close together as possible. A good arrangement would be to have one-half of the coil surround completely the other half. A dimmer of the choke-coil type to be used for theatrical purposes can be constructed much along the lines of an ordinary transformer, the one difference being that some means must be provided for removing the core from the transformer coils. A 110-volt, 60-cycle dimmer should be so arranged that the product of the number of turns of wire by the core area in sq. in. equals about 1000. A dimmer for twenty 60-watt lamps should be wound with No. 10 wire; a dimmer for 140 60-watt lamps should be wound with No. 2 wire.

An old 2200-volt, two-phase motor, having 108 coils, twelve poles, four and five coils per group, connected in series and having 40.75 volts per coil, was changed to operate on a 500-volt, three-phase circuit. Three coils were connected per group per phase per pole, giving thirty-six coils per phase. Twelve coils were then connected in series, or three multiple sets per phase, making the machine a 469-volt motor when connected in delta. The motor heated up considerably, took an abnormally heavy current and ran at only about one-third normal speed. When star-connected with three star groups in multiple, the current taken was not so heavy: but no other change was noted. A delta connection was finally obtained which worked. The machine is a 100-hp motor with a frame large enough to give 200 hp. It has at least 3/32 in. clearance for the rotor and takes 40 amp. at 550 volts running light. Why should the motor require so much power at no load? C. L. H.

The 2200-volt, two-phase motor which you have attempted to rewind as a 500-volt, three-phase motor, seeming, in fact, to have succeeded in so doing, has been connected by you as a six-phase machine. That is to say, the three-phase machine has three separate phase coils per pair of poles, while the winding arrangement used by you has three separate phase groups per coil. In a six-phase winding the adjacent groups differ in time-phase by 60 deg., while in true three-phase winding the difference in time-phase is 120 deg. In order to operate a six-phase machine as a three-phase machine it is necessary to interconnect the three phases as though the first winding were used, the second one skipped initially, the third one inserted in place of the second and the second then reversed and inserted in place of the third. By this means winding A would have zero phase displacement, winding C 120 deg. phase displacement, and winding B 180 deg. + 60 deg. phase displacement, which is, of course, equal to + 240 deg. The machine as rewound by you could best be operated at 489 volts as determined by you. At 550 volts the exciting current would be increased almost in the ratio of 550 to 489. It does not seem that under these conditions 40 amp is greater than one would expect. However, the magnetization at 550 volts would obviously be greater in the same ratio, and it is very probable that the iron portion of the machine will become warmer than was originally intended, although the copper portion will be considerably cooled under load.

Central Station

Management, Policies and Commercial Methods

NEW ENGLAND N. E. L. A. SECTION ACTIVE.

The headquarters office of the New England Section of the N. E. L. A. is actively engaged in collecting statistics upon the subject of central-station rates in New England, in anticipation of the full treatment of this topic, which is planned for the annual meeting in March, 1911. At the New London convention of the section in September the importance of the rate question was emphasized by President A. J. Campbell and several of the speakers, and in view of the great differences in practice noted among the companies in informal discussions of the subject, it was seen that it would be desirable to devote a considerable part of a meeting to the question. The section secretary, Miss O. A. Bursiel, is also collecting data upon operation and is endeavoring to secure copies of electric sign ordinances. Interest is being aroused in connection with the Question Box of the association by the direction of a few questions from each issue to companies specially qualified to make answers. Copies of the "Solicitors' Handbook" and the "Classification of Accounts" recommended by the association are on sale at the office, which is located in the Boston Edison Company's building, 39 Boylston Street, Boston. The membership of the section on Oct. 1 was 713.

INFORMAL EDISON LUNCHEON CLUB AT BOSTON.

For several weeks the plan has been in operation by the Edison Electric Illuminating Company of Boston of assembling the heads of departments and bureaus informally for luncheon at a restaurant near the company's headquarters building on Boylston Street. The gathering takes place between the hours of noon and 2 p. m. five days a week, and it affords an opportunity for personal intercourse and the discussion of matters of company interest which is often lacking in the hours when the officials are scattered over the system. Special agents are also included in the party. During the luncheon hours the telephone operators of the company are in constant touch with the persons in the gathering, and it has been found that in addition to the interchange of ideas and informal good-fellowship aroused the making of appointments has been greatly facilitated and considerable time saved in the transaction of business. The general arrangements are in the hands of a committee headed by Mr. R. S. Hale, the other members being Messrs. C. H. Crockett, J. C. Redmond, W. H. Cole and Daniel Goss. From fifty to sixty men frequently assemble under this plan.

CENTRAL-STATION RESULTS AT LOWELL, MASS.

The return of the Lowell Electric Light Corporation to the Massachusetts Gas & Electric Light Commission for the year ended June 30, 1910, shows a substantial increase in earnings over the previous year. The total revenue of the company for 1910 was $395,298, compared with $348,291 in 1909, or a gain of 13.5 per cent. It is significant that the earnings of the company from the sale of electric power exceeded those of any other department by about $10,000, whereas last year the largest single item of earnings was commercial lighting, which exceeded the power sales in 1909 by $20,000. The total revenue from the sale of power in 1910 was $160,580, a gain of 29 per cent over the preceding year. The commercial lighting income of the company increased from $144,014 in 1909 to $150,214 in the later year. The street lighting income gained about $1,000 in 1910, the total from this source being $17,705.

The principal items of operating expense for the year totaled $253,346, compared with $235,503 in 1909. These expenses included cost of manufacture, distribution expense, office expenses and management, taxes, legal, insurance, and other miscellaneous expenses. There was thus a gain in net earnings after the above items had been deducted of $29,000. The company's total output at the switchboard during the year was 12,986,307 kw-hours, and of this output 8,529,620 kw-hours were sold to commercial customers. The sales of energy for lighting the streets totaled 1,272,843 kw-hours; for lighting by meter, 1,803,568 kw-hours; for contract lighting, estimate, 300,000 kw-hours; and for electric motor service, 6,336,052 kw-hours. The company used in its own service 212,423 kw-hours. The average income per kw-hour sold was about 4.63 cents, and the average income per kw-hour of power sales was practically 2.5 cents. The company burned during the year 18,066 tons of coal at an average cost of about $4.21 per ton.

ELECTRIC LIGHTING IMPROVEMENTS AT FORT WORTH, TEX.

The recent purchase by Mr. J. R. Nutt, of Cleveland, Ohio, of the electrical franchise and other holdings of the Fort Worth Light & Power Company and the electric properties of the Fort Worth Gas Company was accompanied by an arrangement with the city government which provides for the immediate construction of a central hydroelectric plant on the Trinity River with a capacity of 22,000 hp and other large improvements which call for a total expenditure of approximately $2,000,000.

It is stipulated in the contract, which the City Commission has ratified, that the price for electric lighting current in Fort Worth under the proposed merger shall be 10 cents per kw-hour on a basis of 2 kw use per hour, and 6 cents per kw-hour for any excess of this use. It is stated that the effect of this contract will be to reduce the rate that is now being paid by consumers one-half. It is further provided that the city shall reserve the municipal lighting plant and may use it as it sees fit. The city is granted a rate of 4 cents per kw-hour for the fire district and business streets and 3½ cents for city lights in the residence districts, under the provisions of Mr. Nutt's contract. All the wires in the business part of town will be put underground. Mr. Nutt agrees to install an elaborate system of street illumination at an estimated cost of $78,000, which shall become the property of the city upon its completion. The proposed system will include tungsten lamps.

It is planned that power from the proposed central hydroelectric plant shall be sold for operating the local electric railway system, the Northern Texas Traction Company's line between Fort Worth and Dallas, the machinery of the two large meat-packing plants in North Fort Worth and other industries of the city and adjacent territory.

The plans submitted by Charles William Ricker, an electrical engineer who represented Mr. Nutt in the transaction, were formally approved by the City Commission. Mr. Nutt is managing director of the Citizens' Saving & Trust Company, of Cleveland, Ohio.

NEW YORK CITY ELECTRICAL CODE.

The following changes have been made in the electrical rules and regulations of the Department of Water Supply, Gas and Electricity of New York City, Bureau of Electrical Inspection.

Beginning Nov. 1, 1910, the first paragraph of Rule 21 c, which reads as follows: "The rated capacity of fuses must not exceed the allowable carrying capacity of the wire as given

in No. 16," will be eliminated and the following inserted in its place: "Except in cases where Rule 21-d applies correct fusing will be deemed to have been secured when a fuse of the nearest standard rating to the ampere capacity of the wire as given in No. 16 is employed."

Beginning the same date the present sign rules as contained n the list of fittings of the Underwriters' National Electrical Association will be withdrawn and the following, to be known as Rule 12-d, will be substituted therefor:

a. Wires carried on the outside of sign structures must be un in approved metal conduit or approved armored cable. This does not apply to signs erected on roofs or on open ground where rubber-covered wire is employed and is not subject to mechanical injury and where it is kept at least 1 in. rom the surface wired over.

b. Wires within the structure of a sign must be double-braided rubber-covered, and where the difference of potential between wires is over 120 volts, they must be separated by at east ½ in.

c. Must be constructed entirely of metal.

d. Sheet metal must not be less than No. 26 gage.

e. Must be braced by angle iron of such thickness and so laced as to secure sufficient strength and rigidity.

f. All metal must be galvanized or enameled or treated with t least three coats of anti-corrosive paint or compound.

g. If the terminals of receptacles are not of the enclosed ype receptacles must be so constructed that the terminals will e at least 1 in. from the surface wired over. Wires must e soldered to terminals and exposed parts must be treated to revent corrosion.

h. All signs must be made weatherproof and each compartment must have suitable provision for drainage.

i. Where wires pass out of letters or into cut-out box they ust be protected by approved tubes or bushings.

j. Where wire not inferior in size and insulation to approved No. 14 gage rubber-covered wire is used connecting irect to standard sockets or receptacles 1320 watts may be dependent upon the final cut-out.

k. Must have maker's name or trade mark permanently attached to the exterior.

l. Must be so constructed as to render each compartment accessible for inspection, or in lieu thereof must be inspected nd labeled at the factory.

O-OPERATIVE INDUSTRIAL DEVELOPMENT AT BOSTON.

During the past few months the Edison Electric Illuminating ompany of Boston has been engaged in a campaign for furthering the industrial development of the thirty-four cities and owns in which it operates, the plan being a co-operative one which a committee of the company works with committees f two members each from the various municipalities to locate actories, residences and stores in the various communities ngaged in the movement. The campaign is an outgrowth of e electrical show held in Boston last year when special efforts ere made by the company to enter into closer relations with e residents of its territory. The town committees were appointed by the local boards of trade, improvement associations, or in some cases by regular town meetings. The committee from the Edison company consists of W. H. Lott, chairman; L. D. Gibbs, secretary, and L. R. Wallis, superintendent f the sales department, third member. At the outset of the ampaign a general meeting of the committees was held in the ompany's assembly hall in Boston and after a discussion of the lans a dinner was served.

At the meeting Mr. W. H. Atkins, general superintendent of e company, addressed the gathering, referring to the interest f the company in the progress of all the communities which it erves, and pointing out the advantages of Boston and its suburbs as locations for industrial enterprises and homes. He [illegible] lighting and power service, the uniformity of the rates throughout its territory of about 500 square miles, and the benefits of electric power in relation to the maintenance of healthy and attractive conditions of living. He criticised offers of financial assistance as means of attracting business enterprises to towns and pointed out the superiority of good shipping facilities, water supply, roads and sanitary conditions.

The company has made arrangements with various municipalities for the installation of large electrically lighted billboards calling attention to the advantages of the specific municipality as an industrial point of location. Each of these signs is 50 ft. long and 10 ft. high and bears the name of the town, its distance from Boston, the economy of electric power compared with steam and water, with the address of the co-operative development committee. The Edison company erects and equips the signs with lamps and hood reflector and lights them free of charge from dark to midnight six days per week as its contribution to the industrial publicity of the town. At present these signs offer no expense whatever to any town using them, and public-spirited citizens have in every case been willing to give a lease of the land free of charge. The Edison company's name does not appear on any of the signs. In each case the lease provides that the wording of the sign shall be under the control of the local committee. The signs are located so far as possible in conspicuous places where they will be easily seen from passing steam railroad trains and trolley cars by automobile tourists and other travelers.

CENTRAL-STATION FLOAT IN ROCHESTER INDUSTRIAL PARADE.

The accompanying illustration shows a storage battery truck used by the Rochester Railway & Light Company, of Rochester,

Float in Rochester Industrial Exposition.

N. Y., in the industrial parade constituting part of the Rochester Industrial Exposition held during two weeks beginning Oct. 17. The float consisted of a very large slow-moving waterwheel driving a small generator. Under the bows of autumnal foliage which surrounded part of the wheel was concealed a triplex pump, motor-driven from the truck batteries. This pump delivered water from a 200-gal. tank to a weir at the top of the waterwheel; the water then descended, driving the overshot wheel, and was re-collected in the tank. The signs were outlined in green moss, carrying out the more or less rustic effect of the banking about the wheel. The wheel operated continuously throughout the parade, and subsequently was run all afternoon in front of the company's offices on Clinton Street, where it attracted considerable attention. Two electric fans apparently driven by the "generator" added a touch of realism to the float. The parade was held on Oct. 18.

During the exposition, which was the third given in the Flower City, the main streets of the city were attractively illuminated. Immense canopies located at the intersections of the principal thoroughfares on Main and State Streets and lighted by over 1050 lamps each were suspended at least 60 ft. above the roadway. The spectacular lighting did not vary in essential details from that given last year and described in detail in these pages at the time. The Rochester Railway & Light Company with its enthusiastic aggressiveness for all that helps Rochester furnished all of the spectacular illumination free of charge.

SMALL PLANT FAILURES AND A CAUSE FOR THEM.

By Charles T. Johnson.

Electric light plants in towns of less than four or five thousand people seem, as a class, to have acquired an unsavory reputation with bond houses and investment companies in general. Application for funds by these small plants usually brings the reply that the investing company deals only with properties having a gross revenue of more than $30,000 or $50,000 per year.

Investigation into the past history of the small companies shows the principal cause for their bad financial reputation to be lack of appreciation by the owners, usually business men in the small town, of the requisites of a good electric plant manager. In many instances the owners seem to have regarded a man's ability to run an engine and to string wires in houses as the determining requirements of a manager or superintendent. The position appears to be worth not more than $60 or $70 per month. As a result, many plants have been subjected to a $60 per month quality of management and are much the worse for it. The net earnings were not such as to encourage the stockholders to put in additional investment to take care of increasing demand or to replace obsolete machinery, and consequently the finances of the company got into a worse, instead of a better, shape.

In not a few instances all of the difficulties of small companies can be traced to cheap and inefficient management. The superintendent of a small plant should be a broad-minded, diplomatic and technically trained man. His services should be worth at least $100 per month. A man that is not worth this amount is not of the type to be put in charge of an investment of $15,000 and upward. He should be capable of taking the place of any one of his employees in cases of emergency and should be willing and able to work thirty-six hours at a time if occasion require it. He should also be a man with a pleasing personality and one capable of getting into, and staying in, the good graces of the town board or city council. He should have enough technical knowledge to enable him to know when his plant is being operated economically, to test meters, to figure line losses and to take care of the many problems he meets which require for their solution a working knowledge of practical electrical engineering.

When the necessary money is put at the disposal of a superintendent of this caliber he can, in almost every case, turn a losing proposition into a paying one. Practically all of the well-managed plants in small towns are on a good financial basis, and it is safe to assume that the right man is not in charge, or the man is not supplied with sufficient money to get the plant started right, when we see a losing one.

CAPABLE ELECTRICIANS FOR SMALL PLANTS.

While the larger electric corporations appreciate and realize the importance of putting the best men obtainable at the heads of departments the managers of light plants in smaller towns are too much inclined to let a few dollars per month in wages stand in the way of getting good, capable men in their employ. The plant in a town of 4000 people and under usually has an electrician who acts as a general utility man, wiring houses, constructing lines, reading meters, trimming lamps and takin[g] care of all trouble that way. He is continually on the stree[t] and in contact with the people and is very frequently the rea[l] representative of the corporation. The position calls for [a] strong, capable, wideawake man, yet those in authority some times consider it a $50 per month job and put any one into i[t] that can be obtained for this amount.

The man to be got at this price is too frequently one o[f] local origin, who has picked up in a desultory way enoug[h] knowledge to enable him to wire houses so that lamps will burn to read meters accurately if some of the hands are not near 9 or 0 point, and to find new business when it is thrust upo[n] him. The salary and the prospects of a raise are not grea[t] enough to put any life and energy into him.

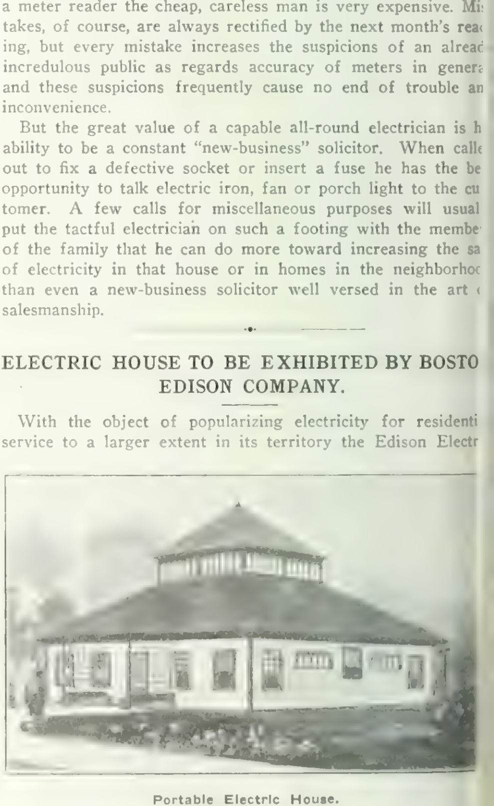
In the average small town where living is low a salary of $7[0] or $80 per month will usually attract a capable, wideawak[e] and experienced man. The management may look upon thi[s] additional $20 or $30 per month as a questionable investmen[t] but it is safe to say that it would be a profitable and wis[e] undertaking.

In the matter of wiring houses alone all of this investmen[t] may be got back. More time can be fooled away by a[n] incapable man in stringing a few wires in a building than [a] person who has not observed the difference in the way me[n] work could possibly imagine. The man who has qualified as [a] wireman by helping another incapable electrician wire a fe[w] houses will consume more time in planning his circuits tha[n] the experienced wireman will expend in completing the jo[b]. And after the would-be wireman has finished his work [it] wouldn't be safe to submit it to underwriters' inspection. A[s] a meter reader the cheap, careless man is very expensive. Mis takes, of course, are always rectified by the next month's rea[d]ing, but every mistake increases the suspicions of an alread[y] incredulous public as regards accuracy of meters in genera[l] and these suspicions frequently cause no end of trouble an[d] inconvenience.

But the great value of a capable all-round electrician is h[is] ability to be a constant "new-business" solicitor. When calle[d] out to fix a defective socket or insert a fuse he has the be[st] opportunity to talk electric iron, fan or porch light to the cu[s]tomer. A few calls for miscellaneous purposes will usual[ly] put the tactful electrician on such a footing with the membe[rs] of the family that he can do more toward increasing the sa[le] of electricity in that house or in homes in the neighborhoo[d] than even a new-business solicitor well versed in the art [of] salesmanship.

ELECTRIC HOUSE TO BE EXHIBITED BY BOSTO[N] EDISON COMPANY.

With the object of popularizing electricity for residenti[al] service to a larger extent in its territory the Edison Electr[ic]



Portable Electric House.

Illuminating Company of Boston is now building a portab[le] bungalow which will be exhibited in all the principal citi[es]

and towns in which the company operates. The present plan contemplates placing the house in a municipality for a season, Winchester being selected as the first town to be visited. The house will be equipped with a great variety of electrically operated conveniences which are now available for use in any home, and only the practical devices which tend to increase the real comfort and convenience of home life will be shown. The house when completed will be 34 ft. square with an 8-ft. x 10-ft. pergola on the front and rear. An entrance hall 10 ft. long x 6 ft. wide is provided, from which double doors on either side open into a dining-room on the right and a living-room on the left. At the end of the hall will be a spacious reception room surmounted by a dome, and beyond the reception room will be a hall similar to that in front flanked by a kitchen on one side and a chamber on the other. A bathroom and pantry will also be provided. Special effort will be made to avoid the installation of so-called novelties which tend only to increase the size of the customer's bill and give no adequate return, either in enjoyment or convenience. The house will be carefully furnished according to the best modern standards of taste, and it will be placed in the general charge of a man well known in each town to which it goes. It is planned to have the house open all day and throughout the evening, and a force of competent demonstrators will be on hand to help visitors make the most of the establishment. Among the possibilities is a so-called "maids' night," when the benefits of electricity will be brought home to domestic servants in representative families. An electrically driven refrigerating plant supplied on the basis of a flat rate per month for off-peak service will be a feature of the equipment, and the house will be provided with a modern electric garage and charging station, equipped with mercury arc rectifier outfit and a Bailey electric carriage, with Edison battery and motor-driven tire pump. It is anticipated that the hospitalities of the company at the house will make it an attractive place socially. The house is designed so that it may easily be taken down in sections and shipped to other points when its visit to any given municipality terminates.

CENTRAL-STATION RATE SCHEDULES FOR RETAIL CUSTOMERS.

By A. C. Einstein.

Electric companies in recent years have experienced much difficulty in their relations with consumers to establish a basis upon which an equitable schedule of rates can be established—some method which will accord the liberal patron and long-hour user of electrical energy for a like requirement a rate proportionate to his value as a customer as compared to the user who draws on the company sparingly and in particular only during the hour of peak loads. It has been the practice for electric companies to charge an established rate for the general run of customers, with a discount, or scale of discounts, on the monthly bill proportionate to the gross amount. This results to the advantage of the customer with a large installation, who pays less per unit of energy used than the "little fellow" even though the consumption of the latter proportionate to his connected load should fairly entitle him to an equal or lower rate per unit.

To overcome this apparent unfairness a method has come into vogue to charge for the energy used on an "hours'-use" schedule based either on the connected load or the demand. This method has the advantage that the electric company then receives for the use of its service during the peak hour the full rate and an adequate return; and it automatically insures to the user a reduced rate for long hours' use. For the customer with a large installation, indicators or other measuring devices are installed to ascertain the demand or maximum rate at which energy is used. For the general run of customers, the masses patronizing the electric company, devices to record the demand are not only an additional expense requiring extra labor and time to read and record such readings, but are a burden which from an investment standpoint the companies in large cities, and more particularly those in the smaller towns, do not wish to incur. To avoid the installation of such indicators or measuring devices many electric companies have resorted to the expedient of basing the hours'-

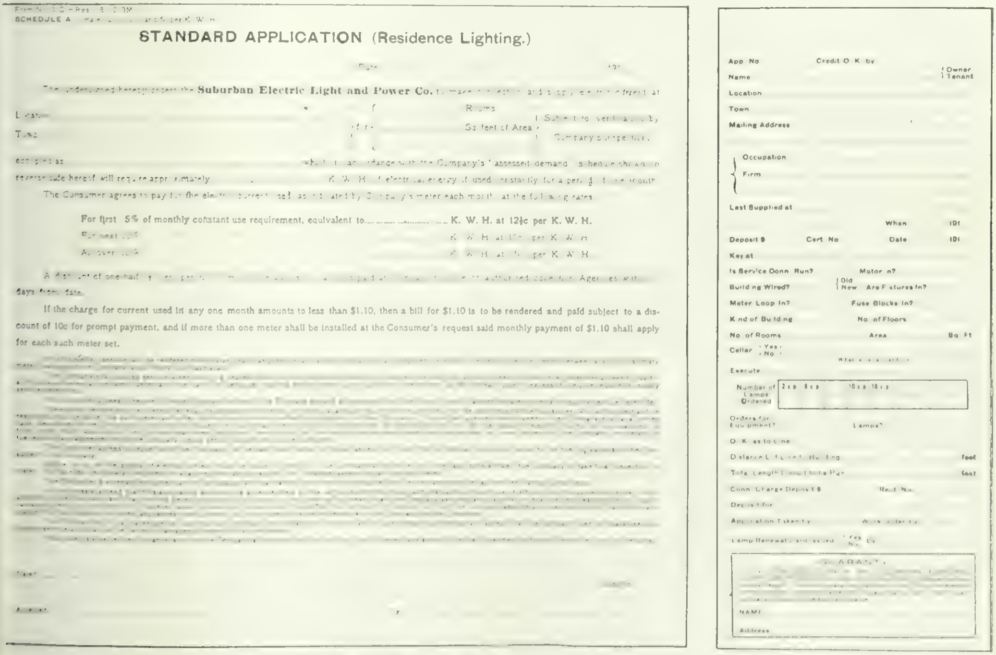


Fig. 1—Standard Residence Application.

use charge on the connected load or a percentage thereof. This practice has many objections, some of which are as follows:

A consumer who, for convenience or decorative effect, is liberal in his installation will be charged on a large connected load unfairly for his hours' use as compared with a patron who wires up his premises with the least possible number of outlets. Although the premises of these consumers may be alike in size and the former use a greater amount of electrical energy, still it is possible for the latter, under an hours'-use schedule based on connected load, to obtain his energy at an average less rate per unit. This seems eminently unfair, and the basis on which the schedule of rates is applied contributes to its unfairness. Charging by the hours'-use schedule of rates based on connected load also places a restriction on the business of the electric company, for the reason that it encourages or compels the consumer to limit his connected load to his actual requirements in order to reach through the hours'-use schedule a possible lower rate for energy consumed.

hours'-use rates, based on connected load, the writer has concluded, irrespective of the actual capacity connected, to establish in lieu of the actual connected load a fixed charge or "assessed demand" per room for residence lighting, and a fixed charge or "assessed demand" per 100 sq. ft. of area for commercial or general lighting. By this method each consumer is treated alike; if one chooses to make a liberal installation he will not suffer thereby, but may secure through liberal consumption the average lower rate to which he may be entitled.

For residence lighting the fixed charge, or, as it should be called, "assessed demand," is as follows: For the first 3 rooms, 100 watts per room; for the next 4 rooms, 60 watts per room; for the next five rooms, 40 watts per room; for the next 6 rooms, 35 watts per room; for the next 7 rooms, 30 watts per room, and all over 25 rooms, 25 watts per room. For stores or commercial purposes, and rooms in excess of 500 sq. ft. in area the following fixed charge or "assessed demand" schedule has been adopted: For the first 1000 sq. ft. area, 30 watts per 100

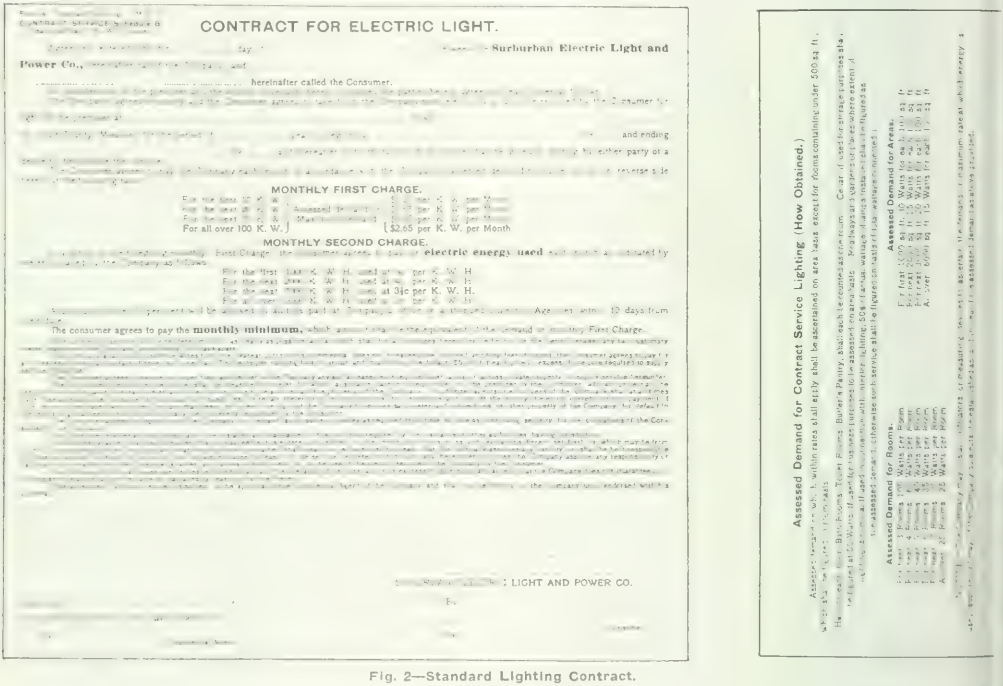


Fig. 2—Standard Lighting Contract.

The connected load is also a variable quantity. A consumer's premises upon inspection may show a certain capacity connected which, without notice to or knowledge of the company, the consumer may increase from time to time. This is not only possible, but has become in the writer's experience a practice. The consumer, knowing the hours'-use schedule of rates applies on his connected load, will, until his premises are inspected, install a connected load temporarily, with the possible intention of increasing it materially after inspection.

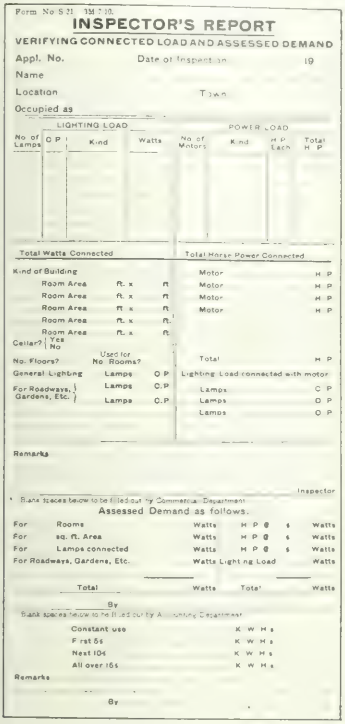
In many cases consumers not familiar with the relation between the hours'-use rate and connected load, having made a liberal installation, will, when receiving a bill seemingly high, not only cut down the use of electrical energy, but also in many instances will remove lamps and discontinue the use of other energy-using appliances. Although the actual hours' use of the then connected load may entitle this consumer to a lower rate, he, however, through ignorance of the relation between connected load and hours'-use schedule, does not secure it, as the record of his original installation has not been changed on the books of the company.

sq. ft.; for the next 2000 sq. ft. area, 25 watts per 100 sq. ft.; for the next 3000 sq. ft. area, 20 watts per 100 sq. ft., and for the next 6000 sq. ft. area, 15 watts per 100 sq. ft. A charge is established for cellars, which in residences are figured as one room, while in stores, if used for business purposes, they are assessed on an area basis. Provision is also made for outdoor or general lighting in connection with residence or store lighting.

It will be noted that the "assessed demand" for residence lighting is based on the number of rooms beginning with three or less at 100 watt capacity each, with proper concession to the subscriber occupying more extended premises, the watts capacity per room or the "assessed demand" decreasing proportionately to the greater number of rooms. By this method subscribers having a like number of rooms will have an established like "assessed demand." There is no discrimination and no restriction to a liberal installation; the more light or electric energy the consumer uses proportionate to his "assessed demand" the lower the rate.

A point in our application forms is that under the residence lighting form of application the monthly minimum payment

der the commercial or general lighting form an increased monthly minimum payment charge applies, for the very good reason that the light is used for commercial purposes, and the concessions made determining "assessed demand" justify a higher monthly minimum charge. Under our contract, the company, however, reserves the right to install indicators or



Form No S 21 3M 7 10.

INSPECTOR'S REPORT

VERIFYING CONNECTED LOAD AND ASSESSED DEMAND

Appl. No. Date of Inspection 19

Name

Location Town

Occupied as

LIGHTING LOAD				POWER LOAD			
No of Lamps	C P	Kind	Watts	No of Motors	Kind	H P Each	Total H P

Total Watts Connected — Total Horse Power Connected

Kind of Building — Motor H P

Room Area ft. x ft. — Motor H P

Room Area ft. x ft. — Motor H P

Room Area ft. x ft. — Motor H P

Room Area ft. x ft.

Room Area ft. x ft.

Cellar? { Yes No

No. Floors? Used for No Rooms? — Total H P

General Lighting Lamps C P — Lighting Load connected with motor

For Roadways, Gardens, Etc. } Lamps C.P — Lamps C P

Lamps C.P — Lamps C P

Lamps C P

Remarks

Inspector

* Blank spaces below to be filled out by Commercial Department

Assessed Demand as follows.

For Rooms Watts H P @ $ Watts

For sq. ft. Area Watts H P @ $ Watts

For Lamps connected Watts H P @ $ Watts

For Roadways, Gardens, Etc. Watts Lighting Load Watts

Total Watts Total Watts

By

Blank spaces below to be filled out by Accounting Department

Constant use K W H s

First 5¢ K W H s

Next 10¢ K W H s

All over 15¢ K W H s

Remarks

By

Fig. 3—Inspection Report Card.

measuring devices to ascertain the maximum demand which can be established by the company in lieu of the "assessed demand."

Thus far our company's experience has been most satisfactory in its relation with our residence and commercial or retail patrons whom we are serving under the above plan.

Wiring and Illumination

LIGHTING OF THE BURLINGTON ARCADE.

It has been customary in the large department stores of John Wanamaker in New York and Philadelphia to feature the latest styles and the world's treasures gathered by a host of foreign representatives in fashion reviews, expositions, conferences, etc., the merchandise or novelties being conveniently assembled in one place for ready inspection by the firm's clientele. During October the fall "Paris Conference" was held and the shops of Rue de la Paix were reproduced in the Stewart store with a complete stock of everything Parisian. At present there is being reproduced in the rotunda of the new Wanamaker Building a duplicate of the well-known Burlington Arcade of London. This is a collection of separate men's shops. In some clothing is offered; in others automobile costumes and accessories, luggage and wraps; another displays men's furnishings, umbrellas and canes; another is devoted to men's jewelry and carries everything from a scarfpin to a coin purse. There is a shop carrying a line of rare imported books, in exquisite bindings. Then comes a line of boots and shoes such as are found in Bond Street, London. There is a hosiery shop, with socks in all colors; a hat shop containing the latest European blocks; a social stationery shop, too, which provides cards, letter paper, engraved monograms, crests, etc.

Fig. 1—Burlington Arcade Looking West From Fourth Avenue.

The sporting-goods shop contains goods ranging from a golf ball to a smooth-bore gun. There is a dainty perfumery shop and also a men's glove shop.

As these shops contain only European goods, imported specially for the Arcade, it will be seen that the effective and harmonious lighting of such a variety, comprising such a wide range of colors, was no easy task. The lighting was entrusted to the Westinghouse Electric & Manufacturing Company, which treated the Arcade as a single unit, entirely independent of the rest of the store lighting. The wiring and placing of outlets were done under the supervision of Mr. C. E. Clewell, illuminating engineer of the Westinghouse company. Mr. Fisher, of the lamp works, inspected the plans and structure and specified the types of lamps he considered best adapted to the show windows and passages.

Fig. 2—Jewelry, Perfumery and Leather Goods Sections.

It was realized at the outset that the rearranging of shop displays and stocks would cause vibration and disturbance and the Westinghouse "wire-type" tungsten was installed throughout.

The details and characteristics of this type of lamp were described in a paper by Mr. C. F. Scott before the St. Louis convention of the N. E. L. A. and can be found in the June number of this paper. The first 40-watt lamps built by the Westinghouse company went to Wanamaker's; the installation comprises 200 40-watt and twenty-two 500-watt lamps.

The Macbeth-Evans Company, Pittsburgh, Pa., cast twenty

[illegible] for these [illegible] fixtures were installed by the Mitchell-Vance Company, of New York, which overcame the difficulties due to size, weight and the heavy sockets required. The Holophane Company furnished the reflectors specially adapted to the Arcade. Without giving details of the shop lighting, a suggestion is furnished by the jewelry shop, for which a satin-finished reflector was used

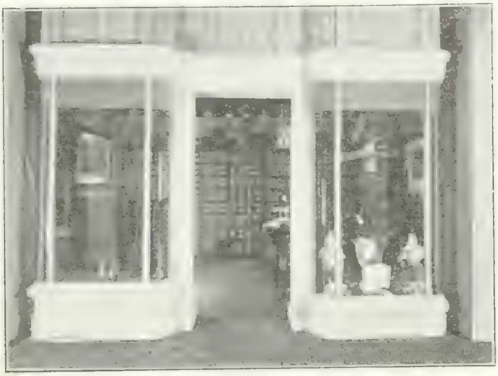


Fig. 3—Shoe and Hosiery Shops.

(in connection with a deep frosted lamp) which affords a low, intrinsic brilliancy and gives a pleasing white light. There is an entire absence of glare. The shape of each type of reflector was carefully chosen to correspond with the class of merchandise in each shop and 110 show-window reflectors were furnished in addition to enough resident reflectors. The Tungstolier Company furnished eighteen special brackets (in cloister finish) required by the unusual architecture of this temporary structure, which has less stability and strength than are usually available.

It is believed that this installation represents the highest skill in the electrical field. The different interests involved co-operated closely to furnish the best in scientific display lighting, at low cost, with far more beautiful effects than carbon-filament lamps offer. A number of shops in the Arcade are illustrated herewith. The illumination is withal cheerful and contrasts remarkably with the cold blue of the arc lamps used elsewhere

Fig. 4—Hat and Umbrella Shops.

throughout the store. Needless to state, the dingy aspect of the original Arcade is entirely lacking in the Wanamaker reproduction because of the modern and scientific illumination. The installation, moreover, is well worth a close study by store managers desirous of bringing out the true color values of merchandise by artificial light. In the field of economics it is destined to play an important pioneer rôle.

PRACTICAL VALUE OF ILLUMINATING ENGINEERING.

One of the features of the Baltimore convention of the Illuminating Engineering Society, held on Oct. 24 and 25, was a session devoted to the discussion of the advantages of illuminating engineering to various interests, papers by Messrs. W. J. Serrill, J. F. Gilchrist and V. R. Lansingh being read on this subject.

VALUE TO THE COMMERCIAL MAN.

Mr. Serrill said that the commercial man is dependent upon the illuminating engineer for the design and development of the electric and gas lamps which he has available to offer to the public. The physical and chemical principles underlying both of these forms of illuminants are abstruse, and each has reached its present efficient form through invention and research on the part of scientific men. It may be admitted that the commercial man need not master the principles underlying the design of lighting units, but constant co-operation and exchange of opinion between the commercial man and the laboratory man are essential. The latter is to a large extent dependent upon the former for a knowledge of the public taste, and of the extent to which the public purse will be opened to its gratification. In addition, the commercial man will understand the requirements demanded by the various kinds of buildings and of occupations, as affecting such points as the size of the unit, the distribution of light from it, its color, its daylight appearance, etc. The association together of these two classes of men at the sectional and annual meetings of the society cannot fail to be of benefit to the art of illumination.

It is evident that the commercial man, having at his command an assortment of lighting units, must, in his efforts to sell them, be possessed of a comprehensive knowledge of the salient characteristics of each of the units. Knowledge of this kind is essential to the commercial man in his efforts to sell and to meet the competition of other forms of illuminants. Here there is reached another point which emphasizes the importance of the commercial man attending the meetings of the Illuminating Engineering Society. At the meetings he learns how to interpret and utilize the data furnished by the laboratories.

Since practical considerations force the application of lighting units to interiors into the hands of the canvasser, it should be unnecessary to furnish an argument toward the education of the canvasser in the principles of illumination. Each company must solve for itself the problem of imparting this education; upon its success will depend whether or not the interiors covered by its field of operation are properly lighted. The author expressed the opinion that the Illuminating Engineering Society should become an active factor in the education of the lighting canvasser. Especially should the local sections take an active part. In these more time should be given to discussions of actual installations. Such installations, illustrated by diagram or photographic slide, when criticised and discussed in public meeting have a high educational value. Commercial men, members of local sections, should be encouraged to present descriptions of such installations and of interesting problems that arise in their experience.

The profession of illuminating engineering is emerging from the state of infancy; it is proper that the scientific principles which underlie the profession should have been mastered before the practical phases of the subject come to the fore. The society is now in a position to devote more time to the latter.

The practice of illumination is not only an art, but is also a profession. Those arts in which the processes are so simple that no knowledge of the underlying principles is needed in order to practise them are arts pure and simple; in proportion as the processes become complex and involved, and as the problems contain many variable quantities, a knowledge of these principles becomes essential, and the art merges into a profession. The more complex the problems involved in [illegible] the more numerous the practical obstacles, the

more essential becomes a knowledge of, and a constant reference to, the principles which underlie the profession of illuminating engineering.

The author contended that the profession of illuminating engineering deals with an important subject, fraught with grave consequences to the future of our race. Conserving the most vital one of those five senses which form the connecting links between the personality of the individual and the physical world, it is destined to exercise an important influence on the progress of civilization. It enlists the services of the physicist, the chemist, the mathematician, the physiologist, the oculist, the manufacturer, the architect, the artist, and in this list the commercial man holds an honorable and commanding position. No one, two or three of the types of men here named can solve the multifarious problems of the profession. It requires the services and the co-operation of them all. The profession cannot afford to have any one of them hold aloof, and it will prosper in proportion to the degree of co-operation and of interchange of opinion that is maintained and to the extent to which those individuals who compose each group endeavor to broaden their views by obtaining as great a knowledge as possible of the activities of the other groups. The commercial man cannot afford to remain ignorant of the progress of illuminating engineering. The best basis upon which to build the knowledge and experience of salesmanship in this commodity is a familiarity with the principles of illuminating engineering.

VALUE TO THE CENTRAL STATION.

In the paper by Mr. Gilchrist it was stated that there can be no doubt as to the very great desirability from the standpoint of their own interests of the central stations fostering the development of illuminating engineering and the training of the young men in the industry to a thorough knowledge and appreciation of the fundamental principles of proper illumination.

Until within the past few years a comparatively small number of men in the electric lighting business have been impressed with the importance of this sort of intelligence and training the attention of most of the best minds having been directed toward the development and operation of apparatus for the generation of electricity and to the engineering problems which pertain to the transforming and the distributing systems incidental to the supply of energy to customers from a central-station plant. It is only recently that, through the work of specialists advanced in their profession and the influence of the Illuminating Engineering Society and kindred organizations, intelligent attention has been given to the very important matters of utilizing the light produced in the most proper, hygienic and economical ways.

Under this new order, however, remarkable progress has already been made in the development of illuminants which are more economical and which are better adapted for various forms of lighting, and the standard of artificial illumination has been increased more, perhaps, than the standard of any other modern product. To appreciate this fact fully one who has been in the business for any considerable length of time has only to compare the illumination in the store of some conservative customer where five or six years ago he laid out a system of illumination in which he took great pride and which has not subsequently been changed with what he considers proper present-day illumination in some similar store recently equipped.

The above simple observation will prove several things. It will prove the advance in the standard of illumination. It will prove to those who have looked on both installations as masterpieces of the period how much advancement has been made in the knowledge of illuminating engineering, although the obtaining of this education may have been involuntary and by a process of absorption rather than through any premeditated effort, and the old unchanged installation by its very rareness will prove to what extent the layman has acceded to the compelling force of the times demanding higher standards of illumination.

It is in this point of the education of the customer that one of the great practical values of illuminating engineering to the central station lies. The progressive layman will rarely turn a deaf ear to reasonable views and advice tending toward better illumination.

The central-station manager should wake up thoroughly to the fact that in the lighting end of his business what he should sell is an effective and useful illumination and not merely electricity, but he cannot sell the former without the aid of representatives who are thoroughly well educated and up to date in matters of illumination, and in such representatives he has nothing more or less than a corps of illuminating engineers, despite any prejudices he may entertain.

The Illuminating Engineering Society has accomplished a vast amount of good for the central stations in the work which it has done up to the present time. Perhaps it has not received the hearty support of the central stations in the way that it should have done, but the work is only begun and it should feel only the greatest amount of encouragement for what it has accomplished and keep on in a larger way year by year. Central-station managers must see their interests and be shown them if they do not see them, and a larger number of the rank and file of the young men selling illumination must be secured as members of the society and placed within the influence of its educational features.

The author remarked that a splendid advance was made in the course of lectures arranged to follow the convention of the society. The society should consider some means of extending these benefits to a very much greater number of men engaged in the practical work of selling illumination than could possibly be gathered together at any one place. Results could possibly be accomplished by giving this form of instruction from several centers, or, better yet, some correspondence arrangement with examinations, etc., might be arranged which would insure the proper amount of individual work on the part of students. With the proper stirring up there should be no difficulty in providing the necessary funds for such courses of instruction, because, from the standpoint of the central station, there is no more practical work in the industry than that being done by the Illuminating Engineering Society.

VALUE TO THE MANUFACTURER.

Mr. Lansingh discussed particularly the value of illuminating engineering to the manufacturers of illuminants, shades and reflectors, appliances and contributing apparatus. He said that a knowledge of illuminating engineering will teach the consumer to choose correctly the character of illuminant desirable for the work in hand, which will lead to a wider extension of such illuminant for such work. Illuminating engineering teaches the salesman of the manufacturer to solicit business intelligently, placing him in a decidedly advantageous position over his competitor who has not this knowledge. It puts the manufacturer employing such methods above his competitors not employing them, making it, therefore, more easy to sell his goods.

A comprehensive knowledge of illuminating engineering not only in its broadest sense, but in its more narrow and usual application, must be employed. Thus, in the case of prismatic reflectors, there are all sorts of candle-power distributions which have been obtained to fit different conditions, as, for example, the so-called "extensive," "intensive" and "focusing" forms of distribution, all of which have been designed to fulfil lighting conditions which it would have been impossible to produce or even know the requirements of without a proper knowledge of illuminating engineering.

Under the heading of appliances the author included all of those devices that are directly applicable to the illuminants themselves. Thus, there are the fixtures used to support the illuminants and their shades or reflectors; the burners in connection with mantle gas lighting; the sockets for electric lamps; the tips for open gas and acetylene lighting, as well as numerous other appliances. The fixture manufacturer has been, generally speaking, slow to recognize the value of illuminating engineering as applied to his art; but to-day the most progressive houses are recognizing its value and are accordingly taking advantage of it, much to their financial benefit, especially in commercial lighting.

The value of illuminating engineering to the manufacturers

of contributing apparatus is indirect rather than direct, but that its value is great no one would deny. Thus in the incandescent electric lamp field the extension during the past few years into new fields has been tremendous, all of which means a larger demand for apparatus of all kinds. The manufacturers of the electric generator, the steam boiler and all the other necessary parts to a generating station—conduits, wire, porcelain—and all the appliances necessary for the distribution of electrical energy have been greatly benefited by the large increase in the use of electric energy, by reason of a more thorough appreciation of its advantages by the public, which have been largely caused by its correct use, due to a knowledge of illuminating engineering, either on the part of the customer or those responsible for the sale of illuminants.

In the discussion of the above three papers Mr. G. H. Stickney read a communication from Mr. W. D. A. Ryan in which attention was directed to the desirability of co-operating with the architects, who usually determine the illumination scheme to be employed in important buildings.

Mr. E. B. Rowe stated that when approximate methods are developed for the use of persons not well versed in illuminating engineering principles especial care should be exercised to insure accuracy in the interpretation of the results obtained by the methods.

Mr. E. L. Elliott claimed that the necessity exists at the present time of educating the contractors and builders with reference to the requirements of illumination, in order that the illuminating equipment may be properly selected while the building plans are being considered.

Mr. G. E. Williamson explained the results obtained by the Denver Gas & Electric Company from applying illuminating engineering principles in arranging lighting installations for its customers. He said that the best feature of the work was the confidence inspired in the customers by the excellent results from following the advice of the company concerning the illumination.

LETTERS TO THE EDITOR.

Converter Substations.

To the Editor of Electrical World:

SIR:—When reading the article on "American Switchboard Practice" in your Aug. 4 issue the writer was under the impression that the cut illustrating a cross-section of a converter substation referred to a substation built by the Boston Elevated Railway Company. The similarity to a substation designed and built by the Brooklyn Rapid Transit Company at an earlier date was commented upon in a letter published in your columns some weeks later.

Since the author of the article on "American Switchboard Practice" has confirmed the writer's impression by his reply of Oct. 6, and further takes the credit for the originality of the design of the Boston substation, I wish to take exception to these claims.

About the time that the engineers of the Boston Elevated Railway Company were contemplating the extension of their system by the addition of converter substations, they visited several of the largest railway systems in the East, and, of all the substations visited, the Thirty-eighth Street station of the Brooklyn Rapid Transit Company impressed them the most. They, therefore, requested drawings of this substation and a complete set of drawings was accordingly furnished to them. They also visited this substation on several occasions at later dates for further information and to make sketches while they were working up the details of their own substation.

I wish now more fully to emphasize my previous statement regarding the arrangement of apparatus and station layout of the station in question, as described and shown in cross-section, and would say that the cut illustrating the Boston substation is not only similar to, but is an exact duplicate of, our Thirty-eighth Street station in the following particulars:

Entrance of high-tension cables into station; wiring to oil switches through disconnecting switches and to high-tension buses; wiring from high-tension buses, through disconnecting switches and oil switches, to transformers and from transformers, excepting alternating-current starting switches, to rotary and to switchboard and outgoing direct-current feeders; the location of negative bus and connection through pedestal switch to rotary; the location of the direct-current and alternating-current feeder pits; location of oil switches and position of disconnecting switches; the construction of gallery for the high-tension bus compartments and battery-room and duplicate high-tension bus arrangement; also the construction of the air chamber and rotary foundation walls.

I would further state that the author of the article here referred to also visited the Thirty-eighth Street station, seeing it in actual operation at a date considerably previous to putting into service the Boston substation, and it is with much surprise I note that he now lays claim to the design of the Boston station, knowing it to be a direct copy, even to small details, of a station previously built.

As to the Thirty-eighth Street station being representative of American switchboard practice, I would question as to where there is another station which is in any way similar or any company where the double high-tension bus is even common practice. The Thirty-eighth Street substation was developed as the result of several years' experience by the Brooklyn Rapid Transit Company and the plans were drawn up entirely by its engineers, without outside assistance; moreover, the plans were not submitted to any manufacturing company for approval and certainly do not represent the practice of any manufacturing company.

I wish also to correct the statement that the Thirty-eighth Street station was designed for 6600 volts, as it is designed throughout to operate at from 11,000 volts to 15,000 volts.

In view of the above facts I fail to see the correctness of the statements of Mr. Hayes, although I do not deny that he may have made suggestions as to the type of rotary and checked the details of station wiring and the method of starting.

In regard to the type of rotary adopted, method of starting used and transmission voltage and the manufacturing company furnishing the equipment, these do not enter into the discussion, as the original comments made by the writer were with regard to the station in question being a copy of a station built by the Brooklyn Rapid Transit Company.

Brooklyn, N. Y. A. K. MILLER.

Arc Versus Tungsten Lamps for Indirect Illumination.

To the Editor of Electrical World:

SIR:—In the letter "Arc Versus Tungsten Lamps for Indirect Illumination" in your issue of Oct. 6 there appears in the last paragraph a statement that the loss in efficiency due to

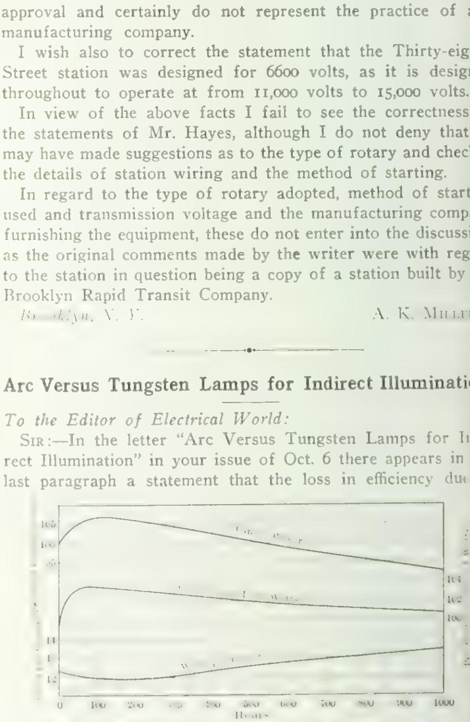


FIG. 1—Candle-power Life Curve for Mazda Lamp.

the rapid deterioration of tungsten-filament lamps may be safely figured at from 25 per cent to 40 per cent during the life of the lamp, and that an allowance should therefore be made for this loss when comparing arc and tungsten lamps

I quite agree with Mr. Eznuk that all comparisons between various illuminants should be based upon the average rather than the initial performance of lamps, but I am not of the opinion that it is necessary to discount the initial candle-power values on metallic-filament lamps when comparing them with arcs. In a bulletin recently issued by the Engineering Department of the National Electric Lamp Association I find the candle-power life curve for "Mazda" lamps which is shown in Fig. 1. Fig. 2 is taken from the "Standard Hand Book for Electrical Engineers," and shows the candle-power life curves for enclosed-arc lamps. The following explanation of the curves is given in the "Standard Hand Book":

"The only other loss in arc lamps which is variable with time is, in the enclosed arc, the loss of light due to the coating formed on the inner globe between successive trimmings. This is not negligible, although very variable in amount. Fig. 2 shows a typical result obtained by Matthews from a

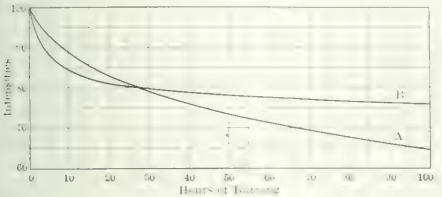


Fig. 2—Candle-power Life Curve for Enclosed Arc Lamp.

direct-current enclosed arc. The deposit forms more thickly in the upper part of the globe than in the lower, so that A, above the arc, shows more loss than B, below the arc. The mean loss of light is 20 per cent to 25 per cent, an amount that must be reckoned with when comparing arc lamps with incandescents."

Cleveland, Ohio. WARD HARRISON.

Bedding of Wire in Magnet Coils.

To the Editor of Electrical World:

SIR:—An erroneous idea that seems to be peculiarly persistent is that the convolutions in each layer of a magnet-coil "bed" between the ridges formed by the convolutions in the layer immediately beneath the one considered, and thereby increase the space factor of the winding. This notion originated, I believe, with Prof. Silvanus P. Thompson, and almost every writer who has discussed magnet windings since this fallacy was started has accepted it blindly and passed it along.

As a matter of both theory and fact, the "bedding" above mentioned, which is so scientifically reckoned on by many writers, cannot possibly occur except at two points, diametrically opposite, in each convolution; the remainder of the convolution crosses the convolution beneath it at a very acute angle, but it *must cross*—it cannot bed for any appreciable distance. The only effect of such momentary bedding as does occur is to distort the shape of the coil perimeter from a true circle, if the core be round, or to reduce the thickness of the coil section slightly at the corners, if the core be of oblong or rectangular cross-section.

What does happen, and to a considerable degree with cotton-covered wires of relatively small sizes (about Nos. 18 to 24), is that the insulation is compressed slightly between the layers by the tension put on the wire during the process of winding the coil. This, however, is rarely sufficient to compensate for the waste of space by the irregular winding of small wires or the reversal of the "thread" at the ends of a coil wound with a large wire. I have directed the construction of several hundred magnet coils and have never been able to get as many convolutions in a given section as the familiar formula,

$$\frac{W \times \Delta}{d^2} = \text{convolutions,}$$

indicated, except when the width W and the depth Δ of the coil were made an exact multiple of the insulated diameter d of the wire, and the latter was fairly large. Except with wires of about Nos. 10 to 14 gage it is usually impossible to get the full theoretical number of convolutions by any method of winding commonly used in factories devoted to the manufacture of electrical machinery. Of course, I am aware of the precision with which coils of very small wire are wound by automatic machines, but those are not commonly used in plants of ordinary size and equipment devoted to the manufacture of electrical apparatus.

New York. CECIL P. POOLE.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Braking Induction Motors.—R. E. HELLMUND.—A discussion of the method of braking an induction motor by means of direct current supplied to the stator. The simplest way of supplying direct current to a star-connected three-phase stator is to pass the current into one phase and use the two other phases in parallel as return. Other possibilities are also discussed and illustrated by diagrams. The fundamental theoretical considerations on which this method is based are given, together with the principal formulas and characteristic curves. The chief disadvantage of the method is that direct current is required and that a converter must, therefore, be provided. Its capacity does not need to be more than 5 per cent or 10 per cent of the motor capacity, but it is an undesirable complication. Even if direct current is available, it cannot be used to advantage, since the usual voltages are too high, so that considerable energy has to be wasted in a series resistance. A further disadvantage of the method is that under practical conditions high saturation in the iron must be employed, which results in iron losses in the rotor and in considerable mechanical stresses in the motor.—*Elek. u. Masch.* (Vienna), Oct. 2.

Self-Exciting Alternators.—P. B[illegible] and M. L[illegible].—An article illustrated by diagrams on the possibility of operating single-phase commutator motors with a series characteristic as self-exciting generators, with special reference to the Latour series motor and the repulsion motor.—*L'Industrie Elec.*, Sept. 25

Stray Fields of Transformers.—W. ROGOWSKI.—A theoretical paper illustrated by diagrams. The author first gives the conditions under which only stray fluxes, without any mutual flux, are obtained in a transformer. This is the case if the primary and secondary windings are supplied with currents in such a way that the primary amp-turns are exactly equal and opposite to the secondary amp-turns. With a transformer of the transformation ratio of 1 to 1 this condition is fulfilled if the two windings are connected in series and opposite to each other, as shown in Fig. 1. In this case the sum of the stray inductances of AC and BC of the transformer equals the self-induction of the single circuit ACB. Any method of measuring self-induction can, therefore, be employed for investigating the stray fluxes of a transformer. Two such methods are described which can be directly applied if the transformer has a transformation ratio of 1 to 1 by connecting the two windings opposite to each other as in Fig. 1. If the transformer has another transformation ratio it is necessary to employ an auxiliary transformer of the same transformation ratio.

The author then discusses the stray fluxes of two coaxial rings of equal size and two infinitely long coaxial coils. The article is to be concluded.—*Elek. Zeit.*, Oct. 13.

Transformer Oil.—Henry.—An account of a report of a committee (consisting of Gerard, Goffin and Lepouse) of the Belgian Society of Electrical Engineers on tests of oil for transformers and high-tension interruptions. The report deals with rapid preliminary tests, the method of charging the oil into the transformer, precautions in the storage and shipment of the oil, practical methods of drying large quantities of oil, specifications for insulating oil, tests of dielectric strength, and investigations of physical and chemical properties.—*L'Industrie Elec.*, Oct. 10.

Mercury-Vapor Rectifier.—W. Hechler.—An illustrated paper read before the Berlin Electrical Society on the latest practical forms of mercury-vapor rectifiers. In the discussion Orlich stated that they used this rectifier in the Reichsanstalt with good success for charging batteries over night without any attendance. Iron resistors in a hydrogen atmosphere are used in series with the battery. Strecker stated that the German telegraph department has used the rectifier successfully for charging batteries. The efficiency of about 80 per cent has been obtained. Passavant emphasized that the rectifier might be useful for charging batteries in engine houses, since many of the German fire departments are about to use automobile engines.—*Elek. Zeit.*, Oct. 13.

Lamps and Lighting.

Vacuum-Tight Seal Between Iron and Glass.—H. J. Sand.—A longer account of his recent British Association paper, which has already been briefly noticed in the Digest. Vacuum-tight seals for the introduction of wires into glass can be obtained by making use of the elasticity of small steel tubes serving as caps. The method is as follows: An iron wire (*b*, in Fig. 2)

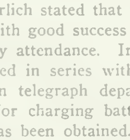


Fig. 1—Transformer Connections for the Measurement of Stray Fluxes.

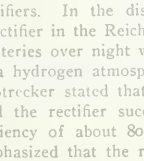


Fig. 2—Vacuum-Tight Seal Between Iron and Glass.

is sealed into the glass *a* and a small piece of heated steel tubing *c* is pushed a few millimeters into the glass while the glass is still hot; after cooling, the tube is soldered to the wire, as indicated by the dots *d*. The contracting steel tube forms a vacuum-tight seal between the inner surface of the tube and the glass inside it, which is put under compression. Tubes into which iron wires of 1 mm (39 mils) had been sealed in this manner were pumped out to a cathode-ray vacuum four months ago and their vacuum has remained unchanged since. In the earlier experiments the seal was usually arranged inside the evacuated tube, because any air trapped between the wire and the glass would be difficult to remove if the seal were outside. A London firm of glass-blowers, however, has recently made cathode-ray tubes with the seals outside. Seals between iridium and quartz glass, into which so far wires had not been introduced, seemed to be realizable in the same way. Whether these seals would technically replace platinum seals could not yet be said.—Lond. *Eng'ing*, Sept. 30.

Electric Arc in Low-Pressure Atmosphere.—H. Buisson and C. Fabry.—An account of an experimental investigation of the behavior of the electric arc between metals in a low-pressure atmosphere. In order to obtain well-pronounced spectrum lines low pressures must be employed. When the substance whose spectrum is desired is a non-volatile metal, such as iron, the only way is to set up an arc in a low-pressure atmosphere, using the metal for electrodes. Experience shows, however, that this arc, which is stable in free air, is much less easy to produce at low pressures. It is extinguished when the points are separated, or else plays between other points than the ends of the electrodes. The conditions necessary for the maintenance of a steady arc in a low-pressure atmosphere have been studied for iron, and it has been found that stability is obtained when the negative electrode is covered with oxide. When the arc is struck in free air the electrodes melt and oxidize. The arc, having been extinguished, is re-struck in vacuo and burns steadily. The same result has been obtained with both copper and nickel. These facts are in accordance with the electronic theory of the arc, according to which the cathode is the seat of emission of abundant electrons, due to its high temperature. The non-volatile metals, such as iron, emit but few electrons, and, in consequence, are only ill fitted to serve as cathodes, while oxides and carbon emit intense negative charges, which fact explains their efficiency. For easily volatile metals the presence of oxides is not necessary, as, for instance, for mercury in the Cooper Hewitt lamp; while a stable arc can be obtained between electrodes of zinc or magnesium in low-pressure atmospheres or in hydrogen.—*L'Industrie Elec.*, Sept. 10; Lond. *Electrician*, Oct. 14.

Train-Lighting System.—A note on a recent British patent (21,219, Oct. 6, 1910) of W. F. Anderson, S. A. Russell and W. E. Gray. This is a two-battery system, in which current can be supplied to the load by both batteries when the dynamo is running below a certain speed. Above this speed the load is supplied and one battery charged simultaneously. A current proportional to the charging current passes through a demagnetizing winding on the field magnets of the dynamo to prevent charging at an excessive rate. When the load circuit is open the two batteries are charged in parallel.—Lond. *Elec. Eng'ing*, Oct. 13.

Generation, Transmission and Distribution.

French Transmission Line.—De Kermond.—An account of the 60,000-volt transmission line between Ventavon and Villeneuve. This line is connected with a hydroelectric station whose present capacity is 24,000 hp, using falls on the Durance. Francis turbines are employed, the head being 160 ft. There are four turbines, each with a capacity of 6000 hp, and these are connected to 4500-kva, three-phase generators, supplying energy at a pressure of 7000 volts to 8000 volts at a frequency of 25. The voltage is stepped up for transmission by four groups of single-phase transformers. Electrolytic lightning arresters are used for a protection, being connected with the high-tension line through horn arresters. The high-tension switchgear is worked from the switchboard by means of 120-volt direct-current motors. The generators are fitted with Tirrill regulators so that the voltage at the Arles and Marseilles substations can be kept constant. The transmission lines consist of three aluminum wires, each 0.2 sq. in. cross-section, which are fastened to bell insulators 14 in. high and of the same diameter. Steel angle-iron masts 50 ft. high are used, the masts being 80 yd. apart. To prevent electrolytic action at places where the aluminum wires join those of copper the joint is made in an ebonite tube, which is filled in with a mixture of paraffin wax and Chatterton compound.—*L'Electricien*, Aug. 27; abstracted in Lond. *Electrician*, Oct. 14.

Electric Drive for Printing Machinery.—A description of an arrangement for driving and controlling printing machinery by means of a reversible booster set. The speed of the paper on the machine in question varies from 3 m to 96 m (10 ft. to 312 ft.) per minute. Three-phase currents at a pressure of 500 volts and a frequency of 50 are obtained from the mains. The parts of the machine which run at a constant speed are driven by two induction motors, each having an output of 15 kw to 17.5 kw. These are controlled by oil starters in the rotor circuit. The set driving the variable speed part consists of a three-phase induction motor of 90 kw capacity and running at

175 r.p.m., coupled to a ... supplying 175 amp at 220 volts and to a separately excited reversible booster which supplies a current of 170 amp at a pressure of 220 volts. Starting is effected by means of a liquid rheostat. The driving motor is fed with current at a variable pressure from this group and develops a maximum power of 65 kw. All the continuous-current machines are fitted with interpoles. The reversible booster and the driving motor are excited from the compound dynamo and are regulated by a field rheostat according to the paper speed. The dynamo-field rheostat has 56 contacts and that of the motor twenty contacts. By varying the voltage of the current supplied the speed of the motor can be regulated between 50 r.p.m. and 80 r.p.m. The motor is connected to the machine by means of a belt and gearing, the reduction ratio being 1 to 2. The motor and the gearing are fixed in a house close to the machine-room, while the regulators are near the machine itself.—*L'Industrie Elec.*, Sept. 25; abstracted in Lond. *Electrician,* Oct. 14.

Traction.

Single-Phase Traction.—Bandow.—An illustrated paper read before the Berlin Electrical Society on the Bergman-Westinghouse single-phase traction system. It has been worked out on the basis of the patents of the Westinghouse companies and their experience, with special reference to German conditions.—*Elek. Zeit.*, Oct. 13.

Installations, Systems and Appliances.

German Electrical Industry.—G. Dettmar.—The conclusion of his illustrated lecture on the present conditions of the electrical industries in Germany, dealing with electric traction and electrochemical industries. It is stated that for the fixation of atmospheric nitrogen by electric discharges at present 150,000 hp to 200,000 hp are employed in "German establishments" in operation or in course of erection (this probably means plants erected or backed by German companies; it cannot mean plants located in Germany). The German industry for the production of caustic soda and chlorine by electrolysis of common salt employs 40,000 hp to 50,000 hp, the production of cyanamide ?,000 hp, the production of metallic sodium 10,000 hp, and the production of aluminum 15,000 hp in "German plants." Reference is then made to electric steel refining and to the use of electricity in the house for heating and cooking and for purifying the air by means of fans and ozonizers. Finally a review is given of telephony and telegraphy in Germany. An abstract of this part of the paper is found elsewhere in the Digest.—*Elek. Zeit.*, Oct. 13.

Melbourne.—An abstract of last year's financial report of the municipal electric station of Melbourne. The total connections to the mains were 10,064 kw, the number of consumers ?212, of which 1178 were taking a supply for power and heating. The total number of motors connected to the mains was 441, representing 4684 hp. For private lighting 3,654,063 kw-hours (an increase of 273,901 over last year) were sold, for power and heating 2,560,991 kw-hours (increase, 649,636). Including public lighting the total number of kw-hours sold was ?,159,963 (increase, 1,067,696). The average revenue per kw-hour was 6.66 cents for the whole supply, the individual figures being 8.24 cents for private lighting, 3.72 cents for power and heating, and 6.12 cents for street lighting.—Lond. *Electrician,* Oct. 14.

Electric Equipment of Laboratory.—A description of the new generating station of the Northampton Polytechnic Institute, which contains two 100-kw gas-engine sets generating 220-volt direct current and 2200-volt three-phase currents. The oil switches of the alternating-current circuits are controlled from a modern desk-type board equipped with the latest instruments and auxiliary appliances. A 45-hp synchronous motor-generator set, a 30-kw rotary converter and a 600-amp-hour battery with a reversible booster-balancer are also installed.—Lond. *Elec. Eng'ing,* Oct. 13.

Battery Plant.—A note on a recent British patent (18,636, Oct. 6, 1910) of A. M. Taylor. In order to reduce the cost and increase the efficiency of battery plant arrangements are made for connecting two or more ... in series and in parallel, and an auxiliary or "bucking" booster is employed during charging with the object of increasing the number of cells in the battery and reducing the output of the main boosters. Instead of a bucking booster a number of additional cells may be employed in conjunction with suitable switchgear. This enables the battery to float on or discharge lightly into the main busbars without the boosters.—Lond. *Elec. Eng'ing,* Oct. 13.

Starting Rheostats.—R. Edler.—An article describing a simple graphical method for calculating the different steps of the starting resistance of a shunt motor. The graphical method described requires no complicated logarithmic calculations.—*Elek. u. Masch.* (Vienna), Oct. 2.

Wires, Wiring and Conduits.

Cables.—F. Fernie.—A continuation of his very long serial on electric cables. The author takes up a discussion of the choice of cables and methods of laying. He first details the circumstances upon which depend the choice of cable and method of installation for a particular system and describes the difficulties which have to be overcome in successfully meeting the conditions—extra-high-tension, high-tension and low-tension cables being all dealt with. The influence of cost on these problems is also mentioned.—Lond. *Electrician,* Oct. 14.

High-Tension Transmission Lines.—Henry.—An illustrated description of several details of high-tension overhead lines, dealing with the wire, the supports, the insulators, protective devices and safety devices to protect against rupture.—*L'Industrie Elec.,* Sept. 25.

Electrophysics and Magnetism.

Peltier Effect.—H. C. Barker.—An illustrated description of a new method of measuring the Peltier e.m.f. in absolute units. The mean value of ten results obtained by this method is 6.75×10^{-3} volts at 28.7 deg., or 1.61×10^{-3} calories per coulomb. Jahn's results give at 0 deg. 5.08×10^{-3} volts; Czermak finds at 19 deg. 8.04×10^{-3} volts.—*Phys. Rev.,* October.

Skin Effect.—A. R. Garnier.—A long article giving formulas for the ohmic resistance and reactance of conductors of large cross-section carrying alternating current, and diagrams for practical use.—*L'Industrie Elec.,* Aug. 10 and Sept. 10.

Alpha Particles.—E. Rutherford and H. Geiger.—Two papers, one dealing with the number of alpha particles emitted by uranium and thorium and by uranium minerals, the other with the probability variations in the distribution of alpha particles.—*Phil. Mag.,* October.

Electrochemistry and Batteries.

Metallic Radium.—Mme. Curie and M. Debierne.—A French Academy paper. Radium amalgam is prepared by electrolysis of a radium chloride solution with a mercury cathode, and the mercury is then distilled off from the amalgam to get metallic radium.—*L'Industrie Elec.,* Oct. 10.

Units, Measurements and Instruments.

Weston Cadmium Cell.—S. W. J. Smith.—A paper read before the (London) Physical Society on the limitations of the Weston cell as a standard of e.m.f. This paper contains an attempt to explain in terms of the theory of solutions F. E. Smith's recent experiments on the cadmium amalgams of the Weston cell. The manner in which the amalgams crystallize is indicated, and it is shown why the effect of the slowness of diffusion is so pronounced. A comparison of "chilled" and "slowly cooled" amalgams is made and the small irregularities of Weston cells are discussed. Finally, the question as to whether there is any range over which the e.m.f. is absolutely independent of the percentage of cadmium is discussed.—Lond. *Electrician,* Oct. 14.

Complex Compensator for Measuring High-Frequency Alternating Currents.—A. Larsen.—For making measurements in connection with telephone instruments and telephone cables a compensation method is employed in which the voltage used for compensation is composed of two partial voltages in series with each other, but differing in phase by 90 deg. When making the measurement the two partial voltages are adjusted until the joint resulting voltage compensates the voltage to be

measured. The arrangement is shown in Fig. 3. Any source of alternating current supplies the compensating current which passes through the testing wire AB and the coil BC. The contact point KK_1 can be adjusted. The alternating current in BC induces an alternating e.m.f. in an adjoining coil. The contact K_2 is indicated as being adjustable, but in practice the adjustment is made by varying the relative position of the two coils. The joint voltage P_1P_2 must compensate the voltage to be measured which is applied to P_1P_2. Adjustment of K_1 and K_2 is made until no sound is heard in the telephone. The author has applied the method for determining the efficiency of a telephone transformer, which was thus found to be 88 per cent. The arrangement of this test is shown in Fig. 4. G is a high-frequency generator, F a frequency meter, HT an auxiliary transformer with two secondary windings. One of these windings is connected with the compensator, the other winding with the transformer T to be tested. R_1 and R_2 are resistances and L_2 an inductance. The primary current is measured by connecting P_1 and P_2 with 1 and 2 respectively, the primary voltage by connecting P_1 and P_2 with 2 and 3 respectively, the secondary current by connecting P_1 and P_2 with 4 and 5 respectively, and the secondary voltage by connecting P_1 and P_2 with 5 and 6 respectively. The method can also be used for determining inductances, effective resistances, etc.—*Elek. Zeit.*, Oct. 13.

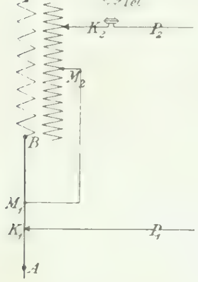


Fig. 3—Diagram of the Complex Compensator.

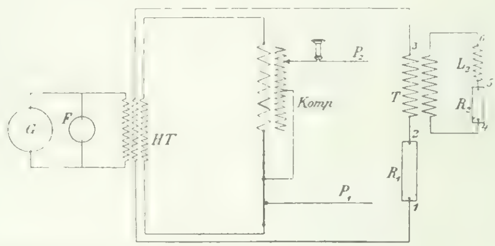


Fig. 4—Compensator Connections for Measuring Efficiency of a Telephone Transformer.

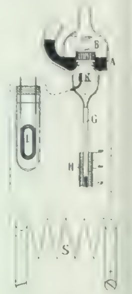


Fig. 5—Direct-Reading Electrolytic Meter

Excess Power Meter.—An illustrated description of a meter shown at the recent exhibition of the Physical Society in Paris for recording the quantity of electrical energy consumed above a certain prearranged amount of power. An ordinary direct-current or alternating-current meter is used, the axle of which is provided with a concentric cylinder of nickel revolving between the pole pieces of a permanent magnet. The moving part of the meter has to overcome the counter torque due to the energy consumed by hysteresis in the nickel cylinder. The work of hysteresis per revolution is constant for a given value of the field in which the nickel cylinder revolves and independent of the angular speed of the latter. The counter torque is, therefore, also constant and independent of the speed of the axle. The meter is unable to start until it can overcome the counter torque and will register at any moment only the excess of energy over that required for starting.—*L'Industrie Elec.*, Oct. 10.

Electrolytic Meter.—An illustrated description of the Stia electrolytic meter in which the amp-hours are read in the same simple manner as the temperature from a thermometer. As shown in Fig. 5, a glass globe contains metallic mercury A covered by a solution of a mercury salt, for instance nitrate. The mercury A is the anode, while the iridium film K forms the cathode. By electrolytic action the mercury is set free at the cathode and drops down in form of droplets into the measuring tube G. The height of the column of mercury in the tube gives directly the number of amp-hours. The connections are so made that only one-hundredth of the current to be measured passes through the meter. For this purpose the meter is connected in series with a high resistance L and the two are in parallel with the shunt S.—*L'Industrie Elec.*, Oct. 10.

Celluloid Condenser.—G. VALLAURI.—An account of experiments with condensers made up of iron plates separated by celluloid sheets. In building up the condenser the sheets were moistened with amyl acetate and subjected to mechanical pressure as each unit was added, so as to get good adhesion between the surfaces and to expel the air. The material used was commercial black celluloid of a horny texture. A condenser of this kind has the peculiarity of being much slower in charging than any hitherto constructed. From the theoretical point of view the results obtained are insufficient to decide to what extent they may be dependent upon (1) phenomena of imperfect polarization, (2) variations in the resistance caused by the polarization itself or by the passage of conduction currents, or, finally, phenomena of electrolytic or other character. Practically the evidence is conclusive that such a type of condenser is entirely unsuitable on alternating current distribution systems. Its slowness in charging gives a very small capacity with ordinary frequencies. Its power factor being more nearly unity than 0, it wastes an excessive amount of energy in heat, with a consequent rapid deterioration, so that it would afford no guarantee of safety when used on high pressures.—Lond. *Electrician*, Oct. 14.

Fused Silica.—G. W. C. KAYE.—An account of an experimental investigation of the expansion and thermal hysteresis of fused silica. The coefficient of expansion in various temperatures ranging between —160 deg. C. and +1100 deg. C. is as follows:

–160° to –120° C.	0.43 × 10^{-6}
–120 " – 80	–0.11 "
– 80 " – 40	+0.14 "
– 40 " 0	0.31 "
0 " 30	0.42 "
30 " 100	0.53 "
100 " 500	0.58 "
500 " 900	0.50 "
900 " 1000	0.80 "

These results refer to clear, transparent, annealed silica. The expansion curve shows two change points, one at about 1000 deg. C., the other at about —80 deg. C. Some observations were also made on thermal hysteresis. The author found that silica compares very favorably with two common Jena thermometry glasses specially designed to show a small after effect. It is concluded that fused silica has qualities which commend it for use as a material for standards of length. A silica standard meter is on the point of completion at the National Physical Laboratory.—*Phil. Mag.*, October.

Electromagnets.—E. JASSE.—The first part of a long theoretical paper on the calculation of electromagnets. In the introductory instalment the author takes up the fundamental equations for the work done by electromagnets and the force exerted by them. A graphical method is described for predetermining electromagnets, while formulas for special electromagnets are to be given in later instalments.—*Elek. u. Masch.* (Vienna), Oct. 2.

Measuring Instruments.—An illustrated description of various instruments exhibited at the recent exposition of the Physical Society in Paris, including an excess power meter, the O. K. watt-hour meter, a recording frequency meter, galvanometers, an electrolytic meter, moving-coil instruments for alternating current, the Fery meter and the Irwin hot-wire oscillograph. Several of these instruments are or will be described separately in the Digest.—*L'Industrie Elec.*, Oct. 10.

Telegraphy, Telephony and Signals.

Telegraphy and Telephony in [illegible]—G. Dettmar.—In a review of the present conditions of electrical industries in Germany the following data are given on telegraphy and telephony. There were at the end of 1908 in Germany 41,394 telegraph stations and 33,541 cities or towns with telephone connection. The total length of telegraph and telephone lines was 325,143 km (202,000 miles), while the total length of telegraph and telephone conductors was 5,160,638 km (3,200,000 miles). There were transmitted 54,098,541 telegrams and 1,519,370,970 telephone messages in 1908. The number of parties with telephone connection was 560,016, with 849,784 telephones. The total receipts of the telegraph and telephone departments of Germany, except Bavaria and Württemberg, were $36,250,000 in 1908. About fifty telegraph lines were equipped for duplex operation by means of the Hughes system and 178 telephone lines were also used simultaneously for transmission of telegrams, and 448 telephone lines were equipped for duplex telephony. Of high-speed telegraph systems those of Baudot, Murray and Wheatstone are employed at some places. The Siemens & Halske high-speed telegraph system, using a photographic method, has proven technically efficient, but there is no commercial need at present for such a high-speed system. The central-battery system is gradually finding greater favor in German telephone stations. Wireless telegraphy is making progress. From stations on shipboard it has been possible to transmit wireless messages to a maximum distance of 3700 km (2300 miles) and from stations on land to distances of 5200 km (3200 miles). Automatic and semi-automatic telephone systems appear to find favor at some places where they have recently been installed. Several long-distance telephone lines have been improved by the Pupin system, which has also been employed on a submarine cable of 12 km (7 miles) length. This has now been in operation for four years and has proved very successful. There are also in operation several telephone cables of an aggregate length of 125 km (75 miles) with extra self-induction uniformly distributed all along the line by means of an iron wire spun around the copper inductor.—*Elek. Zeit.*, Oct. 13.

Wave Detectors.—K. Bangert.—An illustrated translation of his recent German paper. The author discusses the behavior of the electrolytic and the galena detectors, the "tikker" and the coherer, and the various effects produced when one of these is inserted in the oscillatory receiver circuit. He describes experiments which furnish information as to the electrical dimensions of the different elements, and finally briefly summarizes the position as regards the best values to be employed.—Lond. *Electrician*, Oct. 14.

Miscellaneous.

Wood Separators for Storage Batteries.—A note on a recent British patent (25,273, Sept. 29, 1910) of the Tudor Accumulator Company. In order to remove acids and other constituents from wood separators for storage batteries they are treated by a solution of sulphuric acid, or of caustic potash, and afterward washed in water. They are then soaked in a 10 per cent solution of glycerine before drying, in order to prevent warping or cracking.—Lond. *Elec. Eng'ing*, Oct. 6.

Austria-Hungary.—E. Honigmann.—An article with tables and diagrams giving data on the electrical import and export trade of Austria-Hungary from [illegible], Sept. 22.

Fire Alarm.—J. Doenitz.—An illustrated description of Schoeppe's automatic fire-alarm system which fulfils the regulations of the Association of German Fire Insurance Companies.—*Elek. Zeit.*, Sept. 29.

Raw Materials for Electrical Industries.—W. Fillenberg.—In his long serial on the evolution of the electrical industries in the United States and in Germany the author now takes up the discussion of the raw materials used in electrical industries. He discusses the influence which the electrical industry has had on the world's production of raw materials. He gives brief data on water-powers, natural gas, oil, peat and coal, and then discusses the relation of pig-iron and steel production to the electrical industry. The article is to be continued.—*Elek. Zeit.*, Oct. 13.

Book Reviews.

Stationary Transformers. Theory, Connections, Operation and Testing of Constant-Potential, Constant-Current, Series and Auto-Transformers, Potential Regulators, Etc. By William T. Taylor. New York: McGraw-Hill Book Company. 169 pages, 107 illus. Price, $1.50.

The statement by the author that "the treatment does not go into the whys and wherefores very deeply, but simply states the facts . . ." is certainly true as far as the "whys and wherefores" are concerned. The author has had a very wide experience in the installation and operation of large high-tension plants in various parts of the world, and this book is reprinted from his notebook. The theory of the transformer is passed through in a hurry, with a word or two about vector diagrams, which is intended for those not familiar with that form of demonstration, but it is feared that the author's explanation of this tool he uses so extensively will give but little light to the uninitiated. Connective details are given very completely. Almost every possible connection of transformers is given, including standard connections for different kinds of circuits, special connections to get certain voltages and phase relations, incorrect connections, etc. Directions for making certain tests are given. This part might be much more complete and a few whys and wherefores would also be acceptable in this chapter. To those interested in transformer connections this book can be recommended. It is very complete, but the explanation is almost entirely by means of vector diagrams, which are left to explain themselves.

The Corrosion of Iron and Steel. By Alfred Sang. New York: McGraw-Hill Book Company. 139 pages. Price, $1.

This little book sums up in concise language our present knowledge of corrosion of iron and steel. The various theories of corrosion are impartially stated and references given to the works of the original investigators. The effects of physical structure, chemical composition and working environment on corrosion of metal are covered, and methods of inhibition outlined. The book closes with a carefully selected bibliography, compiled from the latest list of the Carnegie Library of Pittsburgh. This book should be of great value as a reference, especially to those who wish to get information quickly. Here they will find the whole subject covered briefly, with full references to the sources. Electrolytic corrosion is treated only incidentally.

Drähte und Kabel. By H. Brick. Leipzig: B. G. Leubner. 108 pages, 43 illus. Price, 1.25 marks.

The German electrical cables are known the world over for their high quality, and therefore a description of the methods of manufacture should prove interesting as representative of the best European practice. This book covers the manufacture of cables in a descriptive way, from the raw material, through the different manufacturing processes to the point where the cables are ready for use. The methods described are those used by the leading cable makers of Germany. The properties of cables, theory of operation and technical data are not included in this work, which is practically limited to a description of cable manufacture.

Fowler's Mechanical Engineer's Pocketbook, 1910. Twelfth edition. By William H. Fowler. Manchester: Scientific Publishing Company. 650 pages. Price, 2s. 9d.

This book, while particularly adapted to British conditions, contains much information of such character as to be useful here as well. The scope is such as to interest the power-plant operator. More than three-fourths of the contents are devoted to power-plant equipment, such as boilers, engines, steam turbines, gas producers and engines, condensers, pumps, cranes, etc. In this connection the properties of fuels (coal, gases, oils) and steam are discussed and rules given for the guidance of the operator in the use of fuels and power-plant equipment.

New Apparatus and Appliances

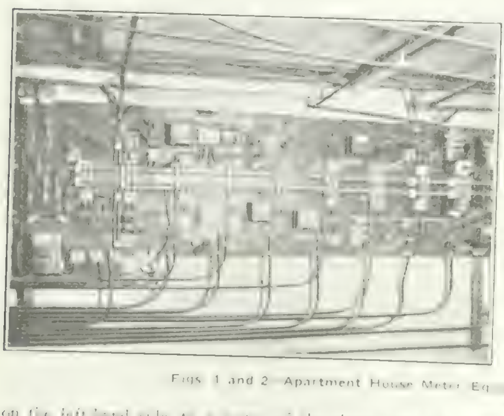
METER PROTECTIVE AND TESTING DEVICES.

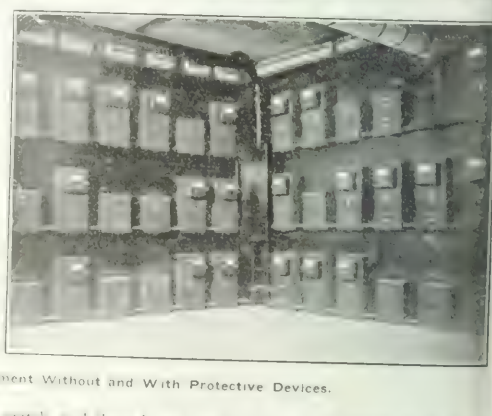
Various electric light companies have adopted with excellent results many of the devices now on the market which facilitate the installation, testing and replacing of meters, and above all make them proof against theft of electrical energy. The accompanying illustration, Fig. 2, shows the application of meter connection and protective blocks to modern apartment house service installations. The illustration tells its story best when compared with Fig. 1. The latter shows the ordinary arrangement of meters in one part of the basement of an apartment house, while Fig. 2 shows the arrangement in the new part of the basement in the same apartment house. The temptation open to unscrupulous persons to tamper with the circuits in the arangement shown in Fig. 1 is entirely lacking in the arrangement shown in Fig. 2. The line wires are protected from illegal manipulations when the meter is in use and when the meter is removed for any cause the open end of the cabinet may be closed with a disconnected service strap, making it necessary to break a seal to get at the service wires. In addition to the above advantages the porcelain test and terminal block forming part of the outfit facilitates the work of the meter tester so that from 30 per cent to 50 per cent more meters can be tested in a given time. In testing, not only are wrong connections impossible, but the customer's service is not interfered with. Fig. 3 illusrates a meter under test.

In Fig. 2 a universal meter box is shown, the base or main part containing the indicating snap switch and combination porcelain fuse and testing block, and the trim or cover enclosing and protecting the service connections and the terminals of the meter. These trims are built for any make of meter and all fit the same base. This permits one to change from one type of meter to another very quickly, a feature which will be appreciated by those who have to change a bottom-connected meter with two wires in and two wires out, with service entrance on the left hand side, to a meter of the shunt type for use ... with service entrance on the right hand side, or vice versa. The illustration shows how a large number of meters are connected. The service mains enter the sealed iron box shown in the center of the engraving containing a main switch

Fig. 3—Meter Under Test.

and fuse and pass thence to the bottom of the boxes. There is not a wire visible; each customer has his own fuse and switch, and there is no possible chance for tampering with the circuits. The Hart Manufacturing Company, of Hartford, Conn., is the maker of the protective and testing devices shown.





Figs. 1 and 2—Apartment House Meter Equipment Without and With Protective Devices.

ORNAMENTAL ARC LIGHTING.

An interesting installation of display lighting by arc lamps in Milwaukee, Wis., is made by the Milwaukee Electric Railway & Light Company. The Public Service Building, which is occupied entirely by this company and covers about one square block, is surrounded by a number of General Electric enclosed-arc lamps on ornamental poles. The poles are spaced very closely and three lamps are hung on each one. The type of pole used is of similar design to the ones that have been adopted by the City of St. Louis, the only difference being a slight change in the ornamental base.

The night photograph reproduced herewith indicates the brilliant illumination, in which there is an absence of shadows.

Display lighting of this character has a distinct advertising value with a direct financial return. That the appreciation of this fact is not confined to electrical companies is well demonstrated in St. Louis, Mo., and Toledo, Ohio, where some time ago the merchants paid for the installation of luminous-arc lamps mounted on ornamental poles and are now rapidly extending this system so as to embrace all of the business districts. Arc lamps hung on ornamental poles make an ideal combination, not alone on account of the economical operation, but because of the brilliancy at night and artistic appearance in the daytime.

Figs. 1 and 2—Day and Night Views of Ornamental Street Arc Lighting in Milwaukee, Wis.

MOTOR-DRIVEN MACHINES FOR MUTILATING DEFACED BILLS IN CHICAGO SUB-TREASURY.

Motor-driven installations are notably cheap to operate, but probably the most expensive 3-hp outfit in the West, when running at full capacity, is one at the corner of Adams and Clark Streets, Chicago, which sometimes consumes as much as $600,000 daily. The site mentioned is that of the Chicago Sub-Treasury, and the machinery installed is for the purpose of mutilating and chopping old banknotes and currency, which are then shipped to Washington, where they are again checked and compared and finally macerated into finely ground pulp.

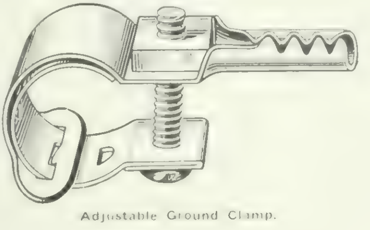
The machinery used in the mutilating and chopping operations at Chicago comprises a 2-in.-stroke punch press belt-driven by a ⅛-hp Westinghouse motor, and a 36-in. Sheridan paper knife, belt-driven by a 2½-hp Westinghouse motor. The soiled and damaged currency returned by the banks is first counted and stacked into bills of similar denominations. These bills are then put through the punch press, where two Keystone-shaped holes are punched near the end of each bill. This Keystone-shaped hole is the designation of the Chicago Sub-Treasury; that at New York uses a crescent shape, and each of the other sub-treasuries has its individual design for identifying the bills canceled by it. After being mutilated by the punch press the bills are taken to the paper knife, where they are cut into lengthwise halves, each of which contains a punch mark. The upper halves of these bills are then forwarded to the Treasury at Washington, while the lower halves are sent the following day, rendering it impossible to match and use the parts from any shipment, even if the telltale punch holes were repaired.

Heretofore the transportation of the soiled money to Washington has been done by the express companies, the bills being sent intact, but the authorities have now decided that expense will be saved by chopping the bills at the sub-treasuries and sending the parts to Washington by registered mail. In this way the Post Office Department will receive the payment for carrying the defaced bills, although the amount thus earned will be less than that which has hitherto been charged by the express companies.

The mutilating machinery in the Chicago Sub-Treasury has been installed and operated under the direction of Assistant Treasurer Boldenweck, whose office destroys from $100,000 to $600,000 each working day and returns it to the Treasury at Washington.

ADJUSTABLE GROUND CLAMP.

The ground clamp illustrated herewith is made of copper in two parts and interlocked together so that it makes a permanent contact when fastened to the pipe with screw and locknut. To adjust it to the pipe the only tool necessary is a screwdriver. The lug for the wire is notched and tinned to permit the free



Adjustable Ground Clamp.

flow of solder, and when it is squeezed together it forms a solid joint. The device is made in two sizes; the smaller fitting pipes from ⅜ in. to 1 in. in size and the larger fitting pipes from 1¼ in. to 2 in. in size. The American Metal Works, Germantown, Philadelphia, Pa., manufacture the clamp.

TIME-SAVING PIPE WRENCH.

The Wright Wrench & Forging Company, Canton, Ohio, is placing on the market a new pipe wrench, illustrated herewith, known as the "Stover pipe wrench." It is a quick-adjustable wrench, with an automatic grip that cannot flatten the pipe and has an instant release which with the automatic opening makes it impossible to lock on a pipe. It requires but one hand instantly to adjust it to any size pipe and one can get a firm and positive grip the first trial, which is stated to be impossible with any other adjustable pipe wrench. The advantages of a pipe wrench which can be adjusted and operated with one hand will readily be appreciated by pipe fitters, who frequently work

Adjustable Pipe Wrench.

in dark and insecure places where it is necessary to hold a lamp or grasp some object for support.

The 14-in., ¾-lb. Stover pipe wrench is stated to be lighter than any other pipe wrench on the market, and 25 per cent stronger, and will grip any pipe from ⅛ in. to 1½ in. The arc on which the jaw moves gives it an automatic grip on any size pipe within the range of the wrench and with an instant release. The wearing parts are all interchangeable and can be easily replaced at the expense of a few cents. The grip is the only part to wear out on this wrench. There are no screws or pivot pins such as are used in wrenches of the overhanging-bar type.

STARTING RHEOSTATS FOR ALTERNATING CURRENT MOTORS.

The increased use of alternating-current motors in the industries has created a demand for suitable and inexpensive starting apparatus. Motors of large capacities were first employed

Starting Rheostat.

as substitutes for other prime movers, but now motors of moderate size have come into extensive use also. The cost of starting apparatus is usually greater proportionally for small motors than for larger units, however, and the practice of throwing these motors directly across the lines causes disturbances and other undesirable effects.

The Cutler-Hammer Manufacturing Company, of Milwaukee, has recently developed new devices for use with alternating-current motors, the starter illustrated operating in the same manner as the Cutler-Hammer direct-current motor-starting rheostat of the sliding-contact type.

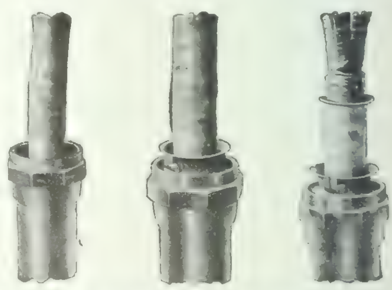
This face-plate-type of starter is for use with two-phase or three-phase slip-ring induction motors. It is convenient, compact and easily operated, and can be mounted on the wall or other handy location. The resistors are mounted on the rear of the face and no extra wiring is, therefore, needed, as is the case where the resistors are mounted separately. The only wiring required is to connect the slip rings of the motor to the three terminals on the face plate.

The contact segments are of hard-drawn copper and can be easily replaced or interchanged without interfering with any interior connection. The resistors conform to the requirements of the underwriters, being of the grid type for all except the smallest sizes, on which the tube type is used. The bushes consist of a pair of contacts at each end of the lever. The leading contact of each pair is made of carbon, while the other is made of copper. This results in long wear, as the carbon takes the arc, while the copper, which has a low contact resistance, carries the current.

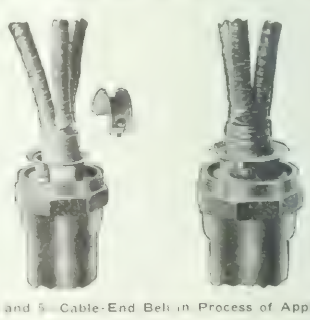
A latch is provided for holding the lever in the running position, but this can be replaced if desired by a no-voltage release. In case of the current failing, the primary circuit is automatically opened and the rotor resistance reinserted. An overload attachment can also be provided to open the primary circuit and cut in the resistance in the secondary when the motor is overloaded. These starters, which are made in capacities ranging from 3 hp to 50 hp, are designed to make more satisfactory the use of alternating-current motors of corresponding capacities and extend their satisfactory application.

NEW CABLE-END BELL.

The Electrical Engineers' Equipment Company, of Chicago, manufacturer of power-station specialties, has recently brought out an improved type of cable-end bell which is worthy of attention. The new device consists of a cable-end bell so arranged that the cable sheath is grounded at the extreme end



Figs. 1, 2 and 3—Cable-End Bell in Process of Application.

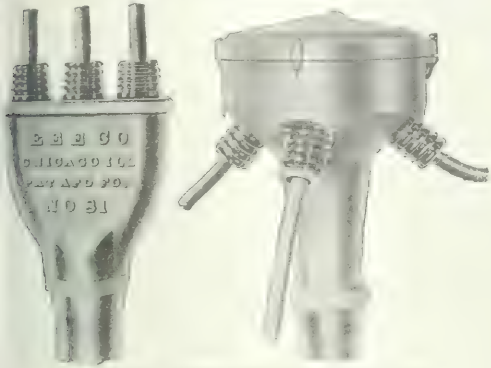


Figs. 4 and 5—Cable-End Bell in Process of Application.

on the cable and on the inside of the bell. The accompanying illustrations show how this operation, which is a simple one, is accomplished. The use of an inside clamp ring permits of cable bells being placed in position, and the cable installed,

in from thirty to forty-five minutes, including the melting of the insulating compound and the filling of the bell with it.

As shown in the cuts, the new type of bell is so arranged that it may be screwed on top of a pipe of any description. The company also manufactures, however, a complete line of cable-end bells with a clamp below or outside of the cable bell for use on cable which is not protected by iron pipe. The



Figs. 6 and 7—Inside and Outside Cable Bells.

advantage of providing a cable bell which eliminates the expense of wiping joints is obvious. The simplicity of this method of protecting a lead-covered cable of any voltage is shown by the illustrations.

Fig. 1 shows the polygonal iron coupling screwed on the protective pipe with the cable pulled through. Fig. 2 shows the inside brass clamp ring slipped over the cable and screwed down into the polygonal bushing. In Fig. 3 the lead sheath is peeled off the cable and the sheath is belled out to fit the clamp ring. The belled-out cable is shown above the clamp ring. Fig. 4 represents the cable sheath belled out and in proper position on the clamp ring, the latter being screwed out for the purpose of forming a good contact. Fig. 5 shows the cable in proper form and completed ready for the cable-bell casing to be screwed on the polygonal coupling. The clamp ring is here shown tightened up into place. Fig. 6 shows a complete cable bell designed for inside service. The outside casing is here shown screwed into place on the polygonal coupling; the leads have been brought out, and the bell has been filled with compound. Fig. 7 indicates how the method shown in Figs. 1 to 5 may be applied to any cable bell manufactured by the company. The cable bell shown in Fig. 7 is for outside service.

The accompanying illustrations are devices for conditions encountered in an actual working installation. The cable shown carries 13,200 volts working pressure, and the system was tested complete, with more than eighty cable bells in place, at 32,500 volts for five minutes. No trouble developed in any of the bells. All the bells made by the Electrical Engineers' Equipment Company are guaranteed for five years' service, and each one is tested to two and one-half times the working voltage for which it is designed. The outside cable bells are all subjected to a wet test corresponding to 1 in. of rain in five minutes, and are likewise tested to two and one-half times the working voltage.

LARGE CANDLE-POWER TUNGSTEN LAMP INSTALLATION.

The recently developed tungsten lamps rated at 500 watts and giving approximately 442 cp are economical substitutes for other lighting units of high candle-power and clusters of small lamps of low candle-power. While they give the large volume of light of the arc lamp or a cluster of small incandescent lamps, they have the simplicity, reliability and convenience of the ordinary incandescent lamp of lower candle-power.

There are many advantages inherent in this type of lamp. The light is steady, with an entire absence of flickering. When the light is turned on the full intensity is attained at once without the delay associated with the "feeding" of arc lamps. There is no deterioration in the quality of the light, it being the same during the whole life of the lamp. The lamp requires neither trimming nor attention, and consequently involves no operating expense. Moreover, the maintenance cost is low.

They can be used to advantage for lighting department stores, store fronts, show windows, billboards and for the general lighting of large interiors, such as auditoriums, armories, skating rinks, factories, yards, streets, etc.

The accompanying illustration shows a part of the book department of Hahne & Company's department store illuminated by 500-watt General Electric "Mazda" tungsten lamps in Mono-

Department-Store Lighting by Large Incandescent Lamps.

lux units. These large fixtures, suspended from the ceiling by ornamental brass hooks and chains and fitted with large iridescent globes and shades with pearl-like reflecting surface, add greatly to the attractiveness of the store. They produce a particularly soft and well-diffused light, which harmonizes with the ornamental effect and makes the illumination agreeable as well as attractive. They also harmonize with the other incandescent lamps in the store.

The height of the ceiling above the floor is 17 ft. 11 in., and the lamps are suspended 14 ft. 5 in. from the floor. The ceiling, posts and wall are white. It is said that the lamps have been in service for 1250 hours and as yet there has been no burn-out of lamps.

Industrial and Commercial News

The Week in Trade

WHILE the volume of business is still below normal, reports last week indicated that there was some quickening in demand both with the jobbers and retailers. This is attributed largely to the improvement in weather conditions and the stimulating effect the touch of winter throughout the West has had upon buying. The number of orders received by the jobbers is not yet sufficient to cause much enthusiasm, and individually the orders are much smaller than usual, showing that buyers are still very conservative, but the reawakening of hope is in itself encouraging. In the leading industrial lines there is not much improvement to be noted. The iron and steel mills are fairly busy, but new orders are not being received in sufficiently large volume to promise much for the future. The demand for structural material is not nearly so active as it was a few months ago, and while there are many rumors of heavy specifications being prepared by the railroads for rails and equipment the actual orders have not yet been placed. The condition in the textile industry is still unsatisfactory, due, especially in the case of cotton goods, to the uncertainty and irregularity in the price of raw material. The excellence of the crop returns and the early movement to market have supplied the agricultural sections with a liberal amount of money and this has done much to stimulate collections. These are greatly improved. Business failures for the week ended Oct. 27, as reported by *Bradstreet's,* were 220, as compared with 197 the previous week, 217 in the same week of 1909, 241 in 1908, 223 in 1907, and 163 in 1906.

The Copper Market.

COPPER declined rather sharply in the New York market during the past week, and there were also some recessions in the European market. This was in a measure due to the withdrawal of speculative activity. It also may be, to some extent, attributed to the fact that consumers in this country bought about all that was required for their immediate needs in the early part of the month of October. The business of the electrical manufacturing concerns and also of the brass manufacturers is hardly up to normal, and it has been the policy of all of these concerns to buy only sufficient copper to cover orders that have been already placed. There seems to be absolutely no disposition on the part of any consumers to lay up stocks for future business. On this account there is always a recession when speculative activity ceases. During the past

[illegible]	Bid.	Asked.	Settling Price.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

The London Market Oct. 31 was as follows:

	Noon.			Closing.		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Standard [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Standard [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest.			Lowest.		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
London, spot	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
London, futures	65	18	0	[illegible]	[illegible]	[illegible]
Best selected	65	10	0	[illegible]	[illegible]	[illegible]

week offerings of lake and electrolytic copper were made quite freely at concessions from quoted prices. The copper market is in a measure, however, strengthened by the general belief that the next report of the Copper Producers' Association, which will be made public about Nov. 10, will show a very considerable reduction in the production of metal, and will probably show a considerable reduction in the surplus stocks now on hand in this country. This will be accomplished without adding any great amount to domestic takings. One copper authority figures that the present rate of production in the United States, Canada, Mexico and South America is about 108,000,000 lb. per month, whereas before the curtailment policy was put into effect the rate of production was about 125,000,000 lb. per month.

Exports for October have been fairly large and imports have not been as heavy as they were several months ago. The total exports for the month, including Oct. 31, were 24,261 tons. The daily call on the Metal Exchange Oct. 31 quoted standard copper as per the accompanying table.

Industrial and Commercial Notes.

Rapid Transit Bids.—The Public Service Commission of the First District of New York received seventy-seven bids last week for the construction of the tri-borough subway system by city money. Every one of the twenty-one sections offered in the proposals received at least one bid. Many of them received quite a number. The Bradley Contracting Company put in a lump bid for the entire construction of $93,000,000. Quite a number of other construction companies bid upon several sections. S. Pearson & Sons, of London, the contractors who constructed the Pennsylvania Railway tunnels into New York, put in bids for that portion of the work which carried the proposed subway under the Harlem River. The tabulation of the bids requires a considerable amount of time and no definite statement can be made at present as to the lowest bidder. When proposals to construct a subway by private capital were asked for, to be opened Oct. 20, the Public Service Commission did not receive a single bid.

United States Light & Heating Company.—The new Buffalo plant of the United States Light & Heating Company is now practically finished, and operations in it are expected to begin next week. The plant has cost over $400,000, and has been paid for, with the exception of about $40,000, entirely from the working capital or current earnings. Ultimately this balance will be paid for from the net profits. It is understood that at the present time the company has about $500,000 cash on hand, and nearly $650,000 of bills receivable. It is said that there has been a persistent buying of both preferred and common stocks of the company, and it is also reported that ultimately the par value of the stock will be changed from $10 to $100 and the stock will be listed on the New York exchange.

Proposals for Electric Machinery for Navy.—Sealed proposals will be received until Dec. 3 at the Bureau of Yards and Docks, Navy Department, for a 75-kw motor-generator set with wiring complete for the power plant at the United States Naval Station at New Orleans, La. Until Nov. 12 the Bureau of Yards & Docks, Navy Department, will receive sealed proposals for one electrically-driven (alternating current) capstan to be installed at the New York Navy Yard, capable of developing and sustaining a rope pull of not less than 35,000 lb. at a speed of 12 ft. per minute or a pull of 1400 lb. at a speed of 30 ft. per minute.

Duty on Tungsten Lamps.—According to a recent ruling of Collector of Customs Loeb, tungsten lamps are to be assessed at 45 per cent ad valorem under the head of manufactured articles wholly or in part of metal. It was claimed by the importing company, the Electrical Accessories Company, that the merchandise is dutiable at 25 per cent as tungsten metal, since the chief value of the lamps lies in the metal used. The protest of the importer has been overruled and the collector's decision affirmed by the Board of United States General Appraisers.

Association of Sales Managers.—C. A. S. Howlett, president of the National Association of Sales Managers, and sales manager of the General Electric Company, addressed a meeting of the Sales Managers' Association of Cincinnati recently on "The Objects of Our Association." He stated that the aim of the organization is to reduce the selling of merchandise to a science, governed by fundamental principles and natural laws, the same as any other science. Walter A. Knight talked on "Unfair Competition" and reviewed a number of supreme court decisions on trademark and patent litigation.

Pennsylvania Storage Battery Company.—A company was incorporated in Delaware last week called the Pennsylvania Storage Battery Company and given the authorization to manufacture and deal in storage batteries. The incorporators were F. R. Hansell, George H. B. Martin and S. C. Seymour. The authorized capitalization of the company is $400,000.

Western Power Company Lease.—Negotiations have been practically concluded providing for the lease of the Western Power Company, of California, by the Pacific Gas & Electric Company. According to the terms of the lease, which are so nearly settled that a semi-official announcement of them has been made, the lease will be operative for forty-six years. The rental that will be paid by the Pacific Gas & Electric Company will be 2½ per cent on the $18,000,000 of outstanding stock of the Western Power Company during the years 1912 and 1913. In the year 1914 the rate will be 3 per cent, and the rental will increase ½ per cent yearly until the rate reaches 7 per cent, the latter figure to stand until the expiration of the lease. It is specifically provided in the lease that all further moneys expended in developing the hydroelectric plants now owned by the company shall be figured in the capitalization, and shall receive the benefits of the lease percentages. The Western Power Company owns the entire capital stock of the Great Western Power Company, amounting to $25,000,000. The latter is the concern which has developed the large hydroelectric plant on the north fork of the Feather River, Cal., which is now selling energy to Oakland and San Francisco. The company also owns two enormous hydroelectric propositions at Big Meadows, Cal. The engineers estimate that if all of the water-power controlled by the company is developed the output will amount to 430,000 hp. The Great Western company also owns, through the California Electric Generating Company, a large steam turbine plant on the waterfront at Oakland. The Western Power Company has already, under a selling contract, been furnishing the Pacific Gas & Electric Company with energy. The latter company practically controls the market in the San Francisco district for all electrical energy not used for traction purposes. The Great Western plant was described in the *Electrical World* in the issues of Aug. 26, Sept. 16 and Sept. 23, 1909.

Slump in Rubber Prices.—Prices for crude rubber are still declining and the market is distinctly weak. Trading is dull, as there is a widespread belief among consumers that further declines are probable. Some users of rubber declare that up-river Para, which is now selling at $1.35@1.37 a pound, will sell for $1 or less before the end of the year. Other grades of rubber are correspondingly depressed, Africans selling for 1.10@1.15 and guayule at 60@70 cents. In connection with this latter decline a correspondent from Torreon, Mexico, writes: "The guayule rubber industry in northern Mexico and southwestern Texas is showing the depressing effects of the recent slump in prices of the shrub and the manufactured product. The guayule shrub, which was selling for $300, Mexican money, or $150 gold, per ton a few weeks ago, is now bringing only $150 Mexican money, or $75 gold, per ton. Some of the independent rubber factories which have large outstanding contracts with land owners to buy at prices ranging from 200 to $300 per ton are uneasy over the situation. It is claimed by these that there is no justification for the sudden drop in prices, and the charge is being made that it is an effort on the part of the Intercontinental Rubber Company to force the sale to it of the independent rubber factories and guayule lands. In this connection it is stated that the independent guayule rubber interests of Mexico have appealed to the Mexican federal government for relief. It is urgently requested by them that the government shall make an investigation of the causes for the recent slump in prices of the shrub and the manufactured produce. It is claimed that the Intercontinental Rubber Company practically controls the industry and that it has enough guayule shrubs upon its own lands to keep its factories running for several years; also that it is storing its stocks of crude rubber as fast as manufactured and that the supply is now being received wholly from independent sources."

Westinghouse Lamp Company.—The plant of the old Sawyer-Man Company, located at 510-532 West Twenty-third Street, which was abandoned by the Westinghouse Lamp Company in April, 1908, has been re-equipped by that company as its tungsten lamp factory. The fact that this would be done was published in our issue of June 23, 1910. The ...ent of this factory will increase the output of tungsten ... of the Westinghouse company by about 10,000 lamps per day. The plant is to manufacture exclusively 25-watt, 40-watt and 60-watt, wire-type tungsten lamps. These lamps are made with one length of filament from one leading-in wire to the other, with a positive electrical connection between the filament and the leading-in wires. The joint is protected by wrapping the filament around the leading-in wires, thus insuring flexibility and eliminating points of rigid contact in the lamp. Due to this construction and the improvements in the method of making the filament it is claimed that fragility of the lamp, which was the most serious objection to its general adoption, is to a great extent overcome. The lamp being constructed by an entirely new process, it was necessary to develop and manufacture new machinery for the equipment of this plant, which machinery is entirely of American design, and it is stated that the starting of the plant marks the separation of American apparatus from the modified European apparatus which has heretofore been made to fit American conditions. The factory itself is organized on new lines which are quite a departure in lamp manufacture, in that it is made up of a number of individual factories, each independent of the other and all operating in one plant.

New York Telephone Company Proposal.—A proposal has been made to the Board of Estimate in New York City by the New York Telephone Company offering a new schedule of rates in return for an absolute monopoly in the city. The company offers to furnish the city service at 50 per cent reduction from its regular schedule of rates; to adjust periodically the rates accorded the public; to limit its net earnings to 10 per cent on the capital actually invested less depreciation and to pay to the city $116,000 a year for the first five-year period, $176,000 for the next five years and $200,000 a year thereafter. It will also file an annual statement with the Comptroller. Practically the same offer was made to the city in 1906, but the Corporation Counsel held at that time that its acceptance might validate certain franchises which were then in dispute.

Apparatus for Clinchfield Coal Company.—Ford, Bacon & Davis, New York, engineers, have just closed a contract with the Westinghouse Machine Company for two 1000-kw turbine, Le Blanc condensers; ten 300-kw, 6600-250-volt, 60-cycle motor generators, switchboard, wiring and all electrical auxiliaries for the Clinchfield Coal Company, of Dante, Va. The firm is also asking in behalf of this company for bids for boilers, stacks and feed pumps. The electrical system will consist of a power station and four substations, with power distribution at 6600 volts within a radius of about six miles from the power station. The work is in connection with large coal developments in Virginia.

Old Municipal Arc-Lighting Apparatus to Be Disposed Of.—Owing to the fact that electrical energy procured from the Chicago Drainage Canal plant of the Sanitary District is now used by the City of Chicago for street lighting, the city finds itself in possession of considerable arc-lighting station equipment at its municipal plants for which it has no use. Accordingly the City Council has authorized the city controller, with the advice of the city electrician, to advertise for bids for the sale and removal of this superseded apparatus, consisting of boilers, condensers, steam engines, piping, shafting and a number of arc generators. Bids must be submitted in writing and must be sealed.

Chicago Office Buildings on Central Station Mains.—In its advertising announcements the Commonwealth Edison Company of Chicago says that more than two-thirds of the office buildings in that city are supplied with electricity from the mains of the Commonwealth company. It is asserted that the owners buy the electricity at less cost, delivered, than it can be produced by private plants. It is pointed out also that the abandonment of private plants has much to do with abating the smoke nuisance.

European Inquiry for American Electrical Machinery.—An American consul in Europe reports that a local business firm desires to receive addresses and catalogs of American manufacturers of heating and lighting installations. The consul also sends the names and addresses of other firms in his district to which similar trade literature should be sent. The various addresses may be obtained from the Bureau of Manufactures, Washington, the file number being 5699.

United States Treasury Proposals for Electric Light Fixtures and Wiring.—Sealed proposals will be received at the office of the supervising architect, United States Treasury Department, Washington, for the installation of electric light fixtures and wiring in post office buildings as follows: Lancaster, Ohio; Athens, Ohio; Brunswick, N. J.; New London, Conn.; Salisbury, N. C.; Davenport, Iowa; Houston, Tex.; Lake Charles, La., and Toledo, Ohio.

The Marion Electric Light & Street Railway Company, of Marion, Ill., has changed its name to Marion Light, Power & Water Company and increased its capital stock from $20,000 to $100,000.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Centralia, Wash.; New Braunfels, Tex.; Buckhannon, W. Va.; Monticello, N. Y.; Georgetown, Tex.; Livingston, Tex.; Providence, R. I.; Brainerd, Minn.; Elba, Ala.; Clayton, N. M.; Forest Grove, Ore.; Olivet, Mich.; Lexington, Va.; South River, N. J.; New York, N. Y.; Buffalo, N. Y.; Concord, N. H.; Cedars, Miss.; Humboldt, Tenn.; Clarksville, Tex.; Cleveland, Ohio; Carson City, Nev.; Pine River, Minn.; Orillia, Ont., Can.; Texas City, Tex., and Spokane, Wash.

Fremont (Neb.) Gas & Electric Light Company.—The Fremont Gas & Electric Light Company has just purchased a cross-compound engine direct-connected to a 300-kw generator, which will be installed in the company's steam station at Fremont.

Financial.

The Week in Wall Street.

EVERYBODY understands that it has been a hard struggle for the bull leaders and for those behind the upward movement to keep the stock market from declining during the past week. With the advance in prices there was a great desire on the part of small speculators and also on the part of some investors to sell out when there was a profit in sight. This disposition is responsible for the reactions that were reported last week and also for the failure of the bull campaign to succeed in pushing the market upward. As far as the sentiment of Wall Street is concerned and as far as practical news features that have developed within the past fortnight are concerned, there is nothing to stimulate a very active bull market, and there is nothing to cause any serious depression. Aside from the fact that the United States Steel Corporation made a report for the third quarter of 1910 which showed that it had on its books Sept. 30 a smaller amount of orders than ever before at the end of any quarter since the reports were made, there has been no news that would tend to discourage the average investor or speculator. Even this report is largely discounted by the fact that the earning figures in the same publication show that the corporation has earned far more than its dividend obligations during the quarter. It is also true that the bond market at the present moment is not so good as a month ago. With a revival of interest in stocks, there seems to occur a loss of interest in bonds. The money market at the present time is not causing any serious trouble, but no one is sure as to what may happen. Foreign banks have advanced the rates of discount, and it is not believed that cheap money can continue to be available in this country when high bank rates are paid abroad. Call money Oct. 31 was 3½ a 4 per cent; 90 days, 4½ a 5 per cent. The quotations in the accompanying table are those of the close Oct. 31.

NEW YORK.

	[illegible]	[illegible]	Shares [illegible]		[illegible]	[illegible]	Shares [illegible]
[illegible]	[illegible]	[illegible]	400	Int.-Met., pfd.	59	57¼	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T.	138¾	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B. R. T.	77¾	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PHILADELPHIA.

	[illegible]	Oct. 31		Oct. 24.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elec. Co. of A.	11⅝*	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Phil [illegible]	[illegible]	[illegible]
E. S. B'ty, pfd	[illegible]	30*	Union Trac.	[illegible]	[illegible]

CHICAGO.

	Oct. 24	Oct. 31		[illegible]	[illegible]
[illegible]	[illegible]	170*	Chi. Tel. Co	[illegible]	[illegible]
Chi. Rs., Ser. 1	75*	79	Met. El. Co	[illegible]	[illegible]
Chi. Rs., Ser. 2	18⅞	[illegible]	[illegible]	[illegible]	[illegible]
Com. Edison	116	114¾	Nat'l Carbon	128	[illegible]
Chi. Subways	5	[illegible]	[illegible]	[illegible]	[illegible]

BOSTON.

	Oct. 24	Oct. 31		Oct. 24.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cum. Tel.	143*	[illegible]	[illegible]	[illegible]	[illegible]
Edison E. Ill.	266	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mass. E. Ry., pfd.	84¾	[illegible]			

*Last price quoted.

Financial Notes.

Vacuum Cleaner Companies Merged.—The stockholders of the McCrum-Howell Company met at Norwich, Conn., last week, and authorized an increase of the company's capital stock from $4,000,000 to $7,000,000. The capitalization of the company will consist of $3,500,000 common and $3,500,000 preferred. The directors also met and declared a special dividend of 50 per cent on the common stock, payable Jan. 30, and the usual quarterly dividend of ¾ of 1 per cent on the common stock, payable Jan. 1. It is given out that about half of the additional capital stock will be used for the acquisition of five competitive companies in the boiler, radiator and vacuum-cleaner business. The companies to be taken over are the Model Heating Company, of Philadelphia and New York; the Cameron-Schroth-Cameron Company, of Chicago; the American Air Cleaning Company, Milwaukee; the Vacuum Cleaner Company, of New York, and the Sanitary Devices Company, of San Francisco. The acquisition of these companies will give the McCrum-Howell Company control of about 80 per cent of the stationary vacuum-cleaning business.

Cities Service Company Stock.—Henry L. Doherty & Company, 60 Wall Street, are offering for sale $1,000,000 par value of the preferred and $350,000 par value of the common stock of the Cities Service Company. This is the holding company recently organized by Doherty & Company to take over the control and ownership of 90 per cent of the stock of the Spokane Gas & Fuel Company, Denver Gas & Electric Company and the Empire District Electric Company, of Joplin, Mo. The authorized capitalization of the Cities Service Company is $30,000,000 of 6 per cent cumulative preferred and $20,000,000 of common. There is now outstanding $8,779,650 of preferred and $4,889,825 of common. The offer of Doherty & Company is $100 par value preferred and $35 par value common for $100. Claude Meeker, a dealer in public utility securities at Columbus, Ohio, is also sending out circulars advertising the stock of the Cities Service Company. Mr. Meeker's offer is $84 for preferred and $64 for the common.

White River Light & Power Company.—Ralph H. Beaton, receiver of the White River Light & Power Company, of Noblesville, Ind., is offering the property of the company for sale under foreclosure Nov. 19. The sale will take place at Noblesville. The property consists of a hydroelectric site on the White River, with a concrete dam in process of construction, power plant already completed and some outside buildings; sufficient land along the banks of the White River to provide for the backing up of the water; transmission lines to Noblesville, and various other fixtures and construction machinery.

Rehearing on Third Avenue Reorganization Plan.—The Public Service Commission of the First District of New York has granted a rehearing upon the plan for reorganizing the Third Avenue Railroad Company proposed by the bondholders. This plan was rejected by the commission July 29 after months of hearings. The application for a rehearing was made as a preliminary to appealing to the courts from the commission's decision. The application for the rehearing was based on the allegation that the commission had erred in its valuation of the property.

Independent Electric Company, Forest Grove, Ore.—The recently incorporated Independent Electric Company, of Forest Grove, Ore., has purchased the plants and holdings of the Haines Light & Power Company, of the same city, and the Hillsboro Water, Light & Power Company, which controls a hydroelectric plant about sixteen miles from Forest Grove. The Independent Electric Company has a capital stock of $100,000. It contemplates extensive improvements and extensions to the plants it has just bought.

Atlantic Shore Line Railway Company.—A decree has been entered by the United States Circuit Court at Portland, Maine, ordering the sale Dec. 1 of the Atlantic Shore Line Railway Company, of Sanford, Maine. The foreclosure suit was brought by the Knickerbocker Trust Company, of New York, trustee for $1,191,500 5 per cent bonds. The railway extends from Portsmouth, N. H., to Biddeford, Maine, and has 94 miles of track.

Columbia Gas & Electric Company.—Arrangements have been made by the Columbia Gas & Electric Company, of Cincinnati, for the immediate sale to an English syndicate of $1,000,000 5 per cent bonds, and for the future sale of a like amount. The price received for these bonds is said to be about 85.

Central Maine Power Company.—Perry, Coffin & Burr, of Boston, are offering for sale [illegible] the thirty-year 5 per cent bonds of the Central Maine Power Company, of Waterville, Maine. The bonds are offered at 98½ and interest. These bonds are a legal investment for the savings banks of Maine. The Central Maine Power Company does lighting and power business in the Kennebec Valley, serving the cities of Augusta, Hallowell, Gardiner, Waterville and other municipalities having a population in excess of 55,000. The company is steadily developing its earning power and is broadening its field of service through new lines and extensions. It operates five water-power developments, supplemented by steam reserve, all interconnected and operated in unison. The hydroelectric plants have a rated capacity of 6800 hp and the steam station a capacity of 2500 hp. The company was incorporated in 1905 and has acquired the entire property and franchises of the Messalouskee Electric Company, the Fort Halifax Power Company, the Sebasticook Power Company and the Sebasticook Water Power Company. It also owns all the stock of the Kennebec Light & Heat Company, the Bingham Electric Company, the Dexter Electric Company and practically all the stock of the Solon Electric Company. The net earnings of the company for the year ended Aug. 30, 1910, were $128,352 and the surplus available for dividends $78,010.

Consolidated Gas Company.—The Consolidated Gas Company of New York has declared a quarterly dividend of 1½ per cent, which places the stock upon a 6 per cent basis. The company formerly paid this rate of dividend, but after the decision declaring legal the 80-cent gas rate, only 4 per cent was paid. The earnings of the company, however, fully justify the higher dividend upon the stock. The New York Edison Company, which is entirely owned by the Consolidated Gas Company, earned in 1909 more than 10 per cent on its outstanding stock. There is no reason to believe that the Consolidated Gas Company will, in the near future, go below the 6 per cent basis.

Aurora, Elgin & Chicago Railroad.—At the annual meeting of the Aurora, Elgin & Chicago Railroad Company, which operates the interurban electric railway between Chicago, Aurora and Elgin, the purchase of the Chicago, Wheaton & Western road, a feeder line, was approved. It was shown that the gross earnings for the year ended June 30, 1910, were $1,536,898. Operating expenses were $902,777 and the net earnings were $634,121. The latter figure may be compared with $615,452 for the year before. The net income was $331,837, and the amount paid in dividends was $293,213. The surplus on June 30, 1910, was $316,670.

Receivers for Interstate Telephone & Telegraph Company.—Fred A. Dolph, of Aurora, Ill., and William C. Niblack, vice-president of the Chicago Title & Trust Company, have been appointed receivers for the Interstate Telephone & Telegraph Company, of Aurora, Ill., operating a telephone service in about twenty-five cities and villages of Northern and Central Illinois, including Peoria, Springfield, Joliet, Aurora and Elgin. The company has failed to pay its bond interest, and charges of mismanagement against a former administration are made by the owners of the company's stock and bonds who applied for the receivership.

Nashville Railway & Light Company.—The earnings of the Nashville Railway & Light Company show liberal increases over the previous year. The September gross scored an improvement over September, 1909, of nearly 5 per cent. The estimated earnings for the year are gross $1,825,000, which is an increase of more than $100,000 over the previous year. If these estimates are carried out, the balance available for dividends after paying interest charges will be about $360,000, which is approximately 4½ per cent on the common stock after paying the preferred dividends.

Bodwell Water Power Company.—The United States Circuit Court, District of Maine, has appointed E. H. Mather special master to conduct the sale of the Bodwell Water Power Company property in Milford and Old Town, Me., under a foreclosure decree dated Oct. 8, 1910, in the case of the Central Trust Company of New York, trustee, to foreclose a mortgage of $1,000,000. Messrs. E. H. Mather and J. W. Harmon have been receivers of the property.

American Light, Heat & Power Company.—Articles of incorporation have been filed in Dover, Del., for the American Light, Heat & Power Company, with a capitalization of $15,000,000. The purposes of the company, as stated in the charter, are "to generate, accumulate and furnish light and heat." No information as to the incorporators has been given out.

Iowa Traction Company.—The Iowa Traction Company has been incorporated under the laws of New Jersey with a capital of $2,000,000, to build a line from Oskaloosa, Ia., to Tama, a distance of sixty-five miles.

DIVIDENDS.

American District Telegraph Company of New York, semi-annual, 1 per cent, payable Nov. 5.

American Gas & Electric Company, preferred, quarterly, 1½ per cent, payable Nov. 1.

American Telegraph & Cable Company, quarterly, 1½ per cent, payable Dec. 1.

Consolidated Gas Company, quarterly, 1½ per cent, payable Dec. 15.

Massachusetts Gas Companies, semi-annual, preferred, 2 per cent, payable Nov. 15.

McCrum-Howell Company, common, quarterly, ¾ per cent, payable Jan. 1, special 50 per cent, payable Nov. 1.

New Orleans Railway & Lighting Company, preferred, quarterly, 2½ per cent, payable Jan. 16.

Portland Railway, Light & Power Company, quarterly, 1 per cent, payable Nov. 15.

Standard Motor Construction Company, semi-annual, 2 per cent, payable Nov. 15.

United States Steel Corporation, quarterly, preferred, 1¾ per cent, payable Nov. 29; common, 1¼ per cent, payable Dec. 30.

Washington (D. C.) Gas Light Company, quarterly, $1.20 per share, payable Nov. 1.

REPORTS OF EARNINGS.

	Gross Earnings.	[illegible]	Net Earning	Charges.	Surplus.
[illegible]					
[illegible]	[illegible]	[illegible]	$255,500	$49,038	$206,462
[illegible]	[illegible]	[illegible]	233,838	43,590	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	306,246	178,802	138,588
[illegible]	[illegible]	[illegible]	273,967	158,124	127,606
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]		57,091
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
Valley Transit Company:					
[illegible]	[illegible]	[illegible]	[illegible]	25,433	[illegible]
[illegible]	[illegible]	[illegible]	56,819	26,650	[illegible]
[illegible]					
Nine months ended Sept. 30, 1910	4,097,807	[illegible]	[illegible]	[illegible]	1,586,997
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
orthern Ohio Traction Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	42,928	[illegible]
ortland (Maine) Electric Company:					
[illegible]	[illegible]	16,287	18,838	[illegible]	[illegible]
[illegible]	[illegible]	11,562	16,804	[illegible]	7,610
io de Janeiro Tramway, Light & Power Company:					
[illegible]	[illegible]	[illegible]	508,148		
[illegible]	[illegible]	[illegible]	[illegible]		
ao Paulo Tramway, Light & Power Company:					
[illegible]	[illegible]	[illegible]	168,792		
[illegible]	[illegible]	[illegible]	120,948		
t. Joseph Railway, Light, Heat & Power Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September, 1909	[illegible]	[illegible]	[illegible]	22,048	[illegible]

General News

Construction News.

ELBA, ALA.—The Pea River Power Company is contemplating the construction of a dam across the Pea River, for which investigations are now being made by Professor Kay of the University of Alabama. If the construction of a dam is not considered feasible a boiler and engine will be purchased immediately for the local plant.

SCOTTSBORO, ALA.—It is reported that the Section Telephone system, formerly owned by a stock company, has been purchased by J. S. Ryan. The new owner, it is said, proposes to extend the lines and install new equipment.

WARREN, ARK.—The capital stock of the Warren Light & Water Company has been increased from $20,000 to $50,000.

FRESNO, CAL.—Preparations are being made for the construction of an electric railway from Fresno to Clovis, a distance of fifty miles, work on which will begin as soon as the right of way is secured. S. N. Griffith is promoter.

LOS ANGELES, CAL.—The Pacific Telephone & Telegraph Company is erecting two new telephone buildings; the one in Glendale will be completed in November and the one in Wilshire will be opened in December. Both will be equipped with new and up-to-date apparatus. The building in Wilshire will be of reinforced concrete and will cost about $225,000.

MANTON, CAL.—The work under way at Eagle Camp, on the North Butte River, nine miles below Manton, by the Northern California Power Company is nearly completed. The work includes a dam 65 ft. wide and 10 ft. high, and a total of 1325 ft. of tunneling has been drilled within a mile. The water will be carried to the Inskip ditch by 3674 ft. of flumes, which will be utilized to generate electricity at the Inskip power house, two and one-half miles below. J. C. Cochrane is engineer.

OROVILLE, CAL.—It is reported that parties interested in the Oro Water, Light & Power Company are making investigations in the Humbug Valley with a view of developing the water-power of Yellow Creek. It is proposed to erect a large plant at the mouth of the creek at the Feather River, about eight miles from Longville. The company has purchased nearly 2500 acres in the valley for reservoir purposes. J. W. Goodwin is president of the company.

PLACERVILLE, CAL.—Work has commenced on the construction of the dam of the Rubicon Power Company, which will be located at Upper Hill Hole, on the Rubicon River, where a small dam will be built that will back up the water three miles. The water will be conveyed down the canyon in ditches, nine miles, into another reservoir at Hale's Crossing, and from there to Pilot Creek. The power plant will be located at Ralston's divide, where the water will have a fall of 2000 ft. C. H. Wilbur is superintendent.

REDDING, CAL.—A tunnel, six and one-half miles long, for carrying water from Pit River to Montgomery Creek is being constructed by the Mount Shasta Power Company, under the direction of Harry Hatfield, of San Francisco. The water will have a fall of 800 ft. from the entrance of the tunnel to the outlet.

SAN FRANCISCO, CAL.—Negotiations are reported to be under way whereby the Pacific Gas & Electric Company, of San Francisco, Cal., will lease the property of the Western Power Company for a period of forty six years from Jan. 1, 1911. Under the terms of the contract the Pacific Gas & Electric Company agrees to guarantee the dividends on the common stock of the Western Power Company as follows: Beginning at the rate of 2½ per cent in 1912 and 1913, and increasing one-half of 1 per cent yearly thereafter until the rate reaches 7 per cent per year, at which figure it is to remain until the expiration of the lease. In addition to guaranteeing the dividends on the common stock the Pacific company, it is said, agrees to maintain the property of the Western Power Company in good order, appropriating a certain amount of the net earnings each year for that purpose. For some years the Pacific company has had a contract with the power company, under which the latter supplied it with 25,000 hp a year. The Western Power Company owns lands and water rights in Northern California, its main power plant being located about 160 miles northeast of San Francisco; it also owns the California Electric Generating Company, which has a large steam turbine plant on the water front in Oakland.

STOCKTON, CAL.—It is reported that the Pacific Gas & Electric Company has secured the control of the Stockton Gas & Electric Company and the American River Electric Company.

WASHINGTON, D. C.—The Commissioners of the District of Columbia have authorized the installation of seventy-five electric incandescent lamps of 40 cp to replace the gas lamps in Brookland. The lamps will be suspended from the trolley poles of the new section of the street railway running through Brookland. The new lamps include a lighting system for the ornamental posts on the Monroe Street bridge. The lamps will [illegible]

FORT MEADE, FLA.—Preparations are being made by S. T. Rivers for the construction of an electric light plant in Fort Meade, Fla., to cost about $4,000, bids for construction of which have been received.

MONTICELLO, GA.—Contracts have been awarded for machinery for the Jasper Cotton Mills. The plant will have a capacity of 10,000 spindles and will be equipped for electrical operation. L. O. Benton is interested in the project.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company has submitted a proposition to the City Council offering to increase the street-lighting system at a lower rate than charged for the present service, provided a five-year contract be given the company. At the present time the city pays about $97 per month for the lighting service; under the proposal submitted the company offers to double the service for $140 per month. The Council is willing to make a contract for one year, but the company is not willing to accept a contract for less than five years.

WALLACE, IDAHO.—The directors of the North Idaho Telephone Company are reported to have authorized an issue of bonds to the amount of $50,000, the proceeds to be used for making extensions to the system.

BENTON, ILL.—Arrangements are being made by the Hamilton Utility Company for the erection of a new electric plant on the property recently acquired in the Martin & Copple addition. The equipment of the new plant will include a 350-hp Corliss engine and the output will be double that of the old plant. The machinery in the old power house will be removed to the new power station and will be used for day service and emergencies. The company also proposes to install a water-works system; the pumping station will be located on a 77-acre tract, where a dam will be built and a settling basin made.

CHICAGO, ILL.—The Interstate Telephone & Telegraph Company, operating in twenty-five cities and towns in northern and central Illinois, has been placed in the hands of receivers. It is asserted that the liabilities of the company exceed its assets by $1,000,000. Fred A. Dolph, of Aurora, Ill., and William C. Niblack, of Chicago, Ill., were appointed receivers.

CHICAGO, ILL.—The City Council has authorized the city controller to advertise for bids for the sale and removal of the old arc lighting equipment in the municipal electric plants, consisting of boilers, condensers, steam engines, piping and a number of arc generators. As the city now secures electricity from the power plant of the Sanitary District of Chicago it has decided to dispose of the above equipment.

CLINTON, ILL.—Extensions are being made to the plant of the Clinton Gas & Electric Company, including an addition to the power house, which will be equipped with two 400-hp Murray-Corliss engines, direct connected to two 200-kw, three-phase, 60-cycle, 1100-volt generators and new switchboard. A new stack is also being erected.

KANKAKEE, ILL.—The directors of the Kanhakee & Urbana Traction Company have called a special meeting of the stockholders, to be held Nov. 22, to vote on the proposition to increase the capital stock of the company from $500,000 to $2,500,000. Preliminary arrangements have been made for the construction of an electric railway to connect Kankakee and Charleston, 125 miles in length. W. K. Brook, is president.

MARION, ILL.—The Marion Electric Light & Street Railway Company has changed its name to Marion Light, Power & Water Company and increased its capital stock from $20,000 to $100,000.

NEW HOLLAND, ILL.—The capital stock of the New Holland Telephone Company has been increased from $2,500 to $10,000.

SAVANNA, ILL.—Plans are being considered for the construction of an electric railway connecting Sterling, Coleta, Milledgeville and Lanark, and from Lanark east and west to Freeport and Savanna. W. Osborne, of Chicago, Ill., is promoter.

CHESTERTON, IND.—The new pole line of the Northern Indiana Gas & Electric Company from Michigan City to Chesterton has been completed. It is understood that the company will soon be ready to supply electricity for lamps and motors in Chesterton and Porter. The service will be supplied from the power plant at Michigan City. The company is erecting a new power plant at East Chicago, Ill., and will erect a transmission line from that city via Chesterton to Michigan City and connect the two power plants. It is expected that the company will supply the entire territory between Hammond and Michigan City by next spring.

CLINTON, IND.—It is reported that the twin collieries of the Bunsen Coal Company, a subsidiary of the United States Steel Corporation, located south of Clinton, Ind., are being equipped with electrical apparatus and a large power plant being installed.

ELKHART, IND.—Plans are being considered by the Elkhart Industrial Association for installing an ornamental street lighting system on Main Street from Jackson Street to the Lake Shore. Under the present plan the Industrial Association proposes to install the posts and lamps and the city to maintain the lamps.

FORT WAYNE, IND.—Preparations are being made by the Home Telephone & Telegraph Company for enlarging its exchange. A contract has been awarded to the Stromberg-Carlson Telephone Company, of Rochester, N. Y., for an addition to the main switchboard to provide for 300 lines.

INDIANAPOLIS, IND.—The capital stock of the Indiana Power Company has been increased from $25,000 to $50,000.

MARION, IND.—The Indiana Supreme Court has handed down a

decision which declares that the M[illegible] Heat Company, which acquired its franchise rights from a preceding company, must carry out a provision providing for the furnishing of heat and light, free of cost, to the library building, notwithstanding the library building was not erected until long after the franchise was granted.

MICHIGAN CITY, IND.—The Chicago, Lake Shore & South Bend Railway Company is building a new substation at Charleston and a new three-phase, 60-cycle transmission line from its power plant in Michigan City to Hammond, Ind. The company has placed orders with the General Electric Company, of Schenectady, N. Y., for two 1000-kw motor generator sets and frequency changers, with necessary transformers, and is preparing to supply electricity for motors on a large scale. C. N. Wilcoxon is general manager.

NOBLESVILLE, IND.—Notice has been given that the plant and holdings of the White River Light & Power Company, of Noblesville, Ind., will be sold at auction on Nov. 19, at the court house, at Noblesville, Ind. The property includes the dam site, together with concrete dam in process of construction, two concrete cottages and certain tracts of land, which constitute the reservoir; also transmission line connecting the power house of the company, about two and one-half miles distant, and the distributing system in Noblesville, and all tools and equipment in connection with the plant; also all contracts, rights and franchises granted the company by the Council of Noblesville. Ralph H. Beaton is receiver of the company.

SOUTH BEND, IND.—The Southern Michigan Railway Company is contemplating the construction of an extension to Buchanan, Mich., a distance of four miles.

ADAIR, IA.—The question of granting an electric light franchise in Adair is under consideration by the Town Council. J. J. Hayden is town clerk.

ALLERTOWN, IA.—The contract for the construction of a new power house for the municipal electric light plant was awarded to A. Mardis, of Corydon. The plant was destroyed by fire on Oct. 6.

CEDAR FALLS, IA.—The Waterloo, Cedar Falls & Northern Railway Company is contemplating extending its railway to Dike, a distance of about ten miles.

CLINTON, IA.—The Commercial Club is reported to have called for bids for the installation of curb lamp posts on Second Street.

ELLIOTT, IA.—R. O. Prather, of Griswold, Ia., is reported to have applied for a franchise to construct and operate an electric light plant in Elliott.

NEWTON, IA.—The Board of County Commissioners has awarded the contract for the installation of an electric light plant at the county farm to the Monarch Machine Company, of Des Moines, Ia., for $1,150.

STANTON, IA.—The installation of an electric light plant in Stanton is reported to be under consideration.

CHASE, KAN.—The Chase Hardware & Implement Company is reported to be contemplating the installation of a private lighting plant.

STAFFORD, KAN.—At an election to be held Nov. 19 the proposition to issue $25,000 in bonds for the installation of a municipal electric light plant will be submitted to a vote.

GRAPEVINE, KY.—The Perry Telephone Company is contemplating erecting a telephone line from Grapevine to Langnaugh, via Chestnut Gap.

WHITESBURG, KY.—Plans are being considered by the Whitesburg Telephone Company to erect a telephone line from Mandrake to Dry Forks and Line Fork, where it will make connection with the Line Fork [illegible] Company's system. Connection will also be made with the lines of the Big Leatherwood Telephone Company.

BALTIMORE, MD.—Plans are being considered for the erection of a large building to be equipped for supplying power either by gas or electricity, to be rented to small manufacturers. The directors of the Consolidated Gas, Electric Light & Power Company have offered to subscribe to half of the stock. The cost of the building is estimated at about $200,000. J. E. Aldred, vice-president of the Consolidated Gas, Electric Light & Power Company, is a member of the committee appointed to promote the enterprise.

HONOR, MICH.—C. G. Hart, of Honor, Mich., is reported to be contemplating the construction of a hydroelectric plant in the near future.

OLIVET, MICH.—A company has been organized in Olivet for the purpose of furnishing electricity in the village and to the college, for which a franchise has been granted by the Village Council, subject to approval of the voters at an election to be held within sixty days. If granted a franchise the company agrees to have the plant in operation within ninety days. E. M. Arnos, treasurer of the college, is interested in the project.

SAGINAW, MICH.—F. W. Carlisle Company, of Saginaw, Mich., have secured the contract for the construction of the leather factory for Spence Brothers in this city. The plant will be equipped with new machinery, including electric motor drive.

BRAINERD, MINN.—A contract has been awarded to the Toltz Engineering Company, of St. Paul, Minn., to supply electricity for a term of ten years in Brainerd. It is understood that machinery will soon be ordered for the proposed plant and it is expected to have the plant in operation by Dec. 1.

PINE RIVER, MINN.—The Village Council has granted a franchise to I. A. and T. L. Arvig to construct and operate an electric light plant in Pine River. A reinforced concrete [illegible] is now being built by Webber & Hill.

PROCTOR, MINN.—The Commercial Club is reported to be considering the question of providing a lighting system for the town.

CEDARS, MISS.—W. C. Wing, of the Kimberly-Wing Company, is reported to be in the market for equipment for an electric light plant, including an engine, generator, switchboard, etc. The headquarters of the company are located at Neenah, Wis., the Cedars plant being operated as a branch.

MERIDIAN, MISS.—The Meridian Light & Railway Company, is contemplating double tracking its street railway on Eighth Street, in Meridian, and also the construction of an extension to Highland Park.

KANSAS CITY, MO.—The Board of Public Works has approved the plans of the Kansas City Electric Light Company for the installation of underground conduits for carrying its wires in the restricted district in this city. Work will commence on the Southwest Boulevard.

KING CITY, MO.—Preparations are being made by the King City Electric Light & Power Company for the installation of an electric light plant. Fred A. Thompson is manager.

SPRINGFIELD, MO.—The farmers residing south of the city on the James River Club House road propose to organize a company for the purpose of erecting a rural telephone line from Springfield to the James River Club House. J. T. Carter, G. W. Campbell and others are interested in the project.

AVON, MONT.—The Avon Local Home Telephone Company, recently organized with a capital stock of $10,000, is planning to install a new telephone system in Avon, work on which will begin at once.

CHINOOK, MONT.—A committee consisting of A. S. Lohman, Thomas O'Hanlon and W. H. Duke has been appointed to look into the question of installing an electric light plant in Chinook, Mont.

LIBBY, MONT.—The City Council has granted a franchise to E. K. Barnum and P. D. Pratt, of Libby, Mont., to construct and operate an electric light plant, water-works and telephones in Libby. The holders of the franchise propose to install water and electric plants and a telephone system, at a cost of about $100,000.

CARSON CITY, NEV.—The Western Smelters Corporation is reported to have taken over the Brunswick mill site and power site with water rights. It is understood that a large reservoir and power plant will be erected to supply power to the new smelter.

CONCORD, N. H.—Plans are being considered by the Central New Hampshire Power Company, recently incorporated with a capital stock of $2,000,000, for the construction of a large power plant, to be located on the Blackwater River, at Sweatt's mills, in Webster. The main dam will be located at Sweatt's mills and the second dam in Salisbury, above Shaw's mill. The directors of the company are: Frederick L. Houghton, Dennison Cowles, of Brattleboro, Vt., and Nathaniel E. Martin, of Concord, N. H.

HAMPTON, N. H.—The Exeter, Hampton & Amesbury Street Railway Company will soon purchase an electrically driven, centrifugal type [illegible]

ORANGE, N. J.—The City Council has notified the Public Service Corporation of New Jersey that its service will not be required for longer than ninety days from Oct. 17, 1910, as provided in the agreement between the city and the corporation. It is expected to have the municipal electric plant finished in about two months, which will give sufficient time to try out the plant.

SOUTH RIVER, N. J.—Proposals will be received until Nov. 28 by Charles Anderson, Borough Clerk, for construction of electric light, power and pumping plant and transmission line as follows: Section 1—Furnishing and installing three 125-hp boilers and piping in and about power house, or alternately furnishing and installing two 200-hp gas producers. Section 2—Furnishing and installing two 190-hp steam engines, or alternately two 190-hp gas engines, together with the piping in and about the gas engine plant. Section 3—Furnishing and installing two 800,000-gal. steam pumps, or alternately two 800,000-gal. motor-driven pumps, including all piping, valves and fittings to well. Section 4—Furnishing and installing two 125-kw electric generators and accessories. Section 5—Constructing radial brick chimney, 100 ft. x 5 ft., or alternately a steel stack, 25 ft. x 4 ft., and induced draft apparatus. Section 6—Constructing a covered suction well, complete except piping, diameter 32 ft., depth 33 ft., or alternating diameter 25 ft. and depth 33 ft. Section 7—Furnishing and erecting standpipe 20 ft. x 100 ft. with ladders, automatic altitude valve and connection to main. Section 8—Constructing concrete foundation for standpipe. Section 9—Furnishing material and erecting the building for the power plant, together with all wall and machinery foundations, sewers and conduits. Section 10—Building electrical transmission line from the power house into the borough, a distance of about 9000 ft. Plans and specifications and form of contract may be seen at Borough Hall, South River, N. J., or at the offices of W. W. Young, consulting engineer, 220 Broadway, New York, N. Y.; 46 Park Street, Bordentown, N. J., and Drexel Building, Philadelphia, Pa. Joseph Mark is Mayor.

WESTFIELD, N. J.—The Town Council has entered into a contract with the Public Service Corporation of New Jersey to light the streets of the town for a period of three years. Under the terms of the contract the company is to furnish tungsten lamps at the rate of $18 each per year.

CLAYTON, N. M.—The City Board has taken over the electric and water plants of the Clayton Electric Light & Water Supply Company. It is proposed practically to rebuild both plants during the coming year. A

will be submitted to the voters as soon as an election can be called.

its transmission lines from its power plant in Deming to many parts of the Nimbres Valley to supply electricity to operate irrigating pumps and other purposes, supplying motors from 5 to 40 hp, is adding to its transmission system and expects to double its present mileage of lines in the valley by the time the farmers are ready to begin spring work.

BUFFALO, N. Y.—It is reported that plans are being prepared by the Augustine Automatic Rotary Engine Company for extensive additions to its plant at Elmwood Avenue and the Erie Railroad, which will involve an expenditure of about $100,000. Two buildings will be erected at once, an addition to one of the factory buildings, 35 ft. x 100 ft., and a power house, 50 x 50 ft. Two other buildings will be erected in the near future.

CLYDE, N. Y.—The Clyde electric light and gas plants, which have been idle for eight or ten years, are being rebuilt. It is understood that new machinery will be installed in the spring to supply this village and vicinity with electricity and gas.

JAMESTOWN, N. Y.—The construction of an electric railway between Jamestown and Dunkirk, on Lake Erie, via Gerry, Stockton, Centralia, Cassadaga, Lily Dale and Laona, is under consideration and preliminary steps have been taken for securing rights of way. V. E. Peckham, Arsell C. Price and Robert M. Garfield are interested in the project.

MONTICELLO, N. Y.—The Monticello Electric Light & Development Company is contemplating the construction of an electric power plant, to cost about $20,000. Blake A. Mapledoram is chief engineer and manager.

MORRISTOWN, N. Y.—The Public Service Commission, Second District, has granted M. W. Gregory, of Morristown, permission to construct and operate an electric light plant in this village.

NEW YORK, N. Y.—Sealed bids will be received by William H. Edwards, Commissioner of Street Cleaning, at the office of the Department of Street Cleaning, Room 1403, 13 to 21 Park Row, New York, N. Y., until Nov. 9 for furnishing and installing a complete electric lighting system in the new eastern portion of stable "A" of the Department of Street Cleaning, Seventeenth Street and Avenue C. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Sealed bids will be received by Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity, at the office of the Department of Water Supply, Gas and Electricity, Room 1904, 13 to 21 Park Row, New York, N. Y., until Nov. 16 as follows: Section 1—For furnishing and installing electric control cables in underground ducts from the South Street high-pressure pumping station to the gate valve vaults in New Chambers Street, east of New Bowery, and in East Houston Street, each of the Bowery. Section 2—For furnishing and installing motor-operated gate valves, subsidiary ducts, etc., with all appurtnances complete, in the high-pressure fire-service mains in New Chambers Street, east of New Bowery, and in East Houston Street, east of the Bowery. Specifications and blank form of contract can be obtained at the above office.

NIAGARA FALLS, N. Y.—Arrangements have been made between the City Council and the merchants whereby the special illumination system on Queen Street, Erie Avenue and Bridge Street will be in operation until the end of the year.

PALATINE BRIDGE, N. Y.—The Board of County Supervisors of Montgomery County has authorized the installation of an improved lighting plant, either gas or electricity, for lighting the county buildings at Palatine Bridge.

HIGH POINT, N. C.—Arrangements are being made by the High Point Hosery Mills for the installation of 125 additional knitting machines, which will be installed in the new addition. The cost of the machinery is estimated at about $25,000. The mills of the company are operated by electricity.

SMITHFIELD, N. C.—Arrangements are being made for the construction of a municipal electric light plant, bids for construction of which have been called for. James A. Wellons is Mayor.

TAYLOR, N. D.—Arrangements are being made by the People's Telephone Company for the construction of new rural lines. Henry Mason

BEREA, OHIO.—The Youngstown Armature & Construction Company, of Youngstown, Ohio, has been awarded the contract for the new switchboard for the municipal electric light plant in Berea, for $1,471.

CLEVELAND, OHIO.—It is reported that plans have been prepared for extensions to the water works system in Cleveland and bids will soon be advertised for equipment for same, which will include two 25,000,000-gal. pumping engines for the Kirkland pumping station, to replace the two 15,000,000 gal. low-duty pumping engines now in use. The plans call for the erection of a high-pressure pumping station with four centrifugal units with a capacity of 10,000 gal. per minute and a 270 lb. pressure. It has not yet been decided whether to install gas engines or electric motors to operate the pumps, for which 2000 hp will be required.

COLUMBUS, OHIO.—It is reported that the Fifth Avenue Railway & Light Company is planning to erect a power plant on West Fifth Avenue, near the Hocking Valley Railroad tracks. The company proposes to operate a crosstown line in East Fifth Avenue and West Fifth Avenue.

COLUMBUS, OHIO.—Contracts have been awarded by the City of Columbus for equipment for the Scioto River pumping station as follows: For two motor-driven centrifugal pumps, one of 20,000,000 gal. capacity and the other of 5,000,000 gal. capacity, to the Platt Iron Works, of Day-

... Manufacturing Company, of Erie, Pa., for two 250-hp synchronous motors to drive the pumps.

IVORYDALE, OHIO.—The Procter & Gamble Company, it is reported, is increasing the output of its power plant and enlarging its machine shop at Ivorydale.

JACKSON, OHIO.—All bids received Oct. 20 for machinery, etc., in connection with improvements to the municipal electric light plant have been rejected by the Board of Public Affairs. New bids will be called for later. W. A. Dallas is clerk of board.

LANCASTER, OHIO.—The contract for boilers for the light and power plant for the Boys' Industrial School, at Lancaster, Ohio, has been awarded to the McNaul Boiler Manufacturing Company, of Toledo, Ohio, at $5,955. F. C. Gurlach is superintendent.

MT. VERNON, OHIO.—The Mt. Vernon Electric Company, recently incorporated with a capital stock of $300,000 by N. C. L. Kachelmacher and others, will take over the local street railway and lighting properties which were purchased at receiver's sale by Mr. Kachelmacher and associates some time ago. Mr. Kachelmacher will be the president and treasurer of the new company, while Charles V. Critchfield will be the secretary. The new power plant now under way will be completed and the street railway lines will be extended to the new state sanitarium just completed near the town.

NEWARK, OHIO.—The construction of an electric railway to connect Newark, Coshocton and Uhrichsville is reported to be under consideration. E. A. Nesbit, of Pittsburgh, Pa., and A. E. Townsend, of Doylestown, are reported to be interested in the project.

OSTRANDER, OHIO.—The directors of the Ostrander Telephone Company have called a meeting of the stockholders to vote on the proposition to increase the capital stock of the company from $10,000 to $40,000.

TOLEDO, OHIO.—Among the proposed amendments to the city charter which are to be voted upon at the coming election is one which will provide that the city may generate and sell electricity for commercial and private use, as well as street and public lighting, the contracts to be limited to periods of three years. It also provides that the city may erect a lighting system and lease it to another person or corporation for operation, under terms to be fixed by the City Council.

HOLLIS, OKLA.—The City Council has granted a franchise for the installation of an electric light plant in Hollis. From twenty to thirty street lamps will be installed.

NOWATA, OKLA.—The Coffeyville-Nowata Railway & Power Company is reported to have awarded the contract for the construction of its proposed railway to connect Coffeyville, Kan., and Nowata, Okla, a distance of twenty-three miles, to Robert L. Plunkett, of Coffeyville, Kan. W. V. Thraves, of Nowata, Okla., is general manager.

FOREST GROVE, ORE.—The City Council has granted A. Welch, of Portland, Ore., a franchise to erect transmission lines on certain streets in Forest Grove for the distribution of electricity for lamps and motors.

FOREST GROVE, ORE.—Negotiations have been completed whereby the Independent Electric Company, recently incorporated in Multnomah County with a capital stock of $100,000, has purchased the plants and holdings of the Haines Light & Power Company, of Forest Grove, and of the Hillsboro Water, Light & Power Company, which controls a hydroelectric power plant located about sixteen miles from Forest Grove. The new company contemplates extensive improvements and extensions to the plants and also extension of the transmission lines to Beaverton, Arenco, Cornelius and Dilley. R. H. Boykin, 502 Fenton Building, Salem, Ore., is president of the company. Headquarters of the company will be located in Portland, Ore.

FORT KLAMATH, ORE.—We are informed that there is a good opening for an electric light plant in Fort Klamath, Ore. For further information address Joseph Hessig, president of the Klamath Telephone & Telegraph Company, Fort Klamath, Ore.

HERMISTON, ORE.—B. A. Chrisholm, of Meadows, Idaho, is reported to be contemplating the installation of an electric light plant in Hermiston.

ALLENTOWN, PA.—The Lehigh Valley Transit Company is asking for bids for one 5000-kw turbine with boilers, condensers and auxiliaries. The bids are requested through Ford, Bacon & Davis, consulting engineers, 115 Broadway, New York, N. Y.

LOCK HAVEN, PA.—The Island Dunnstown Telephone Company ... to erect a telephone line in the vicinity ... Dunnstown to connect with the Bell Telephone Company. Jacob My... is president and Charles Rote is manager, both of Dunnstown, Pa.

MARCUS HOOK, PA.—The Borough Council is considering a proposition submitted by A. R. Granger, vice-president and manager of the Beacon Light Company, of Chester, Pa., to supply electricity for lamps and motors in Marcus Hook.

OXFORD, PA.—M. C. Martin, of New York, N. Y., is reported to be interested in a project to build an electric railway to connect N... N. J., and Wilmington, Del., where it will make connections with the ... way extending from Philadelphia to Kennett.

PROVIDENCE, R. I.—Plans are being prepared by the Rhode Island Company for doubling the output of its Manchester Street power house at a cost of about $300,000. It is expected that contracts for machinery will be awarded within thirty days. The new equipment will include 13,500-kw, 11,000-volt, three-phase, 25-cycle turbo-generator set, with condenser, switchboard panels, three 2000-kw rotary converters with foundations, wiring, exciters, etc., coal-hoisting apparatus, relocation of two 25-

kw, horizontal turbo-generator with a new conde[illegible] piping, etc. It is ex-pected to have the work completed by next Jun[illegible]. A. E. Potter is general manager.

DOYLE STATION, TENN.—The Doyle Springs Telephone & Telegraph Company, recently incorporated, is planning to erect a telephone line to connect Sparta, McMinnville and Spencer, Tenn, sixty miles in length. R. E. Lee Smith is manager.

HUMBOLDT, TENN.—Plans are being considered by R. Lee Reaves, I. H. Duggan and T. E. Babbitts for the construction of a water power plant. They propose to construct two boats to form a race and be anchored in stream. The plant can easily be towed to a new location when necessary. Estimates are now being made on machinery for same. R. Lee Reaves is engineer in charge.

OLIVE SPRINGS, TENN.—The Olive Springs Telephone Company is contemplating the erection of several miles of telephone line connecting Harriman and Clinton, Tenn. J. C. Edwards is manager.

CLARKSVILLE, TEX.—Arrangements are being made to rebuild the electric plant of the Clarksville Light Company, which was recently destroyed by fire. The new plant will have about double the output of the old plant. The company is now being reorganized.

COTULLA, TEX.—It is reported that the City Council is prepared to grant a franchise for the installation of electric light, water and ice plants in Cotulla. For further information address C. F. Burkley, Mayor.

GEORGETOWN, TEX.—At an election held recently the citizens voted in favor of the proposition to issue $45,000 in bonds, the proceeds to be used to purchase water and light plants of the Georgetown Water, Light & Power Company. Extensive improvements and extensions will be made to both systems.

HUBBARD CITY, TEX.—Contracts have been awarded by the Union Central Light & Ice Company, of Hubbard City, Tex., to the Allis-Chalmers Company, of Milwaukee, Wis., and the Skinner Engine Company, of Erie, Pa., for automatic generating machinery, and to the Phoenix Iron Works, of Meadville, Pa., for boilers. W. A. Bass is president and general manager of the Union Central Light & Ice Company.

LIVINGSTON, TEX.—The Livingston Electric Light Company has changed its name to the Livingston Manufacturing Company and has increased its capital stock from $2,000 to $15,000. The company contemplates making improvements to its electric light plant.

NEW BRAUNFELS, TEX.—We are told that the City of New Braunfels is contemplating the construction of a hydroelectric power plant, the power developed will be used primarily for its water-works system and later for an electric system. The proposed work includes the construction of a dam, power house, turbines, pumps, standpipe, pumping station, generators, and several miles of transmission line, as the pumping station will be located some miles from the dam. The city is now ready to have plans and specifications submitted. Adolf Henne is chairman of committee in charge of the proposed plant.

PEARSALL, TEX.—The Pearsall Gin Company is reported to have sold its electric plant to the Pearsall Water, Light & Ice Company. It is understood that the two plants will be consolidated.

PEARSALL, TEX.—It is reported that plans are being prepared by the Southwestern Telephone Company for improvements to its systems in Pearsall and at Cotulla. A switchboard providing for 300 lines has been ordered for the local exchange and the entire system will be overhauled. The erection of several rural lines is under consideration.

SAN ANTONIO, TEX.—The Terrell Hot Wells Company, which is building the new town of San Jose, five miles from this city, is negotiating with the International & Great Northern Railroad Company with a view of equipping that portion of the railroad for electrical operation between San Antonio and San Jose for suburban traffic. Announcement has been made that if this is not done the electric railway system of San Antonio will be extended to San Jose.

TEXARKANA, TEX.—Owing to the refusal of the Southwestern Telephone Company to accept the franchise offered by the City of Texarkana, an effort is being made by the city to purchase the plant of the Texarkana Telephone Company in this place, now in the hands of a receiver. A. C. Stuart is receiver.

TEXAS CITY, TEX.—The stockholders of the Texas City Transportation Company have authorized an expenditure of $1,500,000 for additional improvements to the deep-water port which it is creating at Texas City. Of this appropriation $1,000,000 will be used to extend the company's terminal system, which will include the construction of ten more miles of track, giving the system a total of forty miles; the installation of additional electric cranes and the erection of another steel and concrete warehouse. An appropriation of $500,000 was made for the installation of an [illegible] light system, water works plant and sewer system. The present [illegible] power plant will be enlarged and will have sufficient output to supply electricity for industrial plants in Texas City and adjacent territory. A. B. Wolvin, of Duluth, Minn., is president of the company.

GRAHAM, VA.—The Town Council is reported to have accepted the proposal of the Graham Railway & Electric Company for a franchise to construct and operate an electric light plant and electric railway system in [illegible]

LEXINGTON, VA.—The report of the special committee appointed by the Town Council to investigate the electrical service furnished by the Lexington Light & Power Company recommends the installation of a 200-hp steam plant in addition to the present water-power plant in order to provide adequate service for lighting the streets and residences of the town. The committee advises the improvement to be made within six months. The unsatisfactory service is due to the low water in North River, which furnishes power for the plant.

NORFOLK, VA.—Proposals will be received by the Board of Control until Nov. 19 for furnishing and installing three electrically-driven centrifugal pumps at Colley Avenue sewer pumping station as follows: One 2000-gal. pump, one 3000-gal. pump and one 4000-gal. pump. William Waller is engineer of power station.

BEVERLY, WASH.—It is reported that plans have been completed for the installation of an auxiliary pumping plant at the lower end of the Strahorn power ditch at Priest Rapids.

CENTRALIA, WASH.—The City Council has instructed the city clerk to advertise for bids for a complete generating plant, including two 500-kw steam turbo-generators with boilers and accessories. Plans and specifications can be obtained from C. A. Harmon, city electrician.

ELLENSBURG, WASH.—The City Council has decided to abolish the flat rate system in connection with the municipal electric light plant and install meters. The Council has awarded the Olympic Foundry Company, of Seattle, Wash., a contract for furnishing fourteen lamp standards for cluster lamps, complete with globes, at $46.90 each.

HOQUIAM, WASH.—The City Council has authorized the city clerk to advertise for bids for street lighting on I and Eighth Streets; separate bids will be asked for the rest of the city.

NORTH YAKIMA, WASH.—The controlling interest of the Yakima Valley Telephone Company has been purchased by the Manuel Brothers Company, of North Yakima and Minneapolis, Minn. The new offices of the company are: S. K. Bartholomew, president and superintendent; M. H. Manuel, vice-president, and H. W. Manuel, treasurer.

SEATTLE, WASH.—The contract for installing cluster lamps on Stewart Street, subdivision No. 1, has been awarded to the Agutter-Griswold Company, for $12,972; the contract for subdivision No. 2, on the same street, was awarded to the Standard Engineering Company, at [illegible]

SPOKANE, WASH.—It is reported that the International Electric Company, Ltd., with headquarters in Nelson, B. C., and Portland, Ore., is contemplating the construction of a large hydroelectric plant on the Pend Oreille River, just north of the international boundary.

SPOKANE, WASH.—The report submitted by W. E. Moore, hydraulic engineer, engaged by the City Council to investigate the project to develop the available power at the up-river pumping station, estimates that it will cost about $400,000 and that about 5500 hp can be obtained. As this will not give the city sufficient power it will be necessary to secure other power sites.

SPOKANE, WASH.—The Panhandle Electric Railroad & Power Company has submitted a proposition to the City of Spokane offering to supply the city with electricity for a term of years at a much lower rate than now paid by the city to the Washington Power Company, with the privilege of taking over the plant at the end of the contract. The company offers to enter into a contract with the city to invest approximately $2,000,000 in a power plant on Priest River and supply electricity to the city for a term of five or ten years, and at the end of the contract to turn the plant over to the city at a price to be named in the contract or to be fixed at that time by appraisers. The company has also offered to sell the city its rights on Priest River, allowing the city to build its own plant. The Panhandle Electric Railroad & Electric Company owns two power sites on the Priest River, sixty and seventy-two miles respectively from Spokane, one located six miles north of the Town of Priest River, where it is estimated that about 10,000 hp can be developed, and the other two miles south of Priest Lake, capable of developing about 15,000 hp, the two sites being about twelve miles apart.

WHITE SALMON, WASH.—Owing to the increase in the demand for electrical service, the Husum Power Company, which supplies electricity in White Salmon, Husum and Bingen, has decided to make extensions to its plant, including the erection of a concrete dam, which will be located near the old dam at Husum, six miles north of this place.

BUCKHANNON, W. VA.—The power plant of the Buckhannon Light & Water Company was partially destroyed by fire Oct. 25. The city will be without electrical service until some temporary arrangements can be made at the plant, which will probably be a week or more. The pumping plant of the water-works system was also put out of commission.

PARKERSBURG, W. VA.—Bids will be received by the City Council until Nov. 9 for furnishing electricity for lighting the city after Jan. 1, 1911, each proposal to be on a basis of at least 250 arc lamps of 2000 cp and not less than 50 alley lamps, to be located as directed by the city authorities. Proposals may be based upon one-year, five-year and ten-year contracts. Frank Good is city auditor.

APPLETON, WIS.—The Wisconsin Telephone Company is contemplating the construction of a new telephone exchange in this city, at a cost of about $300,000.

CRIVITZ, WIS.—The organization of a farmers' telephone company in Ellis Junction is under way. It is proposed to erect a telephone system covering an area of about ten miles. C. A. Cornell, of Crivitz, Wis., is interested in the project.

DARLINGTON, WIS.—The power house of the Darlington Electric Light & Water Power Company is reported to have been destroyed by fire, causing a loss of about $10,000.

EAU CLAIRE, WIS.—It is reported that the [illegible] Bros. &

[illegible] Company, of Eau Claire, Wis., has decided upon [illegible] of a steel and concrete building, which will be equipped [illegible] capacity of the one burned last spring. The plant will be equipped for electrical operation.

JANESVILLE, WIS.—The property of the Janesville Street Railway Company was purchased by the bondholders at an auction sale for $125,000. It is understood that the company will reorganize as part of the Rockford Interurban system.

SCHOFIELD, WIS.—Preparations are being made for rebuilding the mill of the Brooks & Ross Lumber Company, which was burned last summer. It is expected that the plant will be equipped for electrical operation.

SHEYBOGAN, WIS.—The Thomas Toy Coaster Company is reported to be contemplating the purchase of an electric generating unit.

SHEBOYGAN, WIS.—It is understood that the S. W. Miller Piano Company will be in the market for a line of motors for its new factory in the near future.

WEYWAUWEGA, WIS.—O. A. Rice is reported to be interested in the organization of a company for the purpose of installing a new telephone system in Weywauwega. Dr. S. M. Keyes and H. Reif are also interested in the project.

WILTON, WIS.—Dr. Carl Vogel is reported to have been granted a franchise to install an electric light plant in Wilton.

SARATOGA, WYO.—The plant and holdings of the Saratoga Light, Heat & Power Company are reported to have been purchased by D. E. Winsor. It is understood that repairs will be made to the system and the service improved.

VANCOUVER, B. C., CAN.—Following the visit of J. R. Freeman, engineer, who was appointed by the Dominion government to make an investigation of the proposed dam to be constructed by the Vancouver Power Company at Coquitland, B. C., it is understood that that company will be allowed to proceed with the construction of the dam provided that certain conditions are complied with, which, it is said, will involve a change in the position of the dam, the present level of the lake to be lowered and the land flooded by the present dam to be stripped of all rubbish and waste material.

DAUPHIN, MAN., CAN.—At an election held recently the by-law appropriating $11,000 for an electric light system was carried.

WINNIPEG, MAN., CAN.—Bids will be received by the Board of Control until Dec. 7 for overhead wire and cables for the electrical distribution system of Winnipeg. Specifications and blank forms of proposal may be obtained from Smith, Kerry & Chase, engineers, Federation Life Building, Toronto, or Winnipeg. M. Peterson is secretary of board.

MATHESON, ONT., CAN.—It is reported that the development of the water-power at McDougall's Chutes to be utilized to generate electricity for lamps and motors in Matheson is under consideration.

ORILLIA, ONT., CAN.—The City Council has decided to make improvements to the municipal electric light plant, to cost about $10,000. A by-law will be submitted to the ratepayers asking for authority to make the expenditure. Further extensions to the plant will be necessary within a year or two, these including the installation of a new unit and waterwheel capacity and involving an expenditure of from $25,000 to $30,000.

OTTAWA, ONT., CAN.—Announcement was made on Oct. 26 that the International Waterways Commission would not render a decision on the proposed Long Sault dam on the St. Lawrence River. The matter will be left to the new commission provided for in the International Waterways Treaty between Canada and the United States, which will be appointed about the end of this year.

PETERBORO, ONT., CAN.—The Canadian Machine Telephone Company is reported to have applied to the City Council for an extension of its franchise in Peterboro for a term of twenty-five years, in return for which the company agrees to make improvements to its system, which will involve an expenditure of $10,000, and to give free connections with all rural telephones within a radius of ten miles.

RENFREW, ONT., CAN.—The power house of the Renfrew Electric Light Company was destroyed by fire on Oct. 20. The machinery was saved, damaged only by water. The Renfrew Power Company will supply electricity for lighting the city until the plant is rebuilt.

TILSONBURG, ONT., CAN.—The by-law to appropriate $25,000 to construct an electric power station for the distribution of electricity supplied by the Hydro-Electric Power Commission in Tilsonburg was carried at an election held recently.

TORONTO, ONT., CAN.—The City Council has rejected the recommendation of the Board of Control that the corporation seek legislation giving authority to the city to purchase the railway system of the Toronto Railway Company.

TORONTO, ONT., CAN.—The Toronto Electric Light Company has submitted a proposition to the City Council offering to sell its entire plant and system to the city, upon a valuation to be determined by arbitration, [illegible] years to run. The company also made an alternate proposal, in case the city did not care to purchase the plant, that it should define the company's rights on the streets of the municipality, under its franchise, to erect transmission lines; also to define its privileges within the newly annexed districts, and, further, what position the city intended to assume with reference to lighting the streets after the present contract with the company expires in Dec. 31, 1910. The City Council has taken the company's proposition under consideration for sale of the plant, and also stated that the company has rights only on the streets which were conferred by the original agreement, and that the Council was prepared to make a temporary arrangement for street lighting, pending the completion of the municipal hydroelectric distribution and lighting system.

MONTREAL, QUE., CAN.—E. A. Wallberg, of Montreal, Que., who holds a water power concession on the Mattagami River, is reported to have secured a franchise to construct and operate an electric railway from Matheson to Porcupine.

MONTREAL, QUE., CAN.—The directors of the Montreal Light, Heat & Power Company have authorized an expenditure of $200,000 for the installation of new power station equipment and lamps to meet the requirements of the new street-lighting contract.

MONTREAL, QUE., CAN.—The directors of the Maritime Railway, Coal & Power Company have decided to equip its mines at Gojjins with electric coal cutters and to install an electric power plant of sufficient output to provide for the present requirements at the mines.

MONTREAL, QUE., CAN.—Contracts have been placed by the Montreal Light, Heat & Power Company with the Canadian General Electric Company for equipment in connection with the new street lighting system, which will involve an expenditure of about $250,000, and call for delivery in a few weeks.

ROULEAU, SASK., CAN.—It is reported that the ratepayers have voted to authorize the City Council to borrow $45,000 for improvements to the water-works system and $15,000 for electric lighting system.

CANELAS, MEX.—Preparations are being made by Roger B. Chase for the installation of a 100-hp hydroelectric power plant at his mines, located near Canelas, to provide electricity to operate the machinery in the miles and reduction mill. The work will include the construction of a storage reservoir and canal.

EL ORO, MEX—Plans are being prepared by the Compania Minera Oro Nolan, of El Oro, for equipping its plant for electrical operation. The present steam compressor will be equipped with a 75-hp motor and several smaller motors will be installed to drive the crushers, ventilators and other machinery. The large pump will be driven by a 100-hp motor. Transformers and lighting equipment will be installed. Electricity for operating the plant will be supplied by the Mexican Light & Power Company.

NECAXA, MEX.—The large dam of the Mexican Light & Power Company, at Necaxa, has been completed. The reservoir has a capacity of 6,000,000,000 and forms one of the five reservoirs for operating the hydroelectric power plants of the company. The transmission lines extend to the City of Mexico, the mining camp of El Oro, Puebla and Pachuca.

YOQUIVO, CHIHUAHUA, MEX.—The Yoquivo Development Company is developing a water-power site with a view of installing a hydroelectric power plant at its mines in Yoquivo. The company has been operating the machinery in its mines and mills with electricity generated by steam. Owing to the plant being inadequate to meet the demands made upon it, it was decided to replace it with a hydroelectric plant.

New Industrial Companies.

[illegible] COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 by Russell F. Birchard, 378 Montgomery Street, James Macbeth, 604 St. Marks Avenue, both of Brooklyn, N. Y., and David D. Mallory, 500 Ray Street, Jamaica, N. Y. The company proposes to manufacture electrical instruments, especially to enable the deaf to hear.

THE AUTO-AD COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing and dealing in advertising devices and apparatus. The incorporators are: B. Moscovitz, L. N. Halpern and G. Rosenson, all of New York, N. Y.

THE BAYER STEAM SOOT BLOWER COMPANY, of St. Louis, Mo., has been chartered with a capital stock of $4,000 for the purpose of manufacturing boiler cleaners. The incorporators are: Frank X. Bayer, Leo J. Bayer, August V. Bayer and Frank A. Bayer.

THE J. S. BRETZ COMPANY, of New York, N. Y., has been incorporated with a capital stock of $30,000 by J. S. Bretz, A. L. O'Shea, of New York, N. Y., and C. V. Tuthill, of Jersey City, N. J. The company proposes to manufacture ball bearings, magneto carburetors, etc.

THE COMET LAMP COMPANY, of New York, N. Y., has been incorporated with a capital stock of $[illegible] by James H. Harris, 1497 Broadway; L. M. Weathers, 237 West 100th Street, and E. B. Hesser, 27 William Street, all of New York, N. Y. The company proposes to manufacture and deal in lighting and heating apparatus.

THE WILLIAM CORLISS ENGINE COMPANY OF NEW JERSEY, of Jersey City, N. J., has been incorporated by W. Corliss, I. G. Ladd, of Providence, R. I.; E. W. Corliss, of New York, N. Y., and J. R. Turner, of Jersey City, N. J. The company is capitalized at $100,000 and proposes to manufacture machinery.

THE DODGE'S INSTITUTE ANNEX OF WIRELESS AND RAILWAY INSTRUCTION, of Valparaiso, Ind., has filed articles of incorporation for the purpose of establishing a school in Valparaiso, Ind., to teach telegraphy, railway accounting and other railway instruction. A wireless sending station will be installed and the students will be fur-

nished with portable receiving sets [illegible] talized at $[illegible] and the incorporators are [illegible] L[illegible]ck, M. L. Dodge and M. Dodge.

THE DRAPER-LATHAM MACHINE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $500,000 to manufacture magnetos and other electrical devices, etc. The incorporators are: George O. Draper, 258 Riverside Drive; Charles J. Dannebaum, Hotel Astor, and Albert C. Day, 59 West Forty-sixth Street, all of New York, N. Y.

THE ELECTRIC STEEL COMPANY, of Hoboken, N. J., has been chartered by G. Vintschger, of Hoboken, N. J.; O. W. A. Hammacher, of Flushing, N. Y.; E. Vintschger, of Montclair, N. J., and C. R. Bryson, of Pittsburgh, Pa. The company is capitalized at $55,000 and proposes to manufacture iron, steel, metal materials, etc.

THE GASOLINE ENGINE EQUIPMENT COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Frederick K. Loid, 105 Lord Avenue, Bayonne, N. J.; Thomas Palmer, 704 West 178th Street; Clayton Von Culin, 705 West 178th Street, New York, N. Y. The company proposes to manufacture and deal in boilers and engines, etc.

THE GETT MANUFACTURING COMPANY, of New York, N. Y., has been incorporated by L. B. Gleason, F. B. von Teuber, of New York, N. Y., and A. C. Schultz, of Albany, N. Y. The company is capitalized at $200,000 to manufacture ball bearings, machinery, engines, motor vehicles, etc.

THE KURR-PORR ELECTRICAL CONSTRUCTION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $17,000 by F. E. Collier, N. E. Wiggins, E. Gresslee, all of 256 Broadway, New York, N. Y. The company proposes to do a general electrical contracting business, supply dealers, etc.

THE LOW SPEED ENGINE COMPANY, of Camden, N. J., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing automobiles, air ships, motorcycles, etc. The incorporators are: J. A. MacPeak, H. L. Reese and J. H. Gaul, of Camden, N. J.

THE NATIONAL SIGNAL POLICE COMPANY, of Buffalo, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing and operating signal systems. The incorporators are: Augustus F. Scheu, John F. Nagel and Solomon S. Scheu, all of Buffalo, N. Y.

THE NEW JERSEY TELEPHONE HERALD COMPANY, of Edgewater, N. J., has been incorporated by G. F. Martin, H. P. Jones and E. J. Forhan, of New York, N. Y. The company is capitalized at $500,000 and proposes to manufacture telephone appliances.

THE PENNSYLVANIA ELECTRIC COMPANY, of Philadelphia, Pa., has been incorporated with a capital stock of $20,000 by Frederick M. Shepard, 7816 Lincoln Drive, Benjamin L. Cates and Leon J. Obermayer, all of Philadelphia, Pa.

THE PENNSYLVANIA STORAGE BATTERY COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $400,000. The incorporators are: F. R. Hansell, George H. B. Martin and S. C. Seymour, all of Philadelphia, Pa.

THE PENOBSCOT MOTOR COMPANY, of Bangor, Maine, has been incorporated, with a capital stock of $100,000, for the purpose of manufacturing and dealing in automobiles, motors, engines, motor boats, etc. The officers are Fred D. Oliver, president, and J. S. H[illegible], jr., treasurer, both of Bangor, Maine.

THE RAPP & WAGMAN MANUFACTURING COMPANY, of Camden, N. J., has been incorporated with a capital stock of $[illegible] by W. M. Rapp, I. Wagman, R. F. Rapp and L. W. Meyers. The company proposes to do a general mechanical and electrical engineering business, and also founders and machinists.

THE ROCKWELL FURNACE COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $300,000 for the purpose of dealing in furnaces and oil, gas and electric appliances, etc. The incorporators are William F. Baxter, Walter Ackerman and L. D. Rockwell, of New York, N. Y.

UNITED STATES ARC LAMP COMPANY, of New York, N. Y., has been incorporated by F. Martin, H. P. Jones and E. J. Fordan, of 154 Nassau Street, New York, N. Y. The company is capitalized at $5,000 and proposes to manufacture and deal in [illegible] devices.

New Incorporations.

WALDENBURG, ARK.—Articles of incorporation have been filed for the Rice Belt Telephone Company by C. E. and A. M. Lashback and W. [illegible]. Burns. The company is capitalized at $25,000.

PALISADES, COL.—The Mutual Light, Power & Telephone Company has been chartered with a capital stock of $[illegible] by H. L. Davis, I. R. Haugh and H. H. Younger.

WILMINGTON, DEL.—Articles of incorporation have been filed for the American Light, Heat & Power Company with a capital stock of $5,000,000 by Warren N. Akers, William J. Maloney and Mildred G. Naylor, all of Wilmington, Del.

TARPON SPRINGS, FLA.—The Polar Ice & Light Company has been chartered with a capital stock of $35,000. The officers of the company are: G. A. Louden, president and treasurer, and Ernest R. Meres, vice president and secretary.

BOISE, IDAHO.—The Raymond Telephone Company of B[illegible] Lake County has been incorporated with a capital stock of $10,000 by Thomas M. Mumford, George H. Hall and others.

OROFINO, IDAHO.—The Orofino Electric Company has been incorporated with a capital stock of $25,000 to build and operate electric power plants, etc. The incorporators are: K. G. Osterhout, T. Lister and J. H. Lister.

GRAND TOWER, ILL.—The Preston Union Telephone Company has been incorporated with a capital stock of $1,350 by J. T. Evans, Adam Lyrley and T. L. Aldridge.

GOSPORT, IND.—The Gosport Electric Company has filed articles of incorporation with the Secretary of State. The company is capitalized at $10,000, and proposes to construct an electric plant and supply electricity for lamps and motors in Gosport and adjacent towns and cities. The incorporators are: Carl Keiffer, Charles Abrahams, Richard Howard and William J. Shroder, all of Cincinnati, Ohio.

WABASH, IND.—The Citizens' Telephone Company has been granted a charter with a capital stock of $25,000 to construct and operate telephone systems in Wabash and adjacent counties. The directors are: William F. Clupper, Frank Tobias, Eldo Cappoch and Cary Bowman.

ALBIA, IA.—The Albia Telephone Company has been incorporated with a capital stock of $10,000 by H. H. Sheriff, G. W. Gordon and J. S. Appleman.

FLUSH, KAN.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $10,000 by Henry Noll, Edward Unscheid, Henry J. Floersch and others.

PRYORSBURG, KY.—The Pryorsburg Telephone Company has been chartered with a capital stock of $1,000 by Dr. M. W. Rossell, W. T. Rossell and Noblin Rossell.

PORTLAND, MAINE.—The New Hampshire Water & Electric Power Company has been chartered with a capital stock of $200,000 by John H. Pierce, John H. Ridge and Charles E. Gurney, all of Portland, Maine.

ALLENDALE, MICH.—The Allendale Telephone Company has been chartered with a capital stock of $4,000 by T. E. Hubbell, John J. Walbrink and J. Albert Hinken, of Allendale, Mich.

CALDERWOOD, MICH.—The Front Creek & Calderwood Telephone Company has been incorporated by Louis Anderson, of Calderwood, Mich., and George and Rosa L. Hardes, of Front Creek, Mich. The company is capitalized at $10,000, and proposes to operate a telephone and messenger service.

DUNDEE, MICH.—Articles of incorporation have been filed for the Farmers' Telephone Company with a capital stock of $10,000.

SANDSTONE, MINN.—The Clover Belt Telephone Company has been incorporated with a capital stock of $50,000 by J. H. Ingraham, Hugo Wickber, M. Bullis and others.

BILLINGS, MONT.—Articles of incorporation have been filed for the Billings Traction Company with a capital stock of $100,000 by C. J. Eddy, J. W. Patterson and J. A. Connolly, all of Muskogee, Okla.

KALISPELL, MONT.—The Pine Grove & Grand View Telephone Association has been incorporated with a capital stock of $5,000 by Fred Blair, E. D. Hopper and others. The company proposes to construct and operate a telephone line from Kalispell to Pine Grove.

COXSACKIE, N. Y.—The Coxsackie Flats Telephone Company has been chartered with a capital stock of $3,000 and the following directors: Michael Dolan, Herrick Sutfin, Fred Hallenbeck, George Van Schaack, Frank Jansen, and others.

FRIENDSHIP, N. C.—The Friendship Telephone Company has filed articles of incorporation with a capital stock of $5,000. Thomas Wakefield and others are the incorporators.

HUNTSBURG, OHIO.—The Huntsburg Telephone Company has been incorporated with a capital stock of $6,000 by G. A. Bartholomew and others.

MERCERVILLE, OHIO.—The Mercerville Union Telephone Company has been incorporated by J. N. M. Davis, E. L. Sheets, S. W. Williams and Samuel Lewis. The company is capitalized at $2,500.

NORWOOD, OHIO.—The People's Telephone Company has been incorporated with a capital stock of $10,000 by Henry Bentley and others.

OSTRANDER, OHIO.—The White Cross Telephone Company has been incorporated with a capital stock of $30,000 by J. W. Harsh and others.

BIG CABIN, OKLA.—Articles of incorporation have been filed for the Big Cabin Telephone Company with a capital stock of $5,000 by J. R. Stevenson, John Gearly and others.

HEWITT, OKLA.—The Darling Telephone Company has been incorporated with a capital stock of $3,000 by W. H. Darling, R. A. Donaldson and W. E. Darling.

JESTER, OKLA.—The Jester Telephone Company has been incorporated with a capital stock of $2,000 by W. F. Corder, A. W. Lock and L. J. McMinn.

DILLSBURG, PA.—A charter has been granted to the Dillsburg Light, Heat & Power Company, with a capital stock of $15,000. The company proposes to supply electricity in Dillsburg. The incorporators are: M. E. Kunkel, of Dillsburg, Pa.; J. J. Logan, of York, Pa., and others.

HARRISBURG, PA.—The Indian Queen Power Company has been incorporated with a capital stock of $5,000; directors are: Chesleigh H.

Briscoe, 187 Columbia Heights, Brooklyn, N. Y.; William P. Bray, of East Bangor, Pa., and Edwin C. Weller, of Portland, Pa.

SCENERY HILL, PA.—The Mariana & Scenery Hill Telephone Company has been chartered with a capital stock of $7,500 by J. W. Shidler, S. G. Fulton and C. Woonsetler, all of Marianna.

DOYLE STATION, TENN.—Articles of incorporation have been filed for the Doyle Telephone Company with a capital stock of $2,500 by R. E. L. Smith, Powell K. Lewis, Alonzo P. Johnson and others.

DALLAS, TEX.—The Dallas Standard Traction Company has been incorporated with a capital stock of $10,000 by E. L. Lancaster, J. B. Martin and R. A. Graves.

McALLEN, TEX.—The McAllen Ice & Light Company has been incorporated with a captial stock of $50,000 by A. L. Strang, C. T. Brown and George Quigstead.

BELLOWS FALLS, VT.—The Southern Vermont Light & Power Company has been incorporated with a capital stock of $50,000 to operate electric light stations. J. P. Meany, of Putney, Vt., is president, and D. Connors, of Bellows Falls, Vt., is treasurer.

REPUBLIC, WASH.—Articles of incorporation have been filed for the Kettle Valley Power & Electric Company with a capital stock of $500,000 by Henry B. Russell and Joseph Mony.

SPOKANE, WASH.—The Washington Consolidated Telephone & Telegraph Company has been incorporated with a capital stock of $1,000,000 by H. H. Reynolds, Fred Howe and others.

SPOKANE, WASH.—The Spokane, Portland & Northern Railway Company has been incorporated with a capital stock of $10,000,000 by E. P. Spalding and others. The company proposes to construct and operate an electric railway from Spokane to Nighthawk, near the international boundary.

MARLINGTON, W. VA.—The Ronceverte & Elkins Telephone & Telegraph Company has been incorporated with a capital stock of $50,000 by Homer N. Hutchinson, H. E. Nease, T. L. Burdette, B. F. Williams and A. M. Kincaid, all of Charleton, W. Va. The company proposes to erect and operate telephone and telegraph lines in Pocahontas County.

SHAWANO, WIS.—The Shawano Telephone Company has been chartered with a capital stock of $5,000 by E. A. Krueger, J. J. Steiger, John B. Gordon and King Weeman.

WINNIPEG, MAN., CAN.—The Manitoba Power Company has filed articles of incorporation with a capital stock of $5,000,000 for the purpose of generating and transmitting electricity for lamps and motors. The incorporators are: H. A. Lovett, of Montreal, Que., and others.

TORONTO, ONT., CAN.—The Interurban Telephone Company has been incorporated with a capital stock of $200,000 by J. S. Lovell, W. Bain, R. Cowans, H. Chambers and S. N. Mehr.

Personal.

MR. R. E. RICHARDSON, formerly manager of the Kansas City Electric Company, has been appointed general manager of the Commonwealth Power Company, Jackson, Mich.

MR. W. A. TORREY has resigned as manager of the Eddyville (Ia.) municipal electric light plant to become manager of the plant of the Avoca Electric Light & Power Company at Avoca, Ia.

MR. M. EKSTROMER presented a paper entitled "The Theory of the Storage Battery" before the commercial branch of the Denver Company Section of the National Electric Light Association at a recent meeting.

PROF. W. L. UPSON, formerly of the electrical engineering department of the Ohio State University, has been appointed professor of electrical engineering at the University of Vermont, Burlington, Vt.

MR. A. BEMENT, consulting engineer, Chicago, addressed the students and faculty of the College of Engineering of the University of Illinois at Urbana, Ill., on Oct. 22. His subject was "The Practical Uses of Coal Analysis."

MR. CHARLES K. MOHLER, consulting engineer, has opened an office at 1839 McCormick Building, Michigan Avenue and Van Buren Street, Chicago. Mr. Mohler is engineer for the Loop Protective and Improvement Association.

Mr. CHARLES C. BADEAU, electrical engineer of the Condit Electrical Manufacturing Company, of Boston, was a recent visitor in Chicago, addressing the members of the Electric Club of that city briefly at the weekly luncheon of Oct. 16.

MR. T. J. BALLARD, formerly of the electrical engineering staff of the municipal central station at Sheffield, England, has accepted a position with the Hydro-Electric Power Commission of Ontario, with headquarters at the City Hall, Toronto.

MR. V. C. GILPIN has been appointed general sales manager of the Eastern Flexible Conduit Company, 41-59 Gardner Avenue, Brooklyn, manufacturer of the non-metallic flexible conduit "Brook-Duct." Mr. Gilpin has also been appointed master of transportation of the National Electrical Contractors' Association.

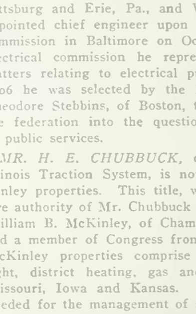
MR. A. BOISSONNAS, of Geneva, head of a large group of electric power plants in Switzerland, recently passed through San Francisco. He is making a tour of the United States, studying our methods of producing and transmitting electric energy, and was accompanied on his Western trip by Mr. E. B. Tracy, of the banking firm of W. P. Bonbright, of New [illegible]

MR. ALFRED CRAVEN, formerly deputy engineer of subway construction, has been appointed engineer in charge of subway construction by the New York Public Service Commission, to succeed Mr. George S. Rice. Mr. Craven is sixty-four years old, and was graduated from the United States Naval Academy in 1867. He has been engaged in engineering work since 1873, when he resigned from the navy. Up to 1884 he was a civil and mining engineer in California, but since 1884 he has been in New York, first with the Aqueduct Commission and since 1900 with the old Rapid Transit Commission and the Public Service Commission.

MR. CHARLES E. PHELPS, JR., who has become chief engineer of the Public Service Commission of Maryland, was chief engineer of the Electrical Commission of Baltimore from 1898 until 1910. Mr. Phelps was born on Jan. 31, 1871, in Baltimore and completed a course in electrical and mechanical engineering at the Johns Hopkins University in 1894. He served as superintendent of electrical construction for the David E. Evans Company from 1894 to 1898. After some private contract work in Pittsburg and Erie, Pa., and Wilmington, Del., for two years, he was appointed chief engineer upon the organization of the present electrical commission in Baltimore on Oct. 1, 1898. While chief engineer of the electrical commission he represented a number of cities in technical matters relating to electrical public service corporations principally. In 1906 he was selected by the National Civic Federation, together with Theodore Stebbins, of Boston, to conduct the investigation carried on by the federation into the question of municipal ownership and operation of public services.

MR. H. E. CHUBBUCK, of Peoria, Ill., general manager of the Illinois Traction System, is now vice-president executive of all the McKinley properties. This title, which is unusual, indicates the administrative authority of Mr. Chubbuck and the confidence reposed in him by Hon. William B. McKinley, of Champaign, Ill., who is president of the system and a member of Congress from the Nineteenth District of Illinois. The McKinley properties comprise street and interurban railways, electric light, district heating, gas and power transmission plants in Illinois, Missouri, Iowa and Kansas. A strong, well-poised, broad-gage man is needed for the management of such a system, and Mr. Chubbuck fills the requirements. He may be said to be an electrical man by inheritance, for his grandfather, S. W. Chubbuck, of Utica, N. Y., was a pioneer electrical inventor and lecturer, and his father, A. S. Chubbuck, established at Utica what is said to have been the first factory for the manufacture of telegraph instruments in the world. Mr. H. E. Chubbuck has been engaged in electrical pursuits all his life and has been twelve years with Mr. McKinley.

MR. JOHN S. BLEECKER, recently elected president of the Georgia National Electric Light Association Section, was born in Washington, D. C., April 8, 1878. He is the son of Rear-Admiral J. V. B. Bleecker, United States Navy, retired. After studying at the English High School, Boston, Mass., Mr. Bleecker graduated in the class of [illegible] and entered the Massachusetts Institute of Technology, from which he graduated in the class of [illegible]. He was employed in the mechanical department of the American Bell Telephone Company at Boston [illegible] graduation, and until [illegible] entered the service of the Stone & Webster Engineering Corporation, with which he has since remained. In the interest of this large holding system he has filled various [illegible] Boston, Mass.; Seattle, Wash.; Houghton, Mich.; Blue Hill, Mass.; Paducah, Ky., and Columbus, Ga., the duties covering the [illegible] of lineman, motorman, inspector, clerk, superintendent and manager. At the present time he is manager of the Columbus Railroad Company, Columbus, Ga., one of the large public utilities of the South, operating the electric railway system as well as a central-station plant. Mr. Bleecker married Miss Parks, of Nashville, Tenn., and has two children. He is a member of the St. Anthony Club of Boston and the Muskogee Club of Columbus and is extremely popular in the South, with whose interests he has thoroughly identified himself. He has taken a very active share in the work of the National Electric Light Association, has strongly advocated the formation of a State section for Georgia, and when steps were taken to [illegible] he was the natural selection for president. Mr. Bleecker is a man of striking presence, standing 6 ft. 4 in. and weighing 210 lb., and is as well a good public speaker.



JOHN S. BLEECKER.

Obituary.

BRIG. GEN. DAVID PORTER HEAP, U. S. A., retired, who was United States representative to the Paris Congress of Electricians in 1881, died at his home in Pasadena, Cal., on Oct. 25, in the sixty-seventh year of his age. General Heap graduated from the United States Military Academy in 1860 and was appointed first lieutenant of engineers. He was promoted rapidly, reaching the rank of colonel in 1903 and being raised to that of brigadier general in the latter part of the same year. Throughout

his military career he was [illegible] the service. During the Civil War [illegible] fortifications, and later, when he was chief of the Pacific division of engineering, he was identified with the lighthouse improvements. Among the books he wrote are "Ancient and Modern Lighthouses," "Electrical Appliances of the Present Day," "History of the Application of Electricity to Lighting the Coasts of France" and the report of the International Exhibition of Electricity in Paris. General Heap was twice married. He married Miss Elizabeth Brown Beal in 1875. She died in 1889, and three years later he married Miss Josephine Bigelow Wright, who survives him.

Trade Publications.

CENTRIFUGAL AIR COMPRESSORS.—The General Electric Company has superseded its old bulletin on "Centrifugal Air Compressors for Industrial Air Blast and Exhauster Service" by Bulletin No. 4774.

THOMSON HIGH TORQUE INDUCTION TEST METER.—The General Electric Company has recently issued Bulletin No. 4773, entitled "Thomson High Torque Induction Test Meter, Type IB-4." This bulletin supersedes the previous bulletin on this subject.

CONNECTORS.—Dossert & Company, 242 West Forty-first Street, New York, have issued an eight-page folder which illustrates and describes a number of new specialties, particularly a new type of anchor connector for use with strain insulators and a new insulated cover for cable taps.

ISOLATED PLANT COMBINATION GENERATOR AND FEEDER PANELS.—Bulletin No. 4763, entitled "Isolated Plant—Direct-Current Combination Generator and Feeder Panels," recently issued by the General Electric Company, supersedes the previous bulletin issued by this company on that subject.

POLYPHASE MAXIMUM WATT-DEMAND INDICATOR.—Bulletin No. 4768B of the General Electric Company has for a subject Type W polyphase maximum watt-demand indicators, which are particularly applicable to motor installations where it is necessary to record the maximum load irrespective of power-factor and voltage fluctuations.

TANTALUM INCANDESCENT LAMPS.—The General Electric Company has recently issued a bulletin (No. 4766) describing the GE tantalum incandescent lamp for general illumination. It illustrates and describes lamps for 100 volts to 125 volts and 200 volts to 250 volts, compares the cost and efficiency of these lamps with those of the carbon and Gem lamps, and contains data of use to those interested in the subject.

TRAIN LIGHTING WITH METALLIC FILAMENT LAMPS.—Bulletin No. 4769, entitled "Train Lighting with G-E Mazda and Tantalum Lamps," should be of interest to all connected with this branch of transportation. Owing to the high efficiency of these lamps they are admirably adapted to this service, while the strong filament of the tantalum and the flexible mount of the tungsten filament render them capable of withstanding the sudden jars and shocks incident to railway service.

ESTERLINE METERS.—The Esterline Company, Lafayette, Ind., has issued a [illegible] page catalog describing and illustrating in full detail the various types of graphic meters of its manufacture, which cover practically the entire field of electrical industry. The instruments are made in four types, namely, switchboard, wall, desk and portable, and include voltmeters, ammeters, watt-hour meters, speed-recorders and [illegible] meters.

MODERN STREET LIGHTING.—"Modern Street Lighting by Luminous Arc Lamps" is the title of an attractive booklet (B-3014) just issued by the General Electric Company, which is devoted to the subject of street lighting by the General Electric series luminous-arc rectifier system. The vertical carbon flame arc lamp is illustrated and briefly described. The station equipment required for this system is mentioned, and a list of cities in which the system has been installed is given.

ELECTRIC VEHICLES.—The Ohio Electric Car Company, Toledo, [illegible] manufacturer of high-grade electric automobiles, has issued a handsome new catalog describing and illustrating its distinctive line of electric vehicles. Features of these machines are the motor control [illegible] mounted on the steering handle. The chassis embodies the gasoline-car standard of construction as to strength and weight. The car utilizes a shaft drive without universal joint.

SINGLE-PHASE INDUCTION MOTORS.—Bulletin No. 4775, issued by the General Electric Company, entitled "Type KS Single-Phase Induction Motors," describes a motor offered by the General Electric Company to meet the power requirements of establishments which, for some reason, are unable to secure other than single-phase current. This motor is, in [illegible], adapted to drive geared and belted machinery requiring constant [illegible] with light or moderate starting torque. It is made in capacities of [illegible] hp to 15 hp, and wound for 110 volts or 220 volts, 60 cycles.

BELT-DRIVEN GENERATORS.—The Westinghouse Electric & Manufacturing Company has just issued a circular (No. 1161) on the subject [illegible] are especially designed to meet the needs of industrial plants and [illegible] central stations and have proved very successful in this class of [illegible]. Simplicity of electrical and mechanical construction and economy in operation and maintenance are stated to be the proved characteristics [illegible].

SWITCHBOARD INDICATING METERS.—The Westinghouse Electric & Manufacturing Company has just issued a circular No. [illegible] on the subject of switchboard indicating meters in which are described and illustrated direct-current and alternating-current indicating meters, including frequency meters and power-factor meters, synchroscopes and instrument transformers. It is pointed out in the circular that with the development of switchboard design has come the necessity for various types and forms of indicating meters, each adapted to its own peculiar purpose. Meters amply accurate for one class of service might prove entirely unsuited for another service, while high-grade meters are in general too expensive for use where accuracy is not of prime importance. With the introduction of meter or control boards forming units separate from the switching apparatus and busbars, a need has arisen for meters with long scales and long-distance readability. The organization of large power developments has necessitated the introduction of the edgewise type of meter, which occupies small space and yet retains the long scale necessary for accurate legibility. For these uses meters of high accuracy are essential. On the other hand, for small power plants, battery-charging plants and similar installations a cheaper instrument will serve the purpose admirably.

WAVERLEY ELECTRICS.—The 1911 catalog of the Waverley Company, Indianapolis, is fully up to the high standard of automobile trade publications, which in design and execution stand easily at the head of this class of literature. The catalogue is 9 x 14 in. in size, printed on heavy enamel paper, and bound in imported hand-made cover stock of a rich mottled brown. On the second cover page is mounted a photogravure representing a Waverley open carriage driven by a little girl of four in a park, the brown tones of the photogravure on Japanese vellum harmonizing well with the cover stock. The illustrations include thirteen full-page half-tones, representing Waverley 1910 models, with backgrounds illustrating prominent buildings and park scenes in the leading American cities. These backgrounds have been ruled down by a new process of halftone work in such a manner that the cars stand out with unusual prominence and give the effect of two separate printings in gray and black. Expert printers and engravers may well be deceived by these plates, as it is remarkable that the effect can be obtained in one impression. In addition to these thirteen pages there are a high-light half-tone on page 19, a ghost picture on page 21, and a two-toned half-tone on page 22, each of which is a successful handling of a difficult problem. The composition and press work are as praiseworthy as the illustrations, while the initials and printer's ornaments, though sparingly used, add much to the artistic effect of the whole.

BUSINESS NOTES.

THE EDISON STORAGE BATTERY COMPANY and the Federal Storage Battery Car Company have opened a joint office at 193 Michigan Avenue (McCormick Building), Chicago. Messrs. W. W. Wheatly and Lucian Wheatly are in charge.

MR. W. P. CARSTARPHEN, JR., of Denver, has developed and is now marketing a very complete line of panel boards and cabinets which has met with a large use in adjacent territory because of quick delivery and ready adaptation to any desired uses.

THE TOLEDO CARBURETOR COMPANY, of Toledo, Ohio, has recently increased its capital stock from $1,000 to $75,000, and proposes to handle a new carburetor invented by a Cleveland man and manufactured by the Kinsey Manufacturing Company, of Toledo. Isaac Kinsey, of the Kinsey Manufacturing Company; W. G. Nagel, of the W. G. Nagel Electric Company, and Frank Collins, of the National Supply Company, are interested in the company.

THE DI-EL-ITE MANUFACTURING COMPANY, of Philadelphia, makers of rheostats, insulating joints, "dimalites," etc., has changed its name to the Wirt Electric Specialty Company. No change in the management will be made and no change in the business or policy of the company, except in the direction of increased facilities. Large premises have been secured at Armat and Lena Streets, where the company has four times its former floor space, and equipment to do four times the former business.

MR. ADOLPHUS BUSCH, purchaser of the American Diesel Engine Company, St. Louis, Mo., has been making inquiries relative to the efficiencies shown by the Diesel engine in electric central stations and other plants. Figures as low as 4 mills per kw-hour at the switchboard have been reported. The Prairie Pebble Phosphate Company, Mulberry, Fla., reports that it has been operating seven 300-kw, 2300-volt, 60-cycle alternators driven by Diesel engines in parallel for over two years. An eighth engine was ordered and the company is now negotiating for a ninth engine of the same kind. Among central stations using the Diesel engine are the following: Sherman Gas & Electric Company, Sherman, Tex.; South Norwalk Electric Works, South Norwalk, Conn.; Board of Public Service, Bellefontaine, Ohio; Atlantic Light & Power Company, Coeymans, N. Y.; Effingham Electric Light & Power Company, Effingham, Ill.; Morgan City Electric Company, Morgan City, La. As is probably well known the Diesel engine uses crude or fuel oil and the maker guarantees a fuel consumption not to exceed 8 gal. when running at any load between half-load and rated capacity for each 100 net effective hp-hours. Very close regulation has been shown by plants in operation. A feature of the engine is that the fuel is not used explosively, which eliminates igniters. At present Diesel engines are built in sizes ranging up to 225 hp in the three-cylinder type, and up to 450 brake hp in the six-cylinder type.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

[illegible] 11 N. Royal St., Mobile, Ala. Third annual convention, Anniston, Ala., [illegible]

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, Engineering Societies Building, 29 West 39th St., New Y[illegible]

[illegible] Lehigh University, South Bethlehem, Pa. Next semi-annual meeting, New York City, April or May, 1911.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

[illegible] Secretary, H. E. Weeks, Davenport, Ia.

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, Little Rock, Ark.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John Farrington, Steubenville, O.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago. Next meeting, Boston, Mass., June 1911.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago. Next annual meeting, Chicago, November, 1911. Semi-annual meeting, Washington, 1911.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allen H. Royce, 48 King St., W., Toronto, Ont.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Indianapolis, Ind. Next meeting, Dayton, Ohio, Dec. 1, 1910.

CHICAGO ELECTRICAL SHOW. Manager, H. E. Niesz, 150 Michigan Boulevard, Chicago. Next show, Jan. 7-21, 1911.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Acting Secretary, F. D. Morris, 323 Hagerman Bldg., Colorado Springs, Col.

EASTERN STATES INDEPENDENT TELEPHONE ASSOCIATION OF PENNSYLVANIA, NEW JERSEY, MARYLAND AND DELAWARE. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West Forty-second Street, New York.

ELECTRIC CLUB, Chicago. Secretary, F. S. Hickok, 824 Marquette Building, Chicago. Meets every Wednesday noon, 303 Wabasah Ave.

ELECTRIC CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Next meeting, Albany, N. Y., [illegible]

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

ENGINEERING SOCIETY OF WISCONSIN. Secretary, W. G. Kirchoffer, 31 Vroman Building, Madison, Wis.

[illegible]

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., April [illegible]

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago. Annual convention, Chicago, 1911.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntington, Ind.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Next meeting, St. Paul, Minn., 1911.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia. Next meeting, Davenport, Ia., April 19, 20 and 21, 1911.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill 208 Des Moines Life Building, Des Moines, Ia. Annual meeting, second Wednesday in March each year.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., Sept [illegible] 1911.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

MAINE ELECTRICAL ASSOCIATION. Secretary, Fred D. Gordon, Auburn Maine.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. P. Biggs, Detroit Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, B. W. Cowperthwait Faribault, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Railway & Light Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION, Secretary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W Schweer, Windsor, Mo. Next meeting, St. Louis, May, 1911.

NATIONAL ARM, PIT & BRACKET ASSOCIATION. Secretary, J. B. Magers Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC CONTRACTORS' ASSOCIATION OF THE UNITED STATES Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day 27 Pliny St., Hartford, Conn. Next meeting, New York, March, 1911.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Fred P. Vose 1343 Marquette Building, Chicago.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, [illegible] Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton [illegible] Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday [illegible] each month.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, L. D. Gibbs, 39 Boylston St., Boston, Mass.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, [illegible] Marks, 312 Carondelet St., New Orleans, La. Meetings, second a[illegible] fourth Tuesdays of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engin[illegible] Societies Building, 33 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, [illegible] Brockett, Cataract Building, Seattle, Wash.

[illegible] ville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL [illegible] ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Next meeting, Nov. 18 and 19, [illegible].

OKLAHOMA PUBLIC UTILITIES ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next reunion, Atlantic City, N. J., 1911.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Building, Chicago, Ill.

PACIFIC COAST ELECTRIC VEHICLE ASSOCIATION. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY, Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

PITTSBURG ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburg, Pa. Meetings, fourth Monday of each month.

RAILWAY ELECTRIC SUPPLY MANUFACTURERS' ASSOCIATION. President, A. C. Moore, Safety Car Heating & Lighting Co., Chicago.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D. Next meeting, Redfield, S. D., Jan. 11 and 12, 1911.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1911.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Lena M. Owen, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester Center, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRICAL ASSOCIATION. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association. Secretary, John S. Allen, Lake Geneva, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 25, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

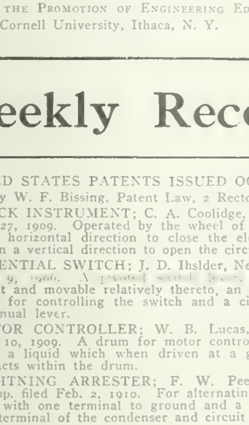
973,478. TRACK INSTRUMENT; C. A. Coolidge, Portland, Ore. App. filed Dec. 27, 1909. Operated by the wheel of the train to throw a lever in a horizontal direction to close the electrical signal circuit and then in a vertical direction to open the circuit.

973,508. POTENTIAL SWITCH; J. D. Ihslder, New York, N. Y. App. filed Apr. 9, 1906. A pivoted switch lever, [illegible] for operating it and movable relatively thereto, an electro-magnetic locking device for controlling the switch and a circuit closer operated by the manual lever.

973,525. MOTOR CONTROLLER; W. B. Lucas, Chicago, Ill. App. filed Mar. 10, 1909. A drum for motor controllers which is hollow to contain a liquid which when driven at a given speed short-circuits contacts within the drum.

973,555. LIGHTNING ARRESTER; F. W. Peck, Jr., Schenectady, N. Y. App. filed Feb. 2, 1910. For alternating circuits including a condenser with one terminal to ground and a rectifier connected to the other terminal of the condenser and circuit to be protected.

973,557. INSULATING MATERIAL; Charles F. Peterson, Schenectady, N. Y. App. filed June 2, 1907. Builds up fragments of mica and heats to expel air, [illegible] of kaolin and silicate of soda and then fires at a red heat.



973,557. [illegible]

973,560. TERMINAL FOR ELECTRICAL APPARATUS; W. B. Potter, Schenectady, N. Y. App. filed Sept. 7, 1907. An air-tight casing containing a tapering tube and a conducting member passing through the tube and having a resilient tapered portion.

973,565. MEANS FOR VENTILATING DYNAMO ELECTRIC MACHINES; Henry G. Reist, Schenectady, N. Y. App. filed Oct. 26, 1906. A machine with stator and rotor and a casing closed at one end, the stator having channels through the interior leading from one end of the casing, with means for forcing the air through the channel.

973,567. SIGN RECEPTACLE FASTENING; F. J. Russell, New York, N. Y. App. filed Oct. 9, 1908. A supporting element with a receptacle body having a depression [illegible] fastening device engaging with the depression and with the supporting element and holding the receptacle when the latter is inserted through the support into the fastener.

973,568. SIGN RECEPTACLE FASTENING EYELET; F. J. Russell, Brooklyn, N. Y. App. filed Oct. 26, 1909. A support, a receptacle with a collar and a fastener engaging the collar and in the receiving [illegible] the support.

[illegible] MOTOR CONTROL; W. I. Slichter, Schenectady, N. Y. App. filed June [illegible], 1909. [illegible] motors mechanically connected to drive a common load and connected electrically in a plurality of groups by starting the motors [illegible] impressing reduced voltages on the groups and varying the connections alternately to increase the impressed voltage.

[illegible] VOLTAGE REGULATOR; [illegible], Schenectady, N. Y. App. filed June 9, 1909. For regulating the voltage of a three-phase, Y-wound transformer by regulating one phase independently of the others by adding a [illegible] to be regulated, the former being in quadrature with the voltage of the adjacent phase so as not to affect it.

973,586. ELECTRICAL WELDING OF SHEET METAL; E. Thomson, Swampscott, Mass. App. filed Oct. 21, 1909. Welding by isolated spots by forming tongues in the body of the sheet, bending them onto the surface, superposing the sheets and applying an electric current and pressure.

973,590. ELECTRIC BRAKING; J. F. Tritle, Schenectady, N. Y. App. filed May 2, 1910. An electric motor with a source of current therefor and means for causing it to act as a braking generator for returning the energy to the source by separately exciting the field of the motor and automatically compounding the excitation to compensate for varying speeds.

973,592. SOLDERING IRON; T. Van Aller, Schenectady, N. Y. App. filed July 17, 1908. The point of the iron is electrically heated by means of a resistance conductor formed into a flat heating unit within a slot in the point of the iron.

973,593. ELECTRIC FLAT IRON; T. Van Aller, Schenectady, N. Y. App. filed Feb. 18, 1909. Includes a body with a narrow resistance strip extending flatwise around its outer portion adjacent to the edge and in heat conductive relation therewith, secured thereto by a metallic plate covered with a removable cover.

973,613. CIRCUIT CONTROLLER; W. A. Atwood, Schenectady, N. Y. App. filed Feb. 16, 1909. Disconnecting switches with the two adjacent terminals bridged by a fuse carried on a movable member, or insulating support mounted upon an arm.

973,625. EXHAUSTING MACHINE; W. R. Burrows, Newark, N. J. App. filed May 11, 1906. For incandescent lamps. Two pumps are connected to a valve which communicates with the bulb, the valve being automatically operated to connect the bulb to the pumps in succession and the filament being caused to glow while the bulb is connected to one pump.

973,627. ELECTRICAL ALARM SYSTEM; Frank Castle, Auckland New Zealand. App. filed June 8, 1910. A fire alarm; the building containing a local circuit which communicates with a central station. Two relays are at central, and each inserted with the closed circuit, one relay of greater resistance than the other so that the current of the closed circuit is prevented from flowing through it, this relay closing a local indicator alarm circuit while the armature of the weaker relay closes a separate local indicator circuit for faults.

973,633. LINEMAN'S CHAIR; J. W. Davis, San Antonio, Texas. App. filed Mar. 19, 1910. A plurality of frames carrying a cross sheet to the upper part of which rollers are secured which run on the line wire.

973,644. AEROPHONE; L. DeForest, New York, N. Y. App. filed Nov. 12, 1909. Wireless telephone, including a singing arc circuit for creating oscillation in the aerial with means for varying amplitudes by sound waves acting through a transformer.

973,645. LIGHTNING-ARRESTER; Frank T. Forester, Schenectady, N. Y. App. filed Feb. 10, 1909. Electrolytic lightning arrester consisting of an aluminum cell, the plates being suspended from the cover and secured out of contact with each other without using spaces within the body of the electrolyte.

973,653. ARC LAMP; C. A. B. Halvorson, Jr., Saugus, Mass. App. filed Jan. 28, 1909. An arc lamp with weldable electrodes which are forcibly struck together and then separated, the arcing face of one electrode being tilted by the blow.

973,657. HIGH POTENTIAL SWITCH; E. M. Hewlett and T. E. Button, Schenectady, N. Y. App. filed Jan. 7, 1902. A driving motor for the switch which strains a spring for throwing the switch and a clutch for connecting the motor, and operating means which are disconnected when the springs are put under compression.

973,672. CURRENT COLLECTOR FOR ELECTRICALLY PROPELLED VEHICLES; W. Kohler, Bremen, Germany. App. filed March 17, 1910. A traveling current collector carrying a connecting cable forming a loop mounted in arms pulled together by a spring.

973,676. ANNUNCIATOR; A. Lungen, New York, N. Y. App. filed Nov. 20, 1909. A sheet metal keeper carries the magnet, armature and shutter, portions of the keeper being struck up to limit the movement of the shutter and armature.

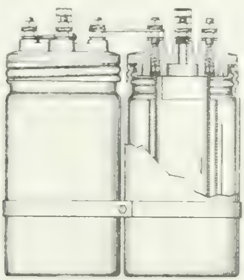
973,685. ARTIFICIAL SKYLIGHT; D. McF. Moore, Newark, N. J. App. filed Oct. 27, 1903. An electric tube lamp for photographers' use with conducting caps for terminals, the tubing being doubled back and forth and multiple tubes arranged in the spaces.

973,703. INCANDESCENT ELECTRIC LAMP; T. E. Robertson, Catford, England. App. filed Nov. 2, 1908. The filament loops are supported intermediate to their ends by extensible elastic anchors capable of transverse movement to compensate for thermal changes.

973,732. PROCESS OF REDUCTION OF ORES CONTAINING SULPHUR AND IRON; Arnold Wiens, Bitterfeld, Germany. App. filed Feb. 27, 1909. Method of reducing ores containing iron and sulphur by smelting the ore in the presence of silica and carbon by an electric current, the silica eliminating the sulphur.

973,736. PRODUCTION OF LIGHTING EFFECTS ON STAGES BY MEANS OF HIGH-TENSION CURRENTS OF HIGH FREQUENCY; Camilla Feher Zhaniel, Charlottenburg, Germany. App. filed July 7, 1909. Impregnates theatrical garments with powdered conducting material and then introduces these articles into high-tension currents or fields.

973,737. DEVICE FOR CONTROLLING THE CONSECUTIVE OPERATION OF ELECTROMAGNETS; F. G. Agrell, Stockholm, Sweden. App. filed Feb. 27, 1907. For consecutively operating electromagnets or relays by means of a series of releasable members which perform a mechanical operation and a series of co-operating members with means for moving a number of the releasing members.



973,645.—Electrolytic Lighting Arrester.

973,747. PULL SOCKET; T. H. Brady, New Britain, Conn. App. filed March 18, 1909. An insulating block, a rotatable spindle, an oscillating driving memb..., ... member held against the driving member and resilient contacts ... driven member.

973,762. SELECTOR SWITCH; E. B. Craft, Chicago, Ill. App. filed Nov. 23, 1907. For automatic telephone exchanges, including a rotating shaft with a series of contact brushes, a disk armature carried by the shaft, an electromagnet with an annular core concentric with the shaft to attract the armature.

973,772. VESSEL LOADING ALARM; J. Gedeon, Cleveland, O. App. filed June 30, 1909. Indicates when the draft of the vessel reaches the desired depth by means of a vertical tube which can be adjusted in a standpipe located within the hull of the vessel, in ac... the ...

973,776. PROCESS OF EXTRACTING METALS FROM THEIR ORES; W. E. Greenawalt, Denver, Colo. App. filed May 25, 1909. Treats copper ore with an acid chlorid solution, electrolyses, subdivides and then brings the liberated chlorium in contact with the solution in the presence of sulphur dioxide and returns the regenerated acid solution to the ore and repeats the cycle.

973,898. SIGNALING SYSTEM; E. Parsons, Chicago, Ill. App. filed Aug. 20, 1908. A plurality of signal receiving and sending stations on the same line with means for selectively calling any station. Details.

973,817. SIGN RECEPTACLE FASTENING EYELET; F. J. Russell, Brooklyn, N. Y. App. filed Oct. 26, 1909. A body with a front shoulder, an intermediate shoulder, a supporting element with an integral eyelet receiving the receptacle body and engaging between the two shoulders.

973,826. ELECTRICAL OSCILLATOR; F. K. Vreeland, Montclair, N. J. App. filed Dec. 15, 1906. An oscillating circuit, a vacuum tube and means for producing an axial magnetic field for directing and concentrating the cathode blast, so as to vary conductivity of the gas.

973,836. BRUSH FOR DYNAMO ELECTRIC MACHINES; H. L. Zabriskie, Brooklyn, N. Y. App. filed Aug. 19, 1908. A carbon brush block with a recess containing a metallic conductor through to a plate or cap and a non-conducting block upon the brush block and secured thereto by the metallic cap plate.

973,838. COIL FOR ELECTROMAGNETS; C. Aalborg, Wilkinsburg, Pa. App. filed June 4, 1906. A magnet coil including a tubular member with cross webbs through the center and lateral slots across the sides connected by the web and diagonal slots across the ends.

973,878. ELECTRIC MOTOR; E. S. Pillsbury, St. Louis, Mo. App. filed May 14, 1910. A laminated field pole, the thickness of the individual laminæ being different on two sides thereof for single-phase motors, so arranged as to exert a starting torque upon the armature.

973,883. PRODUCTION OF INCANDESCENT ELECTRIC LAMP FILAMENTS; Waldemar Ruhling, Berlin, Germany. App. filed No... ... antimony for low-cu...

973,885. CURRENT CONTROLLER; F. L. SESSIONS, Columbus, O. App. filed Jan. 7, 1904. Current switch and resistance controller with oppositely wound blow-out magnets with their coils in parallel with the resistance.

973,889. ELECTRICAL CIRCUIT BREAKER; H. R. Stuart, Wilkinsburg, Pa. App. filed Feb. 6, 1906. A movable switch arm operated by toggle levers with means co-operating directly with one of the toggle levers to retain the circuit breaker in closed position and a loosely mounted lever having an arm for directly engaging the joint between the toggle levers to close the lever and for engaging the retaining means to grip the breaker.

973,898. BINDING POST; A. F. Wallbillich, Bridgeport, Conn. App. filed June 22, 1910. Switch contact and binding post with vertical frame and offset blade, the frame receiving the binding screw and supporting legs forming a wire channel with the frame for receiving the binding screw.

973,913. FLASH-LIGHT SIGNALING APPARATUS; G. H. Butterworth and E. Veevers, Liverpool, England. App. filed Feb. 19, 1909. A lamp and a screen intermittently flashed by means of an electromagnet or solenoid located above the lamp which drops the tubular screen over the lamp and removes it intermittently.

973,924. CIRCUIT BREAKER; J. C. Dow, Wilkinsburg, Pa. App. filed July 13, 1907. An improved release mechanism for a double-pole manual circuit breaker tripped by an electromagnet, operating through a bell crank.

973,926. ELECTRIC BRAKE; R. R. DUNLOP, Columbus, O. App. filed Jan. 17, 1905. Electromagnetically operated brake for conveyors, including a shunt-wound dynamo operating as a motor or generator with a brake for controlling its speed controlled by an electromagnet.

973,938. CIRCUIT INTERRUPTER; F. W. Harris, Wilkinsburg, Pa. App. filed Dec. 14, 1908. Switchboard on which a two-pole circuit breaker is operated through bell crank and solenoid magnet and released by a latch operated by a solenoid trip magnet.

973,951. ELECTROPLATING PROCESS; Francis J. McElhone, Jersey City, N. J. App. filed June 9, 1906. For electrotypes by treating the graphite covering for type mould with an organic acid and electroplating thereafter.

973,971. GAS LIGHTING APPARATUS; M. Primeau and G. McCullagh, Winnipeg, Manitoba, Canada. App. filed Dec. 6, 1909. Portable igniter with battery in the handle and a movable contact controlled by the finger.

973,982. PULL SOCKET; R. A. Schoenberg, New York, N. Y. App. filed Apr. 27, 1910. Binding posts with separate centers and side contacts and fixed spring contacts, and a chain rail carrier having a spring contacting with and co-operating with the chain.

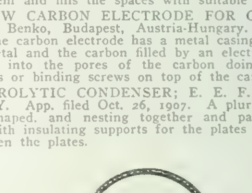
973,984. MAGNETIC ORE SEPARATOR; C. A. Sellon, Halleck, Cal. App. filed Nov. 16, 1909. For magnetically separating gold, etc. from sands by means of a sluice box, a magnetic plate being arranged in the bottom of the trough with magnets on the plate.

973,997. METHOD OF OPERATING VAPOR ELECTRIC DEVICES; P. H. Thomas, Montclair, N. J. App. filed Jan. 27, 1905. Single phase alternating vapor lamp with two negative electrodes and two positive electrodes, the positive electrodes being supplied with alternating current sufficiently strong to operate through either negative electrodes and the negative electrodes having applied to them an alternating e.m.f. to break down the negative electrode reluctance and cause separation of the negative electrode.

974,008. ELECTRODE; R. H. Wolff, New York, N. Y. App. filed Jan. 14, 1910. Forms several parts of a carbon electrode for electro-metallurgy so that one part can be inserted into another to be retained therein and fills the spaces with suitable material.

974,016. HOLLOW CARBON ELECTRODE FOR GALVANIC ELEMENTS; S. Benko, Budapest, Austria-Hungary. App. filed Jan. 19, 1909. The carbon electrode has a metal casing with a space between the metal and the carbon filled by an electrolyte under pressure to pass into the pores of the carbon doing away with the metal contacts or binding screws on top of the carbon.

974,029. ELECTROLYTIC CONDENSER; E. E. F. Creighton, Schenectady, N. Y. App. filed Oct. 26, 1907. A plurality of aluminum plates, disk-shaped, and nesting together and partially filled with electroltye, with insulating supports for the plates and an insulating washer between the plates.



973,836.—Brush for Dynamo Electric Machines.

974,037. MERCURY VAPOR LAMP; L. E. Dempster, Schenectady, N. Y. App. filed March 27, 1905. Mercury electrode, a plunger floating in the mercury, a body of conducting liquid carried by the plunger and insulated from the mercury, a filament in the liquid and electromagnet for moving the mercury to establish momentary con...

974,047. LIFTING MAGNET; C. E. Frederickson, San Francisco, Cal. App. filed June 11, 1910. Three-pole solenoid magnet in a copper water-tight case, held in a saddle or cage so that it may be dropped into the well to lift drill rods and tools.

974,063. SYSTEM OF ELECTRICAL DISTRIBUTION; A. S. Hubbard, Greenwich, Conn. App. filed Feb. 20, 1902. For overcoming insensitivity of the regulating dynamo used with storage batteries plants by means of an induction device responsive to electrical fluctuations on the distribution circuit and causing similar fluctuations in the battery.

974,103. SIGNALING APPARATUS FOR AIRSHIPS AND THE LIKE; P. Lentz, Gross-Lichterfelde, near Berlin, Germany. App. filed Apr. 5, 1910. Gives a bell signal electrically by means of rotating vane wheel driven by the air as the airship rises or falls, thus informing the pilot whether his airship is rising or falling.

974,106. ELECTRICAL SWITCH; A. F. Furbush, Cliftondale, Mass. App. filed July 7, 19... ... machines and the like. A plate carries a fuse for overloads inserted into clips and a spring-pressed circuit breaker tensioned by the ... breaks the circuit when it desired to stop the motor.

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INCREASING EXPORTS.

The increase in electrical exports noted for the whole of last year, and continued into the present fiscal year, is sustained in the figures for September, of which the general statistics have just been issued by the Department of Commerce and Labor. In both smaller apparatus and heavy machinery the gain is marked. The report of electrical apparatus was not less than $762,152, as compared with $686,049 a year ago; while in heavy electrical machinery the advance was from $480,835 to $578,246. The increase is perhaps not so great as in some previous months, but on the other hand, foreign or international trade as a whole was not brisk; so that it is satisfactory to see the tendency maintained. Canada appears to have been an active purchaser, for her takings of machinery rose from $37,220 to $100,665, and in light apparatus her demands were also larger. Japan also increased in machinery from $89,696 to $129,665. There is not, however, much that calls for special attention in the data, beyond the fact that conditions remain very hopeful and encouraging.

MAGNETIC LEAKAGE IN TRANSFORMERS.

An alternating-current transformer is a wonderfully effective and efficient device, but it has certain defects. One of these defects is a magnetic leakage whereby a portion of the magnetic flux attending the excitation of one winding links only with that winding and escapes being linked completely with the other winding. In a perfect transformer all of the magnetic flux produced by sending current through one winding, say the primary, would pass through the core and would thus link with the secondary winding. In the absence of any magnetically insulating substance such a confinement of magnetic flux to the core is a present impossibility. The result is that every transformer behaves like the combination of a perfect transformer devoid of leakage, plus an external choking coil in the circuit of each winding. The smaller the magnetic leakage the smaller the equivalent auxiliary choking coil in primary and secondary circuits, and the larger the equivalent pure transformer. Another way of expressing the same relations is by the use of a "coupling coefficient," which may be defined as the ratio of the flux linked by one coil with the other to the total flux the coil produces. The coupling coefficient may be as low as 5 per cent in the case of an air-core transformer with large, widely separated turns, as used in wireless telegraphy, and as high as 99 per cent in particular types, sizes and constructions of transformers, especially for laboratory use. In the former case 95 per cent of the flux would be leakage flux, and in the latter only 1 per cent.

An article by Herr W. Rogowski in the *Elektrotechnische Zeitschrift*, an abstract of which appears in the Digest, deals with the measurement, predetermination and geometrical distribution of leakage magnetic flux, or stray field, in transformers. It is shown that in a level transformer, or device with equal numbers of turns in the two windings, the leakage flux is the self-inductance of the device when the two windings are connected in opposition series. Consequently, the leakage

can be found by measuring the self-inductance of the transformer under those conditions. In the case of the ordinary step-up or step-down transformer the measurement is not so simple, but the amp-turns in the primary can be brought into equality with, and opposition to, the amp-turns in the secondary by the aid of certain auxiliary devices, when the self-inductance of the apparatus may be measured as before and the magnetic leakage evaluated.

CONDENSER EFFECTS IN INSULATORS.

Not until relatively recent years has proper attention been paid to the condenser relations in insulating materials. Thickness of insulation and distance between supports by the most direct path over the "leakage surface" seem usually to have been the only factors considered when dealing with the dielectric properties of insulators during the earlier years of the industry. At the present time, however, the condenser effects are being considered in connection not only with line insulators, but also with cable cores, transformer terminals and armature coils. Marked progress has resulted from the application of the laws of condensers in the design of each of these classes of apparatus, with the possible exception of the last; and to the extent that practical limits are being reached in the construction of armatures, the condenser effects are now being studied, so that much progress is to be expected along this line also. In the case of transmission-line insulators the limit of practical operating e.m.f. was reached at from 60,000 volts to 80,000 volts with the pin type of insulator, while with the suspension type the limit has been entirely removed so far as the insulator itself is concerned, the maximum permissible operating e.m.f. being set solely by the relation between the size of the conductors and their interspacing. These facts are discussed in detail in an article appearing on page 1127 of this issue.

Quite independent of any factors which may have dictated the proportioning of a transmission-line insulator, the line itself forms one plate of a condenser, the support forms the other plate, and the insulating material and surrounding air form the dielectric. When the insulator "breaks down" its failure is attributed to the concentration of the electrostatic flux at some point to a value sufficient to rupture immediately, or overheat by hysteresis, the dielectric at that point, just as is true in any condenser. Whether the rupture takes place within the solid portion of the insulator or in the surrounding air depends in part upon the relative dimensions of the several sections of the dielectric, but most largely upon the arrangement of the solid insulating material with reference to the exposed edges of the line plate and the supporting plate of the condenser. Since in any event the breakdown occurs at that point where the ratio of dielectric flux concentration to the strength to withstand rupture is a maximum, economy of material would dictate the selection of an arrangement such that this ratio is as nearly as possible constant throughout the whole dielectric. Experience has shown that even when this plan is followed in so far as atmospheric conditions and mechanical requirements will permit, there is reached a certain limiting e.m.f. above which it is uneconomical to design an insulator of the single-condenser type. Evidently, several of the high-voltage condensers can be connected in series for operation at higher electromotive forces, and by using a sufficient number of condensers in series the voltage per condenser can be reduced to any desired value. Transmission-line insulators of the suspension type, which represent the most recent development, are in reality mere high-voltage condensers connected in series. Little difficulty is encountered in designing such insulators to fulfil the condenser requirements, the chief problems being those relating to mechanical requirements.

THE NATURAL WAVE LENGTH OF ELECTRIC OSCILLATORS.

The wave length of a simple musical sound wave emitted by a stretched vibrating string, such as a pianoforte string, does not bear any simple relation to the length of the string. It depends upon the length of the string, but also upon the tension and upon the mass of the string per unit length. It is only when we keep the tension and linear mass uniform that a simple relation is found between the length of a simply vibrating string and the length of the sound wave it emits. In dealing with electromagnetic waves generally, and particularly in dealing with the electromagnetic waves emitted by wireless telegraph oscillators, it is important to know what relation exists between the height of the oscillator and the length of the emitted wave. Of course, the wave length can be altered artificially by inserting inductances or capacities into the antenna circuit. But the principal subject of interest in such an inquiry is the natural wave length of a vertical single-wire antenna when freed from all encumbrances or artificial loads and connected to good ground at the base. From a theoretical standpoint this question is directly associated with another, which takes precedence in natural order of analysis—namely, what is the wave length emitted by a uniform straight-rod oscillator in free space, with a spark-gap at the center of its length? If we know the answer to this question, the question of the grounded vertical antenna is solved at once.

It would seem very easy to find an answer to the double-oscillator problem, either experimentally or mathematically, or both. But the answer is not so easy. From the mathematical standpoint there are at least two schools of thought. One school, led by Abraham, maintains that the wave length of a free double oscillator is a little over, and usually only a few per cent over, twice its length as a rod; so that a rod 10 m long, with a small spark-gap in the middle, would emit a fundamental wave whose length would be a few centimeters more than 20 m. The other school, led by Macdonald, maintains that the wave length is a little over two and a half times the rod length, so that the 10-m free double oscillator would give a fundamental wave about 25 m long. There is obviously a very distinct difference between these conclusions. Experimentally double oscillators of known dimensions have been operated at fundamental frequency, and resonators have been placed in their vicinity to measure the wave length emitted. A resonator usually consists of a conductor just like the oscillator, but arranged as a receiver instead of a transmitter, and with its dimensions adjustable. The length of the resonator is adjusted until the maximum strength of response is found to the waves under investigation. Next arises the question, however, as to what relation there is between the best length of the resonator and the length of the incident wave. Here the same debate recommences under a new title.

In a recent number of the *Physical Review* Prof. J. E. Ives describes some experiments in which the wave length was measured by interference methods. A very short oscillator was

erated before electrical mirrors in such a way as to produce erference between two dividing wave trains. The positions interference were noted, and the length of the waves was in- rred from them. Various difficulties had to be overcome. rst of all, the length of the resonator was found to affect results, whereas a strict interference method should elimi- te the influence of the receiver. This difficulty was traced to use of a low-resistance resonator, which was enabled to set oscillations of its own pitch when excited by incident waves. using resonators of considerable resistance their vibrations re damped and held in check, so that the influence of the eiver upon the measurements was greatly reduced. The ults of the experiments are claimed as a corroboration of Abraham theory. Thus, an oscillator 4.93 cm (1.94 in.) g was found to emit waves 10.42 cm (4.11 in.) long, or hin 3 per cent of the Abraham formula, which involves the io of length to diameter of rod in such a way that the ger and thinner the rod the smaller the excess in the wave gth over double the rod length.

ssuming, then, that it has been demonstrated experimentally t the wave length of a free double oscillator is a little over ce its rod length, then the wave length of a single vertical grounded rod oscillator will be a little over four times its height. Expressing the same fact in reverse order, a gle-rod vertical and perfectly grounded antenna will be a per cent less in height than its quarter wave length. With understanding it is the more easy to determine the wave gth as modified by such condensers and reactances as may be d in connection with the antenna. Incidentally, the experi- ts bear an additional interpretation. It has been known for e years, both from theory and from experiment, that electric es run over perfectly conducting wires, supported parallel ach other, at the speed of light in air. It has come, there- , to be believed that such waves run over a single horizontal , with ground return, at the same speed. But it has been n to question whether they run over a single vertical wire he same speed. The linear capacity and inductance of such ertical wire are not constant, whereas they are manifestly tant for a long horizontal wire. The result of the Ives eriments leads now to the conclusion that over a vertical vell as over a horizontal wire electric waves travel sub- tially with the velocity of light.

ER-FACTOR AND ROTARY CONDENSERS.

ortunately for electrotechnics and for electrical engineers alternating-current generator and circuit came into general after the direct-current generator and circuit had already me familiar and understood. In this order of sequence the rent idiosyncrasies of the alternating-current circuit were e easily analyzed and mastered than if the order had been rsed and no preliminary experience had been provided with relatively simple direct-current circuit. The power-factor iomenon, for example, is peculiar to the alternating-current iit, and a grasp of its details would have been rendered h more difficult if the simpler laws of the direct-current had not first been [illegible] and then modified by ion so as to include the alternating-current case. When current generator supplies, say, 50 amp to an ordinary t-current circuit, under a pressure of 100 volts, it inevitably lies 5 kw of power to that circuit; or energy is liberated the circuit at the rate of 5000 joules in each second of time. When, however, an alternator supplies 50 amp to an ordinary single-phase circuit, under a pressure of 100 volts, it also inevitably supplies 5 kw of vector resultant power to that circuit. All of this power is, however, not liberated from the circuit, part passing to and fro between different parts of the circuit. Under ordinary practical conditions perhaps out of the 5 kw generated 4 kw may be liberated from the circuit. Under unusual practical conditions, or conditions rarely met with outside of the laboratory, only 50 watts of the total apparent 5000 watts may be liberated from the circuit.

The power-factor of the circuit, or ratio of liberated to vector generated power, is 80 per cent in the first case and 1 per cent in the second. The vector balance of the power, or the undelivered balance geometrically subtracted, is exerted either in delivering energy from the generator to magnetic fields, say, induction-motor fields, and back again, once in each current alternation, or in delivering energy from the generator to electric fields, say, condensers, and back again, once in each voltage alternation. This reactive energy, which bustles to and fro in the circuit, without escaping therefrom, is just as much energy as that which is delivered from the circuit to lamps or motors. Likewise, the bustle activity, or reactive power, of pushing the reactive energy to and fro along the circuit to magnetic fields or condensers is just as truly power as that which is liberated externally to lamps or motors. The only difference between the reactive power, or watts in the circuit fields, and the effective power, or watts directed out of the circuit, is that the former is unnecessary and obstructive power, from an engineering and economical standpoint, while the latter is useful and available power. No useful purpose is ordinarily subserved by reactive power except in an incidental and roundabout way. Useful commercial purposes are subserved by effective power. Reactive power costs money to a power plant by interfering with the effective power, which latter earns money for the plant. Nevertheless, it is a misuse of terms to call the reactive power "wattless power," or the current which carries it "wattless current." One might almost as well say that on board a steamship all the power which was utilized in the auxiliary engines was wattless power, and the current of steam delivered to the auxiliaries wattless current, merely because these are not delivered to the main engines that drive the propeller.

In the article on page 1125 Mr. L. S. Thurston point out the advantages of "rotary condensers" operating in connection with a system of low power-factor. It is clearly shown that the best theoretical economy is obtainable from such machines when delivering 70.7 per cent of their kva input in available mechanical power, and also 70.7 per cent in reactive leading power to those devices within the circuit which absorb reactive lagging power. By this means it is possible not only to obtain a very fair mechanical output from the "rotary condenser," considered as a synchronous motor, but also to improve the regulation of pressure on the system and to increase the effective output of the generating plant. It is seldom that the demands of a system in regard merely to regulation or increased output require to be met, in the judgment of the manager, by the installation of a rotary condenser; but where a synchronous motor is needed at some suitable point on the circuit the advantage of making the motor serve the double purpose of delivering mechanical power and carrying the reactive load, without great increase in size and cost, is finding favor increasingly.

Meetings of the A. I. E. E.

A meeting of the American Institute of Electrical Engineers will be held in New York on Nov. [illegible], at which time a paper entitled *Interpoles and Synchronous Converters* will be presented by Messrs. B. G. Lamme and F. D. Newbury.

On Nov. 30 a joint meeting will be held with the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society of Civil Engineers to present the John Fritz medal for 1910 to Mr. Alfred Noble "for notable achievements in civil engineering." Dr. Samuel Sheldon, past-president of the American Institute of Electrical Engineers, will preside, and addresses will be made by Messrs. Isham Randolph and R. W. Raymond and others.

A meeting of the Toronto Section of the A. I. E. E. will be held on Nov. 11, when a paper will be read by Mr. H. H. Morrell entitled *Storage Batteries*. The Washington (D. C.) Section will hold a meeting on Nov. 8 to discuss the subject "Search Lanterns." The speakers will be Commander S. S. Robinson, United States Navy, and Lieut. William H. Rose, Corps of Engineers, United States Army.

The Portland (Ore.) Section has prepared a schedule of papers for its next four meetings, as follows: Nov. 15, *High-Tension Transmission*, by Mr. H. R. Wakeman; Dec. 13, *The Electric Railway*, by Mr. W. H. Evans; Jan. 17, *Conservation of Natural Resources*, by Mr. E. J. Griffith; Feb. 21, *Telegraph and Telephone Work*, by Mr. E. L. Ritter.

Government Control of Wireless.

In his annual report to the Secretary of War, which has just been published, Brig.-Gen. James Allen, chief signal officer of the United States Army, takes issue with the operating commercial wireless telegraph companies that claim to have efficient interference preventers, and, deploring the confusion which he states exists everywhere in the transmission of government messages, urges that measures be taken at once to secure government control of wireless telegraphy, both in peace and war.

Referring to the Berlin international agreement of 1906 he says: "As the United States up to this time has not given its adherence to the convention, ships flying the American flag find themselves without standing in international wireless telegraph circles, as none of the contracting countries is compelled to receive a telegram from a vessel of a non-contracting nation, and any coastal station in a foreign country may refuse to transmit a message to a station on shipboard which is subject to a non-contracting nation.

"The history of the whole matter is recorded in a published copy of the treaty (Government Printing Office, 1907) issued by the Bureau of Equipment, Navy Department; in the report of the United States Ambassador to Germany, 1906, and in Senate Document No. 452. The only action of the United States government looking to the regulation of wireless telegraphy is the approval of the President, July 29, 1904, of the report of an inter-departmental board convened to investigate the entire question of wireless telegraphy in the service of the national government.

"Owing to the absence of definite regulations there is great confusion in the transmission of wireless messages on the coast of the United States, which interferes very materially with wireless communication between the various sea-coast defenses and with our ships at sea. The army now has fifteen wireless stations on shore located at various points in the United States and Alaska."

Investigation of Street Lighting in Chicago.

The Chicago Commission on City Expenditures, generally known as the Merriam Commission, from its chairman, Alderman C. E. Merriam, who is also a professor in the University of Chicago, has been investigating various departments of the city government, with the aid of experts called in to assist it. Its most recent report relates to the Department of Electricity, and was presented to the City Council on Oct. 31. The investigation in relation to this department was conducted by the W. H. Zimmerman Company, engineers and constructors. A summary of the portions of the report referring to street lighting follows:

BOULEVARD LIGHTING.

At present there are 177 arc lamps in the South Park system and 212 arc lamps in the West Park system which are operated and maintained by the city at its own expense. There have been many outages and complaints of poor service on the West Side, due to antiquated equipment. The commission does not see why the municipality should take upon itself the lighting of any part of the park systems, which are under State supervision. The annual cost of this service is about $25,000 a year and this amount might well be utilized elsewhere.

GENERAL OPERATION OF THE DEPARTMENT.

In general, the commission found that the business of the Department of Electricity is well conducted. One case of the substitution of inferior coal at the H. N. May municipal plant was mentioned, however, and this indicated a lack of thorough inspection. Responsibility for the purchase of coal has now been transferred from the Department of Electricity to the Department of Public Works. The Department of Electricity recognizes the labor unions and has acceded to numerous demands and has refused others. The amount of work done by the lamp trimmers and other employees compares favorably with that done in other cities and by private corporations. All positions are filled under the civil-service laws.

STREET LIGHTING BY GAS LAMPS.

For the last few years the number of gas lamps in service has steadily decreased, due to replacement by electric arc lamps, and the time is now approaching when gas lamps will be abandoned entirely, except in the outlying districts. The gas mantle lamps used for street lighting are rated at 60 cp each. It is not expected that this rating can be maintained always owing to varying gas pressures, but the standard should be higher than has been revealed by inspection of lamps in various parts of the city made for the commission.

As the result of individual inspection of 956 gas-mantle lamps it was found that 60.9 per cent could be described as "good" or "fair," while the remaining 39.1 per cent fell under various classifications, as "bad," "very bad," "out," "no chimney" and "broken glass." Lamps were assumed to be "good" when the glass was clear, the mantle in good condition and the burner well regulated. Those that were classed as "fair" were accepted as passable, but still could be much improved by cleaning the glass and regulating the burner. The "very bad" lamps might as well have been left out entirely.

The reason for this unsatisfactory condition of affairs is lack of proper care on the part of lamplighters and poor inspection. Photometric field tests of the mantle lamps which could be classed as passable showed a range of candle-power from 10.6 to 41.6, the average being 24.8. It is probable that the light could be increased 50 per cent with proper care.

It is stated that the efficiency of operation of the Gas Lamp Bureau is not so high as that of other divisions in the Department of Electricity. It is remarked that should the same percentage of error which was found in one district exist in all the amount which the city is paying for gas and labor which it does not receive amounts annually to nearly $7,000. The commission recommends that the position of chief gas inspector be placed under the merit system, and says that until the gas lighting bureau is thoroughly reorganized the city cannot hope to receive full value for the $500,000 expended in gas lighting.

GASOLINE LAMPS.

In outlying districts where electric or gas mains are not available the street lighting is done by gasoline lamps. The lamps are owned, installed and operated by the American Development Company, the city paying $26.40 per year per lamp for proper operation. Each lamp is rated at 60 cp. The commission caused a number of gasoline lamps to be tested, and the average horizontal candle-power of 20 lamps was 19.45. Later tests made when a representative of the American Development

ompany was present showed an average horizontal candle-ower for twelve lamps tested of 26.4. In the latter case the ests showed a great divergence, the candle-power ranging from 4 to 58.4.

The commission recommends that before the renewal of the ontract with the company maintaining the lamps there be a ubstantial revision in the provisions of the contract. It is uggested that a variation of 25 per cent below rated candle-ower be allowed. Between 45 cp and 15 cp rebates on average aintenance should be made on a sliding scale, fluctuating from 00 per cent to nothing. All lamps developing 15 cp or less hould be considered as out of service, and the city should re-eive 100 per cent rebate for them from the first of the current onth to the time of inspection.

The commission recommends that an investigation be made nto the existing contract to ascertain what claim the city may nter against the American Development Company. It says: "If the results of the official tests are considered as indicative f the average conditions existing during the life of the present ontract, up to July 1, 1910, the city is entitled to a rebate of 5 per cent of the cost of the contracted service, which rebate or the first ten months of the contract would amount to ap-proximately $86,000."

ELECTRIC STREET LIGHTING.

The commission refers to the contract with the Sanitary istrict executed while it was making its investigations as an dvantageous one for the city. By this contract the Sanitary istrict will take over the entire operation of the existing ectric street-lighting system of 12,200 arc lamps and operate in connection with an extension amounting to 10,000 addi-onal street arc lamps. The commission says that the enlarged stem of 22,200 lamps will be operated at a cost only about per cent greater than that of the existing system of 12,200 mps. This arrangement the commission cites as an illustration the economy that might be effected by closer co-operation etween the various public bodies expending public money in ook County and particularly by closer co-operation with the anitary District in relation to the use of electric energy. The mmission concludes this part of its report by saying:

"A representative or representatives of the city should be ppointed to confer with representatives of the Sanitary District nd of the other governing bodies interested and should draw a plan which would reduce expenditures for electric light nd power to the lowest possible terms. It seems probable that ery large savings could be effected by this means, and no time ould be lost in formulating plans for this purpose."

It is also recommended by the commission that a more aggres-ve attitude be taken by the Department of Electricity on uestions relating to the gas and electric-lighting interests of e City of Chicago. It is asserted that the assumption of a mer policy by the department in such matters would have sulted in a material saving to the city.

In an appendix the existing methods of operating the munici-al street-lighting plants of the City of Chicago are considered the W. H. Zimmerman Company. However, as during the ogress of the investigation the contract with the Sanitary istrict already referred to was executed this part of the com-ission's report is no longer applicable to the city government. ut it is interesting to note that in the last fifteen months the cords in the office of the Department of Electricity show a tal outage of seven hours and twenty-three minutes due to e failure of the Sanitary District's hydroelectric service. This tal includes nine separate outages, the longest being three and half hours, the next two and a quarter hours and the rest nging from twenty minutes' to five minutes' duration. It is to noted that all of the seven municipal street-lighting stations operated by the Sanitary District's energy from the Drainage nal hydroelectric plant. In four of the plants a standby steam serve is maintained, and it is estimated that if this reserve eam equipment were abandoned the net annual saving would $23,694. If all the electric equipment, as well as the steam uipment, in the four stations were abandoned—that is, sub-stituting static transformer [illegible] for the [illegible] motor-driven generating stations—it is estimated that the net annual saving would be $140,567. Three of the existing stations are simply static transformer stations. They have no steam reserve whatever, and it is declared that none is necessary in any of the stations. The substations to be built by the Sanitary District will all be simply transformer substations.

Electric Railway Power Difficulties in Worcester, Mass.

The Worcester (Mass.) Consolidated Street Railway Company is at present undergoing a series of drastic criticisms from the daily press on account of irregularities in its power supply, which is derived from an old steam plant located at the south end of the city about two miles from the business center. For many years the plant has borne the brunt of the Worcester service, and under the policy of the former controlling interests it was allowed to depreciate beyond a reasonable limit, little money being appropriated for its extension or improvement. The Worcester system is now one of the constituent companies of the New England Investment & Security Company, headed by Mr. L. S. Storrs, of Springfield, and the new management is pushing the construction of a large turbine plant at Millbury, six miles southeast of Worcester, from which power will be transmitted to the Consolidated system and distributed from a rotary converter substation in the center of the city. The old steam station will be utilized in peak service upon the completion of the new plant in the latter part of the coming winter. Meanwhile the present management is obliged to shoulder the troubles arising from the failure of the former owners to set aside funds for plant enlargement. The Worcester Board of Aldermen has appointed a committee of investigation and has retained Prof. Harold B. Smith, of the Worcester Polytechnic Institute, to investigate the physical and operating condition of the company.

Municipal Underground Construction in Chicago.

One of the findings of the recent report of the Merriam Commission on City Expenditures in Chicago in relation to the Department of Electricity is that in various parts of the city there is at the present time 67,258 ft. of underground conduit, representing an investment of $85,000, which is unoccupied. Further, there is 114,005 ft. of conduit, representing $140,000, which is only partially occupied in streets on which there are at present overhead circuits. Some of the underground ducts have been unoccupied for years, having been put in when new pavement was laid, and the city having lacked the funds to transfer the aerial lines underground since then. It is often the case in districts where by ordinance all wires should be underground that the city's circuits are still overhead, and two or three wires necessitate the presence of ungainly pole lines along the curb where private companies' wires are underground.

In view of the fact that the street lighting of the city is about to be taken over by the Sanitary District, supplying hydroelectric energy from the Drainage Canal and adding about 10,000 new street arc lamps, the commission recommends that further extension of underground work by the Department of Electricity be done under the most economical conditions. Generally the character of the recent construction work done by the Bureau of Electrical Construction and Maintenance of the Department of Electricity is good, but before final conclusions are made as to future work the expenditures for equipment and construction should be investigated.

Wireless Work of the Signal Corps Laboratory.

In the Signal Corps laboratory, located in the laboratory building of the Bureau of Standards, Washington, D. C., much experimental work has been accomplished in the past year. A 180-ft. antenna has been erected and the necessary equipment for carrying on such work secured. A high-frequency generator of 2 kw rating capable of giving [illegible] cycles per se[illegible] and has been installed in the basement of this building and

suitable leads provided to the experimental rooms above in close proximity to the antenna masts. The mechanical difficulties in constructing such a high-frequency generator have been finally overcome, according to Brigadier-General James Allen, chief signal officer of the United States. The attainment of this result involves the use of a rotor about 1 ft. in diameter, operative at a speed of 20,000 r.p.m. This machine produces approximately pure sine waves, which are sustained in amplitude and correspond to a wave-length of about 1.86 miles.

In addition to this, two small arc generators have been installed. They are capable of producing sustained oscillations whose frequency is from 400,000 to 500,000 per second. Due to the novel forms of apparatus required for this kind of work, many vexatious delays have occurred in securing a test of the equipment. The laboratory has now a complete wireless telephone plant working satisfactorily, with which experiments are being made.

The laboratory was organized primarily to assist in the development and design of new equipment. As soon as a new electrical instrument or device is thought to be suitable for adoption, its connection with the laboratory ends and its future production is taken up through commercial channels. The laboratory equipment has been added to considerably with the view of preparing for research work along the lines of wireless communication. The limitations of the wireless telephone and telegraph at the present time and the large potentialities of the subject indicate the desirability of further investigations.

Northwest Generating Station of Commonwealth Edison Company.

Work on the foundations of the future Northwestern station of the Commonwealth Edison Company in Chicago is now under way. The site of this station is near the corner of California Avenue and Roscoe Street, on the west bank of the North Branch of the Chicago River, and about six miles northwest of the central business district of the city. The station now building will have an ultimate rating of 120,000 kw in six units of 20,000 kw each. Two of these machines will constitute the initial equipment, and it is expected that the first one will be in service within a year. The company is the owner of a large amount of land in this site, and after the first station is built it is planned to erect a duplicate of it, of equal size, so that the total rating of the two stations when completed will be 240,000 kw.

Holabird & Roche are the architects for the new station, and Sargent & Lundy are the consulting engineers. The general contractor is the George A. Fuller Company. Other contracts have been awarded as follows: Structural steel, bridges and chimney stacks, George W. Jackson, Inc.; boilers, Babcock & Wilcox Company; coal and ash conveyors, Mead-Morrison Manufacturing Company; crane, Morgan Engineering Company; turbo-generators, General Electric Company; condensers, International Steam Pump Company (Worthington).

An important adjunct to the station is a double-track elevated railway, about 0.75 mile long, to be operated by electricity and connecting the power house with the tracks of the Chicago & Northwestern Railway. This railway, which has been carefully built, is nearing completion. The contractor who has charge of this work is James O. Heyworth.

The Importance of the Inventor's Work.

Mr. Donald M. Carter, a Chicago patent lawyer, was the speaker at the weekly luncheon of the Electric Club of Chicago on Nov. 2. His subject was "The Inventor as a Factor in Civilization." He spoke first of some of the "freak" inventors, but said that these men were nevertheless worthy of respect, as they exhibited faith in an idea not yet accomplished, and that faith is the secret of all progress. It is a mistake to ridicule the inventor as a crank. The inventors have done more for the material advancement of the human race than any other class of men; they are the most important men in civilization indeed, civilization itself is really the result of the work o their minds and their hands. As a rule, the work of the ir ventor is not spectacular, and he does not receive the credit t which he is entitled, for he is the emancipator of the huma race from the tyranny of things, and this is as true of the wor of women as of men. The speaker drew a picture of th progress made in the necessities, comforts and luxuries of lif as a result of the work of the inventor.

Few great inventions are made all at one time or by on man; they do not emerge full-fledged, so to speak, as the proc uct of a single brain. Usually there is a step-by-step chain c development to which a number of inventors contribute. On man takes the last step and makes the thing practical, and h gets the patent. Mr. Carter cited the invention of the tel phone as an example of the growth of an invention. Bell onl contributed a small part. Almost literally, he simply tightene up the last screw, but he was the man who took the last ste and he was legally entitled to the invention.

In the case of the aeroplane patent litigation the Wright seem to have conceived the idea of warping the wings to pr serve balance, but their claims apparently were not broa enough to cover other means of effecting the same object b sides those which they described, and as a result of the prelim nary injunction obtained the patent has been dissolved by tl courts and other aviators are flying with aeroplanes. Th case shows the importance of wording the claims so as to pr tect the invention properly.

Mr. Carter said that the patent system of to-day is wron Apparently every man's hand is raised against the invento and even after he has obtained his patent he has to fig strenuously to protect his rights. This ought not to be tl case. The inventor ought to be encouraged in his work, f he is really the hope of the world in doing away with tl drudgery of existence by utilizing the powers of Nature.

Mr. F. P. Vose, who presided, pointed out that the servi which the patent lawyer rendered to the inventor was impo tant and should not be overlooked. Senator N. Juul, Chicago, a member of the Illinois Legislature, made a sho speech, during which he said that when he was in Europe l noticed that the grave of Oersted was almost neglected, a expressed the belief that the work of this great Danish scienti in the early part of the last century had never been adequate recognized. Others who took part in the discussion brie were Messrs. H. F. Holland, V. L. Crawford, of St. Lou and H. A. Fife.

Governmental Electrical Control in the Transvaal.

The Transvaal government has recently passed certain legi lation with regard to electricity. It is clear, in the first pla that the Legislature favors municipal trading. Thus no pe son except the Council of the municipality shall engage in undertaking to supply to any other persons energy exceedi 20,000,000 kw-hours per year unless the undertaking be licens Undertakings existing prior to the commencement of the may, however, be continued for one year and no longer, unle licensed under the act.

There are not many power schemes excepting the larg which fall under such a denomination, but recognition is also pa to the undertakings which are to generate less than that amou of energy per annum. It is provided in the act that if any pe son or company desires to carry out a private supply of ele tricity not exceeding 20,000,000 annual kw-hours he may obta permission from the Governor.

It follows that anyone may enter into a public supply unde taking without being unduly interfered with so long as the pe mission from the Governor is obtained, and assuming alwa that the supply does not exceed the figure set forth in the a Such an undertaking will not be free from ordinary leg obligations, but it is apparent that a reasonable-sized syste could be constructed without statutory powers being nece sary. When giving his permission for an undertaking the Go

ernor may insist on certain provisions being complied with. Full particulars must be given relating to the company when applying for a license, including the proposed location of sites for stations, names of owners and occupiers of the land which it is proposed to acquire, proposed sources of water, etc.

It is clear from the fact that this legislation has been found necessary that the most pressing question at the moment is the supply of electricity on a large scale. The legislation is clearly aimed at defining the position of such concerns as the Victoria Falls power supply and other similar undertakings. At the same time it should be remembered that the Transvaal is growing rapidly.

Traces of the conflict between municipal and private ownership, a conflict which is always characteristic of English legislation concerning electricity, are to be found in the act. No supply may be given in a municipal area without the consent of the municipality. Perhaps the most interesting provision in the act is that which provides that a licensee must neither carry on any other business or undertaking nor, in the generation of electric energy, use coal from any mine in which he is interested, directly or indirectly. The Governor may fix a limit to the amount of power to be generated, and if the company refuses to supply any consumer in its district, the minister must decide the charges and conditions under which the supply shall be carried out.

The price of energy may be revised at the end of seven years and afterward at intervals of three years. The reduction in the price of electricity at the end of such a period, however, is not to be less than one-half of the reduction effected during the interval in the cost of supply of power. If, therefore, a power supplier by means of a new plant or the adoption of a new system shall be able to reduce his costs of production, half of such saving must be given to the consumer.

The licensee, however, must do more than this for his consumer, as he is compelled under the act to give him 25 per cent of the surplus profits. Surplus profits are calculated after all charges have been made and interest on share capital and debentures has been provided for. Various matters in regard to price are to be referred to the minister. It is enacted that any charge to a consumer must not be reduced without first obtaining the approval of the minister. No preference can be given to a consumer without the consent of the minister for the time being.

There are various provisions by which it is possible for a license to be revoked, under which circumstances it is open to the Governor to purchase the undertaking on terms. The Government may take over an undertaking after thirty-seven years upon due notice being given and upon payment of the then existing value of lands, buildings, plant, etc., but no addition is to be given for either good-will or prospective profits.

The act is to be administered by an advisory committee known as the power undertaking board; the government mining inspector is to be chairman of such board and all the members are to be officers in the railway or public services. The number of members is not to exceed five.

New System of Lighting for Atlantic City's Boardwalk.

The lighting and boardwalk committees of the City Council of Atlantic City, N. J., have under consideration a number of schemes for illuminating the city's famous Boardwalk, which at present is illuminated by enclosed-arc lamps along the outer edge of the walk and festoons of incandescent lamps suspended at right angles to the walk. Rival bidders have erected at various points on the Boardwalk working exhibits of schemes proposed by them, so that in considering their quotations the committees may have a sample of the actual installation and its effect before them. Gas and electricity both appear in the bids received, but no one seems to take the gas schemes seriously and it is doubtful if they will receive any consideration whatever.

The exhibits shown comprise tungsten standards in the center and along the edges of the walk with flaming arcs at the street intersections. The bids submitted were in part as follows: Atlantic City Electric Company—Double-arc standards, \$108, \$116.40, \$110.20, \$118.60; single-arc standards, \$102, \$110.50, \$104.20, \$112.60; intermediate ball-top standards, \$81.60, \$90, \$85.05, \$93.45; incandescent standards (five lights), \$69.60, \$78, \$72.65, \$81.05. Atlantic City Gas Company—Gas-arc lamp-

Fig. 1—Lighting Exhibition of Atlantic City Electric Company.

posts, \$64; two gas-arc lamps, \$20; lighting under five-year contract, dusk to midnight, \$80 per post per year; dusk to dawn, \$130 per post per year, company to do all renewing etc. L. L. Jones Company—Short posts, \$77.50; short posts with globes, \$84.50; tall posts, \$124; tall posts with globes, \$128.50; tall posts, style at New York Avenue, \$120; tall post, same style, with globes, \$124.50; flaming arcs, \$55; carbon for flaming arc, \$18.50. Sterling Bronze Company—Cast-iron posts, \$166; cast-iron post with bronze base, \$76.50; additional lamps, 10-hour Stave, \$33; seventeen-hour Stave, \$37.50. Elmer P. Morris Company—Arc posts, \$82; incandescent intermediate posts (five lamps), \$54; globes, \$1.85; sockets, 40 cents; complete cost, Maryland to Missouri Avenue, \$6,420. Welsbach Street Lighting Company—Erect all posts and fittings, etc., at its own expense, same to remain its property, providing it gets a seventy-five-year contract to light the Boardwalk at the following prices

Fig. 2—Tungsten Standards by Night.

per year per post (price variations according to hours of illumination and also to single, double or triple lights), \$154, \$100, \$114, \$78, \$86, \$62. Smyser-Royer Company—Posts, each, \$63.93. Extra charge for balls according to quality, etc.

The Smyser-Royer Company has six posts spaced from 60 ft. to 40 ft. apart consuming 2970 watts per hour, or 12.38 watts per lineal foot of walk. The exhibit of the L. L. Jones Company

[illegible] posts spaced approximately 45 ft. apart, consuming 7755 watts per hour, or 42.8 watts per lineal foot of walk. The Atlantic City Electric Company has two exhibitions; in one four Mott posts are spaced 60 ft. apart with one post on the inside of the walk with festoons, consuming 4140 watts per hour, or 34.5 watts per lineal foot of walk. In the second scheme there are nine Mott posts spaced 40 ft. apart with festoons, consuming 2920 watts per hour, or 11.6 watts per lineal foot of walk. The Sterling Bronze Company has three posts spaced 100 ft. apart, consuming 3120 watts per hour, or 15.6 watts per lineal foot of walk. The Elmer P. Morris Company has thirteen posts, three in the center of the walk spaced 200 ft. apart, five on the outside rail and five on the inside rail spaced approximately 100 ft. apart, consuming 4475 watts per hour, or 10 watts per lineal foot of walk. The present lighting system between Missouri and Maryland avenues consumes 13,020 watts in arc lamps and 55,080 watts in incandescent lamps.

There is much difference of opinion manifested by the public in the lighting scheme on exhibition. The owners of the large hotels along the Boardwalk object strenuously to any system of lamps and standards in the center of the walk and to any system of festoons, maintaining that the first would destroy the majestic width of the promenade and that the second has an undesirable element of cheap plasteriness about it. The hotel men are also insistent on the removal of the unsightly poles and wires from the Boardwalk, claiming that they have been promised for some time that the wires would be placed in conduit under the walk and would no longer mar the view of the ocean. Standards on the sides of the Boardwalk are favored by them.

The majority of the bidders declared that the only proper way to light the walk was through standards along its center, it being impossible to obtain the requisite effect by any other means. The Business Men's League, on the other hand, objects to the removal of the festoons with their Christmas-tree effect, claiming that the Boardwalk is a festive place and that the festoons carry out the carnival idea. The league also objects to the center standards. The electric light company, it is stated, will remove the electric light wires from the poles and place them in conduit on March 1, 1911.

Investigation of High-Tension Transmission Continued in Massachusetts.

The Massachusetts Gas & Electric Light Commission gave a continued hearing on Sept. 27 and another on Oct. 10 upon the investigation of laws and conditions bearing upon high-tension power transmission laid upon the board by Chap. 55, Resolves of 1910. At the earlier hearing Mr. Alton D. Adams, counsel for the Town of Leominster, contended that the proposed bill granting power companies the right of eminent domain riddles the power of local authorities to determine the right of transmission lines in crossing public ways and places. He also objected to the bill on the ground that the right would be exercised by companies who restricted their power markets. He did not oppose the granting of eminent-domain powers under proper control and with the provision that all persons desiring to purchase energy should be sold it by the company. Touching upon the need of cheap power in Massachusetts, Mr. Adams said that the State census of 1905 showed that the manufacturers of the commonwealth were using more than 1,000,000 hp. The actual rating of steam engines installed at that time was nearly 700,000 hp, including a small percentage of internal combustion engines. The last report of the board shows that the total rating of electric motors served by local stations in Massachusetts is practically 100,000 hp, or about one-seventh the engine capacity. The opportunity for electrical expansion would be enhanced under eminent-domain rights, given appropriate regulation and conditions. The foregoing figures did not include the engines of electric railways and electric light companies. Arguing that the so-called small manufacturer needs cheap power relatively as much as the large one, Mr. Adams showed that in 1905 there were 10,723 industrial establishments in Massachusetts, and the average power installation was 93 hp, and in 90 per cent of the establishments it was but 41 hp. Mr. Adams then argued at length that the proposed bill is unconstitutional on account of the proposed limitation of the power market.

Commissioner Schaff then urged the transmission interests to bring forward evidence that an undue expense had been thrown upon them in line locations on account of the lack of the right of eminent domain. He said that the question under the act is what impediment there is to-day, and how much is represented in capital that is due to the absence of the right of condemnation.

Mr. C. S. Davis, Boston, counsel for the Amherst Power Company, stated that Massachusetts manufacturers are coming more and more to depend upon cheap power for successful operation. Water is going to be conserved and made better use of than in the past on the rivers of the State. He cited the case of a large manufacturer in Fitchburg who had recently taken electric power, and who had become convinced that his power was costing practically nothing in comparison with the former cost of steam power, for the reason that the electric power was more constant, enabling steady running of machinery, so that production was regular and of much larger volume than with steam. A prominent cotton manufacturer also found that a very large percentage of the breakage was caused by irregularity of steam power, and that electricity increased the output of the plant to a large extent, with the same mill equipment and personnel. Mr. Davis said that he did not for a moment believe that the hydroelectric companies are going to be without State regulation. He felt that the right of eminent domain should be recommended by the board to encourage the development of the industry. He felt that the principal hazard in respect to investment in hydroelectric enterprises lies in lack of surety to reach a market. The hydroelectric companies only ask to serve such companies and persons as the board requires. Gen. Schaff remarked that if the number of power lines should be limited and the local companies compelled to buy of the transmission organizations it would simplify matters and would go a long way toward establishing the public-service character of the hydroelectric enterprise. Mr. Davis said that the companies are willing to come before the board and be regulated in regard to where their lines shall go, what lines shall be built, what prices shall be charged, and what profits made.

Mr. M. B. Jones, Boston, counsel for the New England Telephone & Telegraph Company, submitted an amendment to Chapter 122 of the Revised Laws designed to give telephone and telegraph companies the right of eminent domain substantially as outlined in the bill presented to the board by Mr. W. Rodman Peabody for the Amherst Power Company. Mr. Jones argued that the quality of service would be improved if more latitude in the location of lines was available. He said that it is becoming more and more difficult to negotiate for private rights-of-way, and he went on to cite a case where the telephone toll service of a neighboring state has been seriously impaired for several years by reason of the close proximity of high-tension power lines and long-distance telephone lines upon the same highway, and yet neither company is able to move because of its absolute inability to purchase private rights-of-way. The passage of an eminent domain statute has at last permitted the difficulty to be removed.

At the hearing of Oct. 10 Mr. Everett W. Burdett, Boston, counsel for the Massachusetts Electric Lighting Association, the Boston & Northern and Old Colony Street Railway Companies, emphasized the present unsatisfactory state of the laws relating to pole-line locations, and agreed with Mr. Jones to present at the next hearing suggestions regarding advisable legislation. Mr. W. Rodman Peabody, for the Amherst Power Company, said that no revision of the right of location upon the highways could benefit transmission companies, as their proper place is clearly on a private right-of-way. He said that his clients are not going to take the chances of extending their lines upon the highways, and that the Amherst Power

Company recently expended a large sum of money to buy a right for two miles over private location rather than accept the offer of a location on a railroad right-of-way at a nominal rate of $5 a pole rental. Mr. Peabody promised to submit a tabulation of percentages showing the relative expenditure for land and the average price of the land where the line was actually placed. The hearing was continued to Oct. 31.

Analysis of Diversity Factors.

In a paper read at the Frontenac meeting of the Association of Edison Illuminating Companies Mr. H. B. Gear presented an analysis of the diversity factors in various parts of the distributing system of the Commonwealth Edison Company. The author defined the diversity factor as the ratio of the sum of the maxima of the subdivisions of any part of the system to the coincident maximum demand observed at the point of supply.

The observations made and results recorded for various classes of consumers are given in Table I. Group 1 represents a residence block in which there are thirty-four consumers

TABLE I.—ANALYSIS OF CUSTOMER DIVERSITY-FACTORS.

Group.	Number of Consumers.	Kw connected per Consumer	Sum of Consumers Maxima	Maximum of Group	Diversity Factor	Average Consumer Load-factor	Group Load factor
			RESIDENCE LIGHTING.				
A.	34	0.53	12	3.6	3.33	7.0	23.3
B	185	0.53	68	20	[illegible]	7.0	23.8
C.	167	0.87	[illegible]	28	[illegible]	7.3	24.[illegible]
Average	128	0.68	57	17.2	3.35	7.1	[illegible]
			COMMERCIAL LIGHTING.				
D	46	1.28	[illegible]	[illegible]	[illegible]	[illegible]	18.0
E	79	0.74	[illegible]	[illegible]	[illegible]	[illegible]	16.0
F	160	0.53	62	41	1.51	[illegible]	[illegible]
G	221	2.70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Average	95	0.70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			GENERAL MOTOR SERVICE.				
H	29	1 h.p.	[illegible]	[illegible]	[illegible]	[illegible]	21
I	18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26
J	11	11.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
K	25	[illegible]	[illegible]	[illegible]	[illegible]	21	[illegible]
Average	21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

having a connected load of 18 kw, or an average of 0.53 kw per consumer. The sum of the consumers' maxima is 12 kw, while the actual maximum as measured at the single transformer supplying to the block is 3.6 kw; the diversity-factor is thus 3.33 between the consumers in the block. The average load-factor of the group of consumers is 7 per cent, while the load-factor of the power delivered from the transformer is 23.3 per cent.

Group B is a similar block having 185 consumers with the same average connected load. The sum of the consumers' maxima is 68 kw, the transformer maximum is 20 kw, the diversity factor is 3.4, and the group load-factor is 23.8.

The premises lighted by these two transformers were practically all apartments and the public halls of the same.

In Group C about two-thirds of the premises were small apartments and the remainder large apartments and residences. This condition accounts for the greater connected load and larger average load on this transformer. The diversity factor, however, remains practically the same as in the previous cases.

The determination of the sum of consumers' maxima in cases where the connected load is less than 1 kw was based upon averages worked out during a time when all consumers were provided with demand indicators, the values varying from 1 to 1 for one lamp to 2 to 1 for twenty lamps.

Among the commercial lighting consumers Group D represents small stores on an outlying business street, with several saloons and restaurants; in Group E there are no large stores, no saloons and no restaurants; Group F includes nine apartments above stores, and an equal number of offices, lodge halls, etc.; Group G represents 221 consumers in an office building together with the general motor service for the building. In the last group the connected load of 603 kw includes 180 hp in ventilating fans, pumps and such other machines as are used in an office building having hydraulic elevators. Since the motor load could not be measured separately, and the total given is not strictly commercial lighting, the results of Group G are not included in the average of the commercial lighting groups.

Among the general motor users Group H consists of twenty-nine single-phase consumers having a connected load of 27 hp and an average load or 1.1 hp. The sum of the consumers' maxima is 30 kva, the transformer maximum is 21 kva and the diversity-factor 1.43. The consumers are "sweat shops" manufacturing men's clothing. In Group I ten of the eighteen consumers are clothing manufacturers using single-phase motors, and the other eight are other manufacturers using three-phase motors. The largest consumer in Group J is a woodworking establishment in which the machinery operates steadily; this fact accounts for the high transformer maximum and the low diversity-factor. About fifteen of the twenty-five consumers in Group K are small clothing manufacturers, each using less than 5 hp.

Various diversity-factors of the system, in addition to those of the customers, are shown in Table II.

THE EFFECT OF DIVERSITY-FACTOR ON INVESTMENT.

By the use of the diversity-factors shown in Table II it is possible to estimate the investment required to serve each of the four classes of consumers under the conditions existing in Chicago.

Assuming that the generating plant can be installed for $100 a kilowatt of rated output, substation and transmission lines for $60 a kilowatt, feeders, mains, services, etc., at an average of $150 a kilowatt and that meters cost an average of $10 each, the investment required to serve a group of residence lighting customers is $440 per kilowatt of generating station load. Of this amount $124 is for consumers' meters, $12 for transformers, $146 for distributing lines, $58 for substation and transmission lines and $100 for generating equipment. These figures are based on an efficiency of 86 per cent from the substation bus to the consumer and an efficiency of 88 per cent for transmission and conversion, making a total full-load efficiency of approximately 75 per cent.

The author said that in scattered suburban territory the cost of distributing lines sometimes runs as high as $300 a kilowatt. In such cases the total cost for residence lighting is

TABLE II.—DIVERSITY-FACTORS OF THE SYSTEM.

	Residence Light.	Commercial Light.	Motor Service.	Large Users.
[illegible]	[illegible]	[illegible]	[illegible]	
Between transformers	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Consumer to substation	[illegible]	[illegible]	[illegible]	[illegible]
Consumer to generator	5.52	2.41	2.46	1.45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

approximately $600 a kilowatt. In certain closely settled residence districts of Chicago, where the feeders are underground but most of the distributing mains are overhead, the investment in distributing lines is below $100 a kilowatt, making a total investment of approximately $390 per kilowatt for residence lighting.

Similar figures for commercial lighting indicate a total in-

vestment of \$354 a kilowatt, of which \$38 is for meter investment. With general motor users the investment is \$330, of which \$15 is for meter investment. For large users the investment is \$215 per kilowatt and the meter cost is negligible. The figure for the large user is based upon an average cost of \$50 a kilowatt on distributing lines, since such consumers are often supplied with energy over separate feeders, which are less expensive than the general feeder and main system.

The above investment costs are given in detail in Table III. The high meter investment required for residence consumers is due to the low average maximum demand and the high diversity-factor of such consumers. The demand of a group of commercial lighting consumers is nearly three times as great as that of an equal group of residence consumers and the cost of the consumers' meters is therefore spread over a larger number of kilowatts than is the case with residence consumers.

The author said that in view of the tendency of high-efficiency lamps to reduce the average consumers' demand without reducing the meter investment it would seem that the appearance

[illegible] INVESTMENT IN DOLLARS PER KILOWATT FOR VARIOUS CONSUMERS.

	Residence Lighting	Commerci'l Lighting	Motor Service	Large Users
Meters	124	[illegible]	15	Negligible
[illegible]	12	12	12	[illegible]
Distributing lines	146	146	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Generating equipment	[illegible]	100	[illegible]	[illegible]
Total investment	[illegible]	354	330	215

of a less expensive type of meter would permit material savings to be made in that proportion of the investment which is chargeable to metering the smaller consumers. The figures further serve to emphasize the desirability of consolidating different kinds of service under similar rate schedules in order to avoid the multiplication of meters in the consumer's premises as far as possible.

Massachusetts Commission News.

The Massachusetts Railroad and Boston Transit Commissions, sitting as a joint board, gave a hearing on Nov. 1 upon the rapid transit situation at Boston in connection with a resolution requiring the two boards to report to the Legislature of 1911 with recommendations upon the construction of certain subway lines, the extension of existing subway leases now held by the Boston Elevated Railway Company and the consolidation of the West End Street Railway Company with the Boston Elevated. The feature of the hearing was a brilliant and candid discussion of the transit situation by Gen. William A. Bancroft, president of the Boston Elevated Railway Company, who reviewed graphically the progress made in the past twelve years, pointed out the relation of comprehensive improvements under construction or schedule for immediate completion to work accomplished in the past decade, and emphasized the need of an extension of existing subway leases before their expiration and the importance of establishing a single transportation system by legal enactment in order that the community shall receive the facilities which it requires, supplied by capital induced by favorable conditions to invest in improvements, unhampered by needless duplication of physical plant and inefficient, restrictive conditions of operation.

A strong plea was made by General Bancroft for the consolidation of the Boston Elevated and West End Street Railways. The terms of the latter's lease to the former are such that at its expiration there is required a physical separation of the systems involving serious waste and duplication of plant, as well as great public inconvenience. The company has purchased a site in East Boston located on tidewater at a cost of about \$300,000, and it should know at once whether the two systems are to be operated independently or not. General Bancroft said that the stockholders of the West End company are prepared to accept consolidation on the basis of an 8 per cent dividend guarantee on second preferred and first preferred stock to be issued by the Boston Elevated in exchange for West End shares. This means an additional charge upon the company of \$125,000 per year, but the unnecessary expenditures of capital and the unnecessary operating costs of separate systems would more than offset this. The Boston Elevated believes that it is a much better plan to take over the West End property on an 8 per cent basis than further to delay the consolidation. In itself the dividend rate of 8 per cent is not unreasonable.

In conclusion General Bancroft discussed the proposed subway in the West End of Boston which various interests desire built in connection with the Boston terminus of the Cambridge subway. The company does not favor this construction, which would necessitate a loop under Tremont Street through Bowdoin Square to the Charles River. The cost would be about \$4,000,000 and the operating difficulties would be most trying, particularly at Scollay Square, which is the logical terminus of a loop extension of the East Boston tunnel and an important station for cars entering the city by the new East Cambridge elevated extension. The hearing was adjourned to Nov. 8 to enable other parties to be heard.

The Massachusetts Railroad Commission has issued a decision in the petition of the Selectmen of Lenox relative to fares on the Berkshire Street Railway. The board declines to order a fare reduction on inter-town traffic, but recommends that a 5-cent fare be established between Lenox and New Lenox. With respect to the service, the board recommends that before the opening of the next summer season a schedule shall be arranged to provide for more frequent trips between Lenox and the local railroad station, and in the event of the failure of the management of the company and the Selectmen to agree the board will, upon application of either party, reopen that branch of the case.

The Boston & Albany and the New York, New Haven & Hartford Railroads have filed with the joint Commission on Metropolitan Improvements, popularly known as the "Big Four," tentative studies of an electrified suburban service at Boston, in accordance with a resolution of the last Legislature. The board consists of the Massachusetts Railroad Commission, Boston Transit Commission, Metropolitan Park Commission and the Harbor and Land Commission, and is required to investigate the problem of electrification and report upon it to the Legislature of 1911 early in January with a draft of a bill providing for electrification by a fixed date. The commission is withholding the studies of the railroad companies from present publication pending their consideration by a sub-committee, but it has been learned that the study of the Boston & Albany Railroad, which is a leased property of the New York Central Lines, provides for electrification on a direct-current, third-rail basis of the main line from Boston to South Framingham, twenty-one miles west of the city, and also the elimination of the steam locomotive from the suburban loop known as the Newton-Brookline circuit. It has not been determined whether the company will erect a separate power plant of its own on tidewater or purchase electricity from the Boston Edison Company. The electrification will involve various changes in the arrangements for handling traffic, including station modifications of a minor character, the erection of additional platforms and shelters and the installation of an alternating-current signal system. The plan at present most favored is to handle the through-train service by electric locomotives and to take care of the suburban traffic by multiple-unit trains, as at New York. It is stated that the low bridges of the Boston & Albany precluded from the start any extended consideration of the use of a catenary trolley system. About 65 per cent of the Boston & Albany service from Boston to South Framingham, including the Newton circuit, is of a suburban character. With the electrification important improvements are projected in the Back Bay district of Boston, including arrangements for the handling of additional traffic on approaches to the South Station and the rejection of the plan for the use of a suburban loop subway beneath the South Station.

In connection with its investigation of the conditions and laws bearing upon the transmission of electricity in bulk in Massachusetts the Board of Gas and Electric Light Commissioners has sent an inquiry to each electric service company in the State asking for a map of any transmission lines of the company, if any are existing, which are located in, along or over land or rights-of-way owned by the company. The company owning such lines is requested to show their location, both as regards the highways or public thoroughfares and private lands, with the location of generating stations, the character of construction, whether poles, conduits or towers, and the voltage at which the current is transmitted.

The Massachusetts Gas and Electric Light Commission has issued a finding permitting the consolidation of the Uxbridge & Northbridge Electric Company, the Douglas Electric Company, the Upton Electric Company and the Millbury Electric company with the Grafton Electric Company. The Grafton company supplies electricity in the towns of Grafton and Sutton and the other four companies have their lines, respectively, in Uxbridge and Northbridge, Douglas, Upton, and Millbury, municipalities contiguous to Grafton and Sutton. All the companies are owned by the same interests. The board points out that the five properties have for some years been treated as integral parts of one system, and that a consolidation will make no change in this nor will it diminish the facilities for service. The Grafton company is to issue 2075 shares of stock to cover 394 outstanding shares of the Uxbridge company and 1681 additional shares approved by the board and seventy-five shares each for the outstanding stock of the Douglas and Upton companies. The board points out that none of the five companies has ever paid any dividends and the Grafton, Uxbridge and Millbury (Millbury Electric Company to be purchased by the Grafton company) companies have large debts. In the applications for the approval of additional stock by the Uxbridge & Northbridge Company in anticipation of the consolidation, the companies have proposed to make substantial reductions in their present debts, which the board in its approvals of such applications has required to be done, and in the event of the consolidation the aggregate amounts of the capital stock and debt respectively of the consolidating companies will be diminished and not increased. Notwithstanding such reduction in the aggregate of the individual liabilities of the companies in question, the board has already found that the fair structural value of the plants will be less than the outstanding stock and debt and has prescribed in another order the conditions and requirements by which this impairment shall be made good. The board states that it may reasonably be expected that one large company will have greater physical and financial ability than the five relatively feeble companies and that by their consolidation, with relief from the burdens incident to their large debt, substantial advantages will accrue to the municipalities served. The board has approved of the issue by the Grafton Electric Company of 425 shares of new stock at the price of $100 per share. The proceeds of 230 shares, in combination with certain assets in possession of the company designated as "mortgage notes, interest prepaid," are to be applied to the cancellation of mortgage notes for $25,000 and certain notes for $5,020, all said notes of the face value of $30,020 being thereby liquidated and canceled; the proceeds of twenty-five shares are to be applied to the payment of obligations of the Upton Electric Company, and the proceeds of 170 shares are to be applied to the purchase of the Millbury company; and of the issue of 2225 shares, of the par value of $100 each, there are to be exchanged 2075 shares for the stock of the Uxbridge & Northbridge company and seventy-five shares for the outstanding stock of the Upton company. From June 30, 1910, the Grafton Electric Company is not allowed to declare or pay dividends in excess of 4 per cent of its stock until it shall have canceled out of income not less than $30,000 of its indebtedness or expended out of income this sum for additions to its plant, or for both purposes combined. The board has also approved the issue by the Uxbridge & Northbridge Electric Company of 1681 shares of new stock to meet the cost of plant extensions.

New York Commission News.

The Public Service Commission, Second District, has announced an investigation of the telephone charges collected by the New York Telephone Company for the transmission of messages between the Borough of Manhattan and the Boroughs of Brooklyn, Queens, Bronx and Richmond, and each of them, to determine whether such tolls are unjustly discriminatory or unduly preferential or in any wise in violation of law, and as to whether or not it shall determine the just and reasonable rates and charges to be hereafter observed and in force as the maximum to be charged, and as to whether these shall be other than the rates now charged. The company is required to appear before the commission at the Engineering Societies Building, New York, on Nov. 28 and submit evidence and arguments as to the matters which are to be investigated.

The order of the commission followed resolutions adopted by the Board of Aldermen of the City of New York asking that the commission make an order fixing the tolls for all telephone calls between any part of the Borough of the Bronx and any part of the Borough of Manhattan at not more than 5 cents for each call, which action was taken upon the filing of a complaint received from the people of the East Bronx; also asking the commission to investigate the inequality in charges between the Boroughs of Manhattan and Brooklyn and order reduction of such charge to 5 cents per individual call, or such sum as would give to the New York Telephone Company proper compensation for such service, also, on the complaint of the Prospect Park South Association of Brooklyn, asking the commission to investigate the rates charged between the Boroughs of Brooklyn and Manhattan. The last-named complaint recites that the company charges 5 cents for telephone service between the Boroughs of Manhattan and the Bronx as far as Kingsbridge, Williamsbridge and Westchester, while 10 cents is charged to Brooklyn, Flatbush or Bay Ridge, and that the volume of telephone business to and from Brooklyn and numbers of subscribers therein are both greatly in excess of the business to and from the Bronx. Complaint is also made about the practice of the New York Telephone Company which provides that discounts may be allowed when messages are contracted for in quantity, and it is alleged that this is a rebate or other device which constitutes unjust discrimination.

The records have been closed in the proceeding brought against the Dwaas Electric Company, doing business at Round Lake, Saratoga County, because of the fact that it had used $3,000 derived from the sale of stock for purpose other than that authorized in the order of the commission. Since the hearing held upon this matter Harold J. Werner, president of the company, has returned to the Dwaas Electric Company and canceled in accordance with the commission's recommendation $3,000 par value of the capital stock which was paid to him for the purchase of a franchise at Round Lake.

Wisconsin Commission News.

A suit is about to be brought in court to determine the legality of the commission's interpretation of a "public utility" as defined under the Public Utilities Law. The Public Utilities Law states that the term "public utility" shall mean and embrace "every corporation, company, individual, association of individuals, their lessees, trustees or receivers appointed by any court whatsoever, and every town, village or city that may own, operate, manage or control any plant or equipment, or any part thereof within the State, for the conveyance of telephone messages or for the production, transmission, delivery or furnishing of heat, light, water or power either directly or indirectly to or for the public."

The suit was filed by the executors and trustees of the estate of E. Harrison Cawker, deceased, of Milwaukee, against the Railroad Commission. They seek to restrain the commission from enforcing upon them the provisions of the Public Utilities act, or in any manner interfering with the operation of the heat, light and power plant in the Cawker Building.

When the Cawker Building was built a steam plant was installed for the generation of heat, light and power. Later it was found that it would be impossible to make use of the full capacity of the plant and that in order to operate it with economy it would be necessary to dispose of the surplus energy. Consequently contracts were entered into with three firms whose buildings adjoined that of the plaintiff. The suit was instigated upon the commission's demand that the plaintiffs comply with the Public Utilities Law and the threatened intention of causing the Attorney-General to prosecute them in case they failed to do so. Under the provisions of the law they would be liable to a forfeit of from $100 to $1,000 a day for each day of the violation of the law.

The plaintiffs showed that they have never applied for or received a permit from the City of Milwaukee to make use of any street or alley and that they have at no time declared that they are willing to furnish power to the public or to any person other than those now being served. Notwithstanding these facts the commission regards the concern as a public utility and as such subject to all the provisions of the Public Utilities Law. The commission considers it highly improbable that the court will render a decision which is adverse to the ruling of the commission, as to do so would take away many of the benefits intended to be derived from the enforcement of the Utilities Law. Especially would it harm those larger utilities which would have to meet competition from a number of small parasitic concerns, which, if permitted to operate without regulation, would encroach upon the legitimate business of the larger concern to the latter's evident detriment.

The commission recently held a hearing in the case of the City of Sheboygan vs. the Sheboygan Railway & Electric Company. The case concerned the question of the street-lighting service furnished the city by the respondent company. Mr. Henry Detling appeared for the city and Mr. E. R. Boler for the company. Messrs. Ernest Ganzenbach and W. B. White appeared as witnesses for the electric company. The city claimed that the arc lamps furnished by the company were not giving the candle-power called for in the contract and that furthermore the cost per lamp per year was excessive. The first contention was satisfactorily disposed of at the hearing, for it developed that the lamps used were 600-watt inclosed alternating-current arcs, which represented the highest development of commercial arcs at the time of their installation. A considerable amount of evidence was introduced by the defendant to prove that at the present price per lamp—$74 per lamp per year—the company was only paying the running expenses on that part of the system properly apportioned to the street-lighting service. The commission will investigate the evidence and will determine upon a rate which will enable the company to enjoy an equitable return upon a fair valuation of its arc-lighting equipment and that portion of the entire system which should properly be apportioned to this service.

The Monroe Electric Company has petitioned the commission for authority to issue $4,000 par value of bonds and $1,200 par value of common stock. The funds to be derived from the sale are to be used in paying a floating debt incurred by reason of acquiring certain improvements and additions to its electric plant at [illegible] Wis.

Canadian Hydroelectric Commission News.

Power from Niagara Falls was turned on during the week at Guelph, which city is the second to receive power from the commission, Berlin being the first, where a celebration was held a short time ago, as reported in these columns. It is expected that power will be delivered to Toronto within the next two weeks, and that the supply will by that time have been furnished to most of the towns and cities in the municipal union. It is proposed to have a ceremony at Toronto to commemorate the delivery of power to that city.

The commission and the City Corporation of Hamilton have come to open warfare over the question of the location of the right-of-way for the commission's line in that city. Negotiations have been held at various times in the past few months with a view to the contending parties coming to some agreement for the construction of the line from Niagara Falls, but the commission has served the Council with notice that it will not construct the line over the route chosen by the city, because its own engineers have selected another route which is better. The City Council, at a special meeting on Nov. 4, refused to accept any responsibility for the proposed route, and rescinded its previous resolution giving the commission the necessary authority to build the line through the city. It is likely that some agreement will shortly be arrived at between the commission and Council.

AMERICAN ELECTRICAL ENGINEERS—XVIII.

Jens Bache-Wiig.

Jens Bache-Wiig was born in Christiania, Norway, in 1880, where he received his primary and general education, finishing the latter in 1898. One year of this period was spent in a machine shop. In the spring of 1898 he entered the Ingenieurschule of Zwickau, Saxony, from which he was graduated in the fall of 1900. He then went to the Technische Hochschule in Karlsruhe, Germany, and followed a two-year course in electrical engineering, finishing in the fall of 1902.

Jens Bache-Wiig.

Upon the completion of his studies, Mr. Bache-Wiig entered the service of the Gesellschaft für Elektrische Industrie, located in Karlsruhe, working as an engineer in the designing department, and about a year later was placed in charge of this department, which position he held until the spring of 1906. During this period this company's lines of alternating current and direct-current motors were entirely redesigned, and it was also developing various other apparatus, including transformers and controlling devices, the design of which was similarly in charge of Mr. Bache-Wiig. As of special interest may be mentioned his participation in the design of direct-current and alternating-current turbo-generators which this company developed during this period in connection with its "Electra" steam turbine.

In the spring of 1906 Mr. Bache-Wiig came to the United States and entered the power division of the engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburg, Pa. This division includes the design

of alternating-current generators, synchronous motors and rotary converters, and from the beginning of the present year he has had charge of the section including this latter class of apparatus. During the time he has been connected with the company he has taken part in the design of its standard and special alternating-current generators, motors and rotary converters. Among work of special interest with which he has been connected may be mentioned a line of high-speed, 60-cycle, 600-volt, self-starting rotary converters now on the market in sizes up to 1000 kw; the development of 25-cycle rotaries up to and including 3000 kw, this latter being probably the largest rotary so far manufactured; the development of rotaries for variable direct-current voltage, by means of direct-connected alternating-current boosters; and the development of self-starting synchronous motors for various uses, in sizes up to 4000 hp.

Mr. Bache-Wiig has made a number of contributions to the technical press and to the transactions of engineering societies, among which may be mentioned the following: "Method of Measuring and Calculating Iron Losses in Induction Motors," *Elektrotechnische Zeitschrift*, 1906; "Application of Tractional Pitch Windings to Alternating-Current Generators," *Transactions* of the American Institute of Electrical Engineers, 1908.

CURRENT NEWS AND NOTES.

Impedance Paradox.—In the numerical calculation of the variable resistance r at Z_{max}, on page 876 of our issue for Oct. 13, in a letter from Mr. H. F. Hagen discussing a certain impedance paradox the quantity 10^2 appears in the formula where 10^4 should have been used. The calculations have been made correctly, the error being wholly typographical.

Electric Lighting in Constantinople.—The Turkish Ministry of Commerce and Public Works has awarded the electric lighting concession for the European quarter of Constantinople to the Société Ganz and others, subject to the approval of the Council of Ministers. The rest of the group of concessionaires is composed of French firms with headquarters in Paris.

Wireless Stations in East Africa.—Within the past few years wireless telegraph stations have been established at five points on the Italian Benadir coast and on the Islands of Zanzibar and Pemba. The first five stations are owned and controlled by the Italian government, the latter by the Zanzibar authorities. Additional stations are now being discussed for the mainland at Mombasa, in British East Africa, and in German East Africa.

Gas and Gasoline Street Lamp Candle-Power.—During a recent municipal investigation in Chicago it was found that 9.1 per cent of the gas-mantle lamps fell in the categories of "bad," "very bad," "out," "no chimney" and "broken glass." Photometric measurement of mantle lamps that could be classed as passable and which are rated at 60 cp showed a range from 10.6 cp to 41.6 cp, with an average of 24.8 cp. Gasoline lamps rated at 60 cp showed, on a test of twenty, an average of 19.45 horizontal cp.

Electrical Energy in Steel Works Construction.—A rather extensive use of electricity is made in the construction of the new steel works of the Minnesota Steel Company, at New Duluth, near Duluth, Minn. The works will represent an investment of $10,000,000 or more, and construction work has been under way for some time. A temporary steam-driven electric generating plant, rated at about 500 hp, has been installed, and a cement plant, hoists, derricks, conveyors, etc., are operated by motors supplied with electricity by temporary circuits. The company itself is doing the construction work.

Civil Service Examination for Mechanical and Electrical Engineer.—The United States Civil Service Commission announces the postponement to Dec. 7, 8 and 9 of an examination advertised to be held Nov. 9, 10 and 11 to secure eligibles for a vacancy in the position of inspector of mechanical and electrical engineer in the office of the Supervising Architect, in the Treasury Department at Washington, at $2,190 per annum. The duties of the position consist of inspecting and testing the mechanical and electrical equipments entering into the modern government or office building. Applicants should apply to the Washington or other office of the commission for examination form No. 1312.

Boston "Edison Life" Discontinued.—The October issue of *Edison Life* announces the discontinuance of that publication. The periodical had been sustained by the Edison Employees' Club of the Edison Electric Illuminating Company of Boston, and the announcement states that the club is not in a position financially to publish a paper to further the purposes for which it was established, namely, to be a medium of communication between the various members and the departments of the Edison company, and to arouse enthusiasm among club members. It is stated that the results have not been in accordance with the time, labor and expense involved.

Gas Companies and the "Ultra-Violet Ray."—"Beware of the ultra-violet ray" reads an advertisement in a Milwaukee paper for the new "Amber Light," a yellow-colored incandescent illuminant, which is the latest gas unit brought forward to compete with the tungsten lamp. "Most modern artificial lights owe their dazzling qualities to their ultra-violet rays," the advertisement continues, and then paradoxically remarks: "These ultra-violet rays are not visible—they are the rays that produce the chemical changes on the photographic plate. The same rays produce similar changes in the tissues of the eye. The effect is irritating and harmful. It is responsible for most of the eye-strain troubles," etc.

Inspection of Electric Meters in Chicago.—A recent report of the Merriam Commission on City Expenditures in Chicago notes that no appropriation has been made for the purpose of operating a bureau of inspection for consumers' electric meters created by the City Council. Consequently the ordinance creating the proposed bureau remains wholly inoperative and there is no officer charged with the duties imposed upon the bureau by the ordinance. Mr. William Carroll, the city electrician, has said that he does not believe it necessary to have such a meter inspection bureau, although he has included a recommendation for an appropriation for it in his departmental estimates because of the action of the City Council.

Advertising Ozonizers.—Within the last year or so there has been a notable increase in the amount of advertising of electrical appliances in daily newspapers and popular magazines. Lamps, fixtures, motors, batteries, electric vehicles, washing machines, electric flatirons, low-voltage transformers, electric toys and other electrical apparatus are advertised in periodicals of general circulation. A late addition to this list is the ozonizer. A recent cartoon in a Chicago daily represented children in a schoolroom drooping from the influence of a nebulous adversary labeled "Foul Air." The artist asked the question, "Cannot modern science banish the specter?" A maker of ozone machines promptly reproduced the picture and answered "Yes" in an effective "ad."

Number of Fire-Alarm Boxes on a Circuit.—A recent independent investigation showed that the fire-alarm and police-telegraph systems in Chicago are maintained in an efficient condition. The practice of the Department of Electricity, which has this service in charge, is to maintain about thirty alarm boxes on each circuit and so arranged that there is no danger of two boxes on the same circuit being "struck" for the same fire, thus interfering with the alarm. It has been possible to adhere to this rule generally, but in some cases the number of boxes has been greatly increased, up to as high as seventy on a circuit nearly thirty miles long. It has been recommended that the system should be subdivided thoroughly to keep down the number of boxes on a circuit and the length of circuits.

Nobel Prize for Physics.—The Nobel physics prize has been awarded to Prof. Van der Waals, who has been connected with the Amsterdam University since 1877.

Next N. E. L. A. Convention.—Though no definite decision has yet been announced, it is probable that the 1911 convention of the National Electric Light Association will be held in New York City. The Hotel Astor and the Engineering Societies' Building have been suggested as headquarters, and the exhibit feature may be omitted next year.

Proposed Illinois River Waterway.—A dispatch from Washington, D. C., states that the deep waterway plan for the Illinois River favored by Governor Deneen, of Illinois, is reported to be feasible by the board of government engineers appointed to study the subject. This plan contemplates a 9-ft. channel and the development of the incidental water-power, which is expected to yield a large revenue. While the board indicates a preference for the Deneen plant it is said to be unable to report to Congress any method of co-operation between the Federal government and the State of Illinois in relation to joint construction of the waterway. As a result, it is not likely that the aid of the national government can be procured until the next Congress meets a year from next month.

North Shore Electric Company Branch of N. E. L. A. Elects Officers.—At its first meeting of the present season, held Friday evening, Nov. 4, the North Shore Electric Company (Chicago) branch of the National Electric Light Association elected officers for the ensuing year. Mr. C. W. Pen Dell was chosen chairman; Mr. H. L. Judd, vice-chairman; Mr. E. G. Schuettge, secretary, and Mr. F. B. Minard, treasurer. A board of control was appointed, comprising, together with the newly elected officers, Mr. J. S. Reesman, the retiring chairman; Mr. A. B. Fitzgerald and Mr. A. Alsaker. Following the business session and the hearing of reports from the various officers and committees the branch members took up the discussion of technical questions propounded in the October issue of the N. E. L. A. Bulletin. The present membership of the North Short Electric Company branch is 106, approximately half of whom were present at the November meeting.

Formation of Sleet on Aluminum Lines.—An engineer who has had an opportunity to compare the behavior of both aluminum and copper transmission lines during severe sleet storms in the northern-border states declares as his experience that, in spite of the larger diameter of the aluminum conductors and their consequently greater surface area on which to collect heavy loads of ice, aluminum transmission lines have come through the heaviest storms without injury, while copper lines suffered badly from the weight and windage of their icy envelopes. The explanation given for this tendency of aluminum to avoid collecting sleet is based on the surface coat of aluminum hydroxide which gives the metal its oily appearance and feeling. Water which strikes the aluminum wire thus does not "wet" the surface and so does not adhere long enough to be frozen into sleet.

Baltimore Telegraph Service Partly Disabled by Early Snowstorm.—Baltimore experienced a snowstorm last Thursday night which lasted over the next day. Although the snow was not heavy, the velocity of the wind was such as to make it appear for a short time that a blizzard was imminent. As a result the Postal Telegraph Company was cut off from communication with New York except by roundabout methods from 9 o'clock until midnight. Another effect of the storm was an informal "quiz" class at the Johns Hopkins University on all of the lectures that had been conducted up to that time by the Illuminating Engineering Society. Only two lectures instead of the usual three were given at the university last Thursday, as it had been planned to have the visiting light scientists attend the aviation meet. The storm prevented the carrying out of the original plan and the "quiz" class was held during the time that the third lecture would have taken place.

Municipal Regulation of Central Station Rates.—The Board of Public Words, of Indianapolis, Ind., has taken under advisement a petition to compel the Indianapolis Light & Heat Company to publish a schedule of classified rates with a view to prevent discrimination. The company's attorney contends that the board had no authority whatever on the question of what rates the company should charge, so long as it did not exceed the maximum rates of 10 cents per kw-hour prescribed by the franchise. He denied that there were discriminations; that the company is governed in its rates by certain conditions, such as distance from plant, amount of consumption, minimum monthly charges and time of service in making special contracts. It was asserted by the petitioners that the ground floor of the Newton Claypool Building has a 6-cent rate, with no minimum monthly charge; that on the second floor 9⅜ cents is charged and on the third floor 12½ cents, including renewals. The city legal department gave the board an opinion that it could require the company to file a classification of rates and that the board would have the right to disapprove the schedule if deemed unfair.

Mechanical and Dielectric Strains in High-Tension Porcelain.—The relation between mechanical and electrical strains in insulators for high-tension lines has been realized sufficiently to cause the insertion of clauses in many insulator specifications requiring that the application of the test potential be made while the insulator is subjected to its rated mechanical stresses, just as if it were supporting a line-wire span. Good evidence of the fact that insulating material, such as porcelain, will break down electrically much more readily when under mechanical strain was afforded by the experience of a Western hydroelectric company which had great trouble with its high-tension entries where the transmission lines were brought through tubes at the centers of circular insulating disks. These tubes were fastened rigidly to the supporting disks, and at frequent intervals, whenever line conditions passed slightly beyond the normal, the tubes would be shattered with a loud report. Realizing that with the construction used any movement of the wires in the wind outside caused strains in the insulator tubes, it was decided to mount the tubes loosely in the supporting disks so that they would be free to move slightly with the wires. After this slight change was made the entry-insulator trouble, which had become really serious, entirely disappeared.

Modern Uses for the Telautograph.—Although by no means a new device in principle, the telautograph, invented by Elisha Gray about twenty years ago and since greatly improved, continually finds new, useful applications in modern life. A number of New York banks have these instruments installed in their tellers' cages for communicating with the book-keepers in certifying checks presented for payment. If the teller is in doubt of the balance standing to the credit of the account on which the check is drawn he picks up the telautograph stylus, unknown to the customer, writes the name of the depositor, which is reproduced in the book-keeping department, and at once receives the amount of the balance. The protective value of the device for this purpose is fully appreciated by banks where book-keepers are separated from the tellers' cages, perhaps at some distance. Several Chicago clubs, among them the University Club and the Chicago Athletic Club, have installed telautographs for "paging" purposes. The first has twenty instruments and the latter eight, located in the various floors and rooms. When a member is called for his name is reproduced on the roll of each machine, and the attendant in the room can quickly observe if the member called is in his department. In this way any member summoned can be located within two or three minutes without confusion or embarrassment through the calling of names.

RECONSTRUCTION WORK IN SALT LAKE CITY.

mprovements and Additions to the System of the Utah Light & Railway Company, of Salt Lake City.

THE property of the Utah Light & Railway Company, of Salt Lake City, has been undergoing thoroughly systematic rehabilitation and extensive improvements since ontrol passed to the Harriman interests about four years ago. he change in ownership took place soon after the City Council f Salt Lake City had granted the company a fifty-year franhise, and, although some of the improvements are conditional pon the existence of the franchise, most of them have been ıade with a full realization of the necessity of placing the sys- :m in excellent condition, with a view, of course, to the ultimate eturn on the investment. That this return will not be brought bout for several years is indicated by the large sums which have een expended in the past three years and which have been stimated for improvements now under way and in contemplaon. With an expenditure of nearly a million for the recontruction of the underground and railway plant, about a half ıillion for a new steam station and one and a half millions for nprovements and additions to its generating system, it can :adily be seen that Salt Lake City is receiving the direct benet of large expenditures which will not bring any return to the ıvestors for many years.

After the new interests took control it was found that the ıost pressing needs were for the railway system and the disibuting system. The first and second years were accordingly :evoted to general reconstruction along a carefully worked out an. The track of the railway system was rebuilt to the extent f about 80 per cent of the mileage, in the central district the old nter-pole type of construction was replaced with side-pole span ınstruction, feeders were placed underground, new rolling ock was added, extensions were made to the track, and modn car houses and shops were built on a ten-acre tract in the ırtheast portion of the city. The improvements in the disibuting system have consisted principally in placing the sysm underground and they are described in some detail below.

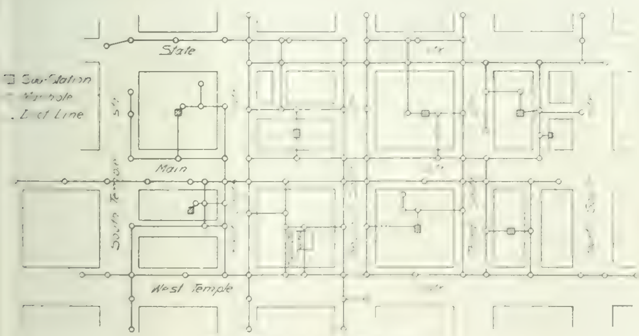


Fig. 1—Map of Conduit System.

The year 1910 is popularly known by the officials of the comny as the "power year," the work of the year including the ginning of a large new central steam reserve station in Salt ıke City, the construction of a new water-power plant on the eber River and general improvements in the transmission tem.

CONSTRUCTION OF [illegible] SYSTEM

Under the terms of the new franchise the Utah Light & Railıy Company was required to remove all pole lines on streets the commercial district and to operate its distribution sysıns through underground conduits within the limits of the disct. Consideration was at first given to the customary method construction for cities the size of Salt Lake City, by means underground vaults in the streets with junction boxes, concting conduits, etc. However, a condition exists in Salt Lake ty which is peculiar and which required special consideration. This condition is due to the exceptional width of the streets, 132 ft., and the unusual length of the blocks, they being 660 ft. from curb to curb, or 792 ft. from street center to street center. There are approximately seven blocks to the mile and each block is ten acres in area.

After plans had been practically worked out for the usual vault construction and after the principal Eastern cities had

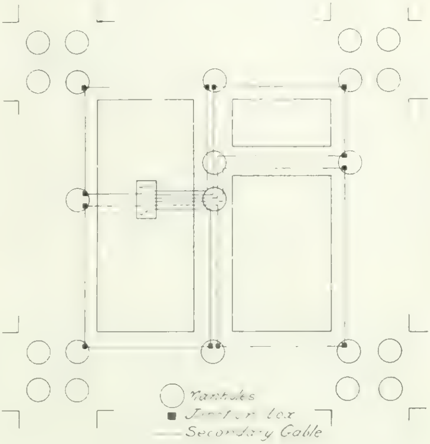


Fig. 2—Map Showing Secondary Cable Ring Circuits.

been visited in order to profit by their experiences, Mr. O. H. Honnold, electrical engineer for the company, devised a scheme which seemed to solve the principal difficulties. His ideas were carefully worked out by the company's engineers and, the advantages being so apparent, the plan was adopted in its entirety.

The system, in brief, consists in doing away with the underground vaults and manholes and placing all the transformers and switching apparatus in substations located in the interiors of the blocks. Double lines of conduits were installed on each street. Radiating from each station were laid four duct lines connecting with the adjacent streets at the nearest points through manholes. This construction eliminated the necessity for large manholes and subway-type transformers. The duct lines are located 4 ft. from the curb of the street and are cross-connected at street intersections. The system handles alternating-current motor and arc circuits and direct-current three-wire and railway circuits.

An outline map of the conduit system is shown in Fig. 1, the substations, manholes and duct lines being indicated in the eight central blocks in which the system has thus far been installed. Theoretically, the idea was to locate the substations in the centers of the blocks, but on account of existing buildings or property interests it was not always possible to do this. Sites were chosen as near the geographical center of the blocks as possible, and where practicable on alleyways or courts.

The construction of the conduit system was begun in the summer of 1907 and up to date the company has installed approximately five miles of conduit, or fifty miles of single-duct line. It is composed of bituminized fiber ducts laid in concrete. The joints are of the male and female type, connected by means of hot asphaltum, thus making the ducts practically water-tight. An inch spacing left between ducts is filled with fine concrete, and strength and protection are provided by an outside covering of about 3 in. of coarse concrete.

The manholes and service holes are built with brick walls, and

floor and roof of concrete, the latter being reinforced. Cast-iron manhole heads and covers are provided. The manholes are of various sizes and shapes, being square, rectangular and elliptical and varying in depth from 4 ft. to 20 ft. to conform to the condition of the duct lines. The service hole covers are water-tight, though the manhole covers are perforated with 1-in. holes for ventilation. Sumps for drainage are provided in the bottoms of all manholes and service holes. These do not afford

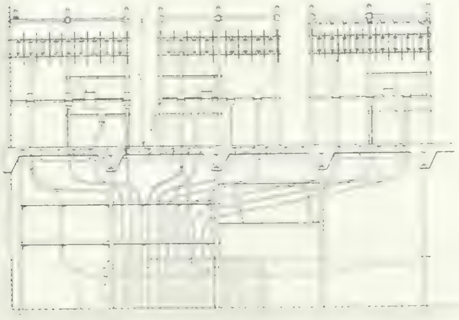


Fig. 3—Fuse Rack, West Temple Station.

sufficient drainage, however, because of the large quantity of water entering during street flushing. The city ordinance forbids sewer connections.

Paper-insulated, lead-covered cable has been adopted as standard for conduit lines. Approximately forty miles of various kinds and sizes of lead cable are in operation.

The secondary cables are 1/0, 3/0, 4/0 and 250,000 circ. mil in size, three-conductor and insulated with 1/8-in. paper for 240-volt potential. The secondary cables are tied together in ring form where possible and connected directly to the secondary busbars in the substations of each block. Wherever it was convenient to install the necessary duct lines, the blocks were divided into quarters, making four independent secondary rings radiating from the substation. These rings or individual circuits may be bused or connected together at the quarter points or corners, or separate blocks may be tied in through conductors at street intersections. Fig. 2 shows a typical block with the four secondary cable-ring circuits entering at the substation and arranged for interconnection midway between street intersections.

Junction boxes are installed at all corner manholes of the secondary ring circuits to facilitate connecting two or more cables together and to aid in disconnecting any cable from circuit in case of a breakdown on the cable. It can readily be seen that this is a very flexible and advantageous arrangement, as practically any portion of a cable can very readily be isolated in case of trouble. Furthermore, it permits the two circuits carrying the lightest loads to be thrown in together on one phase at the substation, each of the two other circuits being carried on a separate phase, thus balancing the load.

Service cables are connected through lead sleeve joints to the secondary cables and three-pole enclosed-type service boxes are interposed between the lead service cable and the customer's main to protect the cable in case of short-circuits on the customer's wiring. No great amount of expense was necessary in changing the service connections to the underground system, as the company long ago foresaw that underground conduits would have to be installed and for many years had made all service connections underground from the street poles.

For the railway feeder system there are used 500,000-circ. mil, 750,000-circ. mil, 1,000,000-circ. mil and 1,500,000-circ. mil single-conductor cables insulated with 5/32 in. paper for 600 volts. Separate cables are provided for each railway section and the system is so arranged by means of terminal boxes on the trolley poles that the overhead lines can at different points be interconnected by the use of copper connectors, thus making it possible to cut out of circuit any cable becoming damaged and needing repairs.

The direct-current 250-500-volt system is divided into six separate circuits with 500,000-circ. mil and 300,000-circ. mil single-conductor feeders, and 2/0 and No. 2 duplex lateral cables insulated with 5/32-in. paper for 500 volts potential. The secondary ground is used for the neutral on the direct-current circuit. It is tied in with the copper railway return cables at frequent points to afford ample carrying capacity for the unbalanced load. Enclosed-fuse type junction boxes are interposed between mains and laterals for protection to the mains in case of breakdown on the lateral cables or services. All service cables are joined to main or branch cables by means of lead sleeves and connected to enclosed-fuse service boxes on the customer's premises.

Series arc circuits, both for the residence section and for the commercial district, are fed through the underground system from the central station by means of duplex and quadruplex cables. These cables consist of two or four No. 6 wires insulated with 8/64-in. paper for a working pressure of 5000 volts. The arcs are of the luminous type and have proven very satisfactory. The lamps hang on ornamental goose-neck brackets at the top of the steel tubular trolley poles. In the principal business streets four arcs are located in each block, and in less important streets three or two arcs. There are eighty-five arcs in the commercial district and eight circuits in the residence section.

The primary cables leading from the central station to the substations are of No. 4, No. 2, 3/0 and 250,000-circ. mil sizes three-conductor, insulated with 4/32-in. and 3/32-in. paper for 4000-volt potential. Each substation is direct-connected with the central station through an oil switch by a separate primary cable, which is protected by expulsion-type fuses on the primary bus-rack in the main station. Fig. 3 illustrates the fuse-rack in the central, or West Temple, station.

Duplicate primary cables have been installed with one tap to each substation. These are carried through different streets and are intended for emergency connection should the primary cable be damaged or the circuit interrupted. Fig. 4 gives a plan of the primary cable distribution. Each duplicate primary cable is operated alive and thrown into circuit with an oil switch in the substation. This switch is normally left open. Fig. 5 is an interior view of one of the substations showing the primary cable, oil switch and one of the large-size lighting transformers.

Energy for the railway lines and the commercial district circuits is brought at 4000 volts from the company's Jordan River substation to the West Temple Street central station by means of six 250,000-circ. mil cables, the lines being carried on First South and Second South Streets.

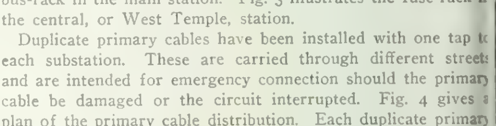


Fig. 4—Showing Primary Cables, Underground System.

SUBSTATIONS.

There are at present nine transformer substations and one subway vault connected with the underground system in Salt Lake City. The buildings are built with brick walls, reinforced

ete roofs and concrete floors and cable pits, and are, there- practically fireproof. Special attention has been paid to the lation of each building. This is accomplished through ers in the walls near the floor and a galvanized-iron ven- r on the roof. Windows have been installed wherever they needed. The buildings vary in size from 8 ft. x 14 ft. to . x 18 ft. Fig. 6 illustrates one of the substations and the connection to overhead motor circuits for distribu- n the interior of the block.

e equipment of each substation consists of separate trans- ers for lamp and motor circuits, oil switches, secondary ack and the necessary attachments. The transformers for circuits are of two sizes, 125 kw and 50 kw, with the ex- n of the two at the Oregon Short Line depot vault, which f the 40-kw subway type. The transformers are wound primary tension of 4000 volts and for 120-240 volts on the dary, and are connected in multiple on both primary and dary sides. The secondary leads are tied solidly to the dary busbars, while the primary taps are connected gh Westinghouse open-type 4500-volt fuses to the primary or protecting the transformers and cables against short- s on the secondary cables. Fig. 7 shows these secondary

path for all stray railway currents that may be picked up by the lead cables. Tests were made to ascertain how much railway current was returning on lead cables, and it was found that a considerable quantity was flowing without heating the lead sheathing or having any apparent electrolytic action.

As has been just mentioned, the results from operation by means of these transformer substations have been remarkably satisfactory. Although the great length of duct necessary to make connections from the streets to the substations in the interior of each block, together with the cost of the buildings, has made the first cost of the system rather high, this disadvantage has been entirely overbalanced by the many advantages gained. The large-size vaults necessary for housing subway transformers have been entirely eliminated, together with the inconvenience of getting into them and the expense of their maintenance. The liability to interruption of service due to breakdowns of transformers on account of flood waters is prevented by placing them in dry, well-ventilated substations that are readily accessible at all times. The use of large-size transformers with ample radiating surfaces makes it possible to reduce the core losses to a minimum, an item in itself of no small moment. Safety to the attendant and ease of operation are ob-

. —Interior of Substation. Primary Oil Switch and Lighting Transformer.

Fig. 6—Substation and Connection to Overhead Circuits.

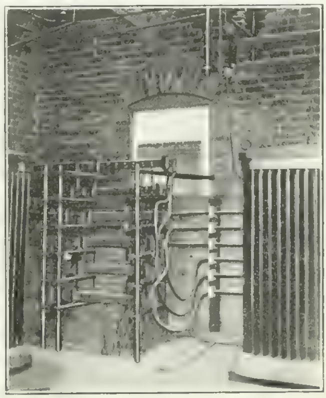


Fig. 7—Secondary Busbars with Open-Type Primary Fuses and Lighting Transformer.

s with the open-type primary fuses and one of the trans- s for lighting loads. It has been found from experience t Lake City that, unless the transformers are working early up to their fused capacity, a secondary short-circuit urn itself free before blowing the primary fuse and in- ing the circuit. The transformer installations for motor s are of the pole type, as shown at the right in Fig. 8. are connected "star" or "delta" on the secondary side and e on the overhead lines in the interior of the blocks.

present connected transformer capacity in the substations kw, while the total load on the underground system is w. The underground portion of the system has been in- to take care of an increase of 50 per cent over the pres- nnected load, while the secondary cables and stations are ough to provide for four times the present capacity. The f the first eight substations was approximately $325,000. tricity was first turned on the cables about Nov. 1, 1908, e system has been in continuous operation since without own due to defective cables or joints. The transformers sed for about 80 per cent to 90 per cent overload to mini- nterruptions to service due to temporary overload or uts, though they are amply protected against secondary ircuits.

primary, arc and railway cables are well bonded to the e railway bus at the central station, while the secondary of each block are bonded to primary cables at the point to the central station so as to afford an unbroken

tained by having all transformers above ground and the primary connections well insulated. Owing to the fact that the blocks cover such large areas, many warehouses and small manufacturing establishments are located in the interiors of the blocks in the rear of the store buildings. All of these are easily accessible from the substation, affording short, inexpensive service connections.

All of the underground work was planned and carried out under the supervision of Mr. O. A. Honnold, electrical engineer; Mr. W. M. Scott, superintendent of electric lines and service, and Mr. C. H. Jenkins, assistant superintendent of electric lines and service.

IMPROVEMENTS AND ADDITIONS TO GENERATING SYSTEM.

As already indicated, about a year ago the Utah Light & Railway Company began to direct its attention to the improvement of the extensive existing generating system and the addition of new plants to keep pace with the growth of the distributing system and the consequent demand for electricity The generating system of the company includes both steam and hydroelectric plants, the latter being located at different points in the Wasatch Mountain east of the city. There are two plants in the Cottonwood Canyon, sixteen miles southeast of Salt Lake City, with a combined capacity of 6000 hp, while 5000 hp additional is available at the Pioneer plant at the mouth of Ogden Canyon, thirty-seven miles northeast of the city. A 1750-hp reserve steam plant is located at the Jordan River station in Salt Lake City, while energy is purchased from the transmis-

sion system of the Telluride Power Company and from the plant of the Utah-Idaho Sugar Company, located in Bear River Canyon, eighty-five miles north of the city. The switching of lines from these several sources and the synchronizing of the company's water-power plants are controlled from a main receiving station at the Jordan plant in Salt Lake City equipped with water-cooled transformers and oil-break, high-tension switches. Nine water-power and three steam stations are handled from this switching station.

The company has just completed at Devil's Gate, on the

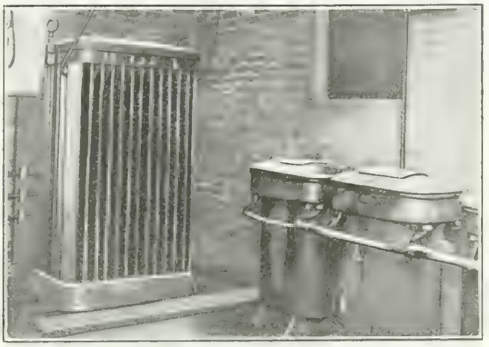


Fig. 8—Pole-Type Transformers Feeding Motor Circuit and Lighting Transformer.

Weber River, twelve miles southeast of Ogden and about thirty miles northeast of Salt Lake City, a 4000-hp hydroelectric plant to meet the increasing demand for service. The plant uses the water from the river by means of an overflow, reinforced-concrete dam located about three miles from the mouth of the canyon. The dam has a spillway 65 ft. long at the crest and rises 14 ft. above the bed of the stream, the total average height to bedrock being about 20 ft. The end abutments provide for an overflow 4 ft. deep. A row of eleven 5-ft. circular openings through the base of the dam, controlled by wicket gates, provides for additional waste flow. At one end of the dam is a fishway and at the other is the intake, which is 20 ft. in width and leads into a 7-ft. concrete conduit. The dam creates a pond about half a mile in length, which is as large as could be installed, because the right-of-way of the Union Pacific Railroad Company's main line follows the canyon at this point and, of course, could not be encroached upon. The reservoir provides a storage for three or four hours' run. The intake is controlled by an 8-ft. vertical-stem steel wicket gate.

The concrete conduit conveys the water down the canyon 2000 ft., where connection is made with a 74-in. wooden-stave pipe that continues 7075 ft. to the pressure main of the power house. The concrete pipe has a shell 9 in. thick, reinforced with 4-in. mesh American Steel & Wire Company's woven-wire fabric, and is designed for pressures of 5 lb. to 9 lb. per square inch. At one point the conduit crosses under the railroad right-of-way by means of a reinforced concrete culvert, 191 ft. long and of massive construction.

The wooden-stave pipe is built of 3-in. x 6-in. yellow fir staves according to customary Western practice, the bands consisting of 5/8-in. and 3/4-in. mild-steel round rods, spaced on 3-in. centers. Near its upstream end the pipe is carried across the river on a 7.5 per cent grade on a 99-ft. span-riveted steel truss, the pipe resting in steel cradles at each panel point. For the greater part of its length the pipe is laid in a trench, it being subject to a static head ranging from 9 lb. to 77 lb. per square inch. At the power house the wooden pipe empties into a double-riveted steel pipe, 75 ft. in length, which connects directly with the water-wheel in the power house.

The power house is a one-story brick structure (Figs. 9 and 10), 46 ft. wide by 76 ft. long, the generator room being [illegible] ft. wide, extending the length of the building. The generating unit consists of a Francis impulse turbine, built by the Pelton Water-Wheel Company, of San Francisco, direct-connected to a 23 volt, 2500-kw, 60-cycle, three-phase Western Electric alterna The water-wheel is designed to develop 5000 hp at full-g opening, with an efficiency of 81 per cent, and operates under effective head of 135 ft. A Pelton governor belted to the sh of the unit regulates the supply of water to the turbine. bank of four Westinghouse oil-cooled 875-kva transformers used to step-up the potential to 46,000 volts for transmissi General Electric lightning arresters of the electrolytic type a Pacific Electric high-tension switches are used.

The transmission line, built specially for this plant, is of ste tower construction, carrying two circuits, and is four and o half miles in length to the point of juncture with the m Ogden-Salt Lake transmission line. It carries No. 1 solid, ha drawn copper wire, with a 5/16-in., 6000-lb. standard galvani ground wire over each circuit and grounded at each tower. the main line junction disconnecting switches are install while at the station similar open-air disconnecting switches installed, supplementing the oil switches.

In order to have reserve capacity sufficient to provide agai breakdowns in the water-power system the company is n building in Salt Lake City a thoroughly modern steam stat Every Western city which is largely dependent upon hyd electric plants for its principal supply has been forced to ins a large steam (or gas-engine) station near the center of tribution to provide for the contingencies of breakdowns so frequently are caused by storms. This has been the exp ence in the cities of Los Angeles, San Francisco, Portland Seattle.

In Utah there have been times, during an east-wind st when all the transmission systems centering in Salt Lake have been put out of service and when it has taken sev hours before connections could be restored. It is evident such emergencies must be provided for, and it is planned the new station in Salt Lake City will be capable of taking c of the main part of the load, that is, the railway and comm cial load, when called upon to do so.

The new station is located at the Jordan River substat where ample condensing water can be obtained. It will be b on the unit plan, the first structure having a capacity of 10, hp. The building will have a steel frame, supplied by the Moines Bridge Company, and will rest on a pile and conc foundation. About 1500 piles, averaging 36 ft. in length, now being driven for the foundation. A concrete slab 4 ft

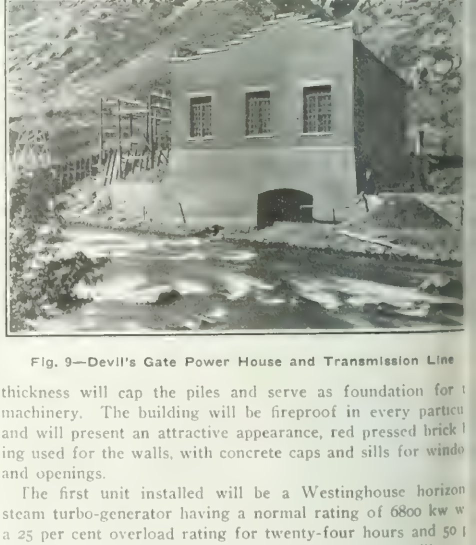


Fig. 9—Devil's Gate Power House and Transmission Line

thickness will cap the piles and serve as foundation for t machinery. The building will be fireproof in every particu and will present an attractive appearance, red pressed brick ing used for the walls, with concrete caps and sills for windo and openings.

The first unit installed will be a Westinghouse horizon steam turbo-generator having a normal rating of 6800 kw w a 25 per cent overload rating for twenty-four hours and 50 cent overload for one hour. The boiler equipment will cons

of six 600-hp Stirling water tube boilers, fed by overhead coal bunkers through gravity chutes and equipped with Roney automatic stokers. The condensing apparatus will be of the Le Blanc type. Coal and ash conveyors will be installed, and other modern devices, so that the station will be a model one. A feature of the plant will be the stack, 225 ft. high., 11 ft. 6 in. in diameter at the top, and built of Kellogg radial brick. A sign reading "Utah Light & Railway Company" on the city side will be worked in with black brick. The sign will be 118 ft. from the ground, formed of letters 4 ft. high, and it will be possible to read it from Fort Douglas, several miles distant, on the opposite side of the city.

The station will have a bench-board control, a storage battery being provided for electrically operating all switches, relays, etc. It is expected ultimately to control all outgoing lines from the new station. The present switching station, which adjoins the new building, now controls all the low-tension and high-tension incoming lines.

The lines coming in from the water-power plants are sectionalized and each section of load is controlled from a bench-control board. In case of trouble on the lines, in nine cases out of ten, it is possible to trip out the bad section and avoid any effect on the distributing system other than a flicker in the light. This arrangement is, of course, particularly valuable in stormy weather. The new steam plant will be synchronized with the rest of the system and will be connected so as to take up the load automatically in case any part or all of the trans-

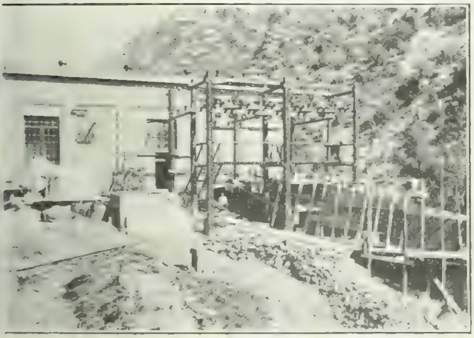


Fig. 10—Devil's Gate Power House.

mission system is cut out. For the present the 750-kw reciprocating-engine unit and the 1000-kw turbine unit forming the original steam reserve plant will be continued in service.

It is planned to have the new station in operation by March 1911, the turbine unit to be ready about Feb. 1. The station has been designed by the engineering department of Messrs. Westinghouse, Church, Kerr & Company, in conjunction with the engineers of the Utah Light & Railway Company. It is being erected by the former company, Mr. R. W. Stovell being the engineer in charge, with Mr. H. A. Brinkerhoff as resident engineer and Mr. O. A. Honnold, electrical engineer of the Utah Light & Railway Company, in direct supervision of the work.

STEEL TOWER TRANSMISSION LINE.

The third important improvement or addition to the generating system of the company is a new steel-tower transmission line which is now being installed between the Ogden plant and Salt Lake City. This line will be thirty-seven miles long and will carry two three-phase circuits of No. 0 seven-strand hard-drawn copper. Ohio Brass Company suspension-type insulators will be used with two units in suspension for the straight runs and three units at strain points. The line will be operated at 45,000 volts. A No. 4 steel telephone circuit will be carried below the transmission circuits, while above each of the latter will be installed a 5/16-in., 6000-lb., stranded, galvanized-iron ground wire. The advantage of a wire of this nature, grounded at each pole or tower, has been very frequently demonstrated on the Utah transmission lines.

The steel towers are of the Riter-Conley type, 65 ft. high above the ground. The height to the lowest wire is 45 ft. and the cross-arms are spaced 5 ft. apart, the three wires of each circuit being carried in a vertical plane without transposition, with a 12-ft. distance between circuits. The ground wires are 5 ft. above the top transmission wires. The towers are spaced 600 ft. apart. The first tower at the power-house end is shown at the left in Fig. 9.

The company is now remodeling the switching apparatus along the Ogden-Salt Lake transmission line, putting in new 45,000-volt oil switches and electrolytic-type lightning arresters at the Pioneer and Jordan plants preparatory to raising the voltage to 45,000 volts when the change is made from the present wooden-pole line to the new steel-tower line. New oil-insulated, water-cooled transformers are being installed at the Pioneer plant for the 45,000-volt transmission line.

The considerable increase in the number and size of the cars operated on the railway system in Salt Lake City has called for an increase in energy supply, which has been met by the installation in the West Temple Street central station of two 1250-kw motor-generators. For the direct-current lighting system a large storage battery has been added to the equipment of the same station.

The company has recently extended its railway lines twelve miles south to Bingham Junction and to Sandy and Midvale. To take care of the load in that section it has built a substation one mile below Murray, which will receive energy through a tap from the Cottonwood transmission line. A similar station is also to be erected in the southeast portion of the city to provide for the rapid growth of that section. Both of these substations will feed railway, motor and arc circuits.

Acknowledgments for valuable assistance in collecting the above data and illustrations are hereby made to Messrs. O. A. Honnold, electrical engineer; L. L. Dagron, chief engineer, and C. H. Jenkins, assistant superintendent of electric lines and service.

POWER-FACTOR AND ROTARY CONDENSERS.

By L. S. Thurston.

The power-factor of an alternating-current system is the ratio of the apparent kilowatts or kilovolt-amperes flowing in the system to the actual kilowatts and equals $\frac{kw}{kva}$. The apparent kilowatts are the product of the volts and "equivalent single-phase" amperes as shown by voltmeters and ammeters, respectively, while the actual kilowatts are those shown by a wattmeter.

The kilovolt-amperes are the resultant of two currents, one of which is the power component and is in time-phase with the voltage, and the other the wattless component, which leads or lags behind the voltage by 90 electrical time-degrees. This relation may be shown diagrammatically as in Fig. 1, where *OE* represents the voltage, *OB* the power current in time-phase with *OE*, and *OC* the wattless component lagging 90 time-degrees behind the voltage. Completing the rectangle there is obtained the resultant *OA*, which represents the kilovolt-amperes. The cosine of the angle *AOB* expresses the power-factor in per cent.

As is well known, the current in any alternating-current system may or may not be in time-phase with the voltage. In commercial practice it seldom is in time-phase (generally it is lagging) nor does it pay, as a rule, to have it exactly so, but there are many systems in operation to-day where the use of induction motors, especially partially loaded ones, causes an extremely low power-factor with the resulting decrease in available permissible generator output, poor regulation, increase in line loss and increased expense in general.

Many owners and managers of plants using alternating current are beginning to realize that the raising of the power-factor of their systems is a subject worthy of their best consideration and are taking steps to do this by the installation of

synchronous motors or rotary condensers whenever feasible. Of course, it is not always commercially or financially practicable to use rotary condensers, but frequently it is, and in such case the sooner one is installed the better it will be for the system, its owners and its customers.

Alternating-current generators are designed for a certain kilovolt-ampere output and should be rated in terms of this unit and not in terms of the kilowatt output. Where the power-factor is unity, or 100 per cent, the kilowatt output and the kilovolt-ampere output will, of course, coincide, but as the per cent power-factor decreases the available output in kilowatts decreases also, although the permissible kilvolt-ampere output remains the same.

Within the range from 80 per cent to 100 per cent power-factor the kilowatt output of a generator varies, for all practical purposes, directly as the power-factor; that is, a generator rated at 100 kva will have a rating of 100 kw at 100 per cent power-factor; 90 kw at 90 per cent power-factor; 80 kw at 80 per cent power-factor, etc.; but when the power-factor is lower this ratio does not hold, because the lagging current, at low power-factors, opposes the magnetic strength of the fields, thus reducing the voltage at the generator terminals. To overcome this reduction greater excitation must be given the fields, but this means increased exciter equipment, increased heating in the generator, reduced output and efficiency and poor regulation.

The effect of a low power-factor on transformers is the same as on generators, although not quite to the same extent.

The curves in Fig. 3 are drawn on the assumption that the kilowatt rating of a generator varies directly with the per cent power-factor. As there are few systems in operation having a power-factor less than 60 per cent, they may be considered correct for all practical purposes, especially as the possible errors in reading meters and the possible errors in the meters themselves will compensate for any corrections that should be made in the curves.

The horizontal lines represent available kilowatts. The vertical lines represent the wattless kilovolt-amperes flowing in the system for any given power-factor. The diagonal lines represent various power-factors in per cent and the curves represent the kilovolt-ampere rating.

Example No. 1.—Given a certain generator output in kilovolt-amperes at a certain per cent power-factor, say, 50 kva at 80 per cent power-factor lagging, how many leading kilovolt-amperes must be supplied to raise the power-factor to 100 per cent? Following the curve corresponding to 50 kva to its intersection with the 80 per cent power-factor diagonal, read horizontally outward, finding 40 kw as the available output of the generator at the given power-factor, and read vertically, finding 30 wattless, lagging kilovolt-amperes in the system. If, therefore, a rotary condenser having a rating of 30 kva is floated on the system and has its field superexcited to such an extent that it will draw from the system its full rated kilovolt-amperes, which will be leading, the wattless, lagging kilovolt-amperes in the system will be neutralized, the power-factor will be increased to 100 per cent and the available generator output will be increased from 40 kw to 50 kw.

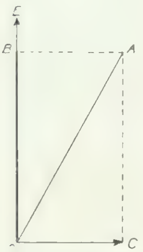


Fig. 1—Current and Voltage Relations.

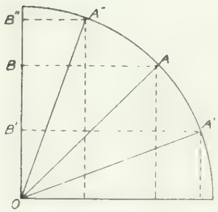


Fig. 2—Power and Wattless Components.

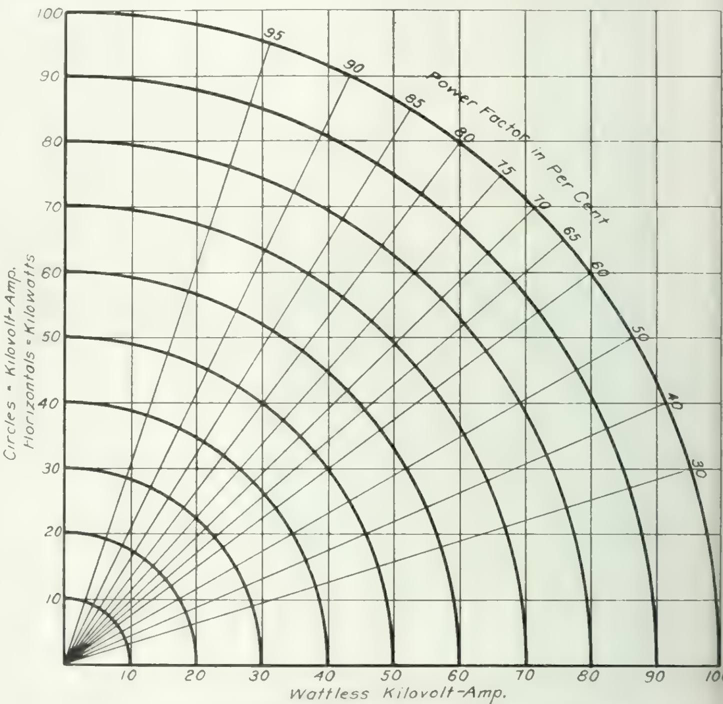


Fig. 3—Chart for Finding Power and Wattless Components.

It seldom pays, however, to install a rotary condenser of a kilovolt-ampere rating just sufficient to neutralize the wattless, lagging kilovolt-amperes, as under this condition there is no power available for doing mechanical work. A synchronous condenser operates most effectively at 70.7 per cent of its kilovolt-ampere rating, because under this condition 70.7 per cent can be utilized to raise the power-factor of the system and 70.7 per cent can be applied to do mechanical work, as will be seen from a study of Fig. 2.

In Fig. 2 OA represents the kilovolt-ampere rating of the synchronous motor and AB is the component of wattless, leading kilovolt-amperes which can be supplied to the system, and OB is the power component representing available mechanical work. When AB and OB are equal each equals 70.7 per cent of OA. This figure also shows that, since the cosine of the angles AOB, $A'OB'$, etc., represents the power-factor, a small addition of leading kilovolt-amperes at low power-factors makes a much greater difference in the resultant power-factor and available

power than does a larger amount at a higher power-factor. The results are tabulated herewith to show the relations even more clearly than does Fig. 4.

Example No. 2.—The curves in Fig. 2 will be found useful in solving a problem similar to the following:

Given a system transmitting 4800 kva at a power-factor of 65 per cent. Let it be desired to add a motor load equivalent to 400 kw and at the same time raise the power-factor to 80 per cent. From the intersection of the 4800-kva curve and the 65 per cent power-factor diagonal read horizontally 3120 kw and vertically 3620 kva wattless. 400 kw + 3120 kw = 3520 kw, the ultimate load.

From the intersection of the 3520 kw horizontal and the 80 per cent power-factor diagonal, on the circle, can be read 4400 kva, the ultimate apparent load, and vertically 2620, the corresponding wattless kilovolt-amperes.

Subtracting the values of wattless kilovolt-amperes found above there is obtained 3620 — 2620 = 1000 kva, which is the amount of leading kilovolt-amperes to be supplied by the synchronous motor.

To ascertain the actual kilovolt-ampere rating of the motor, refer again to the chart, where at the intersection of the 400 kw horizontal and the 1000 kva vertical the circle passing through this point corresponds to 1080 kva, which is the rated capacity of the synchronous motor desired.

When a rotary condenser is installed in a power station its effect in neutralizing the lagging currents of the system will benefit only the generators and that small part of the system between it and the generators. When, however, it is installed at the end of a transmission line, this line and all transformers and generators on it will feel the benefit of the improved power-factor. A certain size of line can transmit more power or for a certain power transmitted the wires can be smaller. For example, if a three-phase line twenty miles long is delivering 1000 kw at a power-factor of 60 per cent, a line loss of 10 per cent and a potential of 12,000 volts, each conductor must be of approximately 220,000 circ. mil area. When, however, a rotary condenser is floated on the end of the line and supplies sufficient leading kilovolt-amperes to raise the power-factor to 85 per cent, the size of each line wire could be reduced from 220,000 circ. mil to 110,000 circ. mil. This change would mean a saving of about 105,000 lb. of copper, which at 15 cents per pound would represent a total saving of $15,750.

From the chart of Fig. 2 it is seen that at 1000 kw and 60 per cent power-factor the wattless component equals 1330 kva, while at 1000 kw and 85 per cent power-factor the wattless component equals only 630 kva. Therefore, a rotary condenser having a rating of 1330 — 630 = 700 kva will be required. Such a machine complete will cost about $5,000 delivered and erected, thus showing a saving by its use of $15,750 — $5,000 = $10,750. If a larger rotary condenser were installed, although costing more money, the net saving would be still greater, as the machine could be made to perform useful work as a synchronous motor.

TABLE SHOWING FINAL POWER-FACTOR UPON ADDING SYNCHRONOUS CONDENSERS.

Kva addition per cent the wattless kva	Original Per Cent Power Factor									
	40	50	60	65	70	75	80	85	90	95
[illegible]	40.0	50.0	60.0	65.0	70.0	75.0	80.0	85.0	90.[illegible]	[illegible]
[illegible]	56.8	62.7	69.5	73.0	76.6	80.4	84.1	88.0	92.[illegible]	[illegible]
[illegible]	68.2	72.1	76.9	79.4	82.1	84.8	87.8	90.7	93.[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	89.0	90.3	[illegible]	93.4	94.9	96.6	98.3
[illegible]	88.9	90.2	91.6	92.5	93.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	96.4	97.1	97.8	[illegible]	99.1
[illegible]	96.2	96.6	97.1	97.4	97.7	98.0	98.3	98.7	[illegible]	99.6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99.4	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100[illegible]	[illegible]

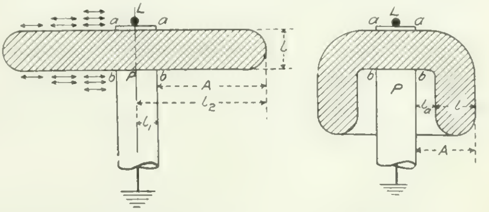
It is impossible to lay down any definite rules regarding the use of, and results obtained by, rotary condensers, but every system having a low power-factor is worth examining, for in many cases the installation of such apparatus would be found to be of advantage.

ELECTROSTATIC LIMITS IN HIGH-TENSION TRANSMISSION-LINE INSULATORS.

With the extension of the long-distance transmission industry there has been a continual crowding upward of the line voltage. For several years the transformers and other high-tension apparatus could be had for voltages much in excess of the highest practicable transmission voltage, which voltage was limited by the line insulators. Line insulators, at first designed almost wholly to fulfil mechanical requirements, increased in size and complication until their cost and weight became prohibitive and constituted a limitation of transmission voltage.

The economics of transmission called so insistently for higher voltage that transmission engineers were tempted time after time to lay out systems for voltages above standard and take it upon themselves to design insulators to fill the requirements. These attempts were seldom attended with success, and the cost was always excessive. The designs may be roughly divided into two classes—standard and freaks. The standard designs were usually successful, but their extreme weight and cost quickly became intolerable as the voltage went up. The freaks were usually based on guesswork, made in the blind hope of improving the standard type, and were unsatisfactory. Most of the freaks were impossible from the porcelain manufacturers' standpoint, and thus after being redesigned were built and installed on the line only to be scrapped or continued in operation at reduced voltage.

The invention of the suspension type insulator cleared the whole subject and set things going along the proper lines. With



Figs. 1 and 2—Elementary Types of Insulators.

this type of insulator the voltage limitation of transmission lines has been transferred to the line itself, and at present it is determined by the critical voltage at which the energy loss to the atmosphere becomes excessive.

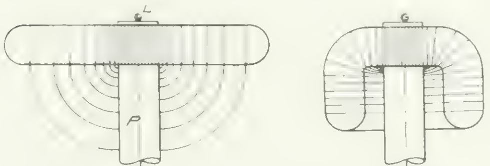
The extreme importance of the subject has caused it to be deeply studied both here and abroad, and, although most of the progress has been the result of experimental work, the radical and rational improvements have been due to proper consideration of the theory. Quantitative theoretical investigation of insulator design is not yet possible, except to those who have proper equipment for experimental determination of the factors involved. On the other hand, a qualitative analysis is easily made and serves well the purpose of indicating the effect of the different factors which enter the design.

Electrically considered, the insulator is a more or less complicated condenser, and evidently it should be so proportioned as to give a favorable distribution of dielectric flux. Large capacity means a correspondingly large charging current, and this current spreads itself over the surface of the insulator, ionizes the air and reduces its dielectric strength, thus preparing the way for the formation of corona, streamers and flash-overs in succession. The effect of rain is to increase the capacity of an insulator and thus greatly to aggravate the tendency to flash over.

In order to determine the effect of shape and relative proportions of the parts upon the effectiveness of an insulator it is convenient to consider two elementary types, as shown in Figs. 1 and 2. Fig. 1 shows a flat circular porcelain disk; L represents the line conductor and P the insulator pin. In Fig. 2 is shown the same insulator bent into the form of a cylindrical cup. The current taken by the insulator may be resolved into

two components—the charging current in leading time-quadrature with the e.m.f. and the leakage current in time-phase with the e.m.f.

The leakage current has two paths—one directly through the mass of the insulator and the other over the surface. Experiments by Mr. C. E. Skinner[1] failed to indicate any perceptible current through porcelain, and, therefore, it is safe to assume that the conductance of an insulator is that of an infinitely



Figs. 3 and 4—Elementary Types of Insulators.

thin surface film, all top surfaces of which may be wet. Referring to Fig. 1, and assuming the top to be wet and of negligible resistance, the conductance is

$$G = \frac{1}{R} = \frac{1}{k \log \frac{l_2}{l_1}},$$

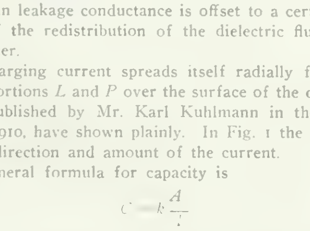
where k is a factor depending upon the character and condition of the surface. This equation indicates that increasing l_2 and decreasing l_1 decreases the conductance almost in direct proportion to the ratio. Bending the disk into the form of a cup, as shown in Fig. 2, decreases the cross-sectional area of the leakage path and therefore decreases the conductance. It is equivalent to cutting a sector from the flat disk; however, this decrease in leakage conductance is offset to a certain extent by reason of the redistribution of the dielectric flux, as will be shown later.

The charging current spreads itself radially from the conducting portions L and P over the surface of the disk, as photographs published by Mr. Karl Kuhlmann in the *Elek. Zeit.*, Jan. 20, 1910, have shown plainly. In Fig. 1 the arrows represent the direction and amount of the current.

The general formula for capacity is

$$C = k\frac{A}{l}$$

wherein k is the dielectric flux constant, A the cross-sectional area of the dielectric circuit and l the length of the dielectric circuit. The dielectric flux constant is a property of the mate-



Figs. 5 and 6—Practical Types of Pin Insulators

rial and is a measure of the dielectric flux which will be established by unit potential gradient. When two dielectrics are connected in series and traversed by a flux of uniform density they divide the voltage in inverse proportion to their dielectric flux constants.

Considering the disk, Fig. 1, the dielectric flux between L and P will be almost entirely through the porcelain disk due to the large dielectric flux constant of porcelain and the shortness of the path. Assuming rain conditions—that is, the upper portion of the surface as a conductor—the distribution of dielectric flux is about as shown in Fig. 3; the flux which goes out into space is neglected. A casual examination shows that a very pronounced maximum strain exists at the center, where the proper value of dielectric strength can easily be obtained. Next taking up the cup-shaped insulator under rain conditions and comparing it with Fig. 2, the approximate dielectric flux distribution is shown in Fig. 4. At a glance it is seen that the total flux and, therefore, the charging current are greater, the zone of maximum flux is much less pronounced, and the worst effect of all is the enormous increase in the strain produced in the air inside the cup. The dielectric flux constant of porcelain is about five times that of air. Therefore, assuming the porcelain to be of the same thickness as the air space, the relative dielectric conductances are as 5 is to 1; that is, if 60,000 volts are impressed across the two there will be 10,000 volts across the porcelain and 50,000 volts across the air. Not only is this great stress liable to break down the air-gap, but it renders the surface film more conducting and, therefore, also increases the leakage.

This theory of the insulator, which demonstrates the futility of petticoat insulators that cling about the pin, is well borne out in practice. In an article by Mr. A. S. Watts in the *Electrical World*, May 19, 1910, in which was discussed in detail the development of the present types of insulators, the two types shown in Figs. 5 and 6 were described. These insulators are shown to the same scale and appear to weigh about the same. The elongated type worked well at 45,000 volts, but for higher voltages it was impracticable to design one that would not break down under storm conditions. The expanded type, on the other hand, was successfully used at 75,000 volts. This is a striking illustration of the effect of storm conditions on the distribution of stress in an insulator.

The suspension insulator may be classed with the disk type, Fig. 1. Not only is the insulator itself a marked improvement over the pin type, but the method of installation introduces important improvements in the reliability of operation. Being beneath the metal cross-arms it is practically immune from lightning troubles, and judged from the mechanical standpoint the flexible suspension relieves the cross-arm from torsional stresses and reduces the stresses due to wind and to accidental breakage of a conductor. From the operating standpoint the suspension insulator leaves little to be desired. However, owing to difficulties encountered in the erection of lines using this type of insulator it is not practicable to use it in all cases. There is a certain voltage above which the extra cost of installation of the suspension insulator is justified by the saving in cost over the pin type. It is used in many lines of over 60,000 volts and is considered standard for e.m.fs. above 80,000 volts.

COMPARISON OF RELAYS FOR TRIPPING CIRCUIT-BREAKERS.

In a paper by Mr. A. S. Loizeaux read at the recent Frontenac meeting of the Association of Edison Illuminating Companies descriptions were given of the more important features of the solenoid type and watt-hour meter type of relay. The former relay consists of a solenoid drawing an armature toward its center against the force of gravity; the latter has practically the same construction as a watt-hour meter, but its windings are differently arranged.

The author stated that in comparison with the solenoid type the watt-hour type of relay is less liable to failure by sticking, less inclined to open too rapidly, can be set more precisely, has less impedance, consumes less power, but is not so simple and has a less range of load setting. He contended that companies that have not used watt-hour type relays should investigate them carefully.

The author expressed the opinion that relays should in general be set at higher overloads than in present general practice in order to make their action sufficiently selective under sh-

[1] [illegible] XXVII, [illegible]

iit conditions. The present practice in the larger Edison ipanies is to set the relays on main transmission feeders ip at a minimum of from two to four times full load. He that an effort should be made to reduce the time element of ircuit-breakers. Further improvements in design and oper- i of relays and other automatic devices should be sought.

NAVAL TESTS OF ELECTRIC COOKING.

iring the spring the Navy Department made a thorough stigation of electric cooking and baking in order to de- ine if the electric range offered advantages over the coal e for use on board warships. We are enabled to give be- some extracts from the report of the board of officers conducted the investigation, which report, it will be seen, ry favorable toward electric cooking, both in general and respect to its use on board of naval vessels.

e board reported that the results of the many tests with the ric range were very satisfactory, and its adoption for naval was highly recommended. The consideration of cleanli- elimination of coal dust and galley coal boxes, broken ick, soot accumulations, etc., aside from its actual work- apacity, were cited as additional reasons for its supplant- the old-style coal-burning range. The range under test been in daily use since its installation and all kinds of that a ship's range would be called upon to perform were nplished by the electric range under test.

e top surface of the electric range was used for all man- of cooking and heating and found to be very satisfactory. cific test was given the top surface in the matter of frying oes. Fifteen minutes after turning on the switch a tem- ure of 340 deg. C. was recorded on the top of the range. quarts of oil were placed in a cooking utensil on one of nits and in fifteen minutes a temperature of 210 deg. C., iently high to fry potatoes, was obtained, and the result excellent. Two regulation baking pans were filled with oes (sautée), placed on the range and cooked in a manner was wholly satisfactory, the vegetables being thoroughly ned, due to the equal distribution of heat on the heating ce. The quantity of potatoes prepared was sufficient for nen. Eggs were scrambled, various foods fried, and, in all manner of cooking that a range would be called upon rform was successfully done on this heating surface. all the units on top of the range in operation for forty- minutes, the consumption of electricity recorded was 6½ ours.

order to test if the heating coils for the top surface are protected against burn-outs, due to accidental spilling of s, a considerable quantity of water (about 3 qt.) was d on the top of the range when heated, and it was found he heating coils remained unharmed. The report recom- s that with the top surfaces of the range should be sup- a square sheet of iron or steel, ¼ in. thick, for the pur- of baking hot cakes. This feature of the ration is much ciated on board ship, and with the equal distribution of obtained on the electric range it would be practicable to i excellent results with a material saving of time. The . with switch at "low," would make excellent warming

broiler units were tried with all kinds of food articles. as chops, steaks, fish, etc., always with uniformly good s. Sufficient steak (80 lb.) was broiled for 150 men, the tion taking two hours, which time could have been ed if it had been possible to have the steak nearer the inits. The broiler as constructed in the range tested was to be not quite close enough to the source of heat and is lacking for regulating the distance of the article be- ooked from the source of heat. A simple mechanical was recommended which would permit of the broiler raised or lowered, as may be required. Steak broiled he range was tender and juicy and much superior to steak fried in pans on top of a coal-burning range. Furthermore, it is practicable to cook a greater quantity of steak on the electric range than on a coal-burning range in the same length of time

With the ovens many tests were made. A test was made of the roasting capacity of the oven, filling each of the ovens to their fullest capacity, in all 180 lb. of beef. This test was not successful, but it was later observed that the roasting pans filled the ovens completely and did not permit of the circulation of heated air; as a result the top of the beef in the upper pans was thoroughly cooked, but that in the bottom of the pans was not well cooked. On the other hand, the top of the meat in the lower pans was almost raw and had not seared in the least, while the bottom was burned. This was due, as stated above, to the lack of circulation of heated air. The report states that this can easily be remedied, either by perforating the walls of the oven with extra holes in order to permit of a free circulation of heated air, or by increasing the size of the range by about 4 in. so as to give a clear space of 2 in. on each side of the standard navy roasting pans for the proper circulation of heated air.

A further test of roasting beef was made as follows: 43½ lb. of beef were placed in two smaller pans with a 2-in. space on each side between the pans and the sides of the oven Fifty-five minutes were required to obtain the desired temperature of 250 deg. C. The meat was thoroughly cooked in two hours and twenty-five minutes, and was very delicious The uniform distribution of heat was partly responsible for the superior result obtained. With the change recommended to permit of the free circulation of heat it is believed that no trouble whatever will be experienced in cooking meat with the ovens filled to their capacity. During nearly the whole time that the meat was being cooked the heat was kept at an even temperature, although as the cooking was nearing completion the temperature rose slightly. This condition was remedied by the use of the switch. It was added that these ovens can be used as warming boxes for storing food that is being cooked on the top surface or on the broilers.

Tests as to relative economy of operation were made, the electricity used and the weight of the coal burned being recorded. Two roasts of beef, of equal size, shape and weight (10 lb.), were cooked in the electric and coal-burning range respectively. The thermometer was used to determine when the meat was roasted, the beef being removed from the oven when a temperature of 55 deg. C. at the center of the roast was recorded. In this test the beef roasted in the electric range was superior, being more thoroughly cooked throughout, due to the uniform distribution and steady supply of heat Following are the data of this test:

	Electric	Coal
Quantity of beef..................	10 lbs.	1[illegible] lbs.
Time required to obtain necessary temperature..................	50 min	2 hr. 2[illegible] min
Time required for roasting	[illegible] hr. 40 min	2 hr. 20 min
Electricity consumed............	7 kw hours	
Coal consumed........		[illegible] lbs.
Cost	$ [illegible]	$0.11[illegible] and .064944 (bit.)

It will be seen that the electric range was slightly less expensive to operate.

The following table shows the relative length of time required to heat different working units of both ranges:

	Electric	Coal	Degrees
[illegible]	1[illegible]	[illegible]	340 C.
Broiler	11 min		
Ovens................	[illegible] min	[illegible] hr. [illegible] min	2[illegible]0 C.

Commissary stewards and ships' cooks who experimented with the range were of the opinion that the relative working capacity is fully two to one. A conservative opinion would rate two electric ranges equal in capacity to three coal-burning ranges. The oven capacity of the electric range is certainly twice as great, the broiler is an additional feature not a part

of coal-burning ranges, and the top surface is in point of capacity on a 2 to 3 basis.

Among its recommendations the report advises that the broilers be so arranged that the distance from the heating units may be adjusted at the will of the operator, which may be done by a simple mechanical device; also, that tight-fitting doors be attached to the front of the broiler sections in order that they may be used as warming boxes, as the present warming boxes at the top of the range are too small to be of any use on ranges in the general mess galley. In addition they serve to accumulate soot and smoke that arises from food in the process of cooking and are liable to rust, due to the steam that constantly rises from the articles being cooked on the top surface.

The final conclusions of the report are that the electric r should supersede the coal-burning range on board ship bec of the following considerations: 1. Cleanliness. 2. Econ of time. 3. Economy of space. 4. Elimination of coal b (additional saving of space). 5. Elimination of draft trou 6. Elimination of soot accumulation. 7. Elimination of e sive heat in galley. 8. Economy of operation.

In view of these considerations, and of the success o electric bake oven, both at the shore station where tested on board ship, and considering particularly the superiorit economy of operation of the electric range, the board stro recommended its installation on board naval vessels, bot officers' and crews' galleys.

Central Station
Management, Policies and Commercial Methods

DISPLACING GASOLINE.

As a result of the work of the illuminating engineering department of the Denver Gas & Electric Company, during the month of September twenty-one gasoline plants were displaced. From the new business the company will receive a yearly revenue of $1,600.

STEAM HEATING FROM CENTRAL STATIONS.

Mr. Reginald P. Bolton at the recent meeting of the Association of Edison Illuminating Companies presented a paper entitled "The Heating Problem in Its Relation to Central-Station Lighting and Power Service," which considers the subject from the standpoint of the metropolitan central station. His conclusion is that in the case of central stations in the great cities the intimate connection of heating with electrical service is undesirable, but it is added that in smaller towns a high degree of commercial success has been attained by direct combination of electric service and house heating. Figures are given for a plant which during the heating season of 1908-9 had an output of 4,368,100 kw-hours; the total charges of the plant, including taxation and interest, were $69,659 and the revenue derived from the sale of steam $65,972, leaving a balance of only $3,687 to be charged for the entire electrical output.

ELECTRICAL INSPECTION IN CHICAGO.

The recent investigation of the Merriam Commission on City Expenditures in Chicago shows that the Municipal Bureau of Electrical Inspection, after rapid growth, is just keeping in touch with new installations of electrical work. It is the policy of the bureau, with its limited number of inspectors, to devote itself to the inspection of all new work and of the old wiring in all buildings where many people congregate, such as theaters, churches, department stores and hotels. The Merriam Commission suggests that if the bureau has not sufficient men to cover all old installations it should be able at least to correct dangerous errors in buildings into which it is called to check up new work. Further, it is suggested that the bureau examine its records of electrical fires and determine what percentage is due to old uninspected wiring and how much to inspected work. From this data information could be obtained to show whether the reinspection of old buildings should be made part of the work of the bureau.

It is also recommended that inspectors in going about their duties be instructed to watch for faulty outside wiring and overhead construction. It is pointed out that 40 per cent of the 201 electrical accidents to persons reported in Chicago in 1909 were due to outside wiring. It may be added that 42 per cent of the accidents were due to street-railway appliances and trolley wires, and the remaining 18 per cent to interior w It is recommended that an assistant chief inspector be appo whose duty it shall be to watch the work of the men in the and have particularly under his jurisdiction the investigati causes of electrical fires.

It is mentioned that the bureau has recently assign special inspector for a resurvey of the wiring of the l Stockyards. It is said that in this district firms are conti making electrical changes and new installations without an application for a permit. The commission says tha rules and regulations for governing electrical installations i by the Department of Electricity in Chicago are even rigid than the National Electrical Code in many instances. bureau of inspection is to be commended for many featur its work, and it stands well in the classification of elec inspection bureaus throughout the country.

ELECTRIC POWER FOR FARMING.

Mr. Edmond P. Edwards in a paper presented at the r meeting of the Association of Edison Illuminating Comp stated that in 1902 thirty-five towns near Hanover, Gerr having a total population of 35,000 including outlying dist were using about 2000 hp in motors for agricultural pur The Mount Whitney Power & Electric Company, in Tular Kern Counties, California, disposes of nearly 4000 kw to

Cream separator	½ to
Milking machine	1 to
Grindstone	½
Bottle washer	½
Water pump	1 to 1
Shredder	10 to 1
Silage grinder	10 to
Feed grinder	5 to 1
Threshing	10 to
Wood saw	3 to
Corn sheller	1 to
Hay press	4 to
Refrigerating	½ to

ate motors for irrigation purposes. The Rochester Railw Light Company has installed sixteen pumping plants on adjacent to Rochester, and the North Shore Electric Com of Chicago, is inaugurating a campaign along the same The paper contains the table given above of horse-powe quired to operate machines used in farming.

CENTRAL-STATION COMPETITION VOTED DO

That it pays for a central station to keep on good terms the public is illustrated by a recent experience of the Light & Railway Company, the policy of which is to deal and frankly in all matters affecting the public.

This company is furnishing electric service to the inco rated town of Sandy, about twelve miles south of Salt

naving a population of approximately 1400 inhabitants. The net revenue from this service is approximately $3,000 per annum, the base rate for energy being 10 cents per kw-hour. Another company recently made application for a franchise, offering to furnish service at 9 cents per kw-hour. Representatives of the Utah Light & Railway Company appeared before the Council and advanced the usual arguments to show that the community could expect no ultimate gain by granting a franchise to a competing company. It was pointed out that the company has maintained a man at Sandy to read meters, exchange lamps, take care of line and other troubles, etc., and that in case the business were divided neither company could afford to maintain a man at this place. After careful consideration of the matter the City Council voted unanimously to reject the application for a franchise.

DETERMINATION OF MAXIMUM DEMAND.

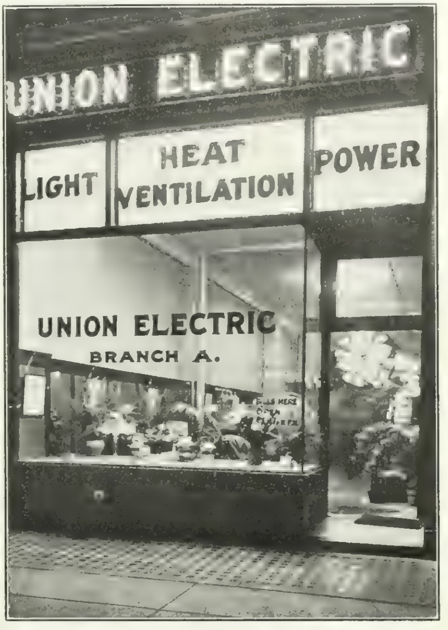
In a paper read by Mr. R. S. Hale, of Boston, at the recent meeting of the Association of Edison Illuminating Companies the various methods used in determining the demand where this factor is one of the charges for central-station service are enumerated. The non-instrumental methods consist in determining the demand from the connected load; the connected load, but omitting lamps in certain rooms or closets; the connected load, but omitting flatirons, desk fans, etc.; on the number of rooms in a house; the area to be illuminated; the valuation of the house. These methods are used in the case of small consumers, but for large consumers the demand is determined by an instrument, such as the Wright demand indicator; the Merz device, which is a kw-hour meter automatically and periodically set back to zero, but leaving a record of the maximum kw-hours used in each period; a curve-drawing kw-hour meter; a kw-hour meter that prints the number of kw-hours consumed each half hour or other prearranged period; a record made on a tape by an attachment to a kw-hour meter which indicates whenever ten or fifty or other number of kw-hours have been used. In Boston a plan is said to be worked satisfactorily whereby the customer names his own demand. A measuring device is then installed, and if the customer exceeds the demand he named a penalty price is charged, but only for the time during which the demand was exceeded. The result is that if the customer names too low a demand the penalty charge makes his bill more than if he had named his correct requirements. If too large a demand has been specified this can be reduced, but in order to prevent the naming of a large demand for December and a small one for July it is provided that the figure cannot be decreased for a year. For each kw-hour of excess demand the charge is 20 cents.

In conclusion Mr. Hale stated that at present the tendency is to do away with instrumental measurements for small customers and either come to a straight meter rate or, if using the demand principle, to base it on some factor related to the connected load or else on one based on the number of rooms or the valuation of a house. In case of large customers the tendency is to measure the demand by some instrument making continuous record and to consider the average of half-hour periods

"BRANCH A" IN ST. LOUIS.

The Union Electric Light & Power Company, of St. Louis, has opened a branch office at 4912 Delmar Avenue, in the West End. Here customers may pay bills, sign contracts, purchase appliances and transact any business having to do with residence lighting service. The office is in charge of a branch manager, to whom the solicitors in that territory report, thus relieving the congestion at the main office. Branch A office is located in the "White Way" district, where there are numerous moving-picture theaters, restaurants and hotels. This district is the "Hub" of the West End, and many street cars, automobiles and other vehicles are constantly passing the new office. If the undertaking proves the success that is hoped the company intends to open other branch offices in various parts of the city.

There was a "grand opening" of the West End office on Oct. 19, and the accompanying illustration is a picture of the new office taken at night. The opening celebration was continued on the following afternoon and evening. One feature of the opening which excited a great deal of attention was the free distribution of electrical household appliances. Each visitor received a card bearing a number, to which was attached a stub bearing the same number and adapted to be detached at a perforated line. The visitor signed his or her name and address on the stub and deposited it in a box, retaining the numbered card as an identification.



Branch Office of the Union Electric Light & Power Company of St. Louis, Mo.

On the night of Oct. 20 there was a drawing and the company gave away forty domestic appliances to the successful visitors. Among these were coffee percolators, chafing dishes, 6-lb. flatirons, shaving mugs, corn poppers, waffle irons, toasters and curling irons. There was a stipulation, however, by which appliances were presented only to patrons of the company or to those signing applications for electric service. The opening was entirely successful, and about 550 persons visited the new office during the two evenings.

ANNUAL MEETING OF COMMONWEALTH EDISON BRANCH OF N. E. L. A.

A notable gathering of central-station men was held in the Gold Room of the Congress Hotel, Chicago, on the night of Nov. 1 by the Commonwealth Edison branch of the National Electric Light Association, composed of employees of the Commonwealth Edison Company. It was notable for its size, there being 461 members of the branch present out of a possible attendance of 485, and for the spirit of loyalty, enthusiasm and good-fellowship. It was the occasion of the annual meeting and dinner of the Commonwealth branch.

After the dinner had been served Mr. J. C. Manley, the retiring chairman of the branch, gave a brief address in which he reviewed the work of the local organization during the successful year just brought to a close. He concluded by announcing

the election of officers. The announcement was received with great interest, because the election followed a spirited campaign in which there were two tickets in the field, following a primary election which was held for the selection of candidates. The names of the officers elected are as follows:

Chairman, Mr. Ernest F. Smith, superintendent of substations.

Vice-chairman, Mr. Oliver J. Bushnell, superintendent of meter department.

Treasurer, Mr. William A. Fox (re-elected without opposition), treasurer of the company.

Secretary, Mr. E. J. Doyle, secretary to the president.

Executive committee: Mr. A. D. Bailey, Fisk Street station; Mr. E. H. Lakeman, construction department, and Mr. Guy W. Lunn, Fisk Street station.

The newly elected officers were introduced by Mr. Manley and they were greeted in each case by a flourish of music and stirring, amusing songs composed in their honor. Mr. Smith and the others made brief remarks. At the conclusion of this feature Mr. Manley turned the meeting over to Mr. Peter Junkersfeld, assistant to the second vice-president, who discharged the duties of toastmaster in a felicitous manner.

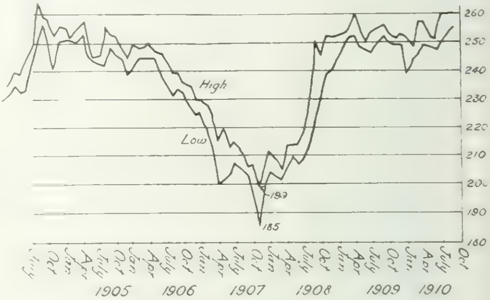
The first speaker introduced by the toastmaster was Mr. John F. Gilchrist, assistant to the president, who gave a talk on the qualities that win in central-station work. He was followed by Mr. W. W. Freeman, of Brooklyn, president of the National Electric Light Association, and also vice-president of the Edison Electric Illuminating Company of Brooklyn, who made a helpful address on the value of membership in the N. E. L. A., showing the benefits that central-station men receive by affiliating themselves with the organization. Mr. Samuel Insull, past-president of the N. E. L. A. and president of the Commonwealth Edison Company, was the next speaker. He also dwelt on the importance of the association, but the major portion of his address was devoted to a brief account of the central-station industry in Chicago. Mr. L. A. Ferguson, another past-president of the N. E. L. A. and second vice-president of the company, was called on and he took advantage of the fact to thank Mr. Freeman in graceful terms, on behalf of the local branch, for his visit to Chicago for the occasion.

During the evening, interspersed with the speeches, there were vocal selections by Messrs. Harold Wright and W. R. White and also a violin solo by Mr. C. H. Bucher, all members of the branch. Mr. R. T. Conger led the glee singing. The whole spirit of the affair was inspiring and the meeting was highly creditable, both to the national organization and to the highly developed central-station organization in Chicago which makes such a flourishing local branch possible.

INCREASING STABILITY OF CENTRAL-STATION BUSINESS AT BOSTON.

Results of operation of the Edison Electric Illuminating Company of Boston examined with reference to conditions prevailing five years ago and to-day show that the central-station business in the New England metropolis is in a most healthy condition, and that the use of electricity in the great area served by the company is advancing with rapid strides. At the end of the fiscal year ended June 30, 1905, the Boston Edison Company's records showed that the earnings for the year were $3,346,027, the total estimated population served was 722,089 and the total sales of electricity required the delivery of 41,910,281 kw-hours to customers. In 1905 the company had just begun to expand its system by the acquisition of suburban properties. It had absorbed the old Boston Electric Light Company two or three years before and was embarking upon a large policy of development which has not yet been completed. Its capital stock was quoted at about $245 maximum in July, 1905; its total [illegible] including stock, bonds and premium on stock, amounted to $18,281,250, and its dividends amounted to $1,070,770, or 10 per cent, for the fiscal year 1904-5.

In the fiscal year recently closed, which ended on June 30, 1910, the company's gross earnings were $4,709,456, the tributary population was figured at about 1,000,000 persons and the total energy sold was 75,684,057 kw-hours. The policy of taking over the comparatively inefficient plants and distributing systems of suburban companies in the Boston district has been carried far afield; improvements in generating plant which were barely foreshadowed in 1905 have been realized; co-ordination



Curves Showing Market Prices of Boston Edison Stock.

of distributing systems in many hundred square miles of territory combined with a vigorous commercial policy has brought the company's service close to communities formerly unacquainted with its character and possibilities. In the protracted period of financial depression which reached its climax in 1907 the company's stock touched as a low point a market price of $185 per share. The maximum price of the stock in October, 1910, was $270, which was asked a few days ago. In the five years, therefore, despite the financial depression from which more than full recovery appears to have been attained, the company's gross income has risen by $1,363,429, or nearly 41 per cent, and the market price of its stock has risen 85 points, or 46 per cent. The total capital, including stock, premium and bonds, on June 30, 1910, was $26,856,515, an increase of $8,575,265, or 47 per cent. The 1909-10 dividends were $1,555,596, representing 11 per cent for the year, and on June 30 last the stock was placed upon a 12 per cent dividend basis, the last quarterly dividend being 3 per cent. Incidentally the net earnings from operation, including all expenses of operation except taxes, interest and depreciation, were $1,989,370 in 1905, compared with $2,602,228 in 1910. Economies in administration are reflected in these figures.

A noteworthy feature of the company's expansion, its increased earnings and recovery from the conditions of the 1907 depression is the lowering of the average income per kw-hour sold from 7.983 cents in 1905 to 6.222 cents in 1910. This means that the general public received its electricity at more than 1¾ cents per kw-hour less in 1910 than in 1905, and if the 1910 consumption of energy had been paid for at the 1905 average rate the community would have been poorer by $595,000 than it is under present prices. The retail price has fallen from 18 cents to 11 cents per kw-hour in the half decade. On its physical side the company's connected motor load of 26,416 hp in 1905 compared with 57,093 hp in 1910, and its total respective connected loads in 50-watt equivalents of 1,360,909 in 1906 and 2,408,926 in the present year show the expansive tendencies of the service offered. The stability of the central-station business at Boston under present conditions is not easily surpassed in other branches of electrical service.

BREAK-DOWN ELECTRIC SERVICE IN NEW YORK CITY.

In New York City 25 per cent, or 185, of the isolated plants have a break-down connection with the mains of the Edison company. The minimum guarantee made by the break-down customers last year was $111,510 and the actual break-down revenue was $158,000.

AN ATTRACTIVE CHICAGO SUBSTATION.

As shown by the accompanying illustration, the Edgewater substation of the Commonwealth Edison Company in Chicago presents an unusually attractive appearance. This is due to the fact that it is the successor, with additions, of a former neighborhood electric light plant erected in a high-class residence section, where it was desired to make the architecture of the building conform to its surroundings. The original plant, which dates back to the year 1889, consisted of two small high-speed non-condensing engines driving Edison bipolar generators. The load was entirely lighting and the plant was operated only from dusk until midnight. In 1898 the plant was acquired by the Commonwealth Electric Company, one of the predecessors of the Commonwealth Edison Company, and was transferred into a substation. The growth of the northern section of the city has made it necessary to provide a distributing center for transmission and distribution commensurate with the demands, and the new Edgewater substation, shown at the rear in the illustration, has been very recently put into service.

The incoming lines for the new equipment are operated at 12,000 volts and 60 cycles. From the 12,000-volt buses the energy is first passed through transformers and reduced to 4000 volts, thence going through circuit switches to the basement, thence to circuit regulators on the main floor and finally to the outgoing cables on the south wall of the new building. As the 12,000-volt lines enter on the north side of the building, the construction permits straight-line buses and lends itself readily to future extensions. The ultimate rating of the station will

Exterior of Edgewater Substation.

be six transformers or 9000 kva. At present two Allis-Chalmers step-down transformers, each rated at 1500 kva, are in service.

The 12,000-volt bus structure is of concrete, and the room containing it constitutes the air chamber. The transformers are air-cooled, the blowers for them being located on the opposite side of the station from the high-tension room. The transformers are provided with a Vernier arrangement of taps on both the primary and secondary sides, by means of which, with only four taps on the coils, a 10 per cent variation of voltage in 2 per cent steps may be had.

The circuit regulators are of the induction type, each having a rating of 36 kw. The reversing switches are mounted on standards in such a way that a regulator may be moved without disturbing the reversing switch and its switchboard connections. The switchboard consists at present of six panels of black Monson slate. As no direct current is available in this substation except that supplied to a small operating battery by two mercury-arc rectifier sets, the pilot lamps are operated on an alternating-current circuit from the light and power transformers. The battery is used only for supplying energy for the operation of switches.

Correct pressure on the circuits is entirely dependent in this substation on the circuit regulators. Air for the step-down transformers is also indispensable. Extreme care is taken, therefore, to ensure continuity of service to the regulator and blower motors. Three 20-kw power transformers, star-connected on both primary and secondary sides, supply this energy ordinarily, and a fourth transformer is installed and may be quickly substituted in place of one of the others if needed.

The absence of frequency changers is an interesting characteristic of this station. Generators wound for 12,000 volts and 60 cycles are now in service at the Quarry Street generating station, and all increases in the 60-cycle districts will hereafter be taken care of by the installation of step-down transformers. The service will thus gradually be made distinct from the 25-cycle system, which has heretofore supplied energy by means of frequency changers.

The foregoing facts are taken from an article written by Mr. H. J. Richardson, of the engineering department of the Commonwealth Edison Company, appearing in *The Edison Round Table*, which is published by that company.

Wiring and Illumination

ARTIFICIAL LIGHTING OF ROOMS.

At a recent meeting of the Royal Society of South Africa the subject of the influence of uniformity and contrast on the amount of light required for the illumination of apartments was brought forward by Mr. H. Bohle. The author dealt first with the adaptation of the human eye to various daylight illuminations, and gave a fresh definition of glare. When the eye looks at an illuminant of great intrinsic brilliancy in front of a dark background it tries to do two things at once—to open wide for the dark background and to close up for the intrinsic brilliancy. The author then considered the physiological effects of radiation, explained overheating of the eyes due to excess light absorption, and considered the effects of the ultra-violet rays of modern illuminants and of solar radiation. In addition, he dealt with the destructive action of rays when applied excessively, and finally, the effect which uniformity and the avoidance of contrast in artificial lighting have on the amount of light required. He came to the conclusion that in a room with black walls an illumination of 3.5 ft.-candles to 4 ft.-candles to 40 candle-meters is required, whereas in a place with white ceilings and light walls the amount of light can be reduced to 3 ft.-candles.

SPECIAL LIGHTING IN MEXICO.

During the recent centennial celebration in Mexico City effective use was made of incandescent electric lamps in illuminating the city. A total of 220,000 electric lamps furnished the illumination. Of these 134,172 were tungsten sign lamps, 58,181 10-cp incandescents, 11,742 of 16 cp, 9112 of 20 cp, 5000 of 5 cp, 7195 of 4 cp and 3000 of 1 cp and 2 cp. Besides these 150 powerful arc lamps shed their glow over parks and street corners, while 88 250-cp tungsten lamps of the latest design helped make midnight like unto noon.

The bulk of the lighting was around the Zocalo, where the cathedral, lit up by 18,800 10-cp and 16-cp lamps, formed the most brilliant gem of all the diadem of light. Then came the National Palace, with 8900 lamps on the outside and 40,000 within, assisted by fifty-six arc lamps. The municipal palace used 10,000 incandescent lamps, while the Monte de Piedad, the government pawnshop, was ablaze with 3000 brilliant tungsten lamps. These made of the Zocalo a green emerald, ringed round with lines of bright new gold, while out from this center, through the principal parts of the city, ran rays of light, transfiguring the somber buildings into squares of glowing gilt.

Up on the Hill of the Grasshopper, where Chepultepec

Castle stands, were 15,000 lamps, 7000 in the palace itself and 8000 more scattered through the paths and around the gloriettas of the beautiful park. To these forty large tungsten lamps and twenty arc lamps gave additional brilliance, while on occasion an electric fountain spread living light above the blue waters of the lake.

TABLE OF COSTS FOR HOUSE WIRING.

In soliciting new business in residences where electric wiring is to be done it is frequently very important to the solicitor, as well as satisfactory to the householder, to be able to arrive quickly and accurately at a fair estimate of the expense which the work of wiring will entail.

A satisfactory and convenient method of finding this cost is given by the accompanying tables, which have been prepared by the Central Station Development Company, Cleveland, Ohio, for the use of solicitors in its campaigns.

According to this method the various openings for switches, receptacles, drop cords and fixtures are considered as "outlets," and on the number of these is based the cost of work in houses of different classes of construction. Adding the cost of switches, receptacles and drop cords, as given below, gives the contract price of all labor and materials necessary to complete the work.

For single floor construction the "outlet" item of the cost for various numbers of outlets is shown in the accompanying table:

Outlets.	Cost.	Outlets.	Cost.	Outlets.	Cost.
5	$15.85	24	$48.95	43	$81.76
6	17.85	25	50.60	44	83.60
7	19.85	26	52.25	45	85.50
8	21.85	27	53.90	46	87.45
9	23.85	28	55.55	47	89.37
10	25.85	29	57.20	48	91.30
11	27.50	30	58.85	49	93.22
12	29.15	31	60.50	50	95.15
13	30.80	32	62.15	51	97.07
14	32.45	33	63.80	52	99.00
15	34.10	34	65.45	53	100.82
16	35.75	35	67.10	54	102.85
17	37.40	36	68.75	55	104.77
18	39.05	37	70.40	56	106.70
19	40.70	38	72.08	57	108.62
20	42.35	39	73.97	58	110.55
21	44.00	40	75.90	59	112.47
22	45.65	41	77.82	60	114.40
23	47.30	42	79.75		

In houses of mixed flooring the prices will be the same as given in the preceding table, except as follows:

Located under double flooring, otherwise than hard wood, second or third story:
- Ceiling outlet.......... $1.00 extra
- Switch outlet (controlling any center outlet).......... 1.00 extra

Located under hardwood flooring, single, double or triple, second or third story.
- Ceiling outlet.......... $3.00 extra
- One switch outlet (controlling any center outlet).......... 3.00 extra
- Additional switch outlets on same gang (controlling same center outlet).......... 1.50 extra

The cost of hardware and drop cords, to be added to the above items, depending on the number of outlets, is as follows:

Push-button switches, each	$1.00 extra
Push-button 3-way switches, per set of two switches	2.75 extra
Porcelain-base switches, each	.35 extra
Porcelain-base Edison receptacles, each	.35 extra
Base-board flush plate receptacles, each	1.15 extra
Drop-cord, key socket each	.60 extra
Drop-cord, chain socket, each	.75 extra

SUSPENSION-TYPE HIGH-VOLTAGE INSULATORS.

Two patents relating to transmission-line insulators of the suspension type were issued on Nov. 1. In a patent granted to Mr. R. M. Johnston, of Mansfield, Ohio, a description is given of a form designed so as to provide a maximum dielectric separation between points of opposite potential and to obtain interchangeability of insulator sections. Means are also provided for permitting the sections to align themselves properly with respect to each other. In the form shown in Fig. 1 the hollow body portion of the insulator is integral with the pro- [illegible]. The upper part is held within clamps compressed against cement held on the conical part of the body. The lower part contains an enlarged cavity within which is cemented a shoulder and sectional washer upon which rests the head of a swivel bolt provided with an eye at its lower end. The inventor calls attention to the fact that there is no conducting material within the interior of the insulating section, the construc-

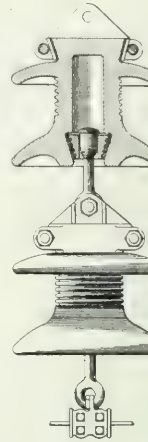


Fig. 1—Johnston Insulator.

tion being such as to reduce to a minimum the electrostatic stresses and the liability to puncture by lightning and abnormal voltages, while the shape and relative position of the upper and lower protecting skirts in combination with the long body of the insulating material prevents the formation of "still-air spaces."

An insulator arrangement patented by Mr. J. E. Noeggerath of Schenectady, N. Y., is shown in Fig. 2. In this insulator special means are provided for resisting the mechanical stresses to which the insulator is subjected in service. The insulating disk is formed of porcelain, the upper knob of which is supported by a cast-iron bell to which it is anchored by means of a wire inserted through a tangential hole cut in the rim of the bell and forced around in the space formed by grooves cut within the bell and along the edge of the insulator knob. Within the knob is a central cavity enlarged at its inner end to form a circular inclined ledge against which is supported a strain

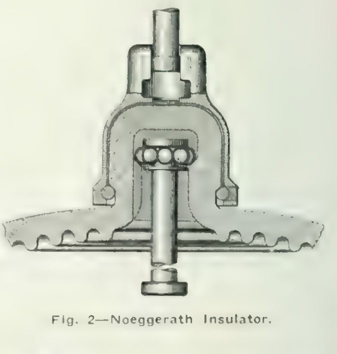


Fig. 2—Noeggerath Insulator.

bolt by means of copper balls, which when forced into contact with the porcelain will compress somewhat and distribute the pressure instead of crushing the porcelain. In order to exclude moisture the unoccupied spaces between the several parts of the unit are filled with a cement which will yield properly to tensile stresses.

FACTORY LIGHTING.

By J. S. Dow.

During the past few years engineers have come to recognize nore and more the desirability of good illumination in factories. Moreover, this recognition has been shared to a great xtent by most of those responsible for workshops, because it as come to be appreciated that improved illumination is really conomical. It *pays* to have good lighting arrangements beause this increases the output of work and diminishes accidents nd mistakes.

But another aspect of the matter, which has not received uite such general attention hitherto, is the value of good illuiination in factories from the purely hygienic and sanitary tandpoint. Considerable advances have been made both in ie recommendations of the governments of the chief European ountries, and also by the inspectors of insurance companies, egarding safety from fire and obvious causes of accidents; ut it is only recently that the bearing of illumination on the uties of the inspector has been appreciated. Yet it may safely e said that recommendations in this direction should be reeived willingly and even gratefully by the employer, seeing iat he, as well as his workmen, stands to benefit. The only bstacle has hitherto been that no very definite rules have been id down for his guidance. Factory legislation, when it refers) illumination at all, has almost invariably contented itself ith specifying that the lighting should be "adequate" or sufficient." Such regulations almost inevitably become a dead tter since there is no general understanding as to what, presely, such terms mean.

It is, therefore, particularly interesting to notice that at the econd Congrès International des Maladies Professionelles, hich has just terminated in Brussels, the subject of illuminaon was brought prominently forward. It should be explained iat this important congress is devoted to all matters connected ith industrial hygiene and is attended not only by prominent edical authorities, but also by representatives of the governents of the chief European countries. Its deliberations, therere, may naturally be expected to have an important bearing 1 future recommendations in relation to illumination.

Now, this year a very important precedent was set by the stablishment of a special section of the program devoted exclu-vely to the eye and effects of illumination, and the Illumiating Engineering Society in Great Britain, realizing the imortance of the occasion, sent two members of its council, Mr. . Gaster and Mr. J. Eck, as delegates to the congress. This probably the first occasion on which a purely medical assoation has invited and received co-operation from those conerned with the engineering aspects of illumination.

It was hardly to be expected that on this occasion very precise onclusions would be formulated. The papers read on the subct seem to have been mainly instrumental in awakening inrest in it. But the meeting ought to give a decided imetus to the spread of interest in illuminating engineering in any influential quarters. Seeing that over 100 papers were resented, it is naturally impossible to deal with the proceedings 1 any detail. There were, however, quite a number of papers hich dealt specially with the subject of illumination. That y Mr. L. Gaster on "The Hygienic Aspects of Illumination" ontained a summary of the legislation of different countries n the subject. It also drew attention to the important referice to the matter in the most recently issued report of H. M. ispector of Factories in Great Britain. Besides the obvious vils of bad illumination there are other points of special consquence to the sanitary inspector. For example, bad illuminaon is not infrequently responsible for want of cleanliness, and ecomes positively dangerous on this account when poisonous iaterials are being dealt with, while in certain trades which are pt to lead to tuberculous diseases it is particularly inimical to ealth. All this was insisted upon in this report and steps are) be taken by the Home Office to collect further data on the ubject. This last point was emphasized by Mr. Gaster, who id stress on the need for more information before attempting lay down hard and fast rules.

From the considerable amount of information presented in papers by Dr. A. Broca, M. F. Massarelli and others two points seem to have received special attention.

Almost all the speakers referred to the need for a specified minimum illumination, from the hygienic standpoint. In Holland, for example, 10 lux (about 1 ft.-candle) has already been prescribed as the general minimum and 15 lux in the case of specially exacting work for the eyes, such as embroidery, jewelry and watchmaking, draftsmanship, etc. Dr. Broca, however, expresses the view that in general an illumination of at least 30 lux to 40 lux is desirable. He explains that although it is generally assumed that a person can read comfortably with an illumination of 1 ft.-candle, this is only true when the head is brought fairly near to the book. This leads to a tendency to short sight, because people get into the habit of close reading. With daylight, on the other hand, the illumination usually suffices to enable a person to read at a considerably greater distance. Seeing that an increase of illumination above 1 ft.-candle, wisely arranged, causes no apparent discomfort to the eye, it may fairly be suggested that we ought to aim at at least 2 ft.-candles to 3 ft.-candles. Yet it might naturally be expected that at first the irreducible minimum would be fixed somewhat lower than this, though a manufacturer might often see the wisdom of adopting an illumination considerably in excess of the minimum value.

A second point which received special recognition was the importance of arranging lamps in factories in such a manner as not to interfere with the convenience of the workers or cause discomfort to their eyes. A case in which this point is specially worthy of emphasis is the lighting up of machinery which is considered sufficiently dangerous to need a guard. For if the outlines of the machinery and guard in question are indistinct, owing to insufficient illumination, there is sometimes a risk that a workman may trip over the guard; and lights that are placed so as to shine in his eyes are more likely to lead to accident than avoid it.

The importance of this connection between illumination and accidents has not hitherto been sufficiently appreciated. In many of the mills and workshops of the past, it is safe to say, many accidents to arms and fingers were due to the operator being obliged to *feel* for the lever instead of being able to see it clearly. And there should be no need to point out that when every step has to be taken cautiously and in doubt, owing to the indistinct surroundings, much valuable time is lost.

There were also a number of other papers which dealt with eyesight of operators and with such nervous defects as "nystagmus," an affection of the eyes from which miners are apt to suffer; this, it was suggested by several delegates, is at least partially due to the peculiar conditions of illumination under which such men work. Again, reference was made to the severe tax on eyesight imposed by certain operations in mills, such as carding, knitting, etc. Mr. A. Glen Park mentioned that in considering a "certificate of fitness" it was always regarded as very important that the applicant should have excellent sight. Now, one may well raise the question how far the exacting nature of these processes is due to defective lighting and whether, if proper precautions were taken in this respect, the conditions as regards eyesight might not be relaxed.

At the recent congress the intention of speakers seems to have been mainly to arouse an interest in the subject of illumination rather than to attempt premature definite rulings. This is the first essential step toward progress and it may be hoped that information will be accumulated by the permanent commission, which exists under the presidency of Dr. M. Christoforis. M. Massarelli, to whose paper reference has already been made, was one of those who pointed out the need for much more definite information than is possessed at present. "How long," he inquired, "will it be before hygienic experts can formulate definite rules for the guidance of practical men?" In fact, the recognition of the need for such recommendations is widespread. The only difficulty in the past has been that the experts concerned have not been brought into contact. This deficiency, we may hope, will be effectually removed by the work of the illuminating engineering societies.

DISPLAY STREET LIGHTING IN TOLEDO, OHIO.

In a paper presented by Mr. W. E. Richards before the annual meeting of the Association of Edison Illuminating Companies held at Frontenac, Thousand Islands, Sept. 6, 7 and 8, and just released for publication, the plan of display street lighting as accepted in Toledo is given. This system of lighting, as well as the general street illumination, utilizes 4-amp magnetite arc lamps, connected fifty in series, there being a total of approximately 2500 lamps, covering an area of 49 sq. miles. Inasmuch as practically all the light emitted from the luminous arc falls below 10 deg. from the horizontal, display signs which are usually above this axis are not affected by the glare produced.

The City of Toledo has contracted with the local lighting company for its illumination at $45 a lamp per year. While this is admittedly low, a higher rate, the author contends, would be inimical to the plan adopted. Obviously, at this contract price and owing to the necessarily excessive construction costs, the business is not desirable from the serving company's viewpoint. The cost of its display lighting is divided between the city and the property benefited, the city paying 15 per cent and abutting property being charged on the tax duplicate with 85 per cent of the total bill. The net cost to the property owners averages 90 cents per foot front per year, an ordinary business front of 20 ft. costing a merchant $18 per annum. By means of extra flexible duplex lamp loops the arc-lighting system has been relieved of many open circuits. In fact, during the five years the contract has run open circuits due to lamp-loop troubles have been extremely rare. The records of the company of outages and dark hours, from all causes, vary from 6/100 per cent to 1 per cent, the greater proportion being due to mechanism trouble in the lamp itself and to trouble in the power station.

The map given in Fig. 2 shows that on some streets lamps are located 80 ft. apart with 80 ft. between street curbs. On certain streets this is extended to 100 ft. centers. In all cases two arc lamps in series or multiple are installed, 80 per cent of this class of lighting being on the series system. In certain locations where the current or voltage is not excessive a remote-control switch is employed to close and open the arc circuits on regular schedule. The series underground circuit lines for the display lighting consist of individual cables for convenience of testing and identification. The lamp loops are taken off the outgoing cable and after passing through the last lamp the circuit is returned through one cable by the shortest path to the station. These cables are made up of No. 10 B. & S. wire paper insulated. Where a lamp loop is cut in the same size cable is used for this loop, but duplex wire with rubber insulation is employed in feeding the lamp. After entering the pole base this cable is spread at the ends, where soldering joints are made to No. 12 wire. The lamp-post wiring is coated with soapstone and drawn into ordinary circular loom. It is then inserted into the lamp-posts, which are designed to be as nearly waterproof as possible. It has been thought that the rubber-covered wire will deteriorate rapidly in iron poles, due to the action of sulphurous gases, but after five years' experience the company finds no trouble whatever from this cause. Rubber-insulated wire is used because of short bends being necessary to conform with the inlet connections. Moreover, a pot-head is unnecessary.

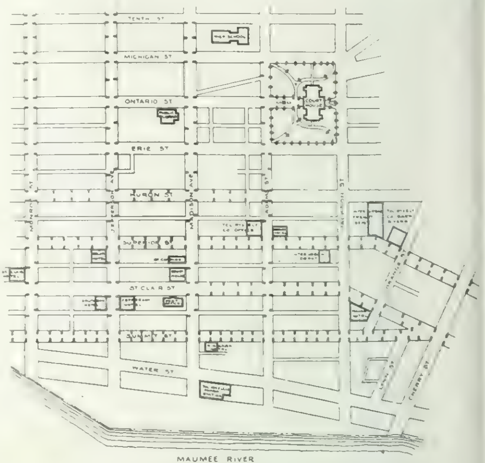


Fig. 2—Map of Business Section, Toledo, Ohio.

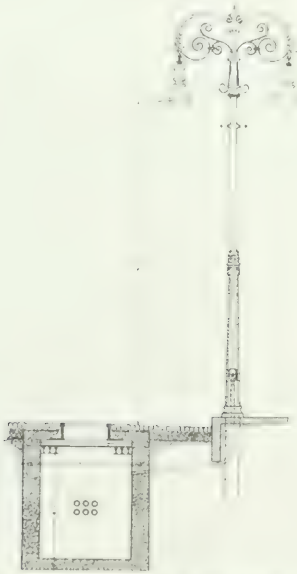


Fig. 1—Arc Lamp Post Details, Toledo, Ohio.

Fig. 3—Ornamental Lamp-Posts in Toledo, Ohio.

and where the lamp loop is joined to the main cable the ordinary wiped joint suffices. The usual conduit system is in use, preference being given to fiber conduit and concrete manholes. The company has found that 1-in. galvanized-iron pipe is preferable for running laterals from the manholes to lamp-posts. In many places the pipe is made up and passed through holes bored through street crossings. In parks, where the conduit is not

Series luminous magnetite arc lamps, cost each	$23.65
Ornamental iron lamp-posts	45.00
Complete cost of construction:	
Series system per lamp installed	106.00
Multiple system per lamp installed	85.00
Total maintenance cost per year	6.30
Cost of mercury arc tubes per lamp per year	3.81
Average life of rectifier tubes	890 hours
Average life of lower electrode	170 hours
Average life of upper electrode	2 years

likely to be disturbed, ½-in. fiber conduit, without concrete, is found to be desirable on account of low cost. Regarding the maintenance of the display-lighting system, the author states that the lamps are permanently fixed about 19 ft. from the street. With the type of lamp employed an average of 170 hours is obtained on a single trim. A trimmer provided with a light ladder of special design is capable of looking after some 250 lamps, since only the lower electrode is changed, the upper electrode having a life of practically two years. The accompanying table contains in a condensed form the items of interest in this class of work.

NEW TELEPHONE PATENTS.

PRIVATE BRANCH INTERCOMMUNICATING SYSTEM.

The combined intercommunicating system and private-branch exchange has become quite an important factor in furnishing telephone service. Such a system provides not only the features of the old intercommunicating system; that is, the means by which any station may call and connect with any other without the assistance of a central operator, but, in addition, it provides for connection with the public exchange from any of its stations. It has been customary to receive all exchange calls at a single designated station and from there to distribute them as desired. Such a special switching system involves the carrying out of numerous special conditions, and considerable effort is being expended to devise a system and apparatus which will give the most comprehensive and satisfactory service.

In the system recently patented by Mr. N. H. Holland, of Chicago, and assigned to the Western Electric Company, means are provided for answering the exchange trunks on any station, from which the trunk may be held pending a supplementary and secret communication with any other station. According to this system each station has a key for answering, one key each for selecting each other station, one key for each trunk and two ringing keys. One of the latter is for ordinary calls and one for calls supplementary to trunk connections. When a trunk call arrives, as indicated by the trunk signal or bell, the trunk key is depressed at the answering station, which establishes connection with the trunk. If it is necessary to communicate with a second station, the selective key of that station is depressed. This key becomes locked, but the trunk key is not coincidently released. The supplementary ringing key is now depressed. This calls the second station, releases the trunk key and simultaneously closes the trunk-holding circuit. This last circuit is controlled by two relays, one a self-locking relay and the second a relay in series with the trunk. The circuit has a normal gap or break at the locking contacts and it is necessary to bridge this momentarily to close the lock and holding circuit. If the second station desires to talk upon the trunk, the closing of its trunk key will connect it and automatically cut the lock and holding circuit. Similarly, if the first station wishes to cut in again on the trunk, its trunk key may be depressed, which will at the same time release its switching key to the second station which was just communicated with.

Another patent granted to the same inventor and similarly assigned describes a Dictograph set comprising switching keys, visual signals, a buzzer and transmitter and loud-speaking receiver all assembled in a frame and casing in a convenient manner. The transmitter and receiver are carried by an auxiliary frame swinging upon the main frame in such a way as to permit of convenient positioning for use.

Mr. O. M. Leich, of Genoa, Ill., has patented a wall-type subscriber's set for rural use in which special provision is made for the mounting or changing of condenser. The condenser is to be used to prevent interference with the transmission of ringing signals due to receivers being off the hooks. The condenser, induction coil and transmitter are all mounted upon the hinged cover of the set and the wiring is led to and from the condenser holder so as to be readily accessible. This patent is assigned to the Cracraft-Leich Electric Company.

SUBMARINE SIGNAL RECEIVER.

One of the difficulties of submarine signal receivers is that of variation of external pressure according to the depth at which used. One of the advantages lies in the ability to use any desired pitch, and therefore resonating chambers are available for reinforcing the received sounds. Messrs. F. M. Durkee, of Newton, Mass., and J. B. Millet, of Boston, have had both these points in view in the design of a receiver they have patented jointly and assigned to the Submarine Signal Company. A sectional view is shown in Fig. 1. The transmitter is designed for sounds of high pitch. The diaphragm is under tension, as its edges are soldered into position while it is expanded by heating. The effects of pressure and the consequent deflection of the diaphragm are overcome by making the microphone of the inertia type. Again, the cavity of the transmitter is made to resonate and thus reinforce the sounds received.

PARTY LINE APPARATUS.

With party-line telephones connected in considerable numbers to a single line, for rural service, there is at times more or less trouble due to persistent listening-in upon the lines of non-wanted stations. This has led to the invention of numerous devices for locking out all save desired stations. Unfortunately, most such systems are unreliable, chiefly through the distribution of rather complicated and delicate apparatus throughout the line, or, in other words, at each station. In the effort to overcome this objection Mr. W. M. Bruce, Jr., of Springfield, Ohio, has produced a lock-out system depending upon a simple limit relay, one of which is to be at each station.

The relays are so proportioned as to resistance and efficiency that any one of them will operate if connected across the line through the closing of the hook switch. This relay in operating closes a shunt contact which short-circuits a large portion of its winding, leaving, however, enough to lock it. The relay of reduced resistance so alters the potential distribution on the line that the relays at all other stations will fail. Thus all are locked out, as the telephone circuit at the stations is closed only through the closing of the relay contacts at that station. Mr. Bruce's patent is assigned to the American Automatic Telephone Company.

Another system for party lines with the same ultimate end in view provides a code signal for each station, which signal is repeated upon the line each time the hook lever rises. Thus, if any conversation is existent an interfering station signals those using the line of its presence, at the same time identifying itself. This system is patented by Mr. J. W. Nilsson, of North Dakota.

SWITCHBOARD-CIRCUIT SYSTEM.

A switchboard-circuit system has been patented by Mr. A. D. T. Libby, of Elyria, Ohio, which is a sort of compromise between the two-wire and three-wire systems. This system, the patent for which is assigned to the Dean Electric Company, employs the usual line circuit and three-wire jacks of the three-wire system. A cut-off relay in the sleeve circuit responds to the plug sleeve and cuts all line signal apparatus from the line.

The cord circuit is the well-known four-relay cord circuit, one relay for each cord serving to cut-on the supervising lamp and a second serving the lamp circuit. In this system, however,

the circuit-closing relay is connected to the sleeve or third wire, the cut-off relay being left connected to the tip cord strand. A retardation coil is used to lead the talking battery to the ring strand of the cord. A feature lies in the connection of the ringing circuit through an extra contact of the cut-off supervising relay. This is done in such a manner that the response of the called party stops further application of ringing current.

TELEPHONE RECEIVER.

Mr. G. W. Pickard, of Amesbury, Mass., has patented a receiver of the head or watchcase pattern. This receiver is adjustable, as a thumbscrew projecting through the rear of the case provides a means of adjusting the air-gap. The thumbscrew drives the whole magnetic system in guides within the case. A further feature lies in the arrangement of the terminals as an open-space cut-out, a middle block attached to the cores of the coils serving to prevent the existence of a heavy potential difference between core and windings.

AUTOMATIC SELECTOR.

In some automatic exchange systems the multiple contact joints are arranged in a circular series corresponding to numbers 1 to 100. With such systems the selector arm has an extremely short travel for low numbers and a long travel for high numbers. As with the usual electromagnetic drive each angular unit requires the same time for operation, such a selector is slow for high numbers. This difficulty may be largely overcome and at the same time the division and sending of numbers by digits may be introduced by the method of driving the contact arm devised by Messrs. H. B. Holmes, of Park Ridge, and E. B. Craft, of Wilmette, Ill. In their selector, described in a recent patent assigned by them to the Western Electric Company, there is provided a constantly rotating main shaft driven by mechanical power, such as a belt. The contact arm is mounted concentrically with this shaft, but it is loose from it. The shaft may be connected and freed at will through the use of a magnetic clutch with a toothed wheel, and this wheel carries a second toothed wheel, the latter secured to the contact arm. The tens digit is sent by a contact maker, the time of closure of which corresponds to the required angular rotation of the power shaft for the desired set of ten contacts. During closure the clutch is fast, and the power shaft drives both the wheels and the arm. For the units figure the upper wheel alone is driven by a stepping magnet, the teeth upon the step wheel corresponding to the angular distance of adjacent contacts. For the number 75, therefore, the travel of the sender arm closes the clutch until the contact arm is carried around to the seventh group of ten. The clutch releases and the retaining pawl holds the wheel. Five impulses to the stepping magnet advance the upper wheel five units. The restoring of the selector is accomplished by withdrawing the retaining pawls, whereupon springs drive the two wheels back home.

PRIVATE BRANCH EXCHANGE.

A patent relating to the private branch intercommunicating exchange has been obtained by Messrs. J. N. Wallace and E. B. Craft, which patent has also been assigned to the Western Electric Company. The particular feature lies in the means of holding a trunk or exchange line while the answering station is transferring the call to a desired station. The holding circuit, a shunt across the trunk line, is controlled by relays. The governing relay is polarized and becomes active only when a calling plug at the central office is occupying the jack of the trunk line. In other words, the battery polarity existing upon the trunk is reversed by calling upon the trunk from the central office. As this is the only condition under which a transfer is necessary, it follows that the trunk can be held only under proper conditions. With the trunk properly poled and the trunk key at any station depressed, if a local key be depressed the polarized relay will respond and in turn cause the operation of a locking holding relay. When the trunk key at any other station is depressed an unlocking relay restores all to normal.

Letter to the Editor.

Electrical Charge on Dead Wire.

To the Editor of Electrical World:

Sir:—In a recent issue mention was made of an electrical charge found on a one-mile section of disused wire which was well insulated from the ground, and it was suggested that the wire might have received its charge from the exhaust of a locomotive which passed on a track parallel to the wire.

A similar incident was recently brought to the notice of the writer. Two linemen who were stringing a section of copper wire for a transmission line received a severe shock by coming in contact with the wire after it had been strung on the insulators for a couple of hours. The incident occurred on a hot, dry day in June, with no wind. Three trains passed parallel to the entire section in the interval between the stringing of the wire and the discovery of the charge.

It seems improbable that the phenomenon could be traced to the exhaust of the locomotives, as there was no wind to blow the vapor across the wire. Readers would confer a favor by suggesting a possible cause of the charge.

University of Illinois, Urbana, Ill. R. St. Clair Seese.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Three-Phase Commutator Shunt Motor.—L. Dreyfus and F. Hillebrand.—In former papers on the theory of the three-phase commutator shunt motor the opinion has often been expressed that the circle diagram of the ordinary induction motor is valid directly for the three-phase commutator shunt motor if its brushes are short-circuited so that no external voltage is impressed on the armature. The authors first show that this is not correct, but that there is an essential difference between the induction motor and the commutator motor because the circle diagram of the commutator motor is affected strongly by the rotor stray flux. Formulas and results of experimental tests of a motor are given. The short-circuit currents below the brushes are also a distinguishing element, but are of much less importance than the rotor stray flux. The paper is to be continued.—*Elek. u. Masch.* (Vienna), Oct. 16.

Stray Field of Transformers.—W. Rogowski.—The conclusion of his paper on a new experimental method for studying the stray field of transformers. The first part of the paper [illegible] in the Digest last week. In the present instalment the author discusses especially the effect of the iron on the stray field and gives results of measurements made with a transformer with a ratio of transformation of 1 to 1.—*Elek. Zeit.*, Oct. 20.

Magnetizing Current.—M. Kloss.—A mathematical paper giving a new quick method for calculating the magnetizing current of induction motors and for calculating the maximum induction in the teeth.—*Elek. u. Masch.* (Vienna), Oct. 9.

Generators, Motors and Transformers.

Iron-Silicon and Iron-Silicon-Nickel Alloys.—S. Guggenheim.—Former work of W. Barret, W. Brown and R. Hadfield has shown that with increase of silicon in an iron-silicon alloy the hysteresis losses and the eddy-current losses decrease, but that the permeability also decreases. The author endeavored to find an iron-silicon-nickel alloy which would combine small losses with high permeability. However, it is known that a small addition of nickel decreases the permeability. Moreover, the addition of silicon alone permits an increase of

the permeability to $B = 12{,}000$, and therefore he experimented mostly with simple silicon-iron alloys. Fifteen rings were tested, containing silicon up to 4.8 per cent and nickel up to 2.8 per cent. Steel containing over 5 per cent of silicon was too hard and brittle. The results are given in Figs. 1 to 3. Fig. 1 gives the specific resistance as a function of the per-

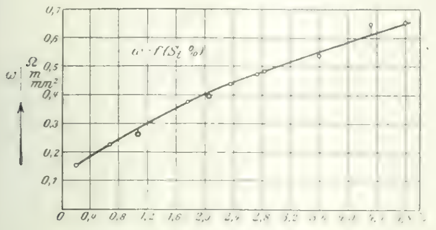


Fig. 1—Percentage of Silicon.

centage of silicon. Fig. 2 gives permeability and hysteresis losses for B maximum $= 8000$ as functions of the percentage of silicon. Fig. 3 gives the hysteresis loss in ergs per cycle per cubic centimeter as a function of the percentage of silicon. The best alloy found by the author contained 94.8 per cent iron, 4.8 per cent silicon, 0.3 per cent carbon and 0.1 per cent manganese. The specific weight of this steel is 7.43, specific

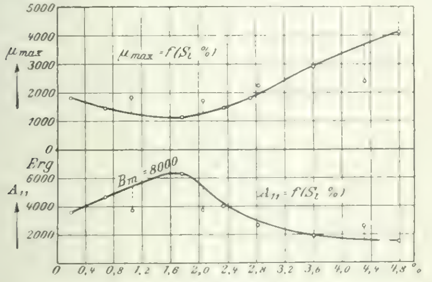


Fig. 2—Percentage of Silicon.

resistance 0.65, μ maximum = 4100 at $H = 1.5$, hysteresis losses 1700 ergs per cycle per cubic centimeter at $B = 10{,}000$; eddy-current loses 0.16 watt per kilogram at $B = 10{,}000$ for a frequency of 50 periods and a thickness of the sheets of 0.5 mm. Beginning with $B = 14{,}000$ the B-H curve bends and becomes very flat and beginning with $B = 15{,}000$ the curve is lower

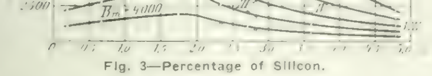


Fig. 3—Percentage of Silicon.

than that of all other alloys. On the other hand, the curve for an alloy containing 2 per cent silicon and 2 per cent nickel rises above all other curves beginning with $B = 14{,}000$, but this alloy is only half as good with respect to the losses. The author did not experiment with higher inductions like $B = 15{,}000$, such as are now often used in practice.—*Elek. Zeit.*, Oct. 20.

Lamps and Lighting.

Cost of Lighting with Incandescent Lamps.—Besides the specific power consumption in watts per candle-power other factors must be considered in determining the economy of different types of incandescent lamps. These are the price, the useful life and the number of candles. The latter is of importance in calculating the amortization, since the prices of lamps of different candle-powers are approximately equal within certain limits, so that the amortization is the higher the lower the number of candles. The cost of one cp-hour in cent is $K = wf + a/(sn)$, where w is the watts per candle-power, f the cost of a watt-hour in cents, a the cost of the lamp in cents, S the useful life of the lamp in hours and n the candle-power of the lamp. $a/(sn)$ is the amortization. The author gives the numerical data for various carbon, tantalum, tungsten and zirconium lamps, and gives a diagram from which the cost of the cp-hour for different lamps can be directly determined. Some numerical examples are added to show under what conditions certain lamps are more economical than others, especially to show how the situation changes with a change in the cost of the kw-hour and with a change in the candle-power of the lamps selected.—*Elek. Anz.*, Oct. 20.

Electricity for Shop Lighting.—Five illustrated articles on electric store lighting and store-window lighting. They commence with some notes on the general arrangement of store-lighting installations, the number and position of lamps required, and illustrations of some suitable shades and reflectors are given. Store-window lighting is next dealt with in a separate article, and the relative merits of various methods of arranging lamps are discussed, several forms of reflectors for effective concealed lighting are illustrated, and this form of illumination is recommended as preferable in a great number of cases to lighting by lamps hung on visible pendants, etc. The use of arc lamps is also considered, and a few notes on decorative lighting are given. A number of forms of lantern for exterior shop lighting are illustrated, and the general question of lighting store fronts from the outside, both by incandescent lamps and by arc lamps, is dealt with. A few figures as to the cost of arc lighting are given. A more technical article follows, giving detailed descriptions of the various electric signs. These range from the simple box sign for window advertising, consisting of a sheet-metal box with painted glass fronts and a thermal flasher controlling a single lamp, to the enormous writing and color-changing signs erected on the outside of buildings. The latter are controlled by motor-driven switches, some types of which are described and illustrated. Various means are adopted to give clear and brilliant effects without producing an unpleasant glare. The exterior signs must also be waterproof and durable. Finally, tables are given showing the cost of lighting by metallic-filament lamps. Figures are given both for osram and tantalum lamps. The latter are not quite so economical in energy consumption as the tungsten lamps, but the cost of the lamps themselves is less, and the lamp will also stand rougher usage, since the filament, which is of wire-drawn tantalum, is tougher.—Lond. *Elec. Eng'ing*, Oct. 20.

Manufacture of Metallic-Filament Lamps.—B. Duschnitz.—An illustrated description of various new appliances used in the manufacture of metallic-filament lamps, especially presses, furnaces, apparatus for the formation of the metallic filaments, etc.—*Elek. Anz.*, Oct. 9 and 13.

Generation, Transmission and Distribution.

Oil Testing.—W. Yorke.—An article on inexactitudes of oil testing in power plants. Notes are given on tests of density, viscosity, flash point, fire test, gumminess, acidity and evaporation, but it is pointed out that the most important property of the oil is its emulsifying tendency. It is emphasized that a mineral oil may emulsify readily with water from one district, and yet may show no inclination to mix with water from another area. It is important, therefore, when investigating this tendency that the treating water be taken from the actual situation. This implies the use of the condensed steam from the particular engine or plant when trying cylinder oils. The good results achieved with an oil in one plant are therefore not necessarily applicable to another and similar plant, unless the characteristics of the water in each are related. When the comparison of various cylinder oils is under discussion the

emulsifying tendency should be regarded as the most significant, for the conditions under which these oils work are such as to completely satisfy any miscible tendency. The chief disadvantages of an emulsified cylinder oil are: (a) The lubricating power is much reduced and a greater quantity of oil is required. (b) The emulsion is more easily washed from the cylinder walls, which also increases the consumption. (c) The pollution of the condensed steam, after which, owing to the very intimate connection between the oil and the water, its use for boiler-feed purposes is undesirable unless a costly purifying plant is employed to destroy the emulsion.—Lond. *Elec. Review,* Oct. 21.

Traction.

Tramway Line with Surface-Contact System.—An abstract of last year's account of the tramway system of Wolverhampton, where the Lorain surface-contact system is in use. The working expenses show a small increase, due mainly to extra repairs being carried out in connection with the permanent way and the Lorain equipment. The system, however, continues to compare not unfavorably with undertakings where the overhead trolley has been adopted. The traffic during the past year shows an increase compared with that of 1908-9, the total number of passengers carried being 9,670,657, as against 9,050,459, the number of passengers per car-mile averaging 9.38 and 9.4, respectively. The number of kw-hours used per car-mile, namely, 1.408, is smaller than last year's figure of 1.56. The consumption for 1907-8 was 1.60 kw-hours. The total working expenses per car-mile, including capital charges, are 18.56 cents (18.74 in the year before). The total working expenses without capital charges are 12.84 cents (against 12.74 cents). The item of repairs and maintenance is 2.90 cents (against 2.36 cents).—Lond. *Electrician,* Oct. 21.

Gasoline-Electric Car.—An illustrated description of gasoline-electric cars used on the tramway system between Point Shirley and Winthrop, in Massachusetts, on account of the great distance of the line from a suitable electric power station. The prime mover is a gasoline engine connected to a direct-current generator. The speed of the car is controlled by varying the impressed voltage. This is done through altering the engine speed by keeping the spark advanced and running on the throttle. The car lighting is by the Apple system, in which a low-voltage, direct-current generator is driven by the flywheel of the engine. The generator delivers energy to a storage battery which feeds 20-watt tungsten lamps. The storage battery also supplements the low-tension ignition system.—*Elec. Ry. Journal,* Oct. 22.

Single-Phase Traction.—Bandow.—The conclusion of his paper read before the Berlin Electrical Society on the Westinghouse-Bergmann single-phase traction system. In the present instalment the author deals especially with the construction of the current collectors, motors, etc.—*Elek. Zeit.,* Oct. 20.

Installations, Systems and Appliances.

Electricity in Textile Mills.—F. Nasmith.—A paper read at the Manchester Engineering Exhibition. The author points out the large field for the adoption of electrical devices in connection with textile machinery. As showing what can be done he describes the application of the Brown-Boveri motor to ring spinning, the quick production of new designs in weaving, and the Chapman electric neutralizer for removing the effect of static electric charges in spinning. A very present evil in spinning mills is static electricity, generated by the friction of the fibers during treatment. Considerable trouble is given to the operators through the presence of this static electricity; woolen roving, for instance, will stick to the rub rollers on the finisher cards, causing breakage and irregularity in the subsequent yarn; the yarn is rough, loose short fibers standing out from the closely adhering main body of fibers; the web passing from the doffer breaks down when starting up, and, due to the before-mentioned sticking, the amount of waste is comparatively high. The remedy devised by Chapman is as follows: A special transformer is provided, which is bolted up to the wall or ceiling in any convenient place, and serves to deliver the electric current in the proper form to the various machin where the static electricity is to be neutralized. A single lir of heavy insulated wire leads from the transformer to th various points of treatment. This line may be run along tl ceiling over the machines or under the floor on which tl machines sit. On each machine is placed one or more i ductors connected to the line wire. The inductor is a ste tube 1½ in. outside diameter, of suitable length to reach acro the machine, slotted on one side from end to end, and havin a series of porcelain blocks in the slot. The blocks contai the active points from which the influence is radiated to th charged material, and a heavily insulated cable runs throug the inside of the tube and distributes the alternating charg to the several active points by induction. The tube itself earthed, but the line wire is connected directly with the cab inside the tube. The connection is made through a convenie form of removable socket at the end of each inductor. Th inductor is placed at some point in the machine where th charged material may pass by it at a distance of from 1 in. t 3 in. and the material becomes instantly neutralized thereb even when running at a speed of 1000 ft. per minute.—Lon *Electrician,* Oct. 21.

Alarm-Signaling Devices for Circuit-Breakers.—S. Lees.—An illustrated description of various signaling devices for us in connection with automatic circuit-breakers. They may hav the form of a bell alarm or a lamp signal, or a combination o

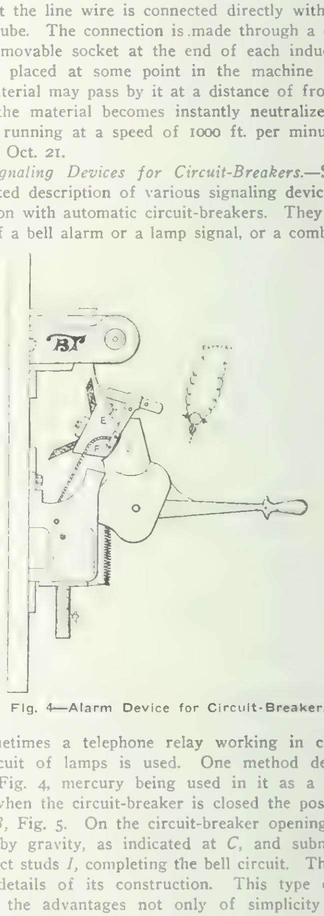


Fig. 4—Alarm Device for Circuit-Breaker.

both. Sometimes a telephone relay working in conjunction with a circuit of lamps is used. One method described is shown in Fig. 4, mercury being used in it as a conductor. Normally when the circuit-breaker is closed the position is as shown at *B*, Fig. 5. On the circuit-breaker opening the mercury falls by gravity, as indicated at *C*, and submerges the metal contact studs *I*, completing the bell circuit. The sketches show the details of its construction. This type of contact device has the advantages not only of simplicity and easy fitting, but also of being applicable to most types of circuit-breakers. The clipper holder *D* (Fig. 5) is simply secured under the screw heads of the "blow-out" subsidiary contact fingers *E*, or coil lead *F* (Fig. 4). For this form of device the author uses for the shell or casting and plugs a good quality of red vulcanized fiber (spent cartridge fuse cases are suitable). An alternative design, with screw-threaded plug, is shown at Fig. 6. A method for fixing the alarm device on the back of the board is also described.—Lond. *Elec. Review,* Oct. 21.

Alternating-Current Motor Starter.—A note on a recent British patent (21,357, Oct. 13, 1910) of A. C. Heap. In order to obtain a gradual increase of the applied pressure when starting alternating-current motors the starter consists of a 1 to 1

ratio transformer with the primary and secondary windings arranged so that their inductive relations can be continuously changed from zero to a maximum. Automatic gear is provided to prevent too sudden an increase in the applied pressure and to cut out the transformer immediately when the full voltage has been applied.—Lond. *Elec. Eng'ing*, Oct. 20.

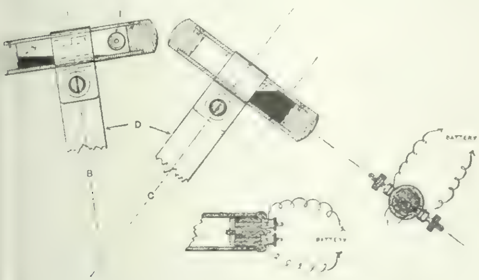
Motor Control.—A note on a recent British patent (1146, Oct. 13, 1910) of the British Thomson-Houston Company (General Electric Company of this country). In the system employing "notching relays" to regulate the successive closing of the contactors the relay series coils are arranged to serve as overload relays to open some or all of the contactors on an overload, thus protecting the motor by reducing the voltage applied. For this purpose contacts on the "notching relays" are connected with respect to the corresponding contactors so that the circuits of the latter are opened when the relays operate on an overload.—Lond. *Elec. Eng'ing*, Oct. 20.

Wires, Wiring and Conduits.

Destruction of Wiring Insulation.—K. Simons.—An illustrated article in which the author describes a case of destruction of a wiring installation and especially the destruction of the insulation due to moisture, growth of fungi and formation of rust.—*Elek. Zeit.*, Oct. 20.

Electrophysics and Magnetism.

Musical Arc Oscillations in Coupled Circuits.—E. Taylor Jones.—The author has formerly given photographs showing



Figs. 5 and 6—Arrangements of Contacting Device.

the variation of potential at the terminals of the secondary of a pair of coupled circuits when the two oscillations of the system are simultaneously maintained by a musical arc connected to the primary. In these experiments the circuits were so adjusted that the frequency of one of the oscillations corresponded either to one of the harmonics of the other or to a perfect fifth above it. It was pointed out in the latter case that it was necessary that the two notes of the system should be equally stable in order that the double oscillation curve might be produced, and that the note when heard was an octave below the lower of the two primaries, being in fact their difference in tone. The author has now extended the investigation to some of the smaller intervals, where he finds similar conditions to hold, although there are some differences.—*Phil. Mag.*, October.

Zeeman Effect.—P. Zeeman [illegible] third paper on the magnetic splitting of absorption lines and its relation to the spectrum of sun spots.—*Phys. Zeit.*, Oct. 15.

Rays of Positive Electricity.—J. J. Thomson.—His full paper on an experimental study of rays of positive electricity presented before the British Association, an abstract of which has already been noticed in the Digest.—*Phil. Mag.*, October.

Canal Rays.—E. Goldstein.—[illegible] arrangements for the production of canal rays.—*Phys. Zeit.*, Oct. 15.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—F. Haber, A. Koenig, A. Platou, W. Holwech and A. Wolokitin.—Five papers dealing with different problems involved in the fixation of atmospheric nitrogen. Haber, Koenig and Platou report on experiments made with a high-tension arc with artificial cooling. The first series of experiments was made with direct-current arcs, the object being the determination of a maximum concentration at reduced pressures. The arc was produced in a fused-quartz tube, water-cooled from the outside. The curve of concentrations produced shows a decided maximum (8.16 per cent NO) at an atmospheric pressure of 150 mm mercury (voltage, 1400; current, 0.27 amp). In a second series of experiments the authors determined the apparent phase difference in an alternating-current arc and the yield obtained. With a power consumption of 0.7 kw, with a concentration of 3.4 per cent NO, 57 grams HNO_3 were obtained per kw-hour; this gives a yield of 500 kg HNO_3 per kw-year. In view of the high concentration this figure is fairly satisfactory. Holwech and Koenig show that with a changed experimental arrangement, using direct current, they were able to obtain yields of 80 grams HNO_3 per kw-hour, with a concentration of almost 2.5 per cent NO. High-frequency alternating-current discharges were employed in experiments of Haber and Platou. The frequency does not have any great influence on the yield as long as proper precautions are taken. Experiments with increased pressure were made by Haber and Holwech, but no improvement of the yield was made. Wolokitin studied the formation of nitrogen oxides in the hydrogen flame. The following figures are given on the yields now obtained in European commercial plants: 50 grams to 75 grams HNO_3 with a 1.0 per cent to 2.5 per cent concentration of NO_2 and NO with preheated air. If the air is not preheated the "horn" discharge apparatus yields 50 grams HNO_3 per kw-hour.—*Zeit. f. Elektrochemie,* Oct. 1. Abstracted in *Met. and Chem. Eng'ing,* November.

Modified Cyanide Process.—J. C. Clancy.—An account of a modified cyanide process in which cheaper materials instead of sodium or potassium cyanide can be used. The author employs especially calcium cyanamide which is made in the electric furnace and which has heretofore been used as a fertilizer only. A solution of calcium cyanamide can be made an effective solvent for precious metals if at the same time electrolysis is employed.—*Met. and Chem. Eng'ing,* November.

Electric Steel.—An illustrated description of the first Norwegian steel works using an electric furnace for steel melting. This is the plant of A. Hiorth, who employs a double induction furnace, with a larger compartment in the center. The capacity is 5 tons to 6 tons.—*Elek. Anz.*, Oct. 13.

Units, Measurements and Instruments.

Electromagnets.—E. Jasse.—Continuation and conclusion of his paper on the calculation of electromagnets. In the present instalment the author gives the formulas for special designs of magnets, both rotary magnets and lifting magnets.—*Elek. u. Masch.* (Vienna), Oct. 9 and 16.

Calibration of Optical Pyrometers.—G. A. Shook.—While for the calibration of optical pyrometers a "black body" is needed as a primary standard, yet for ordinary use a simpler secondary standard is preferable. The author recommends the use of wide-filament incandescent lamps as secondary standards. If a pyrometer lamp is aged at 1900 deg. C. for about twenty hours it will remain sufficiently permanent for the most accurate work for about fifty hours.—*Phys. Review*, October.

Alternating-Current Measurements.—The first part of an article of an elementary nature, illustrated by diagrams, on alternating-current measurements, dealing especially with instruments of the electrodynamometer type and electrometers. The article is to be continued.—*Elek. Anz.*, Oct. 16.

Laboratory Resistances.—M. Siegbahn.—An illustrated description of some forms of simple resistors for laboratory use. The author has found water-cooled manganin wire very useful. While manganin wire of 11.4 ohms per meter in air cannot stand more than 1 amp it stands 5 amp when water-cooled. Another type of laboratory resistor makes use of thin carbon rods.—*Phys. Zeit.*, Sept. 15.

Telegraphy, Telephony and Signals.

Transmission of Pictures.—B. Glatzel.—The first part of a paper describing new experiments on the electric transmission of photographs and pictures. In the transmitter a method of compensating for the inertia of a selenium cell is employed. In the receiver a special "light relay" is employed. The latter, as used by Korn, is shown in principle in Fig. 7, in which *N.S.*

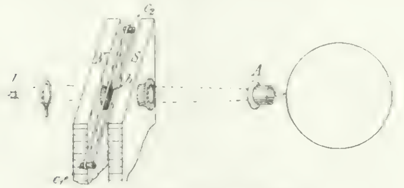


Fig. 7—Picture Transmitter.

are the two poles of a strong electromagnet. The light from a Nernst lamp *J* passes through holes in the poleshoes. In the magnetic field a loop consisting of two thin copper ribbons c_1 c_2 is provided. The current passes through both ribbons in parallel and the two ribbons can be more or less stretched. This loop c_1 c_2 has at its center a small rectangular piece of mica. The light of the lens falls on a screen. When the loop c_1 c_2 is at rest no light falls through the lens. But when a current passes through c_1 c_2 the piece of mica is deflected and more or less light falls through the lens upon the screen. The deflection is the greater the greater the current. Evidently the arrangement is simply a relay, so that the illumination at the receiving end is entirely independent of that at the transmitting end. The paper is to be concluded.—*Elek. Zeit.*, Oct. 20.

Electric Clock.—Clocks controlled by conical pendulums are not so exact in regulation as those having the ordinary swinging pendulums. There are, however, many cases, such as the driving of astronomical equatorials, registering chronometers, seismographs, etc., for which a very uniform and continuous motion is required, combined with a considerable torque, and for these cases the intermittent to-and-fro motion of the ordinary pendulum is not suitable. To meet such cases an improved electric clock, controlled by a powerful conical pendulum, has been devised by R. Thury. It is shown in Fig. 8. This is a master clock, from which any number of secondary clocks can be operated in exact synchronism. It consists of a motor-generator with fixed slotted Gramme-ring armature below and is driven from some outside source, such as a storage

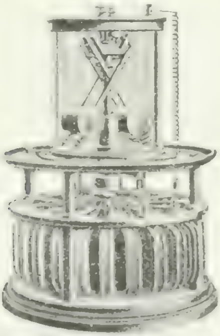


Fig. 8—Thury's Electric Clock.

battery. Inside this armature a soft iron electromagnet is arranged to rotate, and this drives the main vertical clock spindle. This magnet carries two independent windings—one for the main excitation and the other as a regulating excitation. Two collector rings attached to the spindle serve to carry the current from the battery both to the main magnet winding and to the stationary armature through a pair of adjustable revolving brushes rubbing on the stationary commutator of the armature. The double-crossed-arm conica pendulum is attached to the upper part of the vertical spindle as shown. It is arranged to be synchronous over a considerable angle. The upper part of the pendulum rods acts as a adjustable contact maker, which serves to make or break th circuit of the auxiliary regulating winding on the magnet. A soon as the pendulum bobs open out beyond a certain angl the contact is broken and the current cut off from the auxiliar winding. As this auxiliary winding is arranged to act in op position to the main winding, this increases the field strengt of the motor, and thus slows it down. The heaviness of th bobs prevents any appreciable speed fluctuations occurring be tween two successive regulations. The current broken at th contacts is kept very small so as to avoid sparking. Thre equidistant tappings are taken out from the stationary arma ture winding, and these form the generator part of the motor generator, and serve to provide the polyphase alternating cur rent used to drive the secondary clocks. Three wires, or tw wires and an earth connection, join the master clock to th whole of the secondary clocks for this purpose. The secondar clocks contain merely a simple synchronous motor consistin of two stationary armature coils and a permanent magn rotating within them in exact synchronism with the supply cu rent. The actual speed of the secondary clocks can be give any desired value by varying the number of poles in th synchronous motor. If two-phase or three-phase currents d not give a sufficiently constant turning movement it is an eas matter, by means of transformers, to produce a six-phase su ply.—*Zeit. f. Schwachstromtechnik*, No. 5; abstracted in Lon *Elec. Review*, Oct. 21.

Bookkeeping.—G. Johnson.—The first part of an article c the bookkeeping and accounts of telephone undertakings. Nu merous blank forms are given as illustrations.—Lond. *Ele Review*, Oct. 21.

Miscellaneous.

Metals Used in Electrical Industry.—W. Fellenparg.— continuation of his long serial on the development of electric engineering in the United States and Germany. In the prese instalment he gives statistical data on the production and co sumption of copper, zinc, lead, tin, silver, aluminum, nick mercury, antimony, manganese and platinum.—*Elek. Zei* Oct. 20.

Book Reviews.

Electrical Engineer's Pocketbook. Tenth edition. Edited l William H. Fowler. Manchester: Scientific Publishi Company. 566 pages, illus. Price, 2s. 6d.

The title of this book is somewhat ambitious, and althou the book contains many valuable data along certain lines, would not be advisable for an electrical engineer to go in the wilderness to build a plant with only this book for refe ence. The subject is divided roughly as follows: Tabl magnetism, conductors and insulating materials, wiring, resis ance measurements, electrical instruments, batteries, dire current and alternating-current machinery, transformers, swit boards, electric traction, rules and regulations. The section conductors and insulating materials contains many useful d arranged for ready reference. The portions of the book wh deal with heavy electrical engineering are too brief to be much value. The measurement of resistance, the subject magnetism, the laboratory measurements of electric quantiti etc., receive a more or less detailed treatment. The charact of the book is not adapted to the needs of the American ele trical engineer; for instance, the subject of power transmissi occupies less than two pages and of that about half is devot to the Thury direct-current system.

E FOUNDATIONS OF ALTERNATE-CURRENT THEORY. By C. V. Drysdale. New York: L[illegible] & Company. 300 pages, 190 illus. Price, $2.50.

The flow of electricity and the general relations of the energy tors in simple electric circuits are explained by aid of chanical analogies. These analogies are carried out in at detail and occupy the greater share of the book. The pe of the book includes the circuit constants: resistance, intance and capacity; the treatment of series and parallel cuits; the elementary theory of mutual inductance or the nsformer. Hysteresis, eddy currents and the theory of ctrical apparatus are not touched upon. The book is ined merely as an introduction to advanced treatises on the ject, and as such it serves well its purpose. It should give student a physical conception of alternating-current phenena and therefore make it possible for him to follow with etter understanding the theory of electrical machines and cuits when studied mathematically.

ACTICAL DYNAMO BUILDING FOR AMATEURS. Construction and winding of an experimental 50-watt dynamo. By Arthur J. Weed. New York: The Norman W. Henley Publishing Company. 82 pages, 64 illus. Price, $1.

Detailed instructions are given for building a small direct-current machine, most of the work to be done on a small lathe. The successive operations are clearly illustrated, thus greatly facilitating the understanding of the methods of carrying on the work. The author states that he has had considerable experience in building small machines and the one which is here described has been extensively built and represents good practice.

PROCEEDINGS NATIONAL ELECTRIC LIGHT ASSOCIATION. Thirty-third convention, 1910. New York: National Electric Light Association. 2 vols., 2070 pages, 483 illus.

These two volumes include the report of the thirty-third convention of the National Electric Light Association, held at St. Louis last May, and mark the twenty-fifth anniversary of the association. The volumes include 2070 pages and 483 illustrations, among the latter being a fine portrait of President Frueauff and several elaborate colored engravings in the paper on "Street Arcs," by Mr. W. D'A. Ryan. The volumes embrace some seventy papers and committee reports, all of which are briefed in an index for ready references. A year ago the edition was 4500 sets. This year, owing to the rapid increase in membership, the edition reaches 7000 sets and represents about 28 tons of printed matter. The publication this year is ahead of the usual date.

New Apparatus and Appliances

ACTICAL PERFORMANCE OF ELECTRIC COMMERCIAL VEHICLES.

1 the accompanying illustrations are shown two veteran tric trucks which took part in a commercial-vehicle contest . in New York City on Oct. 28 and 29. The "Mary Ann" the first truck built by the General Vehicle Company nine s ago, and the Daussa truck was built by the same company

Fig. 1—Electric Truck Nine Years in Continuous Service.

Fig. 2—Electric Truck 7 . Years in Continuous Service

e a and a half years ago. Although neither of these trucks rdinarily called upon to cover more than twenty-five h covered thirty miles on the first day of the contest ended in creditable order.

the forty entries in the contest twenty-four were electric le seventeen of these were General Vehicle Company ne, of which fifteen were entered by the owners and two manufacturers.

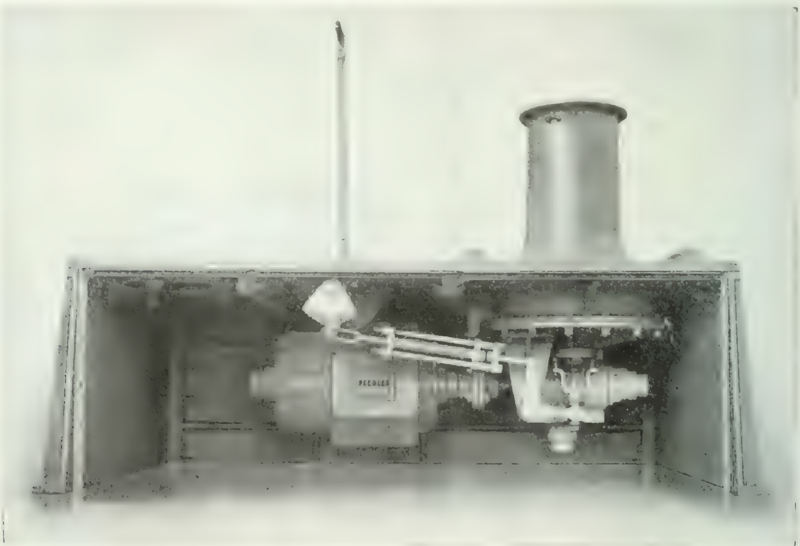
New York Edison Company entered five machines, a 1000-lb. lamp wagon, a 2000-lb. repair wagon, a 2-ton freight truck, a 3½-ton pole-hoisting truck and a 5-ton cable-winch truck. The Edison Electric Illuminating Company, of Brooklyn, entered a similar 5-ton cable truck. The United Electric Light & Power Company entered a 2000-lb. repair wagon and a 3½-ton cable truck. There wei . also entered by the owners a 2000-lb. bread wagon, a 3½-ton milk truck, two beer trucks and one package-delivery wagon. The manufacturer of the above trucks, the General Vehicle Company, entered a 3000-lb. furniture wagon which easily covered the required sixty-five miles on one charge, and a 1000-lb. vehicle which carried its full load for sixty-five miles and after the finish of the run officially made a total of 87.6 miles without exhaustion, thereby showing that the modern electric commercial vehicle can readily cover all the mileage that is needed in a working day. It is said that all of the standard General Vehicle trucks of recent design made perfect scores on both days of the contest.

[illegible] distributing class.

Among the manufacturers' cars the winner in the transfer class was a 1000-lb. General Vehicle at a cost of 2.53 cents per ton-mile and the winner in the distributing class was a 1500-lb. Lansden at a cost of 1.06 cents per ton-mile. Among the owners' cars the winners were as follows: A 1000-lb. General Vehicle, cost 1.08; a 2000-lb. General Vehicle, cost 0.84; a 3000-lb. Commercial, cost 0.48, and a General Vehicle, cost 0.40, the costs being in cents per ton-mile for the electricity consumed, with energy at 4 cents per kw-hour. It is noteworthy that the cost of fuel and engine oil for the competing gasoline cars averaged 46 per cent higher than the energy for the electric cars. The maximum variation in cost per ton-mile in any one class for the electric vehicles was only 4.6 per cent, while the gasoline cars in a class varied in cost as much as 214 per cent

ELECTRICALLY DRIVEN CAPSTAN.

One of the most useful applications of electricity is in connection with the driving of capstans for dockyards, railways, collieries, etc.; installations of this kind having rapidly replaced older forms driven by steam or hydraulic power. The essential requisites of such a device are absolute reliability, efficiency of operation, minimum demand on generating plant and low cost of repairs and renewals of ropes. The chief feature of the capstan illustrated herewith and manufactured by Bruce Peebles & Company, Ltd., Edinburgh, Scotland, is that the head is not fixed to the spindle in the ordinary way, but is revolved by a clutch, sliding on the upper end of the spindle inside the capstan head. By having the head loose on the spindle a wire rope fixed permanently to the head can be used and a positive pull obtained as soon as the head begins to revolve, thus avoiding the heavy losses incurred, especially in hydraulic capstans, when they are revolved without doing work. Moreover, the rope being fixed, there is no slipping and grinding action as in the case of capstans where loose ropes are used. The capstan head and box containing the electrical equipment, gearing, etc., [illegible]

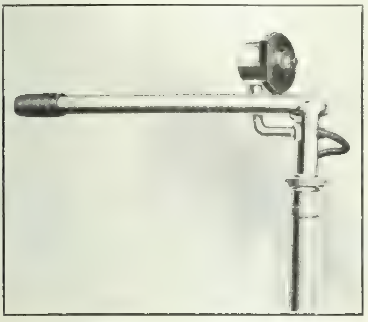


Electrically Driven Capstan, with One Side Removed.

on the top of the box to allow of ready access being obtain to the interior for inspection and repair. The box is arrang to be set flush with the ground, and the provision of a concr pit beneath the capstan is advisable, so as to allow ample ro for access to the working parts. The capstan head has a lar spur wheel attached to it, which is driven from a pinion mount on a worm-wheel shaft, the motor being direct-coupled to t worm shaft. The worm has a triple thread of wrought ir and gears into a phosphor-bronze wheel having ball thrust be ings, the whole running in an oil bath and being provided w a dust-tight cover. Both the pinion and spur wheel are machi cut steel, and are also inclosed in an oil bath and provided w a dust-tight cover. The motor is of the series-wound type, a the motor, controller, main switch, and fuses are totally inclos and mounted on one side of the iron containing-box, the co troller being actuated by a bevel wheel geared to the starti and controlling lever. The starting lever is worked throu the top of the case, and is arranged in such a way as to quite watertight, it being possible to insert and remove the ha dle only when the controller is in the off position. With ea capstan are included a main switch and pair of fuses, two lan also being provided for the convenience of the attendant as w as to keep the atmosphere slightly warmed, which had be found of great advantage with the capstans already install All the necessary internal wiring is provided between the diff ent portions of the apparatus, so as to make the whole compl in every respect, ready for connecting up to the supply cabl In operation, the starting lever is first inserted and moved o to the starting position which actuates the controller and sta the motor, the power from which is transmitted through worm and spur gear to the capstan head, to which the haul rope is permanently attached. At the top, and inside the c stan head, is a clutch which is thrown out of gear by mov the lever in the reverse direction to that necessary for starti this clutch is always in gear except when the lever is thro over in the position mentioned when the capstan head is f to revolve. Should it be desirable to reverse the direction rotation, this can readily be done by moving the starting han over beyond the "clutch out" position. The above descripti refers to a capstan with "handle" type control, but the operati is exactly similar if the "lever and pedal" type be adopted. cepting that the control gear is simplified by the omission of t tension spring referred to above, the clutch in this latter being actuated by a separate pedal.

ELECTRIC AUTOMOBILE WITH AUXILIARY CONTROL.

Control of the motor speed th[illegible] electromagnetic con actors is one of the distinctive features of the Ohio electric utomobile. The controller itself is a small enclosed dial witch mounted on the steering lever. This controller closes uxiliary circuits employing small currents, which energize the windings of electromagnetic switches, completing the main mo- or circuits. The group of contactors is mounted alongside the forward battery under the bonnet. The reverse lever is situ- ated at the side of the seat under the driver's left hand and rovision can also be made for securing an extra high speed by manipulation of a foot lever. The motor speed is reduced by



Controller of Ohio Electric Car.

dent chain gearing to that of the transmission shaft, which, without a universal joint or other complicating feature, drives he rear axle through bevel gearing. From motor to wheels he entire driving mechanism is enclosed in an oil-tight and ustproof case. The braking action is applied directly to the ear axles by foot power, duplicate sets of regular and emer- ency brakes being provided. The standard of construction of he chassis frame approximates the superior steel design em- loyed in high-grade gasoline cars, but the efficiency of the mple transmission results in easy-running characteristics qual to those of any electric vehicle. The Ohio electric car is uilt by the Ohio Electric Car Company, Toledo, Ohio.

ALTERNATING-CURRENT ELEVATOR CONTROLLER.

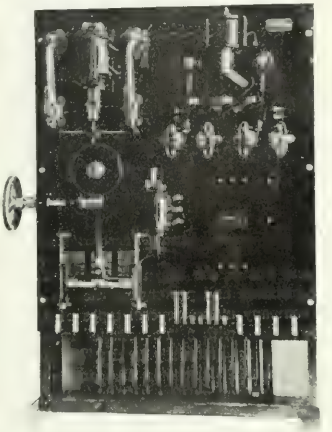
The increasing use in high-class, heavy-duty passenger service f alternating current has created a demand for a magnetically erated system of control from the car switch, thus providing [illegible]ility of acceleration obtainable with direct current. To eet this requirement the Automatic Switch Company, of New ork, has developed a modification of its motor-driven starter d special magnet-reversing switches, which is illustrated in e accompanying engraving.

In the cut in the lower left-hand corner of the panel is shown motor-driven magnetically clutched starting device. This arter is driven by a belt from the motor itself and is arranged cut out nine steps of resistance in the rotor, the steps being [illegible]ered to increase their number. When the magnet on this arter is energized by current from the main line switch, the volution of the worm wheel imparts through the clutching echanism a movement to the horizontal resistance arm, which its upward movement cuts out one after another the various eps of resistance in series with the three leads from the col- lector rings.

Immediately above the starter is shown the double-pole main ne switch, which, by reason of its toggle movement, requires mparatively small energy in the magnet to insure firm seating of the contacts. These contacts consist of alternate copper and carbon buttons.

To the right of the main switch is shown the Darrin magnet reversing switch, which has current in its magnet coil during only the actual operation of throwing from one direction to the other, thus removing all heating and noise from this coil.

Means for preventing the closing of the main-line switch until after the reversing switch has taken a position to correspond with the position of the car switch and until after the resistance arm has fallen to its lowest position are provided so



Alternating-Current Elevator Controller.

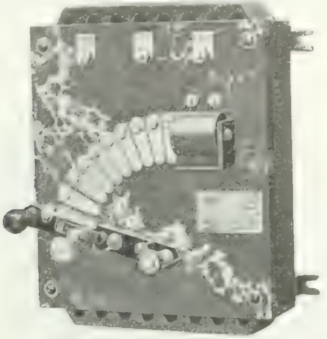
as to prevent the possibility of opening the circuit on the reversing switch, or of closing the main line with any resistance cut-out of rotor. The resistance is of the Whittingham tubular sand-packed type, mounted on angle-iron frame at the back of the panel, so as to leave the wiring at the back of the board exposed to facilitate examining the circuits. Only two magnets are energized when the motor is in operative condition, as the reversing magnet carries current for only an instant. The accompanying illustration shows an equipment now being installed in the State Capitol at Hartford, Conn., by the Springfield Elevator & Pump Company. Four similar equipments have recently been installed in the new laundry building of the Manhattan State Hospital at Blackwell's Island; two of the latter are automatic in that they are operated by push buttons to bring the car to the landing and to send it to another landing.

RHEOSTATS WITH CAST-IRON BOXES.

The Independent Electric Manufacturing Company, of Milwaukee, Wis., is making a new line of controlling devices for both direct current and alternating current. The accompanying illustration shows a motor starter (with underload release), and the company also makes speed regulators, field rheostats and solenoids. A feature of this apparatus is the care used in material and workmanship to make the rheostats rugged and fireproof. The resistance box is made of gray-iron castings and is so designed, with ventilating holes at the top and bottom, that the projections providing for these ventilating apertures also constitute receptacles. Should a resistance unit burn out the melted solder or glowing wire will fall into the lower receptacle and be retained there without any danger of setting fire to inflammable material by which the resistance box may be surrounded. Thus there can be no outburst of flame or molten material from the interior of the box. The resistance units consist of moisture-proof asbestos tubes wound with German silver or iron wire, the tubes being provided with porcelain tips. The front of the box is made of marbleized slate, and all starters and regulators have removable segments and sliding

brushes. With the exception of the wooden handles and the insulation of the magnet wire, all parts of the resistance are of fireproof material.

The ventilating apertures referred to allow a current of air to enter the bottom of the box, pass up and around the resistance tubes and out at the top, thereby providing an effective system of ventilation and prolonging the life of the resistance units. The company makes several types of rheostats. One is of automatic design, with a "no-voltage" release, which allows the lever to swing automatically to the "off" position when the current is interrupted. There is also an automatic type with underload and overload release, which is the same as the no-voltage design with the addition of a solenoid, which allows the handle to swing automatically to the "off" position when a predetermined overload exists which would be dangerous to the motor. Either of the automatic types is furnished mounted on a slate panel with knife switches and fuses, making a complete electric controlling device. Field regulators are also made in open and iron-clad types for the front or rear of switchboards.



Motor Starter with Underload Release.

ELECTRIC RANGE.

The domestic electric range shown in the accompanying illustration, which has been recently perfected by the General Electric Company, is patterned after the ordinary gas range, and cooking, it is stated, can be done with it as quickly as with [illegible] that the heating [illegible] of "calorite," a new alloy discovered by the same manufacturer after years of investigation in its research laboratories.

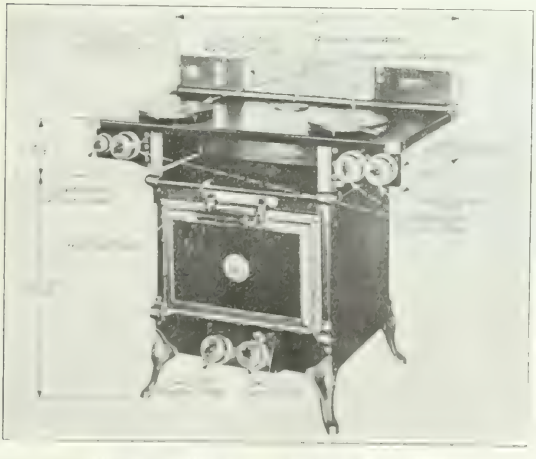


Fig. 1—Domestic Range, Showing Dimensions.

There are three disk stoves on the top of the range designed to be used in the same manner as the burners of a gas range. A turn of the snap switch turns on the heat instantly at full intensity, while another turn cuts it off and so permits the elimination of any expense for energy when the stove is not actually in use, without incurring a delay in getting it into operation again. The two larger stoves are provided with a switch which admits of a three-heat regulation, thus making it possible to get a low, moderate or high heat, as conditions may require. The three stoves permit cooking one, two or three dishes at once.

The combination oven and broiler is commodious, being 18 in. x 18 in. x 12 in. and ample for the needs of a large family, and is provided with heating units at both top and bottom. By removing the ceiling plate of the oven the top heating element of the latter is exposed and may be used as an overhead radiant broiler, or for the purpose of producing a pronounced browning of pies, biscuits, roasts, etc. The ceiling plate can be used as a shelf to support the broiling pan at the proper distance below the heating element. The slide supports on the side of the oven permit vertical adjustment of the broiling pan and oven shelves, and also the use of several shelves at once. The broiling pan (which is furnished

Fig. 2—Domestic Range, Showing Interior of Oven.

with the range) is also suitable for use as a roasting pa[n]. Printed instructions accompany each range, and tell wh[at] "heat" to use and how long to leave it on to bake or roast th[e] various kinds of meat, bread, cake, pie, etc. The stove[,] broiler and oven all have independent controlling switche[s]. It is said not to be necessary to use a thermometer with th[e] oven, as the temperature attained at the various positions [of] the switch for the intervals of time stated in the instructio[ns] accompanying the range will be best suited for each case.

The space between the stove top and the oven is heate[d] indirectly from the oven, broiler and stoves, and so makes [a] convenient plate and food warming closet. To increase th[e] usefulness of the range two additional outlets are provided f[or] individual electrically heated devices, one being an outlet f[or] a percolator, etc., of one heat and not over 600 watts, and th[e] other an outlet for a grid or other three-heat electric devic[e], a three-heat switch being mounted on the range for its control. The equipment of the range is as follows:

Two 8-in. disk stoves, 375-1500 watts, three-heat switc[h]; one 4-in. disk stove, 500 watts, one-heat switch; one broile[r], 1600 watts, one-heat switch; one oven, 575-1150-2100 watt[s], three-heat switch; one warming closet, indirectly heated.

The circuits to each part of the range are separately fuse[d] by a double-pole fuse block, while a main fuse of 60-am[pere] capacity protects the entire range. The wiring is arrange[d] for either two-wire or three-wire connection. The range [is] of sheet metal construction and finished with nickel trimming[s]

Industrial and Commercial News

The Week in Trade.

COLDER and more seasonable weather had the effect of stimulating retail trade to some extent last week. The improvement, however, was not sufficient to cause any great amount of boasting. Among the wholesalers and jobbers the improvement is one of sentiment rather than of actual trade. Re-orders are coming in very slowly, but the majority of dealers believe that after election there will be something almost like a rush of Christmas orders. While heavy frosts were reported over much of the producing section within the last week, the crops were so well gathered that very little damage was done. In fact, the crops all over the country have been harvested unusually early and have been marketed with unusual celerity. This has added to the ready money throughout the entire agricultural district, and has done something toward stimulating retail trade. Relatively the best reports as to retail trade come from the central West and South. Trade in Eastern centers has been fair, but not as good as in the agricultural districts. The labor troubles in New York City have caused some congestion in the movement of freights. In the industrial world there is very little change. The most noteworthy occurrence of the week in the iron and steel industry was the order of 33,000 tons of rails by the Erie Railroad. This is the first considerable order of rails that has been placed, but it is well known that other railroads have prepared specifications, and orders may be expected between this and the end of the year. There is very little doing in the way of structural material and export trade is distinctly slow. Collections throughout the West are considerably improved, although in Eastern centers they are very little better. Business failures for the week ending Nov. 3 were 179, against 220 the previous week, 212 in the same week of 1909, 205 in 1908, 226 in 1907 and 146 in 1906.

The Copper Market

ACTIVE speculation in standard copper did much to liven up the market last week. There was quite an aggressive buying movement of future deliveries for the London market. Dealers here sold heavily and on several days covered their speculative sales by purchases of electrolytic for December and January shipments. The total sales of this character were reported during the past week to be between 15,000,000 lb. and 20,000,000 lb. There were also a few orders placed by domestic consumers for electrolytic copper at prices ranging from 12.70 cents to 8.80 cents cash for January shipment. It is a notable fact, however, that consumers both in this country and in Europe are showing very much less interest in the market than are the speculators. Those who believe that the copper market is still in an unsatisfactory condition are charging that statistics are being manipulated in order to make appearances favor higher prices. By some of the market experts it is said that the present speculative movement and the present advance in prices are due to a belief that the Copper Producers' Association's report in October will be extremely satisfactory. While the figures for this month have not been given out at the time this report is written, it is understood that they will show a very considerable reduction in the rate of production. This is due to the curtailment policy which was put into effect in August and September and which is just beginning to show in the monthly reports of the association. It is not believed, however, that the takings, either domestic or foreign, will appear very large. The sum total of the report will not show much change in the amount of surplus stock being carried from the report of the previous month. There may be a slight increase or there may be a slight decrease. Imports of copper remain about at the same average that has prevailed since the beginning of September. Exports are not particularly heavy, and for the first five days of November were 2374 tons. The daily call on the Metal Exchange Nov. 5 quoted standard copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	price.
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	12.50
[illegible]	[illegible]	12.65	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

The London market [illegible]

	Noon.	Closing. £ s d
[illegible] spot	[illegible] 9	[illegible] 6
[illegible] futures	[illegible] 9	58 17 6
[illegible]	[illegible]	[illegible]
[illegible]	[illegible] 50c	[illegible]
[illegible] spot	[illegible]	[illegible] 0
[illegible] future	[illegible] 9	[illegible] 6
[illegible]	[illegible]	[illegible]

Industrial and Commercial Notes.

Queens Borough Gas & Electric Company.—The Public Service Commission of the First District of New York received a letter last week from Carleton Macy, president of the Queens Borough Gas & Electric Company, which operates in the Far Rockaway district, making a proposition to the commission to have its experts make a thorough examination of the company's books and make a maximum rate for both gas and electricity for the year 1911. This is the first time a request of this kind has been received by the commission from any corporation. The company now charges $1.30 per 1000 cu. ft. for gas and 18 cents per kw-hour for electricity. Two complaints were filed with the commission last spring, each signed by one hundred consumers, one against the price for gas and the other against the price for electricity, asking that a readjustment of rates be made. Quite a number of hearings have been held on these complaints and expert accountants have made a thorough examination of the company's books in order to determine what would be a fair return for the investment. In his letter to the commission asking for the fixing of rates Mr. Macy says that the expenses attending the inquiry made by the commission have amounted to almost the entire net earnings of the company for the year 1910. Mr. Macy says that asking the commission to fix the rates is a policy that has been adopted as a measure of economy. No action has been taken by the commission as yet. It is probable that it will accept the offer of the company and in that case the cost of any inquiry to be made in the future as to the cost of the production of gas and electric energy will fall upon the commission and not upon the company.

Mexican Northern Light, Heat & Power Company.—M. F. Greenwood, president of the Mexican Northern Light, Heat & Power Company, has recently returned from a trip of inspection of the development which is located on the Conchas River in the northern part of Mexico. Mr. Greenwood says that a branch railway has been constructed from the main line of the Mexican Central to the site of the power station, a distance of about twenty miles. This has facilitated the movement of machinery and supplies. The dam which the company is building is well under way and the work is being rapidly pushed forward, the company having at present more than 1000 men employed. The progress of the work is at this time ahead of the engineers' schedule and is about one-third completed.

General Electric and National Carbon.—At the New York offices of the General Electric Company specific denial is made of the report which has been printed in the West to the effect that the General Electric Company was about to take over the National Carbon Company. It is said that there is absolutely no truth in this, and that there is no deal on between the two companies. This report gained credence in the Chicago market as an explanation of the sudden and rather remarkable rise in the price of the Carbon Company's stock. The National Carbon Company's common stock sold last week at 145. The stock has been steadily advancing for the past two years. On Jan 1, 1909, the stock was quoted at 82. On Jan. 1 of last year it was quoted at [illegible].

McAdoo Tubes Open.—The Hudson & Manhattan Railroad Company will open Nov. 10 its system as far north in Manhattan as Thirty-third Street. While it is intended that the road shall eventually be extended to the Grand Central Station, it is likely that the station at Thirty-third Street will be the most northern terminal for some time to come. At the meeting of the board of directors of the company last week C. W. King was retired as secretary, and William Everdell, Jr., was elected to fill the vacancy. W. J. Martin was retired as assistant secretary, and Kenyon B. Conger was elected to that position.

Philadelphia Electrical Credit Association.—The fifteenth [illegible] at Hotel Walton, Philadelphia, on the evening of Nov. 3, 1910, [illegible] total of sixty-six were present, as well as guests from Washington, Pittsburg, New York, Wilkes-Barre, Scranton and Trenton. Antoine Bournonville, of Alfred F. Moore, the retiring president, made a brief but pointed address, assuring the association of his unabated interest in the work. William T. Pringle, of the Pringle Electrical Manufacturing Company, and C. Ross Smith, of the Westinghouse Electric & Manufacturing Company, were elected members of the executive committee to succeed Mr. Bournonville and F. E. Stow, of the H. C. Roberts Electric Supply Company. Immediately following this election a short session of the executive committee was called and H. G. Kepler, of Walker & Kepler, was elected president, and L. R. Browne, of the Western Electric Company, vice-president. The annual report of John W. Crum, secretary and treasurer of the association, showed a most favorable financial condition. Twelve new members were added to the roll during the year and many testimonials to the value of the association's services were received. Following the business session a silent toast was pledged in water (according to the usual custom of the association) to the memory of the late past-president, Charles E. Trump, of the Novelty Electric Company. An instructive report was given by the association's national delegate, Charles M. Wilkins, of Partrick, Carter & Wilkins Company, covering the last annual meeting of the National Electrical Credit Association.

Telephones for Trains in the Far West.—The telephone method of dispatching trains has lately been adopted on the Shasta division of the Southern Pacific Railroad, where telephone circuits have been installed over 291 miles of road. The new method is being used over a 206-mile section of main line between Ashland, Ore., and Red Bluff, Cal., and a branch of 95 miles from Weed, Cal., to Klamath Falls, Ore. The dispatcher is located at Dunsmuir, Cal., which is 98 miles from Red Bluff, the southern terminal of the circuit. There are twenty-five stations on the entire circuit, twelve being located between Dunsmuir and Red Bluff, nine between Dunsmuir and Ashland and four between Weed and Klamath Falls. This entire circuit is composed of specially drawn 300-pound copper wire, metallic circuit. This telephone line goes through a mountainous region, and wire of extreme weight has been selected, not alone for conductivity but for tensile strength as well. This circuit during sixteen hours out of twenty-four is cut into two sections and during the other third the entire circuit is operated by one dispatcher. The apparatus for this dispatching system has been furnished by the Western Electric Company, which has made more than 90 per cent of the train-dispatching telephones now in use in the United States. Passenger and freight trains on the Southern Pacific are equipped with portable telephone sets, enabling train men to get in touch with the dispatcher from any point along the road.

Western Electric Sells More Property.—The Western Electric Company has sold its Clinton Street property in Chicago to a syndicate composed of William V. Kelly, president of the American Steel Foundry Company, George E. Scott and Robert G. Lamont, vice-presidents of the American Steel Foundry Company, and former Judge Barton Payne. The price paid for the property was about $2,000,000. The holdings represent an original investment by the Western Electric Company of $3,718,316. The company has taken a lease of 500,000 sq. ft. of floor space in the property for the next two years, but will remove the remainder of its manufacturing plant to Hawthorne. Only a few weeks ago the company sold its Polk Street property in Chicago to the Pennsylvania Railroad for $1,800,000. These two sales practically dispose of all of the real estate held by the company in the City of Chicago.

Triumph Electric Company.—It has been announced that the Triumph Electric Company, of Oakley, Ohio, near Cincinnati, will place on the market 2000 shares of its 6 per cent preferred stock, through W. E. Hutton & Company, the Fifty-[illegible] Central Trust & Safe Deposit Company, all of Cincinnati. The company is authorized to issue $500,000 preferred stock and of this $275,000 will be issued, including $48,300 outstanding. The common stock authorized is $750,000 and $540,000 of this is outstanding. A large plant has recently been completed at Oakley and a colony formed for the workmen. During the past ten years the finan- [illegible]

Baltimore-York (Pa.) Trolley Line.—The Pittsburgh Bonding Company is financing a proposed trolley line from York, Pa., to Baltimore. Surveys have already been made and the proposed route will run through Glen Rock, Paradise and Logansville. L. H. Roberts, of New York, is in York trying to interest capitalists in the proposition. It is said that $275,000 will be guaranteed to start the road. The line will be extended to New Freedom, thirty-five miles from Baltimore. For several years there has been a movement on hand to reach Baltimore by way of trolley. But few bridges and cuts are needed over the proposed route. The power of the York Railways Company and the York-Haven Water Power Company will be used.

Want Subway Construction Delayed.—The Public Service Commission of the First District of New York has received communications from the Chamber of Commerce and the Merchants' Association asking that the award of contracts for the construction of the Tri-Borough subway system be delayed until further public hearings can be had. The commission is inclined to take the position that these protests come too late. A civic organization of Brooklyn taxpayers has also expressed its dissatisfaction with the Tri-Borough route and has made a personal appeal to President Shonts of the Interborough Rapid Transit Company asking him to bid for subway construction by private capital.

Laclede Gas Company.—The Laclede Gas Company, of St. Louis, is said to be negotiating with the North American Company for the cancellation of the contract entered into last year for the purchase of energy that will be generated at the proposed hydroelectric development in the Mississippi River, at Keokuk, Ia. The contract obligates the Laclede company to pay a minimum charge of $98,000 a year for ninety-nine years, beginning as soon as the Keokuk company is ready to deliver energy. After investigating the matter thoroughly, the directors of the Laclede company have practically decided that the contract is not an advantageous one, and therefore want it annulled.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at San Francisco, Cal.; Manchester, Ia.; Panama; Eau Claire, Wis.; Marshalltown, Ia.; Albia, N. Y.; Williamsville, N. Y.; Marion, Ala.; Bladen, Neb.; Washington, D. C.; Hurricane, W. Va.; Sullivan, Ill.; Clarkstown, Wash.; Camp Hill, Ala.; Campbellsport, Wis.; Des Moines, Ia.; Newark, N. J.; Burlington, N. J.; Hermiston, Ore., and Roseville, Cal.

Added Facilities at Spartanburg, S. C.—The Spartanburg Railway, Gas & Electric Company, which is owned by the Electric Power & Manufacturing Company, will proceed shortly to increase its facilities and also extend its lines to Gaffney, S. C., twenty miles north, establishing a substation there. Vice-president and General Manager F. H. Knox has returned from a trip to Pittsburgh, where he conferred with the stockholders. The additional equipment will add about 2500 hp.

Long Island Railroad Cars.—The Long Island Railroad Company received last week seventy-five motor and baggage cars. This equipment is a portion of the electrical order that was placed some months ago with the Westinghouse Electric & Manufacturing Company and the Pressed Steel Car Company. The company has just ordered 100 more motor cars in addition to those ordered last spring. The entire order aggregates more than $4,000,000.

Cleveland Electric Illuminating Company.—The Cleveland Electric Illuminating Company has applied for a permit for a new station building on the lake front at Seventieth Street, to cost $850,000. It will be equipped with fifty-six boilers and four turbines. The cost of the equipment will be between $2,000,000 and $3,000,000, it is stated. P. L. Cobb is the architect for the building.

Tri-Borough Bids Tabulated.—The Public Service Commission has concluded the tabulation of the bids which were received Oct. 27 for the construction of the Tri-Borough rapid transit system by city capital. The total of the lowest bids for the twenty-one sections is $85,437,570.

Esperanto for Business Correspondence.—The Standard Underground Cable Company, Pittsburgh, has adopted the Esperanto language for its foreign business correspondence in cases where this can be arranged.

Financial.

The Week in Wall Street.

DURING the period immediately [illegible] the election there was a disposition in Wall Street to transact very little business. While it is not correct to say that the feeling of optimism which prevailed during the early part of October has entirely disappeared, it is certainly true that a great many traders concluded that [illegible] well to wait

NEW YORK.

	Oct 31.	Nov. [illegible]	Shares sold.		[illegible]	Nov. [illegible]	Shares sold.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All. C. [illegible] pfd.	[illegible]	34 [illegible]	7[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Amal. Cop.	[illegible]	71 [illegible]	[illegible]	Me[illegible]	[illegible]	[illegible]	[illegible]
Am. D. T.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am. Loco.	39 [illegible]	[illegible]	1,920	Met. St. Ry.			[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	N. Y. [illegible]	[illegible]	[illegible]	[illegible]
[illegible]	84*	84*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T.	141	142 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] R. T.	[illegible]	77[illegible]	[illegible]	W[illegible]	[illegible]	[illegible]	[illegible]
Gen. Elec.	154	[illegible]	3,700	West'h,	[illegible]	[illegible]	[illegible]
[illegible] Met.	[illegible]	[illegible]	18,1[illegible]	W[illegible]	[illegible]	[illegible]	[illegible]

PHILADELPHIA.

	Oct. 31.	Nov. 4		Oct. 31.	Nov. 4
[illegible] R[illegible]	43*	43*	Phil. [illegible]	[illegible]	[illegible]
[illegible]	115⅝*	11¾	Phila. R. [illegible]	[illegible]	[illegible]
[illegible] St. B'ts.	49*	49 [illegible]	Phila. T[illegible]	[illegible]	[illegible]
[illegible] S. B'ty. pfd.	30*	30*	Union T[illegible]	[illegible]	[illegible]

CHICAGO.

	Oct. 31.	Nov. 4		Oct. 31.	Nov. 4
[illegible] City Ry.	[illegible]	[illegible]	Chi. [illegible]	[illegible]	[illegible]
[illegible] Rys. [illegible]	[illegible]	[illegible]	Met. [illegible]	[illegible]	[illegible]
[illegible] Rys. [illegible]	[illegible]	[illegible]	Met. [illegible]	[illegible]	65*
[illegible]	[illegible]	[illegible]	Nat'[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	N[illegible]	[illegible]	[illegible]

BOSTON.

	Oct. 31.	Nov. [illegible]		[illegible]	Nov. 5
[illegible]	[illegible]	142 [illegible]	Me[illegible]	[illegible]	[illegible]
[illegible]	43*	[illegible]	Me[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	N. E. Tel.	136	[illegible]
[illegible]	[illegible]	[illegible]	W. T. & T.	17*	18*
[illegible] Rys.	[illegible]	[illegible]	W. T. & T., pfd.	89*	
[illegible] Rys. pfd.	84[illegible]	[illegible]			

[illegible] sold.
[illegible] the week Oct. 31 to Nov. [illegible]

until after the election. There has been less than the usual amount of political turmoil in Wall Street during the present pre-election period. A large proportion of the traders were satisfied in their own minds as to the result of the election, and are not alarmed particularly over the outcome. Still there is always a disposition to hold off at such a time. The total [illegible] for the week which ended N[illegible] [illegible] only 513,133 shares. While this is an increase over some of the midsummer business, it is not as large a volume of trading as was anticipated in the fall. One check upon activity has been the advance in rates of interest both in England and Germany. While this has not had a serious effect upon the amount of [illegible] carried in our banks, it has had the effect of making bankers a trifle more cautious. The result of the advance of the discount rate by the Bank of England has been to rapidly increase the surplus of that institution, and the bank is now in a very satisfactory condition. The money market here continues to be fairly easy, although rates are much higher than [illegible] were a few months ago. Quotations Nov. 7 were: Call, [illegible] per cent; 90 days, [illegible] per cent. The quotations [illegible] the table are those of the close Nov. 5.

Financial Notes.

New York, New Haven & Hartford Railroad Company.—The annual report of the New York, New Haven & Hartford Railroad Company for the year ending June 30, 1910, which was made public last week, shows that the gross earnings of the company were $60,693,668 and the net earnings $22,004,452. In this report the Connecticut Company, which holds the electric [illegible] properties in Connecticut, shows net earnings of $2,873,086 [illegible] the Rhode Island Company, which holds the electric properties [illegible] Rhode Island, net earnings [illegible]. The Housatonic Power Company shows net income of $102,651. The report states that during the year there was completed 6000 ft. of four and six-track single-phase electrification in the vicinity of Glenbrook, Conn. One electric freight locomotive was received, which, the report says, has proved more than adequate. It is also announced that surveys have been completed for the main line and yards on the Harlem River branch and for the electrification of the main line between Stamford and New Haven. Plans for the rehabilitation of the Warren power station and the elimination of the direct-current machinery have also been completed and it is stated that requisitions have been placed for multiple-unit equipment for the line operating between Providence, Fall River and Bristol. At the stockholders' meeting the election of T. De Witt Cuyler, representing the Pennsylvania Railroad, to the board of directors was ratified and the membership of the board was increased from twenty-five to twenty-seven by the election of A. S. May and A. E. Clark, respectively treasurer and secretary of the company.

Allis-Chalmers Report.—The annual report of the Allis-Chalmers Company for the fiscal year which ended June 30, 1910, shows operating profits of $2,576,819. This is an increase over the previous year of $767,810. The balance left applicable to dividends on the preferred stock, which amounts to $16,050,000, is equal to 3.7 per cent. This is compared with .84 per cent of the preceding year. The company's total surplus at the close of the year was $1,017,161. In his report to the stockholders President W. H. Whiteside says: "While there has been an improvement in the earnings of the company during the fiscal year as compared with the preceding period, the various works have been operated at less than 60 per cent of their present capacity, due to the unsettled business conditions of the country. There has been a very small demand for heavy machinery, which has restricted the company's operations largely to the lighter lines and thus necessitated considerable development of new lines and types of the smaller machinery, for which there has been a fair demand. The unsettled conditions referred to have disappointed the expectations expressed in our last report, but the company feels that it is now better able to cope with them, due to readjustments and improvements in methods made possible by important additions to the West Allis works." At the annual stockholders' meeting, held Nov. 3, the old board of directors was elected with the exception that Frank O. Wetmore was elected to succeed William W. Allis, who retired.

Rockingham Power Company.—The sale of the property of the Rockingham Power Company, which has a partially completed hydroelectric development at Blewitt Falls, on the Pee Dee River, North Carolina, will take place some time in the latter part of this month. The sale of the plant was advertised for Oct. 5, but was postponed at that time because there was no bidder. The upset price was then fixed at $1,000,000. This price has now been reduced to $750,000. Dr. W. Gill Wiley, president of the Southern Power Company, recently inspected the site at Blewitt Falls, but an official of the Southern Power Company denied last week that his company was negotiating for this property.

Vermont Companies Elect Officers.—At the annual meetings of the stockholders of the Consolidated Light Company and the Vermont Power & Lighting Company in Montpelier, Vt., last week, the following officers were elected: A. D. Bennett, of Port Huron, Mich., president of the Consolidated; A. W. McLimont, of Jackson, Mich., vice-president; Kirk Lathrop, of Detroit, treasurer; H. Howard Bennett, of Montpelier, assistant treasurer, and C. H. Senter, of Montpelier, secretary. These officers were also chosen as the board of directors. The Vermont Power & Lighting Company has the same board of directors.

Ware County (Ga.) Light & Power Company.—At a meeting of the directors of the Ware County Light & Power Company in New York City last week, Stuyvesant Fish was elected president; B. Loomis, Jr., vice-president and C. S. Hammett, superintendent. Mr. Fish is also interested in three other companies in Waycross, the Waycross Gas & Construction Company, the Loomis Utilization Company and the Universal Distillation Company. Extensive improvements are being made by the first-named company calling for the expenditure of over $250,000.

American Telephone & Telegraph Company.—The securities of the American Telephone & Telegraph Company, particularly the stock, are looming up as an extremely popular investment. In the first ten months of the current year the company has added 5000 names to its stockholders' list, and to-day it is claimed that there are over 40,000 shareholders. With the exception of the Pennsylvania Railroad and the United States Steel Corporation, the big telephone company is at the present time the most popular corporation in this country.

Edison General Electric Company.—A special meeting of the stockholders of the Edison General Electric Company, which is a subsidiary of the Canadian General Electric Company, has been called for Nov. 16 at the offices of the General Electric Company, 30 Church Street, New York. This call is explained by Henry W. Darling, vice-president of the Edison General Electric Company, as being made necessary because no annual meeting of the Canadian company has been held

Montreal Street Railway Company.—The report of the Montreal Street Railway Company for its fiscal year, which ended Sept. 30, shows gross earnings of $4,352,551, an increase over the previous year of $477,713. The total net income for the year was $1,475,150 and the surplus, after paying 10 per cent dividends and making a liberal allowance for the maintenance fund, amounted to $200,150. During the past year the company secured an amendment to its charter authorizing the construction and operation of underground railways. Preliminary plans for building some underground lines have been prepared and the work will probably be taken up within the coming year. President L. J. Forget says in his report: "During the past year negotiations were entered into between your directors and the directors of the Montreal Light, Heat & Power Company with a view to bringing about closer relations between the two companies. The scheme submitted did not, however, receive the support of the shareholders of either company to the extent anticipated and has been abandoned, and your directors have been notified by the Montreal Light, Heat & Power Company of their withdrawal from any further negotiations in this connection." The report calls attention to the large extension of the company's business, which necessitates the erection of new shops for the construction and repairing of cars, etc., and says that this work has been commenced. At the annual meeting, which was held on Nov. 2, the Canadian Light & Power Company interests showed that they had a clear majority of the stock of the street railway company. The old board of directors announced that they would not ask re-election and an entirely new board was chosen. The new directors are: E. A. Robert, J. W. McConnell, George G. Foster, K. C.; T. Howard Wilson, W. C. Finley, J. M. Wilson and D. Lorne McGibbon. Mr. Robert was elected president and Mr. McConnell vice-president of the railway company. Mr. Robert is also president of the Canadian Light & Power Company, while the other directors are all directors of the power company. Duncan McDonald was re-elected manager and Patrick Dubee was re-elected secretary. W. G. Ross, former managing director, announced that he was going to take a year's rest in Europe.

Whitney Property Ordered Sold.—The Whitney Power Company's electric developments on the Yadkin River, n[illegible] Salisbury, N. C., in litigation for several years, and as yet [illegible] complete, will be offered for sale Nov. 30, a final decree hav[illegible] been given at Asheville by Federal Judge J. C. Pritchard [illegible] the case of the Bankers' Trust Company against the compa[illegible]. The decree granted provides for the sale of the as yet [illegible] finished plant, together with all of the Whitney properties [illegible] volved, the Yadkin River Electric Power Company, the Yad[illegible] Land Company, etc. John S. Henderson and Charles [illegible] Smith are receivers. The decree is to satisfy a judgment [illegible] $5,406,750 in favor of the Bankers' Trust Company, trus[illegible] under mortgage made in November, 1904. It is further p[illegible] vided that the T. A. Gillespie claim of $344,976 for work d[illegible] on the plant, dam, etc., shall be settled before the bondhold[illegible] receive anything, also the cost of litigation, now amounting [illegible] $138,000.

Texas Interurban Line.—The plans for the construct[illegible] of an interurban electric railway between Austin and San [illegible] tonio, Tex., with branch lines to Lockhart, Luling and Seg[illegible] are taking definite shape. Vories P. Brown, of San Anto[illegible] one of the promoters of the project, announces that the for[illegible] organization of the company will soon be completed and a ch[illegible] ter applied for. The company will have a capital stock of $2,0[illegible] 000. Engineers who have gone over the route of the propo[illegible] line between Austin and San Antonio estimate that the c[illegible] of its construction will be approximately $1,500,000, exclus[illegible] of the power plant. The main line will be eighty-five miles lo[illegible]

DIVIDENDS.

American Smelters Securities Company, quarterly, 1¼ [illegible] cent on preferred B, and 1½ per cent on preferred A, b[illegible] payable Dec. 1.

Federal Light & Traction Company, quarterly, preferred, [illegible] per cent, payable Dec. 1.

Georgia Railway & Electric Company, quarterly, 2 per c[illegible] payable Nov. 19.

Metropolitan West Side Elevated Railroad Company, p[illegible] ferred, quarterly, ¾ per cent, payable Dec. 1.

National Carbon Company, preferred, quarterly, 1¾ per c[illegible] payable Nov. 15.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
[illegible]					
[illegible]	....	......	$3,575,980	...	[illegible]
[illegible]		..	3,089,190	..	[illegible]
Bangor Railway & Electric Company:					
[illegible]	$54,806	[illegible]	34,538	[illegible]	20
[illegible]	[illegible]	18,830	32,500	13,202	19
[illegible]					
[illegible]	[illegible]	[illegible]	47,037	.....	16
[illegible]	[illegible]	41,441	42,556	..	[illegible]
[illegible]					
[illegible]	[illegible]	3,587,250	1,985,007	1,572,045	[illegible]
[illegible]	[illegible]	3,794,492	1,489,989	1,332,252	[illegible]
Cumberland Telephone & Telegraph Company:					
[illegible]	7,060,000	4,100,000	2,960,000	647,000	[illegible]
[illegible]	6,615,368	3,879,440	2,735,928	[illegible]	[illegible]
Dallas Electric Corporation:					
September, 1910	[illegible]	[illegible]	44,266	.....	18
[illegible]	[illegible]	[illegible]	33,058	..	7
Fort Wayne & Wabash Traction Company:					
[illegible]	136,684	[illegible]	[illegible]	45,113	16
[illegible]	[illegible]	71,064	60,704	[illegible]	18
Galveston-Houston Electric Company:					
[illegible]	110,145	[illegible]	46,837	...	20
[illegible]	100,837	56,363	44,474	.....	21
Grand Rapids Railway:					
September, 1910	[illegible]	[illegible]	[illegible]	[illegible]	29
[illegible]	97,626	42,199	[illegible]	18,958	35
Interborough Rapid Transit Company:					
[illegible]	7,157,567	[illegible]	4,178,337	2,640,244	[illegible]
[illegible]	6,099,041	[illegible]	3,887,912	2600,053	[illegible]
Lake Shore Electric Railway System:					
[illegible]	115,008	54,416	60,592	[illegible]	25
[illegible]	108,207	[illegible]	58,365	[illegible]	23
Massachusetts Electric Company:					
[illegible]	[illegible]	1,434,626	[illegible]	[illegible]	[illegible]
Quarter ended Sept. 30, 1909	[illegible]	1,290,899	[illegible]	[illegible]	[illegible]
Minneapolis General Electric Company:					
September, 1910	[illegible]	[illegible]	[illegible]	......	43.
[illegible]	[illegible]	38,858	55,626	......	23.
Montreal Street Railway Company:					
[illegible]	[illegible]	2,455,301	1,897,250	507,078	[illegible]
[illegible]	4,874,838	2,255,019	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	8,885,418	3,339,914	[illegible]	[illegible]
[illegible]	11,031,289	8,306,473	2,724,816	161,035	[illegible]
Norfolk & Portsmouth Traction Company:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.
[illegible]	158,233	88,373	69,860	63,058	6
Seattle Electric Company:					
[illegible]	[illegible]	274,705	206,453	.....	[illegible]
[illegible]	[illegible]	305,341	[illegible]	.....	156
Twin City Rapid Transit Company:					
[illegible]	[illegible]	323,061	[illegible]	140,286	231
[illegible]	[illegible]	270,035	[illegible]	140,251	234.
[illegible]					
[illegible]	211,764	[illegible]	[illegible]	66,981	[illegible]
[illegible]	[illegible]	[illegible]	107,783	[illegible]	[illegible]

General News

Construction News.

CAMP HILL, ALA.—[illegible] an electric light plant, plans for which have already been prepared.

MARION, ALA.—[illegible] were sold at [illegible] of Selma, Ala., for $11,000. It is reported that the new owners propose to erect a new power plant on the Cahaba River and build an electric railway between Marion and Selma.

ESCONDIDO, CAL.—The electric light and gas plants of the Escondido Utilities Company have been purchased by a company composed of local men. Charles C. Glass, formerly in charge of the plant, has been appointed president and manager. The property was formerly owned by Seth Hartley.

FORT MASON, CAL.—Sealed bids will be received at the office of the constructing quartermaster Fort Mason, Cal., until Nov. 18 for construction, complete, five single barracks, including plumbing, heating, electric wiring and fixtures, at Fort Winfield Scott, Cal. Plans, specifications and blank forms may be obtained at the above office. Major George McK. Williamston is quartermaster.

LIVE OAK, CAL.—Preparations are being made by the Live Oak & Encinal Electric Light Company to extend its transmission lines north of Live Oak for the purpose of supplying electricity to the ranchers in that district.

LONG BEACH, CAL.—The contract for construction of transformer building at Long Beach for the Southern Caltifornia Edison Company has been awarded to the Richards-Neustadt Company, for $11,550.

LOS ANGELES, CAL.—The stockholders of the Los Angeles Railway Company have voted to increase the capital stock of the company from $5,000,000 to $20,000,000 and to change the name of the company to the Los Angeles Railway Corporation.

LOS ANGELES, CAL.—We are informed that plans have not been completed in connection with the project to construct a large dam across the Colorado River, just across the California line in Arizona and close to the Nevada border, and that work will not begin for some time. Irving E. Bush, Rialto Building, Los Angeles, Cal., is interested in the project.

NEWPORT, CAL.—Bids will be received by L. S. Wilkinson, City Clerk, for a franchise to erect transmission lines in Newport for the distribution of electricity for lamps, heat and motors.

OAKLAND, CAL.—The Southern Pacific Company will soon apply to the City Council for a franchise to equip its Seventh Street line for electrical operation. If a franchise is granted the company will begin work on same at once.

OCEANSIDE, CAL.—Plans are being prepared by the Oceanside Gas & Electric Company to extend its transmission lines to Fallbrook to furnish electricity in that town. The cost of the work is estimated at $4,000. Eugene V. Griffes is secretary and manager.

OROVILLE, CAL.—The Great Western Power Company is reported to be preparing plans for the construction of a large auxiliary dam in the Big Meadows next year, work on which will begin next April. The large dam at Intake in the Feather River Canyon is nearly completed.

RED BLUFF, CAL.—Notice of appropriation of 8000 in. of water in Mill Creek has been filed with the State Engineer by Leon Bly, to be used for irrigation and power purposes.

ROSEVILLE, CAL.—The Pacific Gas & Electric Company has agreed to make improvements to its plant in Roseville.

SAN FRANCISCO, CAL.—Bids will be received by Gen. Charles L. B. [illegible] U. S. Engineer Office, 726 Chronicle Building, San Francisco, Cal., [illegible] Nov. 28 for electrical machinery on drawbridges across Tidal Canal, Oakland Harbor, Cal.

WILLOWS, CAL.—Arrangements are being made by the Department of the Interior for the erection of a telephone line from Poison Glade, near [illegible]nta, to the Covelo Ranger station; a line will also be extended from [illegible]n Glade to the ranger station on Black Butte.

DELTA, COL.—The Delta Interurban Railway Company, which proposes to construct an electric railway to connect Delta, Cedaredge and Fairview coal mines, twenty-five miles in length, has secured all of the right-of-way [illegible] the grading [illegible] will be located in Delta. Charles G. Montz, 1154 Clarkson Street, [illegible]r, Col., is interested.

EAST HARTFORD, CONN.—The Board of Selectmen has granted the [illegible]h, Colchester & Hartford Traction Company a franchise to build [illegible]posed railway over certain streets in East Hartford.

MERIDEN, CONN.—The M[illegible] Westinghouse Pars[illegible] used for auxiliary purposes.

SUFFIELD, CONN.—The Housatonic Company has submitted a proposition to the village officials offering to replace the present 16-cp carbon lamps, for which the village is now paying $9 per lamp per year, by tungsten lamps of 32 cp for $11 each per year, the company to install the new lamps and fixtures at its own expense.

WATERBURY, CONN.—Surveys have been completed and most of the right-of-way secured for the proposed electric railway to extend from Waterbury to Milldale, a distance of ten miles. Charles H. Preston, Jr., of Waterbury, Conn., is interested in the project.

WILMINGTON, DEL.—The West Chester & Wilmington Electric Railway Company is reported to have secured the right of way and has made arrangements for the construction of the proposed electric railway, seventeen miles in length, to connect West Chester and Wilmington. Lewis Delmas, of Philadelphia, Pa., is president of the company.

WASHINGTON, D. C.—The contract for construction of engine house and power plant at the Freedman's Hospital and Howard University has been awarded to the Boyle-Robertson Construction Company, of Washington, D. C. [illegible]

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Commissioners of District of Columbia, Washington, D. C., until Nov. 12 for furnishing and installing a complete electric lighting plant for the temporary buildings of the workhouse located at Occoquan, Va. Specifications and form of proposal may be obtained at the office of the chief clerk, Engineering Department, Room 497, District Building. Cuno H. Rudolph, John A. Johnston and William Judson are commissioners.

ATLANTA, GA.—Bids will be received by King & Walker, architects, 90 North Forsyth Street, Atlanta, Ga., until Nov. 12 for construction of Grady Hospital building. The heating, ventilating, plumbing and electrical installations will each be let under separate contracts, for which bids are also requested. Plans and specifications may be obtained from the architects upon deposit of $25, which will be returned upon return of plans and specifications. Joseph Hirsch is president of board of trustees.

AURORA, ILL.—The Fox & Illinois Union Railway Company has been incorporated with a capital stock of $25,000 by John E. Meredith, Joshua Rhodes, Frank Zimmerman, Henry H. Evans and Ralph C. Putnam, all of Aurora. The company proposes to construct and operate a railway from Yorkville to Morris with connecting lines to Dwight and Sandwich.

CHICAGO, ILL.—The Kling Brothers Boiler Works, of Chicago, Ill., is reported to be asking for proposals for the construction and equipment of a machine shop and foundry 160 ft. x 250 ft. and a forge and power house 60 ft. x 80 ft., through Grossman & Proskauer, structural engineers, 84 Dearborn Street, Chicago, Ill.

GRANITE CITY, ILL.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 8 for the construction of the United States post office building, including plumbing, gas piping, heating apparatus and electric conduits and wiring, plans and specifications for which may be obtained from the custodian of site at Granite City, Ill., or at the above office. James Knox Taylor is supervising architect.

ROCKFORD, ILL.—Plans are being considered for the installation of an ornamental lighting system, tungsten lamps to be used, in the downtown district in Rockford, the new lamps to be included in the regular street lighting system. It is proposed to have the merchants install the lamp posts and then turn them over to the city to maintain.

SAVANNA, ILL.—The Independent Telephone Company of Carroll County has taken over the property and holdings of the Central Union Company, of Savanna, in Carroll County, with the exception of the toll line. The exchanges will be consolidated at once and the switchboard enlarged.

SULLIVAN, ILL.—The plant and holdings of the Sullivan Mutual Telephone Company have been sold to H. S. Hankins, of Decatur, Ill., for $20,000. It is understood that a company will be formed at once by parties who own and control the Home Telephone Company, of Decatur. The new company took possession of the property Nov. 1, and will rebuild the entire plant, including the erection of a new exchange and new lines, work on which will begin immediately. It is understood that the proposed improvements will involve an expenditure of from $30,000 to $40,000.

SYCAMORE, ILL.—The County Telephone Company is extending its telephone lines from its Sycamore exchange and erecting several short lines about Clare.

WAUKEGAN, ILL.—The Waukegan, Rockford & Elgin Traction Company has awarded contracts for the construction of the first portion of its proposed railway from Palatine to Wauconda, fifteen miles in length.

ANDERSON, IND.—Arrangements have been made to supply electricity to Pendleton, Middletown and a number of other towns within a radius of ten miles from the local municipal electric light plant. The towns are erecting their own plants and will extend the transmission lines to the [illegible]

[illegible] Knotts and associates for a franchise to supply electricity, gas and water in Gary. Electrical service is now furnished by the United States Steel Corporation.

GREENFIELD, IND.—Plans are under consideration for the consolidation of three or more telephone companies north of Greenfield with the company at Maxwell. Benjamin McClannon, president of the Curry's [illegible]

INDIANAPOLIS, IND.—The farmers of the Kankakee Valley have appealed to Governor Marshall to prohibit the construction of a dam in the Kankakee River at Momence for power purposes, claiming that the back water will menace their lands.

INDIANAPOLIS, IND.—A new company has been organized recently to take over the plant of the Royse Electric Company, located at 124 Meridian Street, Indianapolis, Ind. The company proposes to make extension and improvements to the plant. The officers are: Robert P. Oblinger, president; Henry E. Rasmussen, vice-president, and Clifford E. Kennedy, secretary.

SHOALS, IND.—The installation of an electric light plant and water works system is reported to be under consideration by the City Council.

SOUTH BEND, IND.—The Kalamazoo, Elkhart & South Bend Traction Company has filed amendments to its charter providing for the construction of its railway from South Bend to Kalamazoo, Mich., via Mishwaka, Elkhart, Bristol, Constantine, Nottville, Three Rivers, Parksville, Vicksburg and Austin. A. D. Harris, of South Bend, Ind., is president of the company.

COUNCIL BLUFFS, IA.—The Omaha & Council Bluffs Street Railway Company has applied to the City Council for a franchise to extend its railway in Council Bluffs.

DEFIANCE, IA.—The plant and holdings of the Defiance Telephone Company have been purchased by A. P. Hulsebus, who will take over the property and manage the business.

DES MOINES, IA.—The Des Moines Electric Company is contemplating extensive improvements to its plant in the spring, which will involve an expenditure of about $70,000.

GLIDDEN, IA.—The installation of an electric light system in Glidden is reported to be under consideration.

KEOKUK, IA.—The sale of the property of the Mississippi Valley Telephone Company, which was ordered to be sold by the Federal Court at public auction Oct. 27, was postponed by the order of Judge McPherson until Nov. 26. The property is to be sold under a foreclosure procedure to satisfy a mortgage of $180,000. It is expected that the property will eventually be taken over by the Bell interests.

MANCHESTER, IA.—Negotiations have been closed whereby L. Matthews, president of the State Savings Bank, has acquired the controlling interest of the Manchester Heat, Light & Power Company and will take over the management of the property at once. It is understood that both the steam and electric service will be improved and extended. The establishment of a day service is also under consideration.

MARSHALLTOWN, IA.—Bids will be received by the City of Marshalltown, Ia., until Nov. 28 for installation of machinery and water wheels for development of water power. O. L. Ingledue is Mayor.

MASON CITY, IA.—An independent telephone company is being organized by the farmers of Cerro Gordo and Hancock Counties.

WATERLOO, IA.—Surveys have been completed by the Waterloo, Cedar Falls & Northern Railway Company for its proposed electric railway from Waterloo to Dike, via Cedar Falls, a distance of twenty miles.

GYPSUM, KAN.—The proposition to issue $9,000 in bonds for the purchase of the electric light plant, owned by the Gypsum Light & Power Company, was defeated at an election held recently.

GLASGOW, KY.—The Louisville, Lincoln Farm & Mammoth Cave Traction Company is reported to have completed preliminary arrangements and will soon award contracts for the construction of its proposed electric railway to connect Glasgow and Hodgeville, a distance of forty-seven miles. J. M. Richardson is president.

LOUISVILLE, KY.—The machinery in the new factory building of the Champion Wire & Iron Works, which is now being erected in Louisville, Ky., will be equipped for electric motor drive.

DENHAM SPRINGS, LA.—The Maurepas Telephone Company is extending its telephone line from French Settlement to Denham Springs, a distance of twenty-three miles.

BALTIMORE, MD.—The contract for electric wiring of the new Emerson Tower Building, at Lombard and Eutaw Streets, Baltimore, Md has been awarded to the Lord Electric Company. Williams & Shock, of Baltimore, Md., engineers, are in charge of the building.

BALTIMORE, MD.—Plans have been prepared for the construction of a large plant at Lexington and Frederick Streets, Baltimore, Md., to replace the old factory of Becker Brothers & Son, recently destroyed by fire. The new factory will be three stories high and will be equipped with machinery for the manufacture of packing boxes, including electric elevators and conveyors. An electric lighting plant will also be installed.

SALISBURY, MD.—The Wicomico Electric & Power Company, recently incorporated with a capital stock of $500,000, proposes to construct and [illegible] Salisbury [illegible] The [illegible] Company, Drexel Building, Philadelphia, Pa., has charge of the engineering work. J. D. Price, of Salisbury, is general manager.

BOSTON, MASS.—The contract for the installation of electric wires for the portion of the Suffolk County jail used for male prisoners, bids for which were opened Oct. 31, was awarded to T. T. Kelly & Company, Boston, Mass., for $1,284.

CHARLTON, MASS.—Bids will soon be called for the construction of a power house for the Masonic Home at Overlook. The plant will supply electricity for lamps and motors for the buildings and also steam for heating purposes.

GRAFTON, MASS.—The Massachusetts Board of Gas and Electric Light Commissioners has granted the Uxbridge & Northbridge Electric Company, the Douglas Electric Company, the Millbury Electric Company and the Upton Electric Company permission to consolidate with the Grafton Electric Company. The Grafton company supplies electricity in the towns of Grafton and Sutton and the other companies furnish electrical service in Uxbridge, Northbridge, Douglas, Upton and Millbury. All the companies are owned by the same interests.

PITTSFIELD, MASS.—The new electric plant of the Pittsfield Electric Company erected on Silver Lake has been completed and will soon be ready to put in operation. The equipment of the power house includes a 750-kw turbo-generator set, with two Babcock & Wilcox boilers. The switchboard and all machinery are new.

ROCKLAND, MASS.—Announcement has been made of a reduction in the rates of electricity for both commercial and street lighting by the Electric Light & Power Company, of Abington and Rockland, to go into effect at once. The price for electricity for commercial lighting is to be reduced from 20 cents to 18 cents per kw-hour, with a discount of [illegible] per cent for prompt payment, and for incandescent street lamps of 32 cp to $15.75 each per year and arc lamps to $69 per lamp per year.

SPRINGFIELD, MASS.—The State Board of Gas and Electric Light Commissioners has refused the petition of the United Electric Light Company to issue 2500 shares of additional capital stock at $160 per share. The commissioners recommended that the directors call another meeting and recommend a higher amount. In its application for permission to increase its capital stock the company states that it proposes to reduce the maximum price of electricity for lamps from 15 cents to 12 cents per kw-hour. Announcement has been made that the new rate will go into effect Dec. 1, 1910. A reduction in the minimum charge has been made from $1[illegible] to $8 per year.

WESTFIELD, MASS.—The Westfield Power Company has changed over its entire plant from steam to electrical operation. The change involved the installation of thirty-four electric motors from 1 to 34 hp.

WORCESTER, MASS.—The Worcester Merchants' Association has decided to withdraw the petition presented to the City Council four months ago for installing more lamps on Main Street and to submit a petition to the Council asking for additional street lamps and for ornamental lamp posts to replace the present arc lamp system. The City Council is considering the question of substituting tungsten lamps for the Welsbach lamps now in use.

DETROIT, MICH.—The power plant of the Edmunds & Jones Company, which is being erected in connection with its plant, will be equipped with a 250-kva, Crocker-Wheeler generator direct-connected to an Erie-Ball high-speed engine; the auxiliary plant will be driven by a [illegible] pressure turbine; two 125-hp return tubular boilers, equipped with Jones stokers, will be installed. The company manufactures automobile lamps.

HOUGHTON, MICH.—Plans have been prepared for the construction of new shops for the Copper Range Railroad Company at Houghton. The buildings will be 106 ft. x 16 ft. and 24 ft. x 148 ft. All of the machinery will be equipped for electric motor drive.

AURORA, MINN.—The City Council is making arrangements for the installation of an ornamental street lighting system in Aurora.

BEMIDJI, MINN.—The Red Lake Valley Telephone Company has applied to the City Council for a franchise to install an independent telephone system in Bemidji.

MANKATO, MINN.—The St. Paul-Mankato Electric Railway Company is reported to be securing rights-of-way for its proposed electric railway to connect Mankato, St. Paul and Minneapolis, Minn. [illegible] Davy, of Mankato, is engineer.

MINNEAPOLIS, MINN.—Sealed proposals will be received [illegible] until Nov. [illegible] for one or two electric [illegible] centrifugal pumps for use in the water-works department, according to plans and specifications on file in the office of the city engineer.

MINNEAPOLIS, MINN.—The Electric Short Line Railroad Company which is constructing an electric railway to connect Minneapolis and Medicine Lake, is preparing plans to extend the road to Lake Minnetonka, Watertown and Winsted next year. Frank E. Reed, of Glencoe, is secretary.

PINE RIVER, MINN.—Plans have been prepared by the Power Engineering Company, of Minneapolis, Minn., for the power plant for Weber & Hill, including the construction of concrete dam, bridge, power house, etc. The company will have charge of construction of the plant and furnishing of the equipment.

RUSH CITY, MINN.—It is reported that Herman Anderson is contemplating the installation of an electric light plant on the site of the old Diffenbacher mill.

SPRING VALLEY, MINN.—[illegible] Light & In[illegible]stment Company, it is reported, will soon establish . day service to [a]pply electricity for motors.

HANNIBAL, MO.—Arrangements have practically been completed by [th]e Bluff City Telephone Company for the organization of a company [to] build a toll line from Hannibal to Wright City, where it will con[n]ect with the Kinloch system of St. Louis. The cost of the line is [illegible]

MEXICO, MO.—The capital stock of the Mexico [illegible] Company is [illegible]

BILLINGS, MONT.—The City Council has granted a franchise to John [J.] Connolly, representing the Billings Traction Company, to construct [an]d operate an electric railway in Billings.

PLAINS, MONT.—The power plant of the Plains Light & Water Com[pa]ny was put into operation Oct. 24. The plant is equipped with a [illegible]-hp Corliss engine, one 80-hp Westinghouse engine, one 50-kw generator, [illegible]-kw generator and tw[o] [illegible]

BLADEN, NEB.—We are informed that contracts will probably be [aw]arded in the near future for the construction of an electric light plant [an]d water-works system in Bladen. Charles F. Sturtevant, of Holdredge, [Ne]b., is consulting engineer.

GRAND ISLAND, NEB.—The Nebraska Telephone Company has [aw]arded the contract for the construction of a new exchange building [on] Walnut Street.

O'NEILL, NEB.—Desimple & Johnson are reported to have secured [th]e contract for the construction of the local electric light plant. The [illegible] ft. x [illegible] ft.

CONCORD, N. H.—The plant and holdings of the Piedmont Caro[lin]a Railway Company, operating in Concord, N. C., and in Salisbury, N. C., [ha]ve been purchased by the Salisbury & Spencer Railway Company for [a] consideration of $125,000. The consolidation includes two miles of [tra]ck at Salisbury and one and one-half miles in Concord.

WOODSTOCK, N. H.—The contract for the construction of a concrete [da]m at North Woodstock, N. H., for the Town of Woodstock has been [aw]arded to the H. P. Cummings Company. The dam will furnish power [to] operate the municipal electric light plant in Woodstock.

[BU]RLINGTON, N. J.—The [illegible] [Ele]ctric Light & Power Company a fifty-year franchise in Burlington. The [com]pany proposes to erect a large power plant and supply electricity for [lam]ps and motors in Burlington and adjacent towns and also to furnish [ene]rgy to electric railways.

[C]HATHAM, N. J.—The Common Council has granted the Morris [Co]unty Traction Company a thirty-five-year franchise to lay its tracks [thr]ough Main Street in Chatham.

HARRISON, N. J.—[illegible] [pla]nt to furnish electricity for lighting the three municipalities is re[por]ted to be under consideration by the Mayors and Councils of Harrison, [K]earny and East Newark.

NEWARK, N. J.—Kaltenback & Stephens, of Brooklyn, N. Y., who [are] building a large plant at 244-256 Sherman Avenue, Newark, N. J., for [the] manufacture of silk ribbons, are having plans prepared for a large [pow]er house in connection with the plant. The contract for the con[str]uction of the main building was awarded to Ritter & Smith, of Allen[tow]n, Pa.

[illegible] [inv]estigate the question of improving the street-lighting system in the [bus]iness district of the town. Charles J. Fisk, Mayor, is chairman of [illegible]

[illegible]E, N. M.—The Secretary of the Interior is reported to have [illegible] M., to proceed with the proposed work. Orders were also issued to [com]mence work on living quarters and the installation of a power plant. [Th]e cost of the entire work is estimated at about $7,000,000, which will [be] done directly by the government. About $750,000 is available for pre[illegible]

[COLUM]BIA, N. Y.—It is reported that bids will soon be awarded for the [illegible] Runyan & Carey, of Newark, N. J., are engineers.

[B]ROOKLYN, N. Y.—The contract for furnishing and installing electric [illegible] York, N. Y., for $2,042.

[FAR] ROCKAWAY, N. Y.—The Queens Borough Gas & Electric Com[pany has] requested the Public Service Commission, First District, to fix [illegible] petitioned the commission to bring about a reduction of the prices [illegible] per 1000 cu. ft. for gas and 15 cents per kw hour for electricity [illegible] by the company. The company has bound itself to put into effect [illegible] year any rates which the commission may decide are reasonable.

[NEW] YORK, N. Y.—The Bronx Traction Company has applied to the [Board of] Estimate and Apportionment for a franchise for an extension [illegible] to Gun Hill Road. Nelson P. Lewis is chief engineer.

[SYR]ACUSE, N. Y.—The Syracuse Rapid Transit Company is contem[plating] [illegible] some [illegible] [fran]chise will soon be requested.

UTICA, N. Y.—Application has been made to the City Council by the Utica & Mohawk Valley Railway Company for a franchise to extend its railway from the present terminus in Genesee Street to its line on North Genesee Street in Utica.

WILLIAMSVILLE, N. Y.—George E. De Golio, 984 Ellicott Square, Buffalo, N. Y., recently granted a franchise by the Board of Trustees to supply electricity for lamps and motors in Williamsville, it is said, will secure energy from one of the Niagara Falls plants. The local plant and distributing system will be erected as soon as materials and supplies can be secured.

FRIENDSHIP, N. C.—The Friendship Telephone Company, recently incorporated, is planning to erect a telephone line to connect Greensboro, Friendship, Guilford College and Colfax, N. C. The proposed line will be from thirty to fifty miles in length, bids for which have been received. The company is capitalized at $5,000. Thomas Wakefield is manager.

ROCKINGHAM, N. C.—The sale of the hydroelectric properties of the Rockingham Power Company at Blewitt's Fall, advertised for sale Oct. 5 but postponed at that time because there was no bidder, it is understood, will be sold the last part of this month, and the upset price, it is said, will be reduced to $750,000.

SALISBURY, N. C.—The plant and holdings of the Whitney Company, including extensive development on the Yadkin River, in litigation for several years, and as yet incomplete, together with the property of the Yadkin River Electric Power Company and the Yadkin Land Company, will be sold at auction Nov. 30 by order of Judge J. C. Pritchard, of the Federal Court. The decree is to satisfy a judgment of $5,406,750 in favor of the Bankers' Trust Company, trustee, under a mortgage made in November, 1904. It is further provided that the claim of T. A. Gillespie, for $344,976 for work done on the dam, plant, etc., shall be settled before the bondholders receive anything, also the cost of litigation, amounting to $138,000, to come out of the proceeds of the sale.

HEBRON, N. D.—The Council is reported to have granted a franchise to Messrs. Brown and Weigel for the installation of an electric light plant in Hebron. It is understood that work will begin on construction of the plant in the spring.

ASHTABULA, OHIO.—The Great Lakes Engineering Works, of Detroit, Mich., is reported to be preparing a list of equipment for its shipbuilding plant at Ashtabula, Ohio. A large part of the machinery will be motor-driven. Plans are being prepared for equipment for distribution of power and for lighting. The heavy machinery, including large generators, air compressors, pumping machinery, etc., has already been purchased. It is expected to have the plant ready for operation in the spring.

CINCINNATI, OHIO.—The Cincinnati Traction Company is reported to be contemplating enlarging its Pendleton power house in the East End of Cincinnati. The building will be 40 ft. x 60 ft. and will be equipped with two additional boilers with a rating of 525 hp each. The output of the plant will be increased to 7250 hp. The cost of the improvements is estimated at about $50,000.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has been granted permission to erect a power house on the lake front at East Seventieth Street, to cost about $850,000. The cost of the plant complete is estimated at from $2,000,000 to $3,000,000.

NAPOLEON, OHIO.—The plant and holdings of the Napoleon Home Telephone Company, now in receiver's hands, will be sold at public auction Dec. 12 at the Henry County court house. Ralph P. Brown is receiver.

CARMEN, OKLA.—Plans are being considered for the installation of additional machinery in the municipal electric light plant.

MUSKOGEE, OKLA.—Plans are being considered by the Muskogee Electric Traction Company for the construction of an extension of its Alta Vista line through the brick yards and Crekola to Taft, a distance of nine miles.

HERMISTON, ORE.—The City Council has granted B. A. and G. A. Chisholm a franchise to construct and operate an electric light plant in Hermiston, the same to be installed within six months.

LEBANON, ORE.—The Albany Interurban Railway Company has applied to the City Council for a franchise to construct and operate an electric railway through Lebanon. The proposed railway will extend from Albany, Sweet Home, Lebanon, Brownsville and Holley. P. A. Young is interested in the project.

LINNTON, ORE.—The installation of an electric lighting and power system in Linnton is reported to be under consideration.

PORTLAND, ORE.—The Portland Railway, Light & Power Company is contemplating an extension of the Cazadero line, three and one-half miles in length, work on which will begin at once.

SALEM, ORE.—The Santiam Valley Development Company, of Salem, has applied to the City Council for a franchise to construct and operate an electric railway on certain streets in Salem.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Nov. 11 for furnishing motor generator sets and appurtenances, lathe, milling machine, manganese steel castings, paper and plugs. Blanks and general information pertaining to this circular (611-A) may be obtained at the above office, or at the offices of the assistant purchasing agents at 24 State Street, New York, N. Y., and 55 Realty Building, New Orleans, La. Captain F. C. Boggs is general purchasing agent.

[illegible] PA.—Plans are [illegible] & St. Thomas Rural Telephone Company to construct and operate a telephone system between Chambersburg, St. Thomas and Edenville, thirteen miles in length.

COLUMBIA, PA.—The Columbia Telephone Company has purchased a building on North Third Street, Columbia, which will be taken over April 1, 1911. The company proposes to remodel the building for a telephone exchange. A new switchboard will be installed and the present wires replaced by cables.

DILLSBURG, PA.—The Dillsburg Electric Light, Heat & Power Company, recently incorporated with a capital stock of $15,000, is installing a power plant at Kunkle's mill, on the Yellow Breeches creek, about four miles north of Dillsburg. The company has purchased the local plant, owned by Merle Kunkle, which will be held for use in emergencies; a new street lighting system will be put in and a twenty-four-hour srvice established. It is expected to have the new plant ready for operation by Jan. 1, 1911. J. S. Rapp, Merle Kunkle, Ira T. Heikes and others are interested in the project.

ERIE, PA.—The Northwestern Traction Company, of Erie, has applied to the City Council for a franchise to construct its proposed railway over certain streets in Erie. James Burke is president.

NEW BUENA VISTA, PA.—A new telephone compeny has recently been organized for the purpose of erecting a metallic telephone line from New Baltimore, Somerset County, to a point near Schellsburg.

PHILADELPHIA, PA.—Th new building of the Ontario Dyeing Company has been completed. The building has a total space of 54,000 sq. ft. and will be rented out for manufacturing purposes. Electricity will be the motive power.

PHILADELPHIA, PA.—The Gilpin-Guernsey Company is reported to be preparing estimates for an addition to the exchange of the Bell Telephone Company, located at Preston Street, north of Market. The proposed building will be 51 ft. x 56 ft., four stories high.

SCRANTON, PA.—It is reported that preparations are being made by the Scranton & Binghamton Light Company to supply electricity for lamps to towns and villages along its railway. The company is installing two 100-kw motor-generator sets and expects to be ready to supply electrical service within sixty days in Clark's Green, Clark's Summit, Dalton, Waverly, Factoryville and other towns.

SUNBURY, PA.—Plans are being prepared by the Sunbury & Northumberland Electric Railway Company for extending its railway from Northumberland to Tuckahoe Springs, a distance of about two miles

YORK, PA.—A movement is on foot to construct an electric railway from York, Pa., to Baltimore, Md., for which surveys have already been made. Electricity for operating the proposed railway will be supplied by the York-Haven Water Power Company and the York Railways Company. The Pittsburgh Bonding Company is said to be financing the project.

DARLINGTON, S. C.—The Darlington Light & Water Company is reported to be contemplating improvements to its electric light plant.

SPARTANBURG, S. C.—Preparations are being made by the Electric & Power Manufacturing Company for increasing the output of its local plant by 2500 hp and extension of its transmission lines to Gaffney, a distance of twenty miles, and establishing a substation there. F. H. Knox is vice-president and general manager.

SALEM, S. D.—The roller mill and electric light plant, owned by the Salem Milling, Light & Heating Company and leased to W. R. Huntington, were recently destroyed by fire, causing a loss of about $18,000.

CROSBYTON, TEX.—Preparations are being made by the Crosbyton Telephone Company to extend its telephone line to Floydada at once. The company is rebuilding its system in Crosbyton.

GREENVILLE, TEX.—The Greenville Railway & Light Company has commenced work on the construction of its seven-mile electric railway in Greenville. The power plant and repair shops will be located in Greenville. The company is capitalized at $300,000. A. B. Coryell, of Greenville, Tex., is general manager.

HEMPSTEAD, TEX.—Extensive improvements are being made by the Southwestern Telephone Company to its local system, which will include the installation of cables to replace wires now in use.

PORT ARTHUR, TEX.—Application has been made to the City Council by the Beaumont-Port Arthur Interurban Electric Railway Company for a franchise to build and operate an electric railway in Port Arthur. I. D. Polk is interested in the project.

BURLINGTON, VT.—The Burlington Traction Company is reported to be considering plans for extending its railway through South Bennington, St. George, Shelbourne and Hinesburgh.

CREWE, VA.—The Town of Crewe is advertising for sale bonds to the amount of $25,000, the proceeds to be used for the installation of an electric light plant and water-works system. C. E. Wilson is chairman of finance committee.

[illegible] will require motor-driven rock crushers and other equipment in the near future for a quarry which it is developing near Herndon, Va.

NORFOLK, VA.—The Southern Bagging Company, of Norfolk, Va., has erected a large plant for the manufacture of cotton felt mattresses at cost of about 100,000. The factory is equipped for electric motor dri

NORFOLK, VA.—The Northside Knitting Mills, recently incorporat with a capital stock of $50,000, has purchased the plant of the Norths Knitting Company and has increased the output of the plant. The mill equipped for electrical operation.

RICHMOND, VA.—The City Council has granted the Richmond Pov Company a franchise to supply electricity in Richmond. The compa was recently organized by S. Dabney Crenshaw, Miles M. Martin, Cly W. Sanderson and others and proposes to erect an electric generati plant at the mouth of the Midlothian Mines and to transmit electricity Richmond and other nearby cities.

CHEHALIS, WASH.—A petition has been presented to the City Coi cil by the business men asking that an ornamental system of lam installed in the business district of the city. It is proposed to plac tungsten lamps in the residence district.

CLARKSTON, WASH.—Plans have been completed by the Lewist Clarkston Improvement Company for extensions and improvements to lighting and power system, which will involve an expenditure of ab $100,000. It is proposed to increase the output of the steam auxili plant from 1000 hp to 3000 hp and to reconstruct the local system. S veys are nearly completed for a larger water power plant on the Grai Ronde River, work on which will begin as soon as plans have been co pleted.

NORTH YAKIMA, WASH.—Plans are being considered for the stallation of an ornamental electric lighting system on Naches Aven bids for which will soon be called.

PORT TOWNSEND, WASH.—It is reported that a company has be organized by Charles C. Gentry, Walter Stange and Arpad Tokay for purpose of constructing Boyes monorail railways to Bellingham, Mo Vernon, Irondale and Port Angeles. The company is capitalized $7,000,000.

SEATTLE, WASH.—J. Frederic Thorne and associates have petitio the County Commissioners for a franchise to construct and operate electric railway from Kirkland to Tolt, a distance of forty miles.

SEATTLE, WASH.—The Puget Sound, Chelan & Spokane Railw Company has awarded the contract for the construction of its propo electric railway to connect Tacoma, Seattle and Spokane to the W. Palmer Company, of Kansas City, Mo. W. W. Shenk, of Seattle, Was is president of the company.

TACOMA, WASH.—The Seattle-Tacoma Short Line Railway Comp is reported to have awarded the contract for the construction of an tension of its railway from Youngstown to Lake Burien, a distance eight miles, to Homer Crosby.

WHITE BLUFFS, WASH.—The Pacific Power & Light Company, North Yakima, is reported to be contemplating extending its transmiss lines to White Bluffs to supply the farmers in this district with electri for lamps and motors. It is proposed to tap the line extending from power plant at Priest Rapids to Hanford and erect a substation [illegible] town. It is understood that a street lighting system will be installed soon as line is completed.

FAIRMONT, W. VA.—It is reported that arrangements are be[illegible] by the Fairmont & Clarksburg Traction Company for the constru[illegible] an extension of its railway from Clarksburg to Northview. S. B [illegible] of Fairview, is chief engineer.

GRAHAM, W. VA.—The Graham Light & Power Company [illegible] granted a franchise by the Town Council to construct and ope[illegible] electric light plant and water works system in Graham. The f[illegible] also carries the privilege of building a street car line.

HURRICANE, W. VA.—It is reported that the Clinchfield [illegible] poration, of Spartanburg, S. C., and 24 Broad Street, New York, [illegible] paring plans for the construction of a power plant and substation [illegible] ricane, also three other substations. The contract for electric [illegible] ment has been awarded to the Westinghouse Electric & Manuf[illegible] Company, of Pittsburgh, Pa., and includes two 1000-kw, 6600-vol[illegible] generators and ten 300-kw, 250-volt synchronous motor generato[illegible] be ready for operation by April 1. Contracts for boilers and oth[illegible] iaries will be awarded soon. Ford, Bacon & Davis, 115 Broadwa[illegible] York, N. Y., are engineers.

KEYSER, W. VA.—Plans are being prepared by the Baltimore & Ol Railroad Company for additions to its car shops at Keyser, W. Va., provide facilities for repairing steel freight and passenger cars. The fi of the new buildings will be 50 ft. x 300 ft., which will be equipped electrical operation throughout.

MIDDLEBOURNE, W. VA.—T. Moore Jackson, of Clarksburg, Va., is reported to have secured the contract for construction of Middle Island Railroad Company's proposed electric railway to exte from Sisterville and Middlebourne, a distance of eleven miles. T proposed railway will connect Sisterville and Clarksburg and interven towns, a distance of sixty miles. John F. Shore, of Middlebourne, Va., is secretary.

ASKEATON, WIS.—The Maple Valley Telephone Company, [illegible] organized, is planning to erect a telephone line to Wrightstown [illegible] the Fox River Valley Telephone Company. John L. Sullivan is gener [illegible]

CAMPBELLSPORT, WIS.—T... Light & Power ...mpany is reported to be contemp... a new ...ant, which will be equipped with a gas-producer plant, gas engines and ...o new electric generators. Richard Thomas, of Milwaukee, Wis., is re...rted to have disposed of his interest in the property.

EAU CLAIRE, WIS.—The Chippewa Valley Railway, Light & Power ...mpany, of Eau Claire, Wis., expects to purchase a 300-kw rotary con...rter for 600-volt direct current with transformers for street railway ...rvice. George B. Wheeler, of Eau Claire, Wis., is general manager.

JANESVILLE, WIS.—Plans have been prepared by the Commercial ...ub of Janesville for the installation of an ornamental lighting sys...m on the principal business streets of the city. It is proposed to use ...ngsten lamps. Under the present plan it is proposed to have the ...operty owners pay for the lamp posts and the merchants to maintain ...e system. The Janesville Electric Company will supply electricity for ... lamps.

MILLTOWN, WIS.—The Milltown Mutual Telephone Company is re...rted to be contemplating making extensions to its lines.

MILWAUKEE, WIS.—The Milwaukee Railway & Light Company ex...cts to begin work on the construction of its proposed electric railway ... connect Whitewater, Elkhorn and Lake Geneva, twenty-one miles in ...ngth, in March, 1911. The company also proposes to furnish electricity ... lamps. The main offices of the company are located at 711 Majestic ...ilding, Milwaukee, Wis. H. B. Kamschutte, of Milwaukee, Wis., ...esident and chief engineer.

NEENAH, WIS.—Work has commenced on the construction of a new ...tory building for the Hardwood Products Company, of Neenah, Wis., ... ft. x 190 ft., three stories high, a boiler house, two dry kilns and ware...use. Plans for equipment have not yet been decided upon, but the com...ny is now considering the question of equipping the plant for electric ...tor drive.

PLUM CITY, WIS.—Extensive improvements have been made to the ...al system of the Pepin Telephone Company, including the installation ... a new switchboard and replacing the old system with a new metallic ...tem.

STOUGHTON, WIS.—The City Council is considering the question ... installing an ornamental street lighting system.

WAUSAU, WIS.—Preparations are being made by the Wausau Tele...one Company for the construction of a new telephone exchange build..., bids for which will be received until Nov. 22. Van Ryn & DeGelleke, ...lwaukee, Wis., are architects.

CHEYENNE, WYO.—Bids will be received at the office of the con...ucting quartermaster, Cheyenne, Wyo., until Nov. 14 for the completion ... certain items of construction in administration building, rear annex ...d ward wings 3 and 4, new post hospital at Fort D. A. Russell, Wyo.; ... for the installation of plumbing fixtures, heating fixtures and electric ...ht fixtures in said ward wings Nos. 3 and 4 of new post hospital. Plans, ...cifications and general instructions are on file in the above office and ... at the offices of the chief quartermaster, Department of Missouri, ...aha, Neb.; Department of Colorado, Denver, Col., and the secretary of ... Builders' Exchange, St. Paul, Minn. Captain F. S. Armstrong is ...structing quartermaster.

PORT ARTHUR, ONT., CAN.—A proposition is being considered by ... merchants of Port Arthur, submitted by the Industrial Bureau, to ...ablish a telephone service to be extended from Port Arthur to towns ...hin a radius of 400 miles on the west and 600 miles on the east and a ...nk line leading to Duluth, to connect ultimately with Toronto and ...nnipeg.

SWIFT CURRENT, SASK., CAN.—Contracts have been awarded for ...ver plant and settling basin as follows: For power house and settling ...in to Laidlaw & McDonald, of Fort William, Ont., at $15,921 and ...499, respectively; and to Chapman & Walker, of Toronto, Ont., for ... [illegible] ... plants at $25,000.

New Industrial Companies.

TH... AMERICAN PISTON COMPANY ... [illegible] ...en incorporated with a capital stock of $30,000 for the purpose of ...nufacturing a new patented piston, which it is claimed will revolu... [illegible] ...lton, president; A. H. Schlaegel, vice-president, and V. D. Mor... ...retary and treasurer.

THE ... ELECTRIC WORKS COMPANY ... [illegible] ... been incorporated with a capital stock of $15,000. The officers ... company are: Otto T. Maler, president; Thomas J. Burke, vice...t, and James Brady, secretary and treasurer.

THE GYROSCOPE ELECTRIC COMPANY, of Bay City, Mich., has ... [illegible] ...al manufacturing and constructing business. The directors are: E. Ingersoll, James C. McCabe, W. J. Kickbush, Charles Englehart and ...ward Lankenaw, all of Bay City, Mich. George M. McBride is general ...ager.

THE INTERNATIONAL ELECTRIC CONSTRUCTION COMPANY, ... [illegible] ... H. Robinson, Arnold S. Doxsee, Leigh A. Doxsee and others.

THE INTERNATIONAL MOVABLE ELECTRICAL DISPLAY COMPANY, of Baltimore, Md., has filed articles of incorporation with a capital stock of $50,000. The incorporators are: Charles J. F. Steiner, 101 North Eighth Street, Baltimore, Md., and others.

THE NATIONAL INSULATOR COMPANY, of Wellsburg, W. Va., is being organized by W. F. Baird, J. E. Inman, C. F. Louthaime and others, of Pittsburgh, Pa. The company will be capitalized at $600,000 and proposes to take over the plant of the Riverside Glass Company and equip same for manufacturing glass insulators.

THE NATIONAL TELEPHONE SUPPLY COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $20,000 by William H. Marlatt, F. H. Pelton, M. Jenkins, J. B. Bolton and M. B. Campbell.

THE OKLAHOMA LIGHTNING ARRESTER & ELECTRIC COMPANY, of Tulsa, Okla., has been incorporated by George A. Stewart, of Tulsa, Okla.; A. B. Shawver, of Grimes, Ia., and others. The company is capitalized at $10,000 and proposes to manufacture a lightning arrester.

THE STANDARD AUTOMATIC MACHINE COMPANY, of New York, N. Y., has been chartered by L. Sachs, B. H. Levy and C. J. White, of New York, N. Y. The company is capitalized at $50,000 and proposes to manufacture and deal in machinery.

THE STANDARD ENGINEERING & CONSTRUCTION COMPANY, of Camden, N. Y., has been incorporated with a capital stock of $100,000 by W. S. Everett, T. S. Bradley, H. P. Gallagher and C. R. Stevenson, of Camden, N. J. The company proposes to do a general engineering and contracting business.

THE UNITED ELECTRIC APPARATUS COMPANY, of Boston, Mass., has been incorporated with a capital stock of $75,000 to do a general electrical business. L. N. Downs, of New York, N. Y., is president and H. A. Rambonnet, of Boston, Mass., is treasurer.

THE WILLIAM CORLISS VALVE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture machinery, valves, etc., by W. Corliss, I. G. Ladd, of Providence, R. I., and E. W. Corliss, of New York, N. Y.

New Incorporations.

WILMINGTON, DEL.—The Scranton & Binghamton Railway Company has filed articles of incorporation with a capital stock of $6,000,000. The incorporators are: Warren N. Akers, Millard C. Taylor and William J. Maloney, all of Wilmington, Del.

ELBERTON, GA.—The Hill Power Company has been incorporated with a capital stock of $50,000 by W. O. Jones, S. L. Hill, L. H. Hill and others.

SPRINGFIELD, ILL.—The Springfield & Central Illinois Traction Company has been granted a charter with a capital stock of $20,000 to construct and operate a railway from Springfield, Ill., to Nashville, Ill. The incorporators are: Isaac E. Smith, George W. White and Noble E. McMillan, all of Springfield, Ill.

OSKALOOSA, IA.—Articles of incorporation have been filed with the Secretary of State for the Iowa Traction Company with a capital stock of $2,000,000 by G. E. Woodhouse, of Oskaloosa, Ia.; J. C. Mabry, of Albia, Ia., and I. T. Hunter, of Newark, N. J. The company proposes to construct and operate an electric railway to connect Oskaloosa and Tama, sixty-five miles in length.

PORTLAND, MAINE.—The Municipal Light & Power Company has been chartered with a capital stock of $250,000 for the purpose of generating and distributing electricity and gas for light, heat, etc. E. E. Witherby, of New York, N. Y., is president, and F. D. Marshall, of Portland, Maine, treasurer.

GORDONVILLE, MO.—The Gordonville Telephone Company has been incorporated with a capital stock of $1,000 by Lewis C. Hitt, A. S. Poe, M. H. Lupke and others.

TRENTON, N. J.—The Trenton-Mercer County Traction Company has been chartered with a capital stock of $10,000 by George W. McPherson, Rankin Johnson and Oscar T. Crosby. Peter E. Hurley is local agent.

PHILIPSBURG, PA.—Articles of incorporation have been filed for the Consolidated Traction Company to construct and operate an electric railway from Philipsburg to Curwensville. The company is capitalized at $100,000. W. Ellis Shomo is interested in the project.

NASHVILLE, TENN.—Articles of incorporation have been filed for the Houston County Telephone & Telegraph Company with a capital stock of $5,000 by G. P. Atchison, W. R. Boone, J. F. Sullivan, G. A. Atterwhite and others.

ROCKPORT, TEX.—The Union Terminal Railway Company has applied for a charter to construct a railway, to be operated by steam or electricity, to connect Rockport, Aransas Pass, Navy City, Port San Antonio and to and over the Sheel Bank and Harbor Island, twenty-five miles in length. The company is capitalized at $25,000 and the officers are: Charles F. Hoff, of Rockport, president; W. H. Verner, vice-president; ... [illegible]

[illegible] are: R. S. Funk, president; C. L. Kneisley, secretary; S. M. Zea, B. R. White and C. D. Brown, all of Strasburg, Va.

ALTA, WASH.—The Alta & Jordan Valley Railroad Company has been incorporated with a capital stock of $200,000 to construct and operate an electric or steam railway from Sandy to Alta, a distance of sixteen miles. The incorporators are: D. J. and M. A. Williams, Will- [illegible]

Personal.

MR. [illegible] WHITE has been elected a director of the Merchants' Association of New York to fill the vacancy caused by the death of Mr. Walter C. Kerr.

MR. C. C. WEBSTER has resigned as chief engineer of the Schenectady (N. Y.) pumping station to become proprietor and general manager of the [illegible] Light, Heat & Power Company.

MR. KENNETH SEAVER has been appointed chief engineer of the Harbison-Walker Refractories Company, Pittsburgh, Pa., which includes among its products lining material for electric furnaces.

MR. EDWIN D. SMITH, formerly superintendent of power station for the United Railways Company of St. Louis, has been appointed manager of the Municipal Electric Light & Water Plant, Columbia, Mo.

MR. PETER SPANG KLEES, sales manager of the Franklin Electric Manufacturing Company, was married Oct. 19 at Hartford, Conn., to Miss Daisy Elizabeth Miner, daughter of Mrs. Caroline A. Miner, of that city.

MR. JUDSON H. BOUGHTON, secretary and treasurer of the National Light & Improvement Company, St. Louis, is delivering at the University of Missouri a course of lectures on "Public Utility Engineering and Management."

MR. J. E. NOEGGERATH, well known from his work with the unipolar direct-current generator, has severed his connection with the General Electric Company and opened an office as consulting electrical engineer in New York City.

MR. A. T. RUTTENCUTTER, who has spent the past three months visiting places of electrical interest in the United States, has returned to Brazil to continue his connection with the Rio de Janeiro Tramway, Light & Power Company, with which he has been associated for the past four years.

MR. T. C. RINGGOLD has accepted the position of general sales manager of the Central Electric Company, of Chicago. Mr. Ringgold's more recent connections have been as sales manager of the Robertson Electric Company, then general manager of the Cataract Electric Company, both of Buffalo, and last in a special capacity with the General Electric Company, of Schenectady, N. Y.

C. M. SEELEY, of Los Angeles, for twenty-three years with the Pacific Telephone & Telegraph Company in Southern California, has resigned his position as division commercial superintendent and is succeeded by J. W. Gilkyson, of Los Angeles, formerly division plant superintendent. Mr. Seeley has acquired an interest in the Fairchild-Gilmore-Wilton Company, of Los Angeles, and will take up his duties with that firm.

MR. C. E. WHITE, who for the past two years has been manager of the People's Electric & Ice Company, Montgomery, Ala., has been appointed manager of the Montgomery Light & Water Power Company, to succeed Mr. Robert J. Chalmers, who resigned after eleven years of service with the company. Mr. White has spent most of his business life with electric and gas companies, having entered the business in Philadelphia. He was at one time acting engineer, with the title of ensign, in the United States Navy.

MR. JULIUS ANDRAE, of Milwaukee, celebrated the fiftieth anniversary of the founding of the large electrical-supply business now conducted by his sons with a reception to his friends and local electrical men, Oct. 22. During the day an electrical luncheon was served, prepared with the aid of electric cooking devices, and in the evening the whole party sat down to a banquet. The electrical supply business of 1860 had to do chiefly with door-bell supplies, being the outgrowth of a me- [illegible] by Mr. Andrae.

MR. CLARENCE H. MACKAY, president of the Postal Telegraph-Cable Company and chairman of the Executive Committee of the Chicago Grand Opera Company, played the part of Santa Claus in Chicago [illegible] in the Chicago office of the Postal company to Verdi's opera of "Aida." About the same number of operators were to be taken on a succeeding [illegible] to Mr. Mackay's plans, as disclosed on the date mentioned. The Postal employees in Chicago appreciated their president's generosity greatly.

MR. [illegible] [illegible] examination for the post under the civil service requirements. The [illegible] tion in the hands of the board, and this has necessitated the creation of a [illegible]

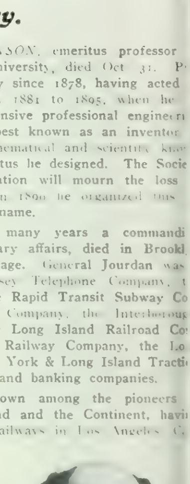
is a graduate of the Massachusetts Institute of Technology, class of 188[illegible] in the course in mechanical engineering, and his experience has been largely along the lines of mill engineering and power production problems. He served as engineer and superintendent of the Lancaster (Mass.) Slate Company from 1888 to 1894; was mechanical engineer of the Massachusetts Cotton Mills, of Lowell, in 1894-96, and was engineer [illegible] tests with the Schlict Combustion Company, of Boston, for a short time in 1897. Mr. Gerrish then became attached to the United States Ordnance Department at Large, and was occupied for about two years in the design and improvement of carriages for disappearing guns and motors. He then became mechanical engineer of the Barber Flax Spinning Company, [illegible] Paterson, N. J., and after a term of service as technical adviser to the president became master mechanic and later general mechanical superintendent of the Dolphin Jute Mills, of Paterson, his engagement with this company covering the period from 1900 to 1907. From 1907 to 19[illegible] Mr. Gerrish was general superintendent of the Commercial Twine Company, New York, and later became superintendent of the soft-fib[illegible] department of the Columbian Rope Company, of Auburn, N. Y. Prior to his joining the staff of the Gas and Electric Commission, Mr. Gerrish was engaged in designing engineering with the firm of Lockwood, Greene [illegible] Company, Boston. He is a member of the American Society of Mechanical Engineers.

Obituary.

MR. STILLMAN WILLIAMS ROBINSON, emeritus professor [illegible] mechanical engineering at Ohio State University, died Oct. 31. Professor Robinson had served the university since 1878, having acted [illegible] professor of mechanical engineering from 1881 to 1895, when he resigned to give more attention to his extensive professional engineering work. Professor Robinson was perhaps best known as an inventor [illegible] a very high order, applying his fine mathematical and scientific knowledge to the best adaptations in the apparatus he designed. The Society for the Promotion of Engineering Education will mourn the loss [illegible] Professor Robinson as its founder, for in 1890 he organized this [illegible] sociation, which later acquired its present name.

MAJ.-GEN. JAMES JOURDAN, for many years a commanding figure in corporation, political and military affairs, died in Brooklyn on Nov. 1, in the eightieth year of his age. General Jourdan was director of the New York & New Jersey Telephone Company, the Interborough Rapid Transit Company, the Rapid Transit Subway Construction Company, the Subway Realty Company, the Interborough Metropolitan Company, the New York & Long Island Railroad Company, the New York & Queens County Railway Company, the Long Island Electric Railway Company, the New York & Long Island Traction Company and several gas lighting, realty and banking companies.

SIR CLIFTON ROBINSON, well known among the pioneers [illegible] electric railway work in America, England and the Continent, having been especially identified with the first railways in Los Angeles, C[illegible] and London, England, died suddenly of heart disease in New York City on Nov. 6. He was born in Birkhead, England, on Jan. 1, 1848. He became a member of the staff of George Francis Train, who built the first street railway in Europe at Birkenhead in [illegible], when Sir Clifton was a small [illegible]. In 1866 he came to America as [illegible] of Train's employees in street railway construction. He later returned to London and in 1871 undertook the engineering work of street [illegible] construction in Cork. Four years later he became general manager of the Bristol tramways and then became manager of the tramways of Edinburgh. In 1884 he started building the Highgate Cable Tramways, the first of their type in England. Returning to America, he put through a



Sir Clifton Robinson.

system of traction for Los Angeles, then designed and constructed the London United Electric Tramways System and in 1895 constructed the first electric tramway at Bristol. As managing director and engineer of the Imperial Tramways Company he constructed and reorganized the Dublin Southern District Electric Tramways in 1896 and the Middlesbrough, Stockton and Thornaby Electric Tramways in 1898. In [illegible] took part in the construction of the great tube railway system of London, and [illegible] designed and put into operation a successful system [illegible] through booking between tramways and railways in London. In 18[illegible] he was engaged by the American Street Railway Association to report [illegible] the general situation with regard to street railways in the United States; this report was presented at the association's convention at Pittsburg in 1891. In the latter year he advised the City of Bristol to change [illegible] cable lines to electric lines and himself took charge of the work. [illegible] 1898 he converted the street car lines of Stockton-on-Tees for the use [illegible] [illegible]. He became managing director of the United Tramways Company of London in 1904 and succeeded in converting it into [illegible] electric system against considerable opposition. In 1905 he was knighted by King Edward for his services in connection with the underground [illegible]

and [illegible] papers on street railway subjects. He is survived by a widow and one son. Sir Clifton was taken suddenly ill in a street car and was carried to a drug store, where [illegible]

Trade Publications.

RAILWAY APPARATUS.—[illegible] briefly described in Folder 4186 just issued by the Westinghouse Electric & Manufacturing Company.

DECORATIVE LIGHTING OUTFITS.—The General Electric Company has just issued a folder, No. B. 3011, describing its decorative lighting outfits for Christmas trees.

MOTOR STARTERS AND CONTROLLERS.—The Cutler-Hammer Manufacturing Company, of Milwaukee, has issued recently five new bulletins relating to alternating-current apparatus. They refer to the company's single-phase motor starter, the face-plate, drum-type and multiple-switch type polyphase motor starter and the radial-arm crane controller.

ELECTRIC RAILWAY CONTROLLERS.—A very interesting, well illustrated booklet has just been issued by the Westinghouse Electric & Manufacturing Company on the subject of unit switch control. The circular, numbered 1189, explains the plan of operation of this type of control, shows complete wiring and piping diagrams and discusses the details of the apparatus.

METALIZED FILAMENT INCANDESCENT LAMP.—In Bulletin No. 4780, just issued by the General Electric Company, is illustrated and described the Gem lamp, which has a higher economy and greater illuminating power than the carbon, but is, of course, less efficient than either the tantalum or tungsten. This bulletin supersedes all previous bulletins on this subject.

BUILDING LIGHTING.—In an attractive publication recently issued by the General Electric Company on the subject of "Building Lighting" many illustrations of both exteriors and interiors of buildings lighted by tungsten and tantalum lamps are shown. In addition to these illustrations there are data relative to the subject and illustrations of the complete lines of both types of lamps. The number of the bulletin is 4777.

SERIES TUNGSTEN LAMPS FOR STREET LIGHTING.—In Bulletin No. 4781, recently issued, the General Electric Company illustrates the series tungsten lamp and offers a good many data on the advantages possessed by this lamp over the other incandescent lamps used for this purpose. The bulletin illustrates also various styles of fixtures used in connection with street illumination and contains other matter of service to all interested in this subject.

HYDRAULIC TURBINES.—Bulletin No. 101 of S. Morgan Smith Company, York, Pa., is a handsome pamphlet of fifty-two pages giving illustrations and data of Smith hydraulic turbines. Among the engravings are excellent views of a number of large hydroelectric equipments, some of which have not yet been described in the technical press. Of particular interest to electrical engineers a[illegible] equipments for the Connecticut River Power Company, Chattanooga & Tennessee River Power Company, Roosevelt Salt River plant, Great Falls (Mont.) Water-Power Company, [illegible] and La Crosse Water-Power Company. Another bulletin recently issued by the same company illustrates and describes head-gate hoists.

ELECTRIC HEATING DEVICES.—The Cutler-Hammer Manufacturing Company, of Milwaukee, has published a thirty-two page booklet in which its new line of electric-heating devices is fully described and illustrated. A section of the pamphlet is devoted to each of the separate lines—electric irons, disk stoves, toilet devices, portable water heaters, instantaneous water heaters, electric radiators and culinary devices. In the back of the book a folded data sheet is inserted. This gives prices, weights, dimensions, energy consumption, time required to heat, cost of operation, etc. The complete information, aside from the general description, is thus presented in a nutshell. The book in itself is a handsome one. The illustrations are very well executed and printed in a rich brown on India tint paper. The text is printed in olive-green ink, making a pleasing combination. A maroon cover, with silver embossed lettering, adds to the effect.

BUSINESS NOTES.

THE AMERICAN TELEGRAPHONE COMPANY has moved its factory from Wheeling, W. Va., to Springfield, Mass.

THE VOHR SALES COMPANY, of Chicago, has been incorporated to be the distributor in Chicago of the Vohr ozonizers, made by the Standard Electro-Utilities Company of the same city.

THE CHICAGO FUSE WIRE & MANUFACTURING COMPANY has moved to its new six-story building, 1014 to 1022 West Congress Street, Chicago. With increased facilities, the company is equipped better than ever to give its customers prompt and satisfactory service.

INCREASED MANUFACTURING FACILITIES FOR NUTTALL COMPANY.—As a result of expansion in its business, the R. D. Nuttall Company has recently made a considerable increase in its factory facilities. A new wing has been added to its building at the corner of Garrison and Fayette Ways, Pittsburgh, Pa. It is expected that the new structure, by greatly adding to the available floor space, will relieve some of the congestion that has existed in the plant. The Nuttall company manufactures gears and pinions, trolleys, flexible couplings, etc.

THE MOORE LIGHT COMPANY, of Newark, N. J., has opened a demonstration and sales room in New York at 500 Fifth Avenue. The Moore yellow and daylight-white vacuum tube lamps are to be pushed vigorously from this new office. The regular business of installing long yellow light tubes for general illumination is to be followed up actively, and some especially energetic work is to be done with a new small portable unit called the "Daylight-Window." This window has been designed especially for use in department stores, haberdashery shops and all places where colors are dealt with. It is claimed to give an absolute reproduction of daylight, which shows colors accurately in their true values, and forms a complete and convenient matching cabinet.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NO[illegible]

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

974,109. CIRCUIT INTERRUPTER; C. B. Auel and J. E. Spurrier, Wilkinsburg, Pa. App. filed Sept. 4, 1906. A mechanical circuit breaker with a fuse in series which is first shunted and then the circuit breaker operated when the fuse is broken.

974,110. TELEPHONE APPARATUS; G. Babcock, Rochester, N. Y. App. filed May 8, 1908. Small-sized transmitter including a casing and an electrode, the latter consisting of two concave plates, one a disk and the other a ring, together with a convex member carrying [illegible]

974,112. CIRCUIT-CONTROLLING MECHANISM; F. Bechoff, Sche[illegible] and a member actuated by the other movable into the path of the indicator so as to prevent simultaneous closing of the switches.

974,152. ELECTRIC MOTOR CONTROL; H. D. James, Pittsburgh, Pa. App. filed March 4, 1907. To avoid flashing in shunt or compound [illegible]tors for elevators by inserting resistance which is automatically [illegible]t out as the speed is accelerated by means of electrically governed [illegible] them in the same sequence.

[illegible]7. THERMO-ELECTROSTAT; Roscoe William King, Las Animas, [illegible] App. filed June 11, 1909. Contains a fluid responding to heat and [illegible]e conduit containing a plunger dipping in the fluid, which plunger [illegible]

[illegible] HEATING SYSTEM; [illegible], 1910. For steam boilers in which a current of electricity passing [illegible] the path of the current, into which the water feed pipe dips, prevent[illegible]

[illegible] TRANSFORMER; [illegible] May [illegible] Oblong [illegible] between adjacent coils with their ends extending beyond the edges of the coils. The blocks are held in place by rods fastened to them.

974,169. TRANSMITTING APPARATUS; F. W. Midgley, Jersey City, N. J. App. filed Feb. 1, 1906. An aerial grounded at one end with a conductor connecting the top non-inductively to earth and a condenser connected in the conductor near the earth end.

974,171. RECTIFYING ELECTRIC CURRENTS; John J. Montgomery, Santa Clara, Cal. App. filed Aug. 28, 1909. For rectifying alternating currents by a rotating commutator or pole changer, one element of which has a step-by-step rotation corresponding to fluctuations in the duration of the waves.

974,177. INSULATOR FOR HIGH-TENSION TRANSMISSION SYSTEMS; J. E. Noeggerath, Schenectady, N. Y. App. filed Feb. 9, 1910. Petticoat insulators with yieldable slugs between the spring bolt and shoulder on the insulator, the slugs preferably being in the nature of ball bearings.

974,191. WIRELESS APPARATUS; F. G. Sargent, Westford, Mass. App. filed April 3, 1909. For receiving and transmitting spherical waves by using a sphere at the top of the antenna.

974,192. ELECTRIC METER; G. A. Sawin, Lynn, Mass. App. filed Sep. 31, 1906. For reducing wear on jeweled bearings and eliminating creeping by providing a winding in series with the coils which lifts the shaft when the current ceases, thus stopping the motor.

974,207. INSULATOR SUPPORT; W. R. Thompson, Chicago, Ill. App. filed May 10, 1910. Petticoat insulator support, including diverging bars connected at one end and each connected to the pole between its ends.

974,2[illegible] ELECTRIC INSULATOR; [illegible] W. West, [illegible] App. filed March 23, 1908. Details.

974,224. ELECTRIC BRAKING; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Oct. 9, 1909. Operates an alternating commutator

[illegible] between the armature and source and the field current to vary the braking effect.

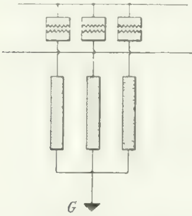
974,223. LIGHTNING ARRESTER; A. J. Wurts, Pittsburgh, Pa. App. filed Sept. 5, 1905. Glass strips coated with graphite, the passage of the current destroying it and fracturing the glass.

974,227. ELECTRODE FOR ARC LAMPS; E. R. Berry and E. J. Guay, Lynn, Mass. App. filed July 9, 1909. Composed of a tube of aluminum with a filling of titanium carbid.

974,232. ELECTRICAL SAD-IRON; W. A. Braun, Fort Wayne, Ind. App. filed Feb. 23, 1910. A hollow base contains the heater and a thermal expanding member controls a lever which breaks the current when the iron is sufficiently heated.

974,238. MOTOR CONTROL; A. M. Coyle, New York, N. Y. App. filed Jan. 30, 1908. For hoisting and lowering theater curtains by means of an electric motor, controlling devices therefor, a brake magnet, a trip magnet and friction disks between the motors and the hoisting drum.

974,275. ILLUMINATED SIGN; W. H. Ingle, Tacoma, Wash. App. filed Aug. 17, 1909. Lamps are arranged in each letter block so that any letter can be formed by the illumination of certain lamps thereon and a rotating controlling cylinder carrying plugs operates a lever to control the contacts.



974,223.—Wurts Lightning Arrester.

974,389. — Electrode for Electric Arc Lamp.

974,279. AUTOMATIC TELEGRAPHY; G. T. Kanzer-Chegodard, Kamenka, Russia. App. filed March 31, 1903. Conducting surfaces on a strip of paper close the circuit to send signals.

974,296. ELECTRIC GLOW LAMP; H. Remane, Berlin, and Emil Gottschalk, Charlottenburg, and Eugen Hurwitz, Berlin, Germany. App. filed July 18, 1907. Tungsten filament lamp with a support having a core of one metal and coating with different metal, one of the metals forming an alloy with the tungsten.

974,328. FLUID PRESSURE CONTROLLED SWITCHING DEVICE; C. Aalborg, Wilkinsburg, Pa. App. filed Dec. 6, 1907. A fluid pressure operated switch for controlling the generation of steam for heating railway vehicles for controlling the electric supply circuit with the variation in steam pressure.

974,329. ELECTRIC HEATING DEVICE; C. Aalborg, Wilkinsburg, Pa. App. filed Nov. 19, 1908. A flattened tube containing fluid and arranged in a coil with insulated flat resistance elements adjacent to the outer surfaces of the tube such as a ribbon of steel.

974,330. ELECTRICALLY HEATED BOILER; C. Aalborg, Wilkinsburg, Pa. App. filed July 8, 1909. An electrically heated steam generator with a flat strip of resistance metal and a receptacle with ribs and slots to receive the resistance element.

974,370. UNIVERSAL FLOOR BOX FOR THE DISTRIBUTION OF ELECTRIC WIRES; J. Fountain, Jr., Elizabeth, N. J. App. filed June 24, 1905. Has two adjustable box body sections, one with an inward flange and the other with an outward flange, the sections being universally adjustable upon the flanges and secured in place.

974,389. ELECTRODE FOR ELECTRIC ARC LAMPS; A. Denman Jones, Holloway, Eng. App. filed Apr. 19, 1909. Includes a carbon electrode with projections and chemical material around the core between the projections holding them mechanically to the electrode.

974,396. LIGHTNING ROD; E. J. Kress, Pittsburg, Pa. App. filed Oct. 10, 1908. A fibrous core with a helical winding of wire and a [illegible]

974,415. PROCESS FOR COMPELLING ELECTRIC MOTORS TO KEEP IN STEP WITH THE WAVES OR IMPULSES OF THE CURRENT DRIVING THEM, AND A MOTOR EMBODYING THE PROCESS; J. J. Montgomery, Santa Clara, Cal. App. filed Aug. 28, 1909. For synchronizing motors with the current waves, the moving element being given a succession of positive and negative accelerations.

974,420. APPARATUS FOR HEATING TOOLS ELECTRICALLY; J. Oertly, Cincinnati, O., and Charles F. Dudley, Bellevue, Ky. App. filed Apr. 6, 1907. The iron has an internal resistance with contacts connected thereto, a support with terminals and a holder, the distance between the outer faces of the contacts being greater than the distance between the terminals and a spring pressing the contacts and terminals together during the heating operation.

974,433. SPEED REGULATION FOR DYNAMO-ELECTRIC MACHINES; C. Renshaw, Swissvale, Pa. App. filed Aug. 2, 1905. A polyphase circuit with a motor having a field magnet connected to one phase and an armature connected to the other phase and an auto transformer between the armature and the circuit, the active lengths of the auto transformer winding being caused to vary by a solenoid operated switch according to the speed of the motor.

974,449. TERMINAL CONNECTION; O. Thieme, St. Louis, Mo. App. [illegible] threaded insulation pieces which clamp the stranded ends together through the intermediate action of washers arranged upon the ends.

[illegible] App. filed Jan. 27, 1910. A sectional band for clamping a conductor passing through the bore of the band, the sections being pivotally [illegible]

974,497. ELECTRIC GENERATOR AND MOTOR; D. Kemble, Lake- [illegible] compensating windings for reducing armature reaction, the winding [illegible]

974,506. TELEPHONE RECEIVER HOLDER; H. M. McAlarney, Puritan, Pa. App. filed Sept. 1, 1910. For desk stand. A bracket is detachably connected to the pedestal and has a hinged and sliding portion to hold the receiver.

974,528. ELECTRIC SWITCH; W. M. Scott, Philadelphia, Pa. App. filed Oct. 9, 1909. For making and breaking an electric circuit by double pole switch, the main contact being operated by its toggle and the shunt contact by a cam operated by one of the toggle members.

974,563. AUTOMATIC PRESSURE CONTROLLER FOR WATER AND OTHER PIPES; I. C. Fosler, Chicago, Ill. App. filed Jan. 6, 1908. To avoid excessive pressure in water pipes. A pressure gage controls an electric circuit which operates a motor that drives the pump.

974,565. AUTOMATIC GAS IGNITER; E. E. Gerald, Baltimore, Md. App. filed March 23, 1910. A bracket to be attached to a burner with isulated uprights carried by the bracket, a thermostatic rod carrying a contact pin and a resistance wire connecting an upright [illegible]

974,576. ELECTROLYTIC CELL; G. C. Landis, Wadsworth, and J. H. Smith, Rittman, O. App. filed July 2, 1909. For keeping cells at a low temperature by proving two series of electrodes to form a tortuous path through the electrolyte and a series of non-conducting tubes with parallel coils, one tube between each pair of electrodes, together with supply pipes for the cooling material connected to the tubes.

974,584. TROLLEY; G. A. Millee, McKeesport, Pa. App. filed Apr. 21, 1910. For retaining the trolley wheel upon the wire, especially on curves, by means of retaining members carried on spring pressed barrels, the members having grooves for the wire.

974,608. PROCESS FOR SMELTING ORE; F. T. Snyder, Oak Park, Ill. App. filed July 1, 1907. Passes an electric current between electrodes dipping into a slag bath, feeds the ore, mixed with producing material to the bath, cools the outlying portions so as to form a container by water-jacketing it.

974,610. STRAIN INSULATOR; L. Steinberger, New York, N. Y. App. filed June 17, 1910. The body has a recess and a bolt hole, the recess and bolt hole passing axially through it, the bolt having an anchor plate fitting into the recess with a plurality of other bolts partially extending through the body.

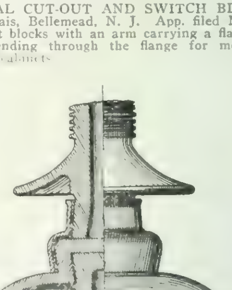
974,611. TROLLEY HARP; W. W. Stewart, Muskogee, Okla. App. filed March 16, 1910. For replacing the trolley harp by means of a guiding U-shaped fork operated by the rope and embracing the wheel.

974,619. AUTOMATIC TRACTION SWITCH; J. L. Yoder, Bellefontaine, O. App. filed Apr. 6, 1910. For electrically operating a switch in advance of the car by means of a solenoid with its core connected to the switch and a contact plate connected with the solenoid, adapted to be operated by a contact arm from the car platform.

974,633. PROCESS OF MAKING AMMONIA, ALKYL AMMONIA OR AMMONIA BASES; H. S. Blackmore, Mount Vernon, N. Y. App. filed Nov. 23, 1908. A horizontally inclined tank rotating on horizontal pivots agitates substances which yield nitrogen and hydrogen, causing their constituents to unite in the presence of mercury under the action of calcium and an electric current.

974,672. INSULATOR; R. M. Johnston, Mansfield, O. App. filed Dec. 23, 1907. A chain of petticoat insulators, including interchangeable sections detachably swiveled together.

974,681. UNIVERSAL CUT-OUT AND SWITCH BLOCK HOLDER; E. R. Le Manquais, Bellemead, N. J. App. filed May 29, 1909. A holder for cut-out blocks with an arm carrying a flange and provided with a slot extending through the flange for mounting porcelain [illegible] cabinets.



974,672.—Johnston Insulator.

974,683. CONTROLLING SYSTEM FOR MOTOR TRACTION CARS; W. C. Mayo, Barstow, Texas. App. filed Feb. 24, 1908. Speed-changing mechanism between the power side of the car and the car axles, controlled electrically, and an electromagnetically operated circuit controller therefor for raising or lowering the speed automatically.

974,712. ARMATURE TESTING DEVICE; L. H. Seyranian, Monterey, Cal. App. filed Dec. 29, 1908. A handle carries fixed contacts which engage movable contacts which engage two commutator bars at the same time and are in circuit with an indicating telephone.

974,741. PROCESS OF MAKING AMMONIA OR OTHER NITROGEN-HYDROGEN BINARY COMPOUNDS; H. S. Blackmore, Mount Vernon, N. Y. App. filed Nov. 23, 1908. See 974,633.

974,7[illegible]. PROCESS OF MAKING AMMONIA, ALKYL AMMONIA, OR AMMONIA BASES; H. S. Blackmore, Mount Vernon, N. Y. App. filed Nov. 23, 1908. See 974,633.

974,760. ELECTRIC FISHING TOOL; H. Eastwood, Fresno, Cal. App. filed Feb. 2, 1910. For recovering tools from wells. Consists of a waterproof casing with a removable sectional armature plug in the bottom and a series of magnets connected with the armature.

974,762. WIRELESS TELEGRAPHY; R. A. Fessenden, Washington, D. C. App. filed Jan. 14, 1907. Projectors for transmitting wireless in one direction, including a relay for re-transmission and shields protecting one apparatus from the other during the simultaneous operation of the two, the shields changing the wave length when in the immediate neighborhood of the receiver and sender.

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VOLTAGE WAVE DISTORTION AND THE LIFE OF INCANDESCENT LAMPS.

In a series of tests made by Prof. Charles L. Kinsloe upon various types of incandescent lamps subjected to sine-wave and peaked-wave e.m.fs., an account of which appears elsewhere, results were obtained that can truly be characterized as unexpected. It was found that carbon, tantalum and tungsten lamps suffered a marked decrease in life and efficiency when the e.m.f. wave was peaked rather than sinusoidal. The decrease in life varied from 25 per cent to 50 per cent when the e.m.f. wave reached a peak value 12 per cent higher than the maximum of the equivalent effective sine wave. An analysis of the tests shows that there was only a relatively unimportant change in the watts consumed by the lamps when subjected to either the sine wave or the peaked wave; there was, however, a considerable change with time in the candle-power—and hence in the watts per candle—of each lamp, the change being accelerated when the peaked e.m.f. wave was used. Few persons, indeed, would have predicted such a result in view of the fact that it is usually believed that the candle-power, specific consumption and life of incandescent lamps vary with the "mean effective" value of the e.m.f. wave quite independently of the maximum value. The tantalum lamp exhibits what might be considered an exception to this rule in that its life is known to be shorter with alternating current than with direct current; but the change in life has usually been attributed to the cyclic change in the value of the current rather than to the higher maximum reached with alternating current as compared with direct current.

When subjected to a unidirectional e.m.f. the filament of an incandescent lamp reaches a certain temperature, the value of which can be judged roughly by the lumens emitted per watt consumed by the filament. The life of the filament depends largely upon the temperature to which it is subjected. A slight change in the voltage upon which the temperature depends makes a relatively large change in the life of the filament; for example, 0.5 per cent decrease or increase in the rated e.m.f. impressed on a carbon filament increases or decreases the normal life by about 10 per cent. In the case of an alternating e.m.f. the mean temperature of the filament will vary largely with the mean effective heating value of the current, but there will be a cyclic fluctuation in the temperature, the range of temperature change depending upon the wave shape of the e.m.f. and the heat-storage capacity of the filament. Even with a sinusoidal e.m.f. and a filament of large diameter—that is, of high heat-storage capacity compared with the radiating surface—there will be an appreciable cyclic fluctuation in the temperature above and below the mean value. To the extent that the increase in disintegration of the filament during the period of excess temperature is greater than the decrease in disintegration during the period of lowered temperature the life of the filament will be less with alternating current than

with direct current of the same effective heating value, the loss in life being greater for a peaked wave than for a sine wave.

To what extent the temperature does vary cyclically in a lamp filament is difficult to determine, but if one were permitted to assume a fluctuation above normal corresponding to an increase of 3.5 per cent in the e.m.f. continuously during one half-cycle and below normal corresponding to 3.5 per cent during the other half-cycle, the resultant disintegration would be increased by 25 per cent, or the life would be shortened by 20 per cent, with relatively small changes in the other quantities involved. In view of the fact that the plus and minus changes in disintegration increase greatly with increase in temperature range it would seem that the life of a lamp filament should be less when subjected to a peaked wave rather than a sine wave. Moreover, the disintegration is probably accelerated at the weak spots in the filament by reason of the slowness in conduction of heat from the restricted location where it is produced to the exposed areas from which it may be radiated. The acceleration in disintegration from this cause would probably be greater with a peaked wave than with a sine wave.

It would seem from the above-discussed relations that the decrease in life when a lamp is subjected to a peaked rather than a sinusoidal e.m.f. wave can be explained, in part at least, upon the basis of phenomena upon which the life of lamps have long been known to depend. On the other hand, it is not improbable that other relations not so well known have a bearing upon the life as affected by the peaked wave e.m.f. However, it is difficult to conceive of any effects attributable to the substitution of a peaked for a sinusoidal e.m.f. wave that would not be found when either an alternating was substituted for a unidirectional e.m.f. of the same effective value or a high-frequency e.m.f. was substituted for an equal low-frequency one. The paper by Prof. Kinsloe is of much value in calling attention to the dependence of the life of incandescent lamps upon the voltage wave-shape, and incidentally in showing the difference between rated and actual average incandescent-lamp efficiency. It is to be hoped that his future investigations will cover tests of the comparative life of lamps when subjected to unidirectional and sinusoidal alternating e.m.fs. of equal effective values and also to equal sinusoidal e.m.fs. of low and high frequencies.

THE CHEMISTRY OF THE FIREFLY.

Those of our readers who have been following the discussion of the light of the firefly in our columns recently will read with particular interest Prof. McDermott's letter regarding the chemical side of the phenomenon. The evidence which is adduced goes to show very plainly that the general hypothesis regarding the character of the action by which the firefly and similar creatures produce light is substantially correct—that is, that the light is really a product of slow oxidation of a substance produced by the creature. The structure of the light-producing region with its intricate system of air passages bears evidence that such is the case, and the experiments on the tissue which carries the light-producing substance leave no doubt in the matter. The fact that the luminous tissue, when dried and kept out of contact with oxygen, long retains its power of glowing when subjected to purely chemical oxidation is sufficient evidence of the fundamentally chemical rather than physiological nature of the light production, with which the living organism would appear to be connected only as it produces the material upon which in the presence of moisture oxygen can act. The supply of the material is a physiological function and its utilization apparently a chemical one.

The clearing up of this one matter lends a new interest to the subject of firefly light, particularly in view of the work of Trautz which Prof. McDermott quotes. This investigator obtained light giving a spectrum analogous to that of the firefly from the oxidation of pyrogallol in the presence of formaldehyde. Now, this reaction, while complicated in the sense in which many reactions of organic chemistry are complicated, is still probably simple compared with the oxidation of any of the fats or albuminous material likely to be present in the firefly. The substances concerned are of well-known structure and free from any forbidding complications. If they are genuinely capable of producing substantially the same spectral distribution of energy as in the case of the firefly's light, an important step has been taken toward the practical production of chemical luminescence. It would be worth while for somebody to investigate this reaction thoroughly with a view to determining the real limits of the spectrum in the light produced.

If it should be found that this light is really unaccompanied by any material amount of other radiations, the situation will become still more interesting. For it will then appear that there is a theoretical available method of producing a continuous spectrum over a very narrow range, a thing which is quite outside of previous experience. Of course, it might turn out that in the case of the firefly the radiations of longer wave length are utilized in doing physiological work in the organism to an extent which would practically suppress them as regards external effects. In this case the total efficiency of the operation might be really very moderate. It is therefore doubly important to examine the cases of luminescence which occur without the complication of having their seat in organic tissues. Of course, the practical difficulty at once occurs to one that all the luminescence phenomena thus far known are relatively of very low intensity, so that they might prove to be utilizable only with great difficulty even if they could be readily produced. All this, however, remains to be seen. It is at least certain that from the chemical standpoint the firefly's secret does not belong in the region of the physiological unknowable, and that there is a fighting chance of its being discovered and put to some practical use.

DATA ON AN ELECTRICAL RESISTANCE FURNACE.

In electric furnaces a distinct advantage of the resistance type of furnace over the arc type is that for laboratory investigations the distribution of resistance may readily be made such that the distribution of heat generated can be controlled or altered in design. By distributing the resistance in a suitable manner the distribution of heat liberation may be such as to keep a uniform temperature within a certain area, or a uniform temperature gradient over a certain distance. In the arc furnace a similar degree of temperature control is probably unattainable, although for industrial purposes it may not be required. In an article on page 1181 Dr. Albert A. Somerville gives

the details of a laboratory resistance furnace with which certain definitely stated results are obtainable. As these details are readily capable of being reduplicated, they should be useful to those who wish to reach and control similar high temperatures in a small space.

HIGHER EDUCATION.

In the days of ancient Greece, and also in the Middle Ages, the persons who attended universities were, with few exceptions, zealous scholars and thirsters after knowledge. It is true that rich men occasionally sent their sons to a university in order to gain some acquaintance with the teachers and the knowledge of the time, but these dilettantists formed so small a minority of those in attendance that they did not appreciably modify the codes of thought and action of the main body. To be a scholar was in the dark ages tantamount to being greatly in need. With the progress of civilization in general, and of applied science in particular, these ancient and medieval conditions and notions changed, until it became not only advantageous for men of ability to develop that ability at college, but it also became socially recognized as a rank mark. A university degree became the only title to permanent social rank that a democracy would countenance and bestow. The result has been that most men who can afford to do so send their sons to college, especially in this country. The aggregate student enrolment in the colleges of the United States during the last century has increased much faster than the population, notwithstanding the fact that less than 1 per cent of all who enter the primary schools pass on to college. The increased popularity of the colleges has probably been productive of much good on the whole, but incidentally it has lowered the average of scholarship in the colleges. Whereas formerly none would go to college who were not studious, now perhaps more go for general social advantages than for study. Consequently, the studious few are exposed to the banter of the many, and those who might become good mental workers, but are ambitious of social recognition, conceal and minimize their studies in deference to the average judgment.

But this is not all. This country is at present committed to the policy and veneration of personal individual selection to such an extreme that discipline is frowned down, in common with all that tends to nominal restriction of individual freedom. In the average home, and in the average school, the discipline is of the least rigid character. The student must be inveigled into applying his mind, and never coerced. This is a wonderful national tribute to the ideal of liberty, but the cost of this ideal must be paid. In spite of the fact that the average American boy is mentally probably more active and alert than the average German boy, the latter at seventeen years of age is generally admitted to be two years ahead of the former in his studies. Consequently, the first two years of American college intellectual life are of German infra-college grade, although the teaching is carried on by men of university rank. Since the colleges have [illegible] into the mass of the people [illegible] they have been compelled to lower their own standards in order to meet the conditions. [illegible] has largely been driven out of the American college into the [illegible]

graduate school. No person ordinarily enters a graduate school in any American university except for study, and no person is ordinarily admitted there except such as have indicated their capacity to study. Therefore, the ideals and purposes that formerly invested the college have trekked across the A.B. degree and have intrenched themselves within the graduate schools of the country. It is mainly in these graduate departments that research and study are conducted. To them is confided the intellectual wealth of the country. From them issue the best students, workers, ideas, ideals and results that American universities can foster.

President Schurman, of Cornell University, in his annual report just out makes a strong plea for the graduate school, and refers incidentally to the present degradation of undergraduate education—to the great weakness in permitting "men who have no intellectual tastes or interests, provided they can find a sufficient number of easy courses or easy-going teachers, to spend four years without much immediate profit to their minds, and with ultimate serious damage to their characters, in consequence of the formation of habits of idleness, listlessness, and perhaps deception, sham and 'grafting'." President Schurman believes that the future of the American university is with the graduate school or department of research. It is, he said, by the enlargement of human knowledge that progress, civilization and improvements in the life and conditions of mankind are rendered possible. The scientist with his useful experiments and the scholar with his productive researches are the seers and accredited leaders of mankind in this twentieth century. These and other considerations are presented in support of a plea for large endowments for research, the need of which endowments gives the multi-millionaire, he believes, the best opportunity that exists to-day in America for an investment to promote the higher intellectual life and civilization of the nation. The advantage of universal higher education may, he says, be retained for all who are qualified to enjoy it, without sacrificing those youth of superior or extraordinary endowments, among whom will always be found the men who advance civilization and move the world forward in the course of progress. "These glorious 'sports of nature' have in their unique endowments the possibility of higher things for civilization, provided only that it is developed by favorable environments. A seminary for the aristocracy of talent would be the highest and noblest institution in the world. No other service to the democracy could compare with this, for to form the mind and character of one man of marked talent, not to say genius, would be worth more to the community which he would serve than the routine training of hundreds of undergraduates." Let, he says, the superior student be regarded as a supreme object; let the men of talent be segregated and instructed by themselves; for what, he asks, is better worth while in the world than provision for the instruction of the world's best minds and the moderate satisfaction of the bodily needs, that they may pursue their studies not only undisturbed, but under the most favorable and stimulating conditions? In these days of "department-store" college organization and the subordination of the true interests of education to the exigences of padded student rolls, the views of President Schurman are both refreshing and a rebuke to the commercial spirit which has little or no interest in intellectual development aside from its incidental effect in strengthening the specific money-making faculties.

Electrification of Boston Railroads.

In a report prepared in compliance with a resolution of the Legislature of the State of Massachusetts, which provides for a study by the railroad corporations with reference to the "electrification of their passenger service" within the Boston district, Mr. E. H. McHenry, as vice-president of the New York, New Haven & Hartford Railroad Company, showed that there would be required for this service an equivalent of 461 miles of single-track equipment, the total cost of which would be $32,751,000, including generating station, locomotives, etc. He claimed that the operation of a mixed steam and electric service near New York has proved very unsatisfactory and expressed the conviction that no general substitution of electric for steam traction should be made unless the substitution be complete, including passenger and freight operation and yard switching. He stated that in making such a substitution the operation should be extended to include the full length of run, or engine district, in order to avoid the uneconomical subdivision of the present "train runs." The estimates given have been based on types of overhead structures and suspended system similar to those installed on the New York division of the New Haven road, subject to certain modifications and improvements which experience has indicated should be made.

In a report submitted by Mr. A. H. Smith as vice-president and general manager of the Boston & Albany Railroad it was stated that the track length involved would total 128 miles, and the net cost would be $6,413,300. The estimates have been based on a direct-current third-rail system similar to that now employed by the New York Central & Hudson River Railroad Company, but using 1200 volts instead of 600 volts. The opinion was expressed that in case the railroad is required to equip its trains for electrical operation it should be permitted to increase its fares to cover the loss in revenue involved in the expense of electrification.

Revision of National Electrical Code.

The biennial meeting of the electrical committee of the Underwriters' National Electric Association will be held in March, 1911, in New York City, the day and place of the meeting to be announced later. As usual, the provisions of the National Electrical Code as they now exist will be the principal matter for consideration. Suggestions for any desired change in, or addition to, the code should be forwarded to Mr. C. M. Goddard, secretary, 141 Milk Street, Boston, on or before Jan. 15, 1911, in order that they may be printed in the bulletin and thus enable the committee and other interested parties to consider the subjects in advance of the meeting. Final action on suggestions not received in season for consideration by the committee before the meeting can only be taken up by unanimous consent. As heretofore, the meeting will be open to all interested, who will not only be welcome, but are urged to be present and give the committee the advantage of their experience and advice.

Ohio Telephone Situation.

The consolidation of rival local telephone exchanges in the various small towns and cities in Ohio is being gradually worked out successfully, as well as dual connections of the long-distance systems with the consolidated exchanges. Early in the month the Tiffin Consolidated Telephone Company took over both the independent and Bell exchanges at Tiffin and merged the two plants into one. Then connections were made with both the United States Telephone Company and the American Telephone & Telegraph Company.

About the same time the Greenfield Home Telephone Company, which had operated in the past as an independent, took over the Central Union Exchange at Greenfield and connections with the lines of both the long-distance companies were made. The toll-line subscribers of both the old companies may use either long-distance line desired, as all such lines are now connected with the one exchange in the town.

The independent and Bell exchanges at Hudson, Medina, Geneva, Savannah, Higginsport, Mowrystown and Bufort have been consolidated within the past few months. In all these cases the Central Union Telephone Company has practically turned over the local business to the home companies in exchange for the long-distance connections for the Bell company.

The Electrical Jobbers' Convention.

The convention of the Electrical Jobbers' Association was held at Hot Springs, Va., Nov. 9, 10 and 11, and was attended by about three hundred electrical supply men and manufacturers. The meetings of this association are mostly social in their character and are intended to promote good fellowship and mutual understanding among the men engaged in the electrical supply trade of the United States.

Several papers of interest to the trade were read and discussed. Aside from the business meetings much time was given to social features. Among the latter was a golf tournament, the prize winners of which were Col. H. V. Carter, Messrs. R. B. Corey, F. Oblinger, M. B. Austin and Al. Palmer. The tennis tournament was won by Messrs. H. I. Sackett and H. M. Betts; clay-pigeon shooting was won by Mr. W. C. Hopkins, and pool and billiards by Messrs. J. A. Vaughan and F. E. Stowe.

During the meeting a pleasing tribute was paid to Mr. W. W. Low, of the Electric Appliance Company, Chicago, in the shape of a song written by Mr. W. H. Sheldon, Jr., and sung by the gathering to the tune of "America." Mr. Low was completely taken by surprise, but he managed to make suitable and appreciative response. Mr. Low has probably done more than any other individual to foster and develop the association. Another pleasant affair was the presentation of a handsome silver mesh bag to Mrs. Searing, wife of Col. George S. Searing, of Chicago, as a mark of respect and of the esteem in which "Uncle George" is held by the entire association.

The next meeting will be held in February, 1911, in the Middle West, at which time plans will be discussed for the Pacific Coast convention, which will be held in May or June of next year. It is probable that some date in June will be selected in order not to conflict with the date of the National Electric Light convention.

Ilgner Patent on Motor Flywheel Device Declared Invalid.

The British court of final appeal on Oct. 20 sustained the decision of the lower court, as reported in our columns April 21, 1910, declaring invalid the Ilgner patent covering the addition of a flywheel to the Ward Leonard motor system. As pointed out in a letter from a correspondent printed in an issue following the decision of the lower court, the procedure in this important patent litigation is very interesting when compared with that of similar litigation in this country. Several of the most important electrical manufacturing concerns in Europe were involved in the litigation, and among the experts in the case were professional leaders such as Swinburne, Parshall, Mordey, Ferranti and Hopkinson. The hearing was in open court, and the judge frequently cross-examined the experts. The entire case from start to finish in the lower court occupied six days. The hearing on appeal lasted about an hour, and the court, composed of three judges, handed down a decision at once. It is said that the entire cost of the litigation to the defendants, including expert service, was less than $15,000.

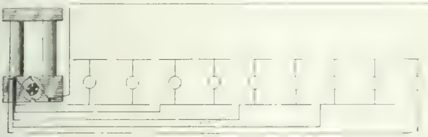
The patent involved was one issued to Ilgner relating to electrically driven reversible rolling mills. In the judgment, which was orally delivered, Lord Justice Moulton said that the court had been impressed with the fact that a plant with a normal output of 3000 hp can at critical moments supply 15,000 hp, and the means whereby this may be accomplished is decidedly an electrical engineering triumph. The court held that the Ward Leonard patent of 1891 anticipated that of Ilgner, and that the Ward Leonard invention had not remained unknown to others than those whose business it is to search the

records of the Patent Office, but was a part of the common stock of knowledge of electrical engineers at the date of the grant of the Ilgner patent. Referring to a Ferranti patent of 1895, the court said that it did not have to decide to-day whether Mr. Ferranti's suggestion of the addition of a flywheel to the Ward Leonard invention was or was not an invention, but its personal view was that the idea of doing so was perfectly obvious to any skilled electrical engineer, and that there was in fact no invention at all in Mr. Ferranti's suggestion. The decision was that the arrangement covered by the Ilgner patent was not the subject of invention.

Sectional Trolley-Wire Patent Sustained.

The full text has just come to hand of the opinion, rendered June 17, of Judge Bradford, of the United States Circuit Court for the Eastern District of Pennsylvania, sustaining broadly a patent granted Sept. 10, 1895, to William M. Schlesinger, covering the use of a sectional trolley wire in connection with safety cut-outs.

The patent, for which application was filed Nov. 24, 1885, contains three claims, the first of which is as follows: "In an electric railway the combination of a series of separate feeding conductors extending in multiple arc relation from one generator pole or terminal to points along the line of way, safety devices for said separate feeding conductors, a working conductor comprising a series of insulated or disconnected sections disposed along the line of way and supplied by said separate feeding conductors, and a return circuit connection opposed to said sections and leading to the other generator pole or terminal." The other two claims relate specifically to an automatic



Schlesinger Sectional Trolley-Wire and Protective System.

electromagnetic device for disconnecting a section of the trolley wire from the feeder in case the current should exceed a certain predetermined value. Only the first claim above quoted was involved in the suit. In the accompanying illustration the sectional trolley wire, the safety devices and the feeders are clearly indicated. The suit for infringement of the Schlesinger patent was brought by the Allis-Chalmers Company against the General Electric Company as manufacturer, and the Hestonville, Mantua & Fairmount Passenger Railway Company as user, of the alleged infringing railway equipment.

The defenses set up were respectively that the prior art negatives invention on the part of Schlesinger at or before the date of the application; that if the claim in suit be valid it must receive a construction so limiting its scope as to negative infringement by the defense; that the invention, if any, was abandoned; that the invention disclosed in the application is substantially different from the combination claimed, and that the rights of third persons respecting patents for inventions made after the date of Schlesinger's application and before the date of the patent suit cannot be affected by the granting of that patent.

The court in considering the defense that the invention disclosed in the application is substantially different from the combination claimed stated that, while it is true that the combination of the claim does not appear in any of the claims in the application as originally filed by Schlesinger, this fact is not of itself determinative of the question whether that combination was not disclosed in the application and its accompanying drawings when considered as a whole. The fact that the original specification was too broad, through including "any translating media," affords no reason why the claims and descriptions should not be restricted, as they have been, to an application of the system to electric railways. The conclusion of the court reached on this consideration is that the invention embodied in the combination of the claim in suit and illustrated in one of the figures (which is reproduced herewith) is substantially the same as that for which application for patenting was originally filed. As to anticipation, the court says that little need be said, as the defence which was set up on this point appears to have been abandoned, and the record does not disclose, so far as the court could find, any anticipation, by patent or other matter, of the combination claimed. While it is undoubtedly true that each of the elements composing the combination was old, the claim presents a true combination and not a mere aggregation.

Taking up the defense that the combination had been abandoned to the public, the court stated that while the file wrapper and contents showed that from October, 1887, to November, 1894, there were no proceedings in the Patent Office in the prosecution of the application, this delay was shown to the satisfaction of the Commissioner of Patents to be unavoidable, owing to the patent attorney of the inventor having become incompetent through a gradual mental ailment that ended in insanity. The record does not disclose any actual intention to abandon, or any act or declaration of abandonment, or any consent to the appropriation or use by others of the invention, and the court decided that the invention in suit was at no time abandoned.

Concerning the rights of third parties receiving patents for inventions made between 1884 and 1895, the court held that in the interim there was no attempt to enlarge the scope of the patent as originally filed, there was no expansion of claims nor anything done by the inventor or those representing him to deceive or mislead the public.

The court then considered in detail the question of actual infringement and held that Schlesinger had a right under his patent to place his safety device in any separate feeding conductor electrically connected with any section of the working conductor in such separate feeding conductor, either at or near the generator or at any other point between the generator and the branch conductor, and that the right could not be lost or affected by the fact that in placing it at or near the generator or central station it would serve as an electrical indicator. He was entitled to any additional use or benefit to be derived from such change in the location of the safety device, and the fact that in the defendant's arrangement the safety devices served as such indicators is wholly immaterial to the question of infringement if their location at or near the generator does not destroy their function as safety devices.

The court concludes that the combination of the defendant's arrangements or system infringes the claim of the patent in suit, since it includes all the elements of the patented combination, co-acting and inter-acting upon the same principle, performing the same function in the same manner and presenting substantially the same results.

Recent Hydroelectric Developments in the West.

Mr. James Lyman, district engineer of the General Electric Company, read a paper on "Recent Hydroelectric Developments in the West," at the meeting of the Electric Club of Chicago, on Nov. 9. Mr. Lyman has lately returned from a Western trip, and his paper contained some of the results of his observations.

Mr. Lyman said that the first step in the conservation of national resources should be the efficient development of the great water-powers of the country. Unlike the forests and the deposits of coal and other minerals, the water-powers are never-ending, with proper protection of the forests. So far practically all the water-power developed in this country has been by private enterprise. Some of the larger plants involved the expenditure of millions of dollars, and these developments can be carried out only by large financial interests.

The laws governing the rights for hydroelectric development are inadequate and indefinite, and the subject should receive the immediate and careful attention of Congress. "There may

be reason," said the speaker, "in the contention that the water-power rights of our country should not be granted forever to private corporations, but the private corporation which is willing to promote them becomes a public benefactor, like the inventor who introduces some great economy. Like the inventor, in my opinion, the corporation should, for a limited time, say forty or fifty years, reap all the profits of the development. Later, such adjustment in power rates, or such division of profits with the government, should be made as will surely safeguard the large capital investments by the corporation."

Mr. Lyman sketched briefly several interesting developments, mentioning first the system of the Central Colorado Power Company. Here, he said, the 100,000-volt transmission line carried over the Leadville Divide at an elevation of 10,000 ft. across very rough country is perhaps the most difficult piece of transmission work ever undertaken. Some of the cable spans are more than 2000 ft. long. At the Boulder plant of this company a little stream is piped down an almost precipitous mountainside, 1800 ft. in height, to two 5000-kw impulse wheels, and passes out into the atmosphere as "white foam and a rainbow."

In California water-power developments of more than 500,000 hp are in service out of an estimated possible total of 9,000,000 hp. As a rule, the water-power stations feeding over long high-tension transmission lines are operated under nearly constant load, while the stations located nearer the center of distribution take the load fluctuations and control the frequency. The voltage of the distribution system is controlled by Tirrill regulators connected to the excitation circuits of synchronous motor-generator sets or rotary condensers.

The Pacific Gas & Electric Company of San Francisco has developed the largest distribution system in the world. With more than 1000 miles of three-phase 60,000-volt transmission lines, it supplies nearly 100,000 kw in electrical energy to 153 cities and towns in an area about 200 miles north and south and 100 miles east and west, containing one-half the population of California. Energy is supplied from eleven water-power generating stations and three steam-generating stations, some of them more than 200 miles apart. All of these stations are controlled by a single power dispatcher, who has become so expert that trouble occurring at any point can generally be located and the section cut out in three or four minutes, usually without cutting off any of the generating stations or disturbing the voltage regulation of the system for more than a few minutes. The average daily load factor is 75 per cent, which is high for such mixed motor and lamp circuits.

The largest electrical supply of this company comes from the Feather River station of the Great Western Power Company, 154 miles northeast of Oakland. This plant is remarkable, according to Mr. Lyman, in having the largest and most efficient water turbines, water-wheel driven generators and step-up transformers ever built. Here the generating units are rated at 10,000 kw and are capable of as high as 50 per cent overload. Further, the water head of 430 ft. is the highest under which turbine wheels have ever run.

The Stanislaus water-power development, 130 miles east of San Francisco, operating over 104,000-volt lines into that city and supplying the street railway system with a large part of its energy, is one of the most expensive and difficult water-power developments in the West, costing, all told, more than $12,000,000. The power house is situated in the deep canyon of the Stanislaus River, a sheer 1500 ft. below the rim of the canyon.

The speaker next considered the group of hydroelectric plants in the Los Angeles region. A large portion of the energy from the Kern River development is supplied to the Pacific Electric Railway Company, one of the largest and best-managed interurban systems in the country. Mr. Lyman described briefly the Owens River aqueduct, which will be 230 miles long and deliver 260,000 000 gal. of pure mountain water daily to the City of Los Angeles. This aqueduct will have water-power development possibilities to the extent of 120,000 hp. Mr. William Mulholland, the chief engineer, believes that the income from the energy developed will pay for the aqueduct in twenty years. Five thousand men are now employed in the construction of this great work. Electric dredges and electrically operated shovels make all excavations. A 3000-kw power plant supplies the energy. Only by the use of electric energy, the telephone and the automobile is it possible to construct this 230 miles of aqueduct across a broiling desert. Its value to Los Angeles and the whole San Gabriel Valley, when completed, will be incalculable.

Mr. Lyman spoke of the Little Falls plant of the Washington Water Power Company, near Spokane, as one of the best hydroelectric developments he had ever seen. Another company, the Great Falls Power Company, transmits energy at 100,000 volts for 150 miles from Rainbow Falls to Butte, Mont. It is proposed to abolish the large steam plants at the thirteen copper mines in Butte, and operate the hoists by compressed air furnished by electrically driven air compressors. These mining plants now use 25,000 hp in steam hoists.

At least five large power-transmission plants are successfully delivering electricity from 50 to 150 miles at from 100,000 to 110,000 volts. Above 110,000 volts air begins to lose its perfect insulating qualities and a slight leakage takes place. However, a 135,000-volt line is under construction, and there is little doubt that means will be found to make the use of this voltage or even higher voltages feasible. So far as the transformers, oil switches and line insulators are concerned, they can all be built for much higher voltages; the insulation of the air alone is apparently all that limits the line potential.

There was a brief discussion, those taking part being Messrs D. W. Roper, F. A. Sager, C. Gilbert Wheeler, A. A. Gray and W. M. Bennett.

Commutating Poles in Synchronous Converters.

In a paper by Messrs. B. G. Lamme and F. D. Newbury presented at a meeting of the American Institute of Electrical Engineers on Nov. 11 there was given a remarkably clear presentation of the m.m.f. flux, e.m.f. and sparking relations in direct-current generators and synchronous converters. The authors described the production of flux locally at the coil undergoing commutation by the local current in the armature and explained the generation of a detrimental e.m.f. in the coil by reason of this flux and because of the local reactance of the coil for the current reversing therein. Commutating poles provide a local m.m.f. to more than counterbalance the armature m.m.f. and hence to produce in the coil under commutation an e.m.f. tending to counterbalance the reactive e.m.f. in the coil and thereby eliminate the causes for sparking. On account of the fact that the m.m.f. of the current on the input side of the synchronous converter is in space opposition to that on the output side, the resultant armature m.m.f. of a converter is much less than that of a direct-current generator of equal output and the commutation conditions are much more favorable; the conditions, in fact, are at least as good as in a direct-current generator with a compensating winding of normal design located in the pole-faces only. In a synchronous converter the uncompensated armature m.m.f. varies between 7 per cent and 20 per cent of the m.m.f. of an equivalent direct-current generator armature. Thus one of the principal sources of difficulty in commutation of the direct-current generator is largely eliminated in the converter, so that commutating poles that may often be a necessity with the former machine are seldom needed with the latter machine.

The authors discussed the commutation conditions in 25-cycle and 60-cycle converters designed for 250 volts and 600 volts and said that 25-cycle, 600-volt converters offer the most promising field for the application of commutating poles; that 60-cycle, 600-volt converters follow next, and that 60-cycle and 25-cycle, 250-volt converters show the least possibilities of improvement from the standpoint of design.

The advantages of commutating poles are that less attention is required during operation and that the life of commutator and

brushes is longer, with a possible reduction of cost in case higher speeds are employed. The disadvantages are: Possibility of increased trouble from bucking on sudden changes in load or short-circuits; possible reduction in efficiencies, particularly in light load, and higher operating temperatures unless the same temperatures as now obtained in non-commutating pole machines are maintained by partly sacrificing the advantage of lower cost.

The authors expressed the belief that from the standpoint of design it seems difficult to make a sufficiently strong case for the commutating pole in synchronous converters to warrant the additional complication in construction. At best the addition of commutating poles, properly applied, represents a refinement over present designs, and the basic question is whether such refinement is justified commercially. They said that this question must be decided, as all engineering problems are finally decided, not by the judgment of one man or any group of men, but by the results of experience in extended operation.

Discussion.

The discussion was opened by Mr. Gano Dunn, who called attention particularly to resistance commutation as contrasted with magnetic commutation, which is the basis of the operation of interpoles. He showed that by the use of dead brushes along the commutator adjacent to the live brushes, but insulated therefrom, resistance commutation becomes quite effective and results equal to those obtained with commutating poles may sometimes be secured at much less cost and improved efficiency.

Mr. H. F. T. Urban claimed that the best field for commutating-pole converters is in intermittent railway work, the converters for which are designed on the basis of commutation with overload rather than heating with average load. With such machines commutating poles are economically necessary. They should also be with high-voltage synchronous converters, built for, say, 1200 volts or 1500 volts. He cited the case of a certain 750-kw, 1200-volt synchronous converter which was not damaged by being directly short-circuited a dozen times.

Dr. C. P. Steinmetz remarked that when the limits of design are set by commutation rather than heating the use of commutating poles allows the manufacturer to build smaller and cheaper machines. In interurban railway service, where the load fluctuates rapidly, the heating limits are eliminated and the only limit of overload is commutation. Hence, for interurban railway work commutating-pole synchronous converters are advantageous.

Mr. Jens Bache-Wiig stated that the chief cause for "flashing over" at the commutator is the sudden interruption of the direct current when the circuit-breaker opens under short-circuit conditions. He suggested the use of an electric interlock between the direct-current and the alternating-current circuit-breakers so that when the former opens the latter will open also.

Mr. Paul M. Lincoln said that only in the cases of high speeds or large outputs are commutating poles necessary on synchronous converters and expressed the opinion that when the conditions requiring commutating poles are approached in converters it is impossible under such conditions to use the split pole converter because the latter takes considerable liberty with the commutating conditions.

Mr. J. L. Burnham described some tests made upon a certain 25 cycle, 1200-volt synchronous converter. The load at which sparking would commence, without commutating poles, was carefully determined. Commutating poles were then fitted to the machine and adjusted so it would carry four times the load to cause the same sparking as without the commutating poles; four times full load could be thrown on and off successfully.

Mr. C. W. Stone expressed the opinion that the principal reason why commutating-pole converters have not been used in interurban railway service, where they could be employed advantageously, is because operating engineers could not be convinced of the advantages to be obtained. The chief advantages in the use of commutating poles on synchronous converters will be the reduction in the size of machines for intermittent service and the building of high-voltage and high-frequency machines.

Mr. Lamme in closing the discussion called attention to the fact that in interurban railway service use is made of small converters with which commutating poles are not necessary, while in high-voltage machines the real limit is not the commutation, but the mechanical difficulties encountered in building the commutator.

Permanent Exhibition of Safety Devices.

The formal opening of the Permanent Exhibition of Safety Devices of the American Museum of Safety, in its new quarters in the Engineering Societies Building, New York, will occur on Monday, Nov. 21, at 8:15 p. m.. The general public is invited to be present on the occasion. The large space taken by the museum is already well filled with various safety devices supplied by the makers or collected by the director, Dr. W. H. Tolman, in order to educate the public on the "conservation of life." The object of the American Museum of Safety is to show how accidents may be prevented by the use of safety devices in connection with machines, systems of transmission, elevators, cranes, steam boilers, explosives, etc. The investigations of Dr. Tolman have indicated that 50 per cent

Exhibit of Safety Devices.

of the accidents to American life and labor are preventable, and to assist in avoiding this needless waste of life the Safety Museum is made a clearing house for every worthy safety device. Among the indirect advantages of accident prevention, as adduced from the world's practical experience, are the lessening of expensive damage suits for accidents through making machines "safe" as well as "foolproof," and in securing greater efficiency through knowledge on the part of workmen that a machine is safe, which feeling in a sense is a cash asset through enabling him to do better and more work, and thus increase the output. It is pointed out that a more general use of safety devices will be a defense against hasty and ill-considered legislation, compelling the adoption of protective devices without regard to their practicability or cost.

New York Commission News.

The Public Service Commission, Second District, will give a hearing this week on the complaint of the Islip Electric Company against the Sayville Electric Company as to alleged unlawful stringing of wires and furnishing of electricity in East Islip, on the application of the Suffolk Gas & Electric Company for authority to acquire all of the outstanding capital stock of the East Islip Electric Company and to merge the latter company with the Suffolk company.

Massachusetts Commission News.

The final hearing upon Boston transportation matters under consideration by the commission on Metropolitan Improvements was held at the office of the Boston Transit Commission on Nov. 8. Chairman W. P. Hall, of the Massachusetts Railroad Commission, presided. Mayor Fitzgerald, of Boston, appeared on behalf of immediate subway extensions to South Boston and Dorchester. He disagreed with the Boston Chamber of Commerce regarding the necessity of pausing in subway development to plan out a scheme for a long term of years. Mr. Joseph B. Eastman, counsel for the Boston Public Franchise League, argued that public opinion is responsible rather than the local traction company for the extensions to the rapid transit system made during the past few years, and he opposed the granting of an 8 per cent dividend on the stock of the West End Street Railway Company in the event of a formal consolidation of that organization with the Boston Elevated. He presented a letter from President C. L. Edgar, of the Edison Electric Illuminating Company of Boston, in which the latter stated that substantially the same rates have been offered the Boston Elevated by the Edison company as were accepted by the street railways in Chicago, which are now supplied with energy by the Commonwealth Edison Company. Mr. Edgar pointed out that the street railways in Chicago had shut down their own plants in favor of purchased energy, and said he regretted that so far the Boston Elevated Railway Company's officials held to the erroneous view that they can produce electricity more cheaply in their own plants. Mr. Eastman said that it would be possible for the Boston Elevated Railway Company to erect a new power plant with the ultimate needs of the West End system in mind, and later, if the two systems had to be separated, it would be a comparatively simple matter to supply the energy by purchasing from the Edison company. He contended that the peak loads do not occur at the same time on the surface and the elevated lines, and that this would materially aid the Edison company in furnishing low-priced service.

Professor Cooley, of the University of Michigan, appeared on behalf of the protective committee of the stockholders of the West End Street Railway Company, and said that in his opinion a dividend of 8 per cent is entirely reasonable for the West End stockholders. He had found the system in excellent condition, both from the physical and the operating standpoint, and considered that its capitalization is reasonable. He also felt that the Boston Elevated system is worth all that its capital represents. Consolidation would bring about many economies and improvements in service, and would lessen the amount of capital required for the system as a whole. Eight per cent on the par value of the West End stock is only about 5.3 per cent on the market price. Professor Cooley said that 90 per cent of the valuation which he had carried out in the past twelve years had been made from the standpoint of the public, and had involved almost $1,000,000,000. From this experience he was certain that the 8 per cent rate was entirely reasonable. He stated that he was familiar with public utilities paying from 8 per cent to 14 per cent without question on the part of the public.

As a result of a recommendation made last week by the Massachusetts Highway Commission, the New England Telephone & Telegraph Company, through its president, Mr. J. N. Keller, has extended the existing four-party and six-party line suburban service until Nov. 1, 1911. The company states that it welcomes this action as an opportunity for subscribers to study the new schedules of rates laid down at the recommendation of the commission, after an exhaustive study of the plant and traffic by Prof. D. C. Jackson, its consulting engineer. President Keller states that several thousand subscribers to the present four-party and six-party suburban service have already made application to the company for service under the new schedule. In case any of these have applied through the understanding that the change will shortly be made compulsory, the company will transfer them to their former service if they so desire, provided they will indicate their intentions by Nov. 21. The company is making every effort to avoid injury to the service on account of construction and operating difficulties during the inauguration of the new rates.

Wisconsin Commission News.

The Railway Commission has reported upon the investigation that it has made in connection with the electric service in Evansville, Wis. The investigation was the result of a demand for a day electric service and an expressed desire on the part of the municipality that the commission investigate the conditions in Evansville and recommend the rates which should be charged for such service.

The report discusses in some detail the probable results of a day service and suggests several alternatives as to the method of supplying energy for the day service as well as the rates that could be charged for the same. Nothing definite could be offered because of the lack of data concerning the probable motor load.

The present sliding-scale schedule of rates for incandescent lighting was found objectionable because it created discrimination between consumers. It classified residences as small consumers and stores as large consumers, and recognized only the quantity of energy consumed without any regard to the fundamental factors of demand and hours daily use of the connected load. The investigation further disclosed the fact that special rates had been granted to several consumers in Evansville under the condition that these consumers furnish lamps, meters, transformers, etc. This is contrary to the public-utilities law, which reads: "It shall be unlawful for any public utility to demand . . . less compensation for any service rendered . . . in consideration of the furnishing . . . of any part of the facilities incident thereto. . . ."

The rate schedules suggested by the commission are based upon the actual cost of service, properly apportioned between the different departments. By prorating the commercial output expenses over the units of energy consumed, the output cost per kw-hour was found to be 5.575 cents. The capacity expenses per kilowatt of active connected load, on the basis of 50 per cent active, were $25.47, which, with the unit output cost, gives the following table of unit costs:

Capacity.		Output.		Total.		
[illegible]	+	[illegible]	=	[illegible]	[illegible]	Operation daily, active connected load.
[illegible]	+	[illegible]	=	12.[illegible]	1	
3.489	+	5.575	=	9.06	2 "	
1.395	+	5.575	=	6.97	5 "	
.698	+	5.575	=	6.27	10 "	

On the basis of the above table several schedules were recommended, as follows:

Ten cents for first sixty hours and 8 cents for excess.

Eleven cents for first sixty hours and 6 cents for excess.

Twelve cents for first sixty hours and 6 cents for excess.

Twelve cents for first thirty hours, 8 cents for next thirty hours and 6 cents for excess.

Eleven cents for first thirty hours, 9 cents for next thirty hours and 6 cents for excess.

With regard to the active connected load, the consumers are divided into three classes, as follows: Class A, residences, pub-

lic buildings, etc., 40 per cent active; Class B, churches, schools and industrial establishments which close not later than 6 p. m., 60 per cent active; Class C, offices, hotels, theaters, depots, restaurants, etc., 75 per cent active. These consumers were apportioned to the several classes after a detailed study of the consumer data as furnished by the consumer ledger.

The receipts from street lighting were found to be so close to the actual expenses of the same as to warrant no change in the rates.

The brief of Mr. Lester C. Manson, special counsel for the City of Milwaukee, in the proceeding pending before the commission in reference to a 3-cent fare has been filed. In its brief the city contends that the Milwaukee Electric Railway & Lighting Company can sell eight tickets instead of six for a quarter and four tickets to Wauwatosa, Whitefish Bay and North Milwaukee for 25 cents instead of 30 cents as now charged. The brief covers the financial transactions of the company from the time the old horse-car lines were bought up, consolidated and transferred into the present system.

It appears from the brief that the original lines were purchased by the North American Company and by it sold to the Milwaukee Street Railway Company, which it controlled, for over $3,000,000 in excess of the original purchase price. When the property of the Milwaukee Street Railway was sold by the receiver in 1896 it was bought for $6,500,000 and was turned into the present company on the same day for $14,000,000.

The engineering staff of the commission made an appraisal of the property of the company in 1896, which Mr. Manson accepts as the proper basis of determining the value of the investment. He objects, however, to certain items being included in the value of the property, such as the cost of paving between the tracks, the proper apportionment of the cost of power houses as between city and interurban service, etc., which matters the commission will consider. The brief also states that the cost of reproducing the property has been increased over $1,000,000 by charges to operation through depreciation reserve, and that the cost of reproducing the property in the inventory exceeds the investment upon which a return should be allowed. The investment of the company, according to the city's basis of figuring, is given for each year from 1894 to 1907, inclusive, and is shown as $6,560,665.47 on Jan. 1, 1907.

A large portion of the brief is devoted to a discussion of the subject of depreciation. Mr. Manson has computed the actual depreciation which has accrued on the property by analyzing the expenditures for construction and replacement during the last fourteen years, and his results vary only one-fifth of 1 per cent from the estimate of the commission's engineers.

The final results upon which the city contends it is entitled to secure a reduction in rates are as follows:

Gross earnings, 1907	$[illegible]
Operating expenses, depreciation, taxes............	1,898,533.12
Profit..................................	$1,323,379.32

A 6 per cent return on the investment as given above would be $393,639.92 and an 8 per cent return would be $524,853.23. Mr. Manson contends that the highest rate of return that could possibly be considered is 8 per cent, and that the present earnings exceed this by $798,526.09. The proposed reduction in rate would, on the basis of the number of passengers carried in 1907, reduce the gross earnings $582,396.67, which would leave a surplus of $216,129.42 for improving the service.

The proceedings in this case were begun over three years ago, but the enormous mass of details which has to be considered by the commission before any intelligent conclusion can be drawn will require considerable time still.

The Wisconsin Telephone Company has filed a complaint with the commission alleging that the Common Council of the City of La Crosse has passed certain ordinances which are unreasonable and void. These ordinances concern the removal of all telephone poles from certain designated streets in the City of La Crosse as well as from the so-called brick-paved district. The company claims that its poles in the affected district carry local wires, both bare and in aerial cables, as well as its toll lines which must necessarily pass through the city, and avers that inasmuch as its toll lines cannot be placed in cables, either aerial or underground, but must be conducted on open wires, any reconstruction would be attended with great practical difficulty and a considerable expense. It would involve crippling the service and the institution of condemnation proceedings to acquire certain rights-of-way which the local conditions would make necessary if the lines were to be removed from the particular streets involved. Without regard to the expense involved it would be impossible to complete such condemnation proceedings within the time limit set by the Council. The hearing has been set for Nov. 18.

A preliminary assessed valuation of $42,788,000 has been placed on the street-railway, light, heat and power utility companies of Wisconsin by the State Tax Commission. This is an increase of $2,318,000 over the preliminary valuations of the past year. The largest increase was made with the Milwaukee Electric Railway & Light Company, from $23,500,000 in 1910 to $24,400,000, an increase of $900,000. The assessment of the various street-railway, heat, light and power companies is as follows:

Milwaukee Electric Railway & Light Company	$24,400,000	Kenosha Street Railway	$275,000
Milwaukee Light, Heat & Traction Company	6,950,000	Menominee & Marinette Light & Traction	240,000
Milwaukee Northern Railway	1,650,000	Ashland Light, Power & Street Railway	285,000
Wisconsin Traction, Light, Heat & Power	1,150,000	Chicago & Milwaukee Electric	180,000
Chippewa Valley Railway, Light & Power	1,000,000	Merrill Railway & Lighting Company	120,000
Duluth Street Railway	875,000	Manitowoc & Northern Traction......	120,000
Sheboygan Light, Heat & Traction.	865,000	Grand Rapids Street Railroad	110,000
Southern Wisconsin Railway	850,000	Beloit Traction Company	110,000
Eastern Wisconsin Railway & Light..	775,000	Waupaca Electric Light & Railway.	86,000
Green Bay Traction.	705,000	Twin City General Electric	45,000
Wisconsin Electric Railway	650,000	Janesville Street Railway	37,000
Wausau Street Railroad	500,000	Bay Shore Street Railway	20,000
La Crosse City Railway	460,000	La Crosse & Onalaska Street Railway	20,000
Rockford & Interurban Railway....	310,000		

These preliminary valuations are subject to review and correction after hearing, which will be held before the State Tax Commission.

Maryland Commission News.

The Maryland Public Service Commission completed its telephone hearing last week and is holding the case under advisement. It is reported that the new schedule of rates which was recently proposed by the Chesapeake & Potomac Telephone Company will not be sanctioned, and that the commission will offer suitable suggestions which the company will favorably consider.

The commission approved the City Council's grant to the United Railways Company of the right to lay tracks on the widened portion of Light Street. There were no protests against this grant. The tracks will be laid between Baltimore and Lee Streets and the Orleans Street cars will be run over them.

Arguments on the question of whether the City of Baltimore

should be compelled to pay a percentage of the salaries of the members of the commission were begun last week before Judge Stockbridge in Circuit Court No. 2. Several months ago Attorney David Stewart, in behalf of the Auxiliary Realty Company, filed a petition for an injunction against the Mayor and City Council to restrain them from paying a part of the salary of the commission, as provided by an act of the last Legislature. The Auxiliary Realty Company claims that as a taxpayer it has the right to apply for such an injunction. Mr. Stewart contends that Article 15, Section 1, of the Constitution prohibits any commissioners under the laws of the State of Maryland from receiving more than $3,000 a year as salary. The chairman of the Public Utilities Commission receives $6,000 a year and each of his two associates $5,000 a year. Of this amount the City of Baltimore is to pay $3,000 a year to the chairman and $2,000 a year to each of the other two members of the commission. Attorneys William Cabell Bruce and Albert C. Ritchie, of the Public Service Commission, and Sylvan H. Lauchheimer argued on the demurrer of the city.

New Jersey Commission News.

The Board of Public Utility Commissioners for the State of New Jersey has issued a certificate of approval of a proposed issue by the Crosswicks Water Company of capital stock to the amount of $7,500 and of bonds to a like amount.

The board has approved of an ordinance of the Town of West Orange granting permission to the Public Service Railway Company to construct and operate so much of a connection between the southerly track of the Public Service Railway Company's street railway in Main Street and track on private right-of-way south of Main Street as lies within West Orange.

The board has also approved an ordinance of the Town of West Orange granting to the Public Service Railway Company the right to construct and operate street railway connections between the single track in Harrison Avenue and the single track in Eagle Rock Avenue, in the Town of West Orange.

AMERICAN ELECTRICAL ENGINEERS—XIX.

W. C. L. Eglin.

William Charles Lawson Eglin was born in Glasgow, Scotland, July 14, 1869, and received his scholastic training at the Andersonian University of that city and at the West of Scotland Technological College. After graduation he assisted Mr. Rankin Kennedy in his early experimental work on alternating-current generators and transformers.

In 1889 Mr. Eglin came to the United States, where he joined the Edison Electric Light Company of Philadelphia, and under Professor William D. Marks, then at the head of the Edison company, had charge of the electrical construction of the first modern central-station plant in that city. Later he was advanced to the position of engineer in charge of the electrical department, and continued in this position until the consolidation of the Edison company with the Penn Heat, Light & Power Company in 1896. Some time after this he was appointed electrical engineer of the Philadelphia Electric Company, which controls all the electric lighting companies in Philadelphia and vicinity.

Mr. Eglin's work after the consolidation of the various companies involved practically rebuilding and rearranging the entire system, in order that uniformly satisfactory service could be furnished throughout the city. To this end several generating stations were enlarged, others remodeled as substations and a new generating station built at Twenty-eighth and Christian Streets (described in our issues of May 27 and June 3, 1909). This latter station, which was designed upon the unit basis, has a present capacity of 36,000 kw and is capable of being expanded to an ultimate capacity of 120,000 kw. The total number of substations built and equipped is thirteen.

The design of the substations—especially the alternating-current substations—was worked out by Mr. Eglin with a view to as possible, in order to meet greatly varying requirements of service. Philadelphia is the leading manufacturing city in the United States, and some of the districts served are largely manufacturing, others are residential and still others demand both manufacturing and residence service. Throughout. Mr. Eglin's aim has been to reduce to a minimum the work of the operator, confining it so far as possible to keeping the stations and apparatus clean. Some of the smaller substations have been designed to operate without an attendant, an inspector merely visiting the plant occasionally to see that everything is in proper working order and that cleanliness is maintained.

Mr. Eglin has taken an active part in all matters relating to the company's progress, and has given particular attention to the various educational and beneficial organizations within the company, formed to enable employees to improve their condition. There are at present three organizations in the company, namely, a company section of the National Electric Light Association, which includes a former meter society as a branch; a beneficial association and an athletic association.

Mr. Eglin represented the Franklin Institute and the Engineers' Club of Philadelphia at the International Electrical

W. C. L. Eglin.

Congress held in Paris in 1900, and was a delegate of the Association of Edison Illuminating Companies to the International Electrical Congress held in St. Louis, 1904, where he presented a paper on rotary-converter and motor-generator city distribution. He has taken an active interest in the affairs of the American Institute of Electrical Engineers, having served as a manager and as a vice-president of that body and as chairman of the Philadelphia section. In 1903 he presented a paper before the institute on safeguards and regulations in the operation of overhead distributing systems, and he has frequently contributed to the discussions of papers. He has also contributed largely to the proceedings of the Association of Edison Illuminating Companies.

Mr. Eglin has been closely identified with the National Electric Light Association, and has occupied in that body the offices of secretary and treasurer, second vice-president and president. During his term as president (1908-1909) the association made great strides in activity, the membership being more than doubled, while the balance in the treasury was materially increased. As chairman of a committee on steam turbines in 1904, and chairman of a committee on gas engines and gas pro-

able reports on the relation of these prime movers to the central-station industry.

Mr. Eglin is also a member of the American Electrochemical Society, the Illuminating Engineering Society, and one of the Board of Managers of the Franklin Institute; member of the Engineers' Club of New York, the Engineers' Club of Philadelphia, the Bryn Mawr Polo Club and the Racquet, Merion Cricket, Pen and Pencil, Country and Union League Clubs, of Philadelphia, and the Mohawk Club, of Schenectady, N. Y.

CURRENT NEWS AND NOTES.

Assistant Electrical Engineer Examination.—The State Civil Service Commission, Albany, N. Y., will hold an examination on Dec. 15 for the position of assistant electrical engineer. The salary is $600 to $900, with maintenance.

Meter Tests.—Of 32,552 gas meters tested during the month of October by the New York City Public Service Commission 55.8 per cent ran fast and 6.2 per cent slow, leaving only 38 per cent as complying with the legal requirement. Of the electric meters tested during the same month, 3.6 per cent were fast, 3.6 per cent slow and 92.8 per cent correct.

Philadelphia N. E. L. A. Sectional Meeting.—A meeting of the Philadelphia Electric Company Section of the National Electric Light Association will be held on Monday evening, Nov. 21, at which the following papers will be read: "The Increasing Prominence of Illuminating Engineering, as Recognized by Technical Societies and Universities," by Mr. G. Bertram Regar; "The Possibilities of Electricity," by Mr. James H. Dentry.

N. E. L. A. Transactions.—Owing to the strike of express employees the delivery of the 1910 *Transactions* of the National Electric Light Association, the publication of which this year was ahead of the usual date, has been somewhat delayed. The two volumes this year include 2070 pages and 483 illustrations, and the edition reaches 7000 sets, or 1500 more than last year, representing about 2800 tons of printed matter. Many of the State and county sections are now so large that the volumes in many instances are being delivered in bulk to the local secretaries for final distribution by them.

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on Nov. 9 President F. P. Vose alluded with regret to the defeat of Mr. R. R. McCormick as president of the Board of Trustees of the Sanitary District. Mr. McCormick was a recent speaker before the club and made a favorable impression. He was an unsuccessful candidate for re-election on Nov. 8. A report from the treasurer was read, showing that the club has a balance on hand of $3,274.45. There was a good attendance. Mr. James Lyman, of the General Electric Company, read a paper on "Recent Hydroelectric Developments in the West," which was followed by a discussion.

Inverted Pole-Type Switches.—The North Shore Electric Company, Chicago, is using for its pole-top disconnecting switches an underslung type which is mounted beneath the cross-arm, where it is more accessible than the usual form inserted directly between the span insulators. In the new construction the spans are dead-ended on tandem petticoat insulators, jumpers being tapped under the arms to the inverted switch mounted on insulators. A slight bend in the clips of the switch holds the knife in a closed position unless a pull exceeding 15 lb. is exerted on it. The inverted arrangement makes the switch much easier to get at and to operate than with the old construction, where the line circuits had to be penetrated.

Cost of New York's Transportation Facilities.—It is estimated that, exclusive of the [illegible] the installation of electrical equipments by steam railroads, the improvements in electrical transportation facilities in Greater New York during the past ten years have cost $285,000,000. This amount is made up as follows: Manhattan subway, $94,000,000; Hudson tunnels, $68,000,000; elevated railways, $31,000,000; surface railways, $50,000,000, and Brooklyn Rapid Transit improvements, $42,000,000. In addition to the above, electrical railway equipments have been introduced by the Long Island Railroad, the Pennsylvania Railroad, the New York Central & Hudson River Railroad and the New York, New Haven & Hartford Railroad.

John Fritz Medal.—The John Fritz medal for 1910 has been awarded to Mr. Alfred Noble, past-president of the American Society of Civil Engineers, "for notable achievements as a civil engineer," and will be presented at a public meeting to be held on the evening of Nov. 30, 1910, at 8:30 o'clock, in the house of the American Society of Civil Engineers, 220 West Fifty-seventh Street, New York City. The program will be as follows: (1) "The John Fritz Medal," by Dr. Samuel Sheldon, Brooklyn Polytechnic Institute. (2) "Civil Engineering," by Mr. Isham Randolph, Chicago. (3) "The Life and Works of Alfred Noble," by Dr. Rossiter W. Raymond, secretary American Institute of Mining Engineers. (4) The presentation of the medal by Mr. Henry R. Towne, president New York City Merchants' Association. (5) Acceptance of the medal by Mr. Alfred Noble.

Engineers Discuss Smoke Prevention at Boston.—A joint meeting of engineers for the purpose of discussing smoke prevention and the economics of combustion was held at the Edison Building, Boston, on the evening of Nov. 10. The meeting was held under the auspices of the Boston Section of the American Society of Mechanical Engineers, with the co-operation of the Boston Society of Civil Engineers and the Boston Section of the American Institute of Electrical Engineers. The meeting was well attended and much interest was shown in the smoke-prevention problem in view of the recent law in Massachusetts which places jurisdiction over smoke in the hands of the Gas and Electric Light Commission. Chairman Ira N. Hollis, of the Boston Section of the A. S. M. E., presided, and after a short business session introduced Mr. Dwight T. Randall, combustion engineer, with Mr. Arthur D. Little, Boston, who read an exhaustive paper entitled "The Problem of Smoke Abatement in New England." Special attention was given to practice in hand-fired plants.

Meetings of the New York Section, I. E. S.—At a meeting of the New York Section of the Illuminating Engineering Society held on Nov. 11 Mr. A. J. Marshall, as secretary of the section, outlined the paper read and discussed at the recent Baltimore convention of the society and the lectures on illuminating engineering delivered at Johns Hopkins University. The convention and the lecture course were then discussed by Messrs. A. H. Elliott, H. T. Owens, E. N. Hyde and A. S. McAllister. Prof. G. S. Macomber described the course in illuminating engineering being given at Cornell University, in which use will be made of the information acquired during the Johns Hopkins lecture course in so far as it can be applied to the conditions at Cornell. The secretary announced that at a meeting of the section to be held on Dec. 8 two papers will be presented. A paper by Prof. E. L. Nichols will deal with the early history of photometric standards. Mr. Bassett Jones, Jr., will present a paper entitled "The Lighting of the Allegheny Soldiers' Memorial Building in Pittsburgh." This paper will be illustrated by means of colored lantern views. Printed copies of the paper will be distributed two weeks or more prior to the meeting. Three papers will be read at the January meeting of the section, the authors being Dr. P. W. Cobb, Dr. Nelson M. Black and Mr. Paul Bauder. At the February meeting of the section Mr. Bassett Jones, Jr., will read a paper entitled "A Study of Reflecting and Diffusing Media."

Argentine Wireless.—The Argentine government has appropriated \$8,500 United States currency for a wireless-telegraphy station at Mendoza, which will be in direct communication with Valparaiso, Chile.

Concrete Poles in Toronto.—The Toronto hydroelectric department will light a number of residence streets with tungsten lamps in a new design of lantern on concrete poles. About 550 poles are now being erected.

Ohio Public Utilities Bill.—Senator Carl H. Keller, of Columbus, has announced that he will introduce another public-utilities bill at the next session of the Legislature, which convenes in January, 1911. He says it will be a real utilities bill "with teeth."

Long-Distance Wireless.—Wireless telegraph communications have passed between the Marconi stations at Coltano, near Pisa, Italy, and Clifden, Ireland, and Glace Bay, Nova Scotia. It is reported that the opening of the new service will result in a lowering of the transatlantic rates for wireless messages.

Christmas Turkeys for Central-Station Employees.—The Commonwealth Edison Company of Chicago will make a Christmas present of a turkey to each employee of the company who will have been in the service of the company for one year or more on Dec. 25, 1910. The undertaking will mean the distribution of probably more than 2000 turkeys.

Denver Electric Club.—Mr. Charles J. Babcock, chairman of the publicity committee of the Denver Chamber of Commerce, was the speaker at the regular weekly luncheon of the Colorado Electric Club on Nov. 10. His subject was "Salesmanship and Advertising," with special reference to the value of such methods applied to the publicity of Colorado's resources.

Ohio Bell Telephone Society.—A meeting of the Ohio Bell Telephone Society will be held at Columbus on Monday evening, Nov. 21, when about twenty-five prominent telephone men outside the State will be guests of the organization. Points of interest will be discussed and a banquet will be served at one of the hotels. This society is made up of officials of the Bell companies in the State and comprises a large membership.

Subways and the Building Code.—Chicago is considering the adoption of a new building code and Mr. B. J. Arnold, chief subway engineer, has written to Mayor Busse to point out that the code should take into account the construction of future passenger subways. In streets where subways may be constructed foundations of all buildings under six stories, or 75 ft. high, should be carried to the depth of the subway structure. All buildings over 75 ft. high should rest upon caissons carried to rock.

Baltimore Scientists' Club.—The first meeting this year of the Baltimore Scientists' Club was held at the Baltimore City College last week. Prof. L. J. Ingham, of the scientific department of the college and president of the club, delivered a lecture on the McCall's Ferry hydroelectric plant preliminary to the trip which the members of the club made to the plant the day following the lecture. The club consists of the teachers of science in the principal secondary schools of Baltimore. A special car conducted the party to McCall's Ferry and an inspection was made of the entire plant.

Safety Locks for Crane Controllers.—The Illinois Steel Company is equipping the controller handles of the various motor-driven cranes and carriages about its mills and open-hearth furnaces with automatic safety snap locks which can be closed to hold the controller in the off position until released [illegible] of them fatal, have resulted from men scuffling near controllers or carelessly handling them when the regular crane operators were out of the building, and the new locks now being installed are intended to prevent the recurrence of these accidents.

Nelson and Saskatchewan River Water-Powers.—Hon. William E. Ogilvie, former Governor of Yukon, has stated that his observations during a recent trip to the Nelson and Saskatchewan indicated that there is 1,000,000 hp available for development on these rivers. On the Nelson River at White Mud Falls there is alone 350,000 hp, and the same power can be developed at Grand Rapids on the Saskatchewan. These powers are within a radius of 100 miles of the proposed Hudson Bay Railway, and Mr. Ogilvie advocates the adoption of electric traction for that line. The matter will be brought to the official attention of the Dominion government.

Telephone Service in Chicago.—At a recent meeting of the City Council of Chicago an ordinance was introduced requiring the installation by telephone companies on all telephones equipped with coin boxes of meters to record outgoing messages. The proposed ordinance was referred to the committee on gas, oil and electric light, which is investigating the general subject of telephone rates. Another alderman secured the adoption of a resolution directing the Corporation Counsel to report whether the ordinances of the Illinois Telephone & Telegraph Company (Illinois Tunnel Company successor) are now in force and effect. These ordinances go back to 1899 and require that company to give unlimited service from business and residence telephones for \$85 and \$50 a year, respectively.

New Washington Street Tunnel Under Chicago River.—A novel reconstruction of the old Washington Street tunnel under the Chicago River will shortly be opened for the passage of the electric cars of the Chicago Railways Company. As originally built, this masonry tunnel was only 16 ft. below the mean level of water in the river, limiting the draft of vessels in the Chicago River at that point. The reconstructed tunnel is 26 ft. below the river surface. Parts of the original masonry walls of the structure were retained, the roof was taken off and rebuilt on steel girders supported on the walls, and the floor lowered sufficiently to allow electric cars to pass. The entire tunnel is 1200 ft. long, of which 200 ft, is subaqueous. The west approach extends beneath the new terminal station of the Chicago & Northwestern Railroad. The track grade is 46 ft. below the river level, and the bore section measures 16 ft. x 25 ft. The reconstruction work has been completed by an interesting use of compressed air for sustaining the rock masses during the work. The method used was one devised for this work by Mr. George W. Jackson, of George W. Jackson, Inc., which did the work.

Students' Wireless-Telegraph and Aeroplane Equipment.—The students of the school of engineering at the Pennsylvania State College are installing a wireless-telegraph station designed for communication with stations at Washington, New York, Philadelphia, Boston and elsewhere. Among the uses to be made of the apparatus will be the reporting of football games played by the college team in other cities where suitable wireless-telegraph equipments have been installed. There is also being erected a level circular track, 200 ft. in diameter, for making tests upon aeroplanes and propellers. A car driven by an electric motor will run upon the track at speeds up to sixty miles per hour. To this car will be attached the planes or propellers to be tested. The frictional resistance or lifting power of the planes and the propelling force and efficiency of propellers will be determined through a series of dynamometers which record by electrical means on instruments placed upon a platform in the center of the circular track. The problem of plane shape and surface can be readily studied by this apparatus, as can also those relating to the shape, size and speed of propellers.

ELECTRIC GENERATING AND DISTRIBUTING SYSTEM IN READING, PA.

Combined Lighting and Railway Equipment of the Metropolitan Electric Company.

THE Interstate Railways Company is a corporation of the State of New Jersey, with headquarters in Philadelphia, under which are combined a large number of public service corporations in the States of Pennsylvania, New Jersey and Delaware. The most important group of these subsidiaries is formed by about a dozen railway and lighting companies in and about Reading, Pa., all of which are now leased to the Reading Transit Company. Among the underlying companies of the transit company is the Metropolitan Electric Company, of Reading, which acts as the sole generator and distributor of energy to the following public utilities: Reading Traction Company, Reading Power Company, Reading Electric Light & Power Company, Reading & Southwestern Street Railway Company, Front & Fifth Street Railway Company, Birdsboro Street Railway Company, Oley Valley Railway Company, Adamstown & Mohnsville Electric Railway Company, Neversink Mountain Railway Company and Neversink Mountain Light & Power Company.

The foregoing corporations serve the entire County of Berks, and also parts of Lebanon and Montgomery Counties. The population served by the Reading Transit Company is about 50,000. The officers of this company are as follows: President, H. G. Louser; vice-president and general manager, W. A. Rigg; treasurer, H. H. Reigel; engineer, C. C. Long.

The system in use before the construction of the station described hereinafter consisted of a main generating plant on Seventh Street, Reading, composed of four brick buildings, which had been constructed from time to time as the needs of the system required. Three buildings were devoted to engines and generators and one was used for boiler rooms and miscellaneous purposes. The total rating of this plant was about 300 hp. Not only was the equipment insufficient for the rapidly growing territory, but the generating apparatus itself had become antiquated. Outside of this plant were two rotary substations to which high-tension energy was supplied by means of 25-cycle inverted rotaries fed with energy from the railway generators.

The generating station at Reading serves practically all the territory included in Berks County. This is accomplished by means of high-tension feeders to the two substations already

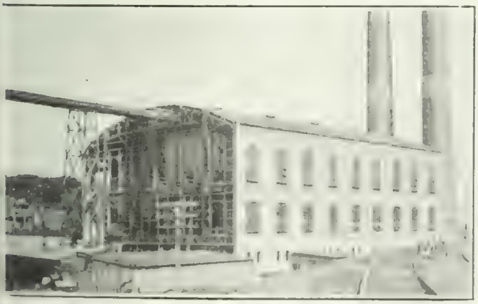


Fig. 1—View of Main Station, Showing the Conveyor Run and Temporary End in Process of Erection.

in operation at Shanesville and on the Oley line, and to four new ones located at Ringing Rocks, Wernersville, Mount Penn and Mohnton. A portable substation is provided also for emergency conditions. Each substation contains one 500-kw rotary and air-blast transformer, except Mount Penn, which has two units, and the main substation on Seventh Street, Reading, which has four 500-kw units. Under the old system the Shanesville and Oley line stations received energy at 15,000 volts, 25 cycles, and consequently it was necessary to change their apparatus to suit the new conditions.

The lighting and motor service systems in Reading have been left undisturbed as far as possible, the only change being the withdrawal of all two-phase motors and the substitution of single-phase and three-phase motors. The Edison three-wire direct-current lighting system, serving the central portion of the

Fig. 2—Interior of the Turbine Room.

city, was shifted from the generators in the old plant to the lighting rotaries in the new main substation at the same site. Future extensions of the service will be made from the three-phase lines wherever possible. The street-lighting system in Reading is composed of magnetite arc and tungsten incandescent

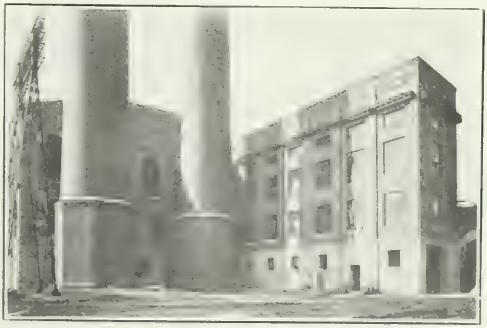


Fig. 3—Front of Main Station, Showing Switch House Annex and High-Tension Tower at Left.

series lamps. From 40 per cent to 50 per cent of the total output is for railway service.

THE NEW GENERATING STATION.

The new generating station is located in West Reading along the Schuylkill River, adjacent to the Pennsylvania and Philadelphia & Reading railroads. These railroad connections furnish excellent facilities for the delivery of building material, machinery and fuel. The shape of the plot made it necessary to lay out the different portions of the station in a rather unusual manner. There was only room enough between the

Pennsylvania Railroad's main line right-of-way and the property line opposite to permit the construction of the boiler and turbine rooms, which are 174 ft. x 88 ft. and 174 ft. x 38 ft., respectively.

A more favorable building cross-section could not be secured because the adjoining property was in litigation. To provide room for the rotaries, transformers and switch apparatus it was, therefore, necessary to build an annex running on to the narrow river end of the property. This annex is 113 ft. long, 38 ft. wide at the turbine-room end and 26 ft. wide at the front. If the building had been located far enough back to allow sufficient width to place the switch gallery between the turbine and boiler rooms not enough room would have been left to allow extensions. Furthermore, the increased length of the condensing-water duct and the additional excavations required by the upward slope of the land would have added materially to the cost of the plant. The natural slope

water level during the spring freshets, it was necessary to waterproof the turbine-room basement to an elevation of 8 ft. higher that the present basement floor. All the stairways and other openings were placed above the maximum high-water line except the opening in the end adjoining the switch-house, where provision was made for a railway track to deliver machinery. At this track entrance there is installed a wooden gate which is always in place except on the rare occasions when it is necessary to bring machinery parts under the floor hatch in the turbine room.

The station building is a steel-frame structure with brick walls resting on concrete basement walls which are carried up to the level of the first floor. The foundations are of rock, concrete-capped piling or solid ground, the differences being due to the extremely irregular geological formation at this place. As the low-water level of the river was 74.5 at grade, the bottom of the foundation was taken at grade 74 in order to make sure

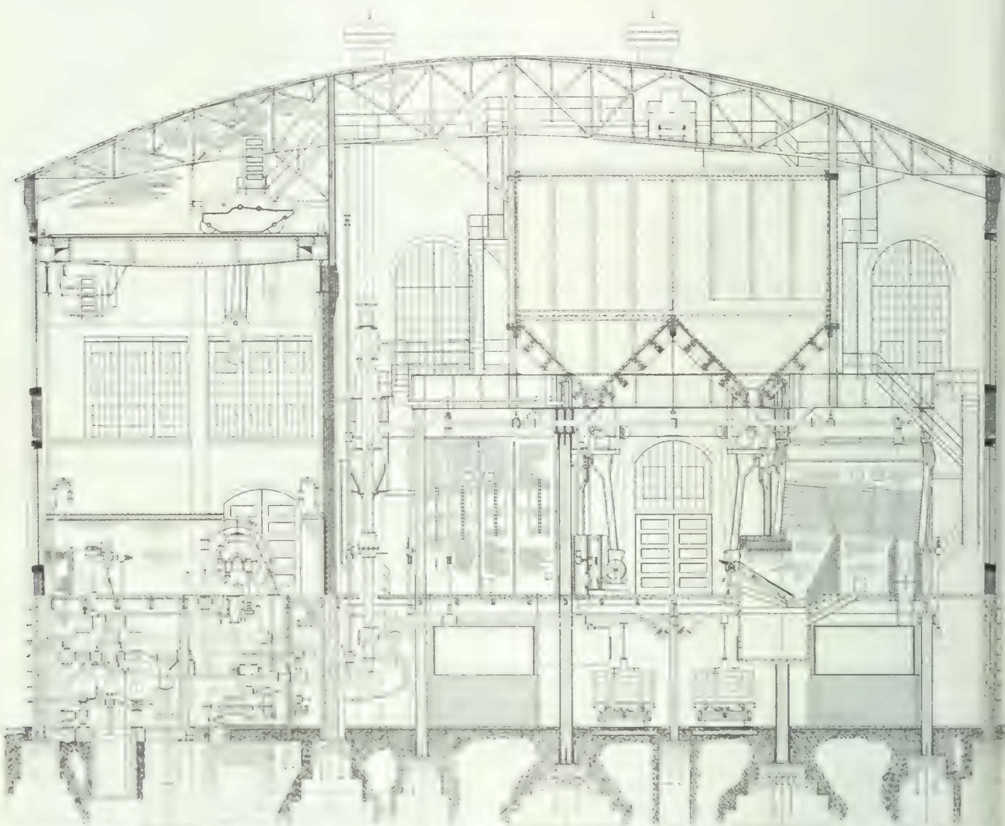


Fig. 4—Cross Section Through the Power Station, Showing the Principal Construction and Equipment Features of the Boiler and Turbine Rooms.

of the land at the river end was so slight that a comparatively level area was available for most of the space needed for the station and only a relatively small amount of excavation was required to provide sufficient drainage area from the building under ordinary conditions. The basement-floor grade of 87 was placed above ordinary floods, only slightly below bad ones and near enough to the highest recorded flood grade of 94.5 to permit complete protection for the turbine-room basement auxiliaries, while the lift for the circulating water pumps at the extreme low-water grade of 74.5 was within reasonable limits.

To protect the auxiliaries from water at the maximum high-

that the piling would always be moist. Concrete basement walls were chosen in preference to stone to give the finished building the proper architectural effect. The brick walls above the first [illegible] thick enough to take approximately half of the wind [illegible] the sides of the building, leaving the steel framing [illegible] the other half. Allowance for wind pressure was a[illegible] in the construction as Reading is located in a mountain valley subject to frequent storms.

[illegible] the structure has an unbroken curved roof, which [illegible] from the ordinary station construction. [illegible] type [illegible] adopted in order to avoid all gutters, to sim[illegible] possible extensions and to attain a more graceful appear-

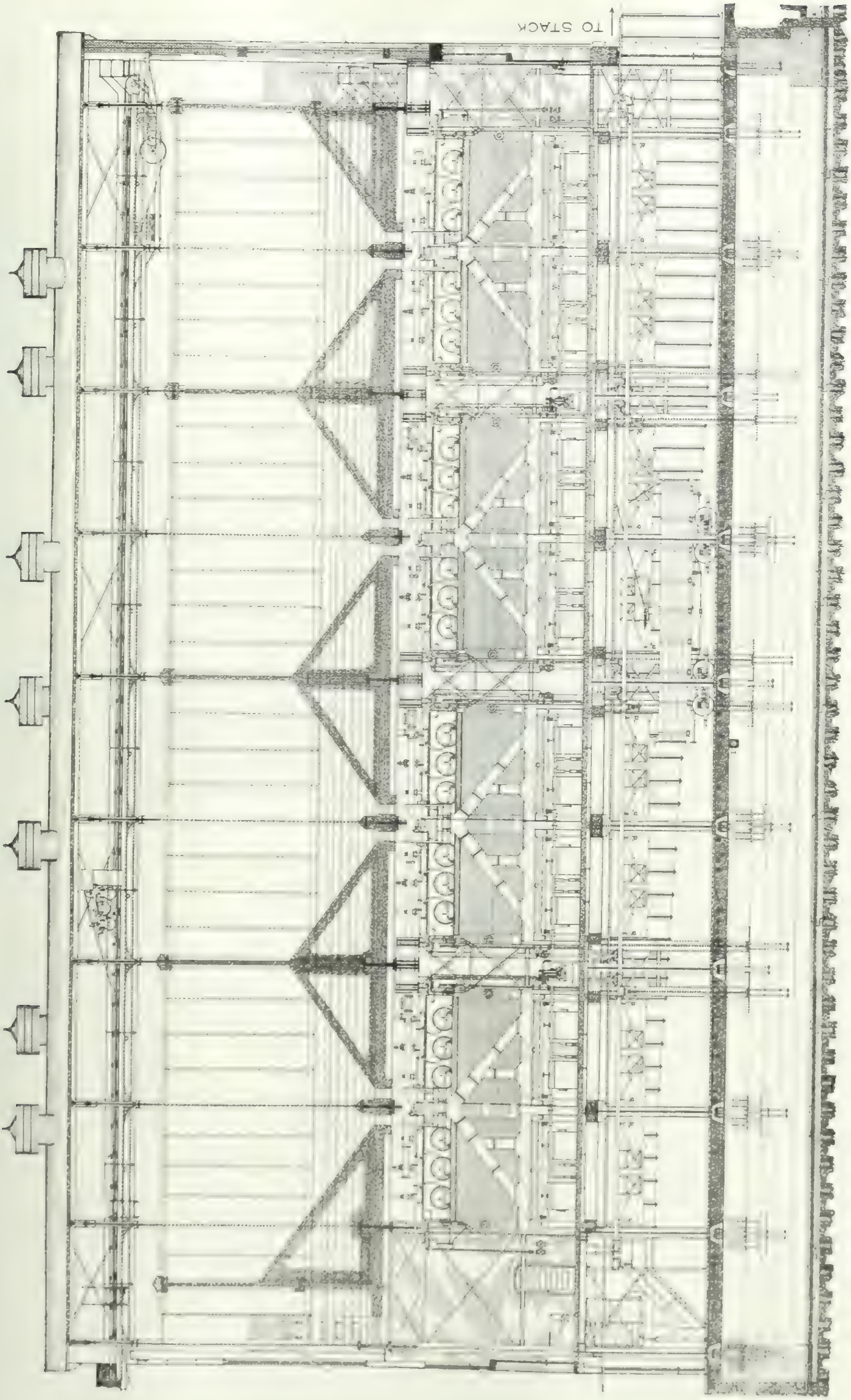


Fig. 5—Longitudinal Section Through Boiler Room.

ance. The supporting truss, although apparently continuous, is made in five sections which are supported by the various column systems carried up to it. The clearance required for the coal conveyor was such that the bottom chord of the roof truss could be curved, with the dual object of improving the architectural appearance and bringing the depth of the unit trusses within the proper shipping height.

The roof framing carries 3-in. reinforced concrete Roebling slabs covered with three-ply roofing felt. Owing to its curved form, the slope of the roof varies from flat at the center to about one-quarter pitch at the sides, which is considered within the limits of safe practice for asphalt roofs. The roof of the switchhouse annex has a slope of ¾ in. per foot and is supported by the usual shallow Pratt truss, with sloping top chord.

The switch-house, as an annex to the main building, has different panel lengths to suit the electrical apparatus, and it, therefore, required different treatment. It was decided to build this portion with flat top windows and to use flat top parapets slightly lower than the main building instead of the curved roof of the latter.

The question of future extensions determined to a great extent the general design of this station. It is so arranged that extensions up to double the present rating can be made, and the additional pair of chimneys required will be placed at the extended end in the same relation to the building as the present pair. The final boiler installation will be symmetrical about the present end bay.

According to the original plan the temporary wall at the extension end of the power house was to be of brick, laid in lime mortar to facilitate removal. The revival of business, however, created such an increased demand for service that it seemed likely that an addition to the present structure would be required very soon. Consequently, a partition of sheet metal supported on girts and columns and stamped to represent brick work was installed instead of a brick wall. This construction lends itself more readily to dismantling, as the bolted connections can be removed and re-erected as often as desired.

[illegible]

The boilers are hung from columns which form a part of the steel building framing, and the coal bunker rests upon girders supported by the front and rear columns of the boiler settings. The side columns of the coal bunker are carried from these girders up to the roof framing, which they help to support. The boiler columns, together with the wall columns, support the first floor and the ash bins and flues underneath.

The width of the coal bunker was determined by the proper relation of the space between the boiler fronts to the space required between the boiler fronts and the walls, as well as by the proper division of the roof into separate truss units. As a result, one side of the coal storage is placed on the center line of the building and the other side is symmetrical about the center of the firing floor, so that it is one-third of the width of the building. The coal-storage space will contain about 3900 tons. The coal bunker is made of concrete slabs, supported by steel beams, and is divided into compartments by cross-girders and vertical beams. Each compartment is directly over two opposite batteries. The ash bins are hung from the first-floor beams. They are constructed without the customary sloping bottom to secure the benefit of maximum holding capacity during the period of spring freshets.

A complete system of walkways reachable by a stairway at each end of the boiler-room was installed for operating the main steam valves. The walkways on each side are cross-connected. At each end of the building additional stairways of easy ascent run from these boiler walkways to the conveyor runways and machinery platform; an extension is carried through the middle wall and the turbine-room, over to the switch-house roof, by which the main roof can be easily reached. A floor hatch is placed at the chimney end of the boiler-room for convenience in transmitting parts for repair to the machine shop in the switch-house basement. Parts can be lowered through this hatch by a chain hoist almost directly onto the trucks in the basement and hauled on the level to the machine shop.

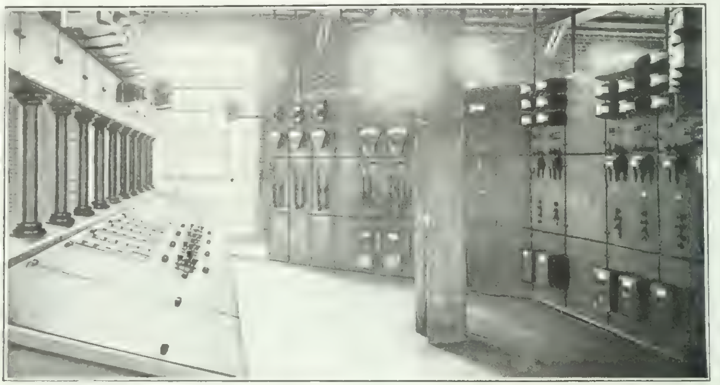


Fig. 6—Benchboard and Switchboard Looking Over the Turbine Room.

At the extension end of the building a clear floor area of 15 ft. has been left between the boiler setting and the temporary wall. The first two columns in this wall are designed for future boiler columns, so that in the completed plant there will be a 15-ft. clear area crossing the firing floor at right angles. Underneath this area, separated by the ash-car tracks, which run through the aisles between the front boiler columns, there are mezzanine floors with lavatories and lockers for the operators. These mezzanine floors are placed above high-water level and the space underneath them is available for future temporary extensions of the flues leading to the present chimneys. However, such extensions are to be used only until additional chimneys are installed, when the flues will end at the mezzanine floors as at present. The flues are placed directly under the boilers and are made up of steel plates, reinforced by angle ribs. They are 13 ft. wide with a level top and taper from a depth of 12 ft. 6 in. at the chimney end to half this depth at the mezzanine bay, which lesser depth is still large enough to permit the operation of an additional battery of boilers. The flues are supported directly from the floor girders and are anchored to the boiler columns at the chimney end.

Roof ventilation is attained by eight 48-in. Burt monitor ventilators. Three more ventilators of the same construction are installed on a line with four of these to receive the atmospheric exhaust pipes from the condensers. To obtain the best light and side ventilation for the building large windows were

›lanned with relatively small window panes and large venti-ator areas. The "Fenestra" sash, made by the Detroit Steel Products Company, proved adaptable to these requirements. n addition, the end walls were designed so that large-sized loors would come at each end of the firing floor, while the coal in was stopped a few feet from each end of the building to ermit good ventilation through the upper windows and the oof ventilators.

SWITCH-HOUSE ANNEX.

The switch house contains a machine shop in the basement, otary converters, transformers and office on the first floor; he main switchboards and oil switches on the second floor, nd lightning arresters on the third or top floor. The con-truction here is similar to the usual brick and steel office uilding, except that the narrowness as compared with the eight made careful provision necessary to resist the side wind ressure. Hence all floor girders were knee-braced through-ut. The end frame, since the walls were brought back to the olumn centers, was sufficiently braced by the deep girders which carry the walls.

On account of the inclination of the property line at this ide of the building it was necessary to incline one side of the witch house, reducing the width from 38 ft. at the turbine-oom end to 26 ft. at the outer end. In addition to this the ailroad track in the turbine-room basement, in order to reach e main-line railroad on the river bank, was curved sufficiently o necessitate offsetting the interior columns at the narrow nd. The sloping sides make each roof truss different, while e offsetting of the interior columns in combination with the oping sides, and the small crane run in the four bays at the mer end over the first-floor transformers, also make each col-mn different from every other. The air duct necessary under e transformers was united with the cable gallery coming rough the wall from the turbine-room basement. Reinforced oncrete construction was adopted for this latter combination s the most satisfactory means of supporting the weights im-osed and of furnishing enough working space to reach the ansformer leads.

BOILER AND TURBINE EQUIPMENT.

The principal equipment in the boiler-room consists of six-een 625-hp Edge-Moor horizontal water-tube boilers set two er battery. These boilers are equipped with Wetzel stokers riven from line shafts, each furnishing power for two bat-eries. The stokers are driven by a small vertical engine, but a omplete spare stoke-engine unit is installed to provide for mergencies. These stoker engines, the air compressor and the ouse-service water pumps mentioned later are the only recip-ocating mechanisms in the entire power house.

Each battery of boilers has a coal scale delivering to the two okers through a Y-connection, so that for running boiler tests e coal consumed by any one boiler can be accurately de-ermined; and in case of a test of a turbine unit the coal re-uired for the number of boilers furnishing steam for that unit an also be determined.

Two radial brick chimneys are now in service. Each chimney 242 ft. high x 14 ft. inside diameter, and, as previously de-ribed, is provided with a steel rectangular flue carried under e first floor connected to eight boilers. This arrangement ives one extra pass for the flue gases in the boiler settings. t was, therefore, decided to dispense with economizers as be-ng of questionable value under good operating conditions.

The turbine-room now contains three 4500-kw Allis-Chalmers orizontal three-phase turbo-generators delivering 13,200-volt, ...e energy. These turbines take saturated steam at 200 pressure. Their steam consumption guarantees per kw-... are based on a pressure of 190 lb. at the throttle of the ...e and a vacuum of 28 in.: 2500 kw, 17.6 lb.: 4500 kw, 16.4 ...000 kw, 16.6 lb. These outputs are based on a power-factor of 80 per cent. Exciting current is furnished by two ...kw General Electric horizontal turbine-driven units fur-ishing direct current at 125 volts.

By referring to the accompanying illustration of the turbine-oom it will be noted that the machines have been placed in a single line parallel to the longitudinal walls of the building This arrangement leaves a clear space in which parts to be in-stalled or dismantled can be moved with the crane to and from the hatchway without interfering with the machines in opera-tion. The turbine-room is served by an 80-ton Shaw crane.

As provision for further growth may require larger turbine units and as it was not considered best to confine the possibili-ties to a horizontal type, the turbine-room was built high enough to admit the installation of the largest vertical turbine unit which might be required. Advantage was taken of this possibility to provide the large coal storage previously de-scribed by keeping the rest of the building up to the height of the engine-room.

An interesting feature of the lighting of the turbine-room is the use of clusters of four 75-watt tungsten lamps in single frosted globes. These give much steadier illumination than arc lamps and avoid considerable cost for maintenance, such as trimming, globe cleaning, etc.

STEAM PIPING.

The piping between the boilers and the turbines is so ar-ranged that it has the advantages both of a unit system and a duplicate main system, while being simpler than the latter. It is possible under all conditions to get enough boilers connected to furnish steam for any one turbine no matter what boilers are out of commission. The arrangement of the main steam pipes over the boilers is as follows: The boilers in each row are connected to a line running lengthwise over each set of boilers and the steam for the turbines is taken by cross-connections be-tween two sets of boilers in each row. By an arrangement of valves where these cross-connections are made any turbine unit can be tested with two or four boilers by the closing of three valves, still leaving the other boilers connected to operate other units. While a turbine is being tested it may be desirable to operate its auxiliary from another steam source. This can be done by closing one valve in the turbine-room basement.

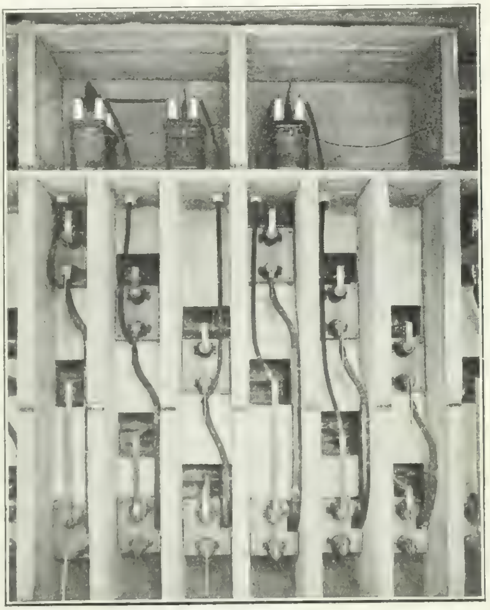


Fig. 7—High-Tension Cells.

Owing to the fact that the turbines operate with a constant flow of steam it was possible to use smaller piping than if it had been necessary to supply the more fluctuating demands of re-ciprocating engines. The 6-in. steam connections from the boil-

ers are joined to 8-in. mains. A 10-in. pipe is used to cross-connect the mains at the places where steam is taken for the turbines. The 12-in. pipe from each cross-connection leads to that point in the turbine basement where the connections to the auxiliaries are made, whence a 9-in. pipe leads to the turbine throttle. In laying out the piping diameters the requirement at the turbine end was taken as the starting point instead of planning from the boilers.

All piping to the turbine exciters is carried under the floor, so that none is visible in the turbine-room except the risers through the floor to the machine. This gives the turbine-room a remarkably light appearance and avoids all trouble from drips and escaping steam.

AUXILIARIES

In the turbine-room basement two Cochrane feed-water heaters and three Jeansville five-stage centrifugal boiler-feed pumps are placed at the end of the present building in such position that when additions are made to the plant the end turbine-room wall may be taken down and a duplicate system of heaters and pumps installed symmetrically along the line of the temporary end wall, thus keeping this apparatus in the middle of the completed plant.

Provision is made in the basement of the turbine-room for the house service water by two steam-driven duplex pumps. A single-cylinder steam-driven compressor furnishes the compressed air used for cleaning out the boiler tubes and for blowing dust out of the switch cells and machine frames. This compressor, by the way, is the only piece of apparatus transferred from the old plant to the new one.

The condensing equipment consists of Tomlinson barometric jet condensers with two heads on each condenser. This arrangement was used to take advantage of the difference in diameter between these heads and what would be required if a single head were used. The combined guarantees for the turbines and condensers are sufficient to insure good results without air pumps. Each condenser has its own centrifugal steam turbine-driven circulating pump, but these pumps are connected with a main so that by means of cut-off valves one pump may be made to supply the needs of another condenser if necessary.

The circulating water is taken from the Schuylkill River in a rectangular duct 6 ft. square which runs into the building directly under the turbine foundations. On top of this duct there is a similar 6-ft. x 6-ft. return duct, into which the hot wells discharge through openings in the foundation wall. On account of the conditions at this site the hot wells had to be constructed so that they would not be affected by floods. This necessitated the raising of the exhaust-pipe connections over the condenser heads to the barometric distance above the possible flood level.

The boiler-feed supply is taken from a dam in Wyomissing Creek at a point nearly one mile distant. A large pipe was necessary on account of the low head between this dam and the feed-water heaters. This pipe line was constructed of discarded boiler shells, which were available for low-pressure purposes. The shells varied in diameter from 30 in. to 40 in. and were jointed by means of concrete envelopes. In this way it was found possible to get head enough to allow the feed water to run into the heaters by gravity, and from the heaters to the pumps with sufficient head to allow them properly to handle hot water. The boiler-feed system consists of three five-stage centrifugal pumps driven by Kerr turbines. These pumps are designed for 700 gal. per minute at a pressure of 260 lb. The piping from these pumps consists of duplicate mains from the pumps down the length of the boiler-room basement. Each boiler has a front connection to one main and a rear connection to the other main, so that no possible breakdown of the piping short of a total disablement can prevent the feeding of any boiler. The feed water can be taken directly [illegible] gencies, and as a feature of the regular practice of this plant, the circulating-water main is connected to the boiler-feed supply so that it is available in case of the failure of the supply line and can be periodically administered to the boilers as a purge for removing scale. The front-feed connections to each boiler are equipped with a feed-water regulator.

All of the auxiliaries exhaust at atmospheric pressure, the exhaust steam being used to heat the boiler-feed water.

COAL AND ASH-HANDLING EQUIPMENTS.

Coal is delivered over spurs from the Pennsylvania and the Philadelphia & Reading railroads, which run side by side at different levels on the same set of reinforced-concrete piers over the coal-storage platform and a track hopper which dumps directly to the crusher, whence the coal goes to the power-house bunker by way of a 24-in. belt designed for 180 tons an hour.

The surplus coal for outside storage is dumped between the concrete piers which support the dumping tracks. Directly under these piers there is a concrete structure which contains a tunnel with roof openings leading to a 36-in. belt conveyor. Ordinarily these openings are closed by cut-off gates. When stored coal is to be used the cut-off gates are opened from the floor of the conveyor tunnel by means of chains which enable the operator to control the amount of coal for the reclaiming conveyor. A loading device in the tunnel regulates the flow of coal to the belt. This conveyor delivers coal to the crusher for transmission to the generating station by way of the 24-in. belt previously mentioned. The latter belt attains the level of the lower chord of the station roof truss back far enough from the building to permit extending the structure in such a way that it would be necessary to disturb only the lower part of the conveyor support. This support consists of wooden bents on concrete piers. Coal to all divisions of the bunker or to any one of them is delivered by a traveling conveyor tripper.

Ashes are dumped directly from the ash hoppers underneath the stokers into full-sized ballast motor cars, which run through the basement. These ashes can be taken away for fills or dumped at any convenient point without rehandling.

HIGH-TENSION DISTRIBUTION AND UNDERGROUND CONDUIT SYSTEMS.

The main generator leads are carried in conduit along the basement wall into the switch-house basement and up the wall to the second floor to the switch cells. The underground feeders are taken in conduits directly down the wall and out through the foundation wall into a manhole, which is the entrance to the underground system hereinafter described. The conduits for the house-service feeders are also carried up the wall from the second floor to the third floor, which contains the lightning arresters. In general, all the high-tension wiring in the building is run in fiber conduit covered with concrete. To keep the window openings clear all conduits between the first and second floors are grouped in the spaces between the windows, the concrete being made to give the effect of wide pilasters.

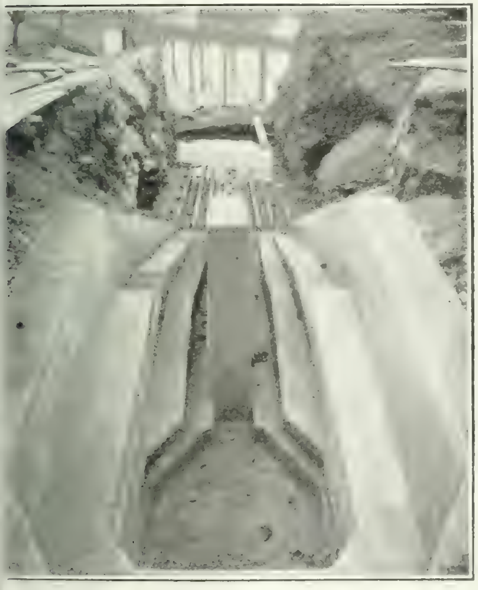
The outgoing high-tension lines are taken out through 16-in. circular openings in the walls, the wires being supported on insulators both inside and outside. The outside insulators and supports are designed for dead-end strains. Provision is made for taking eight three-phase high-tension circuits out of the switch-house over the Pennsylvania main tracks in front of the building and from there distributing the circuits to the various substations. To accomplish this two extra heavy dead-end steel line towers were built to hold the maximum unbalanced load of 9000 lb. which the railroad company's standard specification required. The insulator clamps are designed to cover as far as possible the worst conditions of breakage and still to keep the wires in the proper position.

As the new station was built on the far side of the river at a distance of about one mile from the old plant, which has been converted to a main distributing station, it was necessary to provide a conduit system for the six three-phase feeders to the main substation in question. These feeders are carried under the river and underground through the streets of Reading except where they cross the Schuylkill Canal. On reaching this canal the feeders are brought to the surface and carried across alongside the highway bridge on a special bridge built by the American Bridge Company. This bridge has a decking over the conduit envelope which can be used as a sidewalk.

The accompanying views show some interesting features in ›gard to the underground approaches at the river bank on the .eading side. One novel construction is that going out from ıe river up to the first manhole. The cables are brought up ut of the slots on to the shelves at the sides of the manholes y a system of sloping shelves. In another construction (not lustrated) the submarine cables from the generating station to ıe river are placed in a single layer in slots in the floor of the ınnel and are covered with removable concrete slabs. From ıe tunnel these cables pass through fiber conduits embedded ı the concrete basement walls of the station up to the switches. 'he present installation comprises four three-conductor subıarine cables, leaving available the remainder of the ducts for dditional cables, either single conductor or otherwise. This nderground line also has provision for a telephone cable conecting the generating plant to the main substation and a metalc ground connection from the railway grounds in Reading to ıe generating plant and the main substation.

SWITCH-HOUSE EQUIPMENT.

The first floor of the switch-house or annex building is level ith the turbine-room floor. At present it contains two 500-kw



g. 8—High-Tension Conduits, Looking in the Direction of the River.

'estinghouse railway rotaries and the necessary air-blast stepıwn transformers with provision for one more rotary and ansformer equipment. There are also two transformers for e house supply for lamps and motors with space for a third stallation. A hand crane of 6-ton rating is to be provided ır handling this apparatus. The engineer's offices are located the outer or front end of this floor.

The second floor is laid out for high-tension oil switches follows: Three present generator switches, three future ·nerator switches, two spare switches, one auxiliary bus switch, ıe incoming water-power switch, four present underground vitches, two future underground switches. The remaining vitches are for outgoing overhead feeders. These switches ıd the bus compartments are arranged in the shape of a horseıoe, one set being placed along the south wall and the other ong the north wall. The switch cells face the outer walls ith a 4-ft. aisle between the cells and walls. Instead of the ·ual brick and slab design these cells are made of concrete, except the floor slabs, which are of the customary slate. This construction weighs much less and consequently saved steel in the floor framing. On the rear side of the cells is the bus structure which contains the main and auxiliary bus. This bus structure, which is original with this plant, consists of separately molded concrete cells set into a space in the barriers, which are of concrete like the switch cells. The switch connections are laid in barriers on the floor in the walkways between the cells and the wall and are covered by a false floor of removable slabs.

As noted in the list of high-tension switches, there are two spare switches (one per row) and an auxiliary bus switch. In case of trouble the spare switch in each set takes the place of a regular switch by means of the auxiliary bus. Through the employment of the two spare switches and the auxiliary bus any overhead feeder can be independently operated from any one turbine.

The benchboard for the generator and field-control system is also on the second floor. It faces the window opening into the turbine-room. This board has an open space over the bench and under the instrument board so that the operator can

Fig. 9—City Side Entrance from the River for Underground System.

get a good view of the main floor. The main switchboard, which faces the benchboard, is curved. The control wiring for the switches is in iron conduit embedded in the concrete floor; that for the generator-field circuits runs down the wall into the basement, where it follows the main generator leads.

The third floor contains the electrolytic lightning arresters of all overhead lines. All the switching apparatus and control equipment for the main station and for all the substations were furnished and erected by the General Electric Company

[illegible]

All the lighting and motor-service circuits in each room of the generating plant are controlled from conveniently located slate-lined, steel-panel cabinets. The feeders for these cabinets are taken from the main house-service switchboard on the first floor of the switch house. Alternating current at 110 volts and 220 volts is supplied to these circuits from the house-service lighting transformer. The motor-service requirements are as follows: One 40-hp motor in the roof structure to drive the

24-in. conveyor belt, one 75-hp motor in the coal pocket pit to drive the crusher and the 36-in. belt and two motors for driving the centrifugal fans for the air-blast transformers. Direct current at 500 volts is taken from one of the railway rotaries to operate the crane motors.

[illegible]

The old central generating plant consisted of three buildings facing Seventh Street and a boiler house in the rear. The first of these buildings, a three-story brick structure with wooden floors and wooden columns, contained a line shaft on the first floor belted to a large Corliss engine in the adjoining building. The same floor had seven small engines driving twenty-eight bi-polar generators on the floor above. The second building was a brick wall, steel-frame structure with a traveling crane. It contained three vertical engines directly connected to railway generators and a similar set for the Edison three-wire system; also the belted Corliss engine previously mentioned. The third building contained three large horizontal cross-compound directly connected units and two small engines, each belted to a pair of generators.

To adapt these buildings for a main substation it was determined to reconstruct the first building, substituting steel for the wooden floors, columns and roof trusses. This building as reconstructed contains high-tension oil switches as follows: Six incoming feeders from the underground system, six 600-volt railway rotary converters, eight 250-volt lighting rotary converters, eight 2300-volt lighting and motor-service transformers, two auxiliary switches, two bus section switches, one arc system switch.

On the second floor is the benchboard, the lighting rotary switchboard, the railway rotary switchboard, 2300-volt lighting and motor-service switchboard and twenty-six pairs of interlocking 2300-volt oil switches.

Fig. 10—Stony Creek Substation.

On the third floor are the lightning arresters for the 2300-volt lighting and motor-service feeders and three static dischargers for the three sections of high-tension buses.

The remodeling of this first building was complicated by the necessity of keeping in operation all of the small generators on the second floor. It was also necessary to adopt a column spacing which would interfere as little as possible with the location of the new apparatus and the line-shaft pulleys on the first floor. The new columns were pulled up into place through holes on the second and third floors and the connecting steel floorbeams were set in position a few at a time. To do this each machine on the second floor had to be raised and placed upon blocking equal to the thickness of the future concrete covering over the floorbeams and each machine belt had to be lengthened so that the operation of the plant was hindered in no case. These machines were relocated during the low-load periods of the day. Having installed all the steel structure in concrete floor to accommodate the belts until such time as the machines should be entirely removed and the installation of the switches begun.

The old wooden floors were used as construction forms for the concrete floor. As the steel floorbeams were placed 2 in. above the top of the old floor, it was an easy matter to build up the forms and to remove the wooden columns and floorbeams from below on completing the concrete structure. It is interesting to add that no steel contracting company cared to bid upon the erection of this work under the conditions outlined, but it was successfully carried through by the company's men under the direct charge of Mr. C. C. Long, engineer of the Metropolitan Electric Company.

The second building, which contains the traveling crane, was adapted for railway and lighting transformers and rotaries and the street-lighting incandescent and arc system. The present installation consists of four 500-kw railway rotaries and transformers with provision for two additional units; five 500-kw lighting rotaries and transformers with provision for three additional; four 750-kw, 2300-volt transformers with provision for four additional; four 16-kw regulating transformers for series incandescent tungsten lighting, and twelve seventy-five-light mercury-arc rectifiers and transformers, with provision for eight future sets. This building was lengthened two bays, duplicating the original structure, by removing two batteries from the old boiler house.

The load of the old station would not allow the withdrawal of any of the generating apparatus, and hence it was necessary to install sufficient new machinery with connections to permit the removal of everything from the first building. However, this did not require a large equipment because the small bi-polar units in the first building took up a great deal of space for their output.

In the second building enough room was available to install one lighting transformer and rotary coverter, which, through a temporary switchboard, replaced all bi-polar machinery in the first building. The arc machines were replaced by a lighting transformer temporarily located in the second building. This apparatus could thus be used as soon as the first generating unit in the new plant was ready to furnish energy.

By this arrangement all the machinery was cleared out of the first building, allowing the construction of the switch cells, switchboards, etc., to go forward without any interruption. Then, having installed all of the high-tension switches in the first building, the various transformers and rotaries for the lighting and railway system were gradually placed in the second building to take the place of the directly connected units as fast as they were removed. The third building and the remainder of the boiler house have been rendered available for other purposes.

All the apparatus in this station was furnished by the General Electric Company with the exception of the 600-volt rotaries and transformers, which were furnished by the Westinghouse Electric & Manufacturing Company.

OTHER SUBSTATIONS

All of the four small substations mentioned in the earlier part of this article are of the general construction typified by the accompanying view of the building at Stony Creek. These structures are built of brick and steel with a roof and platform cover of Bonanza cement tile. All of these substations are furnished with waiting-rooms and freight-handling facilities. Use is also made of a portable substation car.

CONSTRUCTION AND ENGINEERING

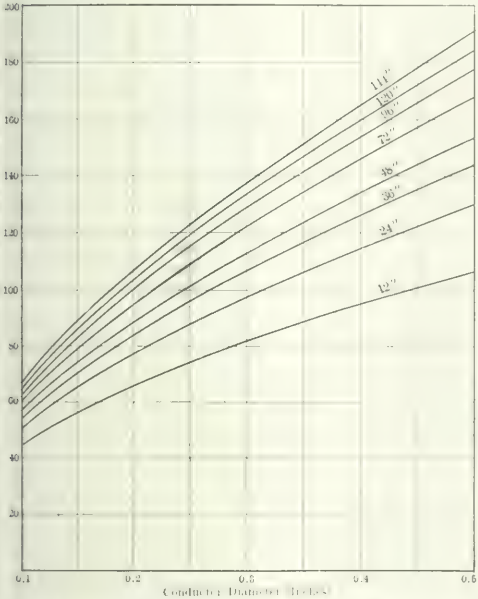
The foundation of the generation station was constructed by Sims & Company, Philadelphia, Pa. The steel framing was fabricated and erected by the Phoenix Iron Company. The reinforced concrete floor and roof were constructed by the Roebling Construction Company and the brick walls by George W. Beard & Company, Reading, Pa.

The entire rehabilitation, together with the electrical, mechanical, structural and architectural designs of all the buildings mentioned, was done by Mr. Walter J. Jones, consulting engineer, New York.

LIMITING VOLTAGES ON TRANSMISSION LINES.

By Erich Ha[illegible]

IN transmitting a given amount of electrical energy from the place of its generation to that of utilization, the weight or cross-section of the conductors varies inversely as the square of the operating voltage, allowing the same percentage oss in the line. As the conductors in long-distance transmission circuits constitute perhaps the largest item of investment, it is lesirable to employ very high voltages. But raising the voltage ncreases the investment for transformers, switching apparatus, ightning protection and insulators, as well as augmenting the lepreciation and repair charges on these items. Therefore, the conomic operating voltage can be determined by expressing ach element of cost as a function of the voltage and equating ne differential with respect to voltage of the sum of such unctions to zero.



itical Voltages Between Conductors on Three-Phase Circuits.

As the manufacture of high-voltage transformers and auxary apparatus progresses the cost per kilowatt will decrease time goes on, and consequently the economic voltages for oposed energy transmission circuits in the future will exceed ose of to-day. There is a limitation, however, to the further crease of voltage on aerial lines, presented by the electric rength of air, for if the voltage is raised beyond a certain itical point an appreciable loss of energy results through the mosphere, due to the ionization of the air particles. This int coincides with the voltage at which luminosity or corona pears on the conductors.

The voltage corresponding to this partial breakdown of the electric depends upon the diameter and spacing of the conductors, but is independent of the conductor material and air [illegible]ity, and may be expressed by the well-known relation

$$E_m = Fr \log_e \frac{d}{2r} \text{ kilovolts} \qquad (1)$$

here E_m is the maximum value of the voltage on a representa/e single-wire perfectly conducting earth-return circuit (or ltage to neutral), F is the maximum electric strength of air the conductor surface in kilovolts per inch, r is the radius the conductors in inches, and d is the interaxial distance tween wires expressed in the same units.

Values of the electric strength of air, near smooth cylindrical conductors from 0.05 in. to 0.50 in. in diameter, as determined experimentally by various investigators, notably Ryan,[1] Whitehead[2] and Watson,[3] indicate that the empiric relation between the electric strength of air and conductor diameter may be represented with sufficient accuracy over this range of wire diameters by

$$F = 95.5\,(2r)^{-.2} \text{ kilovolts per inch} \qquad (2)$$

at 20 deg. C. and 760 mm pressure. Therefore, by substituting this value of F in equation (1) the limiting voltage may be written

$$E_m = 110\,(2r)^{.8} \log_{10} \frac{d}{2r} \text{ kilovolts} \qquad (3)$$

As an illustration consider the 125-mile Cook Falls-Flint (Mich.) line, at present under construction, on which it is proposed to employ a potential of 135,000 volts between conductors. The wires of this three-phase, 9000-kw transmission line are of copper, 0.325 in. in diameter, and their shortest interaxial distance is 12 ft. The critical voltage at which corona appears on the conductors of this circuit would be 1000 $\sqrt{3}\,E_m$, or

$$\sqrt{3}\,.\,110{,}000\,(0.325)^{0.8} \log_{10} \frac{144}{0.325} = 205{,}150 \text{ volts,}$$

which corresponds to a mean effective value (assuming harmonic wave-shape of e.m.f.) of $\frac{205{,}150}{\sqrt{2}}$ or 145,060 volts between conductors. Consequently, the employment of 135,000 volts as intended will not lead to a corona loss. It must be observed, however, that the electric strength of air, F, at the conductor surface may be lowered by dirt and surface impurities. It is also influenced by temperature and pressure changes.

The critical voltages between conductors on three-phase circuits are shown graphically by the accompanying curves, which were plotted from equation (3). The effective voltage values corresponding to the appearance of corona are given for conductors from No. 10 to No. 0000 B. & S. at various spacings from 1 ft. to 12 ft.

EFFECTS OF THE FORM OF ELECTROMOTIVE FORCE WAVES UPON THE LIFE AND EFFICIENCY OF INCANDESCENT LAMPS.

A recent bulletin of the Engineering Experiment Station of the Pennsylvania State College contains an article by Prof. Charles L. Kinsloe in which are reported the results of a series of experiments relating to the effects of the form of alternating e.m.f. waves upon the life and efficiency of incandescent lamps. The tests were made upon plain carbon, graphitized carbon, tantalum and tungsten lamps. Two groups of lamps, each group composed of a number of each of the four types of lamps just mentioned, were operated until their filaments were broken, or to the "smashing point." The first group was supplied with energy from a generator developing a pressure approximately sinusoidal and the second group was supplied by a pressure having the same effective value as the former, but having a maximum about 12 per cent higher than the sine. At frequent intervals the power consumed by each lamp under test was measured, and at the same time each lamp was photometered, so that a record of the specific consumption of each lamp under both conditions throughout its life was obtained.

The lamps used in the tests were supplied by several of the leading lamp manufacturers of America. The lamps were taken directly from the stock-rooms of these companies, so that the results obtained may be taken as typical of what may be expected from lamps of the best grade now on the American market.

Because of the delicate nature of the filaments of the tungsten lamps these lamps, as well as the tantalum lamps, were

[1]*Trans.* A. I. E. E., [illegible]

[2]*Proc.* A. I. E. E., [illegible]

[3]Watson, *Electrician*, [illegible]

never removed from the sockets in which they were burning. To make this possible a special testing rack was constructed in a photometer-room and each socket was connected to the circuit through a baby knife-switch so situated that no possible jar could be given to the lamp in cutting it in or out of circuit. By means of these switches all lamps except the one the candle-power of which was to be measured were cut out and each tungsten and tantalum lamp was photometered without removing it from its socket. The candle-power was measured in one direction only, in a horizontal plane, by means of a portable Sharp-Millar photometer. In this way it was possible to perform the entire test without a single lamp being broken by

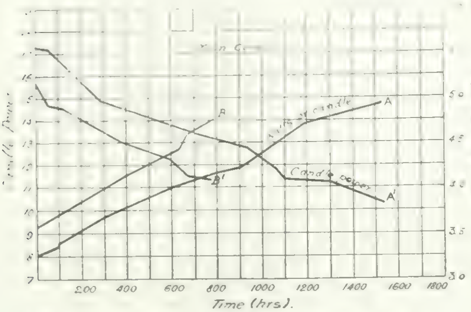


Fig. 1—Candle-Power and Watt Curves of 16-cp Carbon Lamps.

jars or handling. The plain carbon and graphitized lamps were removed from their sockets and photometric measurements were made on a standard photometer bar, while the lamp under test was revolved in a vertical position.

No effort was made to secure absolute constancy in the voltage supplied to the lamps. The tests were intended to show the performance of the lamps under conditions which would be encountered when the lamps were operated on the circuits of the average central station maintaining good commercial regulation. Moreover, no error was introduced from this cause, since both wave-forms were obtained from the same alternator and the two groups of lamps were tested simultaneously. Con-

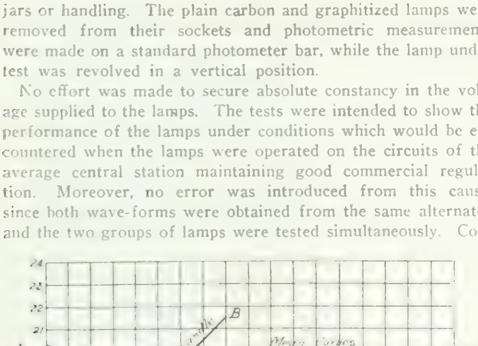


Fig. 2—Candle-Power and Watt Curves of 50-watt Graphitized Filament Lamps.

sequently, any fluctuation in the voltage of one wave was accompanied by a similar fluctuation in the other. The peaked wave was obtained by distorting the original wave by inserting in the circuit a series of reactance coils having highly saturated iron cores. Throughout the test a recording voltmeter was kept in circuit so that any unusual fluctuation would have become apparent at once. Oscillographs of the voltage waves showed that the wave of the generator closely approximated a sine and at an effective value of 110 volts had a maximum of 155 volts. The distorted wave had a maximum of 174 volts with an effective value of 110 volts.

A marked difference in the performance of the groups of lamps subjected to the two waves was at once observed, and it continued throughout the tests. Moreover, the performance of all lamps of the same type in the same group was quite uniform, and since each group consisted of a large number of lamps, the results are all the more significant. In the curves of Figs. 1, 2, 3 and 4 are shown the mean results of the tests the curves marked "A" being for lamps subjected to the sine wave and those marked "B" being for lamps subjected to the peaked wave. All of the lamps tested operated much more satisfactorily with the sine wave than with the peaked wave, as indicated in Table I.

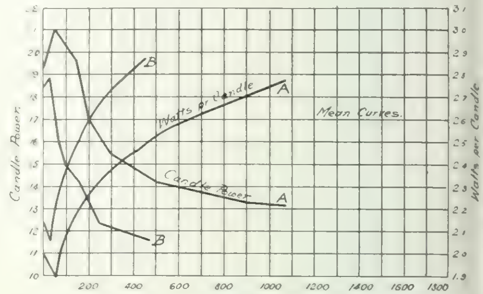


Fig. 3—Candle-Power and Watt Curves of 40-watt Tantalum Lamps.

As shown in Fig. 1, the pure carbon lamps operated with a sine wave gave 17 cp at the start, 13 cp at 800 hours and 10.5 cp at 1500 hours, consuming 3.25 watts per candle at the start, 4.2 watts per candle at 800 hours and 4.9 watts per candle at 1500 hours. With the peaked wave the same type of lamps gave 15.7 cp at the start and 11.3 cp at 800 hours, consuming 3.6 watts per candle at the start and 4.75 watts per candle at 800 hours. The carbon lamps on the sine wave continued in service for more than 1500 hours and it was not until nearly 1000 hours had been reached that the candle-power had fallen by 20 per cent. The lamps on the peaked wave burned out in about 800 hours and before 500 hours the candle-power and efficiency had fallen to

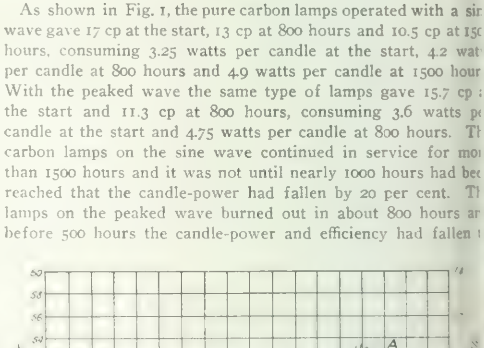


Fig. 4—Candle-Power and Watt Curves of 60-watt Tungsten Lamps.

values not reached by the lamps of the first group until they had operated for over 1000 hours.

The performance of 50-watt graphitized-filament lamps is shown by Fig. 2. The candle-power and efficiency of these lamps decreased by 20 per cent after 800 hours on the sine wave and after a little less than 400 hours on the peaked wave. As was the case with the pure carbon lamps, the candle-power of the lamps on the sine wave was higher from the beginning and retained this advantage throughout the test period. A comparison of the performances of pure carbon and graphitized-filament lamps is given in Table II.

Of all the lamps tested the tantalum-filament lamps were most seriously affected by the peaked wave. While the useful life of all tantalum lamps tested was short even on the sine wave, it was found that the life was reduced by about 50 per cent on the peaked wave. The curves for 40-watt tantalum lamps are shown in Fig. 3, while values for 25-watt and 80-watt tantalum lamps are indicated in Table III.

TABLE I.—LIFE OF VARIOUS TYPES OF LAMPS AS AFFECTED BY THE VOLTAGE WAVE SHAPE.

Type of Lamp	Average Life in Hours.	
	Sine Wave	Peaked Wave
Carbon	[illegible]	[illegible]
25-watt tantalum	[illegible]	75
40-watt tantalum	[illegible]	474
80-watt tantalum	[illegible]	[illegible]
25-watt tungsten	[illegible]	479
40-watt tungsten	[illegible]	1155
60-watt tungsten	[illegible]	767
100-watt tungsten	[illegible]	734

The average performance of the groups of 60-watt tungsten lamps is indicated in Fig. 4. With a sine wave the lamp gave initially 51 cp, but the light output decreased regularly to 38 cp at 1500 hours; the specific consumption at the start was 1.26 watts per candle and it reached 1.62 at 1500 hours. With the peaked wave the candle-power varied from 48 at the start to 43 at 600 hours; the specific consumption began at 1.32 watts per candle and reached 1.47 watts at 600 hours. The performances of 25-watt, 40-watt, 60-watt and 100-watt tungsten lamps are indicated in Table IV. All of the tungsten lamps, regardless of the wattage, showed a marked similarity in their behavior, the advantage of a sine wave over a peaked wave being very pronounced.

TABLE II.—COMPARATIVE PERFORMANCES OF PURE CARBON AND GRAPHITIZED-FILAMENT LAMPS.

Type of Lamps	At Beginning: Candle-power.		At Beginning: Watts per Candle.		Average Hours Life.		At End: Candle-power.		At End: Watts per Candle.	
	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd
16 cp carbon	17.1	15.8	3.25	[illegible]	[illegible]	[illegible]	[illegible]	11.3	4.9	[illegible]
50-watt graphitized	20.2	19.7	2.40	2.54	[illegible]	[illegible]	15.2	13.8	[illegible]	[illegible]

TABLE III.—COMPARATIVE PERFORMANCES OF TANTALUM LAMPS.

Rating of Lamps.	At Beginning: Candle-power.		At Beginning: Watts per Candle.		Average Hours Life.		At End: Candle-power.		At End: Watts per Candle.	
	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd
25-watt	[illegible]	[illegible]	2.32	[illegible]	[illegible]	75	[illegible]	9.0	[illegible]	[illegible]
40-watt	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13.1	[illegible]	2.75	2.85
80-watt	[illegible]	[illegible]	2.23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE IV.—COMPARATIVE PERFORMANCES OF TUNGSTEN LAMPS.

[illegible]	At Beginning: [illegible]		At Beginning: [illegible]		Average Hours Life.		At End: Candle-power.		At End: [illegible]	
	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	51.0	48.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	43.0	1.62	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

A microscopic study of the filaments showed that there was a more serious breaking up of the texture of the filaments under the influence of the peaked wave than under the sine wave. The tests in the case of each group of lamps showed that the sine voltage wave was the more efficient in light output for a certain amount of electrical power input and the life of the lamps was much longer. The author expressed the opinion that much unsatisfactory lighting service can be attributed to irregular voltage waves. His investigations will be continued to ascertain if a flat-top voltage wave will be more advantageous than a sine wave.

DATA ON AN ELECTRICAL RESISTANCE FURNACE.

By Albert A. Somerville, Ph. D.

A FURNACE was desired that would easily attain to the temperatures measurable within the limits of the platinum thermometer and always be under control. It was constructed by wrapping a spiral of "Nichrome" ¼-in. ribbon wire around a porcelain cylinder, slipping another porcelain cylinder over this spiral coil of ribbon wire and inclosing this outer cylinder in asbestos or mineral wool such as is used for insulation on large steam pipes.

The inside diameter is 4 cm.; thickness of porcelain tubes, about 1 cm each; length of tubes, 58 cm; thickness of asbestos wrapping, about 7 cm; total length of wire used, 16 ft.; resistance, cold, 4.4 ohms; resistance at 1000 deg. C., 5.3 ohms. Fig. 1 shows an end view.

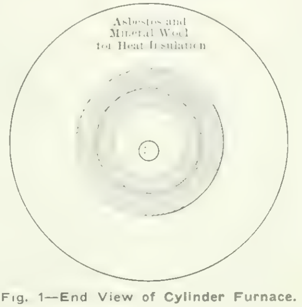


Fig. 1—End View of Cylinder Furnace.

The furnace is used in a horizontal position. Both ends of the tubes are open or may be fairly well closed by means of asbestos plugs. Fig. 2 is a portion of a longitudinal view. Temperatures are measured by means of a platinum resistance thermometer, contained in either a porcelain or quartz tube about 15 mm in diameter and 40 cm in length, introduced into one end of the furnace. This thermometer is connected to a Callendar automatic temperature recorder so that the temperature is known at any time and a complete record of the same is kept during the time of a furnace run.

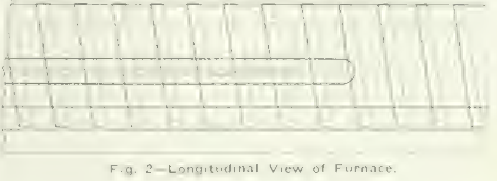


Fig. 2—Longitudinal View of Furnace.

The Callendar recorder consists essentially of a slide wire bridge. The main leads and dummy leads of the thermometer are placed in series at the opposite ends of this slide wire so

that the lead wires cancel each other's resistance and only the resistance of the bulb of the thermometer is left to be measured on the bridge. This is automatically balanced on the slide wire by the galvanometer arm opening or closing circuits containing electromagnets which move the contact point along the slide wire.

In operating the furnace it is put on a 110-volt, direct-current circuit with resistance in series to control the amount of current, or it is shunted around part of a tin resistance frame.

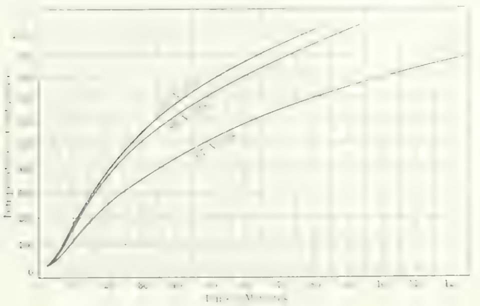


Fig. 3—Temperature Curves.

It has been used entirely for laboratory purposes. The work that has been carried on for two years is the measurement of the resistance of metals and alloys at high temperatures. For this purpose the furnace has served admirably well. In order to show what may be done with it several different curves have been prepared to accompany this article.

Power is turned on, a record is made of the rising temperature until it reaches a maximum, or nearly so, and then power is cut off and a record of the cooling curve is made, all being done by means of the automatic temperature recorder. This is done for various amounts of power and curves are drawn showing the time rate of heating, the power necessary to reach a certain maximum and the time rate of cooling. In Fig. 3 the curves are labeled, showing the voltage used in each case. It is seen from the figure that when pushed the hardest a temperature of 1000 deg. C. was attained in less than one and one-quarter hours. It will also be noticed that the 100-deg. spaces are different distances apart, due to the fact that the resistance and expansion thermometer scales do not coincide.

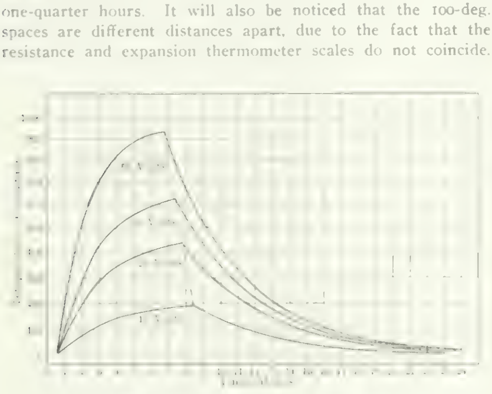


Fig. 4—Heating and Cooling Curves.

The deviation of the expansion from the resistance scale accounts for this lack of uniformity, which is easily calculated.

In Fig. 4 much smaller voltages are used, the time rate of the recorder is changed, and a heating and cooling curve extending over twenty-four hours is drawn. In each case the power is cut off at about the time a maximum is reached, and it is to be noted that in accordance with the laws of radiation a longer time is required to reach a maximum at low temperatures.

The furnace may be heated to any desired temperature, and when the energy supply is made to equal the heat loss it can be held at that exact temperature any desired length of time to within a limit of probably 1 deg. Fig. 5 shows the variation in temperature throughout the length of the furnace for four

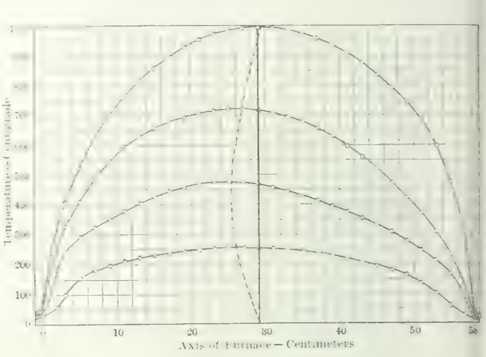


Fig. 5—Curves Showing Variations in Furnace Temperature.

different temperatures. This is obtained by means of a thermocouple, one junction being kept outside the furnace in ice water and the other junction gradually moved through the furnace and a reading of the thermal e.m.f. made for points every 2 cm along the axis of the furnace. It is the intention of the writer to build a furnace soon in which these curves will be very flat near the center of the furnace, or, in other words, the temperature gradient will be very small at that point.

It is to be noticed that the maxima of these curves occur at different points in the furnace. This is due to the thermometer tube being only in one end of the furnace, and at one temperature conduction probably plays a bigger part than radiation while at higher temperatures this condition is just reversed. By putting a similar thermometer tube in the other end of the furnace it is made symmetrical and the maxima of the curves all occur at the geometrical center of the furnace.

Temperature gradients deduced from Fig. 5 are shown in

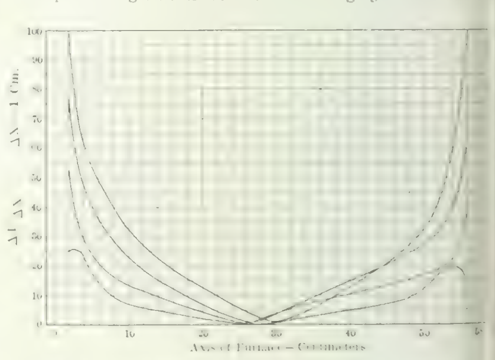


Fig. 6—Temperature Gradients of Resistance Furnace.

Fig. 6. Another method of determining these is to make a thermo-couple having the junctions only 2 cm apart and pass these slowly through the furnace, reading thermal e.m.fs every 2 cm distance along the axis of the furnace, and the readings give the temperature gradient at once without computing the slope of the actual temperature curves as is done in this case.

IMPREGNATED TELEGRAPH POLES.

In the *Zeitschrift für Forst- und Jagdwesen* Mr. K. Havelik, an engineer, of Brünn, publishes some interesting observations upon the frequent occurrence of the so-called house fungus (*Merulius lacrimans*) on telegraph poles impregnated with sulphate of copper in the Province of Moravia.

The poles, which by reason of their having been attacked by his parasite had to be removed and replaced with others, were characterized by a sort of dado or wainscoting on the surface of the underground portion, such as one sees on all wood which has been injured by this fungus. On digging up the poles there was noticed an unpleasant fungus odor. This fungus was found wherever the poles were subjected to alternations of dryness and dampness, no matter what the character of the soil in which the poles stood. The seed-bearing or germ-bearing parts were almost always on the southeast side of the poles wherever that was shielded from the sunlight. In other cases they were found on that side which was most protected from the direct rays of the sun. The form of these germ-bearing portions is various, depending on the neighborhood and the degree of dampness. If the neighborhood of the pole is sufficiently damp the fertile portions are quite high up and have a bracket-like form. If, however, the earth surrounding the pole is dry, they commence lower down and there is manifested an endeavor to reach the surface of the soil.

The life of poles attacked by the *Merulius lacrimans* is from two to fourteen years; where there is sudden alternation of dampness and dryness the pole rots away sooner. The formation of the *Hyphen* can also be observed. The thread-like germs of this fungus always lie in the lengthwise cracks of the wood and are often quite deep. The more quickly the earth about the pole dries the larger are the threads, but the *Hyphen* itself is seldom to be found here. Where the earth dries more slowly, there are formed either weaker threads or none at all. The *Hyphen* usually branch out all around the pole.

In order to counteract the influence of the house fungus the Austrian Telegraph Department has introduced impregnation with tar, which is regarded as a sure preventive of the *Merulius*.

The Imperial German Postal Department has recently published statistics concerning the life of telegraph poles, as well as their durability.

The average life of the poles was as follows for different impregnating materials: Zinc chloride, twelve years; copper sulphate (blue vitriol), fourteen years; corrosive sublimate, seventeen years; tar oil, twenty-two years.

The annual cost per cubic meter treated and delivered was as follows for the several impregnating materials: Zinc chloride, 4 marks; copper sulphate, 3.50 marks; corrosive sublimate, 3.10 marks; tar oil, 2.80 marks.

These figures show that impregnation with tar oil paid the best, that with corrosive sublimate the next best, and that with zinc chloride the least.

Central Station
Management, Policies and Commercial Methods

NEW CENTRAL-STATION OFFICE BUILDING FOR SPRINGFIELD, MASS.

The United Electric Light Company, of Springfield, Mass., is planning to erect a new office building in the business center of the city to provide room for the display of energy-consuming devices and additional space for the clerical and engineering staff. The company has purchased a parcel of real estate on the west side of Main Street, near the Nayasset Club and the Court House. The building will be three stories in height, 61 ft. wide and 75 ft. deep, and the company will occupy the entire property. A demand has arisen for a modern showroom, which is impracticable in the company's present limited quarters in State Street, and the management also desires to concentrate the clerical force, drafting and meter departments under a single roof. The estimated cost of the new building is about $100,000.

IMPROVING METER READING BY PRIZES AND PENALTIES.

The meter readers of an Illinois electric service company operating in a city of 45,000 are encouraged to increase the efficiency of their work by a system of monthly prizes and penalties, the result of which has made the cost of reading meters less, by careful comparison, for this company than for any of a number of other plants controlled by the same interests. Several prizes are offered to the men, making competition keen.

The reader covering the greatest number of meters during the meter-reading days of each month receives a reward of $1. The reader in whose work the fewest errors are detected also earns an extra dollar. A similar prize is given to the inspector obtaining readings from the largest percentage of the meters in his district. Where the consumer is not at home and access to the meter cannot be obtained the company has its inspectors leave dial cards for the customer to mark in the pointer positions. The third prize mentioned was instituted because the employees in their efforts to win one of the other prizes tended to use the return postals too freely when meters were in inaccessible or inconvenient places.

The company also insists that its meter inspectors shall not give out unauthorized information or former meter readings to customers, nor gossip or converse with them while about the premises for business purposes. Inspectors are permitted to tell the customer his latest reading as recorded, but must not waste time to write it down. The penalty for talking with the customer, except in giving the last dial reading, is the loss of half a cent an hour from the infringer's wage during the following two weeks. All information about matters relating to the customer's consumption and the company's relation with him should come from the office, it is believed, and the readers are instructed to refer all inquirers directly there without discussion.

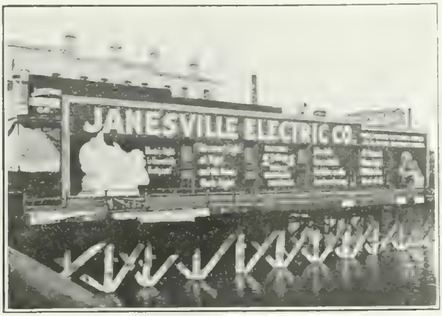
Instead of the present reward feature a penalty was formerly inflicted on those who fell below in the accuracy of their work, territory covered or total number of meters read, but experience showed that this was viewing the situation in a reversed light, as the men became dissatisfied rather than encouraged.

FLAMING-ARC LAMPS IN PUEBLO'S BUSINESS DISTRICT.

The merchants of Pueblo, Col., realizing the necessity of decorative lighting, accepted the plans of the Pueblo & Suburban Traction & Lighting Company to install flaming-arc lamps from Union Depot, on Union Avenue, to the Arkansas River. Since their installation Union Avenue is one of the best-lighted streets in the West. They are of the Adams-Bagnall regenerative type, burning sixty hours with one trimming, on a 110-volt alternating circuit, consuming 7 amp each. The merchants who contributed to the special lighting are very much pleased with it and claim a very large increase in business. With the same interest exercised in the future as in the past few months, Pueblo promises to become one of the best-lighted cities in the West.

CENTRAL-STATION ADVERTISING BY WALL SIGNS.

The central station which uses its wall and sign spaces to effective advertising advantage and changes the display frequently enough to hold interest can gain public attention through this means efficiently and economically. The Janesville (Wis.) Electric Company utilizes the whole river side of its one-story office building as a huge display advertisement for calling attention to the advantages of electric lighting, electric signs and electric household devices. As the office building borders the river bank opposite the principal business corner of the city, the display is a prominent one. At night it is lighted by fifty incandescent lamps shielded by an inverted reflecting trough along the top of the building. The sign is renewed at intervals, other subject matter being substituted for that shown, and the display is always kept bright and attractive.



Central-Station Wall Sign.

DAYLIGHT AND DARK-DAY CHARTS AT MILWAUKEE.

On the walls of the department to which complaining lighting customers are referred the Milwaukee Electric Railway & Light Company has placed diagrams showing graphically the amount of daylight at different seasons of the year and the proportion of cloudy weather of the current month compared with that of the same month for the preceding year. The accompanying sketch shows the arrangement of the weather chart with its black and white sectors giving the percentages of clear and cloudy days. The charts are prepared each month from information furnished by the local observer of the United States Weather Bureau.

WEATHER CHART SHOWING COMPARATIVE AMOUNT OF SUNSHINE, PRESENT YEAR AND PREVIOUS YEAR, IN MILWAUKEE.

Per Cent Clear.	Per Cent Cloudy.		Per Cent Clear.	Per Cent Cloudy.
46.66	53.33	First half	53.33	46.66
73.33	26.66	Second half	46.66	53.33
60.00	40.00	Average	50.00	50.00

Supplementing the weather chart is another diagram showing graphically the proportion of daylight (sunrise to sunset) hours out of the total hours for each of the twelve months. The daylight hours are represented by white blocks and the dark hours by black rectangles. Computed for the latitude of Milwaukee the proportions of daylight hours out of the total hours for each month are as follows: January, 40.5; February, 44.3; March, 49.6; April, 55.3; May, 60; June, 62; July, 61; August, 57; September, 52; October, 46.5; November, 41.5; December, 38.4. This table is, of course, correct for any year in the latitude of Milwaukee.

With the assistance of these diagrams the company's representative is enabled to explain reasonably and convincingly to any customer just why his lighting bill increases during the shortening days of the fall months, and especially during those preliminary months when the earlier approach of darkness is not so noticeable. The comparative-cloudiness chart aids in proving to the consumer why his lighting consumption for a certain period may have increased over that for the same period of the year before, when the cause of this can legitimately be assigned to dark-day conditions. Interiors of downtown business establishments are especially affected by cloudy conditions outside, for the entire lighting equipment may be used throughout the daylight hours without especial attention from the employees or proprietor. The charts referred to assist in demonstrating to the consumer that the variations in his meter readings are actually accountable to natural causes which heretofore he has not considered.

THE DES MOINES PLAN OF METER READING.

Mr. P. B. Sawyer, manager of the Des Moines Electric Company, of Des Moines, Iowa, presented a short paper at the convention of the Illinois State Electric Association at Rock Island Oct. 26 and 27 on the Des Moines plan of meter reading. This plan, which has already been described several times in these columns, consists in reading a portion of the consumers' meters each day, taking the entire city in rotation, thereby keeping one man continually at work reading meters and one man billing. Three years ago the Des Moines Electric Company had 3000 meters and was reading them as near the last day of the month as possible. Under the new plan the city was divided into twenty-five districts, numbered one to twenty-five, to correspond to twenty-five working days, each district being one day's work for one reader. The meters in each district are routed in a reader's loose-leaf meter book and the reader starts out with book No. 1 on the first working day of the month and reads one book on each working day until all the readings are taken. The customers' names as arranged on the addressograph and the meter record book and the customers' ledgers are in the order in which the meter reader's book is routed. On the close of the day following the reading of a district the bills are made out and the gross amount for that district is totaled. The saving in reading meters the first year was approximately $170 and the errors in reading fell to almost nothing. The confusion in the distribution department, from which the readers were drawn under the old arrangement, was eliminated, and in 1908 they were able to get bills collected within fifteen days, which meant several thousand dollars less tied up in the business, as under the old arrangement they were forced to start the readings some months as early as the twenty-second. Errors in billing are also fewer now.

In the discussion Mr. Frank J. Baker, of the North Shore Electric Company, Chicago, said that his company had started this system on trial first in Evanston and had later extended it throughout the entire territory. Mr. E. McDonald, of Lincoln, reported having one man who reads meters and makes out bills. Mr. F. F. Gilchrist, of Chicago, told of a plan adopted by some companies to equalize the summer and winter bills by making the readings represent a shorter period during the winter months than during the summer, gradually working over during the spring and fall. This reduces complaints and tends to increase the use of electricity during the winter months, because consumers will not be so much inclined to economize. In a discussion of the case where the meter reader cannot gain entrance because of absence of the occupant some companies reported

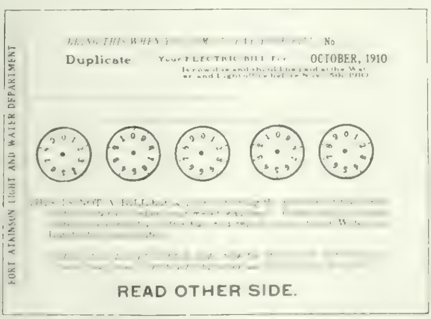
leaving a postal card addressed to the company with the meter dials marked upon it and a request that the consumer mark the position of the meter hands and mail the card to the company. Some companies make it a custom to render a minimum bill when the meter reader cannot gain entrance, but Mr. Baker pointed out that this had a drawback in that when the consumer pays a minimum bill for a certain month's service such a bill ends the question for that month and the consumer objects to paying the large bill which is likely to follow the next month.

Mr. R. S. Wallace, of Peoria, reported having in force a 75-cent minimum bill, but he does not render any bill in case the meter reader cannot get at the meter. The return postal-card scheme spoken of had not proved successful. Mr. N. M. Argabrite, of Belvidere, on the other hand, reported that the postal-card scheme worked very well in his town. The meter reader leaves the cards and nearly all of them come back to the company. Mr. E. W. Smith, of Kewanee, reported having the continuous reading and billing scheme in force, but the bills are not sent until the end of the month. The company renders no bill if the meter is not read. Mr. King, of Lewistown, created considerable laughter with his account of how he sometimes reads the meters from the office by calling up the various ladies in town and asking them to read the meter and report to him over the telephone.

NOTIFYING A CUSTOMER WHEN HIS BILL IS READY.

In places where no prompt-payment discount is offered it is frequently unsatisfactory to allow the original bills to be left in the customers' hands, as they are frequently lost or mislaid and much unnecessary clerical work is entailed on the bookkeeper when the customer finally appears for settlement. The municipal plant in Fort Atkinson, Wis., operating in a town of 5000, employs a duplicate form of notifying the customer that his bill is awaiting him at the office, at the same time presenting to him a record of the meter reading, that he may check this with the position of the dials at the time the reading was made.

The two forms shown herewith are used, the consumer's name and address being entered on the first blank lines and the meter-pointer position on the dials by the meter reader as he makes his rounds. The two forms are bound as alternate leaves into tablet form, so that carbon paper may be used to make the duplicate copy. The original, or "bill," form the meter reader retains, handing the duplicate, or "notification," to the customer at his home at the time of the reading. This duplicate is presented

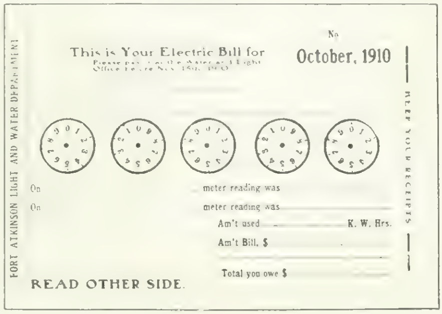


Notification Duplicate Filled in and Handed to Customer by Reader.

simply as a notification that the bill is due at the office. To satisfy himself that the meter was read correctly the consumer can at once compare the marked dial positions with the pointers on his register and is usually pleased at this privilege of checking the reading. As soon as practicable he calls at the office, and, upon learning and paying the amount which has been figured from the reading before taken, he receives the original bill, now receipted.

As a precaution against misunderstanding of the duplicate "notification" this duplicate is canceled if brought in, in order that the consumer shall not afterward suspect or fear he has paid the same bill twice. The backs of both the original and duplicate forms contain a list of "Dont's for Electric Consumers," which are simply popularly written paragraphs of explanation and advice about the service.

The fact that the meter reader retains the "original" and re-



Original Bill, Surrendered to Customer When Receipted.

turns it to the office allows this bill to be kept under attention and carried along until paid without danger of losing a record of the pending amount. When the customer calls it is ready for him and the annoyance of making out duplicates is avoided. The stub from which the perforated "original" is torn is kept for office record of the bill paid. If the bill remains unpaid and a second notice must be sent, an altogether different form is used, the original bill being always retained in the office until the account is settled.

ELECTRIC SHOWS IN SMALL CITIES.

Mr. J. E. Johnson, general superintendent of the Danville (Ill.) Railway & Light Company, gave a paper on electric shows in small cities before the Illinois State Electric Association at Rock Island, Oct. 26 and 27. Last summer his company rented for this purpose a large room in the busiest street in the town, 50 ft. wide x 150 ft. long, with the usual two large show windows in front. The company made a proposition to everybody who handled anything relating to the use of gas or electricity that it would pay the rent of the room and furnish the general decorations and supply free energy. The decorations were made a prominent feature, artificial foliage being used to obtain a garden effect. The company's men built some wooden columns about 10 ft. high with rows of 16-cp lamps on each of the four corners, and wooden crosses at the top equipped with high-candle-power lamps. The columns were coated with white water paint to give a suggestion of white stone and the lamps equipped with green and white paper shades of the ordinary kind made to resemble the petals of flowers.

It cost only a few dollars to paper the background of the two show windows, one with a paper suitable for a dining-room and the other with glazed paper imitating tile for a kitchen. In the windows were put attractive furniture borrowed from merchants, who were glad to lend anything provided a small card was displayed telling the name of the merchant loaning it. One window was called an electric dining-room. A dining table was set for breakfast with the customary china, silver and glassware. On it was a coffee percolator, cereal cooker, toaster and boiler to indicate that the entire breakfast could be prepared with electricity. On the sideboard were put a chafing dish and a tea kettle. The other window was fitted up as a model gas kitchen. Inside, in addition to a complete line of gas appliances, was an exhibition of every kind of electric heating appliance that the company could obtain. There was a new electric

[illegible] and a mercury-arc rectifier vehicle charger [illegible] run continuously with the case off in order that the peculiar light should attract attention. There was a compressed-air water-pressure system operated automatically with a motor, a coffee roaster, coffee grinder and meat chopper, all of which were driven by motors; a few vacuum cleaners, electric washing machines, an electrically driven "Simplex" ironing machine, some soldering irons, electric drills, electric irons, fan motors, vibrators and curling irons. The supply men in addition to the other appliances they handled exhibited quite a line of attractive fixtures. The Burrows company had several motor-operated adding machines and the National Cash Register Company an electrically operated register. One of the sewing-machine companies was glad to furnish machines which were fitted up with motors, and a girl was on hand to demonstrate both. A couple of boys toasting bread and popping corn attracted attention.

An exhibition of the Tel-Electric piano by a local piano firm furnished some music. The work that could be done with vacuum cleaners and electric irons interested many people. The local telephone company also was glad to participate and install telephones in every booth in the room, as well as a public telephone booth and an intercommunicating switchboard connected to the company's main central office.

This exhibition was run for eight afternoons and evenings. The greater part of the adult population of the town of 35,000 visited it. To attract the attention of the passersby an arc headlight was used as a searchlight on the roof. In front of the building was a waving-flag sign and a couple of electrolier posts, which were a new thing at that time. All the company's solicitors and as many of the office force as could be spared were always on duty. The lamp-post in front, they believed, helped to create an interest in that kind of lighting. A couple of dark booths were fitted up to show the difference between good and bad glass shades, and the difference between light obtained from dirty lamps with dirty shades and that obtained from clean lamps with clean shades. The public seemed to believe that the exhibition was an expensive one and gave the company credit for being public-spirited and progressive. Merchants appreciated it because it brought a great many people downtown that week.

It is Mr. Johnson's opinion that such an exhibition will be a profitable investment in almost any town of several thousand inhabitants or more, and that the returns will exceed those obtained from an equal expenditure on solicitation or advertising in the ordinary channels. He hardly believes it would pay in most towns to repeat such an exhibition every year, but he believes that it could be given profitably once every two or three years as new appliances are developed and put on the market.

In the discussion Mr. E. W. Smith, of Kewanee, said his company had successfully experimented along the same line two years ago. Mr. A. G. Mosier told of an electric show held in a park building on the street-railway line a short distance out of Chillicothe, Ohio. This show cost $250 and increased the street-railway receipts $175 above the ordinary run of business on that line. Mr. Theodore Bass, of Farmington, Ill., a town of 3000 population, said that he started day service March 1, 1910. In order to assist in building up a day load a "house electrical" was devised, which the supply men assisted in equipping. A room 50 ft. x 90 ft. was rented and small rooms were arranged along one side of this large room with an aisle along the other side. The company placed 300 irons soon after the show and has been selling devices of various kinds ever since.

Mr. T. W. Gregory, of East St. Louis, said that his company had never attempted an electric show, but had made it a point to exhibit at several pure-food shows, etc., in its territory. Mr. John G. Learned, of Chicago, contract agent of the North Shore Electric Company, said that his company had rented a tent at a county fair in the North Shore territory and exhibited household and family appliances. Mr. M. G. Linn, of Bloomington, reported having had an electric show last spring. Mr. Bell, of Granite City, said that while he had never conducted an electric show, his company had made use of small opportunities at domestic-science meetings, farmers' institutes, etc.

Wiring and Illumination

INEXPENSIVE TUNGSTEN STANDARDS FOR FORT ATKINSON, WIS.

For lighting the downtown business portion of Fort Atkinson, Wis., the local lighting commission is arranging to install forty three-lamp curb posts, each carrying three 60-watt tungsten lamps inclosed in 10-in. Alba globes. The posts will be erected at 90-ft. intervals on each side of the street and opposite one another. A feature of these standards, which were constructed by the commission's employees after designs by Mr. H. G. D. Nutting, the manager of the local plant, has been their low cost of construction and installation. The bare standards cost about $6 each to make, and equipped complete with wiring and globes cost $9. As about $700 will be expended

Tungsten Lamp Post at Fort Atkinson, Wis.

in laying the underground wires in lead tubing, the forty-post installation will represent an outlay of less than $1,100, or $26.50 a post complete. The vertical standard is made up of 4-in and 2½-in. wrought-iron pipe and the cross-arm is of 1.25-in. pipe. Special end and top fittings have been designed and cast and the globes will be held by inclosing yokes which fasten them securely, at the same time preventing the entry of water to the lamp sockets within. The lead conduit is inserted 5 in. or 6 in. into the base of the standard, one line going through a fuse block, to which access is secured by sliding up the base sleeve, which is not a structural part of the post. Each post weighs about 150 lb.

PREMIUMS FOR CONTRACTORS WHO WIRE OLD HOUSES.

A central-station manager in a medium-sized city who believes that the electrical contractors of his town are his best electric light solicitors encourages them to improve the dull winter season by wiring old houses and offers a premium of $3 for each house on the electric company's lines thus wired. As, of course, the cost of wiring such completed houses cannot be computed under a blanket table, the contractor is not limited to the amount he may charge for the job, and in addition receives the $3 reward from the electric company. The offer is one that encourages some initiative on the contractor's part and has resulted very profitably for the electric company, which is content to transfer its soliciting fee from its own office staff to the man actually securing the new connection

SOME TESTS ON SPLICES IN GALVANIZED-IRON WIRE.

By C. T. Ra[illegible]

Galvanized-iron wire is used for guying and in some localities for telephone circuits. The joints or splices between adjacent ends are usually made by twisting the ends one upon the other and are not ordinarily soldered. Several types of splices are in use, and to ascertain which is best a series of tensile tests was made on all of the commonly used types under the writer's directions. The desideratum was to find out which type of splice

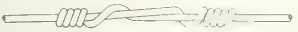


Fig. 1—An Unsatisfactory Splice.

behaved best when subjected to tension and if possible to determine a style of splice that would develop a tensile strength equal to that of the wire of which it is made.

Commercial wire cut from coils in the stockroom of a telephone company was used. It was probably of the grade known as "best best" or BB, although it was not possible to ascertain accurately what the grade was. The samples were tested in an Olsen testing machine.

First, a length of No. 12 (B. W. G.) wire was stressed to failure and was found to break at 475 lb. This value is the average of several. Then splices of the typical forms of Figs. 1, 2 and 4 were made of No. 12 wire, and tested to destruction. None of the three was found to be as strong as the wire of which it was made. Finally, after some trials, splices like that

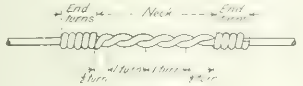


Fig. 2—Splice That Failed.

hown in Fig. 5 were formed and it was found that the wire would break before a splice of this type failed.

Splices like that shown in Fig. 1 are made by clamping the wo wire ends to be joined in a pair of connectors—the tool used y linemen for holding wires in correct relation while they are eing spliced—and, with a pair of pliers, forming the wire into lose end-turns around the wire bodies. What is meant by "endurns" can best be explained by the illustration Fig. 2, whereon he end-turns of a certain splice are indicated. The neck—the ortion of the splice between the end-turns in the type of splice hown in Fig. 1—is not twisted. This type of splice was largely sed at one time, but does not appear to be used now. When splice like that in Fig. 1 is subjected to tension the end-turns rst pull together along the main wires and finally assume the osition indicated in Fig. 3. Then, as the stress is continued, he end-turns gradually upwrap and the two spliced wires usu-

Fig. 3—Appearance of Splice While Untwisting.

lly pull entirely apart. In some cases one of the wires will reak before the end-turns entirely untwist. The break often ccurs at a point where the wire is nicked in making the splice. ncreasing the number of end-turns increases the load at which e joint will start to yield, but in no case could a joint having reasonable number of end-turns of this type be made to deelop the full strength of the wire of which it was made without ielding excessively.

In Fig. 4 a splice is shown which is frequently called in books e American Telephone joint. It has a short neck containing ne turn and a number of end-turns varying with the maker of e splice. The idea appears to be prevalent among linemen that e strength of a splice is dependent almost wholly on the numr of end-turns it has and that the number of turns in the neck of little consequence. It was shown by tests that this idea is erroneous. As tension is applied to a joint like that of Fig. 4 it will untwist entirely, or often, partially untwisting one of the wires, will break at a load considerably less than one equivalent to the full strength of the wire.

It having been shown definitely that increasing the number of end turns of a splice does not increase its yielding point to any great extent, tests were made to ascertain the effect of increasing the number of turns in the neck. Several sample splices were made, each having but two end-turns, but the number of turns in the neck was made different in each case. Each of these splices was tested to failure. The results of the test were as follows:

Turns in Neck	Failure Tension, Lb.	Cause
3	230	Splice slipped.
4	230	"
5	475	Wire broke outside of splice.
6	475	" " " "

It is apparent from the above observations that if a joint has five turns in the neck the full strength of the wire composing it will be developed. The joints for the above-recorded tests were all made from No. 12 wire having a breaking strength of 475 lb. The results in the table are averages of several.

Fig. 5 shows a joint having five turns in the neck, that is as strong as the wire of which it is made. When subjected to tension such a joint will at first yield slightly until it is "set," but as the load on it increases there is little yielding and finally one

Fig. 4—A Common Type of Splice.

of the wires will break outside of the joint at about its normal breaking point. The length of neck of such a joint is determined by the size of the wire composing it. In each case the neck length should be such that it will just safely contain five turns. If the turns be made too short the wires will be "burned" in twisting the splice and if the turns be made too long their power of resistance will not be a maximum. It was found that proper neck lengths to contain five turns safely for different gages of wire are about as follows: No. 14 wire, 3½ in.; No. 12 wire, 3¾ in.; No. 10 wire, 4 in.; No. 8 wire, 6 in., and No. 6 wire, 7 in. After the tests were completed on splices made from No. 12 wire, more were made on the other sizes given above and it was found that for each size the number of turns in the neck of a safe joint should be five. Although five end-turns are shown in the illustration of the typical safe joint, Fig. 5, the tests indicated that two are ample. A joint

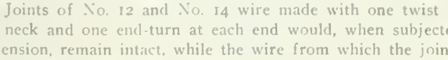


Fig. 5—A Satisfactory Splice.

having five end-turns has a better appearance than one having two, hence five is suggested as a standard number.

A few soldered joints were tested and it was found that, at least for the wire sizes used, almost any joint if soldered would develop a strength greater than that of the wires composing it. Joints of No. 12 and No. 14 wire made with one twist in the neck and one end-turn at each end would, when subjected to tension, remain intact, while the wire from which the joints were formed would break outside of the joint.

Summarizing, the results of the tests may be stated as follows: (1) End-turns do not have much holding power. (2) Most of the holding power of a joint is due to the turns in the neck. (3) A joint having five properly made turns in its neck will be as strong as the wire from which it is made and will yield but little when stressed.

RECENT TELEPHONE PATENTS.

IMPROVEMENT FOR AUTOMATIC EXCHANGES.

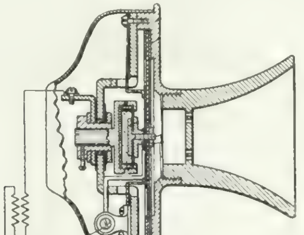
In the modern automatic exchange of the Strowger type the number of switching devices required for a given number of lines has been made relatively small by the use of master switches and preselectors. Through the agency of these, large groups of lines need be associated with a number of switches no greater than the maximum number of coexistent conversations from that group.

The invention of Mr. B. Kugelmann, of Bad Kissengen, Germany, provides for the accomplishment of the same results without the use of a master switch. In his system the lines act upon the preselectors to accomplish the selection of a non-busy first selector.

NEW APPARATUS.

As a means of improving the sensitiveness of a receiver Mr. G. Babcock, of Rochester, N. Y., has introduced a diaphragm consisting of two disks. Both of these are disked and their convex surfaces are opposed to each other and the whole flattened out by driving home the ear cap. The receiver is of the watch-case type and its shell is of steel permanently magnetized with a pole at the rim and one at the center of the back wall.

The cut shows a section of a transmitter which is the joint invention of Messrs. O. M. Leich and N. Pedersen, of Genoa,



Leich-Pedersen Telephone Transmitter.

Ill., their patent being assigned to the Cracraft-Leich Electric Company. The novelty lies in a mica disk at the rear of the diaphragm and in the peculiar L-shaped damping springs which pass through slits in the bridge and bear upon the mica disk.

Mr. A. H. Weiss, of Chicago, has patented a drop especially designed to permit the ready removal of the coil. Both the armature and the shutter trip rod are mounted upon the same pivot. The trip rod is of sheet metal and is so cut that flat spring fingers project from it and bear upon the top face of the armature. This pressure holds the armature and rod normally at right angles. A slight outward pressure upon the armature will overcome the pressure and bring the armature and rod in the same plane, exposing the drop-coil end for withdrawal. The Kellogg Switchboard & Supply Company has obtained this patent by assignment.

A patent granted to Annie K. Cann describes a paper antiseptic device. The paper is cut like the figure 8. The bottom perforation is covered by a thin membrane pasted on. The upper loop is cut at the top point. A fold is then made upon the mid line, so that the slit loop will serve as a clamp to hold the membrane across the mouthpiece of a transmitter.

Messrs. W. C. Thomas and A. C. Hewitt, of Philadelphia, have jointly patented a receiver support. This has the usual adjustments and is carried upon a bracket clamped to the upright of a desk stand. The arm swings about a horizontal pin and when thrown upward until the center of gravity of the receiver crosses over the pin it comes to rest against a stop, being held by the weight of the receiver. As the arm is being thus raised a dog secured to it engages the hook switch of the desk stand and depresses it.

WIRELESS RECEIVING CIRCUIT.

A circuit for wireless telephony is patented by Mr. O. Rochefort, of Paris, France. The ends of the resonator device, with which the antenna is connected, are connected, respectively, to the ends of a two-branch circuit. Each of these branches contains two electrolytic cells, those in one branch being oppositely poled from the other. A source of potential is connected across from one branch to the other in each and between the electrolytic cells of that branch. A telephone instrument is inserted in this cross as a shunt circuit. The opposite poling of the cells, taken together with the polarizing effect of the source of potential, permits of an undulating or alternating current being set up through the shunt circuit containing the telephone.

LOUD SPEAKING DEVICE.

The patent granted to Mr. J. W. Atlee, of Riverton, N. J., describes a loud-speaking attachment for telephones. The megaphone is shaped so that its mouth points in a direction parallel to the axis of the transmitter mouthpiece, so that although the sound passage is long the over-all dimensions are not great. This megaphone is carried upon a convenient bracket and its small or mouthpiece end terminates in a horizontal seat suitable for supporting the ordinary hand receiver. A cushion on the end of the megaphone registers with the receiver sound passage and insures that all sound emitted enters the megaphone. Such a device obviates the necessity of holding the receiver to the ear while holding the line and also permits of conversation with both hands free.

PRIVATE BRANCH INTERCOMMUNICATING SYSTEMS.

Two patents for improvements in intercommunicating private-branch exchange systems have recently been issued, both being assigned to the Western Electric Company. This is the type of system providing exchange lines and intercommunicating lines with full switching means at each station. One of the patents was issued to Mr. J. L. McQuarrie, of Oak Park, Ill. It provides for the holding of an exchange line while the answering instrument is switched off to communicate with some other station. It also provides for the release of the holding circuits as soon as any station comes back on the exchange line.

The second patent was that of Mr. H. D. Currier, of Chicago, which provides for a series use of transmitter and receiver upon local calls, but the use of the standard induction-coil circuit for exchange calls. All of the induction coils are associated with the exchange lines, one for each such line. Furthermore, when used for local or intercommunicating calls the receiver is shunted so that the transmitter will receive its full current, the shunt being inductive, though receiver efficiency is unimpaired.

MISCELLANEOUS ATTACHMENTS.

An antiseptic device for use with transmitters has been invented jointly by Messrs. A. P. Levi, H. Schlessinger and M. Schlessinger, all of San Francisco. The device comprises a sheet-metal ring with in-turned flanges which is adapted to slide over the outside of a transmitter mouthpiece. The flanges are of such diameter as to contact with the outer wall of the mouthpiece all around, while the body of the ring follows the general contour of the mouthpiece. The space between the mouthpiece ring and flanges is filled with absorbent material soaked in antiseptic and small perforations are made through the wall of the mouthpiece to permit antiseptic fumes to pass into the sound passage.

An invention of Mr. C. A. Barnes, Sr., of Greenfield, Ind., covers a handle for the ordinary hand-telephone receiver. This handle is formed of sheet metal and consists of two arms connected by a bow. The bow is of such size and diameter as to fit conveniently the shank of an ordinary hand telephone. The arms are then brought together, clamping the bow tightly upon the receiver, the lower end of one arm locking behind the up-turned end of the other arm. The device affords a sort of handle at right angles to the axis of the receiver.

Letter to the Editor.

The Light of the Firefly.

To the Editor of Electrical World:

Sir:—Your editorials and the notes by Drs. Ives, Coblentz nd Thomson in regard to the light of the firefly have been of reat interest to me. In connection with Prof. J. H. Kastle, of ne University of Virginia, I have had occasion during the past wo summers to make a study of this subject of the light of the refly, with special reference to the chemical problems involved. great deal of chemical work has been done upon it, much of of great interest, and perhaps some of the points brought out ay be of interest to your readers.

So far as now known, two constant chemical factors are ecessary for the production of light by a living organism— ater and oxygen. The third necessary factor, the substance xidized, may be, and probably is, variable. All attempts defi- tely to isolate and analyze this third substance have so far iled, although it has variously been called "noctilucin," uciferin" and "photogen" by different observers, and has een assumed to be either a fat or an albuminous body. The minous organ of the firefly consists of two layers of material ider the outer transparent chitin. The inner layer consists ainly of guanin (a compound similar to uric acid) and prob- ly serves as a reflector; this guanin reflector appears to have en found also among the photogenic fish and cephalopods. ne outer layer consists of a mass of cells, apparently nucleated, d normally of a pale yellow color. Both layers are penetrated by innumerable minute tracheæ, which unite in the interior of the insect to form larger passages and run together in the outer layer of yellow cells, forming a network somewhat resembling the finer veining of a leaf. It is practically certain that in life these passages are filled with air, and it seems probable that the photogenic process is accompanied by the evolution of carbon dioxide and the consumption of the oxygen of the air.

The effect of chemical reagents on the tissue of the photogenic organs is very striking, but cannot be entered into here. A joint paper of Dr. Kastle and myself will appear shortly in the *American Journal of Physiology*, and those interested are referred to that. One interesting point may, however, be cited. The luminous tissue dried over sulphuric acid in an atmosphere of hydrogen retains for over a year its power to glow when moistened with water in the presence of oxygen. If commercial hydrogen-peroxide solution be used in place of water the light is more intense; its spectrum is of very limited range, extending only from the orange to the yellow-green of the visible spectrum. Max Trautz has published in the *Zeitschrift für Physikalische Chemie* an exhaustive article on Chemiluminescence, in which he records the results of a large number of experiments with mixtures and compounds alleged to produce light, and one of these (pyrogallol oxidized by strong hydrogen peroxide in the presence of formaldehyde) he found produced a spectrum which covers about the same spectral area as that of the firefly.

A brief general review of this subject, by myself, may be found in the *Popular Science Monthly* for August, 1910.

Washington, D. C. F. Alex. McDermott.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Squirrel-Cage Induction Motors with High-Resistance Secondaries.—R. E. Hellmund.—An article on the various applica- ns of squirrel-cage induction motors with high-resistance ondaries. Motors of this type are employed in three distinct nditions of service: Firstly, in operation in combination with lywheel, driving machinery which is subject to heavy loads short duration, such as punch presses, etc.; secondly, for ving machines which require comparatively large starting que, either on account of large friction of rest or on ac- unt of large masses to be accelerated; thirdly, for applica- n where a large starting current is objectionable. These ferent applications are discussed separately at some length h the aid of diagrams.—*Elec. Journal*, November.

Radial Ventilation Slits.—T. Hoock.—An article on the effec- eness of radial ventilation slits in electrical machines. The ults of tests are given of a certain machine which show that ring a certain time the machine could be loaded with a ater load when the ventilation slips were closed than when y were open. This was due to the fact that in this case the air from the interior of the armature cannot get out to the me, but heats the field coils and pole surfaces to a higher nperature. This is, of course, detrimental.—*Elek. u. Masch.* ienna), Oct. 23.

Vector Diagram of Three-Phase Induction Machines.—R. denberg.—In constructing the well-known circular diagram three-phase induction machines from the vector diagrams of stator and rotor currents the difficulty is encountered that diagrams relating to different frequencies must be com- ed. The author proves that this may be done by letting the e vector rotate with different velocities in both diagrams. e author applies the diagram to the operation of an induction chine below and above synchronism and corrects a mistake merly made by others in the diagram of the machine run- ng above synchronism.—*Elek. Zeit.*, Oct. 27.

Repulsion Motor.—L. Berger.—A theoretical article illustrated by diagrams. The author gives the theory of Rusch of the single-phase repulsion motor. The diagram of the motor is first given, neglecting the stray fluxes and the ohmic losses, and it is then modified so as to take these factors into account. He then investigates the influence of the coils short-circuited by the brushes at starting and calculates the torque.—*La Lumière Elec.*, Oct. 22.

Lamps and Lighting.

Surface Brightness.—J. S. Dow and V. H. MacKinney.—A paper read before the Optical Society in London describing a new lumeter surface-brightness photometer. The idea of the instrument is to enable an observer to measure the surface brightness of any surface by comparing it directly with a standard illuminated white one. The manner in which this is done is shown in Fig. 1. The observer looks directly at an

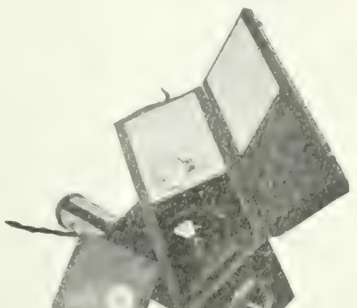


Fig. 1. Interior of Surface-Brightness Photometer.

illuminated screen and sees through an aperture therein the illuminated surface to be studied, for example, a picture or some object in a shop window. This screen is illuminated by an opal glass plate. Behind this is a small metallic-filament lamp at a sufficient distance to render the screen of uniform brilliancy. In the illustration the screen, with its circular aperture, has been taken out and is seen resting against the box. The sector-shaped opal surface can also be noted. The screen has been made by depositing a matt-white precipitate on thin glass and then scraping away a central disk. The screen is subsequently covered by a thin glass plate, which is bound in position. The actual white surface is thus preserved from air and moisture, and the glass cover can be handled with safety and easily cleaned. The position of the screen is such that no direct reflection from this surface into the eyepiece is possible.

Fig. 2—Diagram Showing Method of Altering Illumination.

The method of altering the illumination is somewhat unusual. The screen, *S* (Fig. 2), is covered by an opaque diaphragm which allows only a sector to be exposed. In front of this evenly illuminated sector two corresponding opaque screens, attached to levers *A* and *B*, can be made to pass. As the screen *A* is moved in front of the sector in area, its intensity as a light source will be uniformly diminished from, say, 1 to 0.1. The remaining intensity 0.1 is derived from the part of the surface still visible through the ring *R*. The area of *R* is arranged to be exactly one-tenth of the total area of the bright sector. The lever attached to *A*, therefore, travels on an equally divided circular scale with nine divisions from 1 to 0.1. Having drawn across the lever *A*, the illumination may be still further reduced by also bringing over the lever *B*. This exactly resembles *A*, with the exception that there is no ring cut out. Thereby the illuminated portion of the opal plate still left exposed is gradually cut off and the illumination is uniformly reduced from 0.1 to 0. The lever *B* travels on a second scale immediately above that of *A* graduated from 0.1 to 0. Before using the apparatus a person adjusts the position of the glow lamp illuminating the opal plate until the brightness of the white surface *S* (as compared with another similar white surface illuminated by a standard lamp at a specified distance) is, say, exactly 1 ft.-candle. He then fixes the lamp in this position and regards the scales as registering in ft.-candles. By means of the device already described one can measure values from under 0.01 to 1.0 ft.-candle. It is also proposed to equip the instrument with two dark glasses, each absorbing one-tenth of the light passing through them, in order to increase the range of the instrument upward. As an illustration of the wide range of brightness that can be measured by this means it may be mentioned that the writers have measured values of over 50 ft.-candles in shop windows, while it is also possible to estimate the brightness of the sky in the night time. This proved in one case to be about 0.008 ft.-candle. In another case, owing to the diffusion of light from neighboring arc lamps, a value of 0.015 ft.-candle was registered. Although mainly intended for the measurement of surface brightness, the instrument can be easily employed to measure illumination. In this case a white surface is exposed to the illumination of the standardizing lamp, and the same surface is used for subsequent measurements. For this purpose a screen that is diffusive and dead-white is desirable.—Lond. *Electrician*, Oct. 28.

Metallic-Filament Lamp.—A note on an anti-vibration metallic-filament lamp for use in mills, factories, ships, etc. The tungsten filament is divided up into a larger number of short loops than is usual, and has a specially elastic suspension.—Lond. *Elec. Eng'ing*, Oct. 27.

Swedish Water-Power Plant.—H. CHERVET.—The first part of a profusely illustrated complete description of the Yngeredsfors power plant and 40,000-volt transmission line to Varberg and Mölndal-Gothenburg, in Sweden. The power station at Yngered deals with a normal discharge of 1630 cu. ft. of water per second at a head of 59 ft., and contains three generating sets each of 2750 hp, supplying three-phase current at 4000 volts, 50 cycles, to three single-phase, 40,000-volt transformers. Energy is transmitted over a line fifty-six miles (94 km) in length at 40,000 volts to the Mölndal substation, at the Gothenburg end of the line, where about 8000 hp is transformed to suitable pressures for distribution among the many cotton and paper mills and other factories in the Gothenburg suburbs of Mölndal, Krokslätt, Garda, etc. At the further substations of Krokslätt and Garda, in Gothenburg City, the pressure of the three-phase current from the Mölndal transformer station is reduced from 10,000 volts to 210 volts and 400 volts and distributed by means of overhead cables. At the Varberg transformer station, of 2400 kva rating, the line pressure is reduced to 4000 volts and the energy led to the substation in the town through two underground cables. There the pressure is reduced to 800 volts to supply energy to the motor network, and a storage battery is installed. The Varberg electricity works, of which this substation forms a part, also contain a complete 2750-hp steam turbo-generator plant. This is intended to act as a reserve or stand-by in case of disturbances or low water at Yngered, in which case the transformers would have to step up the e.m.f. to 40,000 volts to assist the main line. The article is to be continued.—Lond. *Electrician*, Oct. 28.

Generation, Transmission and Distribution.

Location of Transformer Stations in Three-Phase Systems.—C. SCHMIDT.—The first part of a paper on problems of energy distribution in urban and interurban systems. In the present instalment the author discusses the most favorable distance between transformers in three-phase systems. This distance is determined on one hand by the cost of energy distribution per kw-hour and on the other hand by the permissible voltage variations due to incidental overloading of partial circuits, such as may be caused by the connection of a 5-hp motor to the mains. In general it is desirable to connect motors with a rating up to about 5 hp directly to the low-voltage network. Curves are given showing under what conditions the cost becomes a minimum.—*Elek. Zeit.*, Oct. 27.

Large Gas Engines.—F. FOSTER.—A paper read at the Manchester Engineering Exhibition. After mentioning the various types of large gas engines the author discusses the difficulties experienced in their manufacture. In this connection cylinders, pistons, cross-heads, valves, valve gear, frames, etc., are considered, and the improved forms of construction now adopted are described. Finally, the higher cost of gas engines, as compared with steam engines, is shown to be justified. The gas engine is a great saver of fuel, and customers "ought to be only too pleased to pay the extra cost of one." In a steam engine the ratio of maximum effective to average pressure is 2.2 for each cylinder; in a gas engine, however, the ratio is about 11, or five times that of the steam engine. The parts, of course, have to be strong enough to withstand the maximum pressure. By putting two cylinders in tandem the connecting rod, main frame and crank shaft are not subjected to any higher stresses, but the intermediate frame, back piston rod, cylinder barrels and valve gear remain as before. Hence, even in this case, the ratio of maximum to average pressure for the whole engine is nearly 4, as against 2.2 for the steam engine. Further, the severe conditions under which the gas engine work

necessitate more expensive materials than in the case of steam engines. The wonder is that gas engines are as cheap as they are.—Lond. *Electrician*, Oct. 28.

Electric Driving of Rolling Mills.—In the British Appeal Court the decision of Justice Parker early in the year, in which he declared the Ilgner patent for the electrical driving of re- ersing rolling mills to be invalid for want of subject matter, was upheld. The court expressed the opinion that the Ilgner atent merely combines the Ward-Leonard system with the ddition of a flywheel, and that no new result is obtained by he combination.—Lond. *Elec. Eng'ing*, Oct. 27.

Traction.

Single-Phase Locomotive.—The Oerlikon Company has re- ently completed, for service on the Loetschberg Railway, a :000-hp, 15,000-volt, single-phase locomotive using compensated- eries motors. The results of a number of trial runs show that vith a 15,000-volt, 13-cycle to 17-cycle current it is able to levelop a draw-bar pull of 13,000 kg (28,600 lb.) when running it a speed of 42 km (26.3 miles) per hour, this being equal to :000 hp developed at the draw-bar. The speed can be regulated ip to 70 km (43.5 miles) per hour. On starting the draw-bar ull rises up to 15,000 kg (33,000 lb.). The load on each axle s about fifteen tons, the total weight eighty-eight tons, this be- ng the weight also available for adhesion and equal, therefore, o 6.7 times the draw-bar pull. The locomotive has a total ength of 15 m (49 ft.). If it is desired to increase the speed t which the normal draw-bar pull has to be exerted, so as to ake it approach the maximum speed, the locomotive can be ade to travel at a 60-km (37.4-mile) speed, developing 3000 hp, y making a slight modification to the secondary winding of e transformer, no increase in weight being necessary. The ectric equipment consists of two similar parts, two current ollectors, two transformers, each with the corresponding witches, two motors, and two complete controllers. The con- ections are so arranged that in case of need the locomotive can e started with a single motor, transformer and controller. he mechanical equipment of the motors can easily be un- oupled from the driving axles. The electric equipment can be orked with three-phase current at the same power, with only ight alterations. The motors can also run with direct current 4000 volts without sparking, after suitably adjusting the unt resistance of the auxiliary pole winding. The two trans- ormers are designed for a normal continuous output of × 1000 kva; they are air-cooled. The motors are 12-pole, mpensated, series machines, with phase-displaced reversing elds. Each motor, with its toothed-wheel gearing, has a total eight of 9600 kg. The locomotive is complete, with air-com- essor set, air brakes and all necessary equipment. It is used r the service on the Speiz-Loetschberg-Simplon line, drawing train load weighing 310 tons up gradients of 27 mm per eter (1 in 37) at a speed of 42 km (26.3 miles), thus devel- ping a draw-bar pull of 10,000 kg (22,000 lb.). The maximum eed is to reach 70 km (43.5 miles).—Lond. *Eng'ing*, Oct. 28.

Gasoline-Electric Omnibus.—An illustrated description of a ew pattern of gasoline-electric omnibus chassis in which the ad wheels are driven through differential and worm gear by single series-wound motor receiving energy from a generator upled to the gasoline engine. Direct drive is not resorted to any speed, and starting and speed control is effected by eans of the engine throttle valve and the generator field rength. The motor field coil is shunted at top speed. No orage battery is carried, and the maintenance costs are, it is aimed, low. Two such vehicles have recently been shipped r public service in India, and a modified pattern is to be em- oyed in London.—Lond. *Elec. Eng'ing*, Oct. 27.

Installations, Systems and Appliances.

British Generating Station.—An illustrated description of re- nt extensions of the Carville electric generating station. It rmerly contained four steam turbines, two of 6500 hp and o of 3000 hp. The latter two have now been replaced by achines of 6500 hp and, in addition, four more, each of oo hp. have been added, thus bringing the total rating of the station up to 52,000 hp. A new departure has been made in connection with the switchgear for operating the generator and feeder circuits. In the original installation the high- pressure switchboard was erected on four galleries at one side of the building, extending the whole length of the engine-room, the two upper galleries containing two sets of busbars and the next gallery being occupied by the main oil switches, while the last gallery was occupied by the instrument transformers and other auxiliary gear. By the recent arrangement the operating panels of the remote-control feeder switches have been placed in a control-room at one end of a new two-story brick building, which houses the operation department, battery-room and offices, as well as containing the control equipment.—Lond *Elec. Review*, Oct. 28.

French Central Station.—A. Soulier.—An illustrated de- tailed description of the equipment of the Mont-sur-Marchienne central station, which is of moderate size only, but is considered up to date in its equipment with modern machinery. There are two gas engines, each driving a 70-kw, 500-volt, direct-current generator. For distribution the three-wire system at 2 × 250 volts is used, the motors being connected between the outers. A balancer is used to equalize the load between the two halves. A storage battery is used to provide energy for lighting when the generators are at rest. The battery is charged by means of a booster.—*L'Industrie Elec.*, Oct. 25.

Electric Plant for India.—G. E. Wright.—An article giving notes on the selection of electric plant and supplies for India, dealing especially with the rating of generators and motors, power-house equipment and low-tension transmission work.— Lond. *Elec. Review*, Oct. 28.

Three-Phase Systems.—G. W. Meyer.—Numerical examples showing the application of the symbolic method for the calcula- tion of three-phase systems with star connection.—*Elek. Anz.*, Oct. 23.

Electrophysics and Magnetism.

"Potential Power."—E. J. Brunswick.—The author does not like the term "puissance déwattée" (wattless power) and pro- poses instead the term "potential power."—*L'Industrie Elec*, Oct. 10. P. Boucherot objects to this because potential power should logically be the rate of the variation of potential energy in time, which is proved to be something essentially different. He prefers the term "magnetizing power." E. Brylinsky pro- poses the term "reactive power."—*L'Industrie Elec.*, Oct. 25.

Röntgen Rays.—G. Rümelin.—An illustrated description of an arrangement of apparatus to produce Röntgen rays of practically constant intensity.—*Phys. Zeit.*, Oct. 15.

Electrochemistry and Batteries.

Ventilation of Storage Batteries.—A note on a recent British patent (4567, Oct. 20, 1910) of A. B. Pescatore and Tudor Accumulator Company. Cells for boats, etc., are provided with a system of ventilation for removing the gases evolved during charging and for cooling the electrolyte. The gases are re- moved through an aperture in the center of the lid and cool air is introduced by means of pipes passing through the lid near this central aperture and terminating in the corners of the cell. Air may be blown in or suction applied, as is most convenient. —Lond. *Elec. Eng'ing*, Oct. 27.

Electrolytic Hypochlorite for Cleaning Schoolrooms.—A note on the use of electrolytic hypochlorite solution (made from common salt) in the schools of the Borough of Poplar in Eng- land. The directions given to the school-keepers are to soak with electrolytic fluid the sawdust used for scattering over the floor and to sprinkle the floors with the fluid by means of an ordinary galvanized-iron watering can with a large rose on the spout. The scattering of the soaked sawdust and the sprinkling of the floors with the fluid are being daily carried out previous to sweeping the floors, as dry sweeping only spreads the dust; for, while part of it is removed, the rest, which has been stirred, settles down when the disturbance is over. The school-keepers are also directed to use the fluid in the water when washing the floors of the classrooms. If the fluid is not diluted enough, a strong odor will be given off at the time of sprinkling or washing, on account of the presence of organic matter in or

upon the floors; consequently the oxidizing process should be gradual.—Lond. *Electrician*, Oct. 28.

Calcium Cyanamide.—M. de Kay Thompson and R. H. Lombard.—An account of an investigation of the equilibrium of the system consisting of calcium carbide, calcium cyanamide, carbon and nitrogen. In the present instalment the arrangement of the experiments is described and an account is given of the electric furnace used, the calibration of the thermo-couple, etc. —*Met. and Chem. Eng'ing,* November.

Units, Measurements and Instruments.

Mercury Motor Meter.—An official announcement of the Reichsanstalt by which a direct-current motor meter of the Solar Meter Company is admitted for calibration. The construction is shown in Fig. 3. The positive current enters the motor at K_1 and passes first through the winding of an electromagnet; it then divides into two branches, one passing through the mercury and the other through the resistor W. After the current combines again it leaves the meter through K_2. The mercury is entered by the current through E; it passes then mainly through the copper disk T and leaves the mercury at A. Above and below this path of the current are two poles, P_1 and

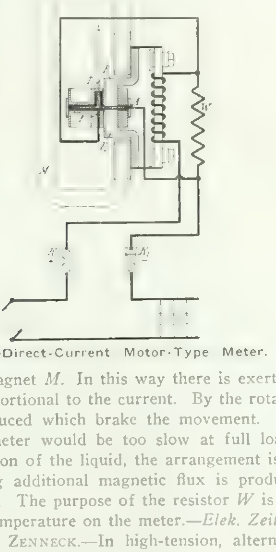


Fig. 3—Direct-Current Motor-Type Meter.

P_2, of the steel magnet M. In this way there is exerted on the disk a torque proportional to the current. By the rotation eddy currents are produced which brake the movement. Since the rotation of the meter would be too slow at full load on account of the friction of the liquid, the arrangement is so made that an increasing additional magnetic flux is produced with increasing current. The purpose of the resistor W is to reduce the influence of temperature on the meter.—*Elek. Zeit.*, Oct. 27.

Wattmeters.—J. Zenneck.—In high-tension, alternating-current systems transformers are generally used to connect the measuring instruments with the low-tension circuit. But in power measurements in high-tension systems containing large flame arcs the use of transformers may cause considerable errors. Reliable results are obtained only if the current coil of the electrodynamic wattmeter is directly inserted in the high-tension line and the voltage coil is connected in series with non-inductive resistors across the line. Since the instrument is thereby charged to high voltages purely electrostatic forces are acting on the movable system and this causes an error which cannot be neglected. This error depends on the position of the movable coil—that is, of the needle—and it is necessary to predetermine this error for as many positions of the coil as possible over the whole scale. Methods of determining this error are described, especially one in which the deflection of the needle is obtained by means of an auxiliary magnetic field. —*Phys. Zeit.*, Oct. 15.

Standard Resistance Unit.—A note on a recent British patent of W. R. Rousfield (27,335, Oct. 20, 1910) for a standard resistance unit suitable for heavy currents, consisting of a glass tube filled with mercury and provided with platinum contacts at each end. These contacts extend into glass cups at each end, which may contain mercury and serve as connectors to the rest of the circuit. A vertical tube of fine bore is attached to the main tube, and the mercury rises in it according to the temperature of the whole. This tube may be graduated in degrees of temperature or in ohms.—Lond. *Elec. Eng'ing*, Oct. 27.

Selenium Cell.—An illustrated description of a new selenium cell devised by Gripenberg. The object is to utilize the light which is reflected by a selenium cell. For this purpose a series of selenium layers is provided so that the light reflected by one layer falls upon the next one, and so on.—*Elek. Anz.*, Oct. 27

Telegraphy, Telephony and Signals.

Telegraph and Telephone Conference.—The first part of a very full account of the recent Paris conference of government telegraph and telephone engineers. This was attended by the chief officials of the telegraph and telephone departments of the governments that subscribe to the International Telegraph Convention and Service Regulations represented by the bureau at Berne. The United States was represented by Messrs. C. E. Scribner, engineer-in-chief of the Western Electric Company, of New York, and John J. Carty, engineer-in-chief of the American Telegraph & Telephone Company, of New York. Abstracts of the papers presented at this conference are given elsewhere in the Digest.—Lond. *Electrician*, Oct. 21 and 28.

Manual and Automatic Telephone Exchanges.—An account of the extended discussion held at a recent Paris conference of government telegraph and telephone engineers. Steidle, in his report, remarked that the discussions on the subject at Budapest had been confirmed by practical experience. In the great and small systems on the Continent of Europe automatic use is made of systems which had proved their reliability and adaptability to technical requirements. The use of automatic table selectors is now only a question of economy. In order to illustrate this aspect of the different technical methods of working, Steidle showed some diagrams of the cost of illustration. He pointed out that in the case both of the semi-automatic and automatic systems the economical advantage is always increasing owing to the growth of telephonic communication and the constant improvement of technical devices. Purely mechanical selectors provide the most economical method of working, and he showed that the development of cheap telephony in urban and rural districts would be encouraged by the use of semi automatic arrangements permitting the connecting up of small groups of subscribers—central secondary exchanges connected with principal exchanges having a manual service. Hersen said that, as the manual service cannot at present be entirely abolished, it is desirable to consider whether that service cannot be improved by performing some of the manipulations automatically, as is done at Copenhagen. Similarly, attempts had been made in Germany to install an automatic line selector for insuring uninterruptable conversation, as well as an automatic distributer of subscribers' calls for interurban communication. He asked Steidle whether he had considered, from the economic standpoint, the question of adopting automatic or semi-automatic working—that is, whether or not to retain, as regards the subscriber, the numbered call disk. Mr. Steidle replied that economically, American statistics as to the relative cost of connections showed a difference of 15 per cent in favor of the entirely automatic system. There are also advantages of working to be considered. At Munich-Schwabing it is found that subscribers are quite used to the manipulation of their instruments, including disks numbered with series of five successive figures. Technically the automatic system is preferable as being more simple. Mr. Hersen asked for the number of calls per hour employed as a basis for the estimates given by Steidle. In Berlin it is considered that one telephonist can deal with 250 calls hourly. It had been stated that in America 1500 conversations per telephonist per hour are possible. Steidle replied that he had taken as the basis for his calculations per telephonist per hour the figure of 800 subscribers' calls for the semi-automatic service and from 140 to 150 conversations for the manual. He asked which is considered preferable, a call selector or an individual manipulator. Hersen said one must consider the time necessary to make contact with the calling

line. If this contact takes place at a distance from the indicator (curseur) time would be necessary, and the subscriber may commence to call before connection is made. This is a drawback in the call-selector system. If it were proposed to introduce it by means of the entirely automatic system one would prefer individual manipulation. Otherwise, for economical reasons, the semi-automatic system combined with the cell selector would be preferred. John J. Carty observed that he could only speak as to American practice. The automatic and manual systems are usually contrasted, but the automatic system is not entirely automatic and the manual system advantageously admits of automatic movements, especially in large systems. Moreover, the apparatus installed would be in use for periods varying from five to twenty years, and it is necessary to consider the system from the point of view of its probable developments. Thus in New York in 1900 there were 43 central exchanges and 51,398 subscribers to 3,437,000 inhabitants; in 1910, 52 central exchanges and 376,000 subscribers to a population of 4,800,000; while in 1930 there will be 109 central exchanges and 2,142,000 subscribers to 8,800,000 people. Further, .t is necessary to meet the suburban and interurban services. In considering an automatic system for a very large town one s astonished to find how many manipulations are still necessary. In America an automatic system which is not suitable for small private central exchanges (branch centers) is not practicable on account of the great number of these small private stations. n 1900, in New York, there were 1050 private exchanges, servng 12,650 points; in 1910, 11,960, serving 162,560 points; while or 1930 it is necessary to estimate 88,400 exchanges, serving .079,000 points. The operating company, therefore, reckons on supplying nearly 80 per cent of the subscribers under these pecial conditions; and as up to the present no way has been ound of operating the small exchanges from the central exhange, it is necessary to retain the operators. Automatic elephony requires, in addition, a numerous staff of electricians o insure the working of the exchange. In Connecticut inestigations had been made with the view to the introduction f the automatic system, and it had been found that the manual nethod would require 892 operators and the automatic 600. or New York similar investigation showed that for 100,000 ubscribers, counting the operators in small private central tations and the mechanicians in the automatic exchanges, 13,000 perators would be required for manual method and only 10,000 r the automatic. The question to be solved is not, therefore, efinitely whether the automatic or the manual system is to be ecided upon, but rather in what parts of the systems and at hat moment in the connection it is desirable to have manual r automatic operation. A manipulator is always necessary to ceive subscribers' calls; thus the best system is that which ovides the subscriber with the simplest installation and leaves omplicated operations to the central exchange. Semi-autoatic least satisfies these conditions. In New York, with the anual method, it is possible to state the time necessary for aking the connection at from thirty to fifty-two seconds, with maximum of eighty-seven seconds. This is an excellent relt, which permits one to consider the problem completely lved by the manual system. He said that he had not found y automatic method so satisfactory as the present manual stem with central battery, but he had no prejudice on the bject and remained always ready to consider propositions. endle then proposed the following resolutions: "In view of ts made in different countries it is possible to affirm: That automatic and semi-automatic systems offer at present, m mechanical and electrical standpoints, sufficient certainty d adaptability of operation to meet all working requirements. The adaptation of these systems no longer depends upon the onomic factor, which naturally varies according to the coun-y." Hersen remarked that in Germany two central exchanges th 1000 subscribers require only two mechanicians, and a all exchange works without a special mechanician. Milon d also visited the principal automatic exchanges in America. e number of technical [illegible]

more perfect systems was higher by about one-fourth than those reported in the manual service, the former requiring 50 per cent more mechanicians than the latter—say, one mechanician present at the exchange during the busy hours per 1000 subscribers. Since, however, the automatic system suppresses errors or manipulation faults of operators, this system is quite comparable with the manual system. The question is whether the subscriber will make the needful manipulations himself or prefer the intermediary of a telephonist as in the semi-automatic system. The answer would vary in different countries according to the character of subscribers and quality of staff. As to depreciation, he stated that selective apparatus has worked seven years without material wear. In regard to cost of installation, contractors estimated that it is slightly higher than that for a manual installation. The president recapitulated the discussion and said that while it might not be possible to end it by a vote the conclusion appeared to be that the satisfactory application of automatic working is no longer doubtful, but that the advantages would depend on local conditions.—Lond. *Electrician*, Oct. 21.

Telegraphy.—W. A. J. O'Meara.—The conclusion of his article (the first part of which was abstracted in the Digest some time ago) giving some notes on the author's trip to the United States. As to the status of telegraphy he says that the Rowland machine has a great carrying capacity when all things go well, but it is a rather complicated machine. The Barclay printing telegraph machine operates on the polar duplex principle, and, being a non-synchronous system, it has a wide range in line current values. Comparative tests have given convincing proof of the advantages of tape transmission over the direct signaling to line. Theoretically, the former appears to involve a loss of time in handling individual messages, but in practice the saving of time in the case of direct transmission can occur only if everything works with smoothness and the staff is so skilled as never to make a mistake of any kind. In practice such conditions will never prevail, and it is for this reason that the tape transmission exhibits its superiority. Some notes are added on the use of electric power in post offices in the United States for conveying mail, etc., the telephone tunnel system in the streets of Chicago and the municipal works at Seattle.—Lond. *Electrician*, Oct. 28.

Interference Between Energy Transmission Lines and Telephone Lines.—An account of a discussion at the Paris Telephone Conference. Collette reported on the subject of "the coexistence of strong and weak current lines." Pleijel cited the case of a railway using for traction alternating currents of 15,000 volts with a frequency of 25 cycles or 15 cycles per second. The railway followed for 6 km ($3\frac{1}{2}$ miles) telegraphic and telephonic lines which were then connected with Stockholm by cables of 5 km (3 miles). The telephonic lines were on one side of the road, the telegraphic on the other. On the former only a slight sound was discernible when the trains started or

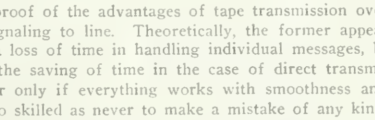


Fig. 1—Secondary Circuit Connections.

stopped. The tension between these lines and earth, when insulated at the Jaspra end, was about 20 volts. On a telephonic line carried on the posts supporting the transmission line there was a tension of 5000 volts. This line was at first unusable, but after having substituted for the lightning guards an induction coil placed between the two line wires, the middle being connected to earth, conversation was possible. On the other hand, it had been found necessary to have a metallic circuit for the telegraph lines. Measurements showed that 75 per cent of the disturbing currents were electrostatic (difference of potential between earth plates) and 25 per cent electromagnetic. Strecker [illegible] two [illegible] to render telegraph

instruments insensible to disturbances from alternating currents. In one method (Fig. 4) a secondary circuit is attached to the terminals of the apparatus comprising an inductive resistance and a syntonized condenser, with the same frequency as the alternating current, through which the alternating current elects to pass while the continuous working current passes through the instrument. The second method (Fig. 5) bridges

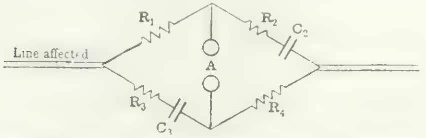


Fig. 5—Apparatus Bridged Between Similar Branches.

the apparatus between two similar branches composed of inductive resistors and two syntonized condensers, so arranged that the continuous current alone can operate the instrument. Pleijel observed that a condenser of such great capacity is necessary that the working of the instrument is retarded and that the power must be increased. He had also used electrolytic capsules, but they also have disadvantages.—Lond. *Electrician*, Oct. 28.

Wireless Telegraphy.—Ferrie.—An article on the equipment of dirigible balloons with wireless-telegraph apparatus and the results obtained in recent tests made by the French army. With the balloon Bayard-Clement it was possible to transmit messages over 100 km (60 miles) at an expense of less than 50 watts.—*La Lumière Elec.*, Oct. 22.

Transmission of Pictures.—B. Glatzel.—In the second instalment of his paper the author gives a review of recent improvements in telautographic apparatus. It is important to reduce as much as possible the inertia of the light relay. Instead of the double-wire light relay, as described in the Digest last week, a single ribbon may be employed according to the principle of Edelman's thread galvanometer. Receivers employing this principle are more sensitive than the telephone, oscillograph or any electrochemical receivers.—*Elek. Zeit.*, Oct. 27.

Bookkeeping.—G. Johnson.—A continuation of his article on bookkeeping and accounts of telephone undertakings. In the present instalment the author deals with the routine between the manager and engineer in regard to construction, withdrawal and other orders, and accounts of stores, etc.—Lond. *Elec. Review*, Oct. 28.

Miscellaneous.

Insulation Materials.—W. Fellenberg.—The conclusion of his very long serial on the development of the electrical industries in the United States and Germany. In the present instalment statistical data are given on insulators, porcelain, gutta percha, mica and asbestos. In conclusion the author points out that the United States has the advantage of having the raw materials for the electrical industries in its own country, while Germany has not. But Germany has the advantage of a greater number of better trained workingmen. The absolute value of the wages is less in Germany than in the United States, since food costs more in Germany. The endeavor of all German industries must be to keep their corps of workingmen satisfied by reducing the cost of living. A change of the tariff law is recommended. If that is not done soon the author thinks the foundation of Germany's trade in the markets of the world will break down. Untrained workingmen receive about the same wages in Germany as in the United States.—*Elek. Zeit.*, Oct. 27.

Electric Accidents.—W. Vogel.—The first part of an account of the electric accidents which happened in the industrial establishments and mines of Upper Silesia during the last year. Fifteen accidents are dealt with, of which eight caused the death of a man. In one case a man was killed by 220-volt direct current.—*Elek. Anz.*, Oct. 23.

Book Reviews.

Fuel and Refractory Materials. By A. Humboldt Sexton. Second edition. New York: D. Van Nostrand Company. 364 pages, 104 illus. Price, $2.50.

The production, handling, testing and utilization of fuels form the subject of the present volume. The general theory of combustion and heating power of fuels is followed by a description of the various fuels (coal, wood, peet, coke, charcoal, oils and gases), their properties and methods of production. A chapter is devoted to furnaces for metallurgical purposes, this being followed by one on pyrometers, calorimeters and fuel testing. The book closes with a brief treatment of refractory materials, giving their properties, composition and some notion of their manufacture into bricks and crucibles. The book is suitable for a text, but should be a useful source of reference to those interested in gas producers, coke and charcoal manufacture and metallurgical furnaces.

Die Seekabel Unter Besonderer Berücksichtigung der Deutschen Seekabeltelegraphie. By H. Thurn. Leipzig: S. Hirzel. 288 pages, 105 illus. Price, 9 marks.

This is an elementary and descriptive volume, abundantly illustrated, giving a very readable account of modern submarine telegraph cables as made in Germany and laid by German ships.

The first chapter is devoted to technical matters and very elementary theory. This occupies about one-third of the book. The remaining chapters discuss cable manufacture historically considered; the need for national cables; the German cable system; the traffic operation of cables; the influence of submarine cables in affairs; the competition between submarine and wireless telegraphy; arrangements for the protection of submarine cables. A good deal of practical and economic information is contained in the book, which will be very useful to cable telegraph engineers desirous of following the details of German practice. Evidently the writer has secured a series of photographs taken during a cable-laying expedition, because some of the pictures are not only instructive but entertaining.

Traité de Physique. By O. D. Chwolson. Paris: A. Hermann & Sons. Vols. 3 and 4. 838 pages, 291 illus. Price, 25 francs.

These volumes are devoted to special branches of physics, namely, Vol. 3 to thermometry, thermal capacity, thermochemistry and thermal conductivity, and Vol. 4 to the steady electrostatic field. It is a commentary upon the rapid growth of the physical sciences that books so complete as these should be treatises upon special branches only. The books are treatises largely by way of compilation. The subjects are developed in historical order, so that the various discoveries and accretions of knowledge are laid down in their order of sequence. A very full bibliography is appended to each chapter by way of supplementing the text.

The translation into French by M. E. Davaux seems to be excellent and effective. Although the work is very minute and detailed, yet the treatment will be more appreciated by the historian of physics than by the student who desires only to arrive at the present status of knowledge in these subjects. The book will be prized for reference by scholars in physics who are interested in tracing the growth of modern ideas and results in these branches.

The Theory of Electric Cables and Networks. By Alexander Russell. New York: D. Van Nostrand Company. 269 pages, 71 illus. Price, $3.

The volume is an elementary text-book of the fundamental principles which enter into the design, construction and use of direct-current cables and wires. It supplements to a considerable extent the more advanced work by the same author, entitled "Treatise on the Theory of Alternating Currents." The treatment of the subject is suited to the requirements of the

electrical engineer and also of the student of electrical engineering. Numerous references to special literature are given in relation to the different matters discussed. The chapters are entitled: Fundamental Principles, Conductivity, Insulativity, Distributing Networks, Insulation Resistance of House Wiring, Insulation Resistance of Networks, Faults in Networks, Dielectric Strength, The Grading of Cables, The Heating of Cables, Electrical Safety Valves and Lightning Conductors. The discussion is very clear and well arranged. The quantitative analysis is confined to simple algebra. Special attention is given to the theory of the various electric tests described. The book will be valued both by the practising engineer as a compendium of reference and by the student as a useful text-book in the subjects of which it treats.

New Apparatus and Appliances

A RECENT CONEY ISLAND SIGN.

The accompanying illustration, made from a drawing rather than a photograph, to indicate by the dotted lines the movement of the arms of the figures, represents one of the newer spectacular electric signs at Coney Island. The sign is 40 ft. high and 30 ft. wide and it contains 1100 4-cp carbon lamps. The table, chairs and the figures of the man and the woman, as well as the bottle on the table, are steady-burning. The arm of the woman is first seen raising a glass to her lips and then the man is shown

A Novel Electric Sign.

rforming a similar action. The arms are seen throughout the hole range of movement. The lettering is flashed on at inrvals, the line "Carstairs" first, then "Rye" and "A Centry Favorite" at brief intervals, the words "Est. 1788" being st. This sign was made by the Hamilton Sign Company, of ew York, and the flasher by which it is operated was supied by the Reynolds Electric Flasher Manufacturing Comny, of Chicago. In the flasher eight single-pole switches are cessary for the moving arms and six double-pole switches for e lettering.

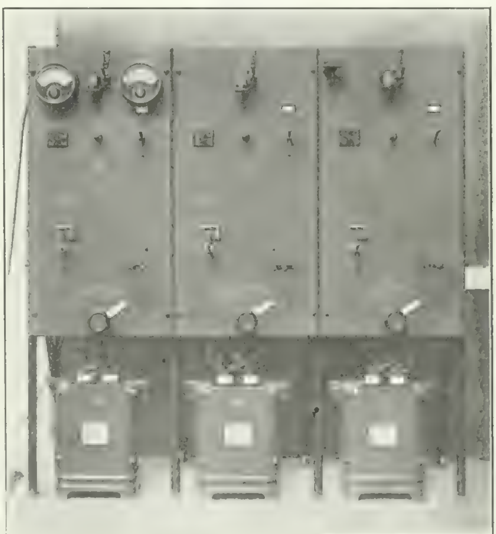
TRAINING INCANDESCENT-LAMP SALESMEN.

The Harrison Works of the General Electric Company has tended its course of training for lamp salesmen by the inclun of other than merely commercial instruction. Men taking is course have usually had some selling experience, but lack chnical training in electricity and illuminating engineering. e duration of the present course is three weeks, the instrucn consisting of experimental lectures, recitations, readings, lling talks, trips through the factory, laboratory work and lks by specialists from the commercial, engineering, sales and ctory departments. The men at the end of the course are failiar with the adaptability of the various units and can design uminating schemes and work out simple illuminating problems.

The work is under the personal supervision of Prof. Sydney W. Ashe, who is provided with assistants to look after experimental and problem work on lamp data. A number of experienced men have also been trained to give experimental lectures and these men are available to the various central stations for lectures to their employees. Such subjects as sign lighting, industrial lighting, automobile lighting, street illumination, store lighting, etc., are among those included in the list.

RECTIFIER FOR COMMERCIAL-VEHICLE SERVICE.

The accompanying illustration shows a mercury-arc rectifier for commercial-vehicle service, exhibited for the first time as a part of the General Vehicle Company's display at the recent electric show in New York City. This rectifier is of the ordinary type except that many of the parts necessary for use with pleasure vehicles are now eliminated on account of the standard voltage requirements of commercial vehicles, where forty-hour



Rectifiers for Commercial-Vehicle Service.

cells are used almost exclusively. The board is substantial in character, the wiring simple and ample in carrying capacity. A most efficient board is produced at the lowest price by a plug system enabling one set of meters to be used for every three panels, each of which can be equipped with any of the standard tubes ranging from 30 amp to 50 amp each. Where necessary this rectifier is supplied with a special switch on each panel, enabling two or more panels to be run in multiple so as to accommodate charging of batteries at high amperage. The meters supplied are of the large type easily read by the operator. The General Electric Company is the manufacturer of th[illegible]

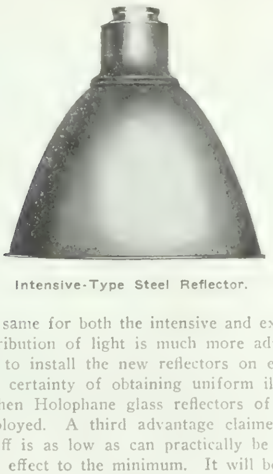
NEW INTENSIVE AND EXTENSIVE STEEL REFLECTORS.

Something over a year ago the Holophane Company, anticipating the need both of better practice and better equipment for mill and factory lighting, placed upon the market its extensive and intensive types of steel reflectors, these being the

Extensive-Type Steel Reflector.

first scientifically designed metal reflectors available for tungsten lamps. While the company considers that these were the most satisfactory reflectors of their type available, from the standpoint of both efficiency and practicability, it was early seen that there was room for improvement, and the Holophane engineering department at once set about redesigning and perfecting the company's product. The results of this work are now being offered to the trade.

The new Holophane-D'Olier steel reflectors shown in the accompanying illustrations are stated to give an average increase of 31 per cent in illuminating efficiency, this increase being



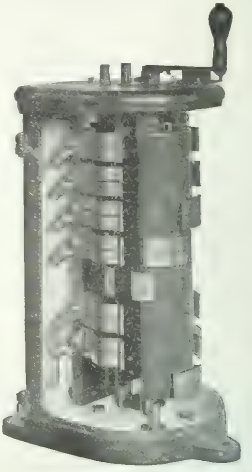
Intensive-Type Steel Reflector.

practically the same for both the intensive and extensive types, while the distribution of light is much more advantageous, it being possible to install the new reflectors on exact spacings with the same certainty of obtaining uniform illumination as is the case when Holophane glass reflectors of the standard types are employed. A third advantage claimed is that the angle of cut-off is as low as can practically be secured, thus reducing glare effect to the minimum. It will be seen that in appearance the new steel reflectors are attractive.

DRUM-TYPE STARTERS FOR ALTERNATING-CURRENT MOTORS.

For starting under load the slip-ring motor has many advantages over the squirrel-cage induction motor. When provided with the proper starting device it is possible to get gradual acceleration with no excessive currents. Up to certain capacities the Cutler-Hammer face-plate type of starter is practicable, but for larger motors the new drum-type illustrated below is preferable. For use in industrial plants and where subject to collection of dust, lint, etc., it is especially adapted, as there are no exposed contacts. The standard sizes manufactured range from 10 hp to 200 hp.

The drums are tightly fitted and the contacts and brushes are made of hard-drawn copper and can be readily and cheaply renewed. The cylinder on which the contacts are mounted is built to remain perfectly true under all conditions. This type of apparatus can be handled by any workman without danger of accidental contact or other trouble. The cutting out of the resistance and the acceleration can easily be controlled. All connections are made inside the drum and the arrangement of the terminals renders them readily accessible. For larger motors



Drum-Type Starter for Alternating-Current Motors.

or those starting under specially heavy load conditions, a multiple-switch type of starter has been developed and is recommended by the manufacturers.

ELECTRICALLY HEATED MELTING POT.

In many industrial establishments it is imperative that means be afforded for melting lead, solder, etc., in greater or less amounts. This has been generally accomplished by means of devices heated by coal, gas, gasoline, oil or other dangerous and unhealthful heat producers, which involve a fire risk in addition to their other objectionable features. An electrically heated device, illustrated herewith and manufactured by the General Electric Company for this purpose, has been designed to obviate these objections. It is clean, sanitary and without odor, and as its operation is not attended with a fire hazard, it can be used

Metal Melting Pot—Designed for 1000 Lb.

anywhere, even where combustibles are scattered about, while its control is so easy and certain that it can be regulated so as to maintain the molten metal at the proper temperature for best results. It is always ready for use, a throw of the switch turning on the heat, and is of extensive application, being suitable for melting lead, solder, babbitt metal, for tinning, dipping and soldering wires and other small articles, for tele-

phone manufacturing establishments, electrical repair shops, etc.

In construction it is a shallow circular vessel of cast iron, the cup being assembled on top of the heating disk and the design being such that the heating unit is readily accessible. There are three degrees of heat regulation, consuming 200 watts, 400 watts and 600 watts respectively. The standard device has a maximum capacity of 15 lb. and is designed for attaching to electric circuits where the potentials are 100 volts, 110 volts or 120 volts by standard attaching plug. In addition to the smaller sizes kept in stock units will be built to order having a capacity (for lead) of 700 lb., 1000 lb., 2100 lb., 2500 lb., 3000 lb., 3150 lb. and 3500 lb. respectively. Some large ones are now being built having a capacity of 1000 lb., one for a large shipbuilding company, to be used as a tin melting pot, and another for a large paper manufacturer for use in melting stereotype metal in the printing department.

QUARTZ-TUBE MERCURY-VAPOR LAMP.

There has recently been developed for the market in England the type of mercury-vapor lamp shown in Fig. 1, which is somewhat similar in appearance to an ordinary arc lamp, but much neater and less bulky in construction. Referring to Fig. 2, the lamp consists of the following four parts: First, a clear or opal globe *E*, which is metal-flanged and arranged :o fit securely on the underside of the totally inclosed metal :ase *D*, or to lower at will to the extent of the length of the :hains *C*, which prevent further falling of the globe, thereby eaving the inside open for inspection, etc. Second, a quartz ube *A* of somewhat irregular shape, exhausted to a high degree of vacuum and containing a quantity of mercury, which s the source of light, the luminous portion in the smaller apacity lamps (1200 hemispherical candle-power, 4 amp, 100-30 volts) being about 1¾ in. and in the larger (3000 hemispherical candle-power, 3.5 amp, 200-240 volts) about 4 in.; the ube is mounted within the globe on the outside of the base of), and is arranged so that it can be tilted in order that the iercury may be free to run to and from each end. Third, a olenoid *B*, the plunger of which is connected to one end of he quartz tube, and an automatic cutout *i*, both mounted on the

Fig. 1—Quartz-Tube Mercury-Vapor Lamp.

ıside of *D*. Fourth, an external resistor *R*, mounted in any ɔnvenient place.

On putting the lamp in circuit by switch *I* the current first ısses from the positive main through the resistor *R*, the cut-ɪt *i* and the solenoid *B* back to the negative main, the solenoid ıusing the positive end of the tube to be tilted and the mercury flow along the tube to the opposite end, thereby completing the ıbe circuit. As the cut-out coil is in series with the tube this ɔw comes into operation and immediately breaks the solenoid rcuit. The quartz tube then falls back to its original position ıd the lamp continues to operate until it is switched off. As soon as the mercury at both ends of the quartz tube meets and the current in the tube is thereby started a small portion of the mercury is vaporized. The vapor alone only constitutes the conducting medium in the tube and is the sole source of light, there being a continual process of vaporization and condensation whenever the lamp is in service.

As it is essential that the correct polarity should be observed, to prevent damaging the tube means are provided in the lamp itself which automatically insure this, as under reversed conditions the lamp will fail to light up. In comparison with arc lamps the mercury-vapor lamp embraces an absolutely steady

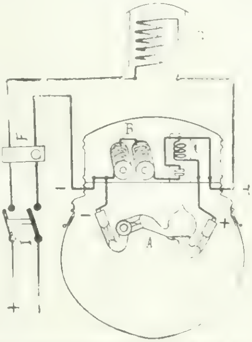


Fig. 2—Diagram Showing Details of Lamp and Connections.

light of uniform quality with no flickering, and is designed for running in parallel, thus insuring economical use.

The shadows shown by ordinary arc lamps are to a large degree eliminated by the use of the mercury-vapor lamp, owing to the fact that the actual length of the arc in the former is very much smaller than in the latter type. The light is bluish-white in color, makes a good illumination for streets, markets, railway depots, freight yards, wharves, docks, steel works, heavy foundries, factory yards, sheds, etc.

In Fig. 3 is shown the polar photometric curve of a lamp consuming 3.64 amp at 220.3 volts and giving 3630 mean lower

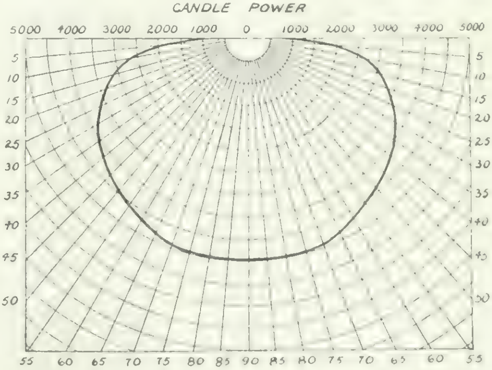


Fig. 3—Light Distribution Curve.

hemispherical candle-power. Owing to the high efficiency, combined with the long life of the burners, together with the fact that the lamps require no attention during running, the total running cost per hour is considerably less than that of ordinary or flame-arc lighting—the actual figures are stated to be 1.14 cents and 2.2 cents per hour, taking the price per kw-hour at 2 cents and 6 cents respectively, which compare with 3.64 and 5.13 cents for the flame-arc lamp.

This lamp has been placed on the market by the Westinghouse Cooper Hewitt Company, 151 Great Saffron Hill, Holborn Circus, London, England.

Industrial and Commercial News

The Week in Trade.

PRINCIPALLY on account of the colder weather trade reports for last week were uniformly more favorable than for some time past. Distribution in retail trade is quite generally improved, and the realization on the large corn and oats crops throughout some parts of the Southwest has furnished considerable buying capital. The wholesalers and jobbers report an increased volume of reorders. There is an especially active movement in holiday goods, and shipments are being made as rapidly as possible. In the industrial world there is very little improvement. The textile condition is still handicapped by the prevailing waiting policy. In the iron and steel industry there does not seem to be a great amount of new business coming forward. Many railroads have announced that their purchases of steel rails for the coming year will be limited to absolute necessities, and specifications for structural materials are also very light. The mills must have much more prosperity if operations during the coming winter are to be conducted at an average rate. The demand for wire products is the one bright feature in the general situation, but it is said that prices on both wire and nails are being shaded. The report of the United States Steel Corporation of the tonnage on its books on Oct. 31 was the smallest in the history of the company. It is claimed, however, that the figures are smaller, owing to a new method of computation, than they would have been had the method in vogue several years ago been followed. The preliminary reports for the October export trade were hardly as encouraging as had been expected. An increase over September figures had been looked for, but it now seems likely that the totals will show a decrease of about 4 per cent. Collections have improved very materially, and this is especially true in the corn-producing territory. Business failures for the week ended Nov. 10, as reported by *Bradstreet's,* were 207 as against 179 the previous week, 221 in like week in 1909, 267 in 1908, 259 in 1907 and 222 in 1906.

The Copper Market.

TAKINGS of copper during the past week were very light, and the market was extremely dull and uncertain. All grades were slightly shaded in price during the week, and there can be heard many reports of concessions being made under quoted figures. The report of the Copper Producers' Association demonstrated the fact that the production of copper during the month of October was at the rate of more than 4,000,000 lb. per day. This was extremely disappointing to many traders, although the report was generally considered to be a favorable one, owing to the fact that total deliveries during the month were heavy and the surplus stock decreased 9,531,800 lb. The official figures as given out were: Production, 126,469,284 lb.; domestic deliveries, 67,814,172 lb.; exports, 68,186,912 lb., making total deliveries of 136,001,084. The surplus stock reported on hand Nov. 1 was 139,261,914 lb. One feature in the report which has caused considerable comment in the metal market is that the figures given out for the exports are said to be 20,000,000 lb. in excess of actual shipments, according to the government's reports. It is pointed out that this excess is therefore still in this country and should naturally be added to surplus stocks. The demand by domestic consumers during the past week amounted to very little. While it is not believed that many melters are carrying large stocks, they seem to be very conservative about buying. The imports continue to run at about the same figures. Exports for the month, including Nov. 14, were 9703 tons. The daily call on the Metal Exchange Nov. 14 quoted standard copper as per the accompanying table.

[illegible]	Bid	Asked	Settling Price.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

The London market, Nov. 14, was as follows:

	Noon. £ s d	Closing. £ s d
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest	Lowest
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Best selected	65 10 0	57 15 0

Industrial and Commercial Notes.

Westinghouse and Georgia Power Companies.—A telegram was published under an Atlanta date in a New York paper last week to the effect that the Westinghouse Electric & Manufacturing Company had gained control of all the water powers on the watersheds of the Tallulah, Chattahoochee and Etowah Rivers. These include the Georgia Power Company, the North Georgia Electric Company, the Etowah Power Company and some smaller plants and hydroelectric sites. This telegram stated that the Railroad Commission had approved a $20,000,000 stock and bond issue for the Georgia Power Company for the purpose of carrying out this great merger. The Northern Construction Company, of Michigan, is reported to have made a contract for developing the holdings, and it is said that in the three rivers energy aggregating 101,000 hp can be developed. With regard to the Westinghouse connection with this matter Robert Mather, chairman of the board of that company, said: "There is no truth in this story whatever. This company has not acquired any Georgia power companies, and does not intend to. We are not in the business of acquiring power properties."

American Association of Electric Motor Manufacturers.—The convention of the American Association of Electric Motor Manufacturers, which was to have been held at the Blackstone Hotel, Chicago, Nov. 14-16, was called off some time ago and all arrangements canceled. It is understood that the association has been dissolved. While no member of the association who could be seen in this city would make any statement to this effect, none would make any denial. Privately, the opinion was expressed by several members that the association had been dissolved. W. H. Tapley is secretary of the association, and has offices at 29 West Thirty-ninth Street, New York. When asked about the association he said that its convention had been postponed indefinitely and no action with regard to it would be taken until the executive committee met again. He said that if the association had been dissolved he had no official knowledge to that effect. F. S. Hunting, of the Ft. Wayne Electric Works, is president of the association.

Apparatus for New York Central.—The New York Central Railroad Company has placed an order with the General Electric Company for four 2000 kw, 660-volt, 25-cycle, direct-current rotary converters with four air-blast transformers. Three of these rotary converters are to be placed in the substation at Irvington and one at Glenwood. Delivery will be made next summer. The company has also ordered from the same manufacturer two 500-kw, 250-volt Curtis turbines for the light and power plant at the new Grand Central Station. The plans of the company contemplate the complete electrification of the line to Croton, N. Y., within the next eighteen or twenty months. The *Electrical World* of Aug. 4, 1910, announced that the railroad was in the market for this apparatus.

Signal Equipment for Illinois Traction System.—H. E. Chubbuck, of Peoria, Ill., vice-president executive of the Illinois Traction System, is quoted as saying that his company has determined to spend $1,000,000, if necessary, to equip its extensive system of interurban railways with block signals. It is said that the Illinois Traction System will be the first interurban network to be entirely equipped with automatic electric block signals. The signals to be installed are to be at least equal to the best used by steam railroads and are designed to eliminate all danger of collisions.

Gasoline Electric Cars on Long Island.—It is stated that short branches of the Long Island Railroad Company will soon be equipped with gasoline electric motor cars. The Pennsylvania Railroad has been experimenting recently with these cars on one of its branches in New Jersey. The cars will be 70 ft. long and will seat ninety-one passengers.

Reduction in Cable Rates.—Clarence H. Mackay, president of the Commercial Cable Company and the Postal Telegraph Company, announced last week a reduction in cable rates which will effect a great saving on ordinary messages. Mr. Mackay said that the cable company had been for some time formulating plans by which the rates for messages sent by the general public and expressed in plain English could be reduced about one-half. A plan has now been worked out, and, if it secures the co-operation of the government land lines in Europe, it will effect a great saving. The present cable rate is 25 cents per word, and on such messages the present plan is to charge 12½ cents for every five letters, the letters being counted instead of the words. In order to make this plan operative, Mr. Mackay says that the land lines must agree to make a proportionate reduction in rates. The company has been endeavoring for a long time to get away from the use of code messages, especially those which are not expressed in ordinary words. Mr. Mackay is of the opinion that the new plan will not only be of great benefit to the outside public, but will induce business men to eliminate as far as possible the use of the code. Following Mr. Mackay's announcement, President Robert C. Clowry, of the Western Union Telegraph Company, has issued a statement to the effect that his company had been studying for a year the modification and reduction of cable rates, and had formed a tentative plan. He said that an agreement had been substantially reached as far as English transatlantic cables were concerned, but that there was some question with the British Post Office authorities owing to the rules of the international telegraph convention. He said that it now seemed probable that an agreement could be reached on a basis of half rates for plain English. This is practically the same basis as proposed by Mr. Mackay.

Cleveland to Have Subways.—It is now probable that Cleveland will continue its present three-cent fare indefinitely, the Council having decided last week not to end it with the limit of the trial period, Dec. 1, as the company is making the required 6 per cent for the stockholders and keeping the expense account squared without touching the interest fund. In the recent election Cleveland voted to approve franchises for both high and low level subways. Under the provisions of the high-level subway ordinance, construction must be started within eighteen months and subway cars must be in operation within four years. Work on the low-level system must be started within two years, and one of the tubes, from the Cuyahoga Valley through to the lake front, must be in operation in four years. The various upper-level subways throughout the city aggregate between thirty-five and forty miles in length. The city can at any time buy these subways back from the builders by paying $350,000 a mile, one-seventy-fifth of the value being taken off each year until the end of the seventy-five year period, when the franchises expire and the subways automatically become the city's property. The low-level subway plan contemplates about three miles of tunnels. These can be bought by the city at any time by the payment of $850,000 a mile.

Westinghouse October Orders.—The sales booked by the Westinghouse Electric & Manufacturing Company during October approximate $2,600,000, a slight increase over September. For the last three months the sales have been very close to $2,500,000 per month. This is a decrease of about 15 per cent from June and July figures. At the same time orders billed to customers during the past two or three months have been running in excess of $3,000,000 a month, and it is said that the net profits of the company since the fiscal year began, April 1, have been at the rate of almost 12 per cent on the common stock. About the first of this month the Westinghouse Electric company shipped fifteen carloads of electric apparatus, weighing almost 500,000 lb., to Valparaiso, Chile. This will be used at Rancagua, Chile, to furnish light and power for the Braden Copper Company. This company is owned by the American Smelting & Refining Company, and is one of the largest developments of its kind in South America. The shipment includes three water turbines. The various Westinghouse companies last month had the largest pay rolls in their history. The aggregate of the four principal companies was [illegible],500,000.

Central Colorado Power Company.—The announcement [illegible] the West that the Central Colorado Power Company had [illegible]cured control of Boyd Lake [illegible] near Greeley, Col., is officially denied. A representative of the Central Colorado Power Company says that his company has at this time no need for this reservoir and has no intention of buying it. It held an option upon the property for several years, but this option was recently surrendered, and the property is now to be developed by its present owner, Burton D. Sanborn. Mr. Sanborn is largely interested in irrigation projects in Colorado. For the purpose of development he has organized the Boyd Lake Reservoir & Irrigation Company. The fact that some of the officials of the Central Colorado Power Company are directors in this company probably gave rise to the report. The Central company is now developing about 30,000 hp and is finding a very excellent market for its energy. A contract is now being negotiated, but has not yet been signed with the Denver Gas & Electric Company.

E. E. Witherby Company.—The E. E. Witherby Company, gas, electric and street railway engineer and operator, of 40 Wall Street, announces that it has recently concluded negotiations and will at once proceed with the construction of gas-distribution systems at Westbrook and also at South Portland, Maine. Companies will be formed in these two places, which will buy their gas from the Portland Gas Light Company. The same engineering corporation has also almost completed the construction of a new gas plant at Shamokin, Pa., which will begin operations about Dec. 1. It is said that this will be one of the most up-to-date plants in the country. The engineers also announce that distribution will be begun by the South Shore Gas Company at Babylon, L. I., about Nov. 15. This plant was constructed under the supervision of these engineers.

New Haven Railroad Buys Equipment.—The New York, New Haven & Hartford Railroad Company has ordered from the General Electric Company a considerable amount of equipment through its electrical sudsidiaries. The Connecticut Company has placed the following orders: For Hartford, one 1000-kw, 600-volt, 25-cycle rotary converter; for Buckland, two 300-kw, 600-volt, 25-cycle rotary converters; for Rockville, two 400-kw, 600-volt, 25-cycle rotary converters; for Station "A," New Haven, one 400-kw, 600-volt, 60-cycle rotary converter. Accompanying all of these are orders for the necessary transformers and switchboards. The Rhode Island Company has ordered one 15,000-kw, 25-cycle, three-phase Curtis turbine, and three 2000-kw, 600-volt, 25-cycle rotary converters with three 2250-kw, three-phase air-blast transformers and switchboard.

Insulated Wire Trade.—Standard manufacturers of insulated wire are still complaining over the condition of business. They say that the fall orders have not come up to their expectations, and that prices have not regained the former basis. A representative of one of the prominent companies said: "Trade has been demoralized by the manufacturers of cheap material, who cut prices below levels that we can afford to make. We are compelled to keep up the standard of our goods, and by doing this we cannot reach the prices that some of our competitors, whom we believe use inferior materials, are now making. Orders have not been up to expectations, and the railroads, which are generally large buyers at this time, have been practically ordering nothing."

Bids for Motor Cars Requested.—H. A. Strauss, vice-president and chief engineer of the Falkenau Electrical Construction Company, Chicago, has completed plans and specifications for six motor cars for the Alton, Jacksonville & Peoria Railway Company, for which tenders are now requested. These cars will be equipped with four Westinghouse interpole motors and double-end electro-pneumatic control. They will have automatic air brakes, steel trucks, and will be 55 ft. long, with a seating capacity of forty-two.

Freeport (Ill.) Railway, Light & Power Company.—The Freeport Railway, Light & Power Company is engaged in reconstructing its combination steam and water-power electric generating station, and in rehabilitating its distribution lines and electric-railway system, the work to be completed early in 1911. The Knox Engineering Company, Chicago, is supervising the engineering features of this reconstruction.

Westinghouse Mining Hydroelectric Equipment.—The [illegible] with the Westinghouse Electric & Manufacturing Company for three 3000-hp, double overhung Pelton water wheels, three 2000-kw alternators, ten 667-kw oil-insulated, water-cooled transformers, two 100-kw 3-bearing motor generator sets and a complete switchboard.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Washington, D. C.; Brookhaven, Miss.; Cincinnati, Ohio; Rocky Ford, Ga.; Oroville, Cal.; Westbrook, Conn.; Atlanta, Ga.; Albuquerque, N. M.; Maricopa, Cal.; Tiburon, Cal.; Alhambra, Cal.; Vergennes, Vt.; Englehart, Ont., Can.; St. Paul, Minn.; Milan, Wash.; Warrensville, Ohio; Chase, Kan.; Oelwein, Ia., and Houston, Tex.

Hudson & Manhattan Railroad Company.—The tunnel system of the Hudson & Manhattan Railroad Company was opened last week as far north as Thirty-third Street in New York City. The new extension is about one-half mile long, and the cost of constructing it was about $3,000,000. In the reports given out by the company the percentage of increase in the number of passengers carried in September was 23.19 and in October 24.65.

Financial.

The Week in Wall Street.

IMMEDIATELY after the election the Wall Street market started upon a rapid decline and entered a period of weakness which lasted for four or five days. On the first day after the election liquidation was very heavy and pressure to sell broke prices several points. After that the market was rather dull, but, while still weak, recorded no severe declines. At the present time the market is largely made up of speculators, and the shrewder of these had accumulated long lines of stocks several weeks ago. Feeling confident of the outcome of the election, they were prepared to put them on the market if there was any rush to buy immediately after their anticipations had been realized. For this reason offerings were very heavy on the day after election, and buyers were reasonably scarce. If any traders made money when the result of the election turned out to be what Wall Street had predicted, it was those traders who bought early and sold before the voting began. The market on Nov. 14 strengthened up a bit and recovered about half of its previous losses upon most of the active issues. Even with this recovery, however, there was very little virility to the buying movement. Except for the poor showing in the reports of orders made by the United States Steel Corporation, there is no news feature in sight to depress the market especially. The money complications in Europe are practically over, and money in this market is as easy as could be expected at this period. Rates Nov. 14 were: Call, 2½ @ 3½ per cent; 90 days, 4¾ @ 5 per cent. The quotations in the table are those of the close.

NEW YORK.

	Nov. 5.	Nov. 14.	Shares Sold†		Nov. 5.	Nov. 14.	Shares Sold.
Al. Ch.	[illegible]	9⅞*	[illegible]	Int. Met., pf	[illegible]	[illegible]	28,400
All. Ch., pfd	34	[illegible]	[illegible]	Mackay Cos..	[illegible]	93*	[illegible]
Amal. Cop....	[illegible]	[illegible]	[illegible]	Mackay C., pf.	[illegible]	[illegible]*	300
Am. D. T....	[illegible]*	[illegible]*	——	Man. Elev...143		141*	1,800
Am. Loco....	40	39	2,400	Met. St. Ry..	15*	15*	——
Am. Loc. pfd.	[illegible]	106	[illegible]	N.Y.&N.J.Tel.	139¼	139¼*	——
Am. Tel. & C	84*	84*		Steel, com..	81	[illegible]	992,600
Am. T. & T.	[illegible]	[illegible]	12,660	Steel, pfd....	118½	117	[illegible]
B. R. T....	77¾	[illegible]	[illegible]	W. U. T....	73	71	2,400
Gen. Elec....	[illegible]	[illegible]	2,450	West'h, com..	73½	71	6,800
Int. Met.	[illegible]	[illegible]	15,820	West'h, pfd..	124	124*	——

PHILADELPHIA.

	Nov. 4.	Nov. 14.		Nov. 4.	Nov. 14.
Am. Rys.	[illegible]	[illegible]*	Phila. Elec.	[illegible]	[illegible]
Elec. Co. of A....	11¼	[illegible]*	Phila. R. T.	[illegible]	16
Elec. St. B'ty......	49½	47	Phila. Trac..	81	82
E. S. B'ty, pfd....	30*	30*	Union Trac.	30	30¼

CHICAGO.

	Nov. 4.	Nov. 14.		Nov. 4.	Nov. 14.
Chi. City Ry........	170*	170*	Chi. Tel. Co.......	123	122*
Chi. Rs., Ser. 1......	76	76*	Met. El. Co.	[illegible]*	[illegible]*
Chi. Rs., Ser. 2	20¼	20¼	Met. El., pfd.	[illegible]*	[illegible]*
Com. Edison.......	116	116	Nat'l Carbon.	143*	125*
Chi. Subways.......	[illegible]*	4¾	Nat'l Car., pfd......	123*	[illegible]

BOSTON.

	Nov. 4.	Nov. 14.		Nov. 4.	Nov. 14.
Am. T. & T.........	[illegible]*	[illegible]	Mex. Tel.	[illegible]*	[illegible]*
Cum. Tel.	[illegible]*	[illegible]*	Mex. Tel., pfd......	6¾*	[illegible]*
Edison E., Ill.......	274½*	[illegible]	N. E. Tel.	[illegible]*	[illegible]
Gen. Elec.	[illegible]	[illegible]	W. T. & T..........	18*	17*
Mass. E. Ry.......	[illegible]*	20¼	W. T. & T., pfd...	[illegible]*	90*
Mass. E. Ry., pfd	[illegible]*	[illegible]			

*Last price quoted.
†Shares sold for week Nov. 7 to Nov. 12.

Financial Notes.

Portland Railway, Light & Power Company.—A special meeting of the stockholders of the Portland (Ore.) Railway, Light & Power Company has been called for Nov. 28 to act upon a plan for the redemption at 105 of the $5,000,000 of preferred stock now outstanding. To accomplish this the plan provides for the increase of the common stock from $10,000,000 to $25,000,000. For each share of the present full-paid common stock and $62.50 in cash there will be issued to the holder two and one-half shares of new stock, which will be 65 per cent paid. The remaining 35 per cent will be subject to call, but these calls will be limited to not more than 5 per cent in any calendar year. If the plan is carried out, instead of having $5,000,000 preferred and $10,000,000 of common, the company will have $25,000,000 of 65 per cent paid common stock. This will mean $16,250,000 paid in. As a result the company will receive $1,000,000 in cash. A circular accompanying the proposal says that the City of Portland and the surrounding territory have grown so rapidly within the past five years that the demands upon the company for increased facilities and improved service have required the investment of large sums of capital, with the result that the earnings have been built up at a very rapid rate. The company is now developing two hydroelectric plants with a total capacity of 70,000 hp, one of which will be completed in about eighteen months and the other in three or four years.

Southern Pacific and Trolleys.—It was published in Los Angeles last week, and also in New York, that the Southern Pacific Railway Company had taken over the Pacific Electric Railway Company, of Los Angeles. The latter company has 581 miles of track and more than 1000 cars, and does a very large interurban business. At the New York office of H. E. Huntington, president of the Pacific Electric Railway Company, it was stated (Mr. Huntington being in the West) that no information with regard to this deal had been sent to the New York office. The report was generally discredited, and it was said that Mr. Huntington had publicly denied it in the Los Angeles newspapers. The Southern Pacific Railway Company is already largely interested in the Pacific Electric Railway Company, but the latter is operated independently.

Niagara Falls Power Company.—The combined income account of the Niagara Falls Power Company and the Canadian-Niagara Company for the nine months which ended Sept. 30 shows gross revenue of $1,607,537 and net revenue of $1,155,346. The total surplus at that time was $997,931. The income of the Cataract Power & Conduit Company, the controlling interest in which is owned by the Niagara Falls Power Company, showed gross earnings of $1,018,368 and net earnings of $260,900. The total surplus of this company was reported as $639,387. The earnings of the Tonawanda Power Company, 2009 shares of a total of 2500 shares of which are owned by the Niagara Falls Power Company, were gross $99,716 and net $41,378.

National Carbon Company Dividend.—Within the past few weeks the common stock of the National Carbon Company advanced from 120 to 145. This advance was attributed at the time to rumors to the effect that the General Electric Company was negotiating to take over the National Carbon Company. This report was officially denied in our issue of Nov. 10. The reason for the advance is now explained. On Nov. 9 the common stockholders of the company received checks for a special dividend of 15 per cent. This dividend was extra to the regular dividend, which is now 6 per cent. The receipt of these checks was the first intimation that many of the stockholders had that such a distribution was to be made.

Manhattan Railway Company.—At the annual meeting of the Manhattan Railway Company in New York last week Paul Morton, president of the Equitable Life Assurance Society, was elected a director to fill the place of the late Dumont Clarke. There was no discussion at the meeting relative to the financing of the $30,000,000 necessary for construction and for third-tracking the elevated lines. It is understood that all of this financing will be done by the Interborough Rapid Transit Company, the lessor of the Manhattan Railway Company.

Frederick (Md.) Gas & Electric Company.—The control of the Frederick (Md.) Gas & Electric Company has passed into the hands of the Frederick Railroad Company unless the deal is blocked by the Public Utilities Commission of Maryland. Application has been made to the commission by the railroad company for authority to issue $72,000 of preferred stock. Of the proceeds of this sale $32,000 is to be used to pay for recent track extensions and $40,000 for acquiring a majority of the Gas & Electric stock.

Washington, Baltimore & Annapolis Reorganization.—The members of the reorganization committee of the Washington, Baltimore & Annapolis Electric Railway Company have agreed upon a plan for reorganizing the property and lifting the receivership. Under the proposed plan the stock is reduced from $5,783,000 to $3,000,000 and the holders are required to pay $500,000 in cash, which is in the nature of an assessment, but for which they receive $500,000 in new 6 per cent non-cumulative preferred stock and $2,500,000 in common stock. Holders of the second mortgage 5 per cent bonds are asked to surrender them and receive in exchange $400,000 of new preferred stock in full settlement for both principal and interest accrued up to March 1, 1911. Whether foreclosure will be resorted to will depend upon how the plan is received by bondholders, but as more than 83 per cent of the terminal bonds and approximately three-quarters of the first-mortgage and terminal second-mortgage bonds already have been deposited, the plan probably will be successful. The new capitalization will be as follows: First-mortgage bonds, $7,500,000, of which $5,000,000 will be issued; 6 per cent non-cumulative preferred stock, $2,500,000, of which $1,400,000 will be issued, and common stock, $3,000,000, all of which is to be issued.

Montreal Street Railway Company.—Explanations as to the reason why the old board of directors of the Montreal Street Railway Company made no contest to retain control at the recent meeting, which fact was referred to in our issue of Nov. 10, are now coming forward in Canada. It is said that not a single member of the old board considered the stock of the company worth to them the $250 a share that the Canadian Light & Power Company interests were willing to pay for it. For this reason they did not come into the market to buy a sufficient number of shares to retain control. The Montreal Light, Heat & Power Company, which for a time appeared willing to pay this price for the stock, had called off its prospective deal a few weeks previous to the annual meeting. The Canadian Light & Power Company management was willing to pay more for the property in order to secure a market for its large amount of surplus energy. The Canadian Light & Power Company is now generating about 22,000 hp, and has prospective developments which will add greatly to this output.

Toronto & Mimico Railway.—The Etobicoke Township Council at a meeting on Nov. 7 passed a resolution authorizing negotiations being entered into with the City of Toronto looking toward taking over the Toronto & Mimico Electric Railway Company's system by the city when the company's franchise expires on Jan. 23, 1912. The line was constructed in 1891 under a twenty-year franchise granted to the Toronto & Mimico Electric Railway Company, which was merged some years ago with other radial lines running north and east from Toronto into the Toronto & York Radial Railway Company, the whole of whose capital stock is owned by the Toronto Railway Company.

Allis-Chalmers Re-elects Officers.—At the meeting of the Board of Directors of the Allis-Chalmers Company following the annual stockholders' meeting the old officers of the company were re-elected. These are: E. H. Gary, chairman of the board; W. H. Whiteside, president; L. F. Bower, first vice-president; Henry Woodland, second vice-president and treasurer; W. W. Nichols, third vice-president and secretary; W. A. Thompson, comptroller; M. C. Miller, assistant to president, and M. W. Babb, general attorney and assistant secretary.

British Columbia Electric Railway Agreements.—The British Columbia Electric Railway Company has submitted a proposal through Assistant General Manager Glover covering the consolidation of all the operating agreements with the cities of Hastings, South Vancouver and Point Grey in case these districts should be annexed to the city and a Greater Vancouver formed. The company proposes that the different agreements shall be consolidated into a new agreement running for twenty-five years, in return for which an increased percentage on earnings will be paid to the city.

DIVIDENDS.

American Railways Company, quarterly, 1½ per cent, payable Dec. 15.

American Telegraph & Cable Company, quarterly, 1¼ per cent, payable Dec. 1.

Chicago Telephone Company, quarterly, 2 per cent, payable Dec. 31.

General Electric Company, quarterly, 2 per cent, payable Jan. 14.

Kansas City Railway & Lighting Company, preferred, quarterly, 1¼ per cent, payable Dec. 1.

Laclede Gas Company, preferred, semi-annual, 2½ per cent, payable Dec. 15; common, quarterly, 1¾ per cent, payable Dec. 1.

Mobile Electric Company, preferred, quarterly, 1¾ per cent, payable Nov. 15.

Philadelphia Electric Company, quarterly, 1½ per cent, payable Dec. 15.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, quarterly, 1¾ per cent, stock dividend, 35½ per cent, both payable Nov. 15.

West Penn Traction Company, semi-annual, 1 per cent, payable Dec. 15.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Baton Rouge Electric Company:					
September, 1910	$8,881	$6,113	$2,774	$1,945	$[illegible]
September, 1909	8,249	4,96[illegible]	3,285	1,951	1,331
Cape Breton Electric Company, Ltd.:					
September, 1910	28,835	13,113	15,72[illegible]	6,148	9,[illegible]
September, 1909	25,89[illegible]	13,267	12,6[illegible]	6,281	6,34[illegible]
Columbus (Ga.) Electric Company:					
September, 1910	30,236	16,71[illegible]	[illegible]	17,908	1,61[illegible]
September, 1909	31,604	18,3[illegible]	13,[illegible]	1[illegible],711	[illegible]
Edison Electric Illuminating Company of Boston:					
October, 1910	427,63[illegible]	183,8[illegible]	[illegible]	..	..
October, 1909	[illegible]	[illegible]	[illegible]	..	
Edison Illuminating Company of Brockton:					
September, 1910	25,792	14,[illegible]	[illegible]	4,[illegible]	6,3[illegible]
September, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
El Paso Electric Company:					
September, 1910	54,846	31,383	23,463	8,216	15,247
September, 1909	[illegible]	[illegible]	[illegible]	8,[illegible]	[illegible]
Houghton County (Mich.) Electric Light Company:					
September, 1910	21,558	10,489	11,069	4,553	6,516
September, 1909	20,645	[illegible]	[illegible]	4,[illegible]	6,[illegible]
[illegible] Electric Company:					
September, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September, 1909	38,375	20,807	17,568	9,522	8,046
Lowell Electric Light Corporation:					
September, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September, 1909	29,187	14,823	14,364	6,761	7,603
New England Telephone & Telegraph Company:					
Year ended June 30, 1910	12,225,332	8,885,418	3,339,914	120,531	3,522,436
Year ended June 30, 1909	11,031,289	8,307,473	2,724,816	161,035	2,823,786
Paducah Traction & Light Company:					
September, 1910	[illegible]	[illegible]	[illegible]	[illegible]	2,8[illegible]
September, 1909	[illegible]	[illegible]	[illegible]	[illegible]	1,1[illegible]
Puget Sound Electric Company:					
September, 1910	[illegible]	[illegible]	[illegible]	[illegible]	9,961
September, 1909	179,956	107,605	72,351	48,552	23,799
Savannah Electric Company:					
September, 1910	51,598	32,606	18,992	18,157	835
September, 1909	[illegible]	[illegible]	[illegible]	[illegible]	48
Sierra Pacific Electric Company:					
September, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tampa Electric Company:					
September, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September, 1909	47,108	27,253	19,855	4,615	15,240
United Railway Company of St. Louis:					
September, 1910	965,943	642,182	329,781	233,233	96,548
September, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

General News

Construction News.

BIRMINGHAM, ALA.—It is reported that the [illegible] Railroad Company [illegible] work on its proposed [illegible] pro-vided the City Council grants the extension of the city franchises asked for by the company. Work will first begin on the construction of the railway between East Lake and Bessemer, a distance of forty-six miles, after which the main line to Tuscaloosa will be built. The cost of the work within the Birmingham city limits will approximate $2,500,000 and include freight and passenger terminals. J. M. Dewberry is president.

BIRMINGHAM, ALA.—Application has been made to the City Council by the Alabama Railway & Electric Company for a franchise to construct and operate an electric railway over certain streets in the Wylam section of Birmingham to extend from the western terminus of the Wylam line of the Birmingham Railway, Light & Power Company to the new No. 13 coal mine of the Tennessee Coal, Iron & Railroad Company. If granted a franchise work will begin on the proposed railway in the near future. R. W. Snyder, Max Blach, Joseph Martin, and W. W. Crawford are among the incorporators.

OPELIKA, ALA.—The contract for pole-line materials, including wire, cross-arms, insulators, etc., for the new street lighting system has been awarded to the Wesco Supply Company, of Birmingham, Ala., for $4,862.

SELMA, ALA.—It is reported that the Tennessee Chemical Company's new fertilizer plant will be equipped for electrical operation. Electricity for operating the plant will be supplied by the Selma Lighting Company.

BISBEE, ARIZ.—Extensive improvements are contemplated by the Tri-State Telephone Company in this district, which will involve an expenditure of about $25,000. Work will soon begin on the erection of a copper circuit and rebuilding of the toll lines between Bisbee and Naco.

KINGMAN, ARIZ.—The Desert Power & Water Company is making improvements to its plant at a cost of about $75,000. The output of the plant will be doubled and one of its transmission lines extended about six miles.

MIAMI, ARIZ.—Extensive additions are being made to the plant of the Miami Copper Company, including the installation of a new concentrator and a large pumping station, operated by electricity, located three miles distant. It is understood that the company will be in the market for equipment in connection with this plant at intervals for some time to come.

HEBER SPRINGS, ARK.—Cyrus F. Crosby, of Heber Springs, Ark., is reported to be in the market for electrical equipment for an $18,000 hotel.

ALHAMBRA, CAL.—Bids will be received until Nov. 26 by Peter T. Anderson, secretary board of trustees, Alhambra City School District, for one 6-hp, horizontal gas engine, standard make; one 2¾-kw generator, to supply 50 lamps, standard make; same to be installed with all necessary pulleys and belting at the Ramona School, the High School, Garfield Avenue School and the Marengo Avenue School.

ANDERSON, CAL.—Five carloads of machinery consigned to the Northern California Power Company have arrived at Anderson, which will be hauled by traction engines to the new power plant of the company, located at Coleman, on Battle Creek, five miles from Ball's Ferry. It is expected to have the plant in operation by next June. The plant will have a generating capacity of about 16,000 hp and will increase the total output of the company to 47,000 hp.

BAKERSFIELD, CAL.—The San Joaquin Light & Power Company expects to have its new substation, located at Twenty-fourth Street and Union Avenue, ready for operation soon. The station will be equipped with a 750-kw generator and Curtis turbine with boilers and other auxiliaries, which will increase the output of the company by 1000 horsepower. Another 200-kw. generator will be installed in the substation within two months.

CHICO, CAL.—It is reported that plans are being considered to enlarge and extend the power plant of the Sacramento Valley Power Company in Chico. Charles Leege, of San Francisco, president of the Central Traction Company, is interested in the company.

FRESNO, CAL.—Preparations are being made by the San Joaquin Light & Power Company to begin work on the erection of its transmission lines from Fresno through the oil fields to Bakersfield, Cal., early in November. It is proposed to run a loop from the plant near Fresno through the oil fields by the way of Bakersfield, returning through Coalinga. The work will begin simultaneously at Fresno and at Bakersfield and will not be completed until next spring. The company is also planning to extend its transmission lines from Fresno to the King's River rock crushing plant, located at the end of the Santa Fe extension line, now under construction. A. G. Wishon is general manager.

[illegible] Plans have been prepared by H. H. [illegible], city engineer, for the erection of a new municipal electric plant in Lodi. It is understood that plans have been approved and bids will be called for in the near future.

LOS ANGELES, CAL.—Preparations are being made by the Los Angeles-Western Railway Company for the construction of an electric railway between Hermosa Beach and Culler, for which, it is said, rights of way have been secured.

MARICOPA, CAL.—Surveys are being made for the Pine Mountain Water Company for the construction of a large water main from the headquarters of the Quyama, near Ozena, into the West Side fields, just back of Maricopa, for the purpose of supplying water to the towns of the West Side oil fields. The water line will be about forty miles in length. The water will be used also to generate electricity for use in the fields as well as for domestic purposes.

OROVILLE, CAL.—Notice of appropriation of 40,000 miner's in. of water in French Creek has been filed by O. M. Enslow, of Berkeley, Cal., engineer, to be used for power purposes. A dam 100 ft. high and 600 ft. long at its crest will be built, and the water carried by a flume to the proposed plant.

OROVILLE, CAL.—Notice of appropriation of 20,000 miner's in. of water in the middle fork of Feather River has been filed with the State Engineer by H. L. Gradon, of Thermalito, Cal., civil engineer, to be diverted by a dam about one-fourth of a mile below Brush Creek and carried by tunnel, flume and ditch, to be used for irrigation and power purposes.

OROVILLE, CAL.—It is reported that plans are being considered by the Great Western Power Company for the development of a large power project, for which preliminary surveys are being made. The project includes the construction of a tunnel, four miles in length, from Bartees Bar to Big Bar, on the north fork of the Feather River. The cost of construction of the tunnel is estimated at $10,000,000.

PORTOLA, CAL.—Plans are being considered for the installation of an electric lighting plant and water works system in Portola. W. J. Crawford, I. G. Lane and Charles T. Tyre have located 40,000 in. of water on Grizzley Creek, about three miles above Portola, where it is proposed to locate a power plant and pipe the water into the city. Work will begin immediately on construction of the dam. A temporary plant will be installed at once and will probably be ready to put in operation the latter part of December.

SANTA ROSA, CAL.—Application has been made to the City Council by Fred J. Bertolani to erect a fireproof building in the rear of the Bismarck restaurant, which will be equipped with an electric generator and gasoline engine. The proposed plant will furnish electricity for 1000 lamps of 16 cp.

TIBURON, CAL.—Bids will be received until Dec. 3 at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing and installing at the United States Navy Coal Depot, Tiburon, Cal., two boilers, one boiler feed pump, steel stack, motor generator set, one transformer, switchboard, wiring, piping, etc., and installing a generating unit to be furnished by the government, as per specifications No. 1756. The cost of the work is estimated at $25,000.

COLORADO SPRINGS, COL.—The City Council has passed an ordinance requiring all electric wires to be removed from Tejon Street within six months.

DENVER, COL.—The Primos Mining & Milling Company is installing a steam auxiliary steam power plant at the Primos Mill in Lakewood. The company is constructing a large hydroelectric power plant near Nederland in Boulder Creek, where about 1100 horsepower will be developed to supply electricity for the two mills of the Primos company and for its proposed railway and other industries. The company has secured the right of way and has purchased locomotives for a train, about twelve miles in length, to connect the mines and mills with the Denver, Boulder & Northwestern Railroad.

GUNNISON, COL.—It is reported that plans and specifications are being prepared by Burns & McDonnell, Kansas City, Mo., for improvements to the municipal electric light and water works plants. It is proposed to develop the water-power of the Gunnison River to operate both plants.

LA JUNTA, COL.—The Pueblo Suburban & Traction Company has purchased the controlling interest in the La Junta Electric Company, of La Junta, Col. It is understood that improvements will be made to the system, including a reorganization of the distributing system and other changes.

PUEBLO, COL.—The city is installing about three miles of conduit and nine miles of cable in connection with the underground fire alarm telegraph system in Pueblo.

WINTERS, COL.—Plans are being made to build additional lines and improve the Farmers' telephone system, which is operating in the vicinity of Winters, in Yolo and Solano Counties.

TIVERTON, CONN.—The Tiverton [illegible] Company has applied to the Town Council for a franchise to erect electric transmission lines on the streets and highways of Tiverton. D. H. Kimball is superintendent.

WESTBROOK, CONN.—W. J. N[illegible] purchased the old Chapman mill property, is contemplating the installation of an electric light plant to supply electricity for lighting the town and shore.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the superintendent of the State, War and Navy Department Building, Washington, D. C., until Dec. 13 for installing an electric system for the State, War and Navy Department Building. Plans and specifications for the above work will be furnished upon application, for which a deposit of $100 will be required which will be refunded upon return of the plans in good condition. Lieut. U. S. Grant, third, is superintendent.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 22 for furnishing at the navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 3029, 2550 lb. of seamless copper tubing. Bids will also be received at the same place until Nov. 29 as follows: Mare Island, Cal., Schedule 3048, 2500 ft. steel tubing; twelve motor end drills. Newport, R. I., Schedule 3051, two turbine generator sets and two motor generator sets. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—The commissioners of the District of Columbia are considering the question of installing an electric plant to supply electricity for lighting the streets and public buildings in the District of Columbia. It is proposed to develop the water-power of Great Falls on the Potomac River, about fifteen miles above Washington, D. C., where it is estimated that about 6400 hp could be developed without storage of water and 8650 hp with such storage. An approximate cost of the plant, including hydraulic and electric plants, power houses, transmission lines, conduits, lamps, etc., is estimated at $[illegible]. An appropriation of [illegible]10,000 will be asked for making surveys, etc. The cost of street lighting for the District of Columbia is about $500,000 per year.

JACKSONVILLE, FLA.—The City Council is considering the question of requiring all companies using electric wires to place them underground. It is proposed to allow three years to put the wires underground in the business district and five years in the surrounding section.

AMERICUS, GA.—At the election held Nov. 8 the proposition to [illegible] in bonds for the construction of an electric light plant and other municipal improvements was defeated.

ATHENS, GA.—The installation of an ornamental lighting system in the business district in Athens is under consideration. It is understood that the business men will install the lamps and the Athens Railway & Electric Company will supply electricity for operating the system.

ATLANTA, GA.—The Solomon-Norcross Company, engineers, has been engaged to take charge of the installation of an electric light plant in the Fulton County almshouse.

ATLANTA, GA.—The Blue Ridge Power Company, [illegible] in [illegible]all County, has applied to the State Railroad Commission for permission to issue $50,000 in capital stock and $1,375,000 in bonds.

ATLANTA, GA.—Application has been made to the State Railroad Commission by the Wofford Shoals Light & Power Company for permission to issue $70,000 in capital stock and $100,000 in bonds. The company is located in Habersham County, Ga.

ATLANTA, GA.—The Georgia Power Company has applied to the State Railroad Commission for authority to issue $10,000,000 in bonds [illegible] common stock, [illegible] for the development of a number of properties on the Chattahoochee River, and [illegible] the Etowah and Tallulah Rivers. Application was also made [illegible]ission to issue $1,370,000 in bonds and $50,000 in capital stock [illegible] Blue Ridge Electric Company. It is stated that this company [illegible] a holding company for the Georgia Power Company, and as the [illegible]ent of the latter company goes forward the bonds isued by the [illegible] Ridge Electric Company [illegible] hands of the Georgia Power Company. The company states [illegible] contract has been awarded for the first development to be com[illegible] by July 1, 1912, and that others are to follow at periods of about [illegible] months. C. Elmer Smith is president of the company.

[illegible]IRO, GA.—It is reported that the question of enlarging the municipal [illegible] light plant is under consideration.

[illegible]OUGLASVILLE, GA.—The proposition to issue $20,000 in bonds, the [illegible] will be submitted to a vote at an election to be held Nov. 28.

[illegible]ACON, GA.—The Brown Wagon Company has entered into a con[illegible] with the Central Georgia Power Company to supply electricity to [illegible] plant.

[illegible]ONTICELLO, GA.—Contracts have been awarded for machinery for [illegible] Cotton Mill for a [illegible] equipped [illegible] electric motor drive.

[illegible]OULTRIE, GA.—[illegible] the [illegible] electric plant, for [illegible] awarded

[illegible]OCKY FORD, GA.—Plans are [illegible] Maynard, of Rocky Ford, [illegible]

ment of the Ogeechee River Electric Power Company, which will include the construction of three reinforced dams and three power houses, all to be of reinforced concrete construction, to be equipped with water wheels, gates, governors, generators, switchboards, transformers, wiring and electric cranes. The cost of the entire work is estimated at $1,200,000.

CHARLESTON, ILL.—Marshall E. Sampsell, president of the Central Illinois Public Service Company, of Mattoon, Ill., has submitted a proposition to supply electricity to operate the pumping station of the water works system at a saving of from $1,500 to $2,000 per year. The plan proposed by Mr. Sampsell calls for the erection of a standpipe, having a capacity of 200,000 gal. of water, in the central part of Charleston and the erection of a power station on the river and the installation of two sets of pumps, one set to be held for emergencies.

EDWARDSVILLE, ILL.—The City Council has passed an ordinance authorizing a contract with the Madison County Light & Power Company for street lighting for a term of ten years.

GARY, IND.—The construction of an electric railway to connect Gary, Chesterton and Whiting is said to be under consideration. C. H. Geist is reported to be interested in the project.

GOSPORT, IND.—The Gosport Electric Company, it is reported, will soon ask for bids for the construction of an electric light plant. Charles Abraham is secretary.

INDIANAPOLIS, IND.—Steps will be taken to introduce a bill in the next Legislature allowing cities throughout the State to own and operate their own water and electric light plants and to issue bonds on such plants.

LADOGA, IND.—The W. F. Epperson Circle Heating & Lighting Company, of Ladoga, Ind., has changed its name to the Ladoga Light Company.

MONTICELLO, IND.—The Monticello Electric Company is reported to be preparing plans for the construction of a new power plant in the spring.

RUSHVILLE, IND.—The contract for installing new boilers in the municipal electric light plant has been awarded to the Heine Safety Boiler Company, of St. Louis, Mo., for $11,068.

DAVENPORT, IA.—The Tri-City Railway Company has commenced work on the extension of its Twenty-seventh street line in Davenport.

FORT MADISON, IA.—Arrangements are being made by the Keokuk & Hamilton Water Power Company to begin work on installation of a second plant above Fort Madison.

LOGAN, IA.—Preparations are being made by the Bullock Public Service Company to extend its telephone line from Logan to Magnolia.

MANCHESTER, IA.—The Delaware County Telephone Company is replacing the original old Farmers' Mutual telephone lines near Ryan with its own system. These lines were constructed several years ago by individuals forming companies and building their own private lines.

OELWEIN, IA.—The plant and holdings of the Oelwein Light, Heat & Power Company are reported to have been purchased by R. W. Saunders and others, of Chicago, Ill. It is understood that the new owners will erect a new power house and install a curb system of lamps.

SEYMOUR, IA.—Preparations are being made to rebuild the municipal electric light plant, which was recently destroyed by fire.

CHASE, KAN.—The City Council has engaged J. Kent White, electrical engineer, to prepare plans and specifications for an electric light plant and water works system. The cost of the plant is estimated at $20,000.

COLDWATER, KAN.—Plans for the installation of an electric light plant and water works system in Coldwater have been prepared by the J. S. Worley Company, of Kansas City, Mo., consulting engineer.

STAFFORD, KAN.—Plans have been prepared by the J. S. Worley Company, of Kansas City, Mo., consulting engineer, for improvements to the electric light plant and water works system in Stafford.

LEXINGTON, KY.—The Lexington Interurban & Street Railway Company is reported to be contemplating the construction of an electric plant, at a cost of about $300,000, for which surveys are being made.

LEXINGTON, KY.—Owing to the unsatisfactory street lighting service furnished by the Lexington Utilities Company, it is said that Mayor Skain will recommend that the city grant a free franchise to some reliable company as an inducement to install an adequate electric system to supply electrical service to the city and to private consumers. The present contract for street lighting with the Lexington Utilities Company will expire in March, 1911.

LOUISVILLE, KY.—The Louisville Railway Company has applied for a franchise to build an extension of its railway in Louisville.

MIDWAY, KY.—The citizens on Nov. 8 voted to authorize the City Council to issue bonds to the amount of $6,000, the proceeds to be used for the purpose of establishing an electric light plant in Midway.

BALTIMORE, MD.—It is reported that plans are being prepared by Dietrich Brothers, 346 North Street, Baltimore, Md., for the erection of a structural shop on the block bounded by Pleasant and Davis Streets, which will include the erection of three buildings. The equipment will include [illegible] span.

BOSTON, MASS.—Sealed bids will be received by Louis K. Rourke, Superintendent of Streets, Room 47, City Hall, Boston, Mass., until Dec. 24, for lighting the streets of the city for a period of ten years from [illegible] approximately 10,000

[illegible]

incandescent electric lamps in addition to the incandescent lamps now maintained under the existing electric lighting contract, or for the extension of the existing electric contract for a term of ten years from Jan. 31, 1911. Items B, C, D and E each call for the installation and maintenance of 10,000 gas lamps with incandescent mantle burners. Items A, B and C to also include the maintenance of approximately 210 fire alarm signal lamps. The city will supply the lamp posts.

COLRAIN, MASS.—The management of the Colrain Electric Light Company was taken over by the Greenfield Electric Light & Power Company on Nov. 1. Electricity for operating the local system will be supplied from Shelburne Falls as soon as the transmission line is completed.

GARDNER, MASS.—Plans have been completed for the construction of two new buildings for the Central Oil & Gas Stove Company at Gardner, Mass. The new plant will be equipped for electrical operation throughout.

ORANGE, MASS.—The hydroelectric plant of the Athol Gas & Electric Company at Wendell Depot has been completed. The work has been under way for a period of fifteen months and includes a large dam, new power house and bridges involving an expenditure of about $200,000. The new plant will have an output of about 1000 hp and will supply electricity to the towns of Orange, Erving, Wendell and Athol.

WOBURN, MASS.—The Board of Public Works has decided to have the street lamps burn all night instead of until 12:30 a. m. The new service went into effect Nov. 1, 1910, and will cost the town $16,519, which is about $3,403 more than the present service. The Edison Electric Illuminating Company of Boston, Mass., owns and operates the street lighting system in Woburn.

WORCESTER, MASS.—The O. C. White Power Company, 15 Hermon Street, Worcester, Mass., is reported to be in the market for a 125-hp Corliss engine.

BAY CITY, MICH.—Plans are being prepared by the Matthew Lamont Company, of Bay City, Mich., for the erection of a new factory building, 96 ft. x 154 ft., three stories high. The company, it is understood, will require power and wood-working machinery, an electric lighting system, steam heating plant, etc.

BIG RAPIDS, MICH.—The joint committee has decided to recommend to the Council that the question of purchasing the electric light plant of the Big Rapids Electric Company be submitted to a vote at an early date. It will be necessary to expend $30,000 to enlarge the power plant to operate the water works. It is proposed to have the city own its lighting plant and operate the water works by electricity.

CARO, MICH.—Plans are being made to organize a company under the name of the Detroit, Bay City & Northwestern Railway to construct an electric railway to connect Detroit, Utica, Romeo, Almont, Imlay City, Burnside, North Branch, Mayville, Caro and Bay City. From Burnside a branch will be built reaching Marlette, Bad Axe and Harbor Beach.

DAVISON, MICH.—At an election held recently the proposition to issue bonds for the installation of an electric light plant was carried.

DETROIT, MICH.—It is reported that the Detroit Edison Company is contemplating making extensive additions to its plant and system.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company is planning to establish a north end branch exchange at Plainfield and Cort Avenues about Jan. 1, 1911. The equipment will cost about $8,000 and will provide for 1500 lines.

MUSKEGON, MICH.—The Muskegon Traction & Lighting Company has secured an injunction against the city preventing the sale of $75,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

PONTIAC, MICH.—The Pontiac Motor Cycle Company is erecting a large plant in Pontiac, Mich., for the purpose of manufacturing motor cycles. The company is now erecting three large buildings, one 45 ft. x 208 ft., another 55 ft. x 100 ft. and the third 55 ft. x 128 ft. The plant will be equipped for electric motor drive throughout. Robert M. Brownson is president and general manager.

BRAINERD, MINN.—Preparations are being made by the Northwest Paper Company for the construction of a new manufacturing plant, which will be equipped for electric motor drive throughout.

CANBY, MINN.—The contract for electrical equipment for use in operating sewage pumps, bids for which were opened Nov. 3, has been awarded to the Marshall Electric Company, of Marshall, Minn., for $1,268.

CHISHOLM, MINN.—The Mesaba Range Power Company, which has recently acquired the property of the Range Power Company in Chisholm, is reported to be contemplating further hydroelectric power development.

KEEWATIN, MINN.—The contract for the construction of a brick power house for the new power plant has been awarded to C. A. Kilander, of Hibbing, Minn., for $4,650, and the contract for electrical equipment to the Enterprise Manufacturing Company, of Minneapolis, Minn., for $4,264.

ST. PAUL, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, Minn., for the construction of a main engineering building and an experimental engineering building for the College of Engineering, University of Minnesota, Minneapolis, Minn., lating and the electrical work and fixtures in accordance with plans and specifications prepared by Clarence H. Johnston, 715 Capital Bank Building, St. Paul, Minn. Bids will be received collectively and separately, to be submitted only on form supplied by the architect. Copies of plans and specifications may be seen at the Builders' Exchange, St. Paul, Minn.; Builders' Exchange, Minneapolis, Minn.; at the office of the dean of the College of Engineering, University of Minnesota, Minneapolis, Minn., and at the office of the State Board of Control.

WINONA, MINN.—The question of establishing a municipal electric light plant in Winona is under consideration.

BROOKHAVEN, MISS.—Bids will be received by the City of Brookhaven, Miss., until Nov. 22 for one compound condensing, high-speed 200 r. p. m. Corliss valve type engine for direct connection to a 200-kva, alternating-current generator, steam consumption stated for operating ½, ¾, 1, 1½ loads at 90 per cent, power factor, 24-in. vacuum, 140 lb. steam. Chester Byrne is city clerk.

GULFPORT, MISS.—Plans are being considered by the Pan-American Mining Company, of Gulfport, Miss., which is developing a group of mines in Mexico, for the installation of a concentrating plant in the near future to serve its various properties. It is expected that electrical power will be used throughout.

LEXINGTON, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 19 for the construction of the United States post office building at Lexington, Mo., complete, including plumbing, gas piping, heating apparatus and electric conduits and wiring, plans and specifications for which may be obtained at the above office or from the custodian of site at Lexington, Mo. James Knox Taylor is supervising architect.

BLUE HILL, NEB.—The Village Board has awarded the contract for the construction of a municipal electric light plant to the Alamo Engine & Supply Company, of Omaha, Neb., for $8,500. The plant will be driven by steam power and the equipment will include an 85-hp boiler and engine with a rating of 75 hp. The plant is to be completed in ninety days.

FREMONT, NEB.—The Fremont Gas & Electric Light Company has awarded the contract for the construction of a new power house 30 ft. x 80 ft. to Richards, Keene & Company.

VALPARAISO, NEB.—D. M. Deane, of Lincoln, Neb., is reported to have submitted a proposition to the City Council to furnish water or steam power from the Valparaiso mills to operate an electric lighting system in Valparaiso.

TONOPAH, NEV.—Arrangements are being made to install a 2-ton skip and a 100-hp electric motor at the West End mine to replace the steam hoisting equipment.

CONCORD, N. H.—The Coos Telephone Company has filed a certificate with the Secretary of State showing an increase in capital stock to $153,000.

CONCORD, N. H.—Surveys are being made by the Concord Electric Company for the erection of a transmission line from its plant at Sewall's Falls over the interval and plains, through East Concord and toward Chichester.

ALBUQUERQUE, N. M.—Investigations are being made by J. W. Billingsley, manager of the Fred A. Jones Company, of New Orleans engineer, with a view of installing a large electric plant in the Tularosa Valley for furnishing power to pump water for reclaiming large areas of unused lands.

ALBUQUERQUE, N. M.—Plans are being made by the Federal Light & Traction Company, which controls the Albuquerque Electric Power Company, for extensive improvements to the local plant, which will involve an expenditure of about $200,000. The company proposes to furnish electricity to the farmers throughout the valley, to extend lease, or purchase lands from the American Lumber Company for power plant site, to lift the city's water supply if necesary.

ROCHESTER, N. Y.—Bids will be received by J. S. Mullan, secretary of board of education, until Nov. 21 for furnishing and installing [illegible] lamps, wiring and fixtures for School 33, located on Grand Avenue.

ASHEVILLE, N. C.—The American Cotton Goods Company, which is planning to remove its plant from Owosso, Mich., to Asheville, N. C., has secured a building and the machinery of the company will soon arrive. The plant will be operated by electricity. D. K. Salisbury is general manager.

CASSELTON, N. D.—The plant of the Casselton Electric Light Company has been purchased by Lloyd Lynch and Chester Hallett, who, it is said, will repair and reopen the plant.

CARRINGTON, N. D.—Bids will be received by the Board of Commissioners until Nov. 28 for installing lighting fixtures for the new court house now being constructed. Buechner & Orth are architects.

CADIZ, OHIO.—We are informed that contracts have been awarded by the Wheeling, Cadiz & Tuscarawas Traction Company for the construction of its proposed electric railway, sixty miles in length, to connect Wheeling and Georgetown and intervening towns. The power station will be located about half way between the terminals. The company will also furnish electricity for lamps. The capital stock is to be increased from $10,000 to $1,200,000 and the bonded indebtedness increased to $1,200,000. A. Evans Townsend of Doylestown, Pa., is gen

CINCINNATI, OHIO.—The N[illegible] Company, [illegible] Baymiller Street, Cincinnati, Ohio, w[illegible] kw. 200-volt, direct-current generator direct connected to engine.

CLEVELAND, OHIO.—The N. J. Rich Knitting Company is erecting a large factory building, 100 ft. x 360 ft., four stories high. As yet it has not been decided whether a power plant will be installed or whether power will be supplied by a commercial company.

FULLERTON, R. D. NOVELTY, OHIO.—The Fullerton Independent Telephone Company, recently incorporated, is planning to take over all the telephone lines between South Portsmouth and Tygart, and proposes to extend the line to Greenup. E. E. Fullerton, G. W. Davis and others, of Fullerton, are interested in the project.

NEWARK, OHIO.—The Newark Telephone Company has purchased a site north of North Street, on which it will erect one of the three sub-exchanges it proposes to build in connection with the new automatic system.

SIDNEY, OHIO.—Bids will be received by the City of Sidney, Ohio, until Nov. 21 for an electric light and power franchise in this city. S. S. Wyer, Harrison Building, Columbus, Ohio, has prepared plans for a street lighting system and drawn up a franchise grant for supplying electricity for public and commercial lighting and for power purposes.

WARRENSVILLE, OHIO.—Bids will be received at the office of C. A. Marvin, secretary of the director of public safety, No. 109 City Hall, Cleveland, Ohio, until Nov. 18, for furnishing and installing a steam and electric generating unit, switchboard and appliances for the service quadrangle, Colony Farm, Warrensville, Ohio. Plans and specifications may be seen and blank proposals can be obtained at the above office.

CHEROKEE, OKLA.—The City Council is reported to be contemplating enlarging the electric light plant and water works system.

FORAKER, OKLA.—C. A. Rees is reported to have secured the contract for an electric light system in Foraker.

OKLAHOMA CITY, OKLA.—The Bartlesville Oil Refining Company, of Oklahoma, Okla., is reported to be in the market for electrical equipment for 200 lamps.

WOODWARD, OKLA.—Judge John H. Cotteral, in the United States Circuit Court, has denied the injunction asked by the Woodward Cotton Company and has dissolved the temporary order restraining the City of Woodward from selling the bonds for the purpose of installing a lighting system. The city is now advertising the bonds for sale.

HILLSBORO, ORE.—The county court has granted the Independent Electric Company a franchise to erect transmission lines on the county road from Oak Park to Hillsboro and from Hillsboro to Orenco and Beaverton.

PORTLAND, ORE.—The property owners on Stark Street have organized the Stark Street Improvement Association for the purpose of installing an ornamental street lighting system on Stark Street from the river to Burnside Street and on the latter street as far as Washington Street.

AVONDALE, PA.—The Elk River Light, Heat & Power Company, of Newark, Del., is reported to have applied for a franchise in Avondale.

CORAOPOLIS, PA.—The citizens on Nov. 8 voted to issue bonds for improvements to the municipal electric light plant and water works system.

HAZLETON, PA.—It is reported that plans are being considered to construct an electric railway to [illegible] Berwick, Nescopeck, Wapwallopen, Beech Haven and Hobbie. The proposed railway will connect at Hobbie with the Wilkes-Barre & Hazleton Railway of Hazleton, Pa.

HOMESTEAD, PA.—Sealed proposals will be received by D. T. [illegible]welson, secretary of Homestead School Board, until Nov. 23, for electric wiring of the new Central School Building, and electrical fixtures for same. Bids for wiring and fixtures must be submitted separately. Plans and specifications can be secured at the office of the secretary, 303 Eighth Avenue, Homestead, Pa.

MILTON, PA.—Plans have been prepared by the Lewisburg, Milton & Watsontown Street Railway Company to extend its service to Lewisburg. It is proposed to equip the tracks of the [illegible] & T[illegible] Railroad Company for electrical operation between Montandon and Mifflinburg, a distance of ten miles, the contract for which has been awarded to the Simplex Surface Contact Company. Electricity for operating the [illegible] will be supplied from the [illegible] plant [illegible] to be built at Vicksburg.

PEN ARGYL, PA.—The telephone lines in the Pen Argyl and Wind Gap districts were badly damaged by the recent storm, causing a loss of about $5,000; the damage to the lines in the Slate Belt district will reach about $10,000. The local service will be out of commission for [illegible] two weeks. A cable containing 100 wires will be placed on new [illegible] to replace the old system of sixty separate wires between Pen Argyl and Wind Gap.

TACONY, PA.—The contract for the construction of the [illegible] boiler house of the power plant of the Frankford, Tacony & Holmesburg Traction Company, at Tacony, has been awarded to the Charles McCaul Company.

WOODLAWN, PA.—Plans are being considered by the Jones & Laughlin Company for the construction of an electric railway to furnish better transportation facilities for its employees. The company will be [illegible] the Woodlawn Southern R[illegible] Company, [illegible] will form a complete circuit of approximately seven and one-half miles, passing along Franklin Avenue to the borough line in the direction of New Sheffield, over the Woodlawn-Aliquippa road to Woodlawn and above the Pittsburgh & Lake Erie Railroad from the present station to the south of the borough. It is proposed eventually to extend the railway to South Heights and possibly to New Sheffield.

SAN JUAN, P. R.—The Porto Rico Railways Company has engaged the Ambursen Hydraulic Construction Company as engineer to take charge of the construction of a dam 125 ft. high and 350 ft. long for impounding storage water for its present hydroelectric power plant, located near San Juan, work on which will commence immediately.

HIGHMORE, S. D.—A. J. Wixson, manager of the Stella Light, Heat & Power Company, of Stella, Neb., is reported to have applied for a franchise to install an electric light plant.

PIERRE, S. D.—The Nebraska Telephone Company is preparing for the extension of a copper circuit from Rapid City to Pierre and to connect with its system in the Black Hills section.

PLATTE, S. D.—F. J. Miller is reported to have been granted a franchise to purchase the local electric light plant or install a new one.

SIOUX FALLS, S. D.—The Sioux Falls Light & Power Company is making extensive additions and improvements to its plant, including the installation of boilers with a rating of 1000 hp, a main steam pipe line and feed-water heater having a capacity of 1250 hp, and the erection of a smokestack 140 ft. high. The cost of the work is estimated at $50,000.

ERIN, TENN.—The Houston Telephone Company, recently incorporated, has purchased local telephone lines, including 200 telephones. It is understood that the company proposes to improve the system, erect additional lines, and install additional exchanges. A. J. Mitchum is president.

BEAUMONT, TEX.—Lynn H. Dinkins, of New Orleans, president of the Beaumont Traction Company, has notified the City Council that the franchise recently granted the company for its proposed electric railway will not be accepted. The chief objection is the clause requiring the company to light the streets occupied by its tracks.

BROWNSVILLE, TEX.—It is reported that application will soon be made to the City Council by Theodore Stegner, of Kansas City, Mo., for a franchise to construct and operate an electric light and power plant and street railway system in Brownsville, Tex.

DALLAS, TEX.—It is reported that the Trinity Valley Traction Company, which proposes to construct an electric railway from Dallas to Palestine, Tex., 100 miles in length, will soon complete locating the route. One of the power plants will be located in Dallas. J. W. Watkins, of Dallas, is interested in the project.

DECATUR, TEX.—The local electric light plant, owned by E. H. Baumguertner, has been purchased by F. A. Mabee, who, it is said, will make improvements to the plant.

HOUSTON, TEX.—The Bay Shore Rapid Transit Company has purchased cross ties and other material for its proposed interurban railway between Houston and points on the bay shore.

HOUSTON, TEX.—The Houston Electric Company has commenced work on the extension of its Fannin Street line to Westmoreland. It expects to have the railway in operation about Dec. 1.

HOUSTON, TEX.—Arrangements have been made for the installation of a water and light plant on the Bellaire town site, located on the Westmoreland farm tract, south of Houston. The two plants will be combined and will cost about $30,000.

JOURDANTON, TEX.—C. S. Young, of San Antonio, Tex., is reported to be interested in a project to construct an electric railway from Jourdanton to Pleasanton, Tex. The railway will be known as the Bonita Valley Rapid Transit Railway.

LAMPASAS, TEX.—The plant and holdings of the Lampasas Light & Power Company have been purchased by E. Habe, owner of the Lampasas ice factory. It is understood that the two factories will be consolidated.

SAN ANGELO, TEX.—Preparations are being made by the San Angelo Telephone Company to construct underground conduits in the business district of the city.

TAYLOR, TEX.—L. E. Walker, president of the Quanah, Seymour, Dublin & Rockport Railroad Company, is interested in a project to build an electric belt railway to connect the different industrial plants and steam railroads in Taylor.

TYLER, TEX.—The Cotton Belt Railroad Company is installing an electric light and power plant in Tyler to provide electricity for lighting and operating the machinery of its shops, which have recently been erected at a cost of about $[illegible].

VERGENNES, VT.—Plans have been prepared by the Vergennes Power Company for the construction of a hydroelectric power plant at Vergennes, work on which will begin as soon as the company is granted a charter by the Legislature. Parties interested in the project have purchased water rights on Otter Creek in Vergennes and propose to develop same at a cost of $75,000. The company will also erect a transmission line to Burlington at an additional cost of about $25,000. The proposed plant will supply electricity in Vergennes and Burlington and to all towns and villages along the line. Chauncey W. Brownell is one of the incorporators.

CHRISTIANSBURG, VA.—The plant and holdings of the Mont-

[illegible] Electric Company, including [illegible] burg and Cambria, and water plant, mill, etc., at Grayson, Va., have been purchased by J. W. Glass, of Vernon Hill, Va.

VIRGINIA BEACH, VA.—The City Council is reported to be considering the question of granting a franchise for the installation of an electric light plant in Virginia Beach.

ABERDEEN, WASH.—Plans are under consideration for the construction of a telephone line from Aberdeen to Westport.

CUSICK, WASH.—Preparations are being made by M. A. Phelps & Company for the construction of a large timber-cutting plant, which will be equipped for electrical operation.

HARMONY, WASH.—The City Council has adopted plans and specifications prepared by the city electrician for the installation of an electric light plant to cost from $40,000 to $45,000.

MILAN, WASH.—Preparations are being made by the Little Spokane Water Power Company for the construction of a power plant, located about one mile south of Milan, Wash., which will supply electricity in Milan. The cost of the plant is estimated at $25,000. The company will also push the work on its irrigation project, and expects to be prepared to supply water for more than 1000 acres within a few months. The main office of the company is located in Spokane, Wash. C. M. Delamater and John T. McGirl are interested in the project.

SEATTLE, WASH.—The Seattle-Tacoma Power Company has applied to the Board of County Commissioners for a franchise to erect transmission lines on the Indian Ferry-Stuck Valley road. Morton Ramsdell is manager.

WILBUR, WASH.—The Washington Power Company, of Spokane, Wash., is negotiating with the Wilbur Electrical Company for the purchase of its plant in this place. If the deal goes through the Washington Power Company will extend its transmission line into this city.

BELOIT, WIS.—Work on the proposed new central system for the Beloit Home Telephone Company will not be started until next spring. The present plans call for the expenditure of about $100,000, of which $20,000 will be used for the construction of a new exchange building, $30,000 for a new switchboard and the remainder for placing all wires in the city in cables and installing new instruments and other changes. The company is a subsidiary of the Wisconsin Telephone Company.

BLOOMER, WIS.—The Chippewa Valley Railway, Light & Power Company, of Menomonie, Wis., it is reported, will extend its transmission lines to Bloomer to supply electricity for lamps and motors.

KENOSHA, WIS.—The Chicago Brass Company, of Kenosha, Wis., is reported to be contemplating improvements to its plant and will probably be in the market for additional electrical equipment in the near future.

MILWAUKEE, WIS.—The Wisconsin Auto Top Company, it is reported, will require some new machinery for the new addition to its factory, including electric motors.

MILWAUKEE, WIS.—It is reported that the Independent Electric Manufacturing Company, of Milwaukee, Wis., will make preparations during the winter for enlarging its manufacturing facilities and will be in the market for machine tools and other equipment.

MILWAUKEE, WIS.—The American Hydraulic Air Compressor Company, Majestic Building, Milwaukee, Wis., is reported to be contemplating the construction of a large central plant for furnishing power to manufacturing industries in the form of compressed air. A. C. Lingelbach is president.

TOMAHAWK, WIS.—It is reported that contracts will soon be awarded by the Tomahawk Pulp & Paper Company for the erection of a large new pulp mill in Tomahawk, which will be equipped for electric motor drive throughout. It is understood that it will not be necessary for the company to install a new power plant.

WAUSAU, WIS.—Plans are being considered by the Marathon County Telephone Company for the erection of eighteen miles of telephone lines next spring.

CALGARY, ALTA., CAN.—The City Council is considering the question of developing the water power of the Bow and Elbow Rivers in connection with the municipal electric plant.

CALGARY, ALTA., CAN.—Application will be made to the Dominion government for the incorporation of the Alberta Electric Railway Company, which proposes to construct railways from Calgary to Banff, from Calgary to Medicine Hat, via Grand Forks; from Coulee to Lethbridge, from Expanse Coulee to Tabier, thence westerly to Lethbridge and Long Coulee; from Thigh Hills to McLeod, from Calgary to Cariboo, thence to Knee Hill Creek; from Medicine Hat to Wood Mountain, Sask. Stuart & Lathwell, of Calgary, are solicitors.

EDMONTON, ALTA., CAN.—The City of Edmonton has engaged John S. Fielding, of Toronto, Ont., Can., to prepare plans and report on the development of the water power of Grand Rapids.

EDMONTON, ALTA., CAN.—Edmonton is endeavoring to secure co-operation with other towns and cities in this province in bringing influence to bear on the provincial government to take under its control the water-power resources of the province and to develop and operate them under the same principle as the Hydroelectric Power Commission in Ontario.

MEDICINE HAT, ALTA., CAN.—The Alberta Electric Railway Company [illegible] applied to the Dominion government [illegible] charter to install telephone and telegraph lines, to construct and operate light and power plants, to acquire and operate coal mines and to construct and operate an electric railway to connect Medicine Hat, Calgary, Lethbridge, Banff and intermediate towns.

BRANDON, MAN., CAN.—The Brandon Electric Light Company has recently installed a central steam heating plant to supply the business district of the city with heat. The system has proven a success and will probably be extended so as to serve the entire city. E. L. Christie is president of the company.

BRANDON, MAN., CAN.—The City Council has extended the franchise of the Brandon Electric Light Company for ten years with provision that if the city at the expiration of the life of the franchise shall give one year's notice of taking the plant of the company over and does not do so the franchise will be extended for another five years.

DUNNVILLE, ONT., CAN.—The question of securing electricity from Niagara Falls through the Hydroelectric Power Commission is under consideration by the town of Dunnville. A committee has been appointed to meet the commission and private companies with a view of finding the most advantageous arrangements. The transmission lines of the Ontario Power Company and the Cataract company at present extend to Port Colborne, twenty miles distant, and the main line of the Hydroelectric Power Commission is about fifteen miles distant.

ENGLEHART, ONT., CAN.—The town has decided to develop the water power at High Falls to generate electricity to be utilized for lamps and motors in Englehart, for which debentures to the amount of $30,000 will be sold.

GUELPH, ONT., CAN.—The Robert Stewart Company is reported to be preparing plans for the construction of a new building for its plant, which will be equipped with electric-driven machinery.

GUELPH, ONT., CAN.—Niagara power was turned on in Guelph for the first time Nov. 2. The service is furnished by the Hydroelectric Power Commission and it is expected to have the system in operation soon.

RENFREW, ONT., CAN.—Arrangements are being made for the reconstruction of the power plant of the Renfrew Electric Company, which was recently destroyed by fire.

SARNIA, ONT., CAN.—In return for an extension of its franchise for a period of five years the Bell Telephone Company has agreed to erect a new exchange and install a central energy system.

STEELTON, ONT., CAN.—A by-law authorizing an expenditure of $30,000 for the construction of a lighting plant will be submitted to the ratepayers of Steelton.

TORONTO, ONT., CAN.—It is reported that the National Electric & Heating Company will remove its plant from Galt to Toronto, in the spring, where a large building is being erected for the company.

TORONTO, ONT., CAN.—The Board of Control in its report to the City Council has recommended that the Council petition the provincial government to purchase the property of the Bell Telephone Company and also advises the city to seek co-operation of the Ontario Municipal Union and other cities, towns and municipalities to this effect.

WATERLOO, ONT., CAN.—The Hydroelectric Power Commission has completed its system to Waterloo and Niagara power was turned on for the first time Nov. 2.

WOODSTOCK, ONT., CAN.—The transmission line of the Hydroelectric Power Commission has reached Woodstock, by which Niagara power will be supplied to the municipal electric plant. It is expected to have the new system in operation by the middle of the month.

MONTREAL, QUE., CAN.—It is reported that plans are being prepared by the Central Light, Heat & Power Company for the erection of a ten-story building at Notre Dame and St. Peter Streets. A portion of the site is now occupied by the power plant of the company. Finley & Spence are architects.

MAPLE CREEK, SASK., CAN.—Proposals are being asked by the Mayor and Council of Maple Creek for the installation of an electric light and power plant and construction of flour mill in Maple Creek.

ROULEAU, SASK., CAN.—J. D. Whitmore, of Regina, Sask., has been engaged to take charge of the construction of the municipal electric light plant. The proposed plant will cost about $60,000. Work on it will not begin until next year.

EL TIGRE, SONORA, MEX.—Announcement has been made that the transmission line that is being erected from the power plant of the Copper Queen Mining & Smelting Company, at Douglas to El Tigre, a distance of fifty miles, will be completed and will supply electricity for the mines and reduction mills in this section by May 1, 1911.

GUANAJUATO, MEX.—The transmission line of the Central Mexico Light & Power Company, a subsidiary of the Guanajuato Light & Power Company, which extends from the distributing station at Guanajuato to San Luis Potosi, has been completed. The line is about 200 miles in length and will supply electricity for the large smelter and other industries in San Luis Potosi and adjacent territory.

MOCTEZUMA, SONORA, MEX.—Olaf Wenstrom has applied to the federal government for a concession of water rights in the Moctezuma River. It is proposed to erect a hydroelectric power plant.

MONTEMORELOS, NUEVO LEON, MEX.—The Graybill Industrial College of Montemorelos has recently installed an electric power plant. J. R. Low is mechanical engineer of the college.

New Industrial Companies.

THE BATTER EMPORIUMS, of Buffalo, N. Y., have filed articles of incorporation with a capital stock of $50,000 for the purpose of dealing in automobiles, parts and electrical devices for same. The incorporators are: T. P. Meinhard, F. A. Johnson and G. Roleton, all of Buffalo, N. Y.

THE BLACKHAWK ELECTRICAL SUPPLY COMPANY, of Waterloo, Ia., has been organized with a capital stock of $100,000 for the purpose of dealing in electrical supplies. H. G. Rogers is at the head of the enterprise.

THE BROWN AUTOMOBILE & ELECTRIC COMPANY, of New Albany, Ind., has been incorporated with a capital stock of $10,000 by Herman W. Brown, Harry P. Brown and O. C. Thompson. The company proposes to manufacture and sell electrical appliances and supplies of all kinds, to deal in electric and gas motors and automobiles and automobile parts and appliances.

THE COX & BALL SUPPLY COMPANY, of Bainbridge, Ga., has been organized with a capital stock of $10,000 by W. C. Cox and others to deal in general machinery and electrical supplies of all kinds.

THE ELECTRIC MANUFACTURING COMPANY, of Pittsfield, Mass., has filed articles of incorporation, with a capital stock of $25,000, for the purpose of manufacturing electrical machinery. G. W. Euker is president, and J. F. MacDonald, of Pittsfield, Mass., treasurer.

THE ELECTRODE COMPANY OF AMERICA, of Niagara Falls, N. Y., has been chartered with a capital stock of $200,000 for the purpose of manufacturing electrodes and carbon articles of all kinds. The incorporators are: P. L. T. Heroult, A. Stetson and F. White, of New York, N. Y., and W. P. Marseilles, of Niagara Falls, N. Y.

THE GEORGE DRAKE SMITH COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 for the purpose of manufacturing and dealing in all kinds of electrical apparatus. The incorporators are: Thomas H. Beardsley and George Tiernan, 54 Wall Street, New York, N. Y., and John L. Gibson, 25 West Forty-second Street, New York, N. Y.

THE LOEB ELECTRO-CHEMICAL COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Leo Harburger, Savoy Hotel; George M. Turner, 135 Seventy-first Street; Stanley D. Brown, 163 West Seventy-first Street, all of New York, N. Y. The company proposes to manufacture chemicals, electro-plating supplies, dynamos, etc.

THE LUNDIQUIST AUTOMATIC MACHINES COMPANY, of New York, N. Y., has been chartered with a capital stock of $7,500 by Leopold Weiscopf, 30 Church Street; H. Lundiquist, 508 Pearl Street; William W. Tait, 160 Broadway, and M. E. Skerritt, 30 Church Street, all of New York, N. Y. The company proposes to manufacture automatic machinery, tools, etc.

THE LUSTER LIGHT COMPANY, of Chicago, Ill., has been incorporated by F. J. Switzer, C. C. Loder and J. A. Blume. The company is capitalized at $30,000 and proposes to manufacture electric lamps and electric appliances.

THE McCONNELL-BROWNING ENGINEERING COMPANY, of Richmond, Va., has been chartered with a capital stock of $25,000. The officers are: W. H. McConnell, president; M. J. Browning, secretary and treasurer, both of Richmond, Va., and H. R. McConnell, vice-president, of Washington, D. C.

THE MISSOURI BATTERY & LIGHTING COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $300,000 by George F. McClain, Max Morris, H. W. Darby and others.

NEW ENGLAND ENGINE & SUPPLY COMPANY, of Boston, Mass. has been incorporated with a capital stock of $50,000 by James N. Schoonmaker, Maurice W. Carsley, of Winthrop, Mass., and Walter E. Brownell, of Boston, Mass.

THE OAKLEY FOUNDRY & ENGINEERING COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 for the purpose of manufacturing and dealing in machinery, etc. The incorporators are: James G. Gregg, John T. McGovern, Clarence W. Gormley, 41 Broadway, New York, N. Y.

THE OTTO MOTOR CAR COMPANY, of New York, N. Y., has been incorporated by J. J. McDonald, of New York, N. Y.; J. M. Lang and H. A. Bedell, of Brooklyn, N. Y. The company is capitalized at $50,000 and proposes to manufacture motor vehicles, motors, engines, machinery, etc.

THE ROBERTS MANUFACTURING COMPANY has been chartered by Joseph N. Kelly, Louis J. Edmonds, William H. Roberts and Elmer Wetzel. The company is capitalized at $10,000 and proposes to manufacture and deal in carburetors and other mechanical devices.

THE VICTOR MOTOR TRUCK COMPANY, of Buffalo, N. Y., has been chartered by Harry B. Clark, Olin L. Neal, Benjamin E. Neal and M. Miller, of Buffalo, N. Y. The company is capitalized at $250,000 and proposes to manufacture and deal in motor vehicles, engines, etc.

THE WASSON PISTON RING COMPANY, of Bayonne, N. J., has been incorporated with a capital stock of $35,000 by Foster Crampton, 60 Wall Street, New York, N. Y., Robert B. Wasson, Cranford, N. J., Hulbert T. E. Beardsley, 45 Cedar Street, New York, N. Y., and Louis Burstein, 180 Pulaski Street, Brooklyn, N. Y. The company proposes to manufacture piston rings, piston packing, etc.

THE WILKINSON STEAM ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 to manufacture and deal in boilers, engines, pumps, etc. The incorporators are: James C. Hitchcock, Frederick Page, 9 Pine Street, New York, N. Y., and Wilbur B. Wilkinson, 2713 Avenue G, Brooklyn, N. Y.

New Incorporations.

MONTGOMERY, ALA.—The Alabama Traction Company has been chartered with a capital stock of $1,000,000, of which $250,000 has been issued. The company proposes to construct a twenty-five mile electric railway in Montgomery, which will eventually be extended to other towns. Material has already been ordered and work will soon begin. Electricity for operating the railway will be rented. Charles G. Abercrombie, of Montgomery, Ala., is president and general manager and John J. Flowers, of Montgomery, vice-president and treasurer.

CRISFIELD, MD.—The Crisfield Light & Power Company has been chartered with a capital stock of $50,000 by C. Owens, R. R. Layton, of Bridgeville, Del., and J. G. Gray, of Wilmington, Del.

DULUTH, MINN.—The Mesaba Electric Railway Company has been incorporated with a capital stock of $50,000 and proposes to construct electric railways in St. Louis, Itasca and adjoining counties. The officers are Oscar Mitchell, president; W. D. Bailey, vice-president, and F. M. Emanuelson, secretary and treasurer.

CENTRALIA, MO.—Articles of incorporation have been filed for the Centralia Light & Power Company by R. H. Baldridge, S. M. Locke and E. R. Locke. The company is capitalized at $50,000 and is constructing a transmission line fourteen miles in length to connect with the plant of the Mexico Power Company at Mexico, Mo.

ATLANTIC CITY, N. J.—Articles of incorporation have been filed for the National Water Power Company by Walter H. Fierce, John W. Fierce and Malvin Beyer, all of Atlantic City, N. J. The company is capitalized at $500,000.

NEW YORK, N. Y.—Articles of incorporation have been filed for the Gotham Electric Company, of New York, N. Y., with a capital stock of $10,000 by Robert Lecouvre, 51 Vesey Street; Richard C. Fitzgerald and James E. Siers, 48 New Street, all of New York, N. Y. The company proposes to construct and operate telephone and telegraph wires.

WILLIAMSVILLE, N. Y.—The Board of Village Trustees is reported to have granted a franchise to George E. De Galia, of Buffalo, N. Y., to supply electricity in Williamsville.

WELLSVILLE, OHIO.—The Yellow Creek Telephone Company has been incorporated with a capital stock of $1,000 by Robert Boyd, Lawrence Boyd, Homer Faloon, S. J. Jarvis and C. G. Swearengen.

CALUMET, OKLA.—The South Calumet Telephone Company has been incorporated with a capital stock of $5,300 by Frank Hornberger, W. F. Reidener and H. O. McGowan.

PORTLAND, ORE.—Articles of incorporation have been filed for the Central Oregon Irrigation Company with a capital stock of $1,050,000. The new company is a reorganization of the Deschutes Irrigation & Power Company and controls 17,000 acres of land to which water for irrigation has been conducted and 150,000 acres yet to be irrigated. The company proposes to have this large tract of land available for settlement within two years and will secure from $600,000 to $700,000 in additional funds to proceed with the work. The officers of the company are F. S. Stanley, of Portland, Ore., president; A. F. Bliss, vice-president, and Jesse Stearns, of Portland, secretary and treasurer.

HARRISBURG, PA.—Charters have been granted by the Secretary of State to the Glendon Power Company, the West Eaton Power Company and the Williams Power Company. Each company is capitalized at $5,000 and the directors are: Bruce S. Lachlan, of Plainfield, N. J., treasurer; William P. Bray, of East Bangor, Pa.; E. W. Evans, of Easton, Pa., and Edwin C. Weller, of Portland, Pa.

HARRISBURG, PA.—Application has been made to the State Department for charters for eighteen new companies as follows: The Edison Electric Light Company, of Boyertown, Oley Township, Lower Alsace Township, Exeter Township, Earl Township, Douglass Township, Colebrookdale Township, Amity Township, Berne Township, Edison Birdsboro, Edison Pottstown, Lower Pottsgrove, Muhlenbert Township, Ontelaunee Township, Robeson Union Township, Upper Pottsgrove and West Pottsgrove Township. Each company is capitalized at $5,000 and the incorporators are: Walter A. Rigg, George L. Roller, Harry H. Reigel, all of Reading, Pa. It is understood that after the charters are issued all the companies will be merged into one company and the entire territory served by one plant.

MAYESVILLE, S. C.—The Mayesville Telephone Company has been granted a charter with a capital stock of $1,750. The officers are: H. J. Harby, president; G. A. Lemmon, vice-president, and Robert Shelor, secretary and treasurer.

[illegible] chartered with a capital stock of $25,000 by C. G. Foulks, W. M. C. [illegible]

JASPER, TEX.—Articles of incorporation have been filed for the Jasper Electric Company with a capital stock of $5,000 by H. C. Howell, J. H. Seale and O. M. Stone.

JANESVILLE, WIS.—Articles of incorporation have been filed for the Janesville Traction Company with a capital stock of $125,000. T. S. Nolan, who recently purchased the property of the Janesville Street Railway Company at public auction, is one of the incorporators. William Murphy, of Janesville, is also interested in the company. The company proposes to build new interurban railways into the territory surrounding Janesville.

Personal.

MR. HENRY L. DOHERTY will present a paper on "Rates" at the annual convention of the National Commercial Gas Association, to be held in Boston Dec. 5-9.

MR. W. L. ABBOTT, chief operating engineer of the Commonwealth Edison Company, Chicago, was re-elected as a trustee of the State University of Illinois at the election of Nov. 8.

MR. S. W. BORDEN has resigned from the staff of the Tuxedo (N. Y.) Electric Light Company to become electrical superintendent of the Commonwealth Water & Light Company, Summit, N. J.

MR. WILLIAM J. CLARK.—The marriage is announced of Mr. William J. Clark, manager of the traction department, General Electric Company, to Miss Blanche A. McCollum, of Lockport, N. Y.

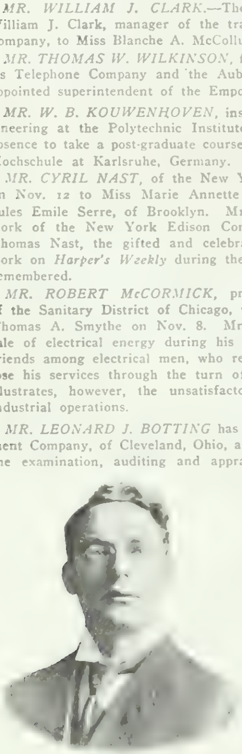
MR. THOMAS W. WILKINSON, formerly with the Missouri and Kansas Telephone Company and the Auburn Telephone Company, has been appointed superintendent of the Emporia (Kan.) Telephone Company.

MR. W. B. KOUWENHOVEN, instructor in physics and electrical engineering at the Polytechnic Institute, Brooklyn, has received leave of absence to take a post-graduate course at the Grossherzogliche Technische Hochschule at Karlsruhe, Germany.

MR. CYRIL NAST, of the New York Edison Company, was married on Nov. 12 to Miss Marie Annette Serre, daughter of Dr. and Mrs. Jules Emile Serre, of Brooklyn. Mr. Nast has charge of the publicity work of the New York Edison Company and is the son of the late Thomas Nast, the gifted and celebrated cartoonist and lecturer whose work on *Harper's Weekly* during the Civil War and after will long be remembered.

MR. ROBERT McCORMICK, president of the board of trustees of the Sanitary District of Chicago, was defeated for re-election by Mr. Thomas A. Smythe on Nov. 8. Mr. McCormick made a study of the sale of electrical energy during his term of office, and he made many friends among electrical men, who regret that the Sanitary District will lose his services through the turn of the political wheel. The incident illustrates, however, the unsatisfactory nature of political control of industrial operations.

MR. LEONARD J. BOTTING has joined the Central Station Development Company, of Cleveland, Ohio, as secretary, and will have charge of the examination, auditing and appraisal work of that company. Mr. Botting was born in England in 1875, coming to this country when about fourteen years old. Prior to his identification with the electrical industry he was associated with financial interests and acquired an extensive knowledge of accounting and bookkeeping. He has had experience with central-station work for many years, and since 1901 has been connected with the Constantine Hydraulic Company, of Three Rivers, Mich., the entire plant of which, including the transmission lines to Three Rivers, White Pigeon and Cassopolis, was built by Mr. Botting. He served this company as secretary and general manager, and has also acted in the capacity of United States receiver [illegible] several financial interests in the West by examining and reporting on hydroelectric and central-station propositions. Mr. Botting has always been an ardent advocate of modern business methods as applied to the central station, and the record of connected load and income per capita at Three Rivers ranks with the best in the country.



[illegible]

MR. W. P. WALLACE, of New York City, has been appointed manager of the Maumee Valley Electric Company, of Toledo, Ohio, to take effect Nov. 1, with offices in the Meredith Building. Since May Mr. Wallace has been in entire charge of the construction of this company's properties along the Maumee River, including the erection of one of the most modern hydroelectric plants in the country and the installation and erection of the complete equipment for high-tension distribution lines to the surrounding cities and towns. Several extensions to the present system are now being contemplated.

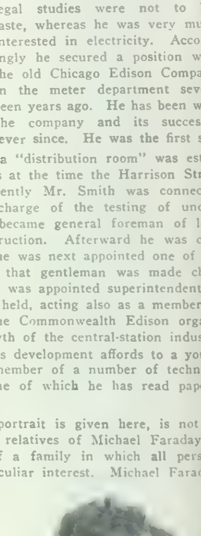
MR. R. E. RICHARDSON, formerly connected with the Kansas City Electric Company, who it was erroneously announced would be connected with the Commonwealth Power Company, of Jackson, Mich., will instead become general manager of the Grand Rapids-Muskegon Power Company, at Grand Rapids, Mich.

MR. S. MORGAN BUSHNELL addressed the regular meeting of the members of the contract department of the Commonwealth Edison Company of Chicago on the evening of Nov. 7. The contract agents took dinner together at a restaurant, and after the transaction of some general business listened to Mr. Bushnell's illustrated account of his recent European trip.

MR. ERNEST F. SMITH, the recently elected chairman of the Commonwealth Edison branch of the National Electric Light Association in Chicago, is at the head of an organization of 485 practical electrical men. He thus occupies a position of no little responsibility, with a large opportunity for helpful work. Mr. Smith is the superintendent of substations of the Commonwealth Edison Company and has charge of 35 substations and 190 men. He was born near St. Charles, Ill., and as a young man came to Chicago to read law. He discovered, however, that legal studies were not to his taste, whereas he was very much interested in electricity. Accordingly he secured a position with the old Chicago Edison Company in the meter department seventeen years ago. He has been with the company and its successor ever since. He was the first substation operator of the company when a "distribution room" was established at the Adams Street headquarters at the time the Harrison Street generating station was built. Subsequently Mr. Smith was connected with the underground department in charge of the testing of underground feeders and mains. He then became general foreman of low-tension underground repairs and construction. Afterward he was connected with the statistical bureau, and he was next appointed one of the assistants of Mr. W. L. Abbott when that gentleman was made chief operating engineer. In 1904 Mr. Smith was appointed superintendent of substations, which position he has since held, acting also as a member of the important advisory committee of the Commonwealth Edison organization. His career exemplifies the growth of the central-station industry in Chicago and the possibilities which its development affords to a young man. Mr. Smith is a student and a member of a number of technical and semi-technical societies, before some of which he has read papers. He is married and has one daughter.

MR. ERNEST F. SMITH.

MR. WALTER FARADAY, whose portrait is given here, is not an electrical man, but as one of the two relatives of Michael Faraday in the United States he is a member of a family in which all persons engaged in electrical pursuits feel a peculiar interest. Michael Faraday, who died in London in 1867, left no direct descendants. He had a brother and two sisters, however, and Walter Faraday is a grandson of Robert, the brother, being thus a grand-nephew of the great Faraday. Walter Faraday is the son of Tertius Faraday, who was the son of Robert. He was born in Birmingham, England, in 1866, but has been a resident of this country since 1887. He was educated at King Edward's School, in Birmingham, and at Hampstead Hill College, near that city. His father, Tertius Faraday, was secretary of the London Coal Exchange for many years. On coming to this country Walter Faraday resided in Rockford, Ill., for a short time, and here he had his only experience with electrical work, being connected for a few months with an arc-lighting plant that was in existence in Rockford at that time. In 1889 Mr. Faraday removed to Chicago and engaged in journalistic pursuits. For a number of years he was connected with the City Press Association, and the fidelity of his court reporting won for him a large circle of friends among judges and lawyers. In 1900 he resigned from the City Press Association to engage in commercial business, and since then he has been connected with several surety companies in Chicago, being now one of the resident managers of a New York surety company. As Mr. Faraday was born just a year before his great-uncle died, he has no recollection of him. He is proud of his illustrious relative, however, and says that he and a cousin, Richard, in San Francisco, are the only members of the family resident in the United States. Mr. Walter Faraday is a member of the Chicago Press Club, the Ridgemoor Golf Club and other clubs, and has a wide acquaintance among the business men of Chicago. He is married and has two children, Benton and Lucy.



MR. WALTER FARADAY.

MR. HARRY F. RAMEY [illegible] ager of the Robbins & Myers Company, of Springfield, Ohio. Mr. Ramey is a graduate of the Washington High School, of Washington, D. C., and in 1892 was graduated from the National University Law School. He entered the government service as a special agent of the Interior Department and resigned Jan. 1, 1902, to connect himself with the late E. W. Gilmer's interests at Warren, Ohio. He represented the Warren Electric & Specialty Company for a time in Indiana and Michigan, and later on became a general representative of this company. At the time the Peerless Electric Company was organized he became associated with that company as general representative, and resigned Jan. 1, 1904, to become secretary and general manager of the Monarch Incandescent Lamp Company, with which he remained until January, 1905, when he accepted a position with the National Electric Lamp Company, of Cleveland, Ohio, as sales manager of the Economy Electric Company, with headquarters at Warren, Ohio. On Jan. 1, 1907, he resigned to accept the position of special representative with the Sterling Electrical Manufacturing Company, where he remained until April 1, 1908, when he became sales manager of the motor department of the Robbins & Myers Company. Mr. Ramey has been lieutenant-colonel of the Fifth Ohio Infantry since May [illegible]

Obituary.

MR. CHARLES A. YERGIN, manager and superintendent of the Public Service Operating Company, of Owatonna Minn., was found dead behind the switchboard of his plant on Nov. 3. But a short time before this discovery Mr. Yergin had gone behind the board to work on the installation of a new regulator. One of the employees came in to get a tool and saw the superintendent busily engaged at his task. This man returned in less than three minutes and found Mr. Yergin stretched on the floor, lifeless. Evidently death was instantaneous. Two doctors were summoned quickly, but their long-continued efforts to restore animation were of no avail. It is believed that in some manner Mr. Yergin received a shock from the 2200-volt circuit at the back of the board. A burn was found on his head and another on the little finger of his right hand. Mr. Yergin was twenty-seven years of age and had been in charge of the plant about a year. He was highly regarded by the people of Owatonna. It is said that on the day of his death he remarked to a friend that there was danger attending the installation of the new regulator, and that some one might get hurt before the job was finished. That he himself should be the victim shows his devotion to his work and his regard for his fellow employees. The body was taken to Goshen, Ind., Mr. Yergin's former home, for burial.

Trade Publications.

CONVEYING MACHINERY.—In its Book No. 96, the Link-Belt Company, Philadelphia, gives numerous illustrations of conveying machinery, arranged with especial reference to its use in sugar refineries.

DIRECT-CURRENT MOTORS.—Steel-frame, direct-current motors, built in all standard sizes for 115 volts, 230 volts, or 500 volts, are described in Bulletin No. 391 of the Triumph Electric Company, Cincinnati, Ohio.

STORAGE BATTERIES.—Bulletin No. 125 of the Electric Storage Battery Company, Philadelphia, Pa., contains a complete description of the storage battery installations used by the Gulfport & Mississippi Coast Traction Company.

NATIONAL METAL MOLDING.—The National Metal Molding Company, Pittsburgh, has issued a new edition of its catalog of metal wiring moldings, which includes several new fittings. Among these are a combination outlet box, a combination twisted elbow and drop tee, and a continuous combination rosette and fixture outlet.

WATT-HOUR METERS.—Much information relating to the constructive details of induction-type watt-hour meters is given in Bulletin No. 125, of the Ft. Wayne Electric Works, Ft. Wayne, Ind. Instruction Book No. 3043 contains numerous diagrams relating to the methods by which these watt-hour meters may be used in various circuits.

RECORDING THERMOMETERS.—Thermometers designed for record- [illegible] Bulletin No. 126 of the Bristol Company, Waterbury, Conn. Numerous illustrations are given of the various types of thermometer bulbs suitable [illegible] numerous industrial processes in which the recording thermometer [illegible]

SINGLE-PHASE MOTORS.—Bulletin No. 14, of the Century Electric Company, St. Louis, Mo., is an illustrated booklet giving much information relative to the constructive features and operating characteristics [illegible] uction type, being provided with a commutator, by means of which the torque under starting conditions is kept at a satisfactorily high value.

AUTOMATIC ELECTRIC TRANSPORTATION.—The Automatic [illegible] t describing its system of transportation, which comprises a series of [illegible] a double steel track of 30-inch gage elevated above the ground. The carriers or motor-cars travel automatically on these parallel rails at any desired rate of speed up to forty or fifty miles per hour.

COMPOSITE TELEPHONE AND TELEGRAPH SYSTEM FOR RAILWAY SERVICE.—The Western Electric Company has issued Booklet T-206 describing its composite telephone and telegraph system for railway service. This system has been devised for the purpose of enabling telephone and telegraph messages to be transmitted simultaneously over grounded telegraph lines. The booklet contains fifty-four pages and is illustrated by many cuts of telephone sets, howlers, coils, condensers, protectors, batteries, line poles and a dozen circuit diagrams.

WATT-HOUR METERS.—The Columbia Meter Company, Indianapolis, Ind., has just issued its revised price list to supplement its type D bulletin. These revised prices took effect November 1, but will not affect existing yearly contracts. The company has also prepared a new bulletin on the subject of its direct-current, rotating-standard test watt-hour meters for checking customers' meters, particularly those of current range between 5 and 20 amp. For this purpose extra wiring and contact plugs have been omitted, making the manipulation of the meter relatively simple.

CENTRAL-STATION ADVERTISING COPY.—The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., has just issued two "Ad Books," Nos. 20 and 21, offering newspaper copy to the central stations booming electrical appliances. No. 20 contains a complete collection of attractive and forceful "ads" covering the Westinghouse company's lines of toaster stoves, disk stoves, irons, luminous radiators, air heaters, bell-ringing transformers and Cooper Hewitt rectifiers. No. 21 contains comprehensive, forceful advertisements of the company's general utility motor. The copy is intended to be of assistance to central-station companies conducting campaigns to build up their day loads.

BUSINESS NOTES.

ROSSITER, MACGOVERN & COMPANY have moved their offices from 90 West Street, New York City, to Claremont and Mallory Avenues, Jersey City, N. J.

CONNECTICUT STEERING WHEEL SWITCH.—Grant, in an Alco, won the Vanderbilt Cup in 1909 and 1910, using a Connecticut steering wheel switch. This little switch on the steering wheel put the absolute control of the car under his thumb without removing his hand from the steering wheel, and permitted him to take the turns and curves with perfect safety.

THE ELLIOTT COMPANY, of Pittsburgh, Pa., has recently acquired the entire business, patents and good will of the Pittsburgh Feed Water Heater Company, Pittsburgh, Pa., and will in the future be the sole manufacturers of the well-known Pittsburgh Feed Water Heater, including the three types, namely, the vertical, horizontal and closed, and will be able to supply heaters in units from 100 hp up to and including 30,000 hp.

PAWLING & HARNISCHFEGER COMPANY.—Owing to the increase of its business in the Pacific Coast territory the Pawling & Harnischfeger Company, Milwaukee, Wis., manufacturer of cranes, hoists and lumber-handling apparatus, has established a branch office in the Washington Building, Portland, Ore. This office will be in charge of Mr. R. K. Morse, for a number of years a member of the engineering staff at the Milwaukee office of the company.

ILLUMINATING ENGINEERING SERVICE.—The Holophane Company is giving much study to the subject of industrial lighting in all its phases and maintains a special bureau, directed by Mr. E. E. Scribner, which is devoted exclusively to this branch of illuminating engineering. As in other departments of lighting, the company offers the services of its industrial engineers without charge to central stations, contracting engineers or consumers who may desire their co-operation in solving mill or factory lighting problems.

WAVERLEY CHICAGO BRANCH.—The gratifying success of the Waverley Electric Vehicle Agency in Chicago has led to the opening of a Chicago branch of the Waverley company temporarily at 1714 Michigan Avenue, but soon to be moved to new and handsome quarters farther south on the same street. Mr. J. C. Cooley, who is in charge of the new branch as manager, has been identified with the Waverley Electric Vehicle Agency since its inception. Mr. Cooley will be assisted by Mr. W. H. Corris, whose experience in the electric vehicle business and personal acquaintance in Chicago will be of much value to the new branch. In addition, there will be an adequate force of salesmen and demonstrators together with as many technical men from the home factory as may be required.

THE MILLAR ELECTRIC COMPANY has been incorporated to carry on an electric heating business, locating at 222-224 South Canal Street, Chicago, where the main office and factory are established. The company is preparing for the Christmas trade an attractive and efficient electric toaster, which it will have all ready for distribution about Dec. [illegible] its field, and it is claimed that its simplicity, general attractiveness and efficiency will recommend it to all toast lovers. After Dec. 1 the company will bring out its other heating appliances, which will include practically a full line. The company will confine itself strictly to a wholesale business, distributing its product only through jobbers and department stores. The officers of the company are: R. M. Millar, president, and Francis Granger, treasurer and general manager.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 7, 1910.

[Conducted by W. H. Boo[illegible], Patent Law, [illegible] St., N. Y. City.]

[illegible] OZONIZER; L. S. Ho[illegible], Newark, N. J. App. filed [illegible] 1, [illegible] [illegible] open glass cylinders spaced apart and concentric and each having a layer of foil with an electrode within the inner vessel.

974,800. SIGNALING SYSTEM FOR RAILWAYS; J. A. Jones, Ward, W. Va. App. filed Nov. 6, 19[illegible]. For [illegible] in the block by means of track sections with signals consisting of dials and pointers constituting a recording mechanism in the cab and bell alarms which are operated by a car-carried generator.

974,812. PROCESS OF MAKING INCANDESCENT ELECTRIC LAMP FILAMENTS; H. [illegible], New York, N. Y. App. filed Apr. [illegible], 1909. Flashes the filament in atmosphere containing hydrogen, oxychlorid of chromium and olefiant gas.

974,838. RECEIVING APPARATUS FOR ELECTROMAGNETIC WAVES; E. H. Smythe, Chicago, Ill. App. filed July 24, 1906. An electrolyte with a cathode and an anode having a very small area and a relatively large area, respectively exposed to the electrolyte and a cathode consisting of a minute wire.

974,838.—Receiver.

974,859. LIGHTNING ARRESTER; W. Butler, Lockport, N. Y. App. filed June 13, 1908. A pole with a horn-type arrester, a magnet, a governing armature with a wire connecting the horn arrester with the magnet, a switch box, a shaft in the box, an insulator disk on the shaft between contacts and carrying a pair of conductors contacting therewith and a motor for driving the shaft.

974,864. RAILWAY SIGNAL; F. L. Dodgson, Rochester, N. Y. App. filed Apr. 23, 1904. Two-blade signal mechanism operated by an electric motor with an electric clutch for each blade consisting of a solenoid magnet which operates a pin to clutch the blade shaft to the signal rod.

974,866. AUTOMATIC TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Aug. 3, 1907. Automatic telephone in which direct selective switches complete the connections by linking local trunk circuits at the exchange with improvements in operating the selective switches.

974,891. METHOD OF MAKING METALLIC FABRIC; M. & L. S. Lachman, New York, N. Y. App. filed Mar. 11, 1909. Forms a projection on a strip, places a member in contact therewith and passes a current through the strip of the member to raise the temperature at the point of contact to a welding heat and then applies pressure.

974,892. METHOD OF MAKING METALLIC FABRIC; M. and L. S. Lachman, New York, N. Y. App. filed Mar. 11, 1909. Forms projections on flat strips, passes a current through them at the point of intersection, the resistance to the passage of the current heating the metal to a welding heat and then applies pressure.

974,920. TROLLEY CATCHER; J. R. Ricketts, Longbeach, Cal. App. filed Sept. 15, 1909. Includes a reel for the trolley rope with a plurality of dogs sliding on the reel and stopped by a stop when the reel moves faster than the dog. A lever projects through the reel casing and is pressed by a spring. The rope is wound around the reel.

974,927. RECEIVING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed Dec. 11, 1906. For wireless, including a wave receiver of normal sensitiveness with means for reproducing a signal and a local producer of high frequency waves for rendering the receiver over-sensitive. The wave receiver is an electrochemical cell.

974,943. ILLUMINATED ANNOUNCEMENT AND DISPLAY SIGNAL; F. W. Wood, Newport News, Va. App. filed June 17, 1908. For producing any numeral by means of elongated lamp cells forming a pair of rectangular frames with a diagonal across one of them, together with rotary drums and guards carrying character-defining positions, which drums act as transmitters.

974,946. INCANDESCENT LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Mar. 4, 1907. A plug lamp socket in which the lamp enters the socket at right angles to the vertical axis of the socket so as to increase the illumination. Details.

974,947. ELECTRIC LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Apr. 11, 1907. A double lamp socket in which each lamp enters the socket at right angles to the vertical axis of the socket or plug to increase the illumination. Details.

974,955. AUTOMATIC TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Nov. 23, 1907. Employs a plurality of selecting switches, including a first selector, a second selector, connector switches and line selectors, the line selectors being connected to a first selector and then temporarily associating the first selector with the calling line by means of automatically controlled apparatus.

974,982. CATENARY OVERHEAD SYSTEM FOR ELECTRIC RAILWAYS; W. A. McCallum, Cincinnati, O. App. filed May 13, 1909. The suspending element is a cable in a vertical plane arranged zigzag between the messenger wire and the trolley, being attached thereto by hooks and ears.

974,985. RECEIVING APPARATUS; F. W. Midgley, Jersey City, N. J. App. filed Feb. 25, 1909. A looped aerial with capacity and inductance in the loop forming a closed circuit, the loop being grounded through either the inductance or condenser and a circuit in inductive relation to the loop, including a wave receiver.

974,986. RECEIVING APPARATUS; F. W. Midgley, Jersey City, N. J. App. filed March 5, 1906. A condenser, the wave responsive device (preferably a primary cell detector) and another condenser are in shunt to the main condenser and the terminals of the circuit are connected to an inductance in the receiving aerial.

975,032. JUNCTION BOX; E. T. Greenfield, Kiamesha, N. Y. App. filed Jan. 16, 1909. Makes use of a screw for securing the conductors in the box, the screw being tapered and extending through a threaded opening so that the side of the screw wedges against the conductor.

975,034. ARC LAMP; P. Hanisch, Cologne-on-the-Rhine, Germany. App. filed Sept. 15, 1908. The electrodes are inclined toward each other downwardly and cross above their lower ends, and automatic means permits movement of one of the electrodes to increase the feed with increased current strength.

975,040. PROCESS FOR REMOVING OXYGEN FROM VESSELS; R. Hopfelt, Cologne-Klettenberg, Germany. App. filed July 14, 1910. For removing oxygen from lamp bulbs by first evacuating them and then mixing in phosphorous-halogen gases with hydrogen to ignite.

975,073. ELECTRICAL HAIR-SINGEING DEVICE; E. A. Roberts and N. L. Johnson, Buhl, Minn. App. filed Jan. 20, 1910. A handle member with a removable head carrying tubes receiving contacts in a cap which connect an electric circuit and heat a wire loop.

975,090. ELECTRICAL COUPLING AND SWITCH; R. H. Wappler, New York, N. Y. App. filed May 25, 1910. An electric coupling and switch for electro-medical use, including a spring finger contacting electrically with the parts so that there is a sliding contact with rotation of the parts between the spring finger and the contacts.

975,105. SEMI-AUTOMATIC TELEPHONE SYSTEM; C. R. Austin, Longbeach, Cal. App. filed April 30, 1907. Central is connected to substations and an automatic subcentral station is provided doing away with an operator, the call being accomplished by removing the receiver from the hook, the call being automatically trunked to one central, where it is manually connected to the trunk leading to the subcentral station, where the trunk is automatically connected to the subscriber's line.

975,107. ELECTRIC BAKING OVEN; J. I. Ayer, Cambridge, and H. B. Gale, Natick, Mass. App. filed Nov. 11, 1909. Contains a plurality of cells with a heating chamber below the baking chamber and heating elements consisting of conducting plates set vertically edgewise with cold-air and hot-air flues.

975,118. ELECTRICAL CONNECTOR; J. J. Burns, Worcester, Mass. App. filed Nov. 23, 1908. Particularly for the high-tension terminal of a spark coil in which the strands of the conductor can be spread out and clamped to a metal plug and a spring-pressed contactor projects inside of the receptacle for engagement with a contact surface therein.

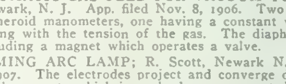
975,126. NERNST LAMP BODY; O. Foell & M. Harris, Pittsburgh, Pa. App. filed Nov. 11, 1908. An insulating base with terminals and a ballast terminal and strip with ballast tube secured to the strip and a cut-out on the base portion and connected to the strip.

975,149. AUTOMATIC GAS FEED FOR VACUUM TUBES; D. McF. Moore, Newark, N. J. App. filed Nov. 8, 1906. Two diaphragms are used for aneroid manometers, one having a constant vacuum and the other varying with the tension of the gas. The diaphragms control a circuit including a magnet which operates a valve.

975,165. FLAMING ARC LAMP; R. Scott, Newark N. J. App. filed June 21, 1907. The electrodes project and converge downwardly and pass through a cup to which iron cheeks are connected forming consequent poles to keep the arc in a definite position.

975,175. ALARM SYSTEM; W. J. St. Onge, Elyria, Ohio. App. filed July 5, 1910. For fire alarm in which the key is confined behind a glass plate which must be crushed before the key can be removed, this operation closing the circuit.

975,186. BURGLAR ALARM SASH LOCK; M. Wheeler, Chicago, Ill. App. filed April 26, 1909. A metallic casing on the window frame with a key shaft in the casing, a cam on the shaft and a contact spring insulated from the casing and an electric circuit including an alarm, the contact spring and the casing.



975,261.—Safety Fuse.

975,261. SAFETY FUSE; S. J. Leveen and E. A. Martin, Rock Island, Ill. App. filed Dec. 4, 1907. A case with a continuous fuse strip extending through the case and self-adjusting contact plates to receive the ends of the strip.

975,302. TROLLEY; J. Tari, East Columbus, Ohio. App. filed Aug. 14, 1909. A trolley with a pivoted end portion carrying a pivoted upright on which two trolley wheels are mounted as well as guards for the wire operated by the rope.

975,338. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Dec. 4, 1906. Automatic and semi-automatic type in which electrically controlled switches operate when the party's receiver is taken from the hook to establish connection between the calling subscriber and any line; the subscribers' lines being divided into groups and a small number of connected switches being assigned to each group under the control of a master switch which upon the initiation of call starts an idle connecting switch to establish a connection with the calling line.

975,346. TELEPHONE DISINFECTOR; B. F. Gardner, Chicago, Ill. App. filed Aug. 29, 1910. Makes use of the destructive discharge of an induction coil whose terminals are arranged within the mouthpiece of the telephone transmitter.

975,358. ELECTRICAL HEATER AND MANNER OF MANUFACTURING SAME IN THE FORM OF TEXTILES; M. Hefter, St. Petersburg, Russia. App. filed Feb. 1, 1910. A nickel wire takes the place of some of the threads of the warp and is periodically brought into the surface of the fabric, the warp threads being nonconducting.

975,359. KNITTED ELECTRIC HEATING BODY; M. Hefter, St. Petersburg, Russia. App. filed Feb. 1, 1910. The fabric contains an insulated electric conductor which is knitted into successive transverse sections of the fabric, the sections being separated by other sections not including the conductor.

975,386. METHOD OF PRODUCING METALLIC ARTICLES BY ELECTRODEPOSITION; F. I. Gibbs, Birmingham, England. App. filed Feb. 23, 1909. For electro depositing on pottery wear by forming a rounded rim at an opening in a metal article and continuing it so that when the metal is electrodeposited a rim will be formed around the top of the vessel from which the model can be removed and the rim filled in and made solid.

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THE SOCIETE INTERNATIONALE DES ELECTRICIENS.

Elsewhere will be found the second of a series of articles descriptive of the more important national electrical engineering organizations of the world, which article, like that in our issue of June 30, 1910, on the British Institution of Electrical Engineers, will repay careful reading by members of our similar national bodies. While the French body differs in many respects from its prototype across the Channel, like the older organization its conduct has uniformly been characterized by professional dignity and adherence to high professional ideals. Like the older body, also, it has a system of nomination for office removed, so far as appears possible, from the machinations of politics. While the method of nomination pursued by these two bodies undoubtedly places their direction with the real leaders in the electrical field, it is questionable whether the same plan, owing to its somewhat undemocratic character, would succeed if applied in this country. For our conditions the method of selection by a board of nominators, such as is provided for in the constitution of the Illuminating Engineering Society, accomplishes practically the same end, and appears preferable in at least one respect, namely, that the board, consisting of the two junior past-presidents and a past vice-president representing each geographical section of the society, changes each year in personnel with the exception of one member, thus tending to make its deliberations more responsive to the spirit of the times as interpreted by those who so very recently carried on the work of the body.

The French society is unique among professional engineering organizations from the part it has taken in directly forwarding the interests of electrical science and the electrical art by the establishing of a testing laboratory and a technical school. France, unlike England, is not open to reproach for neglect of the technical sciences, so that the society was not forced to act in the premises by a fear that otherwise these interests might be indefinitely ignored. Instead, however, of waiting on the usual course of evolution, as soon as the need of electrical laboratory service and special electrical training became evident, it vigorously directed its activities toward supplying that need concretely, instead of resting content with recommending action on the part of other agencies. It would, however, appear hazardous for one of our professional bodies, owing to the shifting nature of their government, to undertake a similar task. The achievements of the French society will probably remain unique, but none the less will serve as a shining example of the exceptional work that professional organizations can accomplish when under wise and stable government and conducted with serious purpose.

A CHEMICAL SPECIFICATION FOR RUBBER INSULATING MATERIAL.

Pure rubber, as refined from the raw product of the tropical forest, is a fairly definite commercial substance, although its chemical composition is complex. If wires and cables were insulated with pure rubber it would be comparatively easy to

define, by specifications and tests, the nature and qualifications of the material. But for good practical reasons, and among them the need of vulcanization, pure rubber cannot be used for the entire coating of insulation. It is generally considered desirable that one-third of the weight of the insulating material shall be rubber and that the remaining two-thirds shall be non-rubber, or filling material, including sulphur for vulcanizing. It is manifest that the specifications for the chemical qualities of a material called rubber, which actually is at best only one-third rubber, are not made easier by the presence of the filler. Moreover, the chemical tests for the rubber in the material are difficult, and depend upon the technique adopted, so that rubber analyses of the same material by different chemists are likely to differ considerably. The article by Mr. C. R. Boggs which we print this week will be useful to engineers having to deal with rubber-covered cables, by supplying a definite and practical schedule of chemical tests with a clearly detailed technique Such a schedule, if agreed to and adopted both by manufacturers and purchasers of rubber-covered wires, would assist them in arriving at a mutual understanding.

DIVERSITY FACTORS.

The subject of diversity factors is one of special importance with respect to residence lighting and load of similar character in which the connected loads and possible maximum demands of the individual consumer are high compared with the normal consumption of energy. It has long been well known that the conditions of residence lighting are such that the ostensible maximum demand, either reckoned from the connected load or obtained by measurements, has no such effect upon the capacity of plant required by the consumer as is found in other classes of work where the maximum demand, or something very near it, is frequently for considerable periods maintained. A paper by Mr. H. B. Gear, recently abstracted in these columns, throws a flood of light on this particular problem. In it is shown by actual analysis of typical groups of residence consumers that in this class of lighting the actual maximum demand of a group may be expected to be about one-third of the sum of the individual maxima of that group and about one-fifth of the total group load. In other words, for this class of work the generator and the transformer capacity need be only about one-fifth of the connected load and one-third the sum of the individual maxima.

This shows a surprisingly low diversity factor for the grouping of consumers who, *a priori*, would be expected to have very similar habits of consumption. It shows, moreover, that if consumers of this class were charged on the basis of the individual maximum demands they would be overcharged in a very large ratio considering the character of the group demand. How large this difference might be expected to be is shown by Mr. Gear's figures on commercial lighting of the smaller sort, in which the diversity factor is just about one-half that found in residence lighting. In other words, the station has to reserve for the work of the residence group only about half the capacity which it has to reserve for a group of small commercial consumers having ostensibly the same individual maximum demands. It is really curious to find so great a diversity factor in residence work, but it seems to be now thoroughly well established and must be borne in mind in the organization of any system of rates intended to be fairly applicable to this class of work. It looks very much as if the residence consumer were on the whole a much better customer as regards his demands upon the station than has generally been admitted.

Mr. Gear makes a further important contribution to the subject in the analysis of the costs of equipment for supplying several classes of customers on the basis of the application of the diversity factor. Basing his comparison on the cost of equipment, including generation, distribution and metering per kilowatt of load on the generating station, he finds that for the residence-lighting group this cost is about $440, while for the small commercial customers it is about $354. This takes account of the diversity factors of the two classes, but it does not take account of another very important matter, namely, the relation of the system capacity to the system load in the two cases respectively. Commercial lighting is essentially peak lighting. Residence lighting is to a very large extent off-the-peak lighting. At least it seems to be well established that the pure residence peak comes on considerably later than the commercial peak, as might be expected from the relative conditions in the two classes of service, and hence the residence consumer makes a considerably smaller demand for total installation capacity than the average for the system.

We hope that Mr. Gear, or some other investigator with similar facilities for obtaining the data, will make it his business to analyze the matter from this particular standpoint and find out what proportion of the total residence output falls at such time as to increase the general peak load. For a guess, it would seem probable that only something like half the residence aggregate demand would go to increase the general afternoon peak, a fact which has a very material bearing on the desirability of residence load as such in a system doing general business. Any disparity of this sort goes far to modify the costs just given as bearing upon the standby conditions. To analyze these costs a little further, Mr. Gear found that of the $440 per kilowatt of generating station load required in the residence work, $124 was charged up for consumers' meters as against $38 in the commercial lighting group. It seems somewhat startling to realize that almost one-third of the total investment in the former case falls to the share of meters, and, as Mr. Gear intimates, it emphasizes the desirability of a less expensive type of meter which would serve for the smaller classes of consumers. Metering in itself is a logical and desirable thing, but if Mr. Gear's figures are typical they furnish a somewhat strong argument for the flat-rate scheme as carried out in Hartford and some other places. The obliteration of an investment charge of nearly 30 per cent of the total, with its corresponding maintenance charges, would certainly go far to offset the moral hazard which is undeniably the chief objection to a flat rate. Abolishing the meter investment would bring the charge figured by Mr. Gear for residence work materially lower than that for the small commercial work; indeed, wiping out the meter charges in both cases would leave them upon a parity. We presume that these meter charges are based upon actual figures at hand, although they seem for the residence consumers, and particularly considering the small connected loads, rather disproportionately large.

We hope that his very striking and able investigation will lead to a further study of the matter. It looks very much as

though analysis of the situation, both with respect to diversity factor and to amount of peak demand, would leave the residence consumer rather in the odor of sanctity than in the condition of a pariah which he at present seems to occupy in the minds of many central-station men. He is certainly not despised by the gas companies, since he is one of their large assets; and the electric central stations might find that it would be wise to profit by the example of their rivals in cultivating this class of business to a far greater extent than has been usual.

ALTERNATING-CURRENT NOMENCLATURE.

In a recent number of our Parisian contemporary, *L'Industrie Electrique,* M. Brunswick raised the question as to what name should best be applied to the quadrature component of voltage, current, or power, in an alternating-current circuit. A French adjective in common use for this purpose is "dewatté," corresponding to our own term "wattless." M. Brunswick attacked his term vigorously, not only on the score of inaccuracy and impropriety, but also on the score of faulty grammatical construction. Several suggested terms were offered by him for substitutes, and among them "potential" current, voltage, or power. M. Brylinski, in a subsequent communication to the same journal, suggested that the term "reactive" might advantageously be used, but criticised adversely the use of "potential" in this connection. M. Boucherot, in another communication, also objected to the use of "potential," but suggested several substitutes, among them "compensé" and "magnetizing." He also suggested the desirability of arriving at an international term through the good offices of the International Electrotechnical Commission. As we have ourselves pointed out on various occasions, the term "wattless" component of current, voltage, or power, is very misleading, because it naturally suggests that the said components are devoid of all power. In point of fact, it is well understood that "wattless power," for example, is just as much power as "real power" in an alternating-current circuit, except that the former is retained within the circuit, or merely moves to and fro within the circuit, whereas the latter is liberated from, or disappears from, the circuit. A term is, therefore, needed as a substitute for "wattless" which shall not contravene the actuality of power in the quadrature component, but which will clearly distinguish between the externally effective component and the quadrature component, which reacts only on the circuit.

In our correspondence columns this week Mr. C. O. Mailloux draws attention to the important consideration that whatever term is selected should preferably be capable of use in all the principal languages of Europe. He shows that since the term "reactance" is in international use a term based upon this word would be very suitable. In this we agree with him entirely, except that, as a matter of detail, we believe that the term "reactive" voltage, current, or power, would be somewhat preferable to "reactance" voltage, current, or power. If "reactive" were adopted, the term "reactance" would be a self-explanatory alternative, when desired. It seems as though in dealing with resistances the real component is generally called the "effective" resistance, the quadrature component the "reactance," and the vector sum of the two the "impedance" or "apparent" resistance. That being the case, it seems very natural to select for the corresponding components of the current, voltage, or power, the terms "effective," "reactive" and "apparent" throughout the series. We should then have, in all languages, the apparent resistance, voltage, current, or power, subdivided into an effective component—i. e., a component effective in producing dissipation from the circuit—and a reactive component. Of course, the term "reactive component" does not indicate whether the said component is leading or lagging with respect to the phase of the standard quantity in reference. In order to meet this need we might use the terms "leading reactive" and "lagging reactive."

We hope that the examples of MM. Brunswick, Boucherot and Brylinski abroad, as well as of Mr. Mailloux over here, will be followed by others interested in clear and accurate terminology, who may have further suggestions to make. The proposition to standardize terms internationally among different languages suggests the possibility of standardizing terms and orthography in different branches of one and the same language. Mr. Mailloux mentions the well-known precision of the French language, and the care which the Académie Française exerts in maintaining the standard of that language. It is generally admitted, in fact, that the well-recognized grace, force and precision of the French language are owing in appreciably, if not in considerable, measure to the labors of the said French Academy, which is charged with the duty of standardizing it. There is only one authoritative dictionary of the French language, and that is periodically issued under the auspices of the Academy. Such a body may be very conservative, and may even retard progress; but, at least, it has the merit of maintaining a single standard of good literature on a uniformly high plane.

In this direction the English-speaking peoples are far behind the French. We have not only already permitted distinct small differences in orthography to appear in well-recognized English and American literature—for example, "honour" versus "honor" and "centre" versus "center"—but we are giving countenance to sporadic attempts at more or less discordant efforts toward simplified spelling, which not only tends to disrupt the English and American literatures yet further, but also to perplex the youthful student and to set a premium on the untrammeled laxities of illiteracy. All impartial observers will admit that there is need for reform and improvement in English orthography; but it would be far better, both for ourselves and for the cause of civilization, to continue in one and the same universal orthography, without any simplification and reform, than that our own English-speaking nation should adopt a reform while the others do not. All such reforms in written language should be made collectively. At a distance of several thousand miles the tie of an absolutely uniform literature and written language is of the first importance and power. It would, therefore, be of great importance and value to the English-speaking countries, as well as to all other countries coming into contact with the English language, that an international English conference should be called, say, in England, with the purpose of establishing a permanent commission having large powers confided to it in the direction of standardizing English orthography and orthographic reform. If such a body issued a dictionary every ten years we should have means of knowing definitely, at any time, what was good English and what was not. At present we have to depend upon the majority among a number of dictionaries.

Interstate Commerce Commission Regulation of Telephone and Telegraph Companies.

The Interstate Commerce Commission has called a conference for Dec. 7 at Washington of representatives of the telegraph and telephone companies to consider the scope of the paragraph of the new Interstate Commerce Law regarding these corporations. The questions to be considered relate to the determination of the companies that are subject to the act to regulate commerce; to ascertaining if these companies can issue franks for interstate service, and to deciding if these companies are required to file their tariffs of charges.

Certain questions bearing on the relation between a local state company and an interstate company will be discussed. Among them will be these: "If a state company receives a message at a point within the state, for transmission to a point without the state, which it transmits over its lines to another point in the state and there delivers to an interstate company for transmission to destination, is the state company, by virtue of its participation in this transaction, made subject to the act?" and "A state company and an interstate company have switchboard connection. If the two lines are connected so that a person within the state talks with a person at a point without the state, or so that a message is transmitted directly from a point within the state to a point without the state, does that amount to interstate commerce which brings the state company within the purview of the act?"

Opening of American Museum of Safety.

The formal opening of the American Museum of Safety occurred on Monday evening, Nov. 21, in the auditorium of the Engineering Societies Building, President Philip T. Dodge occupying the chair. A letter was read from President Taft in which he expressed his interest in the work of the American Museum of Safety. The whole civilized world, he said, was stirred with anxiety and the hope for the adoption of those safety devices which will prevent the loss of life and limb in industrial pursuits, and he knew of no method of bringing about the use of these devices more effectively than in their exhibition in such a museum as that being established. Ex-Governor Hughes also sent a greeting in which he said that at the outset he had been much interested in the work of the museum, because of the appalling number of accidents seemingly preventable and the importance of directing public attention in every possible way to all precautionary means and appliances which may be feasible. He congratulated the officers upon the progress already made in the development of the museum and hoped that through the opportunity it affords for the exhibition of devices and through the interest thus aroused the measure of protection to life and limb will be greatly increased.

Mr. C. S. Dunham, president of the Travelers' Insurance Company, then presented the gold medal offered by his company to the individual or corporation that has done most for the protection of the lives of the workmen by means of safety devices upon machines and processes. The recipient was the United States Steel Corporation, on behalf of which the medal was accepted by Mr. W. B. Dickson, first vice-president. Prof. F. R. Hutton, chairman of the jury of awards, announced that the trustees had awarded the *Scientific American* gold medal for the best safety device exhibited at the museum to the Safety Scaffolding Company for its design and construction of a suspended platform. He pointed out that with the old style of cantilever platform with horses the falls of men from buildings and scaffolds in New York in the five years preceding 1909 numbered 660, of which 177 were from scaffolds. During the last two years 267 buildings have been supplied with scaffolds by the above company and at least 6300 men have worked on them without the loss of a single life. Dr. W. H. Tolman, director of the museum, who spent the summer abroad studying the German system of accident prevention, showed how Germany is reducing the accidents to labor by about 50 per cent. He said that during the last twenty-five years Germany h[as] spent upward of $2,500,000,000 preventing accidents, restori[ng] wage-earning efficiency to sick and wounded workm[en] and in compensation to their families. Mr. T. C. Martin, cha[ir]man of the executive committee, said that the present exhi[bi]tion hall is already outgrown and valuable exhibits are bei[ng] turned away for lack of room. Two adjoining halls are ava[il]able for this overflow, for the library, lectures and demonst[ra]tions if the money can be provided. Twenty-five thousand d[ol]lars is required for this much-needed expansion, and eve[ry] dollar contributed would, he said, be the means of saving hum[an] life. Mr. Edson S. Lott, president of the United States Ca[su]alty Company, speaking for the casualty companies, and [Dr.] N. E. Ditman, chairman of the Department of Sanitation, ga[ve] their respective reasons for believing in the high value of [the] work which the museum is accomplishing.

Some Features of the Forthcoming Chicago Electric[al] Show.

About sixty-five exhibitors have entered into contract to ta[ke] space at the next Chicago Electrical Show, which will be held [in] the Coliseum on Jan. 7 to 21, 1911. As many of the exhibit[ors] are taking larger allotments of space than at the last show, [the] amount of space remaining unsold is comparatively small, a[nd] it is believed that by the time the show opens space will [be] at a premium.

The general scheme of interior decoration and lighting w[ill] be different from anything heretofore attempted. It will r[ep]resent a noonday effect, the ceiling of the large building be[ing] treated and lighted to represent a bright daylight sky with [a] few fleecy clouds. Consistent with this conception will be [the] placing of all exhibits under vine-covered trellises, giving [the] appearance of arbors. A 500-watt tungsten lamp will be s[us]pended from the arbor over the center of each exhibit sp[ace] and smaller tungsten lamps will surmount the posts connec[ted] with the railing surrounding the exhibits. D. H. Burnham [&] Company, the architects, are designing the decorations.

As in former years, the central-station exhibit of the Co[m]monwealth Edison Company will form a conspicuous feat[ure] of the show. The space at the north end of the building he[re]tofore allotted to this company will be used again. The i[dea] of this year's Edison display will be a representation of a s[ec]tion of a street with a 7-ft. sidewalk, street lamps and [six] stores. The street lamps will consist of six posts, each su[p]porting four or five 60-watt tungsten lamps in round frost[ed] glass globes. These posts are of the type adopted as stand[ard] for the various special street-lighting installations in Chica[go].

Commonwealth Edison Avenue is the name given to t[he] "street," and each of the stores fronting on it will be of fai[r] good size, with two show windows and a central entrance. T[he] stores also communicate with one another. One of them w[ill] be a lamp shop, displaying handsome portable lamps and orn[a]mental fixtures, as well as artistic lighting arrangements a[nd] attachments of all kinds. This store will also serve as [a] reception room and will be handsomely fitted up. Anoth[er] store will be a model grocery. All kinds of staple grocer[ies] may be seen here and the various applications of electricity [in] a retail establishment of this kind will be exemplified.

A third store will be a shop for the display of domestic el[ec]tric appliances of all kinds, as washing machines, sewi[ng] machine motors, vacuum cleaners, electric toys and a vari[ety] of miscellaneous appliances for domestic use. Still anoth[er] store will be given over to men's furnishings and its neighb[or] will be devoted to a millinery display. In these two sto[res] especial pains will be taken with the lighting effects, a[nd] with the bright-hued fabrics and modish articles of weari[ng] apparel, the display will be decidedly attractive to both lad[ies] and gentlemen. In all the stores especial attention will be p[aid] to show-window lighting, which will be varied to suit the d[if]ferent requirements of the goods displayed. A prominent el[ec]tric sign will surmount the whole exhibit.

Meeting of Rate Committee, New England Section N. E. L. A.

At the New London convention [illegible] New England Section of the National Electric Light Association it was decided to take up the question of central-station rates by committee investigation and report to the annual meeting of the section in the spring of 1911. The committee held its first meeting in the Edison Building, Boston, on Nov. 12, for the purposes of organization. Mr. Donald C. Barnes, Pawtucket Electric Company, Pawtucket, R. I., was elected chairman, and Mr. E. C. Newman, of the Concord Electric Company, Concord, N. H., was chosen secretary. The other members of the committee are Messrs. W. B. Bragdon, Presumpscott Electric Company, Waterville, Maine; George S. Haley, Rutland Railway, Light & Power Company, Rutland, Vt.; L. R. Wallis, Edison Electric Illuminating Company, Boston; A. T. Holbrook, Excess Indicator Company, New York, and C. A. Learned, Meriden Electric Light Company, Meriden, Conn. In response to requests for information concerning rate practice considerable data have been sent in to the office of the New England Section in Boston from various central-station companies represented in the association. The committee examined the information received and had an informal discussion of the accumulation of further material for its report. Other meetings will be held later.

Electric Wiring Regulation in Louisiana.

In 1910 the Louisiana Legislature passed an act authorizing municipalities of the State of over 25,000 inhabitants to regulate "persons, firms and corporations installing wires or apparatus conveying electric current for light, heat or power." The act provides that laws and ordinances may be enacted in furtherance of its provisions. The Mayor, with the consent of the Council, is authorized and empowered to appoint a board or commission, to be composed of not more than five members, of which the city electrician shall be a member and chairman, provided that the remaining four members shall be electricians who have had five years' experience as such; and the municipalities may, in their discretion, vest the board with full power, control and regulation. It is provided, however, that the power of final inspection of any of the work shall be absolutely in the hands of the city electrician. The municipalities are also authorized to provide methods of punishment for infractions of the rules it may create.

In 1908 an act was passed creating a state board, to be appointed by the Governor, but soon after its provisions had been put into force the act was declared unconstitutional by Judge Chretien, of the Criminal District Court for the Parish of Orleans, in the case of the New Orleans Electrical Board of Examiners versus Gantz. The act of 1908 was never taken up to the Supreme Court of Louisiana.

The Mayor of New Orleans has appointed Messrs. Foster Olroyd, city electrician; I. G. Marks, J. W. A. Richardson, Walter Dilzell and Henry Miller—the latter secretary of the [illegible] Electricians' Union—as commissioners. Messrs. Dilzell and Miller are the only members of the former State board who are appointed on the new board. The ordinance provides a charge of $50 for license, payable before examination for fitness by the board, with an annual renewal fee of $25. A bond for $2,500 is required.

All electrical work done by persons, firms or corporations representing themselves as engaged in the business must be under the personal supervision of a representative who has qualified by complying with the regulations. An applicant failing to pass the examination before the board of commissioners receives a second opportunity and, if successful, pays [illegible] instead of the fee of $50. The bond is to secure action against a defaulting contractor by the real party in interest, which action must be begun within six months after the completion of the work so done.

Inspection and approval by the city electrician, according to this ordinance, fulfils the requirements and releases the contractor from obligation. To continue in business electrical firms and corporations must qualify within sixty days from the passage of the ordinance. Provision is made for the transference of certificates held by a concern whose representative has passed the required examination. The law is essentially the same as the State act of 1908, the full terms of which were published in the *Electrical World* of Aug. 15, 1908, except that the clause exempting the New Orleans Street Railways Company is omitted.

Lightning Phenomena Under Investigation at University of Illinois.

In the effort to devise better means for the protection of buildings against lightning the Engineering Experiment Station of the University of Illinois, at Urbana, Ill., is conducting an interesting investigation. In a large open field twelve 40-ft. poles have been erected. Six of these have been equipped with devices for indicating the effect of lightning strokes at or near these poles. The investigation was begun last spring, and during the summer of this year there were very few storms accompanied by lightning, and none of the poles were hit. However, indications were given of the effect of lightning strokes at a distance. It is planned to add special recording devices to the present equipment and to continue the tests.

When complete the apparatus will consist of a series of spark-gaps shunted by resistance, inductance and capacity in series. The lightning may jump across the gaps or pass around them through the shunt circuits. Any action due to lightning will be recorded on a moving strip of paper driven by clockwork, so that the exact time of the electrical discharge can be told from the record.

Three of the poles have been equipped with sharp needle points and three with 6-in. brass balls. The first points were of steel and rusted badly. Silver-plated points were substituted, but they rusted nearly as quickly as the first set. On inspection all the points were found to be bent over, as if softened by heat. Moreover, all were bent so that they pointed to the northeast. There seems to be no adequate theory to explain this curious phenomenon. The work is being carried on by Mr. T. D. Yensen, of the Engineering Experiment Station Corps, Department of Electrical Engineering.

Building for Chemists' Club.

The Chemists' Building Company, organized by members of the Chemists' Club, New York, has erected a ten-story fireproof building, on a lot 56 ft. wide and 100 ft. deep, at 50-54 East Forty-first Street, New York City. The lower half of the building is leased to the Chemists' Club and contains all the conveniences for a social club, together with a large auditorium for scientific meetings and ample space for a complete chemical library and museum.

The five upper stories have been specially constructed for laboratory purposes and will be rented either as entire floors or in suitable subdivisions to analytical, commercial or research chemists, physicists, electrochemists, bacteriologists, etc., but not as manufacturing laboratories. This section is provided with ventilating flues, water, gas and electric mains, steam and compressed-air lines in suitable locations, but the tenants will make their own connections and provide their own fixtures.

Rental will include janitor and elevator service, heat, and electricity for lighting purposes, and the company will construct proper partition walls for the subdivision of the laboratories according to the tenants' wishes. It is intended to charge low rentals and in many ways facilitate the prosecution of scientific and industrial research.

Underwriters and Electric Wiring.

Mr. W. J. Canada, electrical engineer of the Rocky Mountain Fire Underwriters' Association, gave a talk on Nov. 11 on the "Influence of Underwriters on Electric Wiring" before the student branch of the A. I. E. E. at the Colorado State Agricultural College. He stated that insurance was developed by mathematicians at the same period as the laws of probability were first formulated, and that insurance remains to-day the only commercial application of these laws. The gradual introduction of fire-hazard measurement by analytic methods was discussed, and the present detailing of probability into individual causes, including wiring defects, was noted.

In discussing the present standard of electric wiring Mr. Canada said that the remaining problems include better specifications for rubber insulation, better cut-out cabinets, elimination of cords, mandatory conduit installations, etc. The growth of municipal and state restrictions is securing much needed uniformity, but permanency is still lacking in construction methods. Mr. Canada considers that the opportunities for the technical graduate in this field of work appear to be excellent, as it is by the application of trained minds and liberal methods that the various problems remaining will be worked out.

Addition to Minneapolis St. Croix River Plant.

The Minneapolis General Electric Company has just installed the third pair of 2500-kw waterwheel-driven generators in its Taylor's Falls plant on the St. Croix River, and is completing a second transmission line to convey the additional energy into the Minneapolis substation, where new equipment has also been installed. The Taylor's Falls plant utilizes a head of 65 ft. and is designed to contain eight 2500-kw generators, six of which are now in place, while the wheel pits for all eight are complete. A description of the hydroelectric development of the Minneapolis General Electric Company was published in these columns July 6, 1907. The 50,000-volt line connecting the station with Minneapolis was described in the issue of Sept. 7, 1907, and the receiving station at Minneapolis was illustrated and described in the Oct. 5, 1907, number.

Development of Coon Creek Rapids Near Minneapolis.

The Great Northern Development Company, of Duluth, Minn., which under the direction of Mr. F. A. Cokefair, chief engineer, constructed the Thomson Falls hydroelectric plant on the St. Louis River, furnishing electricity for Duluth and Superior, Wis., has prepared plans for the development of the Coon Creek Rapids in the Mississippi River, six miles above the City of Minneapolis, where about 12,000 kw will be available. The company now owns all of the site and the overflowed lands, and will erect a dam impounding water for six miles upstream to Anoka as soon as permission is granted by Congress for the use of the river. This Coon Creek plant will be the first, it is thought, of an extensive system of hydroelectric development recovering a total of 200,000 hp from the St. Louis and upper Mississippi Rivers.

120,000-hp Mississippi River Hydroelectric Plant.

The Keokuk & Hamilton Water-Power Company, which some time ago began the construction work for a power dam across the Mississippi River at Keokuk, is now starting the legal work of taking up its options on the land which will be overflowed by the large lake formed above the dam. These options expire Dec. 31, 1910. It is estimated that the complete installation of the power plant will cause the flooding of about 15,000 acres, and that the overflow will ultimately extend to a distance of sixty-five miles north of the dam. Options were secured on 60 per cent of the lands to be flooded before construction work was begun. The remainder will be secured by purchase from owners before the gates are actually closed and the water raised, as it is not thought that condemnation proceedings will be necessary. In addition to buying overflow rights the company will supply a new right-of-way for the C., B. & Q. Railroad track, in so far as its present roadbed will be overflowed, which will be for about twelve miles.

The company is now employing about 150 men in its work on the Hamilton side of the river, and will shortly put on fifty more. New equipment in the way of cement-making machinery and small locomotives and dump cars is being ordered. The only change in the construction plans as first announced is that the initial installation as now contemplated will be 120,000 hp instead of 100,000 hp.

A statement in a recent note in these columns that the Keokuk & Hamilton River Power Company contemplated erecting a second plant above Fort Madison has been denied. Owing to the wide bottom lands and lack of head a hydroelectric plant at Fort Madison would, it is stated, not be a possibility.

United States Navy Standard Specifications for Motors and Their Controlling Appliances.

The United States Navy Department has recently adopted a very progressive policy in the standardization of its specifications for electric motors and their controlling appliances for use on shipboard and also at the various yards and stations on shore.

Prior to the adoption of the present standard specifications the different technical bureaus of the Navy Department, of which there were formerly five, each purchased motors under specifications of its own choosing, which specifications differed sufficiently one from another to make apparatus for the same purpose materially at variance, depending upon the bureau by which it had been ordered. The result must necessarily have been to decrease the desirability of navy business from the standpoint of the manufacturers and increase the cost of this material to the government.

The Bureau of Construction and Repair of the Navy Department was active in this work of standardization, having promoted the adoption of uniform specifications by means of representative conferences. The specifications were prepared for the consideration of the conferences by the expert electrical aid of the Bureau of Construction and Repair, Mr. M. W. Buchanan. In addition to officers and engineers from the different bureaus of the Navy Department the conferences included representatives from a large number of the principal American motor manufacturers and from the American Association of Electric Motor Manufacturers. The object in view was to make the specifications broad in their scope and as liberal as is consistent with the best American practice.

The following specifications have been standardized in the manner above outlined, and have been issued by the Navy Department for the use of all bureaus of the department:

Specifications 17-M-1.—Direct-current motors for operating navy-yard machinery, issued Sept. 3, 1909. Specifications 17-M-2.—Induction motors for operating navy-yard machinery, issued Sept. 3, 1909. Specifications 17-A-3.—Auxiliary electrical appliances on shipboard, issued Oct. 26, 1910.

The two first-mentioned groups of specifications are intended to cover first-class commercial motors for general power purposes on shore. The third group of specifications is intended to cover the highest grade of motors obtainable, in which special features of construction and materials are required, having in mind the more severe nature of marine service and insurance for military preparedness.

The standardization of motor specifications is a movement in the direction of uniformity and economy in the purchase of material for the Navy Department, which was the subject of comment in an article of the *Electrical World* of June 23, 1910, entitled, "Electrical Engineering in the Navy."

Rational Basis for Telephone Rates.

In a paper read by Prof. D. C. Jackson before the National Municipal League, at Buffalo, N. Y., on Nov. 15, the subject of telephone rates was discussed in detail with special reference to the differences between the various classes of customers served by a telephone company. The author stated that a telephone company must sell service, which is more difficult to accomplish satisfactorily than the sale of commodities. On account of the wide range of service customers are grouped as residence subscribers, business subscribers, private branch exchange subscribers, special-line subscribers, party-line subscribers, etc.

Prof. Jackson said that the ideal method of charging for telephone service is to charge each customer in proportion to the service he receives from the company, measured in quantity received, this service to be of the quality corresponding to his needs, and to make the charge to all customers as low as is consistent with the operation and maintenance of the property, accompanied by a fair return on the money invested.

The cost of performing the service must be given cautious consideration. For example, in city service the large business users demand a celerity and accuracy for the service which adds much to its cost. Physical conditions prevent providing fast service for one class of subscribers and not for others in intimate intercommunication therewith. However, some of the latter classes, as, for instance, the residence users of moderate means, may have no interest in or care for the remarkable speed and accuracy which characterize the telephone service of many American cities. Service of a lower grade of speed and accuracy, which is less costly to produce, would equally well satisfy the desires and needs of such subscribers. A distinction should, therefore, probably be made in class rates, so that the cost of extraordinary speed and accuracy may be placed on the classes of subscribers who demand it.

A similar condition exists in the relations of city and rural telephone service. The business subscribers of the city demand the speediest and most accurate service obtainable at any cost, but rural subscribers are usually well satisfied by a more leisurely grade of service. However, the city conditions are forced, by the demands of the city, to be spread over both the city and the closely related rural communities; here again the extra cost of the speedy service ought to be borne by the classes of subscribers imposing it. As the provision of the speedier service requires greater investment in rural plant than might otherwise be necessary, it is obvious that the cost of performing specific service in the suburban communities may not always be a fair basis of rates in case the cost is to be put where it belongs.

The foregoing indicates that city business rates may be reasonably expected to be higher than residence or rural rates. A differentiation between business and residence users under flat rates has heretofore been common, and this is additionally justified by the lower average calling rate which is usually characteristic of residence service where flat rates are in vogue.

The relations pointed out above apparently justify an adjustment in favor of residence users of moderate requirements even when measured rates are adopted. The policy of some telephone companies apparently is in this direction, although those companies have endeavored to support their policy on the untenable theory of charging in proportion to what the traffic will bear. Few telephone companies can support the reasonableness of their schedules on a foundation of facts produced from their accounting records, but this condition is likely to be overcome.

Prof. Jackson remarked that the willingness of the telephone companies to co-operate with supervisory commissions in gathering and to some degree in studying cost and traffic statistics is an encouraging indication. With accumulating statistics, which give a clearer understanding of costs of giving service and the relation of speed and accuracy of service to its costs, each modification of schedules under the supervision of wisely constituted commissions ought to approach closer to a rational basis.

Professor Merriam on Municipal Problems.

The work of Prof. Charles E. Merriam, Alderman from the Seventh Ward in the City Council of Chicago, is attracting attention. Mr. Merriam is professor of political science in the University of Chicago and the author of several books on his specialty. Since his election as Alderman he has taken his duties in earnest, and the Chicago Commission on City Expenditures (commonly known as the Merriam commission), of which he is chairman, has performed a useful service in investigating the various departments of the city government in a fair and judicial spirit. Prof. Merriam is also a trustee of the new Bureau of Public Efficiency, which is the logical outcome of the investigations of the Merriam commission. The work of the commission is still unfinished, but a number of its reports have been made public, that on the Department of Electricity being recently summarized in this journal.

At the recent annual dinner of the Chicago Association of Commerce Professor Merriam was one of the speakers and his remarks were important and interesting. Speaking of the transportation question, he said: "We now need not only through routes, but consolidated service on surface lines. We need a system of subways to relieve the intolerable congestion in the Loop district. We need consolidation of elevated lines and consolidation of elevated and surface lines. We need closer co-ordination between the transportation services rendered by the elevated and surface lines and by the steam railways. There is need for the adoption of an electrification policy for railroad lines and for systematic and vigorous treatment of the railroad-terminal problem in its entirety."

Speaking in more general terms this modern type of alderman declared himself as follows:

"The affairs of American cities have reached a point where the amount of money expended and the importance of the work performed make it absolutely imperative that a new type of municipal government be established. People are weary of the grafter and the near-grafter. They realize that there has been too much trifling with the eighth commandment, and insist upon higher standards of civic integrity. Not only is this true, but many sides of municipal administration have become specialized branches of work, requiring special abilities and training.

"The city should provide a proper method of service regulations. It should create a bureau of public utilities, properly equipped technically to deal with questions of service and ready to supply such data as may be required by the City Council for the purpose of the periodical revision of the public-utility rates."

Convention of National Society for Promotion of Industrial Education.

The fourth annual convention of the National Society for the Promotion of Industrial Education was held at Boston from Nov. 17 to 19, inclusive. It was largely attended by educators, publicists, industrial executives and others interested in the better training of juvenile and youthful workers. A large number of papers were read bearing upon mercantile, trade school, apprentice course, factory and special evening instruction facilities. Prominent among these were a paper by Mr. Tracy Lyon which described the apprentice course of the Westinghouse Electric & Manufacturing Company; a paper by Mr. F. W. Thomas upon the apprentice course of the Atchison, Topeka & Santa Fé Railroad; a description by Mr. George C. Cotton of the mechanics' educational course of the Solvay Process Company, and a discussion by Mr. G. M. Basford of the system for preparing recruits in the service of the American Locomotive Company.

All the speakers present voiced the need of first-class skilled mechanics rather than the dearth of mechanical draftsmen and technical graduates. The well-known Westinghouse courses aim to produce all-around mechanics, with encouragement of

latent efficiency in handling specialized tools. The Atchison paper stated that the company spends about $40,000 per year in training boys for future needs, but the result is that the recipients of the training accomplish enough work above the normal amount to pay for their instruction. The importance of paying a living wage to industrial apprentices was generally conceded. Part-time and evening schools also received much attention at the convention, and an able address was delivered by Dr. Georg Kerschensteiner, of Munich, Bavaria, on "Continuation Schools." The final session was devoted to the broader economic aspects of industrial education, the principal speakers being Prof. T. N. Carver, of Harvard University; Miss E. B. Butler, of the Bureau of Research, New York, and Mr. C. H. Winslow, of the American Federation of Labor. A feature of the convention was a banquet tendered the society by the Boston Chamber of Commerce, ex-Governor Guild, of Massachusetts, presiding. Among the speakers were Mr. F. A. Delano, president of the Wabash Railroad, and Mr. F. P. Fish, chairman of the Massachusetts Board of Education and former president of the American Telephone & Telegraph Company. An elaborate exhibit of industrial educational courses, problems and apparatus was held at the Boston Public Library during the convention.

Schoolroom Lighting.

A regular monthly meeting of the New England Section of the Illuminating Engineering Society was held at the Edison Building, Boston, on the evening of Nov. 14. Mr. C. O. Baker, chairman of the section, presided, and there was an enthusiastic attendance of central-station men and others interested in lighting work. Prior to the opening of the discussion of the evening Chairman Baker announced that plans are afoot to establish a question box, with the object of furnishing members with prompt and efficient answers to troublesome problems occurring in their practice. Details are to be announced later. He also stated that the section intends to have an afternoon session in February, with three papers, to be followed by a dinner and informal evening gathering.

SCHOOLROOM LIGHTING.

The evening was principally devoted to a discussion of schoolroom lighting, the opening remarks being made by Mr. B. B. Hatch, of the Boston School Commission. The speaker stated that he wished to emphasize what the society could do to promote and further public-school interests. He said that it is impossible for a man in municipal employ to give sufficient time to the scientific study of illuminating problems, and that the work of the society is capable of being very useful, particularly in putting the illumination of educational institutions on an engineering basis. The general tendency of illuminating engineers and the technical press is to treat the classroom as a problem involving nothing more than placing a few light sources in a room to give practically even illumination, with the object of satisfying the greatest number of persons. Nothing could be further from the truth than this conception of the elementary simplicity of the problem. The first step is to get an even distribution of light and a sufficient number of foot-candles of illumination, but that is not all.

One of the first difficulties of the Boston School Department was the question of color, its effect on the individual, and the relation of furnishings and trimmings on the light itself. Tinting is usually determined by the architectural authorities as follows: They prescribe that a room having a sunny exposure shall be tinted a grayish green in its walls, and on the dark sides of the room the architect calls for light buff or yellow trimmings. Mr. Hatch favors the buff tints on account of their improved coefficients of reflection. Buff gives a coefficient of reflection of 52 or 53 per cent, compared with from 44 to 47 per cent in the case of grayish green. On the other hand, buff has a dead appearance in the night, even with the illumination provided by the tungsten lamp. It is most difficult to provide an illumination which shall be equally satisfactory for day and night school service.

Mr. Hatch then considered various points brought out in the Illuminating Engineering Society paper of Messrs. Knight and Marshall upon schoolroom illumination, read before the society during the past winter. The authors of this paper concluded from tests that a symmetrical six-outlet arrangement was the most satisfactory for the ordinary schoolroom. This conclusion was a surprise to the Boston authorities. The tests given in the paper were made in a room which had never been tinted, in which grayish-white plaster was used, and no consideration was given to the shadow effects of the pupils. The authors referred to a nine-lamp arrangement installed with the lamps 8 ft. 7.5 in. above the floor, and a six-lamp outfit placed 9 ft. 7.5 in. above the floor. In Boston the minimum height of lamps is 10 ft. Mr. Hatch said that in his opinion the authors had overlooked an important factor in taking no account of the shadow effect of the pupils. With 100-watt lamps and the bowl type of reflector the authors estimated that the mean illumination expressed in foot-candles was 3.65, and yet the results were scarcely satisfactory. In Boston the practice prescribes nine 60-watt lamps, or a total of 540 watts, compared with six 100-watt lamps, or 600 watts total, in the authors' paper for the same schoolroom conditions. Mr. Hatch said that it may be possible to get fairly good lighting where the number of rows of desks does not exceed five in width, provided two rows of lamps are used, but the problem is not altogether the particular number of lamps and their location. The height of the room, arrangement of furniture, color of side walls and ceiling, treatment of side walls with relation to the color of the room and the lighting, the actinic qualities of the light, and other factors all bear upon the selection and proper installation of the service.

Mr. Hatch contended that more children come to school with their eyes injured by improper home lighting conditions, particularly at the study table, than are hurt by improper lighting in the school itself. The school authorities naturally have no control over home lighting conditions, and the greater part of the eyesight injury occurs at the pupil's residence, in many cases. He touched upon the difficulties of providing proper illumination in the twilight period.

Referring to unilateral natural lighting specified by architects, Mr. Hatch said that in new buildings the authorities prescribe that the window space shall equal one-fifth the floor area. This gives one-half the illumination on the fifth row of desks that is delivered to the first row. It is very difficult to avoid conditions leading to eye strain in rooms from 30 ft. to 34 ft. wide, containing in some cases nine rows of desks, with one or two windows in the rear of the room. In many cases it is better to draw the shades of the windows than to attempt to blend the natural light and the artificial illumination.

For schoolroom work the tungsten lamp is the best, but even this does not meet the conditions in some instances. The extension of night-school work in large cities is placing more and more difficult problems upon the shoulders of the illuminating engineer, notably in connection with the lighting of sewing rooms, manual-training and drawing rooms. Where a drawing room is lighted by an indirect arc system the color of the ceiling plays a far more important part than with direct illumination. Mr. Hatch cited an instance where a painter overdid the coloring of a ceiling ordered to be light buff, making it a strong yellow in tone, with the result that the actual illumination was improved 100 per cent. He urged in closing that the society take up the question of schoolroom lighting further, in the interest of the general public welfare. Its recommendations carry weight with school authorities, and enable the illuminating force to secure better installations in many cases than would be possible under their own initiative.

[illegible]

[illegible] Bell said that he thoroughly agreed on the wisdom of placing the lamp high enough to be entirely out of the range of the pupil's vision. In a counting-room in a Boston bank he found that ten out of twelve clerks wore blinders continually, and the others frequently, on account of the exposure of the

ncandescent lamps to their direct vision. In this bank the amps are only 6 ft. above the floor. Dr. Bell said that all hrough the Boston suburbs it is possible to find the sins of llumination in profusion. It is of prime importance to educate he school teacher in the fundamentals of proper lighting. The ubject probably receives no attention in any normal school. The society could do good work in this direction, for at present he average teacher has little if any idea of even the rudiments of illumination. Carelessness and ignorance in the use of xisting installations need to be overcome. Mr. J. S. Codman oncurred with Dr. Bell regarding the importance of bringing ome to the teacher through the society the elements of lighting. Ir. Hatch added that various boards of education, business gents and building superintendents should not be allowed to nterfere with the proper use of light by the teachers. Too reat zeal for economy in expenditures often leads to poor lumination on account of the inability of the staff to use the quipment already installed. Mr. Hatch said that shadows can e eliminated by putting in lighting units in sufficient numbers at lose enough intervals and at suitable heights to make it impossible for any one pupil to cast a shadow on the desk of another. eplying to a question, he stated that two installations of ismatic window glass have been put in in Boston, but that the ıll benefit is not obtained on account of the failure to keep ıe windows clean enough, and also in one instance on account f the tendency of the glass to become "stale."

Mr. Hatch said that unilateral lighting has been tried in Boson from rows of lamps placed along the side of the room, ıe second row being screened from the first, but that the sults had not been satisfactory. The pupils were constantly duced to look upward and away from their desks. As in direct lighting the best illumination appears psychologically to overhead. Any plan which would step down the natural ght by the window and step it up, so to speak, within the terior of the room would be a decided help.

Dr. C. H. Williams cited the tendency for schoolhouses of e older type to employ clusters of bare lamps, which produce ouble on account of glare, leading to a diminishing of the uteness of vision and the ability to read without a sense fatigue. Lamps must be screened. He declared that any rm of indirect lighting is necessarily expensive, since 50 per nt is lost initially at the first surface and then only 45 per nt more gets to the eye from the paper. In other words, only out one-fourth the illumination in indirect service reaches the e itself. Yellow light gives a sharper image on the retina an does light reflected from a green surface. With very ıall amounts of gray and black in the tinting of a room one ds the coefficient of reflection decidedly reduced. The use of ackboards covering a large proportion of the wall surface ıds to cause a heavy absorption of light. For the benefit of curing distant vision it would be well to install additional ackboard lamps, screened from the students. Mr. Hatch inted out that the angle of incidence is very important with spect to the question of legibility. Dr. Williams said that it impossible to get a black surface sufficiently absorptive to oid the evils of bad reflection. He has found that test types inted on yellow ledger paper give the best results in the ting of vision. Dr. Bell commended the yellowish paper used classical readers of the old style. Mr. Hatch said that in oston it has been found more restful to the eye to finish rooms lighter woods in preference to dark upper walls and Flemish k.

Final Hearings in Massachusetts Transmission Investigation.

The Massachusetts Gas and Electric Light Commission closed hearings upon Resolve 55, Acts of 1910, upon Nov. 11, intigating the conditions and laws bearing upon the transmisn of electricity in bulk in the State, which were noted in our ues for July 7 and 21. At the hearing held on Oct. 31 Mr. Rodman Peabody, counsel for the Amherst Power Comny, cited cases in Maine and New Hampshire where the right of eminent domain had been granted by the Legislature to central-station companies, and said that all he desired was to sell energy to local distributing companies and that he believed in a minimum limit of 300 hp as laid down by the board in the Fitchburg and Worcester appeals.

Mr. M. B. Jones, counsel for the New England Telephone & Telegraph Company, submitted proposed amendments to Chapter 122 of the Revised Laws of Massachusetts, bearing upon the joint use of poles and other structures in the public streets by different corporations when the ownership of those structures is in one of the corporations, the possible granting of the same location or identical locations to the same wire-using corporations and their joint use of those locations or other structures belonging to them jointly, and other minor matters.

Mr. E. W. Burdett, counsel for the Massachusetts Electric Companies and the Hyde Park Electric Light Company, referred to the pressure of public authorities to require the concentration of wires on a single line of poles. He felt entirely clear on the point that the public authorities cannot force the use of the property of one company by that and some other organization. It is also doubtful if companies can combine to use pole lines without the consent of the municipal authorities. The law should be amended so as to permit the joint use of poles and fixtures, ratifying all locations heretofore granted by municipal authorities under the statutes. Mr. Burdett filed an amendment to remove doubts as to the validity of such locations, and also introduced an amendment simplifying the granting of pole locations to street-railway companies.

At the final hearing on Nov. 11 Mr. Burdett, representing the Massachusetts Electric Lighting Association, stated that the executive committee believes that there is no present necessity of extending to electric transmission companies authority to exercise eminent domain provided the law with respect to the securing of locations in the public streets can be so changed as to affirm the so-called "missing-link" principle which for several years has worked out so well in street-railway practice. The Massachusetts Electric Lighting Association feels that the passage of a law giving the commission the power to overrule obstructive acts on the part of local authorities would avoid the very serious opposition of the public to extending the right of eminent domain to transmission companies. Mr. Burdett contended that the remote highways are safer than the open country for high-tension lines of moderate voltage, such as are coming into use for central-station transmission service. He did not desire to invoke any "missing-link" law except in cases where a real necessity exists for the supply of electrical service.

The final speaker was Mr. Alton D. Adams, counsel for the town of Leominster, who reiterated his argument that eminent-domain rights should not be granted unless the recipient is required to sell electricity to all comers. He criticised the amendments to the law suggested by Mr. Jones and emphasized the importance of having public hearings in connection with lines crossing public ways, on trees or in new locations. He also urged the marking of wires and poles in a more complete manner, touched upon the necessity of better records of location grants and urged the placing of definite responsibility in case of accidents from lines on the public ways. He opposed the passage of a "missing-link" law with transmission companies as the beneficiaries unless all parties are required to be served alike with electricity. The board took the case under advisement and will make a report of its conclusions to the next Legislature early in 1911.

New Jersey Commission News.

The Board of Public Utility Commissioners for the State of New Jersey has approved ordinances of the townships of Glassboro, Woolwich and Washington, Gloucester County, granting franchises to the Gloucester County Electric Company. The board has also approved the ordinance of the town of Morris-

town granting a franchise to the Morris County Traction Company.

The board has approved the agreement of consolidation and merger of the Pitman, Glassboro & Clayton Gas Company and the New Jersey Gas Company. The petition for the approval of this merger set forth that the plants and distribution systems of the companies lie in separate districts and that no competition exists or has existed between them; that all the gas used and sold by the New Jersey Gas Company is furnished by the Pitman, Glassboro & Clayton Gas Company, and that by the merger the companies will be able to effect substantial economics in the cost of operation and afford the public more satisfactory service.

The board has also approved the ordinance of the City of Burlington granting a franchise to the Burlington Electric Light & Power Company. This franchise is for a period of fifty years and as originally passed by the City Council of Burlington was vetoed by the Mayor and passed over his veto. At the hearing upon the question of the approval of the ordinance by the Board of Public Utility Commissioners several amendments to the ordinance were suggested by the board. These were agreed upon by representatives of the company and the city and were incorporated in a new ordinance, which passed the City Council and was approved by the Mayor.

Massachusetts Commission News.

As a result of the recommendations of the Massachusetts Highway Commission the New England Telephone & Telegraph Company has reduced the toll rates from 10 cents to 5 cents between the metropolitan exchanges in Boston and the suburban exchanges within an eight-mile radius of the city. The reduction forms a part of the general rate recommendations of the commission following the recently completed investigation of the problem by Prof. D. C. Jackson, its consulting engineer. Many thousand subscribers have applied for service under the new rates, which are assigned on a provisional contract of one month's duration. In the great majority of cases the tendency will be to reduce the cost of service to subscribers whose interests are largely confined to the business district of Boston and their own suburban zones. Two-party lines with divided ringing are being installed throughout the entire Boston and Suburban district. As a result of an open "experience meeting" held a few days ago at the Boston City Club, at which Professor Jackson explained in full the difficulties of the rate problem and submitted to questions from all sources, hostility to the new schedule of rates appears to be on the wane and the public is slowly coming to appreciate the desirability of a fair trial of the revised charges before passing judgment upon them. The commission has made every effort to hear the suggestions and criticisms of interested parties, holding the hearings open far beyond the time originally expected, and has further requested the telephone company to permit the retention of the old rates for another year when desired. The board has also made it plain that if the new rates are found to be inequitable on trial changes will be in order.

An interesting situation has arisen in connection with the offer of President C. S. Mellen, of the New York, New Haven & Hartford Railroad, to electrify and standardize the gage of the Boston, Revere Beach & Lynn Railroad Company in case the next Legislature permits the purchase of the latter by the former. There is now pending before the Massachusetts Railroad Commission a petition for a certificate of exigency desired by the Boston & Eastern Electric Railroad Company, which has for several years been trying to obtain the right to build a high-speed electric line between Post Office Square, Boston, and the cities of Lynn and Salem. At the last legislative session the company obtained authority to construct a tunnel under Boston Harbor. At the many hearings on this project testimony was introduced by both the Boston & Eastern and Boston, Revere Beach & Lynn companies to the effect that the latter could not at present afford to electrify its lin and build a tunnel into the City of Boston. The propositi of President Mellen has aroused great interest in the No Shore cities and towns and is likely to exert considera influence upon the decision of the railroad commission in Boston & Eastern case. It is proposed to bring the electrif Boston, Revere Beach & Lynn road into Boston by a tun between East Boston and the South Station, thus affordi quick connections between the northern suburban area a points at the south and west of Boston. It is probable t the road will be extended to Salem and Beverly if the Leg lature grants permission for its purchase by the New Hav interests, and with this extension the electrified lines wo in large measure perform the service now proposed by Boston & Eastern company. It is expected that the strug between the Boston & Eastern and the existing transpor tion companies will be renewed in active form shortly af the next Legislature convenes in January, 1911.

The Athol Gas & Electric Company has appealed to Massachusetts Gas & Electric Light Commission against recent action of the Selectmen of Athol granting the L. Starrett Company the right to erect poles and wires in streets of the town. The grantee is a large manufactur company in the community and the local central-station org ization declares itself aggrieved by the giving of the franchi A hearing will be assigned by the board.

The Arlington Gas Light Company has applied to the co mission for authority to increase its capital stock by amount of $100,000. It is proposed to issue 1000 shares stock at the price of $100 each, the proceeds to be applied the payment of floating debt and the cost of constructing ext sions and plant additions.

The Massachusetts Railroad Commission gave a hearing Nov. 16 upon the appeal of the Boston Elevated Railway Co pany against the action of the Cambridge Water Board which the latter refused to agree to the relocation of an imp tant water main in Massachusetts Avenue according to pl proposed by the railway company in connection with the bui ing of the Cambridge subway. It developed at the hearing t the chief issue is the agreement of both parties upon a so tion of the problem, and the case was held open to permit f ther technical conferences. The company maintained that water board did not give it the legal determination of problem to which the statutes entitle it and contended tha had no right to condemn private property for the relocat of water mains. Counsel for the company have also filed brief declaring against the passage of a law requiring str railways to interchange cars, on the ground that such a stat is not needed; that the Boston Elevated is already receivi the cars of foreign companies and that a general interchange undesirable on the ground of safe operating.

New York Commission News.

The Public Service Commission, Second District, has clos upon its records the complaint of Ernest A. Kelly, of P Ewen, Ulster County, against the New York Telephone Co pany as to alleged refusals to furnish telephone service un certain circumstances, complainant having advised the co mission that since the filing of the complaint a satisfacto adjustment has been made with the company.

The commission has consented to the transfer by Willi Stock of certain property, rights and franchises to the Han bal Electric Company; also of a franchise held by him in t towns of Granby and Hannibal and the village of Hannib Oswego County. The Hannibal Electric Company is permitt to sell, transfer and assign its franchises in the towns Granby and Hannibal and the village of Hannibal to t Oswego River Power Transmission Company.

The Livingston-Niagara Power Company has been auth ized to exercise franchises in the towns of Avon, Caledon Geneseo, Lima and York, and in the village of Caledonia,

the County of Livingston, and in the towns of Mendon, Rush and Wheatland, in the County of Monroe. The company proposes to distribute Niagara electric energy through the territory in which it has obtained franchises.

The Islip Electric Light Company has been authorized to issue $30,000 capital stock and bonds to the amount of $20,000. The proceeds are to be used for the improvement and extension of the plant of the company at Islip, L. I.

The Public Service Commission, Second District, has begun proceedings against a number of gas companies who are selling gas of inferior quality. State standards of illuminating power and purity are prescribed and the companies are supposed to manufacture and distribute their product in accordance with these standards. To see that they comply with these requirements the commission has a force of inspectors who are constantly employed in testing gas. These tests are made without warning to the companies. If the inspector reports a deficiency the company is notified and is directed to take steps to improve the quality.

The records in the office of the commission show that the gas of a number of the companies is consistently of an inferior quality in respect to either candle-power or purity, and the commission has summoned these companies to appear before it in Albany, on Dec. 6, to show cause why an order should not be entered requiring them to manufacture and distribute gas in accordance with the prescribed standards, and why suit should not be begun to recover penalties for past deficiencies. The companies affected are the Rome Gas, Electric Light & Power Company, Sea Cliff & Glen Cove Gas Company, Central New York Power Company, of Canastota; Halfmoon Light, Heat & Power Company, of Mechanicsville; People's Gas & Electric Company, of Oswego, deficient in candle-power requirements; the Malone Light & Power Company, Newburgh Light, Heat & Power Company, deficient in candle-power and sulphuretted hydrogen requirements; the Homer & Cortland Gas Light Company, United Gas, Electric Light & Fuel Company, of Sandy Hill and Fort Edward, and Watertown Light & Power Company, deficient in candle-power and sulphur requirements; the Glens Falls Gas & Electric Company, deficient in sulphur requirements; the Waterville Gas & Electric Company, deficient in sulphuretted hydrogen requirements.

Maryland Commission News.

The commission is at present completing its arrangements for [illegible] establishment of a bureau for the handling of all of the [illegible] and electric inspection, both as to meters and quality of [illegible] The law requires the commission to make such in[illegible]ns at the company's station, the company to furnish the [illegible]ments. Chairman Ambler, of the commission, has stated [illegible] the commission is not prepared to say definitely when the [illegible] will be in working order, and that the entire work is in charge of Mr. Phelps, the engineer to the commission.

The commission has given out a statement showing the number of dead telephone wires it has caused to be removed [illegible] its attention was called to the dangerous condition of [illegible] of the lines of the Maryland Telephone Company. From [illegible] to time various orders were issued to the several com[illegible]s operating in Baltimore, and up to date 30,640 lb. of [illegible]s kinds of wire, approximating 215 miles in length, have [illegible] [illegible]ern Union Telegraph Company also complied with an [illegible] [illegible]rms in the southeastern section of the city. The com[illegible]n further notified the Maryland Telephone Company to [illegible]e within ten days a number of dead wires in the district [illegible]vered by the company's Catonsville exchange. These wires were reported by the engineers of the commission as being a menace to public safety.

[illegible]ring the present week the commission will complete the [illegible]phone investigation, at which the complainants will be heard in person and the whole situation thoroughly discussed. During the past few days the local telephone company has also filed with the commission a copy of its annual report, which has been referred to the commission's engineer and accountant for the purpose of investigation and report. A number of important questions concerning the law creating the commission are likely to arise during the hearing, among others whether the law authorizing the $78 grounded service, which is the only unlimited service furnished by the telephone company, has been repealed by the Public Service Commission law.

Answering complaints which flowed into the offices of the commission immediately upon the announcement that the United Railways & Electric Company had discontinued a commuters' special rate on suburban lines, the United Company issued a statement defining its position. In this statement the company concurs with the view expressed by the commission that the special rate was prohibited by the Public Utilities law, but makes the point that the rate was put into effect long before that law was passed, that it was only adopted tentatively and that the result never has been a success financially. The commission gave an opinion that it was not within the powers of the commission to force the railway company to issue commuters' books. "While there is nothing in the law," said Chairman Ambler, "to prevent public-service corporations from issuing commutation tickets and running excursions at reduced rates, yet the commission seems to be restrained from requiring corporations to provide special rates under any conditions." Mr. Allan C. Girdwood, who introduced the Public Utilities bill in the Maryland Legislature, has expressed the opinion that the members of the commission are mistaken in their interpretation of the law. The withdrawal of the commutation tickets was the result of a resolution by the Public Service Commission after hearings for the reduction of fares on the company's line between Baltimore and Ellicott City, in which the commission criticised the United Railways for unjust discrimination and had its counsel advise the company that all patrons of the company should be subject to the same fare as the residents through which their lines passed. The company has therefore adopted the only plan possible to comply with the wishes of the commission.

Société Internationale des Electriciens.

MANY of the older members of the electrical profession will recall with a thrill the International Electrical Exposition which was held in Paris in 1881. It was there that the power of the new agent which was partly to revolutionize the world industrially was first adequately revealed, and the enthusiasm at that time can be compared only to that which is aroused to-day by the progress in aeronautics.

At the close of the exposition a group of men conceived the idea of continuing the movement thus initiated by the creation of an international society which would bring together all those who were interested in or concerned with electricity. A provisional committee with M. Maurice Loewy, then director of the Observatory of Paris, as president, was formed on June 21, 1883, which transformed itself on July 7 of the same year into a committee of organization under the chairmanship of M. George Berger, who had been general commissioner of the exposition of 1881. On Aug. 25 a printed draft of the constitution and bylaws was sent to all countries, and more than 1000 favorable replies were received within a very short period. Three hundred and fifty members were present at the first general meeting, held Nov. 15, 1883, and upon these were conferred the title of founder member. There are to-day still living about 220 of these original members. Among the founder members the following names may be mentioned: d'Arsonval, Becquerel (father and son), Shelford Bidwell, Bosscha, Branly, Breguet, Carpentier, Crompton, P. Curie, J. B. Dumas, Fitzgerald, de Freycinet, Gaulard, J. Gavey, R. Kaye Gray, Von Helmholtz, Hittorf, Hospitalier, Jablochkoff, Jamin, Fleeming Jenkin, Kirchkoff, Maurice Leblanc, Lippmann, Marcy, Melsens, G. Plante, Preece, Sir William Siemens, Werner Siemens,

Stoleton, Violle, Weber and many others whose names have been celebrated in the field of electricity.

The new society set itself at work immediately, and the contributions presented at its first sessions were full of interest. One of the first papers was that of Gaulard on the transformer and Hospitalier at an early session began his advocacy of a logical and correct nomenclature for designating the quantities and units employed in the study and practice of electricity.

In 1885 the vigor of the young society manifested itself by the organization of an exposition which, without pretending to be on a plane with that of 1881, was a considerable success. This exposition was entirely free. It opened on March 21, in the building of the Observatory of Paris, which had been courteously put at the disposition of the society by its director. From 6000 to 7000 persons a day crowded its halls, which were entirely too small to accommodate properly the visitors. The curiosity excited by the electrical displays, still so new, was great, and instruction sought at the exposition was imparted through inspection of many interesting novelties exhibited there by the most eminent investigators. In 1896 the society organized on a more modest scale an exposition of the domestic applications of electricity.

The greatest achievement of the Société Internationale des Électriciens was, however, the creation of the Laboratoire Central and the École Supérieure d'Électricité. The exposition of 1881 terminated with a surplus of about 330,000 francs. The association which had guaranteed financial aid to the exposition, if necessary, to assure its certain success, resolved to leave this sum to the State, to be devoted to a useful purpose in the development of electricity. On Feb. 24, 1882, the President of the Republic, at the suggestion of the Minister of Posts and Telegraphs, signed a decree instituting at Paris a Central Laboratory of Electricity.

For various reasons, which are difficult to appreciate at the end of thirty years, several years passed without anything being done by the State to carry out this project, but the men to whom the success of the exposition of 1881 was due had continued their work by founding the Société Internationale des Électriciens, and it is to them that thanks are due for coming to the rescue of the plan to establish the laboratory. On May 30, 1886, the society appointed a committee to consider and report practical means for carrying out the project. After long and complicated negotiations with the State, extending over several years, and much study and discussion, the Société Internationale des Électriciens took upon itself the work of establishing the Laboratoire Central d'Électricité. The laboratory began operations in 1888, but it was not until 1892 that a regular agreement was made between the State and the society. According to this agreement, the State retained the entire control of the laboratory from the financial point of view and nominated the director, leaving the technical administration entirely to the Société Internationale des Électriciens. This organization remains unchanged. The laboratory has all the characteristics of an official establishment, but it is administered by a private organization devoted to public utility.

Fig. 1—Laboratoire Central d'Electricite (Rue de Stael)

Fig. 2—L'Ecole Supérieure d'Electricité (Rue Ernest Renan)

This organization has yielded excellent results. Instead of being administered by public officials, as is too often the case with government establishments, the laboratory is under the direction of men connected with the industry which it serves, and its resources are utilized with the greatest possible efficiency.

The laboratory is equipped to make all tests demanded by the industry. Since its foundation up to Dec. 31, 1909, 13,379 tests have been made, of which an itemized list is given below:

Ammeters	1,422	Primary batteries	470
Voltmeters	1,330	Resistances	942
Watt-hour meters	3,910	Wattmeters	119
Incandescent lamps	2,307	Sheet-iron	279
Arc lamps	295	High tension measurements	169
[illegible]	[illegible]	Precision measurements	17
Storage batteries	[illegible]	Tests of installations	38
Insulating materials	476	Miscellaneous	484
[illegible]	[illegible]		
Lightning arresters	69	Total	13,379

Furthermore, numerous researches are carried on, the results of which are published under the title "Travaux du Laboratoire Central d'Électricité," the first volume of which has been issued by Gauthier-Villars. Among these investigations may be cited, as having a particular bearing on practical engineering, researches on the electric arc, photometry of lamps, oscillatory phenomena in conductor networks, etc. From the scientific standpoint may be cited researches on photometric standards and, above all, on electrical standards.

From the origin of the laboratory a number of students have been allowed to take part in its routine work, but no regularly organized instruction had been given to them. In 1894 the Société Internationale des Électriciens deemed it advisable to develop this branch by founding a technical school, intended to complete from a practical viewpoint the electrical education of young men possessing a well-rounded general education. This was the origin of l'École Supérieure d'Électricité, which school has to-day an organization independent of the laboratory, except that it is under the same director. The present director is Prof. Paul Janet, who is also professor at the Sorbonne. The school is administered by two councils, one of which occupies itself with administration and the other with instruction, both councils being composed for the greater part of members of the Société Internationale des Électriciens. Most of these are foundation members, that is, individuals, societies or bodies which contribute to the support of the school by an annual payment of 1000 francs, or by a single donation of 10,000 francs. In contradistinction to the laboratory, l'École Supérieure d'Électricité is entirely independent of the State, being exclusively under the supervision of the society. The school has been very successful and has developed rapidly. In 1894 it had twelve students, while to-day there are more than 100. The State regularly sends officers and engineers there and a large number of students come from foreign countries. The foundation of the school and of the laboratory is the crowning achievement of the Société Internationale des Électriciens. The buildings of the laboratory and the

École Supérieure were constructed at the cost of the society on a site conceded by the city of [illegible] for a term of sixty years.

The society has constantly maintained the liveliest interest in its monthly meetings. A great number of important communications have been submitted to it; and, without attempting to cite all, attention may be called to a few of the more important, such as the papers of d'Arsonval on the physiological action of alternating currents; by Blondel on the parallel running of alternators and on photometric units; by Hospitalier on the ondograph; by Boucherot on self-exciting alternators, polyphase motors with high starting torque, parallel operation of alternators and oscillating devices for alternating current; by Carpentier on measuring apparatus; by Cuenod and Thury on constant-current transmission; by Maurice Leblanc on the transmission of energy by alternating currents; by Mascart on alternating-current motors; by Potier on asynchronous motors, etc. On several occasions the society has undertaken extensive investigations on subjects of technical importance, including an exhaustive report, made in 1901, on the parallel operation of alternators and on the rôle played by governors therein; specifications and acceptance tests for cables; magnetic measurements, etc. Its services were also availed of by the Ministre de la Marine in the preparation of specifications for electrical materials used in the navy.

President A. Bochet.

The society has played an active part in different electrical congresses which have been held since 1889. It took the initiative in the formation of the French Electrotechnical Committee, a branch of the International Electrotechnical Commission. It sent a delegate to the International Commission on Photometry. It provided for the expenses of a delegate from the Laboratoire Central d'Électricité, to participate in the international experiments on the silver voltameter and the cadmium standard cell which were recently carried out at the Bureau of Standards in Washington.

The Société Internationale des Électriciens is administered by a president, who is elected each year, six vice-presidents, and a council of forty-eight members, sixteen being elected each year. The president is selected a year in advance, and during this time takes part in the work of the council. He is chosen alternately from men of science and from men engaged in commerce.

The ex-presidents (fifteen in number) are ex officio members of the council. This body is divided into six sections, which meet once a month, their work being recorded in the monthly *Bulletin* of the society. The subjects of which the six sections have respective cognizance are as follows: (1) Production and mechanical utilization of electricity. (2) Electric lighting. (3) Eletrochemistry, electrometallurgy, primary and secondary batteries. (4) Conduit systems, general distribution and traction. (5) Telegraph and telephone. (6) Physical research, electrophysiology and measuring instruments.

The bureau of the society, consisting of the president, president-elect, vice-presidents and the general secretary, meets monthly for the consideration of the affairs of the body. It formulates the order of business to be brought before the monthly meetings and supervises the editing of the *Bulletin*. Annually it prepares a list of candidates for offices to become vacant at the end of the society year. Ordinarily the past-presidents propose the candidates for the offices of president and vice-president. The list thus prepared is submitted to the council, and, when approved, is printed and sent to all members of the society, whose votes are considered at the general meeting held in April, the members not residing in Paris voting by correspondence. The list thus prepared and submitted has always up to the present been accepted without modification.

The total budget of the society during the year 1909 amounted to \$58,056, of which \$11,672 was for the expenses of the society itself, \$16,973 for the laboratory, and \$29,470 for the school.

The president of the society is M. A. Bochet, Engineer of Arts and Manufactures, chief engineer of Sautter, Harlé & Company, and director of the ship and engine works of Augustin Normand. Mr. Bochet was born in Paris, 1863, graduated from l'École Centrale des Arts et Manufactures in 1886, and joined immediately the staff of the Sautter-Lemonnier Company, now Sautter, Harlé & Company, of which he soon became chief engineer. In this capacity he is chiefly occupied with the installation of electric lighting plants and the application of electricity in the army and navy. It may be noted that he was the first to introduce internal combustion engines into the navy by applying them on board submarines. Mr. Bochet is a Chevalier of the Légion d'Honneur.

AMERICAN ELECTRICAL ENGINEERS.—XX.

Carl J. Fechheimer.

Carl Joseph Fechheimer was born in Cincinnati, Ohio, Feb. 11, 1882, and after completeing the usual course in the primary schools entered at the age of fourteen years the Technical School of Cincinnati, a manual-training high school. After graduation in 1899 he was employed for eight months in the shops of the Triumph Electric Company and for two and one-half years in the testing department of the Bullock Electric Manufacturing Company. In September, 1902, Mr. Fechheimer entered Purdue University with sufficient credits to enable the electrical engineering course to be completed in three years, but there being a possibility that he might not be able to remain at Lafayette for more than two years he determined to complete the course in that time if possible. Through the cooperation of one of the seniors a schedule of studies to this end was determined, but this rendered it necessary to take examinations in a number of subjects without classroom preparation. The course was completed in two years with a good record, though the number of hours spent in university work was about 50 per cent greater than required in the regular course. The graduating thesis was based on an experimental and theoretical investigation of armature reaction in synchronous converters at various loads and power-factors, an abstract of which appeared in these columns in the issue of Oct. 7, 1905. The degree of B. S. in E. E. was obtained in 1904.

In the early part of 1904 Mr. Fechheimer found he would be able to devote another year to study and accordingly entered the post-graduate department of Cornell University, where, during that year, he studied under Prof. H. J. Ryan, Dr. A. S. McAllister and Dr. F. Bedell. For a thesis a study was made of alternating-current commutator motors, including an experimental and theoretical investigation of the compensated repul-

sion motor with the secondary of a transformer connected in series and with the brushes normally short-circuited, the primary being connected across the line.

After obtaining his degree from Cornell in 1905, Mr. Fechheimer again entered the employ of the Bullock Electric Manufacturing Company, which in the meantime had become a part of the Allis-Chalmers Company. For three and a half years he was engaged in the engineering department on the design of alternators, turbo-generators and induction motors as an assistant to Mr. A. B. Field, and under the guidance of Mr. B. A. Behrend. For somewhat more than a year following this period he was responsible for the electrical design of most of the alternators and turbo-generators built by the Allis-Chalmers Company. In January, 1910, Mr. Fechheimer left the employ of the Allis-Chalmers Company to take charge of the design of the alternating-current apparatus, including alternators, turbo-alternators and induction motors, built by the Crocker-Wheeler Company, which position he now occupies.

Carl J. Fechheimer

Mr. Fechheimer is the author of two papers read before the American Institute of Electrical Engineers in 1908 and 1909, having for subjects respectively "The Relative Proportion of Copper and Iron in Alternators" and "Comparative Costs of 25-Cycle and 60-Cycle Alternators." For a number of years he has studied the relation of current, voltage and power required to develop a definite torque at starting in polyphase synchronous motors, and a paper on this subject is now in preparation.

Mr. Fechheimer is an associate member of the American Institute of Electrical Engineers and a contributor to its *Transactions* and to the columns of the technical press.

International Comity in "Wireless."

One of the important wireless stations of the world is at Scheveningen, near The Hague, Holland. It is said that it was by means of this station, and not through the Eiffel Tower station in Paris, that the French people remained in touch with their President in 1908, when he visited England. President Fallières was on board a battleship at that time, and it was desirable that he keep in constant touch with his own capital. It was in vain, however, according to the present story, that communication by way of the Eiffel Tower was attempted. An attempt was then made to signal the Scheveningen station and this proved successful. After that the President's battleship communicated with France through the Dutch station. An important part of the duties of the powerful station at Scheveningen is to be on the alert for signals of distress from vessels in the North Sea. The latter has been divided into an eastern and a western part, the former being apportioned to the Dutch station and the latter to England. This imaginary boundary line is not very closely observed, however, in case a ship signals that it is in distress.

CURRENT NEWS AND NOTES.

Chicago I. E. S. Section.—The next meeting of the Chicago Section of the Illuminating Engineering Society will be held on Dec. 8, at which two papers will be presented by Professor Brown and Professor Hay.

Meter Tests.—Of 6580 electric meters tested during September, 1910, by the New York Public Service Commission, Second District, 356, or 5.40 per cent, were fast; 4985, or 75.76 per cent, were accurate, and 1239, or 18.84 per cent, were slow.

Convention of Alabama Light and Traction Association.—The annual convention of the Alabama Light & Traction Association has been postponed from Nov. 21-23 to Nov. 28-30. The meeting will be held at Aniston, Ala. Mr. George S. Emery, of the Alabama Light and Traction Association, is secretary.

Johns Hopkins Illuminating Engineering Lectures.—At a luncheon on Nov. 17 members of the Chicago Section of the Illuminating Engineering Society were entertained and instructed by five-minute reviews of the lectures delivered in the recent course in illuminating engineering at Johns Hopkins University. These lectures are now being prepared for publication in two octavo volumes of about 700 pages each

Electric Vehicle Association of America.—A meeting of the Electric Vehicle Association of America will be held in the Engineering Societies Building, New York, on Tuesday, Nov. 29, at which Mr. C. L. Morgan, manager of the maintenance department of the General Vehicle Company, will present a paper entitled "The Proper Garaging of Electric Vehicles." This will be the first regular monthly meeting of the new association.

Sanitary District Asks to Be Investigated.—Upon the recommendation of President McCormick the trustees of the Sanitary District of Chicago have asked the new Bureau of Public Efficiency to make a thorough investigation of the affairs of the district at its earliest convenience. Mr. McCormick thinks it desirable to get an unprejudiced judgment upon the work of the various departments in charge of the trustees, particularly the electrical department.

Chicago Electric Club.—At the weekly luncheon on Nov. 16 of the Chicago Electric Club Mr. Fletcher Dobyns, formerly assistant United States district attorney, was the principal speaker, his subject being "Lesson from the Recent Election." Mr. Dobyns contended that if we are to have truly representative government in this country we must have not only the Australian ballot and the direct primary, but a corrupt practices act preventing the corrupt use of money in elections, state-wide civil service on the merit basis, and the initiative and referendum, so that the people may have power to control their representatives when the latter are faithless to their trust. These reforms will enable voters to vote for principles as represented by candidates unhampered by bosses, machines and interests. Part in the discussion which followed was taken by President F. P. Vose and Messrs. Thomas G. Grier, Donald M. Carter and Max W. Zabel.

Wireless Time Announcement from Eiffel Tower.—Un-er the direction of the Academy of Science, Paris, standard ime will be announced by wireless telegraphy daily at 11 o'clock rom the Eiffel Tower for the benefit of ships at sea within ıe range of communication.

Telephone Census.—The Bureau of the Census has just ;sued its report of the 1907 telephone census. The report pre-ents statistics concerning the physical equipment, service and nancial operation of the commercial and mutual telephone sys-ems of the country and the independent rural telephone line or the year ended Dec. 31, 1907.

Chess by Wireless on Ships.—According to reports from ictoria, B. C., Captain Phillips and four passengers on the eamship *Zelandia* from Australia played a chess match by ireless telegraphy with Mr. Frick and four passengers from ie *Makura*. The game began when the steamers were in sight each other and the last move took place when they were 400 iles apart.

Massachusetts Technology Registration.—The total reg-tration during the present year at the Massachusetts Institute Technology is 1506. Students who come from other col-ges number 405, representing 93 colleges, of whom 215 are aduates. There are 93 foreign students, representing 34 untries. Of these 27 are from China, including 13 students om the Imperial Polytechnic College at Shanghai.

Local Travel in New York City.—The number of pas-ngers carried annually by the local railways in New York ty has increased by 458,000,000, equivalent to 90 per cent, ice 1899, when the contracts for the present subways were let. 1899 the surface cars carried 360,000,000 passengers and the vated cars 174,000,000. In the year ended June, 1910, the rface cars carried 430,000,000 passengers, the elevated cars 3,000,000 and the subway cars 269,000,000.

Toronto N. E. L. A. Section.—The Toronto Section of National Electric Light Association has now over 100 mem-rs, and has been very successful in having good programs r its monthly meetings. Mr. J. H. Hughes, chief inspector the Toronto Board of Education, addressed the October eting on "Technical Education," and on Nov. 28 Mr. R. M. arle, vice-president of the Rochester Light & Railway Com-ny, will be the speaker. Mr. T. C. Martin, executive secre-y of the N. E. L. A., will address the regular meeting to be d Jan. 26.

Electric Steel Furnaces.—In a paper read before the En-ieers' Society of Western Pennsylvania on Nov. 16 Mr. P. Niven Bennie, of Niagara Falls, N. Y., reviewed the history the development of electric furnaces. He stated that elec-furnaces in the United States will produce a total of 125,000 s of steel during 1910, so that the process can no longer considered experimental. He claimed that although the elec-furnace will not replace the modern open-hearth steel fur-e or the Bessemer converter, yet it will become a serious npetitor of the present crucible process for making high-ide steel and will create a new metallurgy which promises to duce vast changes and improvements in steel making

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Electric Lighting and Railway Opportunity.—Among the eign trade opportunities noted by the United States Bureau Manufactures, Washington, is one reported by a consul in tin America, who states that an English company owning a lway which is being extended in his district is about to ain a concession from the local government for the establish-nt of electric light, power and railway systems in and about city in which he is located. According to the provisions of the proposed concession, the works are to be established within five years from the completion of the present undertaking, which it is expected will be finished in 1911. This company also contemplates electrifying an entire line of railway which extends a distance of about 225 miles. The name of the official to whom correspondence, either in English or Spanish, should be sent is given in the report, the file number of which is 5799.

Tungsten Lamps for Train Lighting.—In an article in the November issue of the *Yale Scientific Monthly* Mr. D. F. Crawford, general superintendent of motive power of the Pennsylvania Railroad, states that there is no doubt that the tungsten lamp will replace the carbon lamp in train-lighting service. The success attending its use is attributable to the development of the so-called "hot circuit." By means of the hot-circuit method instead of turning the current completely off from the lamps when light is not required the lamps are merely disconnected from the main batteries and joined to one or two "hot-circuit" cells, sufficient current being produced in the lamps to show merely a faint red at night. This arrangement minimizes the breakages of the filaments.

Standard Tests of Insulating Materials.—The American Society for Testing Materials has appointed a committee on standard tests of insulating materials of which Mr. C. E. Skinner is chairman. The committee is securing from manufacturers, users and testing laboratories information in detail as to the methods pursued in making regulation electrical, physical and chemical tests. The more important of these tests will probably be standardized to the benefit of all concerned. The committee desires to obtain information and suggestions from all producers and users of insulating materials, and has asked for co-operation in this respect. The correspondence is being conducted by Mr. H. B. Brooks, Bureau of Standards, Washington, D. C.

Civil Service Aid for Bureau of Standards.—The United States Civil Service Commission will hold an examination on Jan. 4, 1911, for the position of aid at the Bureau of Standards, Washington. The examination will cover elementary algebra, geometry, trigonometry, general physics and elementary mechanical drawing. The applicants must be graduates of mechanical training, technical or scientific schools. The salaries for the position range from $600 to $720 per year. The work of the Bureau of Standards is scientific and technical in character, consisting principally of physics, chemistry, and mechanical and electrical engineering. It employs a large number of experts in each of these branches. Young men filling successfully the position of aid are eligible for promotion in the lines of work in which they have become efficient. The opportunity for study and advancement along the lines indicated is equal to that of the leading commercial or educational institutions.

New York Railroad Club Officers.—At a meeting of the New York Railroad Club held on Nov. 18 the following officers were elected: President, Mr. H. S. Haywood, superintendent of motive power of the Pennsylvania, Jersey City; vice-presidents, Messrs. Frank Hedley, vice-president and general manager Interborough Rapid Transit; W. J. Harahan, assistant to the president of the Erie; E. Chamberlain, chairman freight-car repair pool, New York Central lines; treasurer, Mr. R. M. Dixon, president Safety Car Heating & Lighting Company; executive member for three years, Mr. George Wilden, mechanical superintendent of the New Haven; member of finance committee for three years, Mr. Charles Shults. Secretary Vought's report showed that the club had 1500 members in good standing Nov. 1. A paper entitled *Employers' Liability and Railroad Relief Departments* was presented by Mr. Joseph N. Redfern, Chicago, superintendent of the relief department of the C., B. & Q.

Tungsten Production.—The total output of tungsten in Boulder County, Col., for the present year is estimated at $1,000,000.

Colorado Electric Club.—At the regular Thursday luncheon of the Colorado Electric Club on Nov. 17 Mr. John F. Greenwalt, of the Colorado Telephone Company, in the chair, articles of incorporation were presented and also a new constitution and by-laws. It was voted to incorporate the club for social and commercial advancement of electrical matters in Colorado.

Carnegie Gift to Technical School.—Mr. Andrew Carnegie has made a gift of $3,500,000 to the Carnegie Technical Schools in Pittsburgh. Of this amount $1,500,000 will be put at once into buildings and equipment, and $2,000,000 will be forthcoming as endowment. The gift is looked upon as a birthday offering from the donor, who will reach the age of seventy-five years on Nov. 25.

Ohio Society of Mechanical, Electrical and Steam Engineers.—At the annual meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers, held at Springfield on Nov. 18 and 19, the following officers were elected: President, Mr. Oscar F. Rabbe, Toledo; vice-president, Mr. H. L. Patterson, Youngstown; managers, Messrs. John J. Hoppes, of Springfield, and Daniel Delaney, of Cincinnati. It was decided to hold the next meeting in Youngstown on May 18 and 19. Cleveland was also an applicant for the meeting.

Kentucky Independent Telephone Association.—The first annual session of the western division of the Kentucky Independent Telephone Association was held at Paducah on Nov. 15. State President E. M. Coleman, of Louisville, addressed the meeting on organization in general, while Mr. J. W. Edwards, of Hopkinsville, talked on "Construction" and Mr. R. H. Polk, of Memphis, Tenn., on "Wood Preservation." Officers were elected as follows: President, Mr. W. R. Stanfield, Mayfield; vice-president, Mr. John M. Moore, La Center; secretary-treasurer, Mr. R. C. Royce, Mayfield. The next meeting-place will be selected later.

Suggested New York Subway Plans.—Mr. Frank J. Sprague has submitted to the Public Service Commission of the First District of New York two plans by which the city can build extensions to its subway routes and share properly in the profits derived from operation. According to one plan the extension to the present subway would be built with city funds, the operative equipment being provided from private sources, and the city would participate in all net profits after certain deductions. The alternative plan is for an independent subway line built by the city with the city sharing in both the management and the profits. Mr. Sprague expressed his willingness to bid for the operation of this proposed line, independently of the Interborough interests.

Smoker of Electrical League of Cleveland.—The Electrical League of Cleveland at a smoker held on Saturday evening, Nov. 19, under the auspices of the engineers of the National Electric Lamp Association, in the new engineering building of that organization, made a record in attendance, which numbered 375. The auditorium was handsomely decorated for the occasion and a collation was served in the luncheon-room maintained by the National Electric Lamp Association for its employees. The entertainment of the evening consisted of musical numbers, including mandolin solos and selections by a stringed orchestra, monologues, dialogues and an elaborately staged and costumed minstrel show. All the talent was supplied by the hosts, and the forty enthusiastic young collegiates who took the various parts earned a reputation for themselves in the theatrical line. Pipes, apples and cider were continually dispensed by the reception committee. The league contemplat holding three more smokers during the coming winter and expects to accept the hospitality of other prominent electric concerns.

Elevator Control.—A meeting of the Armour Institu branch of the American Institute of Electrical Engineers w held in Chicago on the evening of Nov. 17. Mr. G. E. Willian ('11) read a paper on "Otis Elevator Control," and there w some discussion. The author described the development of tl control from the old rope-operated type to the presently pure electrical system. He also referred to the number of safe devices now available and pointed out that the working circui are controlled by auxiliary circuits, so that the operator cann damage the actual working parts by rough usage. Another poi is the development of the dynamic brake combined with tl ordinary friction brake. Attention was also directed to tl load magnet, which operates to stop the car, when adjusted f that purpose, at a certain predetermined point, no matt whether the elevator is fully or partly loaded.

Proposed Telephone Regulations in Ohio.—As a result the investigation of the Cleveland telephone service by a co mittee of the City Council last spring it is probable that a b will be introduced in the Legislature the coming winter givi cities and towns power to regulate and control the servic Councilman Arnold, chairman of the committee mentioned, h prepared a resolution to be brought before the City Coun which will ask the members of the Legislature from Cuyaho County to support and work for the passage of a bill to th end that has been drafted. The resolution and copy of the b will be sent to the councils of all other cities and towns of tl State, asking that they present the matter to members of tl Legislature from their districts and ask for its support. Tl report made by the Cleveland committee was to the effect th the service in Cleveland is inadequate. City Solicitor Baker i formed the committee that the city has no power to regulate tl matter, and members of the committee say that the telepho men asserted that the people are receiving just the kind service they are paying for.

Minneapolis Electric Show.—The Minneapolis Electr Show will be held in the Minneapolis National Guard Armo during the ten days from Jan. 26 to Feb. 4, inclusive. This is tl second annual exhibition held under the auspices of the Nort western Electric Show Association, and elaborate decorati and entertainment features have been planned in addition to tl exhibitors' displays. The 15,000 sq. ft. of the armory flo will be divided up into ninety booths and aisles. The ceili will be hung with black velvet, and in the center will be a hu reproduction of an electric "shower" fixture studded wi lamps and with 500-watt tungstens in the pendants. Spectacul electric displays will include a flasher rocket effect, ending i a burst of stars at the "shower" centerpiece, in which a shim mering fountain effect can be produced. The pergola arrang ment of booths similar to that of last year, but with a differe color scheme, will be used. The Northwestern Electric Sho Association, which holds the Minneapolis Electric Show, is co-operative organization representing the various electrical i terests of the city—manufacturers, jobbers, contractors, sal representatives and central-station company. The officers are President, Mr. Frederick G. Dustin, chief electrical inspecto Minneapolis; vice-president, Mr. George J. Cadwell, Cadwell Brown; secretary, Mr. C. D. Wilkinson, Northwestern manag Western Electric Company, and treasurer, Mr. A. W. Leonar general manager Minneapolis General Electric Company. I addition to the above, the following are directors: Mr. W. I McDonald, Westinghouse Electric & Manufacturing Compan Mr. J. L. Barnard, Bryan-Marsh Company; Mr. W. F. Smit General Electric Company. Mr. Robert W. Clark, assista commercial agent of the Minneapolis General Electric Com pany, will act as general manager of the Electric Show.

THE HIGH FALLS DEVELOPMENT OF THE PESHTIGO RIVER IN NORTHERN WISCONSIN.

SINCE Oct. 29 the electric lighting and motor service and the street and interurban railway systems of Green Bay, Wis., and several adjoining towns have been supplied with electric energy over a 62-mile, 66,000-volt transmission line from the High Falls of the Peshtigo River, in Marinette County, in northern Wisconsin. The present development at High Falls comprises a concrete and earthen dam, almost a mile in length, creating an 85-ft. head for the 5000-kw generating plant at its base and impounding a storage area aggregating 1700 acres. This great undertaking has just been completed for operation; and to supplement its output the Northern Hydroelectric Power Company is now developing a 3000-kw site at Johnson's Falls at a point two miles below High Falls, where a head of 45 ft. will be available.

The Peshtigo River, on which these water-power sites are located, is notable among Wisconsin streams for its 1000 ft. or more of fall within its length of ninety miles, and for the comparatively uniform rate of its flow during the year, ranging from the normal value, 300 cu. ft. per second, to a maximum flood of 700 cu. ft. per second. The upper course of the Peshtigo, including the sites at High Falls and Johnson's Falls, is in the pre-Cambrian igneous rock, the backbone of the continent, which lies exposed here through the glacial drift and gravel. For ages this flint-hard granitic stone has remained the floor of these cataracts, and on this firm foundation are laid the hydraulic structures of the present development. High Falls is in the midst of a wild and sparsely populated region, where deer, wolves and bear are still to be found. Lumbering is the principal industry of the section, although the great forests near by have suffered badly from fire. The site of the power plant is sixteen miles from the nearest settlement, Crevitz, or Ellis Junction, on the Marquette division of the Chicago, Milwaukee & St. Paul Railroad, and is reached from there only by driving across country. All of the machinery and power-plant supplies had to be transported over this distance by horses. Part of the apparatus was skidded over the snow during the winter season, but delays in getting other machinery in time required that trucking be resorted to over the hilly, winding and soft roads. It is reported that the total haulage cost exceeded $100,000 for the sixteen miles.

Fig. 1—Panorama of Concrete Section.

DAM AND HYDRAULIC WORKS.

The High Falls dam, constructed of concrete and earth embankment, closes between two rocky spines, the crests of which are almost a mile apart. Its average height of 45 ft. rising above the 40-ft. brink of the old cataract makes available a head of 85 ft. above the tail-race. The dam structure comprises several sections, differing in construction and direction to conform to the elevation of the rock beneath, and altogether aggregating 4500 ft. in length. The concrete section extends 900 ft., approximately in the center of the dam, and is flanked by earthen wingwalls locking into the hills at the sides. This concrete section contains the penstocks, discharge gates, log-chute and spillway, and in average section measures 45 ft. high, with a 64-ft. base carried on the native-rock ledge.

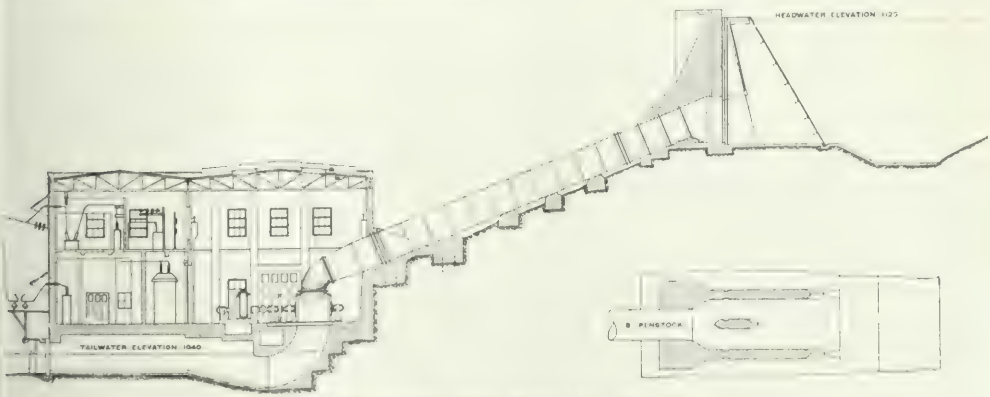


Fig. 2—Section of Power House, Penstock and Headworks.

The six 12-ft. x 12-ft. tainter gates provided are capable of discharging any normal excess of flow in the Peshtigo River. They are raised and lowered by a hand-operated hoist, mounted on a track so that it may be used to handle any gate. For dis-

charging excessive floods the 180-ft. spillway is provided, with its crest at the 85-ft. level. This spillway empties over a concrete apron built in a reverse curve to discharge its flow without vertical impact on the rock masses below. As the Peshtigo traverses a wild uncut forest region logging is one of the native industries of the surrounding country, and most of the wood obtained is floated down the nearby streams. Therefore, in accordance with the provisions of the Wisconsin state law, which recognizes the priority of the logger's right to the use of the streams, it was necessary to provide a log chute for "driving" timber through the High Falls dam. This chute is a wooden runway, 8 ft. wide and 260 ft. long, supported by timber trestle work. With the settling of the surrounding country and the decline of logging there this chute may later become unnecessary and can then be removed. Two 4-ft. x 4-ft. hand-screw-operated waste gates are also provided for bypassing the river water during the construction of the dam.

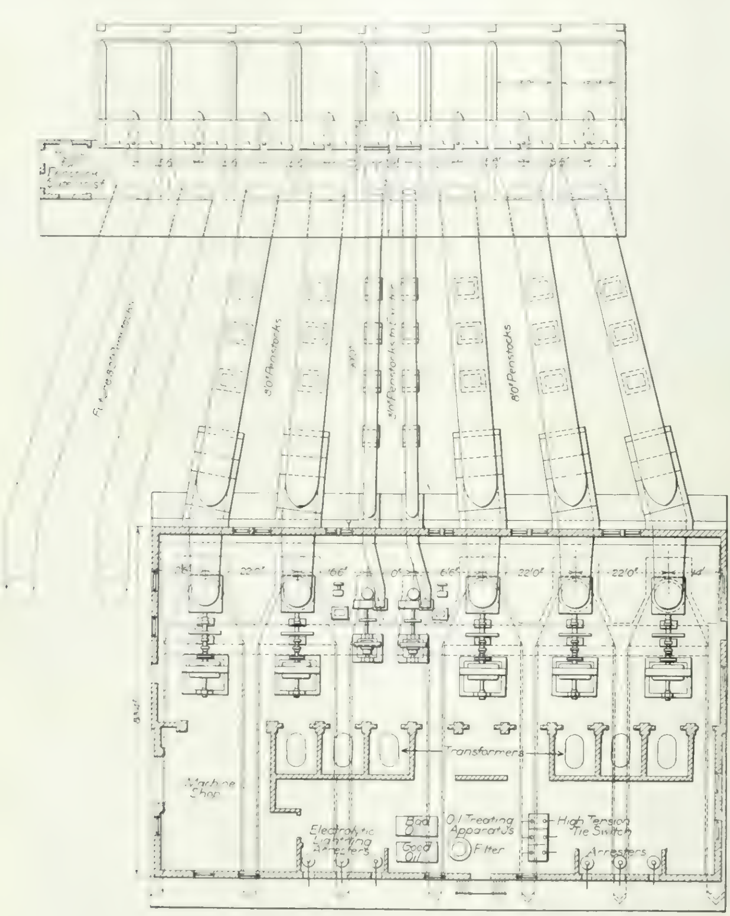


Fig. 3—Plan of Penstocks and Generating Station.

The east wingwall of the dam is 1250 ft. long and the west wingwall 2500 ft. Both are trapezoid in section, with 64-ft. base, 10-ft. top and one-to-three and one-to-two slopes on the upstream and downstream sides respectively. The wingwalls are of gravel and earth, with concrete core walls up to the 75-ft. level. On their upstream fans the wingwalls are faced with a riprapping of cracked granite, 6 in. thick. This is to be reinforced by the application of a lining of cement, while at th toe of the walls 6-in. groove-bolted timber piling will b driven 15 ft. into the soil, thus rendering the dam practicall water-tight.

As now completed the High Falls dam at its 85-ft. leve creates a series of three lakes extending back eight miles an having a total area of 1670 acres. This represents a storag of about 859,805,000 cu. ft., or th equivalent of 1,254,630 kw-hours allowing for 80 per cent efficienc of the water turbines. At th 75-ft. level 840 acres are im pounded, storing 174,000,000 cu ft., or the equivalent of 348,00 kw-hours. The possession of thi large storage capacity enables th total monthly flow of the strear to be conserved and utilized a the load demands it. Thus, whil the minimum daily flow of th river is equivalent to only 120 kw throughout twenty-four hour it becomes possible with the ai of the poundage to develop 700 kw under the average load fac tors equivalent to ten hours' dail use of this demand.

POWER HOUSE.

At the foot of the rock ledg on which sits the dam, and wit its north wall 65 ft. from the pen stock entries, is the power hous containing at the present time fiv 1000-kw turbine-generator set Water is conducted to the turbir wheels through huge ⅜-in. boile steel conduits, 8 ft. in diamete and 80 ft. in length. At the upper ends these penstock entrie are protected by trash racks an by double vertical-lift gate raised through racks by a movab gate hoist driven by a 7.5-h motor. Each entry chamber provided with a small hand-oper ated filler gate, for filling th penstock, and with a 10-in. a vent, through which is als brought out the chain controllin the valve to the drain which clea the penstock chamber of leakag water. The penstocks for the ex citer turbines are 3 ft. in diamete

The main generating units com prise five 1000-hp horizonta shaft twin-runner plate-case waterwheels driving 1000-kw, 2300 volt, 25-cycle, three-phase alternators at 375 r.p.m. Thes units are individually controlled by oil governors equipped wit several improved features for securing steadiness of actio On account of the long penstocks and the comparatively ligh rotating parts of the units it is necessary to change the admis sion-gate settings comparatively slowly, so that use is made flywheels on the turbine shafts to overcome momentary chang of load. These flywheels are solid cast-steel disks with heav hubs 7 ft. 10 in. in diameter, and have a moment of inertia o 80,000 ft.^{2}-lb. The turbines are designed to operate under maximum effective head of 80 ft., but show sustained hig efficiency under heads down to 65 ft. and at partial and fu loads. The exciter sets comprise two 375-hp, horizontal-shaf single-runner, spiral-case turbines, driving 200-kw, 120-vol direct-current generators at 500 r.p.m. The output of either se is sufficient for the excitation of the entire plant. Discharg

water from the turbines is conducted through draft tubes, molded in the power-house concrete foundations, under the generator room and out into the tail-race below the dam. All of the generating machinery—water turbines, alternators, exciters and governors—was built by the Allis-Chalmers Company.

The power house is a two-story concrete structure, 136 ft. x

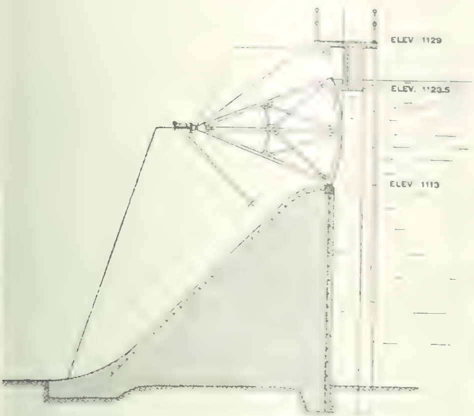


Fig. 4—Tainter Gates and Spillway Section.

3 ft. in plan, the second floor forming a gallery for the installation of switches, etc. The flat-tile roof is supported by steel truss construction 38 ft. above the generator room floor. Directly beneath it is the runway for a 30-ton hand-operated Northern crane. Besides the generating units, on the first floor are installed the step-up transformers, the 66,000-volt lightning arresters, the 66,000-volt tie switch, the transformer oil-treating outfit, and a machine shop. On the gallery level are the main switchboard, the 2300-volt generator and transformer switches, the main-line switches, the 66,000-volt series transformers and the operators' office.

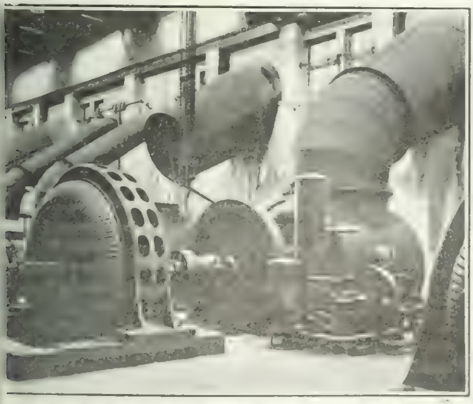


Fig. 5—One of the 1000-kw Water-Wheel Driven Generating Sets

From the generators the main 2300-volt leads are brought up fiber conduit onto the gallery to Westinghouse solenoid-operated 400-amp generator oil switches, closing to the 2300-volt bus, which (except for disconnecting switches dividing it into three parts, each carrying two machines) runs through to the other generator switches. One of the generators is arranged with duplicate oil switches for throwing it onto either of two of the three bus sections. As the transformer switches close onto two of these sections the arrangement makes it possible to operate any number of generators, up to the transformers' rating, on either bank of transformers. The 2300-volt buses are made of ½-in. x 3-in. copper section, protected by suspended barriers of ⅜-in. asbestos board. The series transformers for the 2300-volt meters are inclosed in 2-ft. x 2-ft. concrete compartments, with hook-suspended asbestos-board doors.

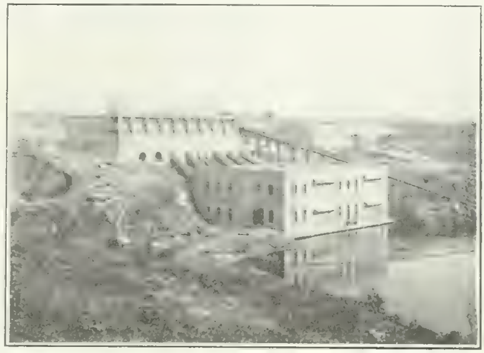


Fig. 6—Penstock Section and Power House.

The two main banks of three 1110-kw General Electric oil insulated, water-cooled transformers, stepping up from 2300 volts delta-connected to 66,000 volts with secondaries in star, and neutral grounded, are inclosed in separate concrete compartments on the first floor. Each recess is closed by a steel roller door. The valve for the cooling water and the discharge from the coils are brought outside the compartment at each side of the entry door, thereby avoiding the necessity for entering the transformer chambers. Combined with the transformers is a Westinghouse oil-treating and filtering system, capable of purifying and drying 2.5 gal. each minute. This outfit comprises a motor-driven centrifugal pump, a sand

Fig. 7—High-Tension Line and Lightning Arrester Entries

filter and a lime drier, through which the oil is forced, and a pair of oil-receiving tanks, one for "good" oil and one for "bad" oil, each holding the contents of one transformer tank. With the arrangement of piping provided connecting the transformer tanks with this oil-treating outfit the contents of any transformer can be delivered to either receiving tank, treated, stored, or returned to the same or any other transformer in the plant.

SWEDISH IRON HIGH TENSION BUSES

From the high-tension terminals of the transformers the 66,000-volt buses, mounted on petticoat-type insulators and protected by suspended asbestos-board barriers, are carried up through the ceiling to the line switches on the second-floor gallery, taps being taken off at the ceiling for the 66,000-volt tie buses. A novel feature of all the high-tension buses in this station is the use of Swedish-iron conductor, 0.375 in. in diameter, to increase the inductance of the station buses as a preventive of the entrance of lightning. Where the lines enter the station from the outside the copper conductors are led directly to the lightning arresters, while the main lines to the transformers are of iron tapped on the outside of the station wall and connecting to the iron buses within. Before entering the Pacific Electric solenoid-operated, 66,000-volt oil switches on the gallery floor the outgoing high-tension lines are le through series transformers installed in separate concrete con partments with asbestos doors. The use of series transforme inserted in lines of potentials as high as 66,000 volts is u usual, and to guard against damage from surges the termina of these transformers are bridged by aluminum cells and ai gaps, which provide a shunt path in case of rise in volta across the terminals.

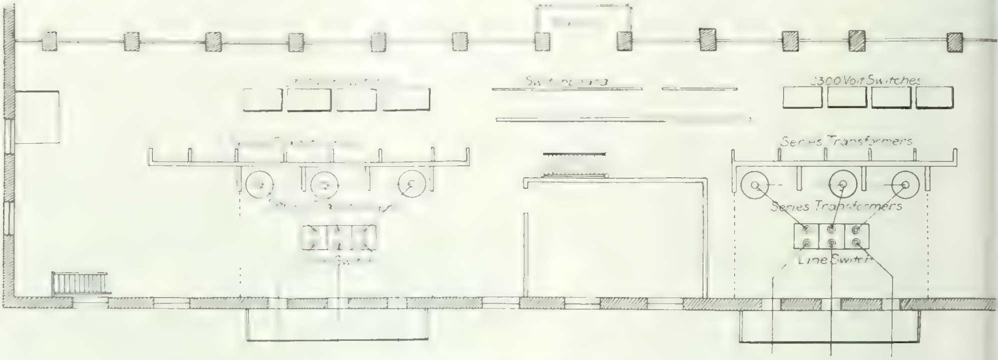


Fig. 8—Plan of Second Floor or Gallery.

The 80,000-volt, 150-amp-type Pacific Electric oil switch used for the two line switches and the high-tension tie swit are interesting because of their very small external dimensior measuring only 17 in. to the top of the bank. They ar mounted on low pedestals on the concrete floor, the line cor ductors being dropped down from the buses above. The t switch is arranged with an overload-release device designed t

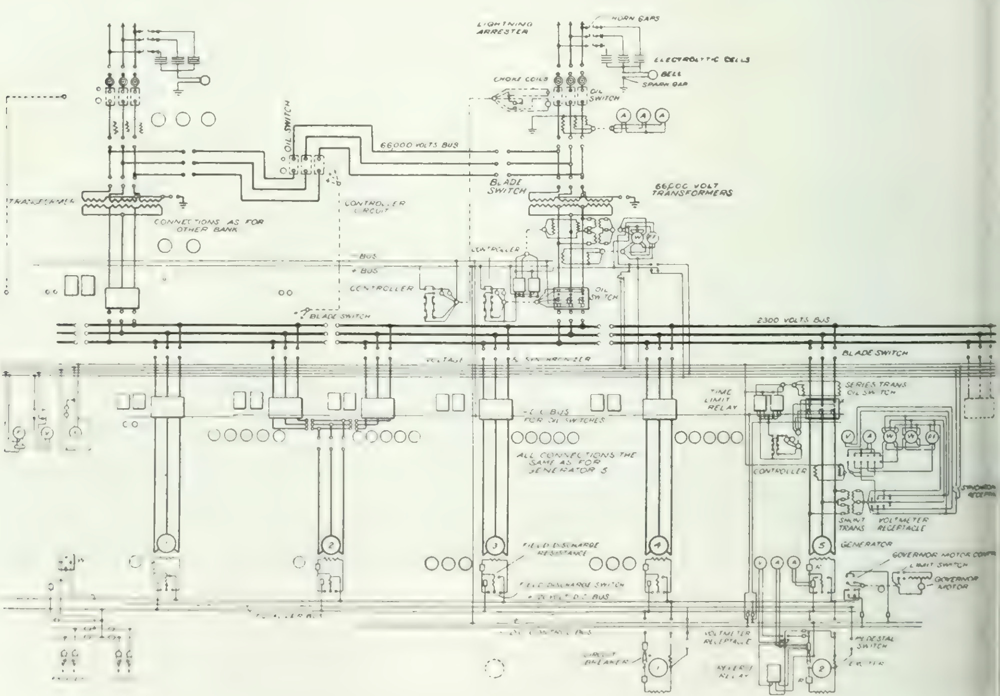


Fig. 9—Diagram Showing Electrical Connections.

-ip the holding latch in case excessive currents are exchanged etween the high-tension bus sections. The 66,000-volt switches, ›gether with the high-tension series transformers, are inclosed ı wire caging so that accidental contact is impossible. From

ı. 10—Map of Poundage Created by High Falls Dam at 85-Ft. Level.

: oil switches the outgoing lines are carried through the choke ils, also of Swedish iron, and out through the second- or entries, protected by molded concrete hoods, to the copper e wires, as shown in Fig. 2. The line wires, as before ex- ined, are carried down to the horn-gaps mounted on brack- outside the building wall, and thence through the first-floor ries to the Westinghouse aluminum-cell lightning arresters. alarm gap in the ground path of these arresters is shunted oss a bell on the switchboard gallery, which rings when the esters are discharging. Throughout both the 66,000-volt l 2300-volt circuits hook-type disconnecting switches have n inserted at all points where it is necessary to have access high-potential apparatus.

he control of the station apparatus is effected from a tchboard on the gallery floor overlooking the generator m. The black-slate board comprises five generator panels, line panels, two exciter panels and two station distribution els for controlling the various motor and lighting services ut the plant. The generator panels include the wattmeters, ver-factor meters, voltmeters, field ammeters, governor con- switches, generator-switch remote-control contacts and plug ‹s for connecting in the frequency meter and synchroscope ınted on a swing panel at the right of the board. The ler-Hammer field rheostats are mounted over the switch- rd, and are manipulated through sprocket chains from the dles on the generator panels. The two line panels carry remote-control contacts for the high-tension and low-ten- ı transformer switches and line tie switch, the high-tension ıeters, etc. Besides the exciter panels and the distributing

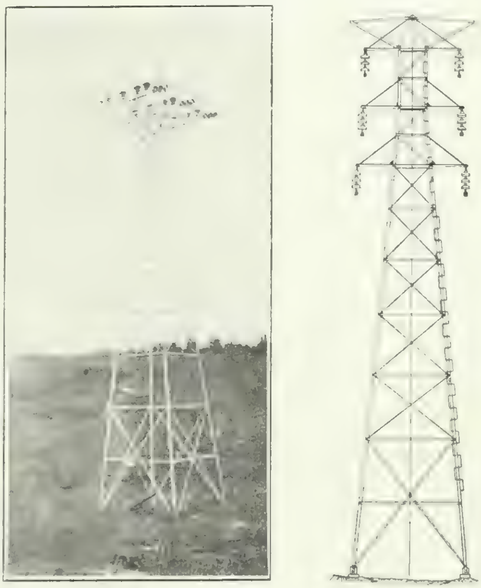
11—Fox River Crossing at Transmission Line Into Green Bay.

[illegible]ls for the motor and lighting circuits, which are taken off he 120-volt exciter buses, extra black panels are installed a future motor-driven exciter set and for the additional 1000-kw turbo-alternators which the plant will ultimately contain. All of the switching and control apparatus, with the exception of the 66,000-volt oil switches before referred to, was built and installed by the Westinghouse Electric & Manufacturing Company.

Special attention has been paid to the interior illumination of the plant. The generator floor is lighted by eleven clusters of four 60-watt tungsten lamps mounted on the ceiling. In lighting the switchboard gallery care was taken to place the lamps so that glare and reflection on the instrument glasses would be avoided. The lamps are inclosed in Holophane globe reflectors, mounted well above the switchboard level.

TRANSMISSION LINE.

The 66,000-volt transmission line into Green Bay, sixty-two miles distant, parallels throughout its southernmost fifty-mile section the track of the Chicago, Milwaukee & St. Paul Railroad, leaving the railroad at Left Foot Lake and striking off twelve miles through the country to the falls site, over a 50-ft. cleared right-of-way. The two transmission circuits of three six-strand hemp-center copper cables, equivalent to No. 0 in conductor section, are hung on suspension-type insulators from



Figs. 12 and 13—Transmission Tower.

the cross-arms of 60-ft. steel towers. Each of these four-legged Aermotor towers, built of angle-steel sections, weighs 3000 lb. They were erected by bolting each leg onto steel angles set in concrete pedestals 9 ft. long and 20 in. in diameter at the base, which had been previously buried, guided by a template. On the tangent sections these pedestals weigh about 350 lb. each, while the larger anchors used for the angle towers weigh 1100 lb. each. The towers are erected at average intervals of 520 ft., or ten to the mile, 636 towers having been required for the sixty-two-mile line. The three wires at 6-ft. vertical distances on each side of the pole comprise each of the two circuits, and when the lines are paralleled in operation wires at the same level are at the same potential. The conductors are hung from three-disk Thomas suspension-type insulators, each disk having been individually subjected to 75,000 volts dry test and 50,000 volts rain test. Inclined arms at the top of the pole carry the two No. 2 equivalent, copper-clad steel ground-wires 4 ft. above and slightly outside the topmost of the line wires. From the peak of the pole there also rises a 3-ft. pointed lightning rod.

Besides being set in concrete pedestals each tower is addi-

tionally grounded through a copper jumper to a 15-ft. 2-in. x 2-in angle iron driven its full length into the earth. The lowest cross-arm is 40 ft. above the ground, and at the center of the 500-ft. spans is designed not to come within 20 ft. of the ground. In designing the spans a liberal factor of safety has been allowed, beyond assuming such severe conditions as 100 deg. Fahr. summer temperature and — 20 deg. Fahr. winter temperature, with a seventy-mile wind and 0.5 lb. of sleet per foot of conductor. The longest span on the line is 800 ft., where a wide valley is crossed.

Leaving the High Falls generating plant the transmission line cuts across a bend in the Peshtigo River, crossing it at the site of the Johnson's Falls development. Here the two circuits are separated onto separate poles, passing on each side around the power-house site and joining again beyond. Pole-type disconnecting switches are inserted in the separate lines at this point, which, with the lines from the Johnson's Falls plant that are to be taped into the main lines on each side of the disconnecting switches, will enable the two generating stations to be paralleled or each to transmit singly into Green Bay, as desired. Paralleling the transmission line is a private telephone line carried on wooden poles. Other connection is provided with the Bell system through a line from High Falls of Crivitz.

Entering the City of Green Bay, the transmission line crosses the Fox River between two 185-ft. special steel towers, the lowest of the 563-ft. spans being 155 ft. above the surface of

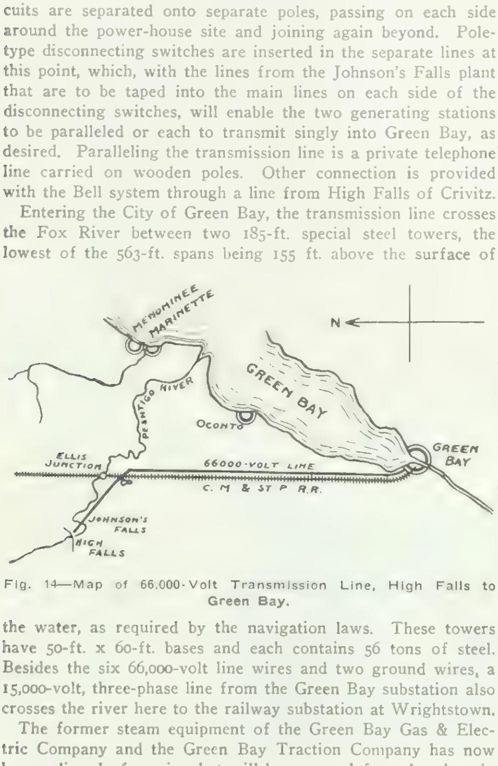


Fig. 14—Map of 66,000-Volt Transmission Line, High Falls to Green Bay.

the water, as required by the navigation laws. These towers have 50-ft. x 60-ft. bases and each contains 56 tons of steel. Besides the six 66,000-volt line wires and two ground wires, a 15,000-volt, three-phase line from the Green Bay substation also crosses the river here to the railway substation at Wrightstown.

The former steam equipment of the Green Bay Gas & Electric Company and the Green Bay Traction Company has now been relieved of service, but will be reserved for relay duty in connection with the operation of the transmission line. This steam-driven apparatus comprised two 500-kw, cross-compound Corliss engines driving 360-volt, 25-cycle, three-phase alternators, and a 500-kw, 60-cycle turbine-alternator set. The station equipment consisted of one 250-kw frequency-changer set for the lighting service and two 500-kw rotary converters for the railway load. To this has been added the 5000 kw in step-down transformers from the incoming 66,000-volt transmission line; two 350-kw banks of 15,000-volt transformers for railway transmission to Wrightstown (where there are two 300-kw rotary-converter sets) and a 500-kw frequency-changer set.

The high-tension panel at the Green Bay substation is equipped with reverse-power relays so that if the two transmission lines are operating in parallel and one goes out it will be automatically disconnected without shutting down any synchronous apparatus or interfering with the other line's operation.

There are 1200 lighting and motor-service customers in Green Bay. The two present largest consumers are paper mills, each with 500 hp in 440-volt motors, a demand which continues throughout the twenty-four hours from Monday morning at 7 o'clock to Sunday morning at 6 o'clock. There are a number of other factories and mills in the city that will in time become consumers of hydroelectric energy. It is planned to extend the transmission line to other manufacturing cities south of Green Bay, where there will be additional demand for energy.

The High Falls and Johnson's Falls water-power developments are owned and operated by the Northern Hydroelectric Company, of which Mr. F. Josslyn is president, Mr. L. E. Myers vice-president and general manager, and Mr. L. N. Boisen superintendent. Prof. D. W. Mead, consulting engineer, designed the High Falls development and supervised in part its construction, his resident engineer on the work being Mr. W. Reineking. The L. E. Myers Company, of Chicago, constructed the transmission line and has fulfilled certain contracts on the hydroelectric features under the direction of Mr. C. E. Collins, superintendent.

ELECTRIC DRIVE AS AFFECTED BY INCORRECT MOTOR SIZES.

By Morse O. Dellplain.

To be entirely successful the electrification of an industrial plant should mean (1) a minimum investment, (2) a reasonable maintenance cost, (3) reliable service and (4) an efficient use of energy. The attempt to electrify industrial plants without a proper regard to each of these items and their relation to

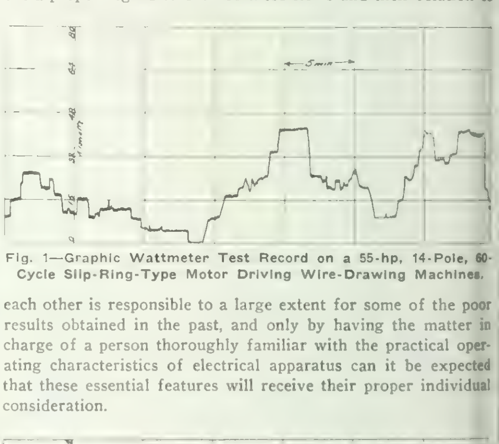


Fig. 1—Graphic Wattmeter Test Record on a 55-hp, 14-Pole, 60-Cycle Slip-Ring-Type Motor Driving Wire-Drawing Machines.

each other is responsible to a large extent for some of the poor results obtained in the past, and only by having the matter in charge of a person thoroughly familiar with the practical operating characteristics of electrical apparatus can it be expected that these essential features will receive their proper individual consideration.

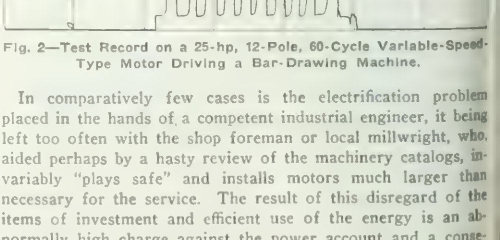


Fig. 2—Test Record on a 25-hp, 12-Pole, 60-Cycle Variable-Speed-Type Motor Driving a Bar-Drawing Machine.

In comparatively few cases is the electrification problem placed in the hands of a competent industrial engineer, it being left too often with the shop foreman or local millwright, who, aided perhaps by a hasty review of the machinery catalogs, invariably "plays safe" and installs motors much larger than necessary for the service. The result of this disregard of the items of investment and efficient use of the energy is an abnormally high charge against the power account and a conse-

quent poor showing for the electrified plant as compared with the old layout.

The over-motoring of industrial plants has become so common and its effects so uniformly detrimental that the co-operation of industrial engineers, apparatus manufacturers and central-station managers can well be solicited with a view to overcoming this erroneous tendency.

The consulting engineer, however conscientious, is seriously handicapped in his efforts to overcome this general tendency, for the reason that in the cases where supervision of the electrification of a plant is given to a competent consulting engineer his supervision is usually retained only during the initial lay-

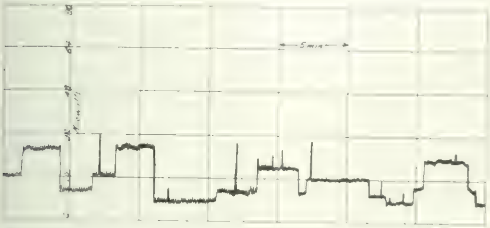


Fig. 3—Graphic Wattmeter Test Record on a 75-hp, 10-Pole, 60-Cycle Slip-Ring-Type Motor Driving Wire-Drawing Machines.

out, all future changes being beyond his control; he is thus forced in self-protection to recommend a high factor of safety with regard to motor sizes.

Manufacturers of electrical apparatus have done much in the past few years to correct the evil tendency by maintaining well-equipped industrial engineering departments which are always at the service of the prospective buyer; in addition to this, their salesmen carry carefully compiled data as to the proper sizes and applications of motors. Even this can only partly remedy the conditions, as the manufacturers find themselves continually forced to protect themselves against a demand on the part of the prospect for an unqualified guarantee covering the recommendations made by their representatives.

A well-organized power department as part of the new-business organization of central stations having a power field offers perhaps the simplest and surest solution of the problem. The central-station representatives, being in daily touch with the local industrial world and keeping careful watch of individual operating conditions, can make recommendations as to motor

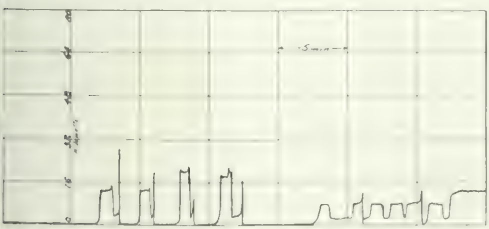


Fig. 4—Graphic Wattmeter Test Record on a 35-hp, 12-Pole, 60-Cycle Variable-Speed-Type Motor Driving Bar-Drawing Machine.

sizes more in accord with the actual service requirements and at the same time be prepared to guarantee these recommendations without fear of unfair future developments. Consulting engineers and apparatus salesmen thus find it advantageous to confer with the local central station with regard to any new electrification in the territory, thereby securing access to complete and accurate information regarding the operating conditions of that particular plant, the data probably having been compiled from observations and tests actually made by the central-station engineers in that plant or in similar plants. Whether an isolated plant be determined upon or central-station power purchased, the advantage derived by the client from this co-operation is equally manifest, the important result being an example of a properly electrified industrial plant.

Since central stations are so logically the branch of the electrical fraternity in best position to exert a correcting influence in the matter of improper electrification, and, furthermore, are the ones to reap the greatest benefit through improved power-factor conditions and satisfied consumers, it is not surprising to find that up-to-date central stations throughout the country are maintaining well-equipped power departments which endeavor to oversee the electrification of both old and new industrial plants with a view to having them become profitable consumers of central-station power. Often a central station finds it desirable to go over a plant already electrified and correct errors made in the original layout, thus making the electrical

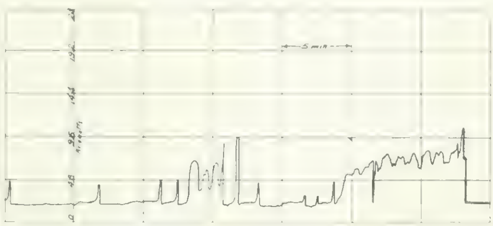


Fig. 5—Graphic Wattmeter Test Record on a 15-hp, 6-Pole, 60-Cycle Squirrel-Cage Motor Driving Wood-Working Machinery.

conditions of that plant more satisfactory to both the consumer and the central station.

A bit of industrial engineering of this nature has recently been completed by the power department of the Syracuse (N. Y.) Lighting Company at the plant of a local steel company which, when first built, was laid out almost entirely for electric drive to be operated with central-station power at 220 volts, three-phase, 60 cycles. In laying out the equipment originally entire stress seems to have been placed on having the motors large enough, the result being a motor in practically every case from 100 per cent to 200 per cent larger than necessary. The consequent low operating efficiency and power-factor entailed such a continued loss to both consumer and central station that it was decided to correct the existing conditions, and with this in view a complete test was made on each of the forty motors in the plant.

The motors, aggregating over 1300 hp, ranged in sizes from 2 hp to 200 hp, and the tests were made with a graphic recording wattmeter having 12 in. per hour paper feed, the high-speed

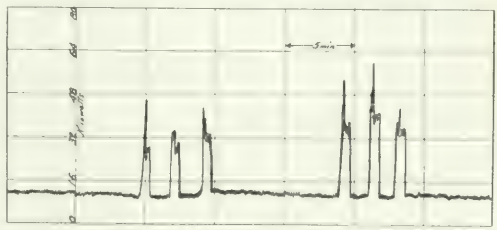


Fig. 6—Graphic Wattmeter Test Record on a 200-hp, 12-Pole, 60-Cycle Squirrel-Cage Motor Driving a 14-Reeler.

paper feed having been chosen in order that a test record might be secured sufficient in detail to insure an intelligent selection of the proper size and type of motor for each service. Each motor was tested under the severest load conditions, and in selecting the new motor due consideration was given to the low efficiency at which the tested motor was operating and also to the relation of maximum load to average load, the good overload characteristics of induction motors being always kept in mind. Continuity of service was not overlooked nor was the abnormally severe service to which machinery in general is subjected in a steel mill lost sight of.

Changes in the distribution system of the central station made it possible to change the frequency at this plant to 25 cycles, making the electrification more nearly ideal from a steel-mill

standpoint. Copies of the graphic wattmeter charts here given suffice to show the average conditions as found and it is needless to detail the improvement in both operating efficiency and power-factor derived through the changes in motor sizes.

The motors for which power-demand charts are shown in Figs. 1 to 6 were the ones originally installed and all were arranged for 60-cycle operation. The motors for Figs. 1, 4 and 5 had twelve poles each, Fig. 2 ten poles, Fig. 3 fourteen poles and Fig. 6 six poles.

The motors which replaced these six each have four poles and are designed for the new 25-cycle circuit. The same type of motor was used except in the case of Fig. 1, where a slip-ring motor replaced the former squirrel-cage machine. The sizes were cut down as follows: 200 hp to 50 hp, 75 hp to 35 hp, 55 hp to 35 hp, 35 hp to 25 hp, 25 hp to 15 hp and 15 hp to 7½ hp.

Investigations and electrification analyses, such as described above in plants, both old and new, together with a thorough co-operation between industrial engineers, whether acting in a consulting capacity or as representatives of manufacturers or central stations, cannot fail to bring about a more careful selection of motor sizes with the consequent improvement in electric drive conditions in industrial plants throughout the country

A CHEMICAL SPECIFICATION FOR RUBBER-COVERED WIRES AND CABLES.

By C. R. Boggs.

In recent years there have been in use many specifications for high-grade rubber compounds used on insulated wires and cables which have included chemical tests. There has been some improvement in these tests, but a want of standard methods of analysis has always been felt. A difference of opinion has often arisen between the purchaser and the manufacturer as to whether the rubber met the specifications, each relying upon the report of his chemist; and sometimes this has led to serious misunderstandings. The fundamental cause of these differences of opinion has been the different methods employed by the chemists, the use of which was made possible by the lack of any specified methods. To complicate matters it has been the tendency of the purchaser to accept the report of his chemist as final without the manufacturer knowing either the chemist or his methods. The fair adjustment of such a difference of opinion would have been to use that method which the purchaser and the manufacturer had in mind when the specification was drawn up and accepted. New methods which show unexpected results, even though more correct, should not be used when neither purchaser nor manufacturer ever realized that such results could be obtained from that class of compounds.

Such differences of opinion could be entirely avoided if there were adopted a standard method of analysis, including definite details of chemical procedure and interpretation of results and excluding general statements, such a specification to hold in all its details until experience demonstrated that changes would make an improvement.

As in other cases, the Germans have led the way in the adoption of such a specification. About a year ago their association of United Cable Manufacturers and the Royal Association for Testing Materials[1] agreed to a specification for the analysis of one class of rubber compounds which includes all the chemical details of procedure and interpretation of results. The specification also more nearly approaches that ideal condition under which the final product is tested for its value alone and the manufacturer is not limited with detail instructions of how that product shall be made.

The specification could be utilized in this country for the same class of compounds by changing some of the details and fixing the limits to suit the case. The details are not perfect and the results obtained can probably be criticised, but the form of the specification with its exact directions is the essential point. I have checked up the methods in the laboratory of the Simplex Electrical Company and the results are as good as by most methods and decidedly better than those by the methods in common use. The specification follows:

Scope of Tests.—The composition of the rubber compound on the normal wire shall be as follows: 33.3 per cent rubber, which shall contain not more than 4 per cent resin; 66.7 per cent fillers, including sulphur. Ceresin (paraffine hydrocarbons) is the only organic filler allowed, and that only up to 3 per cent. The specific gravity of the compound shall be at least 1.5.

The above specifications shall be applied to the rubber compound after stripping off the covering, whether or not the compound has been changed in its chemical composition by the impregnating mixture of the covering.

The tests shall include: (1) Determination of specific gravity. (2) Qualitative test for mineral oils, asphalts and similar substances. (3) Determination of the acetone extract; in the latter shall be determined (a) ceresin (paraffine hydrocarbons) and the sulphur held in it; (b) the sulphur in the total acetone extract. (4) Determination of the fillers. (5) Determination of the constituents soluble in one-half normal alcoholic sodium hydroxide.

The tests are discontinued if the compound fails to meet any one of them. If the specific gravity is below the limiting value, the chemical tests are nevertheless continued.

PROCEDURE FOR TESTS FOR RUBBER COMPOUND USED ON INSULATED WIRE.

Preparation and Taking of Sample.—At least 30 gr. of the compound is taken for the test. As this sample is to be taken from the finished wire, enough of the wire shall be submitted to the office to enable 30 gr. of the rubber compound to be taken for the analysis. The compound shall be cut into cubes of 0.5 mm to 1 mm on an edge.

1. *Determination of Specific Gravity.*—The expression "specific gravity" is used here in the sense of volume weight. The compound to be tested must sink in a zinc chloride solution of specific gravity 1.49 at 15 deg. C.

2. *Qualitative Test for Mineral Oils, Asphalt and Similar Substances.*—The solution formed by allowing the sample to swell up in solvents, as xylol, carbon tetrachloride, pyridine, nitrobenzol, shall show neither fluorescence nor dark color. The test is carried out at room temperature.

3. *Determination of Acetone Extract.*—Two samples of 5 g each are extracted on a water bath for ten hours in a Soxhlet apparatus, excluded from light (with freshly distilled acetone). The acetone is then distilled from the flasks. The residues in the flasks are dried to constant weight in a steam drying oven and weighed. One of the two extracts is treated with 50 c.c. warm absolute alcohol, filtered and washed with 25 c.c. boiling absolute alcohol. The filtrate is placed for one hour in a freezing mixture at — 4 deg. C to — 5 deg. C., and is then filtered immediately and washed with about 100 c.c. of 90 per cent (by volume) of alcohol cooled to the same temperature. A part of the sulphur present in the acetone solution remains on the filter. The filtrate is cooled once more to test for the presence of paraffine hydrocarbons. The residue on the filter is dissolved back into the flask used, first with alcohol and then with warm carbon bisulphide, the solvents evaporated and the residue weighed after drying at 100 deg. C. For the determination of the sulphur contained in the paraffine hydrocarbons the mixture of paraffine and sulphur in the flask is heated to weak boiling for one-half hour with about 20 c.c. conc. HNO_3 (specific gravity 1.48), diluted with 100 c.c. water and filtered cold. The filtrate is evaporated to dryness in the water bath with the addition of some crystals of sodium chloride and the residue boiled down with 5 c.c. conc. hydrochloric acid

After diluting to 50 — 100 c.c. the sulphur is precipitated with barium chloride in the regular way. The other acetone extract is used for the determination of the entire free sulphur present in the acetone extract according to the procedure given above

[1] Mitteilungen ... Kgl. ... [illegible] ... Chem. ... [illegible]

The other substances of the compound soluble in the acetone are considered rubber resins and can be calculated from the results obtained.

4. *Determination of Fillers.*—That amount of the acetone extracted sample is taken which corresponds to 1 gr. of the original sample and dried at 50 — 60 deg. C., put into a weighed 100 c.c. Erlenmeyer flask provided with an air condenser, with 25 c.c. petroleum (230 — 260 deg. C. fraction) and boiled in a paraffine bath until the rubber is dissolved.[2] After cooling the flask is nearly filled with benzol and the precipitate allowed to settle twenty-four hours. The supernatant liquid is decanted on to a weighed Gooch crucible provided with double filter papers and suction applied[3]; the liquid is continually poured through until it comes out perfectly clear. The contents of the flask and the residue on the crucible are repeatedly washed with hot benzol until the filtrate comes through colorless; then the crucible and flask are washed with petroleum-ether, alcohol and ether and dried at 105 deg. C. If a centrifuge is available decanting with the help of the centrifuge is preferable, as this accomplishes the purpose more quickly.

After evaporating the rest of the wash liquids by drying at 105 deg. C. to constant weight the flask is weighed. By the above described procedure organic fillers insoluble in petroleum, as lampblack, cellulose, etc., are included with the mineral matter. The sum of the fillers thus determined, plus the free sulphur and paraffine hydrocarbon, shall not exceed 65.7 per cent. The difference between this and 100 corresponds to vulcanized rubber. The per cent of pure rubber of the compound shall be calculated by subtracting 1 per cent as an average value for combined sulphur, calculated on the compound. (The direct determination of combined sulphur is omitted for the present to avoid the otherwise disproportionate increase in cost of the test.)

5. *Determination of the Constituents* [illegible] *Normal Alcoholic NaOH.*—The acetone extract sample is dried in a drying oven at a low temperature (50 to 60 deg. C.), taken out of the Soxhlet thimble and put into a small Erlenmeyer flask (100 c.c.), 50 c.c. of one-half normal alcoholic NaOH added and boiled on a water bath with reflux condenser for four hours. The solution is filtered into a beaker, washed first with 100 c.c. hot absolute alcohol and then with 50 c.c. hot water evaporated to about 15 c.c., put into a separatory funnel, diluted with about 100 c.c. water, acidified with dilute H_2SO_4 and shaken out with ether. The solution of ether, alcohol and water is evaporated off carefully, without boiling if possible, in a weighed beaker covered with a watch glass, dried to constant weight and weighed. In view of the fact that pure rubber may contain a certain amount of substances soluble in alcoholic NaOH, as high as 0.5 per cent of the weight of the compound is allowed.

CEMENT CONCRETE VATS AND TANKS.

Impervious, odorless, tasteless and sanitary vats and tanks for ... and for buttermilk, wine, pickles, sauerkraut, etc., can be constructed of reinforced concrete, the reinforcing to be designed by a competent engineer, provided the interior surfaces are treated as follows:

After the forms are removed, grind off with a carborundum ... any projections due to the concrete seeping through the ... between the boards. Keep the surface damp for two ... from the placing of the concrete. Wash the surface thoroughly and allow to dry. Mix up a solution of one part water-glass (sodium silicate), 40 deg. Baumé, with four to six parts water, total five to seven parts, according to the density of the concrete surface treated. The denser the surface the weaker should be the solution.

Apply the water-glass solution with a brush. After four hours and within twenty-four hours wash off the surface with clear water. Again allow the surface to dry. When dry apply another coat of the water-glass solution. After four hours and within twenty-four hours again wash off the surface with clear water and allow to dry. Repeat this process for three or four coats, which should be sufficient to close up all the pores.

The water-glass (sodium silicate) which has penetrated the pores has come in contact with the alkalies in the cement and concrete and formed into an insoluble hard material, causing the surface to become very hard to a depth of 1/8 in. to 1/2 in. according to the density of the concrete. The excess sodium silicate which has remained on the surface, not having come in contact with the alkalies, is soluble, therefore easily washed off with water. The reason for washing off the surface after each coat and allowing it to dry is to obtain a more thorough penetration of the sodium silicate.

It is obvious that concrete surfaces so treated if hard, impervious and insoluble have been made also tasteless, odorless and sanitary.

[2] In case petroleum does not [illegible] other solvents, such as camphor oil or [illegible]

[3] The filter papers are pressed on moist and then dried by washing with alcohol and ether.

INFLUENCE OF SIZE ON THE COST OF AN ELECTRICALLY DRIVEN TEXTILE PLANT.

A recent report upon the cost of a hydroelectric textile development in the southern Appalachian district by the engineering firm of Lockwood, Greene & Company, Boston, illustrates the marked effect which an increase in the size of a mill has upon the investment and annual operating expenses per unit of power. The report was made on the construction of a cotton mill in conjunction with the electric power development for its operation, and the development necessitated the construction of a dam, a power house, a short transmission line and the mill. Investigation showed that the primary power (ten-hour power) available was 800 hp at the generator terminals, and that 95 per cent of the time 1000 hp, 60 per cent of the time 1700 hp and 55 per cent of the time 2000 hp will be available. Any mill development in excess of 1000 hp required an auxiliary steam plant. The estimates were based on a 21-ft. fall, although under normal conditions the fall is 22 ft.

The proposition resolved itself into five definite possibilities, as follows:

(A) A development of 10,000 spindles with a wooden dam.
(B) A development of 10,000 spindles with a concrete dam.
(C) A development of 25,000 spindles with a wooden dam
(D) A development of 25,000 spindles with a concrete dam
(E) A development of 50,000 spindles with a concrete dam.

The accompanying table shows the estimated unit costs and the estimated yearly cost for power under these various developments.

TABLE I.—ESTIMATED COST PER SPINDLE

Development.	No. Spindles	[illegible] Dam	Hp Required.	Total Cost per Spindle, Cents.	Operating Power, Cost per Hp per Year
A	10,000	[illegible]	500	35.58	
B	10,000	Concrete	500	38.00	$22.49
C	25,000	Wood	1,000	26.10	
D	25,000	Concrete	[illegible]	27.05	13.12
E	[illegible]	Concrete	2,000	24.80	

Regarding the question of the adoption of a timber or a concrete dam it was considered unnecessary to go beyond a comparison of the estimated costs per spindle.

The large difference between the yearly power costs of developments B and D is caused by the fact that the cost of the dam for either size of development is the same. The power costs given here include administration, maintenance and repair, [illegible]

The textile machinery costs were based on a gray goods 36 in. wide product to be manufactured of about No. 24 or No. 26 yarn, sixty-four square or thereabouts.

It is proposed to locate the mill on a plateau 100 ft. above the

river, where there is sufficient room for future development and where there is a perfect drainage. Electrical power transmission makes it possible to utilize the very best location available for the mill. The above costs were based on the adoption of concrete as the construction material for the mill. A quotation from the engineer's report will show how the local conditions favored this type of construction:

"The type of construction to be used in the mill has received considerable thought. The bricks which are made locally are of rather poor quality and we do not recommend their use, and as all materials except sand and stone to be used in the construction will have to be hauled a distance of fourteen miles the use of timber interior construction is not recommended a this time, though more detailed study of this feature may lea to a change of view. There is in the immediate vicinity of th proposed development a large amount of heavy oak timber, bu this is not a desirable material for mill construction, although i could be used in the construction of a timber dam. It, there fore, appears to us that the mill might properly be constructed o reinforced concrete and the estimates have been made upo this basis."

In view of the facts given above the engineers recommende an initial development of not less than 25,000 spindles with th power house designed for an ultimate increase to 50,000 spindle

Central Station

Management, Policies and Commercial Methods

CENTRAL-STATION STORES BUILDING AT OKLAHOMA CITY.

A large two-story brick addition to the power house of the Oklahoma Gas & Electric Company is being completed by the H. M. Byllesby Company, which controls the former concern. The annex will serve as an apparatus storeroom and employees' quarters. The new building is 75 ft. x 150 ft. in ground plan and has a wagon driveway running throughout its length. Adjoining this on the first floor are the employees' lockers and the heavy-apparatus storerooms, with a machine shop at the rear of the building. On the second floor are the offices for the superintendents of departments, a meter storeroom, a meter-testing room and the employees' dining-room and library. Adjoining the new store's building is a garage for the use of the company's automobiles. The generating capacity of the Oklahoma City plant is also being increased by the addition of a 2000-kw engine-driven unit.

COMBINED ADVERTISING CARD AND INQUIRY BLANK.

The Union Electric Light & Power Company, of St. Louis, is distributing a display card which is unique in bearing a pad of tear-off inquiry blanks in the form of postal cards. The card is 11 in. high and 21 in. wide, and may be displayed in any prominent position, as in a street-car advertising panel. It is printed in colors, representing a man and his wife enjoying the benefit of electric light over the living-room table. The lettering on the card first states that "Electric light makes day of night," and then proceeds to ask, "Have you Union electric light in your home?" If the answer is in the negative, the reader is urged to use electric light for sixty days on trial, and is asked to tear off a card for full particulars.

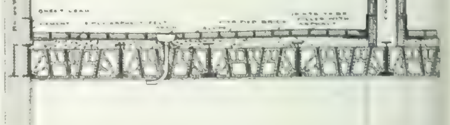
On tearing off a card it is seen to be a postal card (unstamped, of course), addressed to .the Union company. On the "message" side of this card the company offers to loan electric globes, inspect house wiring and make free outside wire connections to any residence on its lines on sixty days' trial. At the end of the trial period, if the service is not satisfactory, the company will take back the lamps and disconnect the wires, charging only at the regular rates for the electricity used. If the prospective customer's house is wired, but no fixtures are installed, the company will furnish six electric-light fixtures complete for $12.63, giving the customer a year to pay for them. If the house is not wired, the company will wire it for electric-light service, with one fixture outlet in each of five rooms, for approximately $18, additional fixture outlets to be supplied at a proportionate advance. A year will be allowed for the payments for this work also. If the trial service is satisfactory the company charges 15 cents each for the 16-cp lamps supplied, with free renewals thereafter. Space i left at the bottom of the card, so that the recipient may giv his name and address and mail it to ask for an applicatio blank.

HOUSE WIRING DURING THE DULL MONTHS.

The months of January and February are usually dull one in a business way for the electrical contractor as well as fo the central-station company. The Janesville Electric Compan Janesville, Wis., takes advantage of this slack season to offer i "fourteen-dollar" house-wiring proposition to intending users o electricity. This offer is for equipping five outlets, two twe lamp fixtures and three single-lamp cords or wall outlets. Th price of $14 is divided equally between the contractor and th lighting company, the former receiving $7 for his work an materials and the latter the same amount for the plain fixture furnished. Although the special rate made represents a sul stantial decrease in the ordinary charge for the same material, satisfying number of prospective consumers usually take ac vantage of the low figure and have their houses wired. Th electric light company has the satisfaction of adding these in stallations as new business, while the contractor usually fin that the house owner desires several little extras, such as add tional outlets, switches, etc., out of which he can secure a ma gin of profit.

STATION FLOOR CONSTRUCTION FOR STORAG BATTERIES.

In a recent address on modern fireproof building constructio delivered before the Commonwealth Edison branch of th N. E. L. A., Mr. N. A. Rollins, of the Commonwealth compan



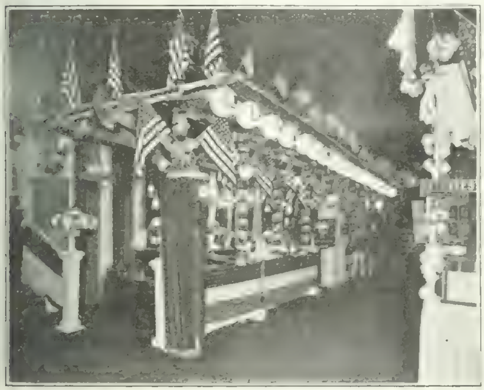
Details of Battery-Room Floor Construction.

gave some information on the erection of floors for stora batteries, where, owing to the presence of sulphuric acid, speci work obtains. A concrete floor is laid over the terra-cotta wo with ridges and valleys to give proper drainage. All steel co umns passing through this floor are protected by sheet le

carefully placed around the fireproofing, and the lead carried up on the face of the column and turned into the plaster. This lead is carried out on the floor around the columns, the concrete having been left 0.25 in. lower at this point for this purpose. All the joints in the sheet lead, as well as the joints in the lead pipe from the floor drain, must be burned, as joints made with solder will be readily attacked by the battery acid. After the lead work has been completed two-ply asphalt felt is laid over the entire floor, the joints being carefully mopped with hot asphalt filler, and then special vitrified brick is laid with 0.25-in. joints. The joints and all spaces around walls and columns are filled later with the same asphalt compound poured into the joints and spaces at a temperature of 450 deg. Fahr. The details of battery-room floor construction are shown in the accompanying engraving.

DENVER COMPANY EXHIBIT AT STREETS OF ALL NATIONS FAIR.

The Denver Gas & Electric Company made a very striking exhibit at the Streets of All Nations Fair which was recently held in Denver under the auspices of the Women's Club. The attendance during the week of this exhibition was 60,000 and the company thus had an opportunity of showing its exhibit to a large number of people. The exhibit was specially interesting on account of the large number of applications made of gas and electricity which appealed to the ladies. Special prominence was given to the sewing-machine motor, the vacuum cleaner and similar appliances.



Denver Company Exhibit.

ATTENDANCE OF CENTRAL-STATION MEN AT COUNCIL MEETINGS.

To attend time after time the meetings of the town board or city council gets to be rather monotonous, but the manager of the electric plant in the small town who appears at such meetings frequently takes one of the best means possible of avoiding trouble and disagreeable controversies between his company and the municipality.

The natural tendency of some such boards seems to be to regard the public service companies in their jurisdiction as being organized expressly for the purpose of getting everything they can from the municipality and its citizens and of giving as little as possible in return. At times the spirit of antagonism so prevails in the council chamber that newly elected members speedily become possessed with antagonistic feelings for the company without themselves knowing why.

The appearance of a representative of the company at the meetings of the town board is the most effective means of keeping this antagonistic spirit out of the council or of routing it if it be present. At every meeting there are likely to come up for discussion questions regarding the relations between the company and the city. If no one is in attendance to present the company's side of the case, the councilmen may simply assume that the city is being abused and the discussion may take the form of a tirade against the corporation. With a representative present, however, all matters will, in all probability, be settled amicably.

The attendance of the manager at the meetings usually has a beneficial effect in another direction. Frequently the council meetings are attended only by the members of the board and by the few citizens who have matters to bring to its attention. In time the members develop a species of fraternal feeling among themselves and this feeling is to a greater or less degree extended to anyone who attends the meetings regularly and shows himslf interested in the matters discussed. When a lighting plant manager gets on such terms with the council that the members extend this feeling to him he may rest assured that the body will not misinterpret every act of his company, but instead will be inclined to view its actions in a favorable light until they are proved objectionable. This is, of course, conducive to a "pull together spirit" of inestimable value to the company.

SUCCESSFUL ELECTRIC COOK-STOVE CAMPAIGN.

For the past two years the Billings & Eastern Montana Power Company, Billings, Mont., has been conducting an active campaign for the introduction of electric irons, coffee percolators, chafing dishes, heaters, etc., but it was found that, aside from electric irons, less than 2 per cent of customers became interested in the appliances. It was also found that offering these articles at absolute cost was no inducement to the average consumer, for the reason that they are looked upon as luxuries and only for people who do not miss the money spent for appliances of that kind.

After a thorough investigation regarding the needs of the average consumer it was decided that what was required to introduce electric cooking was something along practical lines that would eliminate the drudgery and danger of the kitchen from the use of gasoline, kerosene and gas stoves. It was believed that with the electric iron and the washing machine placed in the kitchen it would not be a hard matter to introduce cooking by electricity, provided an efficient stove were available. After investigating the different stoves that had been placed on the market prior to June 1 the Hughes electric cook stove was adopted, a number were ordered and a campaign was immediately started to demonstrate to customers what could be done with the stove. As the campaign was not started until about July 1, part of the season for introducing an appliance of this kind was over. However, a ready sale was found for the stoves, and at the present time more than one dozen electric cook stoves have been placed and are doing good work, some customers going so far as to remove their coal ranges entirely with the intention of doing their cooking both summer and winter by electricity.

A rate of 5 cents per kw-hour is given for cooking under the following conditions: The stove is sold outright and connected by running a separate circuit for cooking. A customer for an electric cook stove is entitled to this same rate of 5 cents for his electric iron, electric washing machine, and, in fact, any other appliance, provided it is connected to this separate circuit, on which there is a separate meter. There is a minimum charge for this meter of $1 per month in order to protect the business already secured for electric irons. Where there is little current used on percolators, toasters, etc., the electric iron is the principal part of the appliance load of any central station, and, therefore, if any customer should dis-

continue the use of his stove at any time [illegible] yet leave it connected in order to get the rate of 5 cents on his iron, the $1 minimum would give the same revenue that the central station was getting before the installation of the electric stove.

This kind of a rate also induces the people who have washing machines, electric irons and other appliances to install a stove in order to get the benefit of the 5-cent rate, as this rate applies only where there is an electric cook stove installed. The company has found the electric cook stove by far the best means of educating the people and making electricity in the home so popular that customers finally decide that it is an impossibility to get along without it. In fact, the central station can on this ground give a rate for electric cooking leaving a very small margin of profit.

Mr. J. F. Riche, manager of the company, to whom we are indebted for the above information, believes it would be well for the manufacturers of electrical appliances to look into the matter of electric cook stoves and awaken to the fact that with them they can cater to 100 per cent of the users of electricity instead of 2 per cent as they are now doing. With a thoroughly efficient electric cook stove and a heater that will enable the consumer to have hot water without having to use a coal or gas range, gasoline or kerosene stove, an important problem of the central-station man will be solved and his company placed in a much better light in the public eye.

DISCUSSION ON SIGN AND DISPLAY WINDOW LIGHTING AT THE ILLINOIS CONVENTION.

Mr. E. W. Osborn, advertising manager of the Rockford Electric Company, Rockford, Ill., presented a short paper before the convention of the Illinois State Electric Association at Rock Island, Oct. 26, on the above subject, which was followed by a free discussion.

Mr. Osborn said that successful merchants are using electric light liberally in store-window and sign illumination, and that the central station should lead the way by having an attractive display in its own window each week. One good plan is to loan the window free of charge to different concerns in the city for periods of a week. This creates a friendly feeling and also demonstrates how well advertising may be done by good illumination.

All sign and window lighting should be sold strictly as advertising and billed as such, separate bills being rendered for this service. If this is not done the merchant is likely to figure that he is spending too much for the lighting of his place. A good solicitor can readily show a merchant who is paying a high rent how he can increase the earning value of his location by well-lighted windows. The best method of securing this business is on a flat-rate basis from dusk until midnight, turned off and on by the company, which can be done by the installation of a lock switch on the front of the customers' premises. A check meter should always be placed on these circuits so if the sign man becomes negligent the leak can be stopped. In a city where the maximum rate is from 10 cents to 15 cents per kw-hour a rate around 6 cents can be safely figured on for the flat-rate business.

Since the introduction of the tungsten sign lamps the consumer can be given a much larger amount of sign and window lighting for the same amount of money. Sign and window lighting may be the opening wedge in securing the entire lighting of a customer's store, or it may mean the awakening of his neighbor. On the flat rate mentioned dusk-to-midnight signs and windows will be lighted about 2400 hours per year, and at 6 cents per kw-hour will earn $144 per kw-year. This 6 cents includes lamp renewals.

In discussion Mr. J. G. Learned, of the North Shore Electric Company, Chicago, emphasized window lighting as an entering wedge for other lighting inside the store. A storekeeper with electrically lighted windows and signs may direct trade to side streets off the main thoroughfares and increase the value of his advertising. Mr. Learned told of the flat-rate window lighting which his company is carrying on at a rate of 20 cents per 60-watt lamp per week, including lamp renewals.

Mr. T. W. Gregory, of East St. Louis, said that his company started flat-rate window lighting with free renewals of tungsten lamps. The free-renewal privilege was abused by customers working in lamps for renewal other than those furnished by the company for the window in question. As a result his company now makes a flat rate on such lighting for electricity only and the consumer must furnish his own lamps. Mr. Learned thought it necessary for the company to furnish the renewals in order to prevent some lamps being out and making a bad appearance and poor illumination. If left to the customer the renewals may not be made promptly. In order to prevent the abuse of the lamp-renewal privilege by customers working in other lamps, his company adopts a peculiar marking on the bulb of tungsten lamps used in show windows on a flat-rate free-renewal contract. If desired this could be further safeguarded by the use of a lock socket.

Prof. E. J. Burg, of Urbana, said that many streets have more traffic along one side than the other. It is possible by lighting to change the flow of traffic, particularly if the windows are filled with displays. Mr. R. S. Wallace, of Peoria, said this fact had been demonstrated in Peoria on a certain street. In this case it was the establishment of nickel theaters with their well-lighted fronts which changed the flow of traffic.

President E. W. Smith, of Kewanee, suggested to members a trial of the plan of lighting the windows and signs along one side of a street for a few nights and noting the number of people passing on the light side as compared to the dark side and then reversing this process. The result would be very convincing. He thought that the best plan of handling this business is to charge a flat rate of about 1 cent per watt per month, sell lamp renewals at cost and control the service by having the company's patrolman turn on and off at certain times. He had found by experience at Kewanee that this rate will give a return of 6.3 cents per kw-hour with the service turned off at 10 p. m. every night except Saturday, when it is run later.

Mr. N. M. Argabrite, of Belvidere, told of a plan for this class of business which consists of short lines of secondary circuits supplying signs and window lighting, operated by remote-control switches from the power plant, which open the circuits at 10 p. m. The rate on this service is 16 cents per watt per year. The service has been successful in meeting gasoline competition. He also told of the special street lighting installed along the main street in Belvidere. This consists of 10-watt tungsten 10-volt sign lamps placed about 5 ft. apart on No. 6 wires stretched between the poles along each side of the street. The average number of lamps per front foot is 4.5. The rate charged for this service is $1 per foot per month, which is about at the rate of 22 cents per kw-hour. The company, however, furnishes all the installation. He has materially changed the appearance of a street by inducing merchants to light their windows. One advantage of the flat rate is that it removes the temptation of a merchant to cut down on his lighting bills in the fall by turning off signs and windows when his bills increase, as they do when the hours of darkness are longer. Within the last week he said that he had closed contracts for 112 installations of display street lighting, which would net $112 per month.

HEAVY CENTRAL-STATION LOAD.

On Nov. 2, 1910, the maximum load on the electric service system of the Commonwealth Edison Company of Chicago reached a trifle over 165,000 kw. This is the greatest load ever carried by the Commonwealth Edison Company, and is believed to be the greatest load every carried by a central-station company anywhere up to this time. On the corresponding day in 1909 the maximum load of the Commonwealth Edison Company was 33,000 kw less.

A large proportion of the load carried by the Commonwealth company is due to the electrical energy supplied to surface and elevated electric railway companies. The Chicago company has

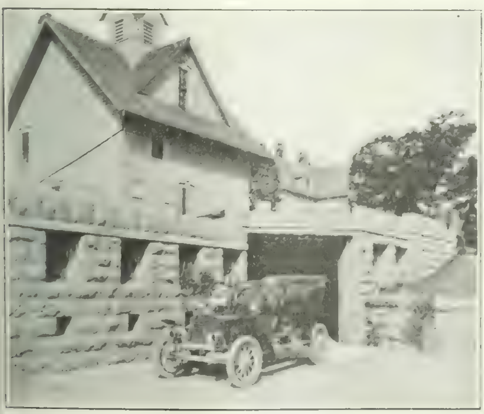
been notably successful in securing this class of business, selling large blocks of energy for this purpose at wholesale rates. A considerable proportion of the electricity taken by the railway companies is used in heating the cars, and it is a notable and interesting fact that a sudden drop in temperature as the season advances has a more decided effect on the central-station company's maximum load than does the increased demand for light owing to the shorter days of the fall and winter months.

ELECTRIC VEHICLES AT ROCKFORD, ILL.

Rockford, Ill., deserves to be classed as one of the "electric vehicle" cities of the country, for with a population of 45,000 no less than 170 electric automobiles are owned and operated in the city. Accounts of the work that has resulted in this record were given in our issues of Feb. 17, 1906, March 27, 1907, and April 1 and April 29, 1909, and what follows brings the subject up to date.

Figs. 1 and 2—Private Electric Garages at Rockford, Ill.

Rockford is not particularly favored with well-paved streets, but the situation has simply been one where the inherent characteristics of the electric vehicle have demonstrated it to be the logical car and the appreciation thus secured has spread to other automobilists. Most of the electric automobiles are owned by persons having gas cars and who use the electrics when they want to get to some place without being bothered with the intricacies of the big gasoline machines.



Figs. 3 and 4—Private Electric Garages at Rockford, Ill.

The introduction and operation of electric vehicles in Rockford has been assisted greatly by the very liberal rate which the Rockford Electric Company makes for charging service. The rate for this purpose to private consumers is 6 cents per kw-hour, measured under a separate meter from that registering the energy used for residence lighting, for which 13½ cents per kw-hour is charged. A minimum charge of $1 per month is made for the separate meter connection. The private consumer can utilize any demand he may require, but is limited during the winter months to taking service only outside of the peak hours, from 4:30 to 9 p. m. The average income from each machine is about $60 a year, or $5 a month, although, of course, the latter amount may vary greatly with the seasons of use of the car.

The majority of the electric vehicle owners in Rockford have built their own garages at their residences and many handsome and ingenious examples are visible in a few minutes' ride over the principal residence streets. Besides some of the really imposing structures used for electric garages, some owners have combined the garage with a porch or basement of the residence itself, making a compact and convenient arrangement. The accompanying views show several of these Rockford private garages.

There are ten public garages in Rockford, most of which have battery-charging facilities One of these garages is exclusively for electric vehicles, repairing them and storing business men's runabouts during the day. Little or no "boarding" of automobiles is done in Rockford, as is the case in other

cities, although some owners keep their machines in their own barns, driving them into the garages for charging. The public garages purchase electricity from the central-station company at 4 cents a kw-hour, guaranteeing $5 minimum income from each charging plug connected.

All of the downtown distribution and much of the service in the outlying residential district is direct current, so that comparatively few owners have to purchase mercury-rectifier or motor-generator sets. The convenience and economy of having the direct current available, together with the low rate charged for it, are probably the most potent factors in the recognition which electric vehicles have received at Rockford.

Fig. 5—Electric Garage at Rockford, Ill.

Wiring and Illumination

ORNAMENTAL STREET LIGHTING AT BELVIDERE, ILL., BY LOW-VOLTAGE TUNGSTEN LAMPS.

A permanent ornamental street-lighting system employing low-voltage tungsten lamps suspended from catenary spans bordering the curb line has been installed at Belvidere, Ill., the merchants paying $1 per store front per month for the special illumination. An iron messenger cable is suspended between the various electric light and railway poles along the curb, and from this messenger the low-tension lighting mains, two No. 6 rubber-covered copper wires taped together, are supported at a uniform height of 12 ft. above the pavement by drop hangers of suitable lengths. Ordinary weatherproof sockets are attached at 4-ft. intervals, each containing a 10-watt, 8-cp Buckeye tungsten 12-volt lamp. Mounted on the poles at intervals sufficiently frequent to avoid line drop 250-watt, 20/1-ratio transformers step down from the store-lighting circuit voltage, 240 volts, to the 12-volt low-tension lighting mains supplying the lamps.

Low-Voltage Multiple-Tungsten Ornamental Lighting at Belvidere, Ill.

In all about 800 lamps have been installed, representing nearly three-quarters of a mile of special street lighting in this little city of 2500 inhabitants. Each merchant pays $1 a month for his store-front illumination, averaging from four to five lamps in front of each store. The lamps burn from dusk to 11 p. m., so that the equivalent gross income from this service is 22 cents per kw-hour. Out of this charge the local lighting company expects to recoup its cost of the original installation and to furnish renewals for the lamps, which have a life of 800 hours. The service is rendered under a yearly contract agreement.

The present installation has grown from an original experimental string of lamps half a block in length near the electric company's office. The effect of these first lamps is said to have been so noticeable on the adjacent business houses that merchants not in the illuminated zone clamored for the extension of the installation, soliciting among the backward ones in their vicinity and making up the monthly rental in some cases in order to secure an unbroken line of illumination. This unique low-voltage tungsten street-lighting system was designed and installed by Mr. N. M. Argabrite, general manager of the Belvidere Public Service Operating Company, which supplies the electricity and maintenance for the installation.

250-WATT LAMPS FOR SPECIAL STREET LIGHTING.

So numerous have become the special street-lighting installations in Chicago that it seems possible to look forward to a time when one neighborhood will be connected with the adjoining one by lines of lamps, thus uniting the scattered groups in one extensive system which may be several miles in length. Possibly in time these systems may cover a considerable portion of the city, supplementing the regular street lighting.

The special street-lighting installations are paid for by merchants for the purpose of advertising the neighborhood and attracting trade. One of the latest of these neighborhood installations is on Lincoln Avenue, in the vicinity of Belmont Avenue. Here 109 aluminum-painted iron posts with fluted columns have been placed on the sidewalk, near the curb, each one supporting a 250-watt tungsten lamp inclosed in an 18-in. Alba globe. This is the first instance when incandescent lamps as large as the 250-watt size have been used for street lighting in Chicago. In the other special street-lighting installations four or five 60-watt tungsten lamps are suspended from one post. The Lincoln Avenue lamps are not spaced at regular intervals, but each one is placed in front of the place of busi-

250-Watt Sidewalk Lamps on Lincoln Avenue, Chicago.

ness of a merchant, who pays the Commonwealth Edison Company $1.50 a week under a two-year contract for the service. As may be judged by the accompanying illustration, the lamps present a handsome appearance, and the local merchants are well satisfied with their investment. The picture also shows festoons of incandescent lamps strung across the street in a local celebration.

WIRING AND ILLUMINATING CHART.

By H. D. Austin.

In the design of interior-lighting systems the engineer needs a rapid and approximately accurate means for calculating the intensity of illumination at various points, and in determining the proper sizes of wire to use.

The graphic chart shown below was designed to meet these requirements. It consists essentially of a system of hyperbolas of the form $XY = A$, where A is a constant.

Thus the well-known equation

$$I \times H^2 = \cos^3 \Theta \times C$$

where I = the intensity of illumination normal to the plane to be illuminated,

H = distance of lamp above plane of illumination,

C = candle-power reading from photometric curve,

Θ = angle made by reading C with normal to plane illuminated,

can be written

$$I \times H^2 = A = (\cos^3 \Theta \times C),$$

and may be plotted as a hyperbola. Then by moving along this

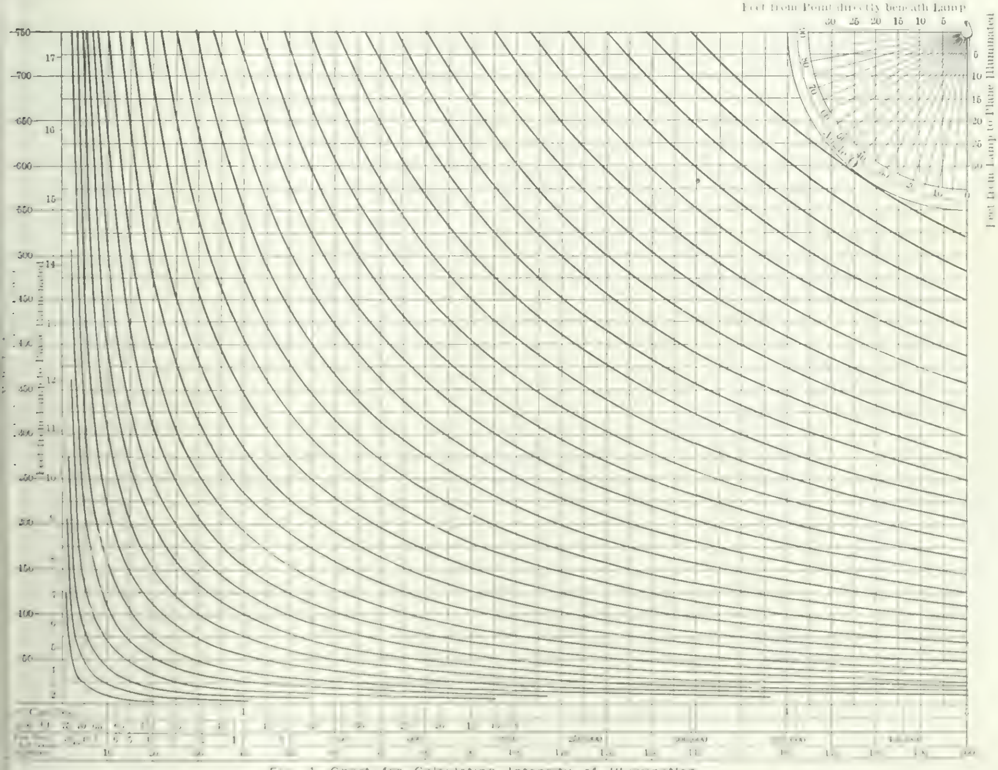


Fig. 1—Chart for Calculating Intensity of Illumination.

curve from one set of co-ordinates representing $I \times H^2$ to the other set of co-ordinates representing $\cos^3 \Theta \times C$ any one of the four quantities contained in the above equation can be determined graphically. This is the method used in designing the accompanying chart.

EXAMPLE.

Using a lighting unit giving the photometric curve shown in Fig. 2, it is required to determine the intensity of illumina-

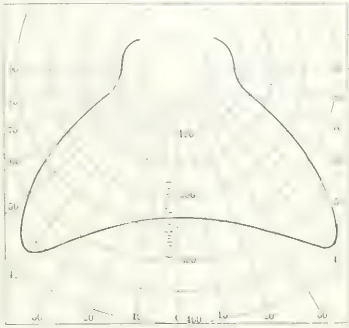


Fig. 2—Photometric Curve.

tion at a point 9 ft. below and 7 ft. distant horizontally from lamp. From the angle diagram in the upper right-hand corner of the chart the angle Θ corresponding to the chosen distances is found to be 40 deg. From the photometric curve of Fig. 2 the candle-power of the unit at the angle of 40 deg. is 370 cp. Upon the left-hand side of the chart is found the length of the ordinate representing 370 cp, and along the bottom of the chart is found the length of the abscissa representing $\cos^3$ 40 deg. The point upon the chart determined by these two co-ordinates

... close to a given hyperbola ... follow downward to the point of intersection with the horizontal line representing 9 ft., as shown on the scale at the side of the chart; from this point dropping vertically to the bottom of the chart 2 ft.-candles is found as the intensity required.

When the point determined by the co-ordinates representing either half of the equation falls upon or near one of the hyperbolas, the values representing the other half of the equation as taken from the curve will be sufficiently accurate for all practical purposes. When the point determined by the co-ordinates falls between two hyperbolas, rather than assume that either curve represents the exact product of co-ordinates, it is preferable to take the quantity sought from an imaginary curve which is assumed to lie between the two hyperbolas and passes through the point located.

The equation for determining the wire sizes or volts lost in an electric circuit can be solved by means of the chart in an exactly similar manner. This equation is

$$c.m.V = 21.6\,AD$$

where *c.m.* is the sectional area of the wire in circular mils; V is the volts lost; A is the current in amperes and D is the distance in feet. The use of the chart in the electrical circuit problem should be self-evident from the description given above.

COEFFICIENT OF DIFFUSED REFLECTION.

In a paper presented before the Philadelphia Section of the Illuminating Engineering Society on Oct. 21 Mr. F. H. Gilpin described a series of tests showing the effect of the variation of the incident angle on the coefficient of diffused reflection. In order to judge of the effect use was made of a photometric

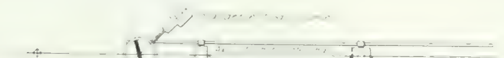


Fig. 1—Arrangement of Photometric Apparatus.

curve of the reflected light in the plane of the incident ray. From the curve thus obtained the ratio of the lumens reflected to the lumens incident on the plane may be calculated for each incident angle.

In the apparatus used to obtain the curves a spot of light, with sharply defined edges, was thrown on the sample surface which rotated about a central vertical line in its plane, the surface coinciding with the plane shown in Fig. 1.

The light source was an upright mantle-gas burner with a clear chimney. A seasoned mantle was used to insure a constant value of the source during a set of readings. The light source revolved and the test plane rotated, either together or separately, through 360 deg. about the same axis. Suitable pointers and a graduated scale indicated the relative position of the plane and the source and the angle between the plane and the axis of the photometer. A tantalum lamp, behind a ground glass screen, was used as a secondary bar standard of about 2.5 candles; it was checked at frequent intervals against a standard 10-cp carbon lamp. The disk box used was a Lummer Brodhun contrast prism. All parts of the apparatus were suitably shielded from each other and from all stray light.

Owing to the interference of the light source and the disk box, readings at certain angles could not be obtained. The corresponding points on the curves were obtained by interpolation or extrapolation, which was comparatively simple, owing to the regularity of the curves.

In calculating the percentage of light reflected from a surface two quantities were determined; first, the total amount of

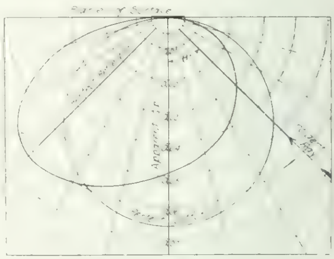


Fig. 2—Photometric Test of Paper.

light falling on it, or incident light, and, second, the total amount of light given off by the same surface, or reflected light. To obtain the former four quantities were determined: (*a*) The distance of the effective center of the light source from the axis of the surface in feet. (*b*) The area of the light spot on the surface in square feet. (*c*) The intensity of the light source in candles. (*d*) The angle between the incident ray and the normal.

The first quantity was determined once for all by revolving the light source into the line of the axis of the bar, where direct comparison was made between it and the standard lamp. A large number of readings with the disk box at various positions were then taken. Then by equating the candle-powers observed at the various points the distance of the effective center from any fixed point was ascertained. This distance was found to be 27.63 cm, or 0.905 ft., from the axis of the surface plane.

The area (*b*) was obtained by direct measurement, as it represents a series of oblique sections and does not follow the cosine law, as would a series of similar sections of a cylinder. The maximum difference was about 4 per cent, due to the divergence of the ray of light.

The intensity of the light source (*c*) was determined by direct reading in place on the photometer bar.

Angle (*d*) was read directly from disk and pointers

Paper No.	Kind of Paper	Finish.	Color.	Efficiency of Incident Angle with Normal of 60°	45°	30°	15°	0°	Mean
1	Pulp tint......	Matt (smooth)...	White...........	56.0	61.5	58.2	56.5	54.6	57.3
5	Pulp tint	Matt (smooth)...	Light buff........	46.0	47.4	45.7	43.8	42.7	45.1
6	Pulp tint......	Matt (smooth)...	Lt. orange yellow	42.5	44.1	43.0	42.8	42.4	42.9
7	Silk fiber..... ..	Semi-gloss......	Orange yellow...	38.5	36.0	33.3	31.4	30.0	33.8
4	Silk fiber.......	Semi-gloss......	Pea green	37.6	32.2	25.6	22.6	21.0	26.0
13	Silk fiber.......	Semi-gloss......	Light pea green ..	27.8	25.7	21.4	18.9	18.5	22.2
15	Silk fiber.......	Semi-gloss......	Dark pea green ..	23.5	18.6	14.4	11.2	9.3	15.4
9	Silk fiber.......	Semi-gloss......	Light green	16.8	14.6	11.7	10.9	10.3	12.9
19	Silk fiber.......	Semi-gloss......	Light blue.......	15.5	13.0	10.0	9.2	8.1	11.2
10	Silk fiber.......	Semi-gloss......	Cherry red.....	13.7	11.8	8.9	7.0	6.3	9.5
8	Imported stock.	Fibrous.........	Tan..........	19.3	19.0	17.3	16.3	15.7	17.5
17	Imported stock.	Fibrous...... ...	Light blue .	13.5	13.4	12.0	11.0	10.2	12.0
18	Duplex	Rough	Light blue	12.7	12.0	10.5	9.1	8.2	10.5
11	Duplex	Rough	Cherry...........	6.6	6.4	6.2	6.0	5.7	6.2
[illegible]	Plain	Rough	Yellow buff......	31.4	34.3	35.6	35.6	35.0	34.4
14	Plain	Rough	Light pea green...	21.5	20.4	19.8	18.8	18.2	19.7
16	Plain.........	Rough	Dark pea green ..	13.4	12.7	11.3	10.7	8.9	11.6
12	Plain.	Rough..........	Deep red	7.3	7.0	5.9	5.3	4.9	6.1
2	Varnished tile	Gloss	Cream	66.3	71.1	73.1	71.8	70.8	70.6
20	Imported	Embossed gloss	Gilt	[illegible]	49.8	43.7	37.7	27.0	41.7
	White blotter			72.7	80.0	73.9	72.9	71.1	74.0

The computation is as follows:

Incident lumens = (area $\times$ *cp* $\times \cos\theta) \div d^2$,

where *cp* = intensity [illegible] dis-tance from effective center of light to center of spot on plane.

The angle for any incident ray having been selected, the light source and plane were clamped for that angle; both were then revolved about the fixed axis and five readings on the photometer were made at each of the 15 deg. reflected light stations. From these data the candle-power was calculated according to the inverse-square law, and a curve was plotted on polar co-ordinates for each such incident angle.

From this curve values were taken at ten prescribed equal zone angles in each quadrant, such that their average gave the mean hemispherical candle-power. The mean hemispherical candle-power multiplied by 2π gives the total lumens or the total reflected light.

In the following demonstration the coefficient of reflection is obtained for paper designated as No. 5 at an incident angle of 45 deg.

Incident Light.—The area of the lighted surface having been found by measurement and calculated to be 0.0426 sq. ft., at 45 deg. the equation for incident light is reduced to:

Incident lumens [illegible] (0.905)² [illegible]

Candle-power of source = 11.93.

Incident light = 11.03 × 0.0368 = 0.439 lumens.

Reflected Light.—In Fig. 2 are shown two curves marked (1) and (2) taken in a horizontal plane. No. 1 is a theoretical curve for a perfect diffusing surface for light at any incident angle, but drawn to have the same mean hemispherical candle-power as No. 2. This curve, it will be noted, is a circle and its maximum candle-power will always show at 0 deg. and its average candle-power will always be one-half the maximum. No. 2 is the curve as actually obtained on paper No. 5 with a 45-deg. incident angle. It is decidedly not a circle and has none of the characteristics of No. 1. Therefore, values must be read off at the equal zone angles shown by the dotted lines and their mean thereby determined.

In order to show the difference between these characteristics [illegible]lue at 0 deg. and equal-zone angles are here tabulated:

[illegible]	Reflected Candle-Power No. 5 Paper. Left Side.	Reflected Candle-Power No. 5 Paper. Right Side	Reflected Candle-Power Theoretical Curve. Left Side	Reflected Candle-Power Theoretical Curve. Right Side.
[illegible]	[illegible]	0.002		0.0330
[illegible]	0.020	0.006	0.0990	0.0990
[illegible]	0.031	0.011	0.1650	0.1650
[illegible]	0.041	0.015	0.2313	0.2313
[illegible]	0.049	0.019	0.2975	0.2975
[illegible]	0.056	0.023	0.3637	0.3637
[illegible]	0.060	0.028	0.4297	0.4297
[illegible]	0.062	0.033	0.4958	0.4958
[illegible]	0.061	0.037	0.5620	0.5620
[illegible] 12	0.056	0.043	0.6280	0.6280
	[illegible]	0.217	3.3050	[illegible]
	0.217		3.305	
	20)0.661		20)6.61	
	0.03305	—M. H. S. C. P.	0.03305	
	0.0492		0.0661	

[illegible]ted.

[illegible] dotter.

Apparently for a matt surface the greatest efficiency is obtained at 45 deg. angle of incidence, while for other types of [illegible]es the angle of maximum efficiency varies—as a rule, in-[illegible]

Taking the above as a basis, the author said that the general [illegible]on illumination with various wall coverings, assuming the [illegible]

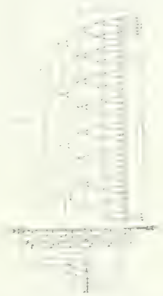
For high, narrow rooms, for indirect lighting or where the lamps are placed near the walls, a glossy paper will give the best results, while for wide, flat rooms or centrally located lamps the difference between the rough and the smooth papers would be practically negligible

RECENT TELEPHONE PATENTS.

IMPROVED SYSTEM OF SELECTION.

With automatic systems it is necessary to select at will any one of a large number of contacts. It is, of course, impracticable to make all selections with a single series of impulses; although this method is used where all numbers are relatively low, the delay would be unbearable for high numbers. Usually the selection is made in several processes, one for each digit. This, however, requires the switch arms of each switching limit to be capable of considerable travel and to have several different stable positions.

In a system patented by Mr. E. Blos, of Germany, the selection is distributed into several different parts and the normal positions of each are reduced to two, an upper and a lower. In



Blos Transmitter for Teleselectors.

the cut the circles represent contacts. The vertical lines represent operating rods, while the lines crossing them represent switch blades. As at present shown it will be noted that all switch blades are up, and the circuit leads to the uppermost contact. It will be seen that the left-hand bar divides the contacts into halves. The next series selects by quarters; the next reduces groups to eighths, while the right-hand switches select odds and evens. The switch rods are actuated by magnets and are also interconnected with a contact wheel. The circuits are so arranged that two series of three impulses, each in proper order, will affect the selection of any number. This is accomplished through two different impulse circuits, impulse over one of which drives the contact wheel, but not the switch rods, and impulses over the other drive both. Thus, three driving steps followed by three operating steps would leave the left-hand three rows of switches up and the right-hand three down, selecting No. 18.

REPEATER.

To control the action of a telephone repeater Mr. C. Adams-Randall, of New York City, has introduced control relays. One of these is in each incoming circuit and, responding to the incoming voice currents, must operate to close the re-transmission circuit in the forward direction only, leaving it open toward the line from which currents are being received.

PARTY LINE KEY INDICATOR.

Where party lines are used it has been found essential for good service to provide some indicator associated with the ringing key of cord circuits in order that re-rings may safely be made without bothering the calling party to repeat the code or designation of the desired station. Such indicators have taken the form of a manually operated pointer swinging over a dial where code ringing is used. In such cases the setting of

the indicator is a special operation. Where selective ringing is used with a special key for each station it is easy to provide a mechanical indicator which shall be set incidentally to the depression of the key.

As an improvement upon such a mechanical indicator Mr. C. C. Bradbury, of Chicago, uses electric lamp indicators. For each calling cord there is provided as many supervisory lamps as there are units in the selective ringing key. That particular lamp is switched in by auxiliary contacts which correspond to the particular selective key last depressed. All other lamps are out of circuit. The patent for this indicating system has been assigned to the Kellogg Switchboard & Supply Company.

PARTY LINE DEVICES.

A busy signal for step-by-step party-line systems has been patented by Mr. J. H. Blythe, of Denver. Each station has a properly marked target which is displayed whenever the local stepping mechanism is off normal. This is accomplished by a cam attached to the display plate, which seats itself in a notch when the apparatus is at normal, thereby withdrawing the busy notice.

In the apparatus patented by Messrs. W. C. Fisk and H. L. White, of Orofino, Idaho, any non-wanted station coming in on a line gives a characteristic and identifying signal upon the line. To this end the hook level is made to drive a wheel, which produces a series of coded buzzes. The wheel carries contact plates arranged to give the proper code and also a series of teeth to interrupt periodically the signal supply current. A locking device is provided to hold the hook switch up for a period sufficiently long to suffice for the sending out of the signals, so that the latter cannot be tampered with. The latch is released when the signal wheel has made a sufficient movement.

RECEIVER HOLDER.

A receiver holder bent up out of metal strips forms the subject of a patent granted to Mr. J. F. Hines, of Pittsburgh, This is adapted to clamp upon a desk stand of standard type. A chain attached to the device and provided with a hook at its free end serves to hold the switch-hook lever down if caught over it.

Letter to the Editor.

"Wattless" or What?

To the Editor of Electrical World:

Sir:—In the Digest of Current Electrical Literature, in the issue of Nov. 17, 1910, on page 1191, I notice a reference to the attempts made recently in France (as indicated by the contributions made by various writers to a discussion in the columns of *L'Industrie Electrique*) to find a suitable adjective to replace the objectionable word "déwatté" (unwatted), which is the French equivalent of the English adjective "wattless."

Since "wattless" is a shade or two worse than "unwatted" it is plain that the need of reform is, to say the least, as much "long felt" in the English as in the French language. Nobody ever liked these words. The French have, seemingly, decided "to do something about it." Their efforts acquire what they would call "actualité," i. e., become a matter of immediate interest for the English-speaking world, as soon as reference is made (as is done by M. Boucherot in his letter to *L'Industrie Electrique*, published Oct. 25, 1910) to the international bearing of their deliberations over the matter.

It certainly seems desirable that the "substitute," whatever it may be, which is adopted for "unwatted" ("déwatté) should be, as much as possible, homogeneous in etymology or derivation with the term replacing "wattless," the word which we all would like banished from the English language. The world recognizes the ability of the French to think and to write clearly. Nobody doubts that they will soon find, now that the have decided to do it, a substitute for "unwatted" which w maintain the reputation of the French language for clearne and precision. Unfortunately, they are not likely to give much weight or pay as much attention as they should to point which, I consider, is of great importance, namely, th "translatability" and "exportability" of the term selected. Th has already happened many times. One could cite dozens words like "entrefer" (air-gap), "sur-voltage," "sous-voltage "sur-volteur," "sous-volteur" ("boosting" and "boosters" f raising or for lowering the e.m.f) which are simply matchle in their aptness and their appositeness, but which are untran latable otherwise than by circumlocution or by using phras instead of words to convey the whole of their meanings. these and other expressions had been formulated partly wi reference to their "translatability"—and "exportability"—it possible that greater uniformity would have been secured, wit out material harm to either language.

We recognize the advantages of standardization and inte changeability in the large manufacturing industries of whi ours is a most striking example. The International Electr technical Commission is one of the evidences of the desirabili of standardizing our technical language, or, in other wor of making technical language more interchangeable and mo international, and, consequently, more easy to import or export.

I find an interesting example of lack of translatability in so of the substitutes already proposed. The terms "puissan dépensée" (power expended) and "puissance compensée" (co pensated power) have been proposed for expressing, respectiv ly, "watted" power and "wattless" power. This suggestion really excellent—for "domestic purposes" or for "home" co sumption. The moment, however, that we "look at" the sar ideas through another language we see that they "change colo and are far from being as effective. We know that the sy metry of ending of the two words makes them more impressi just as the symmetry of ending of "offensive" and "defensiv heightens the contrast between their meanings. The symmet and the appositeness of "dépensée" and "compensée" are lo substantially, when these words are translated into other Eur pean languages. These words are not suitable for "export tion."

M. Boucherot himself has used, provisionally, or, as he sa "while waiting for something better," the expression "puissan magnétisante" (magnetizing power). It is a satisfactory ter for which the expression "magnetizing current" has alrea paved the way in all countries and has established a precede It is suitable for "export," therefore.

The suggestion of the adjective "potential" to be used in t sense of "wattless" does not meet with favor. M. Boucher and M. Brylinski have given very convincing reasons why th term would not be suitable and why it would be objectionab Aside from the technical reasons which they have advanc there is the question of "exportability." It is very doubtful the term would be accepted elsewhere, especially in Ameri and in England, where the word "potential" is already ove loaded and overworked.

The best suggestion thus far made is that of M. Brylinsk who proposes the adjective "réactif." This word has th advantage of denoting or implying the "reaction" (electr dynamic) attending the phenomenon in question without su gesting any hypothesis or postulate regarding its nature, leavi us free to decide for ourselves, or let others do it for us, as whether the energy is potential or kinetic, or partly, or su cessively, both. The term is more "descriptive" than the othe It can also be translated and "exported."

In America we are prepared to go a step nearer to t actual phenomenon. Everybody here would understand wh was meant if, instead of writing "wattless" power, we were write "reactance-power." I believe that the term "reactan current" has already been used in this country to some exte We use the terms "reactance-component" and "resistance-co ponent." Why could we not, "by symmetry," say also "resi

ance-power," "reactance-power" and also "resistance-current" (that current which produces ohmic "drop" and dissipates energy by "Joulean" loss) and "reactance-current" (the component of the resistance-current which is in quadrature therewith and which is a factor of energy that is undergoing a process of displacement or transfer and not of dissipation)?

The hyphen in a compound word like "reactance-power" enables an English substantive to answer, very admirably, the purpose of an adjective. Hence we could get along without any adjective to express the idea we intend to convey when using the term "wattless." The hyphen has the same property in other European languages, notably in the Dutch and Scandinavian languages. The German language is even more accommodating in this case, because the two components of the word can be joined together directly without the hyphen. Tabulating the possibilities for some of these languages, we have:

In English	Reactance-current	Reactance-power
In German	Reaktanzstrom	Reaktanzkraft
In Dutch	Reactance-stroom	Reactance-kracht
In Swedish	Reaktans-strom	Reaktans-kraft

The French equivalents would be "courant de réactance" and "puissance de réactance." It is to avoid the preposition "de" as a connecting link—which makes the expressions less simple and wieldy—that it is desired to find an adjective. The participial adjective "réagissante" would be the logical one; and one could say "courant réagissant" and "puissance réagissante" to convey substantially the same meaning as is conveyed by the English, German, Dutch and Swedish corresponding expressions just given. The expressions "puissance réactante" and "courant réactant" would be shorter and more "descriptive"; but, unfortunately, it is very difficult in France to improvise new words without the knowledge and consent of the French Academy, which has always been noted for its extreme conservatism and its unwillingness to depart from traditional rules. The form is not "regular"; but the same thing could be said of many other words derived from various dialects, from the "argot" ("slum" language) or from the "langue verte" ("slang" language), which have, nevertheless, found their way eventually into the vocabulary sanctioned by the Forty Immortals. They were words born either of necessity or of fortuity, which made a "hit" and became so popular that even the Academy could not help recognizing them. The adjective "réactant(e)" would certainly be useful enough to be worthy of further consideration. The expressions "puissance de réactance" and "puissance réactive" would, in any case answer the purpose pretty well. Whatever expression may be found suitable for the French language will probably be able more or less readily and easily to the other "Latin languages, because the problem of "exportation" from the French into any of these languages is usually a simple one. The difficulty comes, generally, in "synchronizing" with the other European languages.

The above is a suggested solution of a small problem in international terminology. It may not be the best, however. Let us hope that all who can contribute ideas will do so without delay.

New York. C. O. Mailloux.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Three-Phase Commutator Shunt Motor.—L. Drey[illegible] and F. Hillebrand.—A continuation of their paper, illustrated by diagrams, on the theory of the three-phase commutator shunt motor. In the first instalment the authors showed that a three-phase induction motor with short-circuited slip-rings and a three-phase commutator shunt motor with short-circuited brushes are not equivalent. They differ with respect to the unequal action of the rotary stray field and with respect to the action of the currents in the coils short-circuited by the brushes in the commutator motor. In both respects the commutator motor was originally inferior. But in recent years it has become possible to overcome the bad effect of the rotor stray field by suitable connections and to overcome the commutation troubles due to the currents in the coils short-circuited by the brushes. Recent progress has been due chiefly to the use of an e.m.f. impressed on the commutator for phase compensation and speed regulation. The different methods employed differ only in the way in which this impressed e.m.f. is produced and regulated. The first method employed was to use an auxiliary regulating transformer with its primary connected to the network in parallel with the stator and with the secondary acting on the commutator. The theory of this method is given, and it is shown that it permits the regulation of speed without losses and gives an excellent power-factor. The next step of the evolution was to avoid the use of a special regulating transformer and to arrange the stator itself so as to act as a transformer. For this purpose the stator is provided not only with the normal three-phase primary winding, but with a similar winding uniformly distributed over the main winding and arranged in such a way that connections may be made at different points. By changing the connections the speed can be regulated at will. For phase compensation, however, another voltage is required and it is necessary either to provide a small auxiliary winding in the stator or to use a special compensating transformer. The latter case is first considered. Since this transformer needs to be of only a small size it is inexpensive; nevertheless it represents a certain complication. The arrangement is shown in Fig. 1. Every rotor phase is connected in series not only with the auxiliary winding on the stator, but with the secondary of a small transformer, the primaries of which are connected to the network. The vector diagram for this arrangement is given and the fundamental formulas are derived. The paper is to be concluded.—*Elek. u. Masch.* (Vienna), Oct. 23 and 30.

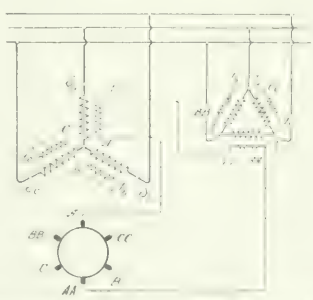


Fig. 1—Connections for a Three-Phase Commutator Shunt Motor.

Voltage Regulation of Compound-Wound Rotary Converters.—Jens Bache-Wiig.—The author first discusses the combined effect of the ohmic resistance and reactance and armature reaction in a rotary converter, and shows that an approximation of their combined effects is all that is needed for practical results. The proper way to operate a compound-wound rotary converter to obtain a flat or slightly rising voltage characteristic is to adjust the shunt-field rheostat so that a lagging current is produced at no-load and to adjust the series-field turns so that sufficient series ampere-turns are produced as the load comes on to make the sum of these ampere-turns and the constant shunt-field ampere-turns produce unity power-factor at the average load. The field may be adjusted so that unity

power-factor will occur at half-load or full-load or at any other desired point on the load curve. For normal operating conditions and with the fields properly adjusted the power-factor will be nearly unity over a considerable range of load, which, of course, is desirable from an operating point of view. In order to predetermine the voltage characteristic of a compound-wound rotary converter, the total amount of reactance and resistance in the converter circuit must be known. Furthermore, the ratio of the series-field ampere-turns to the armature ampere-turns should be known. With this information the voltages and power-factors of a converter for a certain setting of the field rheostat can be closely approximated. This is illustrated by a numerical example. A number of diagrams are given showing power-factor and voltage curves of rotary converters under different conditions. They emphasize the effect of an increase of reactance. A total reactance of 15 per cent might be said to be the maximum required in the converter circuit in order to obtain an approximately flat voltage characteristic. Assuming a reactance of 5 per cent in the converter itself, it thus requires approximately 10 per cent additional reactance in the transformers and choke coils to fulfil this requirement. This is the reason that at least one of the large manufacturers of rotary converters in this country has established the standard practice of allowing for 10 per cent reactance in the transformers, thereby saving whenever possible the extra expense and space required for installing special choke coils.—*Elec. Journal,* November.

Leakage Coefficient of Induction Motors.—R. E. HELLMUND.—The first part of a mathematical paper illustrated by diagrams. The author gives a summary of formulas by means of which the different parts of the leakage coefficient of induction motors can be calculated with sufficient accuracy for practice. The formulas are not empirical, but are the result of theoretical considerations. They are simplified, however, for practical use.—*Elek. Zeit.,* Nov. 3.

Compounding Alternators.—P. NOEL.—An article in which the author first briefly outlines the theoretical problem of compounding alternators and then describes, with the aid of diagrams, the following compounding methods; Ganz & Company, Heyland, General Electric Company, Alexanderson, Hutin and Leblanc.—*L'Industrie Elec.,* Oct. 25.

Armature Cores.—A note on a recent British patent (824, Oct. 27, 1910) of Crompton & Company, J. C. Macfarlane and H. Burge. To assist cooling the radiating surface of the armature is increased by using core-disks of two different diameters, one slightly greater than the other. By threading these disks on alternately the larger ones give radiating surfaces at the sides as well as at the edges.—Lond. *Elec. Eng'ing,* Nov. 3.

Lamps and Lighting.

Tungsten Filament.—A note on two recent British patents (2983 and 3610, Oct. 27, 1910) of the Westinghouse Metallfaden-Glühlampen-fabrik (Vienna). The first specification describes a method of decarbonizing tungsten filaments, consisting in heating a large number together in a vacuum furnace to a very high temperature. An electric resistance furnace for this purpose is described. It is stated that with a good vacuum and a temperature of about 1200 deg. C. the carbon content can be reduced to 0.04 per cent. The second specification claims the process of adding a quantity of pure powdered tungsten (from 40 per cent to 50 per cent) to a paste of tungsten dioxide and binding material before squirting. Strong filaments can be produced from such a mixture without raising the temperature above 1000 deg. C. during the reduction of the dioxide.—Lond. *Elec. Eng'ing,* Nov. 3.

Phosphorescent Lamp.—A note on a recent British patent (4098, Oct. 27, 1910) of E. Urbain, A. Feige and C. Scal (Paris) for a high-efficiency lamp consisting of a Geissler tube containing phosphorescent sulphides painted on the inside surface of the tube or fixed on a support. The tube may contain a rarefied gas, helium being suitable. The sulphide is excited by the action in the tube and emits a white light.—Lond. *Elec. Eng'ing,* Nov. 3.

Mercury-Vapor Lamp.—W. MATTHIES.—An account of e periments on ionization and luminescence in the aureola of t mercury-vapor lamp. Ionization as well as luminescence has maximum for a certain pressure, but the pressure is not t same for the maximum of ionization and for the maximum luminescence. There seems to be more than a mere paralleli between light emission and ionization in the luminescence of t aureola of the mercury-vapor lamp.—*Phys. Zeit.,* Nov. 1.

Metallic-Filament Lamp.—H. VON LÖTI.—An English tran lation of his German paper on the development of the "1-wa metallic-filament lamp" in the last two years.—Lond. *Electrici* Nov. 4.

Wires, Wiring and Conduits.

Impregnated Poles.—An account of a long discussion at recent International Telephone Conference in Paris. Petrits raised the question whether the process of Boucherie, whi makes use of sulphate of copper, is a suitable and reasonal means of preservation. It was used almost exclusively for te graph poles in nearly all the central European states toward t end of the last century, but it has since been entirely abandon by several administrations. Posts thus prepared have mai fested in certain sections and localities very troublesome dra backs; in other cases the posts deteriorated as rapidly as if th had never been protected in any way. Since the destruction the wood is due to vegetable mold and particularly to certa kinds of fungus, methods of impregnation which are antise tic and destructive to fungus have been taken up. Sulphate copper, as compared with other impregnations, such as cre sote, mercuric chloride and even chloride of zinc, gives t weakest antiseptic effect. But protective action does not see to be in the same proportion as antiseptic properties. In fa sulphate of copper yields a better result than its antisep action would indicate. Collette estimates the cost of an in proved Boucherie process at 7 francs 50 centimes ($1.50) p cubic meter of wood treated. For this sum more than 60 l (132 lb.) of creosote could be bought—that is, sufficient to in pregnate the same quantity of wood by the Ruping proce The latter, therefore, should supersede the copper-sulpha process even where the conditions are most favorable to Massin's report clearly established that where the conditio were unfavorable no one would think of using the copper-su phate method. When it is necessary to replace the posts eve two or three years it is certainly necessary to use additional other measures. To take all the precautions recommended him would cost a sum in excess of the result obtained and would cost as much to treat the base of the post as to creoso the entire pole. In his "Recent Tests of Creosoted Woo Poles" Henley says that under the British Post Office, whe creosoted poles are almost exclusively used, not more tha 50,000 of these posts are required annually for maintenanc This is amply sufficient proof of the great economy of suc poles, especially with the process of Ruping, Rutgers, et Mycological investigation shows that 0.5 kg (1.1 lb.) of creo sote gives nearly the same antiseptic effect as 1 kg of coppe sulphate, costing 100 times as much. The newer processes facil tate penetration of the creosote almost to the heart of the woo with the use of a much smaller quantity than formerly. Th problem now relates to the extent to which the absorption c creosote can be reduced without injury to the life of the post Henley has shown in the case of sections of creosoted woo which, after remaining in the soil, had been placed at the to and in the middle of the post, that only one-third of the orig inal quantity injected had been found at the foot and one seventh at the top and middle. The Rutgers method, used b the Austrian administration, seems to be an improvement o the Ruping process. It is possible to affirm, in view of th results obtained, that these two processes turn out posts muc superior to those impregnated with sulphate of copper, espe cially where fungi and other destructive elements exist. Th [illegible] the common pine wood can [illegible] practice be creosoted. In certain regions and even in som [illegible] impossible or very expensive to procure pin

oles. Efforts are, however, being made to overcome the difficulty of treating other woods, and in Hungary considerable success has been achieved. This leads to a demand for competitors. The older Kyan method, by which the wood is immersed in a weak solution of mercuric chloride, offers a promising competitor to systems using creosote. In the discussion which followed Collette stated that an alleged average life of fifteen years for posts prepared with sulphate of copper in Holland by an improved method is too low. As to chloride of zinc, creosote and sublimate processes, the Holland administration has not had sufficient experience to compare the results with those obtained with the copper sulphate method, the value of which, as found elsewhere, may be placed between that of the creosote and that of the sublimate process. The copper method requires the wood to be treated within a few days of being felled and presents difficulties with posts more than [illegible] ft. long. This has led to the employment of kyanization. Creosote gives excellent results as regards arresting decay, but its emanations attack the clothes and skin of the workmen. This can only be partly met by storing the poles after treatment for a year before use. From the working point of view he is not, therefore, a partisan of creosote. Kuhlmann said that in Germany preference is given to poles creosoted under the Ruping method, the results of which have hitherto been satisfactory. Ritter said that footings of concrete are an excellent means of preservation, because it is especially at the surface of the soil that the post perishes. Statistics show a life of 15.6 years for kyanized poles. Petritsch said that other insects, such as ants, attack the wood, but he stated that creosoting offers sufficient protection. As to cement footings there has not been sufficient experience to estimate the prolongation of life which results. According to German statistics posts give the following durabilities, stated in years: Creosoted, [illegible]2; kyanized, 15.5; sulphated, 15.5; chloride of zinc, 12.1. These results do not apply, however, to regions or conditions where the climate or soil is different. Henley said that in England kyanization is not employed because well water might be poisoned by the bichloride of mercury. Further, the salt is very soluble and may be washed out of the posts by rain. The price of creosoting in England is unimportant, and it is preferable for the creosote to be in excess. Ritter placed entire faith in the accuracy of the German statistics. Cemented footings double the durability of the poles. The men handling the creosoted posts receive higher wages, which must be taken into account. Haltenberger said that thirty years' experience has shown the insufficiency of sulphate, and in Hungary creosoting has been adopted. The process at first was complete injection, then the more economical methods of Ruping and Rutgers were applied. They employ perforating machines to make radial punctures in the base of the post and force a greater quantity of creosote into the base, as it is most liable to attack. This method requires 90 kg (198 lb.) per cubic meter, of which 50 per cent penetrates the base and 50 per cent the staff. According to Henley the post after erection ultimately retains in the lower portion only one-seventh of the weight injected, but under the Hungarian process, after several years' exposure, the exact quantity injected into the base by the Ruping process, namely, 3 kg (6.6 lb.), is found there, but after a further [illegible] of several years this is reduced to 1 kg (2.2 lb.). This corresponds to experiments made in France. The improved [illegible], as compared with that of Ruping or Rutgers, could be applied to all resinous woods, which is a considerable economical advantage. Massin remarked that the drawbacks of creosoting are aggravated in hot countries.—Lond. *Electrician*, [illegible]

[illegible] overhead transmission lines, especially steel, iron, bronze, hard copper, aluminum and "spree aluminum" (the latter being a [illegible] especially with respect to their mechanical strength (sag [illegible] rent spans, etc.) and cost. His conclusions are favor- [illegible] alloy "spree aluminum." The latter is mechanically equivalent to hard copper and is cheaper as long as 1 kg costs less than 1.5 times the cost of 1 kg of pig copper.—*Elek. Zeit.*, Nov. 3.

Electrophysics and Magnetism.

[illegible] A paper in which the author gives an account of further experiments with his improved method on the determination of the electric charge carried by an ion. The method is somewhat similar to that used by Millikan, but it would seem that the particles used by Ehrenhaft are much smaller. He does not get concordant results and he concludes that there are in nature electric quantities which are smaller than the so-called ionic charge. The paper elicited a very long discussion, in which Planck emphasized that the experiments presupposed the exactness of Stokes' formula.—*Phys. Zeit.*, Nov. 1.

Radium B.—A paper by S. Russ and W. Makower deals with the deflection by an electrostatic field of radium B on the recoil from radium A. It is shown that radium B is positively charged when it recoils from radium A and that the "recoil-atoms" can be deflected by an electric field. Another paper by W. Makower and E. J. Evans deals with experiments on the deflection suffered by the radium B when it passes through a strong magnetic field. From their experiments they find that the value for the atomic weight of radium B is 194. Considering the difficulty of the experiments, this number is in good agreement with the theoretical value of 214.—*Phil. Mag.*, November.

[illegible] author describing new experiments made by him on the speed of Röntgen rays, which is found to be practically the same as that of light. The author does not believe that Röntgen rays are of a corpuscular nature.—*Phys. Zeit.*, Nov. 1.

Magnetic Alloys from Non-Magnetic Metals.—A. D. Ross.—A long paper presented before the British Institute of Metals and giving the results of experiments with the following ternary alloys: copper-manganese aluminum, copper-manganese-tin, copper-manganese-antimony, copper-manganese-bismuth, and with the following binary alloys: copper-manganese, copper-aluminum, manganese-antimony, manganese-boron.—Lond. *Eng'ing*, Nov. 4.

Electrochemistry and Batteries.

[illegible] A description of a coulometer for demonstration purposes. The object is to avoid the waste of time in weighing the cathode deposit. The apparatus is shown in Fig. 2. The anode is con-

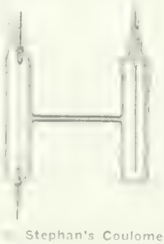


Fig. 2.—Stephan's Coulometer

tained in the tube on the right. The cathode, in the tube on the left, consists of a platinum wire connected to copper wires at the top and the bottom of the tube. Instead of weighing the cathode, the decrease of its resistance due to the deposit is measured. This is much simpler and quicker than weighing and each experiment lasts only a few minutes.—*Phys. Zeit.*, Nov. 1.

Generation, Transmission and Distribution.

High-Tension Transmission in Europe.—An article on the first 110,000-volt transmission system of Europe. The Lauchhammer Steel Company of Germany has four works in different districts which have had their own generating plants. Since

extensive lignite deposits have been discovered on one of these works a steam plant will be erected and all the works of the company will be connected together by a transmission system. This will also supply energy to a central station in Gröba which serves the agricultural and industrial districts in the neighborhood. For the present three 5500-volt turbo-alternators, each of 5000 kw, will be erected. The voltage will be raised from 5500 to 110,000 by four three-phase oil transformers, each of 6800 kva.—*Elek. Zeit.*, Nov. 3.

Swedish Water-Power Plant.—H. Cheret.—The conclusion of his long illustrated article on the Yngeredsfors power plant and 40,000-volt transmission line to Varberg and Molndal-Gothenburg, in Sweden. In the present instalment the author deals with the transmission line and substations.—Lond. *Electrician*, Nov. 4.

Charging Blast Furnaces.—H. Hermanns.—A fully illustrated article on the use of an electrically operated suspended conveyor system for charging blast furnaces.—*Elek. u. Masch.* (Vienna), Oct. 30.

Traction.

Glasgow.—An abstract of last year's financial account of the municipal tramway system of Glasgow. The number of passengers has increased from 221,744,569 to 222,730,571, the revenue has grown from $4,463,755 to $4,483,600, and the working expenses have decreased from $2.528,090 to $2,514,555 in spite of an increase in the number of car-miles from 20,802,797 to 20,974,016. On the car-mile basis, however, the total revenue works out as 20.52 cents per car-mile, compared with 20.60 cents formerly. A figure which is not often stated and which is, therefore, of interest is the traffic revenue per car-hour. On the Glasgow tramways this averaged 159.6 cents, as against 158.8 cents a year ago. The specific energy consumption was 1.28 kw-hours per car-mile, compared with 1.25 kw-hours per car-mile in 1908-9. From the generating station 28,618,128 kw-hours were supplied and the cost per kw-hour sent to the substations was 0.748 cent without capital charges and 2.416 cents including depreciation, interest and sinking fund.—Lond. *Electrician*, Nov. 4.

Cleaning of Tramway Rails.—A. Schörling.—A report made to the International Tramway and Light Association. After pointing out the great importance of properly cleaning the rails of a tramway system, from the point of view both of the rolling stock and of the passengers, the author goes on to describe the various apparatus that are used for this purpose. In conclusion some figures relating to cost are given.—Lond. *Electrician*, Nov. 4.

Traction Motor.—An English translation of the French paper of P. Bary, recently abstracted in the Digest, on a new form of traction motor. The feature of the motor is that the windings of the main poles and those of the interpoles to some extent overlap.—Lond. *Elec. Review*, Nov. 4.

Installations, Systems and Appliances.

Circuit-Breaker Relay Systems for Power Transmission.—R. P. Jackson.—As used on transmission lines, circuit-breakers and their relays are not so much required for overload purposes as for the elimination of defective lines. The strictly overload requirements can ordinarily be met by circuit-breakers on the low-tension side of the substation transformers. On the other hand, the certain localizing of a ground or short-circuit on a transmission system without serious disturbance to the delivery of energy to otherwise unaffected apparatus is often a difficult problem. The three abnormal circuit conditions which may arise and for which relays may be arranged to serve in cutting out the damaged portion of the circuit are reversal of energy flow, a ground and loss of energy between stations, or, in other words, cases in which an appreciable portion of the energy leaving one station does not reach the receiving station. The use of relay systems for these three conditions is discussed with the aid of diagrams. It sometimes develops that simpler and more generally reliable operation can be obtained without any overload or reverse-power protection, while in some cases a simple overload relay system with definite limit is the most satisfactory. When the generating sta and line are of moderate rating it has been found practica case of trouble simply to lower the voltage on the genera system until a short-circuit has cleared itself and then the voltage and resume operation. This is, of course, a so what crude method of operating, as is also the burning of a ground or short-circuit, and is only applicable to system limited size. Another method which has given fair resul to erect two lines to each substation, but let each station energy from only one line at a time, the lines to be parallel at the generating station. If with this system of opera overload relays with definite time limits are provided at generating station and intermediate switching stations and for progressively longer periods from the distant ends tov the generating station, only the defective portion of the will be cut off and energy can at once be obtained at any tion by closing the switches to the other live line.—*Elec. J nal*, November.

Earthing Three-Phase Networks.—At Frankfort, in many, one of the phases of the three-phase network has earthed at the generating station through a water column ohms resistance, with the result that pressure surges have greatly diminished in frequency. The danger of leakag earth in the network is reduced by one-third, and when a occurs on one of the insulated lines the circuit-breakers opened at once. Switches are required only on the insu conductors. In the case of overhead lines the earthed cor tor is carried on the top of the poles on low-pressure in tors and is protected at intervals by low-pressure lightnin resters, thus reducing the cost of installation. The resul the system are regarded as very favorable.—Lond. *Elec. view*, Nov. 4.

Electricity in Fire Fighting.—Some notes on the use of tricity in German fire departments. Electric automobiles being generally introduced in Hanover and Berlin to su ment horse-drawn engines. For dealing with high-pre cables a special set of tools is provided.—Lond. *Elec. Re* Nov. 4.

Units, Measurements and Instruments.

Audiometer and Its Use in Telephony.—C. A. Smith.— author refers to the invention by Hughes of the induction ance and the audiometer some thirty years ago. He urges the audiometer should now have many practical applicat It consists of two flat coils A and B (Fig. 3), about 7.5 c diameter and 1 cm deep, which are fixed upon a suitable board in a vertical position about 25 cm apart with their p parallel and their similar pole-faces in opposition to each c

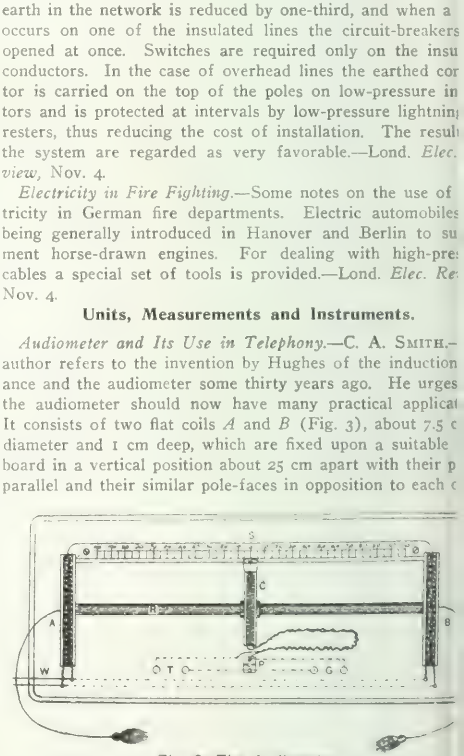


Fig. 3—The Audiometer.

These coils are wound with the same length of insulated per wire, so as to have an equal resistance, from 60 ohn 100 ohms, and to produce exactly equal opposing field stren Between these two coils a third similar one, or "search coil wound with finer wire and about 5 cm in diameter and 7 deep, is made to slide to and fro along a vulcanite ro This rod is grooved the entire length longitudinally u neath to allow a pin fixed into reel C to slide along either of the silk cords shown is pulled. The search co supplied with a vernier which slides edge to edge wit

fixed scale S and is connected up to two pairs of terminals T :o G and plug-switch P. The scale is divided into 110 millimeter divisions on either side of a center zero. The two coils A and B are connected together in parallel and operate by a suitable tone vibrator or standard telephone set reserved for he purpose. Either would, of course, be placed away from he balance, so as not to be audible without the receiver beonging to the apparatus. Since the two coils A and B are so onstructed as to be equal and opposite electrically, the opposng magnetic fields produced will have no effect upon the search oil when it occupies the central or nodal position, and the elephone will be mute. If, however, it be moved toward either A or B it will be "out of balance" and the telephone will ound accordingly. To test the hearing of a person it is only ecessary to apply the vibrator or standard telephone set, beinning with the search coil well out of balance and gradually noving it toward the center until the sound or voice is ust audible. This should be repeated on the opposite side of ero and the mean taken for each person or ear tested. Simiarly a telephone company can ascertain the qualities of the perators' hearing upon their engagement and also examine he acoustic values of receivers with it. From a telephonic iewpoint the quickness of operators' hearing, as well as the ensitiveness of receivers, could be even better judged by quantitative measurements made with a vibration or thermoalvanometer placed in the search-coil circuit by plug-switch P, nown in the sketch.—Lond. *Elec. Review*, Nov. 4.

Gear Testing.—An illustrated description of a new gearsting apparatus of English make which enables accurate meas-

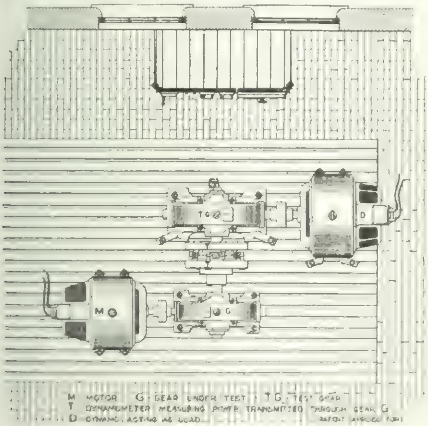


Fig. 4—Gear-Testing Apparatus.

ement of the efficiency of worm gearing. It is shown in Fig. The gear to be tested is driven by a motor, the loss in which accurately known, so that the brake-horse-power input of e gear is given immediately. The power given out by the ar at the slow-speed shaft is measured by a transmission namometer, and the ratio of the two represents the gear effincy. Use is made of a second gear in which the wheel ives a worm which in turn operates a generator forming the ad. This second gear is a special test gear, which can be arnged to give any ratio of speed. This enables a test to be ade on a gear of any horse-power or speed. In addition to the wer measured by the dynamometer that taken from the gen- accurately measured, and the efficiency of the test gear known an additional means of arriving at an efficiency of gear to be tested is provided. With two similar gears a rely electrical or Hopkinson test is made, and this is, of urse, a very accurate method of testing. Any required load n be instantly obtained from no-load to a considerable overd.—Supplement to Lond. [illegible] Oct. 28.

Telegraphy, Telephony and Signals.

Time Signals by Wireless Telegraphy.—In 1904 and 1905 Albrecht provided chronometers with a recording mechanism for their control at a distance by means of radiotelegraphic signals. It is evident that such signals would be very valuable, especially for longitude determinations out at sea. The Eiffel Tower radiotelegraphic station has been partly fitted out for that object. Registering mechanisms are apt to complicate chronometers, however. The method adopted at Paris was that of the observation of telephone coincidences suggested by Guyou in 1906 and tried between Paris and Brest. Tests as to the reliability of this method have been carried out by A. Claude, Ferrie and L. Driencourt and have been described in a communication presented to the Académie des Sciences in April, 1910. For this purpose sharp, distinct radiotelegraphic signals have to be sent out at regular intervals; these intervals should hardly differ from the intervals of the beats of the two pendulums under comparison, but not absolutely coincide with them. An electromagnetically excited pendulum was fitted with a short cross-bar of silver, the bar was fixed at a distance of about a quarter of the pendulum length from the pivot, and it just touched when at rest two elastic rings of fine silver wire. These rings formed the terminals of the relay circuit which actuated the radiotelegraphic apparatus. Ordinary Hertzian waves would, therefore, be emitted as long as the pendulum was not swinging. When the pendulum started to oscillate the one ring would be compressed and the current interrupted at the other. The emission of waves would thus stop. By means of a micrometer screw the rest (zero) position could be adjusted in such a way that only one spark was given each time the pendulum passed through the zero; a sharp signal was then given. These signals were sent from the Eiffel Tower by means of a pendulum whose length was so adjusted that in eighty-eight seconds it made one oscillation more than the two pendulums to be compared. Of the two chronometers under trial, the one was at the observatory at Paris, the other at the Montsouris Observatory. Each of the observatories was provided with a small antenna in order to make the conditions similar to those of a receiving radiotelegraphic station at a considerable distance from the transmitting station on the Eiffel Tower. The electrolytic receivers were so tuned that the operator heard, in the telephone, not only the sharp rap of the arriving signal, but also the beats of the chronometer in his station. As the two sounds are similar in acoustical character the coincidences were not difficult to observe. Each of the two stations thus determined the coincidences of its chronometer and the signals—that is, the pendulum beats on the Eiffel Tower and the difference between the two chronometers could then be ascertained. One of the chronometers was marked mean time, the other stellar time. Both before these tests were carried out and after their completion Guyou telephone tests were also made. In this way the difference "telephone signal minus radiotelegraphic signal" was determined. This difference proved always very small, 0.01 second in the worst case; it was sometimes positive and sometimes negative, and the average was ± 0.006 second. The research would thus show that very accurate comparisons of chronometers and determinations of longitude can be effected by means of the radiotelegraphic method, and this should become valuable for geodetic survey.—Lond. *Eng'ing*, Nov. 4.

Bookkeeping.—G. Johnson.—The conclusion of his article, illustrated by various blank forms, on bookkeeping and accounts of telephone undertakings.—Lond. *Elec. Review*, Nov. 4.

Miscellaneous.

Electrical Industries in the United States and Great Britain.—J. S. Peck.—His presidential address to the Manchester Section of the (Brit.) Inst. Elec. Eng. He summarized his chief impressions from a recent visit to the United States and compared American with English practice. What impressed him most in the United States were the enormous quantities of standard machines that are being manufactured and the great advances made in electric traction. As to high tension trans-

mission he said that several plants are operating successfully at 110,000 volts, "and a pressure of 200,000 volts appears much nearer than did one of 100,000 volts ten years ago"; in fact, one of the best known transmission engineers in America told him that he was quite prepared to recommend 200,000 volts now and was sure it could be handled successfully. The transformer manufacturers will certainly jump at the chance of building commercial apparatus for this voltage. With pressure of this order, a generating station in the Manchester district could reach every large city in Great Britain. The higher the voltage the less the trouble experienced from lightning on transformer apparatus, but, on the other hand, the greater the trouble on the transmission line itself, due to broken insulators. This may be explained by assuming that ordinary lightning effects have a value which is independent of the line voltage, so that apparatus built for a very high line voltage is much better able to withstand lightning effects than is a machine wound for a lower voltage. On the other hand, when a lightning discharge takes place over an insulator, the higher the line voltage the greater the tendency for the arc to hang on and rupture the insulator. The general tendency on very high-voltage lines is to cut out protective apparatus for the transformers and endeavor to protect the line. Apparently the most satisfactory method yet proposed for doing this is the use of the overhead grounded wire, though lightning rods on each pole or tower, metal rings round the pin, etc., are being tried. For e.m.fs. below 40,000 volts lightning arresters are almost always used, for at these pressures the lightning discharge voltages are far higher in proportion to the line voltage than they are at pressures in the neighborhood of 100,000. The electrolytic arrester is being almost universally adopted. In turbo machinery the tendency is toward higher and higher speeds. The general practice is to build machines with poor regulation and to supply automatic regulators for maintaining constant voltage. With reference to direct-current turbo-generators much greater progress has been made in Great Britain than in America, for while large numbers of very small machines are being built in America, the large ones are few, and, in general, of lower speed than are found in England. The majority of the transformers are of the shell type, whether made for single-phase or three-phase. The core type is used when the voltage is very high in relation to the rating of the transformer. An enormous business is being done in transformers from house-to-house lighting in sizes from 0.5 kw to 100 kw. As to the manufacture of measuring instruments he was impressed by an American plant turning out 1000 alternating-current watt-hour meters per day. "The meters are beautifully made and contain various adjustments and refinements not found on European meters, yet on account of the enormous output they are able to be manufactured for much less than the same instrument could be made for in England in spite of the fact that the price of labor in the United States is more than twice as high as in England." He referred to the "keenest engineering competition" between the General Electric and Westinghouse companies. "As a result, they strive not only for the improvement of shop methods, but for advances in the electrical and mechanical design of their apparatus and for the development of new and improved types." He summarized the difference in conditions in the United States, where the electrical industries are flourishing, and England, where "manufacturers deplore the condition of the business." The United States is a new and rapidly growing country and the directors of British companies are often too conservative. There is no doubt that Great Britain is far behind both Germany and America in the extent to which technical education is adopted, especially with respect to higher technical education. The electrical manufacturer of America has never been seriously hampered by those restrictions which labor organizations attempt to impose upon British manufacturers. Municipal control of electric supply and tramways was never seriously undertaken in American cities. The policy of the municipal undertakings in Great Britain in accepting the lowest tender is in part responsible for the cut-throat prices which rule to-day. Perhaps the greatest electrical development in America h been in traction work, and while a great part of this has be in the cities, there has been an enormous development in int urban railway lines—a field which has been scarcely touched Great Britain, owing to the expense of getting bills through P liament, the jealousy of town councils and the opposition wealthy property holders along the proposed lines. The lar electrical manufacturing companies in America employ speci ists in all departments of engineering, and it is generally mitted that these men know more about their particular lin of work than the consulting engineer can be expected to kno The consulting engineer tells what he wishes to accompl and the manufacturer says how this could best be accomplish by standard apparatus, so that they can supply a better a cheaper plant than if the consulting engineer called for manner of special apparatus. In England the practice h been for the consulting engineer to specify in great detail particulars regarding all the work to be done by the manuf turer. In America the demand for labor is usually greater th the supply and the rate of wages at least double that in E land. This condition naturally creates a great difference in demand for labor-saving machines and is in part responsi for the enormous demand for small electric appliances. very large market for electrical apparatus has been created America by the utilization of water-powers. "Regardless whether a tariff would help Great Britain or not, there is doubt that it has greatly helped the American electrical mar facturer, for, with an enormous home market, he has push ahead with its development with the assurance that it was served for him and that no foreign competitor could take from him. So large is this home market that its demands ha filled his works with orders at remunerative prices and left tle inducement for him to compete for foreign business. T tariff wall is naturally responsible for higher prices in Ameri but low prices and prosperity are not synonymous terms." Lond. *Electrician*, Nov. 4.

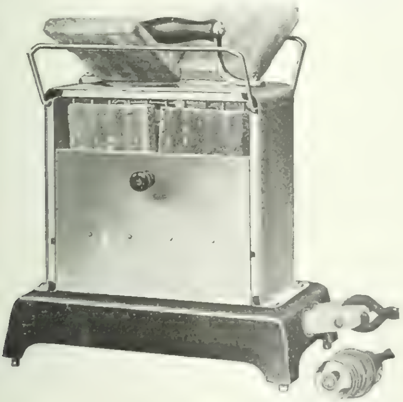
[illegible] Alex. Siemens.—His pre dential address to the (British) Institution of Civil Enginee "A review of the history of knowledge from the prosper period of Greece during the fifth and fourth centuries bef Christ down to the present time shows that in literature, and philosophy we cannot boast of being greatly superior the ancients, but as far as engineering problems are concer we have enormously advanced, thanks to the practical appli tion of scientific theories. Comparing generally the conditi of life then and now the difference may be summed up by clai ing that our progress is due principally to the improvement the means of communication and to the saving of manual lal by the introduction of mechanical power, which main featu have caused a general lowering of the cost of 'obtainabl Both these features characterizing modern civilization are outcome of the work of the engineering profession and progr has by no means ceased in our time." The development of manufacture of incandescent lamps is a striking example the advantages of labor-saving machinery. The introducti of a labor-saving machine does not diminish opportunities f employment, but benefits the skilled workman and opens a nues for the employment of unskilled labor. By the great i provement in the means of communication engineers of countries are put on an equal footing with respect to techn knowledge. A broad distinction should be made betwee tractors' work and manufactured produce. With regard contractors' work, the consulting engineer must be the r expert, with a varied practical experience in similar work, possession of all the necessary preliminary data for design the complete works, and well acquainted with all the details the method of carrying them out. The case is different w manufactured produce which is utilized in engineering wo the variety of which is constantly increasing, so that it is p [illegible] who requi manufactured goods to carry out his designs can be acquaint [illegible] Moreover, trai technical experts are nowadays intrusted with the task of

recting industrial operations in factories, and it is inevitable that they should know more about manufacturing methods and requirements than outsiders. The author spoke of the rôle which the Engineering Standards Committee has assumed by deciding cases arising between engineers and manufacturers with respect to specifications and tests. Every profession must have its science which teaches the sound reasoning on which its art is based, and for both science and art training is a necessary condition for success. College teaching should occupy itself principally, though not exclusively, with science, leaving the art of engineering to be developed by practical work either in the field, in the drawing office or in the workshop. If the improvement in communication has a tendency to aggravate the burden of competition and to place all nations on a footing of equality, it insures, on the other hand, the continued progress of our civilization by guarding it from the fate that befell the culture of so many ancient empires which have left only scant traces of their once flourishing state, because no adequate means existed for spreading their knowledge or for protecting it from destruction. There is the further advantage that, in conjunction with the saving of manual labor, modern facilities of communication insure leisure and thereby opportunity for cultivating the mind in other respects than merely on utilitarian lines.—Lond. *Electrician*, Nov. 4

New Apparatus and Appliances

BREAKFAST-ROOM TOASTER.

The Simplex Electric Heating Company, of Cambridge, Mass., has made an improvement to its well-known breakfast-room toaster in the shape of a rack on top of the device, which, when the toaster is not in use, may be dropped out of sight. The toast rack consists of two wire supports projecting upward at an angle of about 45 deg. from either side, coming out of the top of the toaster. These provide supporting bars to hold the toast, the other end of the toast resting on the top of the frame. The rack in no way interferes with the operation of the

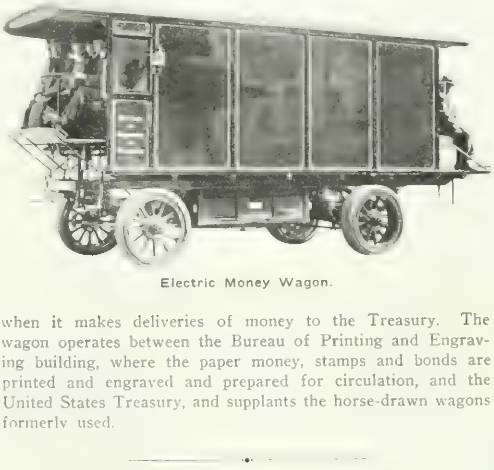


Breakfast-Room Toaster.

toaster, but places the finished product directly over the hot air rising from within the device, keeping it warm, or drying fresh bread while other toast is being made. In the Simplex toaster the bread is inclosed while toasting so that it does not curl out of shape, nor do crumbs fall on the table about the toaster. Being highly polished, the toast can be kept in its hot condition within the toaster for ten or more minutes after the circuit is opened. The device consumes 500 watts and can be obtained in boxes wrapped in holly for the holiday trade.

ELECTRIC "MONEY" WAGON.

An electric "money" wagon is the latest acquisition of the United States Treasury Department, Bureau of Printing and Engraving, Washington, D. C. The vehicle was built by the Studebaker Company to combine strength, ample size and safety—qualities highly necessary to meet the peculiarities of the service in which it is employed. The accompanying cut suggests the commodious interior of the body, which is closed at the front and provided at the rear with heavy doors, which when closed and bolted present as formidable an appearance as the barred door of an express car laden with a shipment of gold. Space is provided on the front seat and also on a rear seat extending the width of the vehicle for a number of armed guards, and mounted horse guards also accompany the vehicle



Electric Money Wagon.

when it makes deliveries of money to the Treasury. The wagon operates between the Bureau of Printing and Engraving building, where the paper money, stamps and bonds are printed and engraved and prepared for circulation, and the United States Treasury, and supplants the horse-drawn wagons formerly used.

RELAY FOR INDUCTION REGULATORS.

The Westinghouse Electric & Manufacturing Company has just brought out an entirely new design of secondary or auxiliary relay for its induction regulators, which embodies several features that have been found desirable in this class of apparatus by the Westinghouse company. The new relay is of the dry type, while the former was oil-immersed. The non-inductive resistance that was used in the old-style relay is used with the new style, but is now built as a primary part of the relay. This resistance, permanently connected across the contacts, absorbs the inductive discharge of the coils at the moment of breaking of contact and assists in the elimination of sparking.

As all the wearing parts used in the new relay are case-hardened, it is very durable. In fact, the relay has been designed as a continually operating, hard-service mechanism instead of as an instrument. The use of nickel for the relay contacts is a marked advance, as it gives all the advantages of platinum at a cost for renewals that is negligible. The result obtained from the operation of motor-operated regulators by means of this relay are stated to be very satisfactory. The wear on the contacts is so slight that the adjustment and renewal of contacts are reduced to a minimum. When necessary,

however, this adjustment or renewal can be very easily effected.

A feeder regulator will pay its cost in a short time by main-

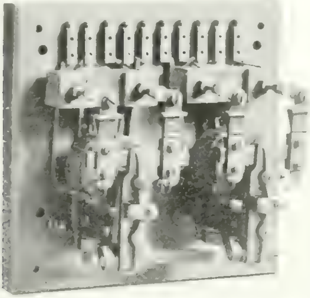


Fig. 1—Relay for Voltage Regulator.

taining the voltage at a constant point, as close voltage regulation causes a decrease of lamp renewals, an increase in the sale of energy, an increased feeder capacity and a higher econ-

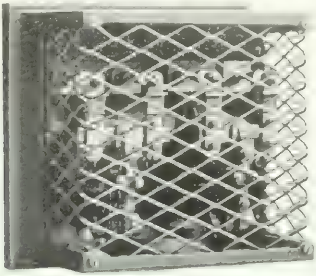


Fig. 2—Relay Inclosed in Wire Cover.

omy of operation of the system, while helping greatly in making the customers satisfied with the illumination and service.

A FLEXIBLE ELECTRIC-CRANE INSTALLATION.

An unusual electric-crane installation in which the carriage with its load may leave the movable bridge, running off onto side spurs leading into the nearby buildings, is that employed by the Simmons Manufacturing Company, Kenosha, Wis., for conveying scrap and pig iron from its storage yard to the foundry cupolas.

For this purpose a 60-ft. span Pawling & Harnischfeger crane is fitted with two I-beams forming a trolley runway on which the suspended cars can move transversely. At a point opposite the entrance to the cupola house a trestle-supported I-beam is brought out to the craneway, matching with the trolley track so that the cars can be run off to discharge their loads into the cupola house. The crane-bridge runway is several hundred feet in length, its 60-ft. span covering the entire scrap yard, so that material from any part of the yard can be picked up, loaded into the bucket and conveyed directly to the charging floor without subsequent handling.

Two cars of the suspended type are provided, as shown in Fig. 1. One is equipped with a 40-in. Electric Controller & Manufacturing Company's electromagnet for handling pig and scrap iron, and for breaking up material with a skull-cracker ball (Fig. 2), while the other car is fitted with a large dumping bucket for hauling coke, limestone, etc. The magnet carriage comprises a 5-ton hoist, and the bucket is handled by a 3-ton hoist, each controlled from the inclosed operator's cage trailing behind its respective hoist.

The trolley conductors supplying energy for the carriage travel are, of course, extended along the spur I-beam tracks. On the bridge of the crane other conductors connect to the bridge-movement motors, so that the longitudinal movement as well as the transverse motion of the load can be manipulated directly from the operator's cage while the car is on the crane bridge. In case of necessity for repairs to either car it can

Fig. 1—Bucket Car Leaving Crane and Passing Onto Spur Runway

be removed from service by running it off onto the spur, while the other hoist is used for either the magnet or bucket by unhooking the swivel hook at the lower block.

Since on the bridge the cars move on independent I-beam runways, 5 ft. apart, their relative positions are entirely independent as far as transverse motion is concerned. Safety stops are provided so that neither car can be accidentally run off the bridge beams unless in position opposite the spurs. The hoist cars can travel at a speed of 450 ft. per minute, approximately the same as the rate of bridge travel, and while the cars are on the bridge both motions can be combined.

The present crane installation, which requires the services of one or two operators and not more than two ground men, has

Fig. 2—Crane Carriage with Magnet on Spur Runway.

replaced the former system of charging the cupolas by narrow-gage push cars, which required twenty-five or thirty men.

ELECTRIC CULTIVATOR FOR INTENSIVE FARMING.

The electric motor application illustrated herewith is of more than passing interest, for it represents the attempt of its inventor, Mr. F. H. Kerr, 5969 Union Avenue, Chicago, to anticipate an economic change in the agriculture of this country

which will result in more intensive farming, involving the use of electrically driven machinery on comparatively small parcels of land. Mr. Kerr is a practical farmer, born and brought up on a farm and also trained in scientific soil cultivation in an agricultural college. He is convinced that there is an impending change in farming methods in the United States owing to growth of population, the taking up of all virgin arable land, the development of irrigation, the high cost and scarcity of labor and the "back-to-the-farm" movement. He points out that since the limit of farming area in this country has been reached, or nearly reached, the acreage per capita must decrease. It will be necessary to obtain a greater yield from smaller farms. Conditions in this country do not permit this being done by cheap manual labor, as in Japan, for instance, and it will be necessary to employ machinery for intensive cultivation to an extent now unknown. This machinery may be driven most conveniently and, as the number of plants increases, most cheaply by electricity. The use of horses in farming operations means widely separated rows of plants, involving a proportion of unused land that cannot be afforded with intensive farming.

Mr. Kerr believes that in time to come, as holdings of land diminish in size, farm houses or country homes will be much closer together, and that it is likely that electric distribution lines will be built between parallel roads, bare coppered steel service wires extending from this line to the houses on each side. By sliding or rolling contacts and a flexible conducting cable of suitable length electrical energy may be available for a considerable distance on each side of the service wires, thus serving an area of respectable size. However, this is a hope for the future. The present machine may be operated from any suitable source of electricity through a practicable length of conducting cord.

The inventor has already produced an electric lawn mower (*Electrical World*, July 22, 1909, page 219), and the cultivator illustrated herewith is an outgrowth of that invention, and, indeed, the machine illustrated may be used either as a lawn mower or cultivator. As shown in Fig. 1, a 1-hp alternating-current motor is mounted between a pair of tubular steel handles and over a small traction wheel. In front and journaled to the handles is a tubular shaft carried about 6 in. above the ground and in front of the traction wheel. This shaft carries spirally arranged teeth spaced 2 in. apart on the shaft and projecting out 6 in. on each side of the shaft. A chain drive and sprocket

Fig. 1—Electric Cultivator for Intensive Farming.

wheel with suitable gearing provide means for driving the traction wheel and the shaft supporting the teeth. The teeth on the shaft cut into the ground to a depth which may be regulated, converting the surface of the land into a blanket of fine dust without breaking the delicate roots of plants near the surface, effectually closing the minute pores of the earth so that the moisture does not escape, but is preserved for the growing plants. The teeth on the revolving shaft may be taken out as desired to allow cultivation close up to the rows of plants and yet allow space so that the machine will pass over the rows without injury to them. A mud-guard is provided to prevent the particles of earth from flying in the air.

The machine can be easily fitted with a cutter bar for mowing, the attachment being shown in front. The revolving teeth then

Fig. 2—Electric Cultivator Motor Connected to Washing Machine and Vacuum Cleaner.

act as a tedder to gather the cut grass or hay. The motor may be used also to drive a vacuum cleaner, washing machine or other electrical conveniences of the household. Fig. 2 illustrates the manner in which it is used for this purpose. The whole machine weighs 100 lb. and is provided with roller bearings.

PROTECTIVE DEVICES FOR HIGH-TENSION CIRCUITS.

For the opening of circuits carrying heavy loads at high voltage no device has proved more satisfactory than the oil-immersed switch developed particularly for this service. These switches possess the one disadvantage of being expensive. Where only a small amount of power is to be utilized it is essential to employ some circuit-opening device less expensive than the high-tension oil switch. In Fig. 1 is shown a device employed for this purpose. It consists of a fuse mounted in a suitable holder which acts as a disconnecting switch for the circuit and permits interrupting the charging current of a line or the magnetizing current of a transformer, at the same time disconnecting the fuse holder from the circuit so that a fuse can be easily and safely removed or replaced. These fuses, under proper conditions, furnish adequate protection for lines and apparatus because by reason of their property of generating a high pressure at the rupturing point of the fuse and their quick action the circuit is opened with little if any more disturbance than where an oil switch is used.

There are a number of engineering features which should be carefully considered before deciding upon the use of fuses. Fuses should not be used: (1) When the current to be ruptured exceeds the rating of the fuse or when the capacity of the system exceeds the rupturing capacity of the fuse; (2) where the arc formed by the blowing fuse is objectionable; (3) where short interruptions of service, due to the time necessary to replace fuses, are an objection; (4) where overloads or short-circuits are frequent, and circuits should be opened selectively after a certain time interval.

In order to provide automatic protection for apparatus under abnormal conditions of overload or short-circuits two schemes are now in general use. The first, and oldest, involves series transformers (Fig. 3) the primaries of which are connected in the high-voltage circuit to be protected. The secondary winding, suitably insulated from the primary, is connected either directly or through suitable relays to the coil which attracts the tripping mechanism of the switch controlling the circuit. In the second scheme use is made of relays thoroughly insulated from the ground, the solenoids of which are connected directly in the main circuit. These operate the tripping mechanism of the switch either directly by means of insulating rods or by means of an auxiliary source of power and a trip coil on the switch mechanism. These relays are designed only as single-pole units, one of which is connected in each line wire, and are not suitable for conditions which require the bringing together of two high-voltage circuits in one unit. A view of a high-potential series relay is given in Fig. 2. A very satisfactory indicating device for use on high-voltage circuits is formed by mounting a standard ammeter on a suitable insulator to prevent leakage to ground, as shown in Fig. 5. These instruments are connected directly in the main circuits and are so mounted that accidental contact with them by the station attendant is impossible. These instruments are installed in those installations which lend themselves to the use of series relays and together they form a very compact and cheap equipment.

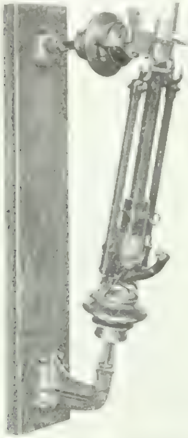


Fig. 1—Combined Fuse and Disconnecting Switch.

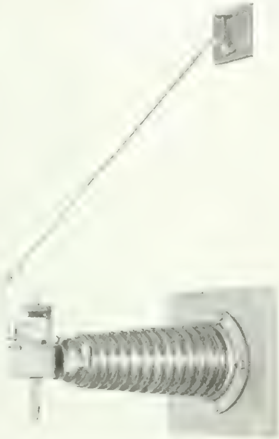


Fig. 2—High-Potential Series Relay Mounted on Post Insulator.

Fig. 3—Series Transformer.

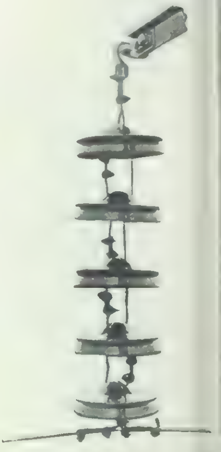


Fig. 4—Link Insulator, Suspension Type.

Where wattmeters or watt-hour meters are required series transformers are necessary. Such a transformer equipped with an oil-filled terminal is shown in Fig. 3. A transformer of this type can be used to operate protective devices as well as to carry the instrument load.

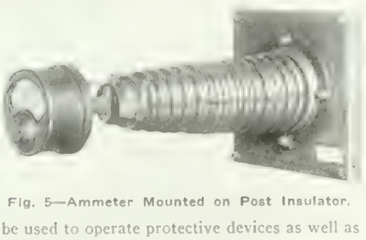


Fig. 5—Ammeter Mounted on Post Insulator.

The most difficult problem in high-voltage development and one on which the success of any energy transmission scheme depends has been the production of suitable insulation for the lines. As the lines are exposed to all weather conditions, traverse long stretches of exposed country and are compelled to [illegible] bends and to follow the natural grades it has been necessary to produce insulators to meet any and all service conditions.

With the old-style pin insulator construction the line e.m.f. was limited to about 60,000 volts, due to the great weight of the insulators for higher voltages and the high cost of towers which had to be erected at close intervals. Higher voltage transmission has been made possible by the introduction of the insulator of the link type, of which two forms are in use, known as the suspension type and the strain type. Each insulator consists of a number of porcelain units joined together by suitable links, the number of units in series being varied in proportion to the voltage.

An important element in a transmission line is the disconnecting switch for isolating one part of the line from another. Use is frequently made of switches of the knife-blade type, the spacing and break distances of which depend upon the voltage. These switches are not, as a rule, intended to open a circuit under load. In Fig. 6 are shown open-air switches designed for interrupting a moderate amount of power. They are mounted on a pole or tower structure and may be operated from the ground by means of a suitable mechanism. The final breaking of the arc is accomplished on metal horns which, bending upward and outward, allow the arc to follow its natural course upward and to rupture itself at the ends of the horn.

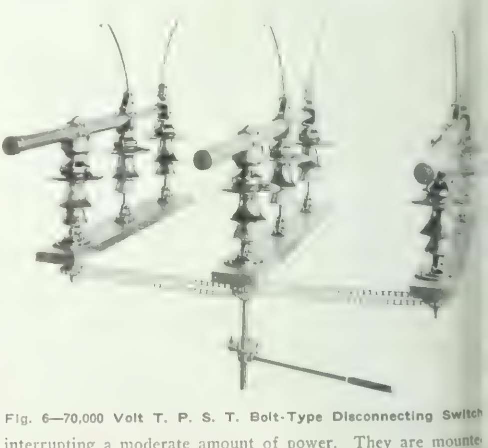


Fig. 6—70,000 Volt T. P. S. T. Bolt-Type Disconnecting Switch

The above-described devices have been developed by the General Electric Company, Schenectady, N. Y.

Industrial and Commercial News

The Week in Trade.

BETTER distribution at retail, due to the cooler weather, is the principal trade feature worth reporting for the past week. The jobbers and wholesalers report some larger ling-in orders, for which the advance of the season and the ·evious light buying of the retailers are mainly responsible. t best, however, there is considerable room for improvement the season's trade. While there is more doing on the spring count, buyers are as yet very conservative and in many lines ·em disposed to hold off, believing that prices will soon be wer. On the other hand, manufacturers are displaying no rticular anxiety to book heavy orders for future delivery on count of the present high levels of raw materials. The ricultural sections of the country are exhibiting more pros- rity than the industrial sections, but in the agricultural sec- ›ns there is at present a disposition to hold crops for higher ices. The industrial situation as a whole is comparatively iet, and outdoor construction work becomes less active as e season advances. The gross earnings of railways are ninishing, and this is causing the railway managers to go ›w in ordering equipment on anything like a liberal scale. ıere was some further buying of steel rails during the past ·ek, the total amounting to about 73,000 tons, and it is given t that a number of roads are now negotiating their season's quirements. It is also said that quite a number of cars ll probably be ordered before the end of the year. The mand for structural material is very light, but the new siness in wire products and in tubes shows very satis- :tory increases. The favorable returns of export trade r October have done much to encourage the business nmunity, and it is generally believed that as prices decline ›orts will grow. Collections, especially throughout the West l South, are improved, and are now classed as from "fair good." Business failures for the week which ended Nov. as reported by *Bradstreet's*, were 248, as against 207 the vious week, 232 in the same week of 1909, 273 in 1908, 265 1907 and 212 in 1906.

The Copper Market.

COPPER-SELLING agencies made a stronger effort last week to secure business from domestic consumers than has been made for many months. Some price conces- ns were offered, and an especial solicitation was made for ral orders. It is believed that they succeeded in disposing between 7,000,000 and 8,000,000 lb. of electrolytic copper for cember and January shipment. Most of this business was en at from 12 7-8 to 13 cents. Wire drawers, brass foun- es and electrical companies were the principal purchasers, l the sales were mainly in lots ranging from 250,000 to ,000 lb. There was very little export trade during the

Standard Copper	Bid.	Asked.	Settling Price.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
ruary	12.70	12.90	12.80
[illegible]	[illegible]	[illegible]	[illegible]

The London market Nov. [illegible]

	Noon.	Closing.
[illegible] copper, spot	[illegible]	[illegible]
[illegible] copper futures	[illegible]	[illegible]

[illegible] fluctuations for the [illegible]

	Highest.	Lowest.
[illegible]	[illegible]	[illegible]
[illegible] spot	[illegible]	[illegible]
[illegible] futures	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

ːk, the prices asked here being almost as high as the de- ·red price in Europe. In the early part of the week there ·e some speculative transactions in standard warrants in ıdon, and this in a measure supported the local market. ːre is still much gossip in the copper market over the last ort of the Copper Producers' Association. The considerable uction which was made in the surplus stock in this report ; largely offset by the disappointing discovery that the pro- tion of copper had not been curtailed. The optimists in market prophesy that the next report will show a material uction in the production figures. The exports reported by the Customs House through the Metal Exchange for the month of November, including Nov. 21, are 20,014 tons. Especial attention is now being paid to these figures, owing to the fact that in the reports for last month the statistics of the government were 20,000,000 lb. below the export statistics of the Copper Producers' Association. Imports continue at about the same rate and are not nearly as high as they were in the summer. The daily call on the Metal Exchange Nov. 21 quoted standard copper as per the accompanying table.

Industrial and Commercial Notes.

Studebaker Electric Commercial Vehicle Campaign.—During the annual meeting of the branch house managers of the Studebaker organization, which took place last week at South Bend, Ind., a notable incident was the announcement to the branch managers by the administration of its determination to prosecute vigorously a broad electric commercial vehicle program. It was made known that the executive committee had for some weeks previously examined into the progress of the energetic campaign, largely of an investigating character, which has been conducted for the past three years; ways and means of a forceful nature were decided upon to broaden this work and the branch house executives were instructed to spare no effort or expense in carrying out the details of the program announced. It was stated that with relation to locating the commercial vehicle manufacturing plant at Detroit, which has been under consideration, it was decided to retain this division of the production department at South Bend and it is very likely that additional buildings will be erected to meet the demand for electric commercial vehicles which is reasonably within expectation as the result of the new campaign coming into effect. The execution of the field work in the campaign has been delegated to William P. Kennedy, who, in addition to his advisory function to the administration as consulting engineer, was appointed sales manager of the commercial automobile department with extensive authority.

Electrical Devices for the Holidays.—There has been a general movement all over the country to push the sale of electrical devices for the holiday trade. This movement has had a wide growth, and has been pushed forward not only by supply dealers, but in many parts of the country by central stations. There has been a special campaign made for this business, and it has been extremely successful. This trade covers a wide range of supplies, not only electrical ornaments and novelties, but all kinds of household devices, especially percolators, toasters and chafing dishes, which have had an extensive sale for the Christmas trade. The representatives of the General Electric Company in all parts of the country have been especially active in securing this class of business. Another jobber in holiday devices, who controls the output of a New York factory, says that the demand upon him has been so heavy that his plant was entirely unable to fill it. This salesman represents only novelties, Christmas trees, fancy lights, etc., and these, he says, have sold beyond all expectations.

General Electric Managers.—The annual meeting of the district managers of the General Electrical Company was held in Schenectady last week. No business of a public nature was transacted, but a thorough discussion of the trade situation in all parts of the country was held. The reports from these managers in all sections of the United States were very encouraging. Almost without exception, they declared that business seems to be improving, and that the outlook for a very large volume next year is extremely bright. Business has been especially good in lamps and electric meters.

Heany Lamp Company.—The Heany Lamp Company expects to begin operations in its new factory at Weehawken, N. J., before the beginning of the new year. This factory will have when in full operation a capacity of 10,000 tungsten lamps a day. The officials of the company state that the new facilities are very badly needed on account of the heavy rush of business. The company is unable to fill its orders at this time, and its present factory is working overtime in an effort to keep up with the heavy demand for lamps.

Westinghouse Companies Prosper.—In addition to the very satisfactory business being done by the Westinghouse Electric & Manufacturing Company, which was referred to in our last issue, it is also reported that the other companies owned by the same interests are equally successful. The Union Switch & Signal Company, which closes its fiscal year Dec. 31, will show the most favorable report the management has ever been able to present. Judged by the business that the company has done during the year up to Nov. 1, the entire gross earnings for the year will be over $6,000,000, and the net earnings will probably exceed $1,250,000. This exceeds by over $1,000,000 the highest previous yearly gross record. The Westinghouse Machine Company, the fiscal year of which ends March 31, will also show gratifying results. During the present year orders for turbines, steam engines, gas engines, condensers and automatic stokers have been very large, and in October the company reported record-breaking shipments representing about $600,000 for that month alone. Since coming out of the hands of the receivers two and a half years ago the company has added largely to the field of its production, and it is now manufacturing several products which were not originally in its catalogue. The Westinghouse Air Brake Company is continuing to do a large business, and the additions to the works at Wilmerding, which have recently been completed, are now in operation and the company is beginning to reap the benefit from these improvements. The Westinghouse Electric & Manufacturing Company last week leased an eight-story building at 429 First Avenue, Pittsburgh, for a term of years, and will move its North Side warehouse to this location. A repair department will also be established in this building.

Proposal to Operate New Subway.—William G. McAdoo, president of the Hudson & Manhattan Railroad Company, has written a letter to the Public Service Commission offering to equip and operate the proposed Tri-Borough subway system after the completion of the plans. Mr. McAdoo suggests the postponement of the construction of the Broadway-Lexington Avenue Brooklyn branch, the Canal Street branch and the elevated arms extending into the Bronx. He suggests building a subway under Wall Street and the East River to Brooklyn and a connecting line under Broadway between the Hudson & Manhattan station at Thirty-third Street and the Tri-Borough line at Tenth Street. Mr. McAdoo also suggests a connection with his proposed line at Grand Central Station and a moving platfrom from his Thirty-third Street station to the Pennsylvania Railroad terminal. It is estimated that the cost of equipment and rolling stock will be about $50,000,000. Frank J. Sprague, electrical engineer, has also written the commission that within sixty days after an acceptable contract for construction of the Tri-Borough system has been made he will put in a bid for operation of the line.

Telephones on New England Railroads.—The railroads operating in New England have been especially active in the movement to replace the telegraph with the telephone for train dispatching. The New York, New Haven & Hartford has in operation telephone circuits covering 100 miles of its road from Northhampton to New Haven. In this section there are twenty-nine telephone stations, which are equipped with test panels, selectors and flexiphones. The Boston & Maine has in operation sixty-eight stations covering the White Mountain and Concord divisions. The Central Vermont has just ordered a telephone equipment to cover its northern division from St. Albans to Windsor. On this stretch of 150 miles there will be thirty-eight telephone stations. The Boston & Albany has in operation telephone equipment covering all of its main line and all branches from Boston to Albany. On this division there are 165 stations. All of the equipment for these New England roads was furnished by the Western Electric Company, which has supplied about 90 per cent of the telephone equipment for railroads now in use in this country.

Testing Edison Battery Car.—The large two-truck Beach car constructed by the Federal Storage Battery Company, fitted with Edison storage batteries, described in our issue of Oct. 27, was tested very thoroughly last week on the Erie Railroad in the neighborhood of Orange, N. J. Quite a number of prominent railroad officials and engineers were present at these tests, including F. D. Underwood, president of the Erie Railroad. In fact, the tests were made especially to give the officials of the Erie an idea as to the suitability of this type of car for service on some of the branch lines where the traffic is light. The officials of the Federal Storage Battery Company say that the performances of the car under various weath conditions exceeded their expectations. The car made a high speed than had been promised for it, and was operated at less expenditure of energy than had been estimated. This the car that was built for the South Shore Traction Compar It is now ready for service, but will be used for demonstrati purposes for a few weeks before being delivered to its ultima owners. The South Shore company intends to use it in servi across the Queensboro Bridge.

Electrification in Boston.—The reports of the enginee of the New York, New Haven & Hartford, the Boston Alband and Boston & Maine Railroad systems who inves gated the matter of the electrification of that portion of t three roads within the metropolitan district of Boston ha been submitted to the joint Board on Metropolitan Improv ments of Massachusetts. They show that the work as ou lined would cost in the neighborhood of $40,000,000. In the reports it is agreed that to run electric trains in the metropo tan district would result in a large deficit for the Boston Albany in operating expenses. A. H. Smith, vice-preside speaking for the New York Central railroad, of which t Boston & Albany is a part, says that in view of this defi the railroads should have authority to assess all passenge and traffic using the facilities with a terminal charge sufficie to bear the financial burden imposed with some profit to t operating company. The Boston & Maine and New Hav roads would be required to electrify 461 miles of track a the Boston & Albany 128 miles.

Western Power Company.—The report which has be published in the West that the Great Western Power Co pany, which is a subsidiary of the Western Power Compar was making preliminary surveys and preparing plans to build four-mile tunnel from Bartees Bar to Big Bar, on the nor fork of the Feather River, has been denied explicitly by o of the officials of the company in the New York office. Th authority says that there is no intention of undertaking th development at the present time, and that no preliminary wo is now being done. Eventually, he says, this development m be carried out, as this is one of the sites which the Weste Power Company has in reserve when the demand for its ener will warrant the investment. The construction of such a d velopment, it is estimated, would cost $10,000,000, and it wou require several years to build it. The company also has in r serve a prospective development of immense possibilities at B Meadows, Cal. No work is contemplated on this site for ma years to come.

Western Electric Company.—For the twelve months en ing Nov. 30 the gross sales of the Western Electric Compar according to present estimates, will be about $62 000,000. A lowing a profit of 5 per cent on its business, which is a tri less than last year's margin, the company's net earnings will about $3,100,000. The surplus, after paying dividends a fixed charges, would, therefore, be about $1,237,000, or little better than 8 per cent on the capital stock. T company is now spending large sums of money enlargi its plant and concentrating its manufacturing interests Hawthorne. It has been announced that the compa will probably extend its present annual report to cover thirte months, in order to make its fiscal year correspond hereaft with the calendar year.

Westinghouse Turbine McAlpine-Melville Reduction-Ge Railway Equipment.—The San Diego Electric Railway Co pany, of San Diego, Cal., has just placed an order with t Westinghouse Electric & Manufacturing Company, Pittsbur for two 1000-kw, 600-volt, 514-r.p.m. generators to be driven Westinghouse-Parsons low-pressure steam turbines running 3600 r.p.m. The generators and turbines will connect throu Melville-McAlpine reduction gears. In addition to this equi ment the Westinghouse company will shortly ship one 1200-k 600-volt, 80-r.p.m. engine, type D. C. generator, to the sar company.

Electrical Construction.—Among the items printed und Construction News in our present issue are announcements proposed new plants or considerable extensions to present plan at Lancaster, Pa.; Muscatine, Ia.; Coldwater, Ohio; Buffal N. Y.; Sylvia, Kan.; North Yakima, Wash.; Olivet, Mich Bridgewater, Mass.; Winnipeg, Man., Can.; Bowling Gree Ky.; Chase City, Va.; McPherson, Kan.; Islip, N. Y.; Newpo R. I.; Manistee, Mich.; Muskegon, Mich., Vine Grove, Ky Fairview, Okla., and Marseilles, Ill.

Financial.

The Week in Wall Street.

Although the net result of the trading in Wall Street last week was in almost every instance an advance, there seems to be little confidence in the permanence or stability of the upward movement. The total sales for the week were almost 2,500,000 shares, but this does not indicate that the outside public has taken any part in the transactions. It would be hard to imagine a more thoroughly professional market than has existed since the second day after election. Outsiders seem wholly indisposed to speculate and the buying for investment is very small. The sharp decline which immediately followed the election, and which indicated so clearly

NEW YORK.

	Nov. 14.	Nov. 21.	Shares Sold		Nov. 14.	Nov. 21.	Shares Sold
[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]
[illegible], pfd.	31*	32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Amal. Cop....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	— —
Am. D. T....	[illegible]	[illegible]	----	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	39¼	40	[illegible]	[illegible]	[illegible]	[illegible]	———
[illegible] pfd.	106	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	———
Am. Tel. & C.	[illegible]	[illegible]	———	[illegible]	[illegible]	[illegible]	[illegible]
Am. T. & T..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	118¼	4,995
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Int.-Met	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PHILADELPHIA.

	Nov. 14.	Nov. 21.		Nov. 14.	Nov. 21.
[illegible]	43*	43	Phil. Ele	[illegible]	[illegible]
Elec. Co. of A....	11¾*	11¾*	Phila. R. T.......	[illegible]	[illegible]
[illegible]	[illegible]	48	Phila. Trac....	[illegible]	[illegible]
E. S. B'ty, pfd....	30*	30*	Union Trac....	[illegible]	[illegible]

CHICAGO.

	Nov. 14.	Nov. 21		Nov. 14.	Nov. 21
[illegible] R.	[illegible]	[illegible]	Chi. Tel. Co.	[illegible]	[illegible]
[illegible]	[illegible]	82½	Met. El. Co........	21*	[illegible]
Chi. Rs., Ser. 2.....	20¼	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BOSTON.

	Nov. 14	Nov. 21		Nov. 14.	Nov. 21
[illegible] T. & T	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Tel.........	[illegible]	145*	Mex. Tel., pfd......	6¾*	[illegible]
Edison E., Ill......	282	288	N. E. Tel..........	137	[illegible]
[illegible] Ele	[illegible]	[illegible]	W. [illegible]	[illegible]	[illegible]
[illegible] Ry........	[illegible]	20½	W. T. & T., pfd....	90*	[illegible]
Mass. E. Ry., pfd..	86¼	[illegible]			

*Last [illegible] quoted.
[illegible]

that the insiders who had loaded up at low prices were attempting to unload upon the general public, has had a tendency to rebuff any inclination that might have been felt toward speculation. When it is so plainly demonstrated that the market can be jerked up and pulled down at the will of professional traders, it is not surprising that the investor and the business man prefer to keep their money at home. During the week there was no news feature calculated to stimulate a buying movement, except the announcement that some of the railroads had released heavy orders for steel rails. The monthly reports of earnings of the railroads are not considered satisfactory, nor is it believed that the prospect of securing an advance in rates is very bright. At the present moment it is considered that the market is somewhat oversold. This may explain the determination of the powerful interests that are generally the leaders in manipulation to hold prices at a higher level than the condition of commercial business war[illegible] There is still plenty of money, and the market for this [illegible]rly easy. Borrowers, however, are not particularly eager. [illegible]tations Nov. 21 were: Call, 2½@2¾ per cent; 90 days, [illegible]4½ per cent. The quotations in the table are those of [illegible] close Nov. 21.

Financial Notes.

Georgia Power Company.—[illegible] the [illegible] and the Etowah Power Company into the Georgia Power [illegible]any has been approved by the Railroad Commission of [illegible]gia and permission given to issue $20,000,000 of stocks [illegible] bonds. The outlines of the plans of this company were [illegible] in the issue of Nov. 17. Bonds will be issued as soon as [illegible]rtgage can be prepared and recorded, of which the Knickerbocker Trust Company of New York will be named as trustee. It has not yet been determined which one of several hydroelectric developments will be taken up first. The S. Mor[illegible] Smith Company, of York, Pa., is not interested in the [illegible]t, as at first reported, but the proposition is being handled by C. Elmer Smith, an officer of that company, in connection with foreign interests.

General Motors Company.—The annual meeting of the stockholders of the General Motors Company was held in Jersey City last week. Ten of the eleven directors resigned, and their places on the board were filled by representatives selected by the bankers who took the company's recent issue of $15,000,000 five-year 6 per cent notes. Under the terms of the loan the bankers furnishing the funds were to be allowed to name the majority of the board of directors until the notes were redeemed. W. C. Durant, vice-president of the company, was the only one of the old directors who was re-elected. The new members of the board are: Anthony N. Brady, James J. Storrow, Albert Strauss, J. H. McClement, Nicholas L. Tilney, Richard Lukeman, Jr., George Richards, Jr., Benjamin F. McGuckin, Herbert L. Carlebach and Arthur P. Bush, Jr.

Electric Boat Company.—In explanation of the passing of the regular quarterly dividend of 2 per cent on the preferred stock of the Electric Boat Company, President I. L. Rice says: "The company has a large amount of business on hand and the outlook is excellent, and this has required the use at present of all the capital and earnings. It was the opinion of the directors that under the circumstances it would be wise to suspend dividends for the present." The passing of this dividend provides about $55,000 of working capital per quarter. The company was organized in 1899 and has outstanding $4,999,600 of common stock and $2,627,500 of 8 per cent non-cumulative preferred. Dividends have been paid for the last seven years upon the preferred stock.

Kings County Electric Light & Power Company.—The indications now are that the Kings County Electric Light & Power Company for the fiscal year which ends Dec. 31 will show a surplus available for dividends equal to about 10 per cent on the $10,000,000 outstanding capital stock. The gross earnings will probably be more than $4,000,000 and the net earnings about $2,000,000. During the calendar year of 1909 the company increased its number of consumers by over 3000, or about 23¼ per cent. In view of the unusually favorable showing made by the company thus far in the current year, it is believed that the increase in the number of consumers will exceed last year's record.

Cataract Power & Conduit Company Bonds.—Spencer Trask & Company, New York, are offering at par a large block of the first mortgage 5 per cent bonds of the Cataract Power & Conduit Company. These bonds are a first mortgage on the entire property and franchises of the company, which distributes in Buffalo power received from Niagara Falls. The company is now paying 6 per cent on its $2,000,000 stock. The outstanding bonds amount to $1,384,000 and they are due in 1927.

Union Switch & Signal Company.—A special stockholders' meeting of the Union Switch & Signal Company has been called for Dec. 14 to vote on a proposition to increase the capital stock from $2,500,000 to $5,000,000 by issuing 50,000 shares of a par value of $50. It is proposed to authorize the board to issue the new stock to stockholders in payment of dividends and also to offer it to them for subscription. The present capitalization is $500,000 preferred and $2,000,000 common.

Gary & Interurban Railway Bonds.—Lawrence Barnum & Company, bankers of New York and Philadelphia, having sold a large portion of the $1,000,000 first refunding mortgage 5 per cent bonds of the Gary & Interurban Railway, are now offering the balance at 95 and interest. This is the new electric railway of the United States Steel Corporation's manufacturing city. The bonds are due July 1, 1950, and subject to call at 105.

Detroit-Edison Company.—The quarterly dividend of the Detroit-Edison Company has been increased from 1½ per cent to 1¾ per cent. This increase has been prompted by the exceptionally favorable earnings that have been shown thus far in the current year. These earnings, it is said, after deduction of the allowance made for depreciation, are at the rate of about 14 per cent per annum.

Bronx Gas & Electric Company.—The Public Service Commission of the First District, New York, has ordered a hearing for Nov. 28 on the application of the Bronx Gas & Electric Company for permission to issue $153,000 5 per cent bonds. The proceeds of these bonds will be devoted to extensions and improvements.

Southern Pacific's Electric Deal.—An official statement of the deal between the Southern Pacific Railroad Company, the Pacific Electric Railway Company and Henry E. Huntington, which was referred to in our last issue, is now given out. For several years the Southern Pacific has owned 45 per cent of the stock of the Los Angeles Railway Company and Mr. Huntington has owned the balance. The stock of the Pacific Electric Railway Company has been owned equally by Mr. Huntington and the Southern Pacific Railroad. Under the new deal Mr. Huntington now acquires from the Southern Pacific Railroad its stock in the Los Angeles Railway, thus becoming its sole owner, while the Southern Pacific Railroad buys out Mr. Huntington's interest in the Pacific Electric Railway, thus becoming its sole owner. The Southern Pacific also acquires control of the interurban portion of the Los Angeles & Redondo Railway lying between Hawthorne and Redondo, while the urban portion between Hawthorne and Los Angeles will hereafter belong to the Los Angeles Railway Company. Mr. Huntington's new interests have been reorganized under the corporate name of the Los Angeles Railway Corporation, having a capitalization of $20,000,000. The active management of this property will be in the hands of Howard E. Huntington. The reorganization of the Pacific Electric Railway properties has not been completed, but a new company will probably be formed which will be called the Pacific Electric Corporation. The present capitalization of the Pacific Electric Railway Company is $10,000,000, but its assets are several times that amount. The ownership of the ten-story Pacific Electric building in Los Angeles where the lines of the railway enter has been transferred to the Southern Pacific Railroad. The Southern Pacific, it is said, will immediately invest large sums in the Pacific Electric Railway properties in extensions and improvements of equipment. The new directors of the Pacific Electric Railway are: W. H. Herrin, president; Paul Shoup, vice-president; William Hood, Walter F. X. Parker, J. W. McKinley, Eps. Randolph and R. C. Gillis. The new directors of the Los Angeles Railway Corporation are: H. E. Huntington, president; Howard E. Huntington, vice-president; W. E. Dunn, Albert Crucher, J. E. Brown, C. A. Henderson and J. C. Ward.

Boston Edison Company Stock.—For the last few weeks the stock of the Edison Illuminating Company of Boston has been very strong in that market, and has sold as high as 292½. The stock pays 12 per cent dividends, making it at that figure a trifle more than a 4 per cent investment, but it is not unreasonable to anticipate an extra dividend some time during the winter. It is also believed that there will be a further reduction in the rates to consumers. One feature that adds to the strength of this stock at the present time is the belief that the company will be able to secure a contract for furnishing power to the steam roads entering Boston upon the completion of the electrification of these lines within the metropolitan district. The Edison company for the past five years has expended large sums in bringing its plant to the position where it is able to turn out energy at a lower cost than at any time in the company's history. There is no question that it would be able to supply the railroads with the energy required at a cheaper rate than they could generate it themselves, and in addition to this it would obviate the necessity of large capital investments by the railroad companies.

North Carolina Electrical Power Company.—A mortgage was filed at Asheville, N. C., last week by the North Carolina Electrical Power Company to the Wachovia Loan & Trust Company for $2,000,000. The mortgage covers the various real estate holdings of the company in Western North Carolina, together with several power developments now in operation and in course of construction. The North Carolina Electrical Power Company recently merged with the W. T. Weaver Power Company, assuming at the time all of the bonded indebtedness of that company, which amounted to about $225,000. The company also had some bonds of its own outstanding.

DIVIDENDS.

Blackstone Valley Gas & Electric Company, preferred, quarterly, 1½ per cent, payable Dec. 1.

Brooklyn Rapid Transit Company, quarterly, 1¼ per cent, payable Jan. 2.

Citizens' Traction Company, Pittsburg, semi-annual, 1½ per cent, payable Nov. 17.

Detroit Edison Company, quarterly, 1¾ per cent, payable Jan. 15.

General Motors Company, preferred, 3½ per cent, payable Nov. 30.

Kings County Electric Light & Power Company, quarterly, 2 per cent, payable Dec. 1.

National Lead Company, quarterly, ¾ per cent, payable Dec. 31.

New England Telephone & Telegraph Company, quarterly, 1½ per cent, payable Dec. 31.

New York and Queens Electric Light & Power Company, quarterly, 1¼ per cent, payable Dec. 1.

Norfolk (Va.) Railway & Light Company, 2½ per cent, payable Dec. 1.

Rochester Railway & Light Company, preferred, quarterly, 1¼ per cent, payable Dec. 1.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings	Charges	Surplus.
American Light & Traction Company:					
[illegible]	$356,685	[illegible]	[illegible]	...	
[illegible]	[illegible]	8,865	304,902	.....	
Bangor Railway & Electric Company:					
[illegible]	[illegible]	20,041	29,552	$13,734	[illegible]
October, 1909	[illegible]	[illegible]	29,132	[illegible]	[illegible]
British Columbia Electric Company:					
[illegible]	[illegible]	[illegible]	135,149	......	
[illegible]	[illegible]	[illegible]	109,865	....	
Detroit Edison Company:					
[illegible]	[illegible]	152,270	96,906	[illegible]	[illegible]
October, 1909	182,871	[illegible]	[illegible]	[illegible]	[illegible]
Fairmont & Clarksburg Traction Company:					
[illegible]	[illegible]	19,385	[illegible]	[illegible]	[illegible]
[illegible]	41,432	14,353	[illegible]	[illegible]	[illegible]
Hudson & Manhattan Railroad Company:					
[illegible]	[illegible]	157,183	[illegible]	192,088	[illegible]
[illegible]	[illegible]	[illegible]	148,787	145,268	*[illegible]
Keystone Telephone Company of Philadelphia:					
[illegible]	[illegible]	[illegible]	48,029	[illegible]	[illegible]
[illegible]	91,561	[illegible]	[illegible]	[illegible]	[illegible]
Kings County Electric Light & Power Company:					
[illegible]	[illegible]	[illegible]	182,526	[illegible]	[illegible]
[illegible]	[illegible]	159,638	[illegible]	[illegible]	[illegible]
Lewiston, Augusta & Waterville Street Railway Company:					
[illegible]	[illegible]	17,162	3,382	.	
[illegible]	[illegible]	[illegible]	3,484	..	
Portland (Ore.) Railway Light & Power Company:					
[illegible]	[illegible]	[illegible]	278,367	[illegible]	[illegible]
[illegible]	426,708	[illegible]	[illegible]	[illegible]	[illegible]
Schenectady Railway Company:					
[illegible]	[illegible]	[illegible]	163,214	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	136,146	[illegible]	[illegible]
Syracuse Rapid Transit Railway Company:					
[illegible]	[illegible]	[illegible]	130,705	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	79,855	[illegible]	[illegible]
Toledo Railways & Light Company:					
[illegible]	239,415	[illegible]	86,008	[illegible]	[illegible]
[illegible]	217,738	121,779	[illegible]	[illegible]	20,833
Westchester Electric Company:					
Quarter ended Sept. 30, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Quarter ended Sept. 30, 1909	[illegible]	100,468	[illegible]	[illegible]	[illegible]

*Deficit.

General News

Construction News.

[B]ESSEMER, ALA.—It is reported [illegible] be sub[mit]ted to the City Council advocating [illegible] of a municipal [ele]ctric light plant in Bessemer.

BIRMINGHAM, ALA.—The Coosa River Electric Power Company [ha]s applied to the City Council for a franchise to erect transmission [lin]es throughout the city for the distribution of electricity for lamps [an]d motors.

[B]IRMINGHAM, ALA.—Application has been made to the Board of [Re]venue of Jefferson County by the Grandview Street Railway for per[mi]ssion to construct an electric railway over certain roads in this county. [J.] W. Jordan is interested in the project.

[B]IRMINGHAM, ALA.—Announcement has been made that the Tide[wat]er Railroad Company has awarded the contract for the construction [of] its proposed electric railway. Work will begin on the section be[tw]een East Lake and Bessemer, a distance of forty-six miles. J. M. [Ne]wberry is president of the company.

[H]AZEN, ARK.—It is reported that contracts have be[en] [illegible] [mac]hinery for the plant of the Hazen Power & Light Company. Work [will] soon begin on construction of the buildings, which are to be com[plet]ed by March, 1911. W. H. Fox is president of the company.

[A]LAMEDA, CAL.—The City Council is reported to have voted to [issu]e $12,000 in bonds, the proceeds to be used for the construction of [a n]ew power house to replace the present building for the municipal [elec]tric light plant on Park Street.

[F]RESNO, CAL.—It is reported that the San Joaquin Light & [Pow]er Company has made arrangements for financing its $1,500,000 [outsta]nding bonds issue. The company is building a large dam on the [San] Joaquin River, at Crane Valley. The proposed dam will be 1865 [ft. l]ong, backing the water for miles at a minimum depth of 125 ft. [and] impounding 5200 acre ft. It is proposed to supply electricity in [the] oil fields and valley lands between Bakersfield and Merced, and [parti]cularly to operate pumps on the ranches, where abundance of [wate]r may be obtained from wells. The water will be carried through [illegible] miles of conduit to the power house. It is said that there will [be n]o attempt to complete the third unit of the power plant until next [Marc]h. Two units of 5000 hp each have been cut in. The Kern Oil [Fie]lds Company has recently placed orders for 100 General Electric [moto]rs and for about the same number of Westinghouse motors for [illegible] its property.

[N]EVADA CITY, CAL.—The Pacific Gas & Electric Company, which [has i]ts principal office in San Francisco, Cal., has recently filed articles [of] corporation in Nevada City, Cal., with a capital stock of $3,000,000. [Amo]ng the directors are: E. de Sabla, John Martin, F. G. Drum, [illegible] McEnerny.

[OA]KLAND, CAL.—A project is on foot to compel the Oakland Gas [illegible] Heat Company to reduce its rates [illegible] [The agitat]ion was started by the fact the City of Alameda has reduced the [price] of electricity for cooking and heating purposes from seven to four [cents] per kw-hour. The installation of a municipal plant is also under [consi]deration and may be made an issue in the next mayoralty campaign.

[OR]OVILLE, CAL.—Notices of appropriation of large quantities of [water] have been filed, to be taken from the Middle Fork, Falls River [and] Bear Creek. All applicants state than an electric power plant is [to be] erected on a high hill, near the junction of the Middle Fork and [Falls] River. Paul Rohrig has filed notice of appropriation of 20,000 [illegible] to be taken from the Middle Fork [illegible] [illegible] with Bear Creek, in Plumas County, which is to be conveyed by [a] ft. ditch for a distance of twenty-two miles to the junction of the [Fork] and Falls River. The application states that a concrete dam, 25 ft. [high,] 10 ft. through and 200 ft. long, is to be built at the point of the [illegible] [of] the stream.

[RE]D BLUFF, CAL.—Three deeds have been filed conveying to the [Nor]thern California Power Company the right to construct and main[tain] ditches, flumes and tunnels, transmission lines and wagon roads [over] the lands of Elmer L. Fullwright and Willis H. Stone. The [lands] are located about eighteen miles northeast of Red Bluff.

[SA]N BERNARDINO, CAL.—The Board of Supervisors has granted [the P]acific Light & Power Company a fifty-year franchise to erect trans[missi]on lines for the distribution of electricity on Orange Grove Avenue, [illegible] San Bernardino.

[TU]RLOCK, CAL.—The plant and holdings of the Turlock Electric [Comp]any have been taken over by the La Grange Water, Light & Power [Comp]any, of La Grange, Cal.

[WI]LLOWS, CAL.—The new electric company which is being formed [by] R. Wickes and [illegible] [f]ranchise to erect transmission lines [illegible]

The company proposes [illegible] for operating its system from the transmission line of the Sacramento Valley Power Company.

WONDER, CAL.—Surveys have been completed by the Mono Electric Power Company for the erection of its proposed transmission line from Lucky Boy to Wonder, a distance of about seventy-five miles, to be completed by Feb. 15, 1911. The line will carry 60,000 volts and will supply electricity to the mining companies and other industries for lamps and motors. The power plant of the company is located in Mono County in the Sierra Nevadas.

BOULDER, COL.—It is said that work will be resumed on several old properties in Boulder County when the transmission lines of the Central Colorado Power Company are extended to some of the outlying districts and when the milling plants now under construction or being remodeled are completed. The Blue Bird Mines Company is making arrangements to open its mines. The Utica and Gage mines in the Ward section are awaiting the completion of the transmission line to resume work. The Central Colorado Power Company is extending its lines from the Frigid Mine, near Crisman, to furnish electricity to operate the compressor plant. The Pollock Mill, at Salina, is being overhauled and will soon be placed in operation. A large electric motor is being installed in the Wolf Tongue mill, at Nederland, to supplement the water-power plant.

DENVER, COL.—The Denver & Interurban Railroad Company, which operates an electric interurban railway between Denver and Boulder, forty-six miles in length, is contemplating extending the service beyond Boulder to Longmont, Loveland, Fort Collins and Greeley. Ultimately electric locomotives will be used and freight will be handled by electricity. Energy for operating its system is supplied by the Northern Colorado Power Company.

BROOKLYN, CONN.—The construction of an electric railway to connect Brooklyn, Danielson, Willimantic, Attawaugan and Ballouville is reported to be under consideration. William Clewley, of Brooklyn, is interested in the project.

NEW HAVEN, CONN.—The Shore Line Electric Railway Company is reported to be contemplating the installation of a 300-kw rotary converter at its power house in Waterford. It is understood that the company is planning to supply electricity to the New London & East Lyme Street Railway.

WATERBURY, CONN.—Application has been made to the Council by the Connecticut Company for a franchise to build several extensions to its railway system in Waterbury.

WASHINGTON, D. C.—The Bankers' Electric Protective Association, of Boston, Mass., has been awarded the contract for installing electric linings for certain vaults in the Treasury Department, Washington, D. C.

WASHINGTON, D. C.—Plans are being considered by the Capital Traction Company for the construction of a power house on Thirty-sixth Street and M Street, in Washington. The building will be of brick and concrete construction, one story high.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 14, for furnishing and installing lighting fixtures in the United States buildings at Beatrice, Neb.; Clifton Forge, Va.; Jackson, Mich.; Belfast, Maine; Bristol, Tenn.; La Crosse, Wis.; Moscow, Idaho; Owensboro, Ky., and San Angelo, Tex., in accordance with plans and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

ATLANTA, GA.—The Georgia Power Company, which has secured permission from the State Railroad Commission to issue $10,000,000 in capital stock and bonds to the amount of $10,000,000, will absorb the plants and holdings of the North Georgia Electric Company, the Etowah Power Company and other power plants and sites at Dunlap, Buford, Newnan and Tallulah, giving it practically the control of all the water power of the Tallulah, Chattahoochee and Etowah rivers. It is understood that the Georgia Power Company is controlled by the Westinghouse Electric & Manufacturing Company interests. The company has entered into a contract with the Northern Construction Company, of Detroit, Mich., for the development of the acquired holdings. The [illegible] will ultimately be developed. For further information address C. Elmer Smith, of York, Pa.

CAIRO, GA.—The contract for improvements to the municipal electric light plant has been awarded to J. B. McCrary & Company, of Atlanta, Ga. The cost of the work is estimated at about $15,000.

GRIFFIN, GA.—The Central Georgia Power Company is reported to have offered to furnish electricity for an electric sign to be erected on top of the new hotel. The offer has been accepted by the City Council.

WAYCROSS, GA.—The Southern Bell Telephone & Telegraph Company is contemplating extensive improvements to its local system, in[cluding] [illegible] building and the installation [illegible]

of a new switchboard. The cost of the improvements is estimated at $50,000.

WRIGHTSVILLE, GA.—Preliminary arrangements are being made for the construction of an electric railway from Wrightsville to Lyons.

DECATUR, ILL.—Powers Brothers are reported to be contemplating the installation of a new 150-hp boiler in the power plant of the Powers Block.

DE KALB, ILL.—The Exchange Telephone Company has applied to the City Council for a franchise to erect and operate telephone lines in De Kalb.

MARSEILLES, ILL.—Preparations are being made by the Western Railway & Light Company to begin work on the construction of a new hydroelectric power plant at Marseilles, which will involve an expenditure of about $300,000. The proposed plant will supply electricity throughout this section of the Illinois River Valley.

MATTOON, ILL.—It is understood that the Decatur, Sullivan & Mattoon Traction Company will begin work on construction of its proposed electric railway, forty-eight miles in length, early in the spring. J. A. McFall, of Mattoon, Ill., is secretary of the company.

MOLINE, ILL.—The People's Power Company of Moline, Ill., has entered into a contract to supply electricity to six allied manufacturing companies in Moline and East Moline, as follows: Deere & Company, Deere & Mansur Company, the Moline Wagon Company, the Velie Motor Company, the Union Malleable Company and the Marseilles Company.

MOLINE, ILL.—Plans are being considered by the farmers on the Rock River bottoms to drain several acres of land by means of electrically operated pumps at stations located on the dikes along the river banks. It is stated that H. Arp, one of the parties interested in the project, proposes to utilize electricity for plowing, replacing gasoline motors.

PEORIA, ILL.—The Union Brewing Company is reported to be contemplating changing the motive power of its large brewing plant from steam to electricity.

STANDARD, P. O. GRANVILLE, ILL.—The Berry Coal Company, it is stated, is equipping its mines for electrical operation, energy for which will be furnished from the plant at Granville. Electricity for lighting the village is also supplied from the Granville plant.

ANDERSON, IND.—The City Council has decided to abolish all flat rates and install an exclusive meter service beginning with Jan. 1, 1911, for both the water and electric light service.

BEECH GROVE, IND.—It is reported that the Beech Grove Traction Company is planning to construct a substation on Twenty-fifth Street and Churchman Avenue, in Beech Grove. The building will be 26 ft. x 34 ft., and will be equipped with motor generators, supplied by Fairbanks, Morse & Company. Arrangements have been made by the company to secure power from the Indianapolis Light & Heat Company, of Indianapolis, Ind.

MUNCIE, IND.—The Delaware & Madison Counties Telephone Company is contemplating improvements to its local system and erection of additional toll lines, which will involve an expenditure of about $25,000. New toll lines will be built to Newcastle, Gaston, Alexandra and other cities.

NEWCASTLE, IND.—It is reported that improvements to the municipal electric light plant and water works system are under consideration.

NEWCASTLE, IND.—R. R. Faulkner, principal owner of the Newcastle Independent Telephone Company, has sold his interests to the Eastern Telephone Company, of Winchester. The new owners, it is said, will make improvements to the local system, including the erection of additional toll lines direct to Muncie and Winchester.

ATLANTIC, IA.—At an election to be held Dec. 5 the proposition to issue $5,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant, will be submitted to a vote.

CENTERVILLE, IA.—Plans are being considered for the installation of electroliers for the public square. G. M. Barnett is chairman of the committee.

EMMETSBURG, IA.—The farmers of Great Oaks Township have organized a mutual telephone company.

LINEVILLE, IA.—The Iowa Telephone Company has applied for a franchise to install a long distance telephone exchange station.

LORIMOR, IA.—The farmers in this vicinity are organizing a company for the purpose of installing a telephone system.

MASENA, IA.—The Masena Telephone Company is reported to be contemplating improvements to its system.

MUSCATINE, IA.—The Vienna Pearl Button Company is erecting a large addition to its plant. An electric power plant will be installed to furnish electricity to operate the machinery.

OSKALOOSA, IA.—The local telephone exchange has been taken over by a new company which, it is said, will make extensive improvements to the system, involving an expenditure of about $25,000.

OSKALOOSA, IA.—Surveys have been completed by the Iowa Traction Company for its proposed electric railway from Oskaloosa to Tama, a distance of sixty-five miles. The project has been financed and it is understood that contracts for construction of the road will be awarded within sixty days. George E. Woodhouse is president.

ROCKFORD, IA.—The Cartersville and Rudd Mutual Teleph Companies have applied to the Town Council for a franchise to es lish exchanges in this town.

McPHERSON, KAN.—Bonds to the amount of $7,000 have been v for improvements to the municipal electric light plant in McPherson.

PARSONS, KAN.—The proposition to issue $50,000 in bonds for construction of a municipal electric light plant in Parsons, Kan., been abandoned.

SYLVIA, KAN.—The City of Sylvia has decided to purchase local electric light plant, owned by B. McKeown, which was burned some time ago. Bonds to the amount of $6,000 have been voted, of w the proceeds of $2,000 will be used to purchase the property and $4 to erect a power house and a new engine.

BOWLING GREEN, KY.—The Kentucky Rock Asphalt & Coal C pany, recently incorporated, proposes to erect a rock asphalt plant an output of 200 tons daily, and also contemplates building a by-pro plant for extraction of liquid asphalt. Equipment required for the p will include engines, boilers, pump, rock crushers, rolls, elect machinery, etc. B. F. Gardner is president, and M. H. Crump, president, both of Bowling Green, Ky.

DANVILLE, KY.—Preparations are being made by Louis Herrin and H. Dean, both of Richmond, Ky., to develop the water power Dix River. The present plans call for the construction of a dam Danville. It is proposed to supply electricity in Danville, Harrodsb Nicholsville, Lancaster, and other cities.

VINE GROVE, KY.—It is reported that W. A. Burkhart, owne the Vine Grove Milling Company, is contemplating the installation an electric plant to supply electricity for lamps in Vine Grove.

PORTLAND, MAINE.—The Consolidated Electric Light Company commenced work on the construction of its proposed new power p at Bonny Eagle, on the Saco River. The initial installation will dev 6000 hp.

BALTIMORE, MD.—Sealed bids will be received by the Boar Awards, Baltimore, Md., until Nov. 30 for construction of office laboratory building and transformer house at the Back River sewage posal works. Plans and specifications can be secured upon applica to the Sewage Commission, Room 904 American Building, Baltim Md., for which a deposit of $10 will be required, which will be refur upon return of the plans. Calvin W. Hendrick is chief enginee the sewerage commission.

ASSONET, MASS.—A new electric light plant is being installe the gun factory of W. R. Davis & Sons.

BOSTON, MASS.—The New York, New Haven & Hartford Rail Company has petitioned for legislation granting it permission to acq double track and equip for the electrical operation the Boston, Re Beach & Lynn Railroad. The proposition involves an expenditur about $15,000,000.

BRIDGEWATER, MASS.—A new dormitory is being erected Grove Street, to be used in connection with the State Normal Schoo Bridgewater. An appropriation of $175,000 was made by the Legisla last spring, which will provide for a new power plant as well as dormitory. The plant will supply electricity for lighting and steam for the building.

GRANITEVILLE, MASS.—The Lowell Electric Light Corporatio extending its transmission line to Graniteville for the purpose of su ing electricity for lamps and motors to the machine shop of the C Sargeant Sons Corporation. It is expected that other residents utilize the service in the near future.

NORTHFIELD, MASS.—The electric light committee has ent into a contract with the Greenfield Electric Light & Power Company Greenfield, Mass., for lighting the streets of Greenfield. Electricity operating the system will be transmitted from the plant at Green A twenty-four hour service will be established for both lamps and tors. It is expected that the company will furnish commercial ser in West Northfield and South Vernon.

STERLING, MASS.—At a special town meeting, to be held Nov. the proposition to install an electric light system, the cost not to ex $8,000, will be submitted to a vote.

WORCESTER, MASS.—A committee has been appointed by Wo ter Merchants' Association to make a tour of several large cities the purpose of investigating the street lighting systems with a view enabling the association to recommend a new system for lighting streets of Worcester. The committee consists of Edwin E. Dodge, ident; William A. Lytle, chairman on lighting, and John P. Cog The committee will be accompanied by Henry A. Knight, superinten of lights, who will represent the city, and Fred H. Smith, assis superintendent, representing the Worcester Electric Light Company.

GRAND LEDGE, MICH.—The Commonwealth Power Company reconstructing its entire street lighting system in Grand Ledge. ornamental lighting system is to be put in.

OLIVET, MICH.—E. M. Arnos, manager of the proposed ele light company, writes that bids will be received until Nov. 25 for struction of its electric light plant, to cost from $10,000 to $15. Dr. J. C. Shedd, of Olivett, Mich., is consulting engineer.

MANISTEE, MICH.—Plans are being prepared by Daniel J. Alt son, of Kalamazoo, Mich., for a hydroelectric system for the Man County Electric Company, work on which will probably begin in

spring. A large steam auxiliary ste[illegible] plant will probably be erected in Manistee. For further information address the Manistee County Electric Company, care of Clyde J. Homes, 256 Houseman Building, Grand Rapids, Mich.

MUSKEGON, MICH.—It is reported that Vandervest & Peas, Montgomery Building, Muskegon, Mich., are receiving bids for the construction of a new municipal electric light plant for the City of Muskegon, to cost about $75,[illegible].

BLOOMING PRAIRIE, MINN.—Plans are being considered by the Blooming Prairie Farmers & Merchants' Telephone Company for the erection of a new telephone exchange. The company has purchased the telephone system of the Steele County Telephone Company and proposes to make extensions to the various lines.

CROSBY, MINN.—The Deerwood-Aitkin Telephone Company is reported to be contemplating the erection of a telephone line to Ironton, Minn.

DASSEL, MINN.—The installation of an electric light system in Dassel is reported to be under consideration.

DEERWOOD, MINN.—M. D. Storer, of Bemidji, Minn., has been granted a franchise by the Council to install an electric light plant in [illegible].

HIBBING, MINN.—Preparations are being made by the Mesaba Electric Railway Company for the construction of an electric railway from Hibbing to Gilbert, thirty-six miles in length. The cost of the proposed railway is estimated at $1,000,000. The company has been granted a franchise by the Board of County Commissioners of St. Louis County.

MINNEAPOLIS, MINN.—The Park Board of Commissioners has granted the Northwestern Telephone Company permission to lay conduits in the Lake Harriet district.

WORTHINGTON, MINN.—The local telephone company is reported o be contemplating the installation of a new switchboard.

OSYKA, MISS.—Contracts have been awarded for machinery and naterials for the municipal electric light plant and water works system, is follows: For tank and tower to the Memphis Steel Construction Com·any, Henry R. Worthington, pumps; Walsh & Weidner, boilers; Walter Castenado, engine; electrical apparatus to the Fort Wayne Electric Works and to the Interstate Electric Company for supplies. The construction vork will be done by day labor under the supervision of Xavier A. Kramer, engineer, of Magnolia, Miss.

CAINSVILLE, MO.—The installation of an electric light plant in Cainsville is reported to be under consideration.

COLUMBIA, MO.—The Council has appointed Prof. H. B. Shaw, ean of the school of engineering of the University of Missouri, as onsulting engineer, in connection with the reconstruction of the municipal electric light plant and water works system in Columbia.

KANSAS CITY, MO.—Preparations are being made by the Kansas Missouri Railway Company to begin work on construction of its roposed electric railway to connect Fort Scott and Pittsburg, Kan., nd intervening cities, thirty-seven miles in length, in the spring. L. H. hillips, 610 Broadway, Kansas City, Mo., is president.

KANSAS CITY, MO.—Bids will be received by the Board of Fire nd Water Commissioners, City Hall, Kansas City, Mo., until Nov. 25, or furnishing the Water Department of Kansas City and erecting at e Turkey Creek station the following machinery: One side-crank itomatic cut-off steam engine, one 50-kw, 220-volt generator, with witchboard and equipment. Plans and specifications may be seen at ie office of the superintendent of water works. E. B. Harrington is cretary.

MARIONVILLE, MO.—The installation of a municipal electric power [illegible] umping plant in Marionville is reported to be under consideration.

[illegible]IBBY, MONT.—E. K. Barnum and P. D. Pratt, of Libby, Mont., [illegible]orted to have been granted franchises to install and operate electric [illegible] plant, water works and telephone systems in this city. The cost of [illegible] posed plants is estimated at about $100,000.

[illegible]SOULA, MONT.—Bids will be received at the office of the Super[illegible] Architect, Treasury Department, Washingon, D. C., until Dec. 27, [illegible]struction, including plumbing, gas piping, heating apparatus, elec[illegible]nduits and wiring, of the United States post office building in [illegible]t, Mont., in accordance with plans and specifications, copies of [illegible]ay be obtained from the above office or from the custodian of site [illegible]ula, Mont. James Knox Taylor is supervising architect.

[illegible]ND ISLAND, NEB.—The City Council is contemplating improve[illegible] and extensions to the municipal electric light plant, plans for [illegible]

[illegible]ENTOWN, N. J.—The contract for construction of the proposed [illegible] W. W. Young, 220 Broadway, New York., is engineer.

[illegible]OMFIELD, N. J.—The Town Council has authorized the lighting [illegible]ttee, of which James M. Walker is chairman, to take steps toward [illegible]g legislation that will enable the town of Bloomfield to own and [illegible]ate an electric light plant. The present contract with the Public [illegible]

BURLINGTON, N. J.—The Board of Public Utility Commissioners has approved the ordinance of the City of Burlington granting a franchise to the Burlington Electric Light & Power Company for a term of fifty years. This franchise was originally passed by the City Council and vetoed by the Mayor and passed over his veto.

MORRISTOWN, N. J.—The Board of Freeholders of Morris County has granted the Morris County Traction Company permission to extend its railway on the county roads around the park and down Morris Street.

PITMAN GROVE, N. J.—The Board of Public Utility Commissioners has approved ordinances of the townships of Glassboro, Woolwich and Washington, granting franchises to the Gloucester Electric Company, of Pitman Grove.

WHITEHOUSE, N. J.—The question of establishing an electric power plant to supply electricity to the towns of Whitehouse, White Station, Lebanon and Annandale is under consideration.

ALAMOGORDO, N. M.—The Alamogordo Improvement Company, which is constructing a hydroelectric plant in Box Canyon, near Alamogordo, at a cost of $60,000, contemplates the erection of a series of power plants in that region for the purpose of supplying electricity for the towns and industries in that section.

SANTA FE, N. M.—Vernon L. Sullivan, Territorial Engineer, has approved the application of Messrs. Boulware and Johnson, of Silver City, N. M., for appropriation of 100 cu. second ft. of water in the upper Gila River, to be utilized for generating electricity. It is estimated that 3689 hp can be developed at a cost of about $1,200,000. The proposed plant will supply power to the Mogollon mining district. The work will include the construction of a dam 80 ft. long and 29 ft. high and a pipe line twelve miles in length. The project is reported to have been financed by the Baldwin Locomotive Works, of Philadelphia, Pa.

BALLSTON SPA, N. Y.—The Village Trustees have granted the Schenectady Railway Company, of Schenectady, N. Y., and Hudson Valley Railway Company, of Glens Falls, N. Y., permission to lay tracks through the village to connect the two roads.

BUFFALO, N. Y.—It is reported that bids are being received by the Larkin Company, 663 Seneca Street, Buffalo, N. Y., soap manufacturers, for a 2000-hp electric power plant, steam heating plant and elevator equipment for an eight-story building. Electricity for operating the plant will be secured from one of the Niagara Falls plants. Equipment required will include alternating-current motors, from 5 to 50 hp, transformers, switchboards, ammeters, etc. John D. Larkin is president.

HANNIBAL, N. Y.—The Public Service Commission has granted William Stock permission to transfer certain property rights and franchises to the Hannibal Electric Company; also a franchise held by him in the towns of Granby and Hannibal and the village of Hannibal. The Hannibal Electric Company has received authority to transfer its franchises in the towns of Granby and Hannibal and the village of Hannibal to the Oswego River Power Transmission Company.

HIGHLAND MILLS, N. Y.—The establishment of a lighting district in Highland Mills is under consideration by the Town Board.

ILION, N. Y.—The Board of Electric Light Commissioners has decided to replace the present arc lamps with tungsten lamps throughout the village. One of the reasons for changing the lighting system was the lack of power at the power station, making it necessary to change the street lighting system or to install an additional engine.

ISLIP, N. Y.—The Public Service Commision, Second District, has authorized the Islip Electric Light Company to issue $30,000 in capital stock and bonds to the amount of $20,000, the proceeds to be used for improvements and extension to its plant at Islip, N. Y.

NEW YORK, N. Y.—The Bronx Gas & Electric Company has applied to the Public Service Commission, First District, for permission to issue $153,000 in bonds, the proceeds to be used for extensions and improvements to its plant.

NEW YORK, N Y.—Sealed bids will be received by Kingsley L. Martin, Commissioner of Bridges, until Nov. 25, for electrical and ornamental work, elevators, stairs, drainage and anchor piers of the Queensboro Bridge over the East River, between the Boroughs of Manhattan and Queens.

NEW YORK, N. Y.—Bids will be received by the Board of Health, Department of Health, Fifty-fifth Street and Sixth Avenue, New York, N. Y., until Dec. 1, for furnishing and installing new gas piping and lighting fixtures in two tuberculosis clinics, one day camp and one department stable in the Boroughs of Manhattan and the Bronx. Blank forms and further information may be obtained at the office of the chief clerk, Department of Health. Ernest J. Lederle, Ph. D., is president.

OSWEGO, N. Y.—The Oswego street railway system is now operated by Niagara Falls power. The new substation in Oswego has been completed, which will be used in connection with the extension of the Syracuse, Lakeshore & Northern Railroad from Fulton to Oswego. The extension will not be in operation until next year. The substation is connected up with the high-tension wires at Fulton. The local street railway system is owned by the Syracuse, Lakeshore & Northern Railway Company. The People's Gas & Electric Company has supplied electricity for operating the local railway system in the past.

SENECA FALLS, N. Y.—Plans have been adopted by the Village Board and the Geneva-Seneca Electric Company for installing a new [illegible]

[illegible]
mental posts, each carrying five lamps.

WATERFORD, N. Y.—[illegible] is reported to be interested in a project to construct an electric railway [illegible] the towns of Halfmoon, Crescent and Vischer Ferry. The cost of the proposed railway is estimated at from $150,000 to $200,000.

ASHEVILLE, N. C.—The Asheville Electric Company has awarded the contract for the construction of certain extensions of its transmission lines in Asheville to B. J. Luther & Company, of Baltimore, N. C. The company contemplates erecting several miles of extension to its lines in West Asheville, contracts for which will be let later.

ASHEVILLE, N. C.—The North Carolina Electrical Power Company has filed a mortgage in favor of the Wachovia Loan & Trust Company, of Asheville, N. C., as trustee, to secure an issue of $2,000,000 in bonds. The North Carolina Electrical Company recently took over the property of the W. T. Weaver Power Company, assuming the entire bonded indebtedness, amounting to about $225,000. The company is to issue refunding bonds to take up all bonds of both companies and also to secure funds for further extensions and improvements to the plants it controls.

GRAHAM, N. C.—The River Falls Cotton Mills Company is planning to erect its proposed plant, contracts for which were awarded some time ago. It will be equipped with 10,000 spindles and 240 looms. A hydroelectric power plant will supply electricity for lighting and operating the mill.

HENDERSONVILLE, N. C.—It is reported that contracts have been awarded for the construction of the proposed Gastonia, Hendersonville & Asheville Interurban Railway. Work on construction of the road will begin soon.

HIGH POINT, N. C.—The City Council is considering the question of issuing $100,000 in bonds, the proceeds to be used for the installation of a municipal electric light plant and other public improvements.

WARRENTON, N. C.—The installation of a municipal electric light plant in Warrenton, N. C., is reported to be under consideration. J. H. Bridgers, of Henderson, N. C., is consulting engineer.

BERTHOLD, N. D.—John I. Moore has been granted a franchise to install an electric light plant in Berthold, N. D.

BARBERTON, OHIO.—The City Council has refused to grant a franchise to George W. St. John and L. M. Clifford to operate an electric light system in Barberton. The Northern Ohio Traction & Light Company, of Akron, Ohio, now supplies the electrical service in this town.

CLEVELAND, OHIO.—The Sabin-Curtis Machine Company is reported to be in the market for electric motors for its new shop now being erected at 6536 Carnegie Avenue, Cleveland.

CLEVELAND, OHIO.—A new company has been organized by the parties interested in the Cleveland Foundry Company under the name of the Cleveland Metals Products Company, capitalized at $200,000. The company has purchased a site of sixteen acres at Callamer Avenue and the Nickel Plate Railroad, and will erect at once two buildings, one 60 ft. x 170 ft., two stories high, which will be used as a press shop, and the other 80 ft. x 200 ft., one story, for an enameling shop. The company will do the enameling required by the Cleveland Foundry Company and will bring out a line of metal stamping, including lamp shades, outdoor lamps, railroad signals and other products. The plant will be operated by electricity, which will be purchased from a commercial company.

COLDWATER, OHIO.—Rapid progress is being made on the construction of the new plant of the New Idea Spreader Company, of Coldwater, Ohio. The buildings now under construction have an approximate floor space of 100,000 sq. ft. It is understood that plans are being made for the erection of several other buildings next spring. The entire plant will be equipped for electric motor drive, electricity for which will be supplied by the company's own plant.

COLUMBUS, OHIO.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 5, for the installation of a vacuum cleaning system in the United States post office and court house at Columbus, Ohio, in accordance with plans and specifications, copies of which can be obtained at the above office, or of the superintendent at Columbus, Ohio. James Knox Taylor is Supervising Architect.

DEFIANCE, OHIO.—The City Council has authorized the Director of Public Works to enter into a contract with the Defiance Gas & Electric Company for street lighting at the rate of $70 per lamp per year. The rate for electricity for commercial lighting is to be 9 cents per kw-hour, with a discount of 10 per cent if paid before the tenth of the month. The price for gas is $1.35 per 1000 cu. ft., with a discount of 10 per cent.

EMPIRE, OHIO.—The Union Clay Manufacturing Company has awarded the contract for the electrical work for its entire plant to the Risinger Manufacturing Company, of East Liverpool, Ohio. The work will include power apparatus, motor generator set, electrical mine equipment and lighting the plant and office buildings.

MT. GILEAD, OHIO.—Preliminary plans are being prepared by the General Traction Development Company for the construction of an elec- [illegible] 516 Hippodrome Building, Cleveland, Ohio, is president of the company.

POLAND, OHIO.—John McClure is reported to be interested in a project to construct an electric railway from Poland to Boardman, and there to connect with the Youngstown & Southern lines.

FAIRVIEW, OKLA.—It is reported that the city will soon ask for bids for equipment for the extension to the municipal electric light plant. D. H. Denman is Mayor.

FORT SILL, OKLA.—Sealed proposals will be received at the office of the constructing quartermaster, Fort Sill, Okla., until Dec. 15 for furnishing and installing a cold storage and ice plant in the power house at new artillery post, at Fort Sill, Okla. Plans and specifications can be obtained upon application, for which a deposit of five dollars will be required, which will be refunded upon return of plans. Captain David L. Stone is constructing quartermaster.

MUSKOGEE, OKLA.—The Muskogee Industrial Development Company, of Muskogee, Okla., has increased its capital stock from $250,000 to $300,000. The company was organized to erect a hydroelectric plant on the Grand River.

PORTLAND, ORE.—The Alameda Improvement Association has been organized by the property owners in Alameda Park and Olmstead Park for the purpose of securing electric lighting, telephone and mail service in that district. L. O. Roberts is a member of the committee.

EDDYSTONE, PA.—I. T. Silverman, of Philadelphia, Pa., is reported to be interested in a project to construct a new electric railway to extend from Eddystone to the old rifle range in Tinicum township, from which point it will branch across the marsh lands to West Philadelphia.

EVANS CITY, PA.—Arrangements are being made by the Allegheny & Northwestern Railway Company for the construction of an electric railway from Evans City to Harmarville, a distance of twenty-four miles, bids for construction of which have been asked. The cost of the proposed railway is estimated at about $400,000. J. G. McPherson, of Philadelphia, Pa., is president.

HAZLETON, PA.—The Markle coal interests are reported to be interested in the organization of four companies which propose to furnish electricity in Hazleton and three adjoining townships, for which charters have already been obtained. The incorporators are: C. B. Houck, A. Markle and W. H. Lawall, all of Hazleton, Pa.

LANCASTER, PA.—The Canestoga Portland Cement Company is reported to be considering the construction of a large Portland cement plant, which will be equipped for electric motor drive. A large electric power plant will also be installed.

PHILADELPHIA, PA.—Arrangements are being made by the Philadelphia & Suburban Elevated Railroad Company for the extension of the proposed Broad Street subway and elevated system to Olney, by means of a loop from Lehigh Avenue and Broad Street, passing through Kensington and Frankford to Wayne Junction.

PHILADELPHIA, PA.—The Manayunk power station of the Philadelphia Hydro-Electric Company has been completed. The new plant was erected at a cost of about $150,000 and will have an output of about 6000 hp. The company will supply electricity to the Philadelphia Rapid Transit Company and the Philadelphia Electric Company.

PITTSBURGH, PA.—The contract for the construction of the new power plant of the American Locomotive Works for its works on the lower North Side, has been awarded to the Cuthbert Railway Company, for $25,000. It is proposed to equip the locomotive works for electrical operation.

READING, PA.—The Metropolitan Electric Company, of Reading, Pa., it is reported, will discontinue service from its hydroelectric power at Klapperthal, near Reading, as soon as its new plant in this city is completed. It is understood that the company is contemplating rebuilding the Klapperthal plant.

SHARPSBURG, PA.—The contract for furnishing and installing two 300-hp boilers, feed-water heater, feed pump and necessary piping at the municipal light and water plant has been awarded to the Oil City Boiler Works, of Oil City, Pa., for $9,353. Albert F. Young is borough clerk.

WILLIAMSON, PA.—The Williamson Rural Telephone Company, recently organized, is planning to erect a telephone line from Williamson to Upton, connecting there with the belt line to the Greencastle exchange. J. W. Barnhart is president.

NEWPORT, R. I.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 29, for furnishing and installing at the naval training and torpedo stations, Newport, R. I., generator sets as per schedule No. 3051. Blank proposals will be furnished upon application to the navy pay office, Newport, R. I., or at the above office. Applications for proposals should designate the schedule desired by number.

CAMDEN, S. C.—The contract for installing the electric lighting equipment in the Hermitage Cotton Mills has been awarded to the Ideal Electric Company of Charlotte, N. C. About 500 lamps will be required.

GREENVILLE, S. C.—It is stated that the Greenville, Spartanburg & Anderson Electric Railway Company will award contracts for the construction of the proposed railway from Greenville to Belton, S. C., and for building the line northward to Mount Holly, N. C., simultaneously; the last-named road will be 110 miles in length. W. E. Lee is chief engineer.

ROCK HILL, S. C.—[illegible], electrical engineer, engaged by [illegible]

the Town Council to make [illegible] of the plant of the Rock Hill Water & Electric Company, has submitted his report to the Council. In the report the value of the plant is given at about $92,000, including the recent improvements made at a cost of $22,000. It is said that the Board of Public Works has recommended to the Town Council that [illegible] the Board of Public Works to make an offer of approximately $100,000 for the purchase of the plant, and that if the offer is not accepted without delay the Council instruct the Board of Public Works to proceed with the construction of a municipal electric and water plant.

ALPENA, S. D.—The Missouri [illegible] Railway Company is reported to be planning the construction of an electric railway from Chamberlain to Huron, for which surveys are now being made.

HOWARD, S. D.—C. A. Laurson has awarded the contract for the construction of an electric light plant in Howard to Harry Lyon, of Sioux City, Ia.

JOHNSON CITY, TENN.—A contract has been awarded by the Watauga Electric Company for the installation of a 500-kw steam turbine. A. Smith is secretary and manager.

MARBLE FALLS, TEX.—Preliminary steps have been taken by E. C. Alexander and associates, who are erecting a large concrete dam across the Colorado River and a 30,000-hp hydroelectric power in Marble Falls, for the erection of a transmission line extending from Marble Falls to Temple, which will also furnish electrical service to the towns of Taylor, Georgetown, Granger, Bartlett and Holland. It is also proposed to extend the lines to Austin, San Antonio, Llano and other towns.

PALACIOS, TEX.—It is reported that C. D. Deal, of Colorado Springs, Col., who recently purchased the local electric light and ice plants, is contemplating the installation of additional machinery.

BEAVER, UTAH.—Plans are being considered for the construction of an electric railway to connect Beaver and Milford, for which surveys are being made. M. T. Burgess is chief engineer.

BURLINGTON, VT.—It is understood that the committee appointed to make investigations in connection with improvements to the municipal electric light plant will [illegible] equipment for the plant.

BRISTOL, VA.—The construction of an electric railway from Bristol, Va., to Kingsport, Tenn., is reported to be under consideration.

CHASE CITY, VA.—The City Council has engaged J. Kent White, of Waynesboro, Va., to prepare plans and specifications for an electric light plant and water-works system, to cost approximately $20,000.

MARTINSVILLE, VA.—At an election to be held Dec. 8 the proposition to issue $35,000 in bonds, the proceeds to be used for enlarging the municipal electric light plant, will be submitted to a vote.

NATIONAL SOLDIERS' HOME, VA.—Sealed proposals will be received at the office of the treasurer, southern branch of National Home for Disabled Volunteer Soldiers, National Soldiers' Home, Va., until Dec. 12, for furnishing and installing fixtures for hospital, installing electric motor in machine shop and repairs to quarters of surgeon and quartermaster. Plans and specifications can be secured upon application to John T. Hume, treasurer.

CHEHALIS, WASH.—The City Council has passed a resolution providing for the installation of cluster lamps in the business district of the city, the cost of which is estimated at $15,000.

NORTH YAKIMA, WASH.—The contract for lighting Naches Avenue has been awarded to the Pacific Light & Power Company. It is understood that an ornamental lighting system will be installed. The Pacific Power & Lighting Company is reported to be preparing plans to enlarge the old power station at Fruitvale. The power house will be enlarged and additional machinery installed.

SPOKANE, WASH.—The National Power Company, of Spokane, Wash., is planning to construct a large plant at Dishman, a few miles east of Spokane. [illegible] large amount of machinery installed by the first of the year. The cost of the plant is estimated at [illegible]

WALLA WALLA, WASH.—Preparations are being made by the Pacific Power & Light Company for the erection of a transmission line from Walla Walla into the Freewater country in Oregon to supply electricity to pump water [illegible]

EAU CLAIRE, WIS.—The Chippewa Valley Railway, Light & Power Company has been granted [illegible] mission to issue $100,000 in bonds, the proceeds to be used to complete [illegible] lights and to pay for additions, including the transmission line from [illegible]

KENOSHA, WIS.—[illegible] Railway Company for the construction of a branch from Middle Street Kenosha, to Washington Island.

LA CROSSE, WIS.—At the election held Nov. 8 the proposition to [illegible]

MENASHA, WIS.—The question of making improvements and extensions to the municipal electric light plant is reported to be under consideration by the City [illegible]

WINNIPEG, MAN, CAN.—Bids will be received by the chairman of Board of Control of Winnipeg, Man., until Dec. 15, for 500-kw motor generator sets, plans and specifications for which can be obtained at the office of Smith, Kerry & Chace, engineers, Carnegie Library Building, Winnipeg, or at their office in Toronto, Ont. M. Peterson is secretary.

BROCKVILLE, ONT., CAN.—The Hydro-Electric Power Commission has submitted to the Town Council rates for furnishing Niagara power to the town as follows: For 1000 hp, $49.34; 2000 hp, $32.48, and for 3000 hp, $27.83. The Council considered the rates too high and no further action was taken. The rate quoted to Prescott for [illegible] hp was $21.74 and to Morrisburg [illegible]

COBALT, ONT., CAN.—Work has commenced on the construction of a hydro-electric power plant on the Mattagamia River at Sandy Falls, in the Porcupine district, six miles from the Timmins mine. Contracts have been placed for generators having a rating of 3000 hp with the Canadian Westinghouse Company, Ltd., and for turbines to drive same with the S. Morgan Smith Company, of York, Pa. For further information address John B. Holden, Manning Arcade, Toronto, Ont.

DUNDAS, ONT., CAN.—The Town Council has entered into a contract with the Hydro-Electric Power Commission for 600 hp to operate the municipal electric system. No extra equipment will be required in Dundas, but a transmission line from the transformer station to the town, about one mile in length, will be erected. The Hamilton Cataract Power, Light & Power Company now furnishes the service.

NEW HAMBURG, ONT., CAN.—The power house of the municipal electric light plant is being enlarged to provide space for the installing of transformers to utilize the power from the system of the Hydro-Electric Power Commission.

NIAGARA FALLS, ONT., CAN.—Owing to the inefficiency of the present street lighting system, Manager Folger has recommended discarding the 100 open arc lamps now in use and providing for the installation of new system, using either arc or tungsten lamps, the cost of which is estimated at about $9,300.

OTTAWA, ONT., CAN.—Arrangements are being made by the Ottawa, Rideau Valley & Brockville Railway Company to begin work at once on the construction of its proposed railway to connect Ottawa and Brockville, a distance of sixty miles. Andrew Hayden is president.

OTTAWA, ONT., CAN.—The construction of an electric railway extending from Ottawa to Kingston is reported to be under consideration. A company is being formed to build the road. The directors are: R. McElroy, M. L. A. Crop; F. A. Henry, of Westboro; J. S. McCann, of Kingston, and E. P. McGrath, of Ottawa.

SEAFORTH, ONT., CAN.—The ratepayers have voted in favor of the by-law authorizing a contract with the Hydro-Electric Power Commission for 500 hp, at an estimated cost of $41.25 per year per hp.

TORONTO, ONT., CAN.—The Canadian National Exhibition Board has adopted a report recommending the expenditure of $10,000 for wiring the exhibition grounds. Percy MacKid is electrical engineer for the exhibition grounds.

WINDSOR, ONT., CAN.—The question of extending the transmission system of the Hydro-Electric Power Commission from St. Thomas, Ont., to Windsor, Ont., is being considered by the Hydro-Electric Power Commission and the Provincial Cabinet. The proposed extension would be more than 120 miles in length and would involve an expenditure of about $1,000,000. Other extensions are under consideration, the cost of which is estimated at about $1,000,000.

MONTREAL, QUE., CAN.—The contract between the City of Montreal and the Saraguay Electric & Water Company has finally been ratified by the Board of Control and sent to the Council. Under the contract seventy-five arc lamps are to be installed in Notre Dame de Grace Ward at $90 each per year. The municipality before becoming annexed to Montreal had contracted for 350 lamps, but the city refused to pay for so many. The company has agreed to install only seventy-five lamps at present, and as the ward becomes more thickly populated will add more lamps until the full number of the original contract are installed.

QUEBEC, QUE., CAN.—At a recent meeting of the finance committee of the City Council it was decided to grant the Dorchester Electric Company a franchise to enter the city from the south shore to supply electricity in Quebec. Under the terms of the franchise the company is to erect a plant at a cost of $200,000, and to supply electrical service at a maximum rate of 10 cts. per kw-hour.

SHERBROOKE, QUE., CAN.—The Sherbrooke Railway & Power Company has been granted permission by the Council of Ascot to erect transmission lines from its plant in Sherbrooke to the Capelton mines, a distance of eight miles.

CHIHUAHUA, MEX.—The Sierra Mining Company is planning to install a hydroelectric power plant at its mines in this State. Under the terms of the concession granted by the State government the plant must be in operation within eighteen months.

MEXICO CITY, MEX.—Plans are being prepared by the Compania Irrigadora de Santa Maria, recently organized, for the installation of a large hydroelectric power plant in the Jojutla district, State of Morelos. Electric transmission lines will be erected to industrial centers and plantations in that region. The company will also construct an extensive system on its own lands, using electricity to operate the pumps. Emilio Pardo is president of the company; Lt.-Col. Armando I. Santacruz, vice-president and treasurer, and Indalecio Sanchez Gavito, Jr., secretary.

PACHUCA, MEX.—The stockholders of the [illegible] de Luz y Fuerza del Estado, S. A., have voted to change the name of the company to the Compania de Luz y Fuerza de Pachuca, S. A. The following officers were elected: R. C. Brown, president; Emilio Pardo and Luis Riba y Cervantes, vice-presidents; F. D. [illegible], director general, and Antonio Pacheco, general manager.

New Industrial Companies.

THE A. C. CAMERON STEAM PUMPS WORKS, of Jersey City, N. J., has been incorporated with a capital stock of $1,000,000, by H. O. Coughlin, L. H. Gunther and J. R. Turner, of Jersey City, N. J. The company proposes to manufacture pumps, motors, engines, air compressors, etc.

THE CENTRAL ELECTRICAL LABORATORY COMPANY, of West Lebanon, N. H., has organized with a capital stock of $5,000. The company proposes to erect a laboratory and factory for the purpose of testing and repairing electric light and power meters; also for designing, manufacturing and dealing in electrical, scientific and mechanical instruments and devices of all kinds.

THE DUAL IMPULSE MOTORS COMPANY has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $100,000. The incorporators are: F. C. Tygard, of Pittsburgh, Pa.; W. A. Loegler and C. H. Abbott, of Mt. Oliver, Pa. The company proposes to acquire patents on the international combustion engine and to manufacture apparatus for same.

THE DUNLAP ENGINEERING OPERATING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000 by D. C. Dunlap, O. F. Cole and W. Armstrong, of Chicago, Ill. The company proposes to do a general engineering and contracting business.

THE ELECTRIC SAW COMPANY has filed articles of incorporation under the laws of the State of New Jersey, with a capital stock of $300,000. The incorporators are: A. H. Phillips, J. H. Longstreet and J. R. Furey, of Philadelphia, Pa.

THE ELECTROTONE AUTO MUSIC COMPANY of New York, N. Y., has been incorporated with a capital stock of $25,000 by A. G. Clark, M. Schoenfeld, G. Rockwell, Jr., of New York, N. Y. The company proposes to manufacture pianos, musical instruments and automatic instruments.

THE GOURLEY HYDRO-CARBON CONVERTER COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing hydro-carbon converters and other mechanical devices. The incorporators are: T. P. Gourley, of Brooklyn, N. Y.; W. J. Hamilton and S. T. Williams, of Plainfield, N. J.

THE GREATER INDIANAPOLIS INDUSTRIAL ASSOCIATION, of Indianapolis, Ind., has been incorporated with a capital stock of $25,000 by John N. Carey, Henry Janesen, S. G. Vancamp, J. C. Schaf, C. A. Bookwalter and L. A. Cox. The company proposes to purchase land adjacent to the City of Indianapolis and build an industrial suburb, establish a power plant and locate factories.

HUNT & McCREE, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000, for the purpose of manufacturing and dealing in mechanical and electrical appliances, etc. The incorporators are: E. J. Forhan, G. F. Martin and H. P. Jones, of New York, N. Y.

LATEY & SLATER, Inc., of New York, N. Y., has been incorporated by H. N. Latey, F. L. Booth, of New York, N. Y., and F. R. Slater, of Yonkers, N. Y. The company is capitalized at $50,000, and proposes to do a general consulting and construction engineering business, etc.

THE LEWEN SYSTEM CONSTRUCTION COMPANY, of New York, N. Y., has been chartered with a capital stock of $50,000 to construct bridges, tunnels, tanks, railways, etc. The incorporators are: C. Kriser, of Brooklyn; H. L. Lewen and S. L. Baron, of New York, N. Y.

THE MADISON T. B. WASHINGTON COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 by M. T. B. Washington, M. W. Gilbert, and J. S. Brown, Jr., of New York, N. Y. The company proposes to manufacture automobiles, machinery, electrical apparatus, etc.

THE PERFECT FIRELESS & ELECTRIC COOKER COMPANY, of Toledo, Ohio, has been chartered by Luther D. Smith, W. A. Humphrey, Charles F. Nighswander, Max C. Roth and E. R. Kirkendall. The company is capitalized at $50,000, and proposes to manufacture a fireless and electric cooker.

THE STROMBERG MOTOR DEVICES COMPANY, of Boston, Mass., has been incorporated with a capital stock of $[illegible] by H. [illegible] Coulter, Charles G. Bancroft and William F. Poole.

THE WARREN POWER SYSTEM, Inc., of Cape May, N. J., has been chartered with a capital stock of $2,000,000 to manufacture and deal in apparatus for moving machinery of all kinds. G. G. Steigler and [illegible], of Wilmington, Del., are the incorporators.

Personal.

MR. R. M. SEARLE, vice-president of the Rochester Railway and Light Company, will address the Toronto N. E. L. A. section at its regular monthly meeting on Nov. 28.

MR. D. F. CRAWFORD, general superintendent of motive power of the Pennsylvania Railroad Company, is the author of an article entitled "Electric Car Lighting," in the November issue of the *Yale Scientific Monthly*.

PROF. D. S. JACOBUS, advisory engineer of the Babcock & Wilcox Company, delivered a lecture on Nov. 10 before the Franklin Institute on the "Generation of Power," which sketched the development of recent years in steam boilers and prime movers.

MR. C. M. CALDWELL has been appointed inspector of electric meters for Kansas City, Mo. Mr. H. Guy Porter, James Milliken University, class of 1907, is his deputy. Both were appointed as a result of a competitive examination under the civil service rules.

MR. L. B. MARKS delivered a lecture on "Factory Lighting" on Nov. 17 before the Manufacturers' Association of Bridgeport, Conn. On Nov. 28 Mr. Marks will lecture before the Brooklyn chapter of the American Institute of Architects on natural and artificial lighting of interiors.

MR. A. C. FROST, of Chicago, has announced his intention to retire from the presidency of the Chicago & Milwaukee Electric Railroad Company when the proposed reorganization is completed. The company is now in the hands of receivers, and it is expected that a reorganization will be effected within six months.

MR. WALTER BRINTON, superintendent since 1895 of the manganese-steel department of the Taylor Iron & Steel Company's plant at High Bridge, N. J., has resigned to become consulting engineer for the Edgar Allen American Manganese Steel Company, which is manufacturing manganese steel at Chicago Heights, Ill., and at New Castle, Del. Mr. Brinton's headquarters will be at the New Castle plant.

MR. J. H. VAIL, of New York, addressed the Toronto A. I. E. E. section at the Engineers' Club, on Friday, Nov. 18, on "The Electric Truck and Its Uses." Over one hundred lantern slides were used during the lecture, showing the electric tricycle of 1881, the car built for the Sultan of Turkey in 1888 and Mr. Fred M. Kimball's vehicle of 1888, as well as present and past commercial types of vehicles.

MR. FRANK G. BOLLES, commercial engineer of the Allis-Chalmers Company, has resigned in order to devote his entire attention to the Reliance Engineering & Equipment Company, Majestic Building, Milwaukee, in which he has an equal interest with Mr. C. A. Tupper and others. The company, which is taking on a number of additional exclusive agencies, will remove December 1 to offices in the new Engineering Building and considerably extend the scope of its operations.

MR. ALBERT SCHEIBLE has opened an office as research engineer at 125 La Salle Street, Chicago. Mr. Scheible is held in high esteem by the electrical men of Chicago, among whom he has a wide acquaintance. He was recently chairman of the Chicago Section of the Illuminating Engineering Society, and he is also an active member of the Western Society of Engineers. He has been a frequent contributor to the technical press. Mr. Scheible will devote attention to the investigation of both electrical and mechanical problems.

MR. W. S. LEE, chief engineer and general manager of the Southern Power Company, has returned from Europe, where he made a study of the processes used at several Continental plants for the electrical fixation of nitrogen for use in the manufacture of fertilizers. As a result, his company has recently purchased the rights for two processes that are used on the Continent, and Mr. Lee will have them investigated by the chemists and engineers of the Southern Power Company with a view to establishing one or more plants near to or on the lines of the several hydroelectric plants of the company.

MR. RALPH S. GAVITT, manager of the Leominster Electric Light & Power Company of Leominster, Mass., has tendered his resignation to the Massachusetts Lighting Companies of Boston, to take effect Jan. 1, 1911. After that date Mr. Gavitt will become superintendent of the Calgary Power Company, Ltd., of Calgary, Alta., Can. As stated in our issue of Oct. 20, this company has under construction on the Bow River a 19,500-hp hydroelectric station. Mr. Gavitt has been connected with the Massachusetts Lighting Company since his graduation from Williams College, three years ago.

Trade Publications.

SUBWAY BOXES.—Manhole boxes of the subway type are described and illustrated in Circular No. 114 of the D. & W. Fuse Company, Providence, R. I.

AUTOMOBILE LIGHTING.—Electric lighting outfits for automobiles and motor boats are illustrated, described and listed in a catalog issued by the Electric Storage Battery Company, Philadelphia, Pa.

PORTABLE DESK TELEPHONE.—The Stromberg-Carlson Telephone Manufacturing Company has issued Pamphlet No. [illegible], giving a brief outline of its portable desk telephone and flat-type metal bell box for use the[illegible]ith.

ADJUSTABLE SPEED MOTORS.—The Reliance Electric & Engineer-g Company has issued an illustrated mailing folder devoted to its ad-stable speed direct-current motors. These motors are of the variable-eluctance type.

LIGHTING FIXTURES.—The Western Electric Company has issued ulletin No. 9635, devoted to fixtures designed particularly with reference use with metallic-filament lamps. These fixtures are of both the fold-g and non-folding types.

BUSINESS NOTES.

J. R. DEANE & COMPANY, 46 Van Buren Street, Chicago, have een appointed agents in Cook County for the Independent Electric Ianufacturing Company of Milwaukee, manufacturer of controlling de-ices.

THE FOX MULTAX ELECTRIC COMPANY, 126 Lafayette Street, ew York, reports very active sales of its Fox-Multax Century flaming-rc lamps. Prominent among the recent contracts taken was one from e United States government.

THE METROPOLITAN ELECRIC MANUFACTURING COM-ANY, formerly the Metropolitan Switchboard Company, has moved s offices and factory to Fourteenth Street and East Avenue, Long Island ity, just the other side of the Fifty-ninth Street bridge.

THE GREGORY ELECTRIC COMPANY, of Chicago, Ill., reports unusual demand for lighting apparatus, and has recently shipped a ng list of direct and alternating current apparatus to different sections the country. Among the apparatus was a carload of National 220-volt otors to the Creamery Package Manufacturing Company, of Lake ills, Wis.

THE NOISELESS TYPEWRITER COMPANY, Middletown, Conn., d New York City, has recently completed the development of a noise-s typewriter which is now being put on the market. The special ature of this machine is that the typing is done by a pressure stroke tead of a blow. Hence the machine is practically noiseless and has low maintenance cost. Less force is required to operate it and it gives a clearer impression than the ordinary machine. Moreover, the number of legible carbon copies which can be made by it is greatly multiplied. The president of the company is W. Caryl Ely, of Buffalo.

MESSRS. BRUCE, PEEBLES & COMPANY, LTD., of Edinburgh, have just secured an important order for sixteen Peebles 50-cycle, 6600-550-volt motor converters (La Cour patents) each of 475 kw capacity. The machines, which are for the Calcutta Electrical Supply Corporation, will convert from alternating to direct current or vice versa, and be used for supplying a three-wire direct-current network. Tenders were invited for induction and synchronous motor generators with permission to offer alternatives for rotary converter or motor converters. After an investigation by the consulting engineers, Messrs. Kennedy & Jenkin, of London, it was decided to place the contract with Bruce, Peebles & Company for the sum of £25,000.

THE DE LAVAL STEAM TURBINE COMPANY, Trenton, N. J., announces that the Dravo-Doyle Company, by which it has heretofore been represented in Pittsburgh, Philadelphia and Cleveland, will open a Chicago office in the Marquette Building, in charge of Mr. H. S. Budd. The Dravo-Doyle Company has been very successful in the introduction of De Laval steam turbines for high and low steam pressure, and for direct connection to electrical generators, centrifugal pumps, blowers, etc., and has a wide experience in the general engineering and installation work connected with this kind of machinery, as well as with De Laval centrifugal pumps, all classes of service, including boiler feeding, hydraulic pressure service, water works, etc.

RECORD CONCRETE LAYING BY ELECTRICITY AT GATUN LOCKS.—All hourly records for concrete laying were broken on Oct. 6, 1910, by the cableways used in constructing the great locks on the Panama Canal at Gatun. Lidgerwood cableways, equipped with electric power, are used for placing the concrete, the cableways being arranged in duplex form on four pairs of towers, 800 ft. apart. Of the pair of cableways that broke the record, strand A placed 49 cu. yd. in one hour, and strand B placed 50 cu. yd. during the same hour. This means that the carriage on each strand made 25 trips per hour. The cableways were sold under a guarantee that they would make twenty trips per hour. One operator controls the entire operation on each strand.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 14, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

[illegible]. STARTING MEANS FOR VAPOR RECTIFYING DEVICES; F. Conrad, Swissvale, Pa. App. filed Sept. 20, 1906. Particularly for mercury-vapor rectifiers which are started automatically by the direct current by means of an auxiliary terminal, in addition to positive and negative terminals, the starting means including inductively re-lated primary and secondary circuits and a condenser and means for [illegible]ng the primary circuit after the rectifying process has begun.

[illegible]. MAGNETO-ELECTRIC MACHINE; S. B. Daugherty and F. Johnson, Indianapolis, Ind. App. filed March 21, 1910. For [illegible]ters with improved frame construction, having opposite longitudi-nal portions with angular offsets joined together by a ring portion and a bearing plate.

[illegible]. ELECTRIC LOCOMOTIVE; G. M. Eaton, Wilkinsburg, Pa. App. filed March 15, 1909. A truck and propelling motor and skele-ton cradle in which the motor is mounted with standards supported upon one of the main structural elements of the truck, the cradle being pivoted in the standards.

[illegible]. ELECTRIC CIRCUIT SWITCH; F. W. Harris, Wilkinsburg, Pa. App. filed Jan. 10, 1908. Knife-blade switch whose contacts are rigidly mounted on insulating posts with insulating ribs for high-potential work.

[illegible]. ELECTRIC SWITCHING DEVICE; F. W. Harris, Wilkins-burg, Pa. App. filed March 9, 1908. High voltage mechanism in-[illegible]ling an electrically operated switch mounted on the top of a pole whose contact members are on porcelain insulators with a movable contact on the third insulator located between the two and rotatably mounted, so as to bridge or disconnect the fixed contacts and caused to rotate by a solenoid magnet.

[illegible]19. ELECTRIC CIRCUIT SWITCH; F. W. Harris, Wilkinsburg, Pa. App. filed April 10, 1908. Stationary terminals with a horizontal bridging member, having a fusible element, which is suspended from the terminals by means [illegible] the other.

[illegible]. SYSTEM OF ELECTRIC CIRCUIT PROTECTION; F. W. Harris, Wilkinsburg, Pa. App. filed Jan. 21, 1909. An electromagnet for operating a circuit breaker, which magnet is connected directly to the high voltage line and is supported by one of the line insulators so that it is only necessary to insulate the magnet against the drop in its own windings, the magnet operating a relay switch through a long insulating bar or acting upon the tripping mechanism of an [illegible] circuit breaker.

[illegible]. CIRCUIT BREAKER; F. W. Harris, Wilkinsburg, Pa. App. filed [illegible] strains and includes a fuse wire and [illegible] with greater tensile strength than the wire.

[illegible]. DISCONNECTING SWITCH FOR HIGH-POTENTIAL CIR-CUITS; S. Q. Hayes, Pittsburg, Pa. App. filed Nov. 8, 1909. In-cludes a stationary contact, a pivoted lever above it, a movable con-tact suspended from its outer end and an interposed insulating struc-ture, including a series of insulators one above the other, connected by linked connections.

975,424. BRUSH HOLDER; W. T. Hensley, Wilkinsburg, Pa. App. filed Nov. 8, 1907. A rod carrying a clamping ring with a notched surface, an arm rotating on the rod and a double spiral spring be-tween the arm and the rod.

975,425. FIELD WINDING COIL FOR DYNAMO ELECTRIC MA-CHINES; W. T. Hensley, Wilkinsburg, Pa. App. filed March 9, 1908. A wedge-shaped coil with a plurality of single layer turns of conducting material of varying widths and uniform cross section.

975,421.—Circuit Breaker.

975,431. ELECTRIC CIRCUIT INTERRUPTER; R. P. Jackson, Wil-kinsburg, Pa. App. filed Feb. 2, 1907. A switch arm pivoted to a stationary member and comprising an insulating tube, containing a fusible conductor which separates the tube from the contact when it fuses.

975,476. ARMATURE WINDING FOR DYNAMO ELECTRIC MA-CHINES; N. E. Storer, Pittsburg, Pa. App. filed Jan. 3, 1906. For alternating motors, including a slotted armature core containing the winding with high resistance conductors in the slots, a commutator, low resistance conductors arranged in two concentric rows and connected to the opposite ends of the high resistance conductors and to the armature and commutator segments.

975,477. ARMATURE WINDING FOR DYNAMO ELECTRIC MA-CHINES; N. W. Storer, Pittsburg, Pa. App. filed Jan. 3, 1906. A commutator cylinder with an armature winding, including groups of coils and resistance conductors for connecting the winding to the cylinder segments with strips of good heat conductors between the re-sistance conductors, but electrically insulated.

975,478. ARMATURE WINDING FOR DYNAMO ELECTRIC MA-CHINES; N. W. Storer, Pittsburg, Pa. App. filed March 2, 1908. An armature winding, a commutator with resistance conductors be-tween the winding and the cylinder segments, having reduced end portions with means for increasing their conductivity.

975,490. VISUAL INDICATOR FOR KEY-OPERATED SWITCHES; J. J. Wesley, Hackensack, N. J. App. filed June 9, 1909. A wall switch, having a rocker to which stems are connected and a shutter [illegible] of the parts which exposes the exterior of the switch.

[illegible]. TELEPHONE SYSTEM; C. C. Bradbury, Chicago, Ill. App. filed Oct. 16, 1907. Central energy system with simplified signaling apparatus at central, in which instead of using a cut-off relay ener-gized between one side of the talking circuit and a third conductor with a second relay in series, the patentee uses a cord circuit with a single high resistance relay, which unbalances the line as little as possible.

[illegible] SWITCH; W. K[illegible]. Electrical switches for automatic telegraphy, including an arc-shaped bank of fixed contacts with a rotary concentric member, carrying a plurality of sets of wipers, each detachable as a unit from the member.

975,530. SWITCH; W. Kaisling, Chicago, Ill. App. filed Feb. 18, 1909. Selective switch for automatic telephones in which the wipers are adjusted in two intersecting plants with details relating to the mounting of the electromagnets which operate the switches, the pawl mechanism and the mechanical connectors for the circuit connections, etc.

975,533. STORE SERVICE CREDIT SYSTEM APPARATUS; C. F. Kettering, Dayton, O. App. filed Dec. 14, 1904. For quick investigation of the credit of customers while making purchases, including a telephone system with a marking device at the sending station, controlled from the receiving station through the medium of the message transmitting and signaling agencies.

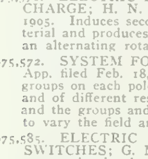
975,569. MULTIPLE FUSIBLE CUT-OUT FOR ELECTRICAL CIRCUITS; A. E. Partington, Sydney, New South Wales. App. filed May 6, 1910. Includes a revolvable barrel of non-conducting material consisting of two end disks, spaced by a tube, and separably held in their assembled condition by fastening means with fuses supported by the apertured end disks, having their metallic ends projecting beyond the barrel ends and contacts engaging the fuse ends.

975,571. ELECTRIC FURNACE WITH MAGNETICALLY ROTATED CHARGE; H. N. Potter, New Rochelle, N. Y. App. filed July 1, 1905. Induces secondary currents within the body of the molten material and produces a rotating force upon the currents by maintaining an alternating rotating magnetic field in inducing relation thereto.

975,572. SYSTEM FOR MOTOR CONTROL; F. B. Rae, Boston, Mass. App. filed Feb. 18, 1910. A series motor with field coils wound in groups on each pole, the groups including different numbers of turns, and of different resistance with interpoles in series with the armature and the groups and the means for cutting out the groups successively to vary the field and interpole magnetization and armature current.

975,585. ELECTRIC CIRCUIT CONTROLLER FOR RAILWAY SWITCHES; G. M. Thompson, Seattle, Wash. App. filed May 18, 1909. An insulated housing, supported by the trolley wire which supports resilient contact plates and trolley guides, together with a magnetic track switch in circuit therewith, and closed by the trolley.

975,592. ELECTRIC CABLE JOINT; W. O. Wilson, Chicago, Ill. App. filed Aug. 16, 1909. Lead coverings for the cables with a lead jacket soldered to the coverings, a copper sleeve for the ends of the conductors and paraffin surrounding the sleeve, with paper surrounding the paraffin.



975,7[illegible].—Conduit Hood.

975,608. SWITCH FOR AUTOMATIC TELEPHONE [illegible], Ill. App. filed July 5, 1907. Selective switch, including a plurality of groups of contacts, each constituting a self-contained and removable unit with adjustable contact devices and means for moving them, step by step, each step causing them to select a different unit, and means common to said units for holding them in fixed position.

975,650. LATERAL TROLLEY FOR ELECTRIC RAILWAYS; A. J. Steinweg, Chicago, Ill. App. filed April 1, 1907. Third rail system, in which the car has a shaft bearing in which the shaft rotates and can shift laterally and carries a trolley arm.

975,712. ELECTRIC HEATER; L. F. Parkhurst and H. G. Weeks, Binghamton, N. Y. App. filed Sept. 27, 1909. A base supporting a plurality of open flues with a heating element in each flue, consisting of a flat insulating material with an electrical resistance spirally wound thereon in double length, the terminals being at the same end of the element.

975,756. MULTIPLEX TELEGRAPH APPARATUS; S. D. Field, Stockbridge, Mass. App. March 25, 1910. Combines with a transmitter branch, an artificial line and a differential receiving instrument, a pair of transmitters, one in the main line, the other in the artificial line, the contact points of the transmitter being closed simultaneously.

975,757. CONDUIT-HOOD; L. A. Fleury, Jr., Indianapolis, Ind. App. filed Oct. 8, 1909. The hood has meeting ends, a shoulder and a collar all stamped from one sheet of metal.

975,777. ATTACHMENT FOR ELECTRICAL CONDUITS; A. McMurtrie, New York, N. Y. App. filed April 25, 1907. A plate through which an armature sheath conductor passes, which is attached thereto by means of a wedge to force the sheath in binding engagement with the opposite wall of the aperture.

975,794. ELECTRIC FURNACE WITH MAGNETICALLY ROTATED CHARGE; H. N. Potter, New Rochelle, N. Y. App. filed July 25, 1904. Produces a rotary magnetic field within a chamber for the molten metal, which is traversed by the induced current, thus stirring the metal.

975,823. LIGHTING FIXTURE; G. D. Beinert, New York, N. Y. App. filed Dec. 19, 1908. For use with gang work tables for sewing machines, etc., including junction boxes connected to each table with lamp brackets supported by each junction box and a conduit extending between the boxes.

975,835. PROCESS OF ELECTROLYTICALLY TREATING TANNIC INFUSIONS OF PLANTS; H. Damkohler and H. Schwindt, Bremen, Germany. App. filed June 16, 1909. Used in leather manufacture and includes a zinc container, an aluminum member connected therewith, forming a cathode, a porous cell, and an anode composed of zinc and aluminum, dipping into the cell.

975,845. WELDING METALLIC FILAMENTS FOR LEAD WIRES; K. Farkas, New York, N. Y. App. filed Oct. 4, 1909. Includes a supporting member for the stem carrying the filament, to which member an electrode is connected and a second electrode for forming the small fusing arc when the first electrode is close by.

975,875. ELECTRIC PLUG AND SOCKET; L. W. Kutsch, Chicago, Ill. App. filed Feb. 10, 1910. For theaters, including a forked wooden handle with porcelain between the forks carrying terminals, supports protecting the porcelain against injury.

[illegible] FOR TESTING ELECTRICAL APPARATUS; [illegible] Lehman, Columbus, Ohio. App. filed June 6, 1910. For testing spark plugs and the like, inclu[illegible] an in[illegible] block

975,885. ALKALINE BATTERY CONTAINING CHROMIUM AN[D] MERCURY; W. Morrison, Des Moines, Ia. App. filed Nov. 2[illegible], 19[illegible] A reversible alkaline battery, including an anode containing zinc a[nd] a chromium-oxygen compound.

975,909. THERMOSTAT; R. H. Waite, Denver, Col. App. filed Ju[ne] 16, 1909. Operates both at low and high temperature by the co[n]traction and expansion of mercury contained in a vessel which w[ill] not leak vapor. The contact maker includes a resilient tube stretch[ed] by the force of the expanding fluid.

975,918. LOCK FOR SWITCHES; G. Wuelser, New Kensington, [Pa.] App. filed July 26, 1910. A plate with a casing, a partition therei[n] carrying a binding post, a binding post on the outside of the casin[g], a switch arm normally engaging the outer post, and which may [ex]tend into the casing to engage the inner post and rotatable lockin[g] disks within the casing to lock the arm in engagement with the bin[d]ing post.

975,922. SWITCH SIGNAL; T. W. Adams, Collinwood, Ohio. Ap[p.] filed March 2, 1910. An incandescent light at some distance fro[m] the switch which is illuminated when the switch points are operated.

[illegible] TELEPHONE REPEATER; S. L. Campbell, Prairie City, O[re.] App. filed Oct. 29, 1908. Includes a microphone at the ser[v]ing end with a receiver at the receiving end, which actuates an arm[a]ture operating a microphone, the receiving end also being provid[ed] with a transmitter, inductively related to a line leading to the origin[al] transmitting station, also including a receiver.

[illegible],935. ARC LAMP; T. L. Carbone, Charlottenburg, Germany. Ap[p.] filed March 19, 1909. Makes use of a globe for flaming arcs, divid[ed] into a plurality of superposed chambers, the middle chamber havi[ng] a transparent wall surrounding the arc closely for preventing t[he] gases from condensing on the walls.

975,936. COMBINED ELECTRIC IRON AND STOVE; B. R. Charl[illegible] Portland, Ore. App. filed Feb. 25, 1910. A supporting base wi[th] a handle which may carry the base below it to form an iron or abo[ve] it to form a stove.

975,980. ALKALINE BATTERY; W. Morrison, Des Moines, Ia. Ap[p.] filed Dec. 3, 1909. A positive electrode for reversible alkaline b[at]teries, carrying a mechanically applied mixture of finely divided oxid[es] of silver and mercury.

975,981. ELECTRODE FOR REVERSIBLE GALVANIC BATTERIE[S]; W. Morrison, Des Moines, Ia. App. filed Oct. 10, 1910. The ele[c]trode has a central internal conductor about which the active m[a]terial is held.

976,002. PRODUCTION OF LONG STABLE ELECTRIC ARCS; [illegible] Schonherr and J. Hessberger, Ludwigshafen-on-the-Rhine, German[y.] App. filed Jan. 10, 1907. The process of producing long stable ele[c]tric arcs, side by side in a tube or passage provided with insulat[ed] electrodes, by passing currents of gas through the tube and causi[ng] the arcs to strike against one common electrode.

[illegible] PROCESS OF TREATING VEGETABLE MATTER; G. [D.] Burton, Boston, Mass. App. filed Oct. 22, 1906. The vegetables a[re] steeped in solutions and subjected to an electric current, produci[ng] gas, which passes through a condenser and is then collected for ta[n]ning purposes.

976,036. METHOD OF UNHAIRING AND TANNING HIDES O[R] SKINS; G. D. Burton, Boston, Mass. App. filed Sept. 9, 19[illegible] Treats hides by first eliminating the oil by subjecting it to a curre[nt] while immersed in an electrolyte, and finally placing them in a ta[n]ning solution and passing an electric current therethrough.

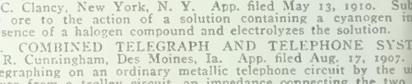
976,035. PROCESS OF WASHING CLOTHES; G. D. Burton, Bosto[n,] Mass. App. filed Oct. 12, 1906. Confines clothes in separate co[m]partments of rotatable drum, containing water to which salt [is] added, and passes a current through the water, adds a soapy su[b]stance and again electrolyzes.

976,045. TREATMENT OF PRECIOUS METALLIFEROUS ORE[S]; J. C. Clancy, New York, N. Y. App. filed May 13, 1910. Subje[cts] the ore to the action of a solution containing a cyanogen in t[he] presence of a halogen compound and electrolyzes the solution.

976,050. COMBINED TELEGRAPH AND TELEPHONE SYSTE[M]; E. R. Cunningham, Des Moines, Ia. App. filed Aug. 17, 1907. F[or] telegraphing on an ordinary metallic telephone circuit by the use [of] power from a trolley circuit, an impedance connecting the two sid[es] of the telephone circuit and a lead connecting the electrical cent[er] of the impedance with the groups, a telegraph receiver in the lea[d,] a high-tension line wire, and a connection between the line wire a[nd] lead, including a sending key.

976,092. REVERSIBLE GALVANIC BATTERY; W. Morrison, D[es] Moines, Ia. App. filed Oct. 19, 1910. A reversible battery, includi[ng] a negative electrode having an oxidizable metal and a chromium co[m]pound and a positive electrode containing silver and mercury and [an] alkaline electrolyte.

976,100. TERMINAL FASTENER; A. Schmidt, Flint, Mich. App. fil[ed] Feb. 7, 1910 A terminal stem with a groove, an eye receiving t[he] stem and connected to a conductor, and a spring secured to the e[ye] projecting into the opening to engage the groove.



[illegible].—Wire Connector.

976,111. WIRE CONNECTOR; P. F. Williams, Chicago, Ill. App. fi[led] Nov. 7, 1904. To avoid short-circuiting by the breakage of the ov[er]head electrical conductor. The wire connector comprises two se[p]arable members, one having a hook with spring means for disen[gag]ing the hook when the connected wires are in their normal position.

976,123. SELECTIVE RINGING MEANS FOR TELEPHONE SY[S]TEMS; E. E. Clement, Washington, D. C. App. filed Jan. 1[illegible], 19[illegible] Subscribers' lines terminate in different switchboards with a trunk l[ine] interconnecting them and an operator's apparatus connecting a c[all]ing line through the trunk with a called line terminating at the [B-]switchboard, selective apparatus at the B-board, and actuating devi[ces] at the A-board controlled through the same trunk.

[illegible] ALTERNATING-CURRENT CONTROLLING APPARATU[S] FOR HYDRAULIC ELEVATORS; [illegible] Lindquist, Yonkers, N[. Y.] App. [illegible] A [illegible] electromagnet having t[wo] sets of windings, with an armature intermediate to the sets, connect[ion] between the armature and the controlling mechanism, a ph[illegible] between the alternating current supply and the elect[illegible] [illegible] to determine the direct[ion] of movement of the armature.

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RATES FOR HYDROELECTRIC POWER.

The article by Mr. Alton D. Adams printed elsewhere gives an instructive statistical view of the amount and price of sales of energy made by various hydroelectric systems to large consumers. As our readers well know, the great developments in energy transmission in the last few years have been in the direction of wholesale supply of energy. The transmission system working over many hundred square miles of territory is seldom inclined to undertake a general distributing business throughout its entire territory, for much of this territory is already occupied by electric lighting and power plants and the places served by these cannot usually be reached by the transmission company without a fight costly both at the start and in competition afterward. As a rule, therefore, the transmission company makes as fair terms as it may with local distributors and furnishes them with energy at wholesale rates. In the case of single large industries or communities as yet unsupplied with energy, it may also take up the sale of energy directly to the consumer. In such instances, as Mr. Adams shows, the rates may be even lower than the public-service corporations'. It is proper enough that wholesale rates should be made to those charged with the burden of distribution, but from the standpoint of ordinary rate-making it is not obvious that sales to private consumers at a lower rate even for smaller amounts of energy are defensible. An electric supply corporation serving any given community is generally recognized as a natural monopoly and as such subject to a considerable degree of local control. Nobody wants two or three competing systems in a given territory, with their separate systems of pole lines and methods of service, particularly in view of probable amalgamation later, leaving the town bristling with poles and without the lower rates which exist temporarily only so long as competition lasts.

Bearing this in mind and recognizing the fact that public authorities should look after the interests of the public which they serve, the question naturally arises why electric energy transmission companies should be permitted that discrimination in rates which is denied to the company which operates locally. One asks with considerable interest why it is that individual private consumers are sometimes able to obtain from transmission companies much better rates than public-service corporations. Of course, in certain instances this difference may be a very proper one, due to radical difference in the nature of the service, but it does not appear that such is always the case. The long and short of the matter is that transmission companies appear to be doing now the very common thing which the supply companies did twenty years ago; that is, they charge what the traffic will bear. There is much to be said, commercially speaking, for this point of view. It practically implies furnishing to each consumer energy at a rate which seems a good thing from the consumer's point of view, for if a large consumer, whether a private individual or a corporation, cannot see profit in taking electric energy, he is not likely to take

it. However, this very principle of charging what the traffic will bear is one that has practically been legislated out of existence as regards public electric supply corporations, proceeding on the principle that all of the community are contributors to the charter rights under which such corporations conduct their business.

It is now pretty universally held that supply corporations must conduct business on as nearly the one-price plan as is practicable, that they must have a schedule which metes out even-handed justice to all comers. This is good equity considering the supply corporation in its rôle as a public servant, although this principle is sometimes carried too far. But this sort of discrimination, which is forbidden to the retail electric company, is winked at or openly permitted in the case of the wholesale electric company. It must be somewhat discouraging to a small electric light company to see a private corporation near by buying energy at a lower price than central-station cost even when it presents load conditions not more favorable to the generating plant. The situation is a difficult one to meet, but from the standpoint of the larger public it needs investigation. There is something to be said for the right under proper restrictions of making special contracts, but it is a thing not likely to be encouraged. If it is proper to require a local supply company to sell at a uniform rate or with a certain definite schedule of discounts within a single municipality, then why is it not proper to apply a similar ruling to the case of the large electric supply corporation that operates over several counties?

This question has never been fully answered, nor is it likely to be in the near future. The tendency is to conserve as far as possible the rights of the ultimate consumer, and on this principle the propriety of charging higher rates to users of wholesale energy than charged at retail directly may well be open to question. On the other hand, there is no doubt, considering the nature of hydroelectric load, that undue obstacles should not be put in the way of securing paying load whenever it can be found. The difference between the hydroelectric plant and the ordinary station is perhaps chiefly in the fact that the fixed charges in the former case are relatively much greater as compared with operating expenses than in the latter case, the fixed charges hence varying little with the load. The mere fact that an energy-transmission plant takes on a large consumer at a rate apparently absurdly low may justify it also in reducing prices to other consumers. If a hydraulic plant can secure a large amount of electrochemical business even at a very low figure it may go so far toward paying fixed charges as to wholesale energy for lighting purposes at decreased rates. The difference between the hydroelectric company and the ordinary station in this particular is, of course, one of degree rather than kind, for the same argument applies to taking on large consumers within the limits of service of an ordinary supply company. All one can say at the present time is that it looks very much as though some general examination into these questions of rates must soon be made. A final settlement will doubtless have to come by intelligent general regulation of rates, not directly according to any so-called scientific system of rate making, but according to the fundamental principles of a square deal, in which we are happy to say electric supply companies and the public are now disposed to co-operate without friction.

CENTRAL STATION ICE MAKING.

A recent inquiry from this office shows that 105 central st tions manufacture ice as a by-product. In addition there a 122 central stations throughout the South which have the wo "Ice" in their corporate name. How many of these may ha followed the fashion set by central stations which includ "Heat" in their corporate name will later be determined. may, however, be assumed that there are not far from 200 ce tral stations that have taken up ice making as an auxiliary electric lighting and we have known of no case in which, on taken up, a station has abandoned that extension of its activ ties. During the past several years a number of articles ha appeared in these columns descriptive of central stations th have embarked in ice making, and in every case the result h been highly satisfactory. We shall continue our investigatio into this branch of central-station work, but the time is no gone by when any special demonstrations should be necessa to convince the enterprising manager of an electric lighti plant of the possibilities of ice making as a central-stati auxiliary.

That, after all of the talk in recent years about the desir bility of straightening the load curve, central-station ice ma ing has not made more progress is at first sight not a litt surprising. When, however, we look back and reflect on t many weary years that it took to instil the idea of a mot load into the central-station consciousness and the apparent hopeless status of the flatiron and other electric heating d vices during a long-drawn-out period, it appears that the pop lar idea of electrical progressiveness requires some qualific tion. Moreover, in the past the larger central stations ha been looked to as leaders, the smaller ones waiting upon the to try out new things. In the present case the subject is o that affects specifically the smaller stations, and leadership the development cannot be awaited from the upper rank Little time and trouble will be involved in central stations ma ing individual investigations of the subject. Refrigerating m chinery suitable for central-station application is now offer by a number of manufacturing companies, any one of whi would doubtless be happy to supply information to a centra station inquiry; and as a matter of comity most plants no having an ice-making auxiliary would not refuse to answ reasonable questions as to their experience.

Where ice making is conducted as a separate enterprise it almost invariably a money-making proposition. In fact, as strictly business proposition an owner of an unprofitable ele tric lighting station would, in almost any town of modera size, be often justified in using as a basis for an ice-makin plant such of the equipment as would be suitable and scrappin the purely electrical equipment. Aside from the larger centr stations, an ice-making plant is almost a natural part of a electric lighting plant owing to seasonable conditions. Add to this are the economic principles that come into play in suc a combination, whereby favorable conditions as to load cur enable better terms to be made for electric lighting, thus lea ing to the extension of the original business. Even in the fa North, experience has shown that competition of natural ice not an obstacle, for the manufactured product always receiv the preference and usually can be furnished at a price that wi sooner or later discourage ice harvesting. Moreover, exper ence has further shown that where a supply of good artifici

e is always available the ice-using habit is quickly formed a community and constantly grows, so that it is an exceponal town where risk would be involved in the establishment f such a plant on the score of probable lack of demand for the roduct. These by no means exhaust the arguments favoring e ice-making auxiliary, but appear to be sufficient to justify e central-station manager in making a personal investigation detail of a subject that has come permanently to the front.

NSTANT-VOLTAGE VARIABLE-SPEED GENERATOR.

Of the many schemes that have been proposed for obtaining constant e.m.f. from a generator driven at widely varying eeds, one of the simplest is noted in the Digest in this issue. se is made of a separately excited generator, the field strength which increases as the speed decreases, having zero value at certain very high speed and a certain high value at zero speed, d changing regularly from one value to the other with change speed. Since the armature e.m.f. of a generator is directly oportional to the product of the speed and the field strength, follows that for constant armature e.m.f. the field strength ould vary inversely with the speed; that is, the field should ich infinite value at zero speed and zero value at infinite speed. ith speeds plotted as abscissas and field strengths as ordinates required curve becomes a hyperbola, while the curve obned according to the scheme mentioned in the Digest is a aight line. It is evident, therefore, that constant e.m.f. at speeds is not obtained. However, both the position and ipe of the straight line can be altered at will, so that it may caused to intersect the hyperbola at any chosen two points. ien these two points are sufficiently close together, the devia- of the hyperbola from the straight line between these points l beyond them for a limited range can be kept within a small centage. That is to say, the generator can be caused to iver the desired e.m.f. at a high speed and at a low speed, produce a slight excess of e.m.f. at intermediate speeds, and eficiency of e.m.f. at speeds either above or below the range e indicated. It is stated that with a ratio of speed of two to between the highest and lowest the voltage variation does exceed 6 per cent above and below the average e.m.f.

LROAD STATION LIGHTING.

lectric service companies supplying energy for lighting iin populous districts of extended area sometimes look to d station illumination as a field for exploitation. The ge revenue to be derived from a single installation of this l is small, but it is apt to be gained from a somewhat rsified use of the company's facilities, and is therefore deble as a means of widening the lighting demand on the em. The tendency of many transportation companies is to iomize to the harshest limits in station lighting; but as the lity and quantity of illumination rise in public buildings to dards representative of modern electrical practice, the pubwill surely call for improved lighting at all the more imant railroad stations within easy reach of central-station ice. The superior illumination of suburban trolley cars is her factor which will force the railroads sooner or later to ide facilities for reading and familiar conversation some ees better than are evidenced in the makeshift installations [illegible] An [illegible] ashamed of the facilities provided in not a few modern railroad stations within a quarter of an hour's ride of large city terminals.

Good service in railroad station lighting calls for long-hour use of lamps in the waiting-rooms and on the platforms, stairways and passages. Baggage-rooms, express offices and freight stations are in operation in many cities and their suburbs until 11 o'clock or 12 o'clock every night except Sunday. It is true that many station agents are obliged to cut off energy from the platforms the moment a train leaves, and the ticket office lighting is sometimes switched on while the passenger buys his transportation and turned off immediately afterward. Even if the platform illumination has to be reduced by one-half, however, that of the waiting-rooms deserves to be constantly maintained until the station closes for the night, and at such a standard that one can read without eye strain. The business ought to be practically continuous throughout the evening except in the case of country stations, and for this reason it is desirable even though moderate in volume at each installation. The co-operation of suburban improvement associations might be helpful in securing this sort of business in cases where the policy of the transportation company is so niggardly that the real benefits and economies, as well as the traffic-attracting power, of good electric lighting are not appreciated. The kerosene lamp and the gas lamp should be banished from railroad stations within reach of central-station service. In few other ways can the transportation companies so easily increase their stock of public good will.

GLARE IN ILLUMINATION.

Of the many problems in illumination that are now receiving consideration none is of greater importance than that relating to the detrimental effects of light upon the eye. Whatever may be his opinion of the conditions under which light may injure the eye and the prevalence of these conditions, no one will deny that to the extent that such conditions can be eliminated or minimized without involving extra cost or impairing the "efficiency" steps should be taken with this object in view. Doubts may exist in the minds of some as to the injury to the eye that may be caused by "glare," and not all will agree upon the limit within which glare may be considered not to exist, but every one will admit that when all signs of glare can easily be avoided it is advisable to do so. One of the most encouraging features of the problem relating to glare, and the one to which most of the present-day agitation can be attributed, is the fact that the illumination obtained from a certain lighting installation is rendered much more effective, and hence seemingly more "efficient," when glare is avoided.

The most common example of glare in artificial illumination exists with arc lamps mounted on low posts for street lighting. Although it is known that the foot-candle illumination obtained from arc lamps used for lighting extended areas is independent of the mounting height, yet in the lighting of streets, which represent long areas of limited width, the foot-candle illumination increases at a rapid rate as the lamps are placed nearer and nearer the street surface. To this fact are due the low mounting heights frequently seen. If the criterion of street illumination were ability to see objects at considerable distance along the street rather than merely the density of light flux as meas-

ured by an illuminometer, considerable changes would be made in the usual mounting heights, and by this means much of the effect known as glare would be avoided. In time possibly legislation will be enacted with the object of removing all glaring lamps from the range within which they are annoying to the eyes of the public. It is fortunate for such a movement that all parties concerned will be benefited by a change in the direction indicated.

Recent experiments tend to indicate that when the lamps are without the direct range of vision by an angle of from 15 deg. to 30 deg. the glare effect is negligible so far as concerns the "efficiency" of illumination. From the standpoint purely of ability to see an object, it is probable that a lamp separated by not less than 25 deg. from the object viewed would have a negligible effect upon the sight, assuming the vision and mind to be concentrated on the object. However, when there are glaring lamps in any position where they can be viewed, they prove attractive to the eye, and the "after image" formed upon the retina as the lamps are seen seriously interferes with the subsequent effective vision of the illuminated objects. Opinions differ as to the brilliancy which may cause injury to the eye, but there seems no doubt that the detrimental effect of glaring lamps upon the ability to see is properly minimized when the lamps are removed from the direct field of vision and the brilliancy is reduced to such a value that no after image can be formed.

While legislative action with reference to glaring lamps would doubtless be confined to the lighting of streets, parks and public buildings, yet it is to be noted that the crime of the glaring lamps is quite as prevalent in domestic as in public lighting. Moreover, it is not improbable that the detrimental effects of improperly equipped and used lamps upon the eyesight are much greater in interior than in exterior illumination because of the time element involved. In exterior lighting the conditions as viewed by one person are continually changing, while the interior lighting conditions affect advantageously or disadvantageously each individual for considerably extended periods. Thus, a single improperly equipped reading lamp may be the cause of permanent injury to the eyes of a whole family. There are many methods for minimizing the glare effects in interior lighting. Possibly the placing of the lamps well out of the direct line of vision and suitably reducing the brilliancy to eliminate after images is as good a plan as any that can be stated in simple language. In any event, it is safest never to make use of clear-bulb metallic-filament lamps, and to employ an eye-protecting reflector with an incandescent lamp and place the lamp where the light cannot reach the eye either directly from the unit or by reflection from any smooth surface.

THE HISTORY OF THE LOGARITHMIC SLIDE-RULE.

It has been said jocosely of pins that they have saved thousands of lives by not swallowing them; but it has been said earnestly of logarithms that they have doubled the effective lives of astronomers. The first publication of logarithms was by their discoverer, Napier, in 1614, but their practical importance was so soon recognized that Briggs published a 14-place table of them between the numbers 1 and 20,000 in 1624, or ten years after the first publication. It is curious that the early tables of logarithms, like that of Briggs, were carried to a high degree of precision, such as fourteen significant figures. As time went on the logarithms shortened, until nowadays we rarely see tables of more than seven places. Still more remarkable is the fact that the great bulk of the modern use of logarithms is mechanical use, with the aid of slide-rules, on which are engraved logarithm scales, and which are usually equivalent to three-place logarithms. Thus, taking the 50-cm (20-in.) slide-rule, the longest usually constructed in one straight length, the easy limit of precision is 0.1 per cent, and the logarithmic scale is usually engraved on the slide to divisions of ½ mm, or 1000 in all. This degree of precision is ordinarily attainable with care, but without much difficulty, on a 25-cm (10-in.) slide rule. The slide rule is in very extensive use among engineers and applied scientists, although very little among pure scientists. This is for the reason that engineers are frequently satisfied if they can obtain, quickly, numerical results that are reliable to a few tenths per cent; and that the 25-cm slide rule meets this requirement. Pure scientists usually aim to secure the highest attainable degree of precision.

A history of the slide-rule has recently been published, from which it appears that Prof. Edmund Gunter, of Gresham College, London, brought out a rule in 1620 on which a logarithmic scale was marked off in a single straight line. With the aid of a pair of compasses additions or subtractions of distances could be made along this line, and the corresponding multiplicative or divisive results obtained. The sliding feature seems not to have been added to the rule until 1657. A great number of different types of slide-rule are now in use. A few of the more complex types attain the dignity of five-place logarithm tables, or give four significant digits in a multiplication with a shrewd guess at the fifth into the bargain. Slide-rules are used in a great number of applications, and many different species have been engraved for special adaptations. In Germany one regular species is much used for electric wiring calculations. Among other special types may be mentioned those engraved for hydraulic engineers, lumber measurers, illuminating engineers, mechanics, barrel gagers, etc. One comfort derived or derivable from the pocket slide-rule by non-mathematical users is that by its use they use their logarithms unconsciously and unawares; or, like Coleridge's ancient mariner they "bless them unaware."

THE LIGHTING OF SCHOOLS.

A recent report from a medical adviser of the London County Council deals with the necessity of closer attention than is generally paid to school lighting. Much in the report will be commonplace to the illuminating engineer, but certain things are brought out which are well worth comment. In the first place, it is very gratifying to note that in the London schools investigated the daylight illumination furnished more cases of lighting classified as "fair" and "bad" than did the artificial illumination. In a number of schools the daylight illumination was found to be altogether unsatisfactory, and it is specially to be noted that certain rooms showed in daylight illumination dark regions in which the hygienic conditions as regards lighting were thoroughly unsatisfactory. Of the greatest interest perhaps is the comment upon the direction of lighting. Dr. Kerr, the author of the report, paid special attention to the effect of lighting from the wrong direction, and showed that under this condition pupils were apt to sit in cramped and uncomfortable

positions, sometimes developing tendencies toward spinal curvature in addition to the familiar ocular troubles from straining due to convergence and accommodation in trying to get near enough to the work to see it properly. Dr. Kerr goes so far as to lay down a general rule that no classroom should be lighted from behind the scholars, since this position is productive of very troublesome head and hand shadows. To avoid these the children often twist themselves into cramped positions and work under very serious disadvantages.

This rule is upon the whole a very sound one for schoolroom illumination if coupled with the caution that the lighting should not come from a point too far to the front or side. Its fundamental purpose is to avoid head and hand shadows, which are certain to be produced if the general illumination comes from the rear. In this connection it is worth noting that both the London authorities and the Boston (Mass.) authorities, who have investigated this subject in the past few years, concur in recommending a general direction of artificial lighting which, while coming from lamps placed near the ceiling, was given by the location of these lamps in a general predominant direction slightly from the left and slightly from the front. The lamps to secure this result, which was reached independently by the two sets of investigators referred to, are placed unsymmetrically with respect to the axis of the room, being shifted several feet to the left and several feet to the front of the position which would make them symmetrical over the desk area. The shift to the left tends to avoid throwing the shadow of the hand upon anything being written. The shift to the front avoids the head shadow. There is thus a logical reason for the rule laid down by Dr. Kerr.

This same line of reasoning applies to light furnished for general illumination in rooms occupied for various clerical purposes. One cannot take advantage generally in such places of an asymmetrical position of lamps, but one accomplishes the same result by proper placing of the rows or groups of desks. If a room for clerical work is to be definitely furnished with lighting for this purpose, a symmetrical placing of the lamps can be easily carried out; but since as a rule the outlets are located before the use of the room is fairly determined, there is nothing to do but to arrange the desks so as to take advantage of the light available. This can generally be done with very little trouble if the occupants will pay attention to the direction from which the light is coming and are willing to sacrifice an entirely needless symmetry in arrangement in order to gain good and effective lighting

STANDARDIZATION OF ELECTRICAL PRACTICE IN MINES.

As recently noted in these columns, the Bureau of Standards has issued a circular on the Standardization of Electrical Practice in Mines, containing a number of proposed rules for the installation and use of electricity in mines. The history of the action is printed in the circular, and, briefly, is that the American Mining Congress held last year at Denver appointed a standing committee on the above subject, and the Bureau of Standards was invited to take part in the work. The circular under consideration is virtually a preliminary report on the work of this committee. The standing committee was appointed because the use of electricity is rapidly extending in mining, and the standardization of its use is rapidly becoming necessary. It was desirable, therefore, that the work should be taken up on a comprehensive and national basis. The use of electricity in mines has important relations to life and property in mining operations. Its use may be attended with marked benefits both to the property and to the miners. Mules can be replaced by electric traction machines with a great increase in effectiveness, cleanliness and output. Incandescent lighting can replace oil lighting with marked improvement in effectiveness, convenience, safety and ventilation. Electric blasting can replace time-fuse blasting with increased convenience and safety. But although electricity can be used in these and in other directions of mining work with a reduction in hazard of all kinds, yet, if the electrical installation is carelessly made, or abused, there may be in its use marked danger of fire to the property or of shock to the men. It is, therefore, important that reasonable and elementary precautions of a nature obvious to those accustomed to electric installations should be insisted upon when introducing electricity into mines.

An instance of this kind is narrated by an engineer who has spent much time in installing electrical mining machinery. A certain miner of considerable practical experience and good average intelligence, but of limited electrical experience, remarked one day that electricity, although very useful in a mine, "was very hard on the teeth of the mules." It seems that a mule in the mine had chanced to receive an electric shock and, under the straining influence of the shock, had bitten on the tram rail with sufficient force to break a tooth. The man, having witnessed the event, had arrived at the conclusion that this was a regular incident in electric mine working and a casual property of the electric current. The unfamiliarity in these matters does not, however, lie entirely on the side of the miner. The physical conditions of life underground are distinctly different from those on the surface. Electrical men accustomed to surface work are apt to forget how damp everything becomes underground, how easily grounds occur within apparatus in such surroundings, and how readily a severe shock may be received from relatively low voltages when the apparatus, as well as the hands, feet, and clothing of the miner, are wet. All sets of mining regulations governing electrical installations must specify certain conditions under which the installation shall be made and maintained; but more important than such regulations is the regular inspection of such installations by a competent practical inspector, and the requirement that when electricity is used to any considerable extent in a mine the electrical equipment shall be placed in charge of a competent man who possesses sufficient knowledge and experience to enable the work to be carried on without risk. We are glad to see that the proposed rules call for such inspectors and mine electricians, and that they are also conservative in mandatory provisions. In mining, as in every other walk of life, the fewer mandatory rules we can comfortably work under, the better for all persons, as well as for the rules. A list of the mining electrical regulations in various parts of the world is printed in the circular, as an appendix. They include rules made in West Virginia, Ohio, Idaho, Montana, Missouri, Kansas, Pennsylvania, Great Britain, Belgium and New South Wales. The most voluminous rules in the list are those of Great Britain, and the briefest are those of Kansas, the latter occupying about two lines and thirty-one words of text. Kansas legal enactments have not always been so terse. The circular has been widely circulated by the Bureau of Standards with the expressed invitation to send in suggestions or criticisms upon the proposed rules.

New President of Western Union.

As a result of the purchase a year ago of the control of the Western Union Telegraph Company by the American Telephone & Telegraph Company Mr. Theodore N. Vail, president of the telephone company, was elected president of the telegraph company on Nov. 23. The retiring president, Col. Robert C. Clowry, continues as a director and a member of the executive committee of the Western Union Telegraph Company. Another change in the management of the Western Union company was the election of Mr. Newcomb Carlton, formerly vice-president and general manager of the British Westinghouse Company, as vice-president, to fill the vacancy caused by the resignation of Mr. George J. Gould at the annual meeting last October.

The retiring president was brevetted lieutenant-colonel by President Johnson in 1865 for meritorious service as superintendent of the Southwestern telegraph lines during the civil war. He had begun his apprenticeship as a telegrapher with the Illinois & Missouri Telegraph Company in 1852 and became manager of one of that company's offices. When he was twenty-one he was superintendent of the St. Louis & Missouri River Telegraph Company. After the war Colonel Clowry rose rapidly in the Western Union Telegraph Company, holding one official post after another until in 1902 he was promoted to the presidency.

The new president was born on July 16, 1845, in Carroll County, Ohio. In 1866, when he was twenty-one years old, his family moved to Iowa. The Union Pacific Railroad was then in process of construction and the young man obtained a position as telegraph operator and station agent at small points west of Omaha. Through the friendly offices of Gen. Grenville M. Dodge, chief engineer of the railroad, Mr. Vail obtained an appointment in the United States railway mail service in 1869. In seven years he was in Washington as general superintendent of the entire railway mail service, which he reorganized and improved to a high state of efficiency.

In 1878 Mr. Vail took hold of the telephone and developed the invention of Bell, as his uncle, Mr. Alfred Vail, had done forty years earlier for the invention of Morse. Bell and his associates were looking for a practical man to become business manager and builder of the telephone system. They asked Mr. Vail to take the place. He resigned from the government service and began to work on the structure that stands to-day as the American Telephone & Telegraph Company, with its associated companies. He retired from active service for a time, but was recalled by the stockholders of the telephone company about four years ago to reassume his post as president. Now as head of both the American Telephone & Telegraph and Western Union Telegraph companies Mr. Vail is mapping out a still broader field of work along the line of the transmission of intelligence.

Annual Report of North Shore Electric Company.

For the fiscal year ended Sept. 30, 1910, the gross earnings of the North Shore Electric Company of Chicago were $1,386,062. The net earnings were $478,506 and out of this amount $80,000 was set aside for special depreciation reserve, $212,323 was paid for bond interest and $143,431 for dividends, leaving $42,752 to be carried to surplus, the total of which now stands at $197,651.

The amount of capital stock outstanding and subscribed is $4,964,000 and the amount of bonds issued is $4,705,000. The depreciation reserve under the terms of the company's mortgages stands at $347,640. The total assets are $10,705,432, of which plants, real estate, franchises and construction constitute $9,414,020.

Mr. Samuel Insull, the president of the North Shore Company, remarks that the increase in connected business during the year was more than double that of any previous year, and the increase in gross earnings was much the largest in the history of the company, notwithstanding the fact that the full benefit of new properties acquired was not received during the year. The number of 16-cp equivalents connected on Sept. 30, 1910, was 453,238, compared with 309,786 the year before.

Mr. Insull notes that during the year the company has extended its system into the lake district of northeastern Illinois and that the entire territory now served is approximately 1284 square miles. There are four generating stations and eight substations.

During the year an increase of the capital stock from $5,000,000 to $7,000,000 was authorized, and new stock to the amount of $964,000 was issued. The bonded indebtedness was increased $705,000 during the year.

For the purpose of retiring its 5 per cent first mortgage gold bonds and providing adequately for further financing over a long period of years, the company has made a new mortgage called a first and refunding mortgage, and during the year it has issued under this mortgage $1,981,000 of bonds, retiring therewith $1,976,000 of first-mortgage bonds and $5,000 of other outlying liens. The annual meeting of the stockholders was held on Nov. 28.

Annual Report of Commonwealth Edison Company.

At the annual meeting of the Commonwealth Edison Company in Chicago on Nov. 28 President Samuel Insull presented his report for the year ended Sept. 30, 1910. The earnings and expenses for that year were as follows:

Gross earnings (including merchandise sales)		$13,083,724.59
Expenses (including depreciation and cost of merchandise sales)		8,441,883.16
Earnings for the year		$4,641,841.43
Charges against earnings:		
Interest on bonds	$1,266,918.01	
Depreciation reserve (Under the terms of the mortgages made by the Chicago Edison Company and the Commonwealth Electric Co.)	532,089.00	1,799,007.01
Available for dividends		$2,842,834.42
Dividends paid		1,847,243.93
Balance carried to surplus		$995,590.49

For comparison it may be noted that the gross earnings for the year ended Sept. 30, 1909, were $10,639,446.50 and the net earnings $3,996,752.83. The increase in gross earnings during the year amounted to $2,444,278.09, which is approximately double the increase in any previous year in the history of the company. The total charges against earnings in 1909 were $1,609,756.63, leaving available for dividends $2,386,996.20.

On Sept. 30, 1910, the total capital stock issued or subscribed amounted to $32,721,897.50 and the total bonded indebtedness to $27,635,000. The depreciation reserve (under the terms of mortgages) is $2,753,839 and the surplus on Sept. 30, 1910, was $3,025,407.19. The total value of the assets on that date was $67,847,438.34, of which $63,643,076.38 was value of plants, real estate, etc.

In his report Mr. Insull remarks on the generally increased cost of all kinds of labor and material, and the unusually large expense to which the company was put, partly in storage of coal and partly because of its increased cost owing to the scarcity resulting from the difficulties of transportation caused by the severe weather of last winter. To guard against the possibility of a shortage of fuel the company took the precaution to have on hand at all times during the year an unusually large supply of coal; consequently the coal miners' strike, extending over a period of five months, did not endanger the continuity of the company's service.

The company's connected business (exclusive of electrical energy supplied to other public-service corporations) amounted to the equivalent of 5,915,622 standard 16-cp lamps on Sept 30, 1910. The corresponding figure for the year before was 4,920,800, showing a gain during the year of 994,822 16-cp lamp

·quivalents, or 22 per cent. This is exclusive of the "railway" oad, which is considerably larger than the commercial load.

During the year the company called for redemption $5,335,000 vorth of Chicago Edison bonds and issued $3,117,000 of Comıonwealth Edison bonds to replace those already turned in, at he same time depositing with the Northern Trust Company 2,405,000 in bonds to insure the retirement of the outstanding :hicago Edison bonds. During the fiscal year the authorized apital stock was increased from $30,000,000 to $40,000,000, and 2,721,897.50 was paid in at par for new stock during the year. ıdditional bonds issued and sold during the year amounted) $3,050,000.

Perhaps the most important development of the year was the eginning of work on the new Northwest generating station. Ir. Insull refers to this as follows: "In order to take care of ıe company's continued increase in business your directors ave acquired 112 acres of land on the North Branch of the hicago River, north of Belmont Avenue, for the purpose of ıilding thereon a central power plant which will have an ultiate capacity of 360,000 hp. Work on the first section of this ant is now in progress and it is expected that 60,000 hp of achinery will be installed and in operation by next autumn."

The report, which is a most satisfactory one, includes the ımes of the directors and officers of the company, a list of e four generating stations and thirty-six substations and the rtificate of Arthur Young & Company to the effect that they ıve examined the books and accounts of the company and ·und the figures to be as stated in the report.

nnual Report of Department of Electricity, Chicago.

The annual report of the Department of Electricity of the ty of Chicago for the year 1909, somewhat belated, has rently made its appearance. The report shows that there are 7 officers and employees in the department, which has charge der the city electrician of the street lighting of the city, the e-alarm telegraph and police telegraph systems, the inspection all electric wiring, and all other electrical matters in which e city is interested. Mr. William Carroll, the city electrician, at the head of the department.

During the year 1909 the department expended $1,373,891 and rned $177,102, principally in fees for electrical inspections. ı Dec. 31, 1909, the city was operating from its municipal stans 12,189 arc lamps and renting 881 arc lamps from the Comınwealth Edison Company. The average number of lamps ned and operated wholly by the city during the year was 592 and the average cost of the operation and maintenance these lamps is said to have been $41.25 per lamp per year. ıis amount includes all cash expended for labor and matel, superintendence and advertising, but does not include inter-, depreciation, allowance for taxes, water rates, rents of city ctrician's quarters, rental of poles belonging to private comnies and used by the city, nor a portion of the cost of the rk of other branches of the city government which conbute more or less to the electric lighting service, as the detment of finance and the law department, for instance. Mr rroll notes in his report that these charges, "it is claimed," uld be included in the cost of city lighting. The contract ce of each of the arc lamps rented from the Commonalth company is $75 a year.

Of the cost given for each lamp per year, $41.25, it is intering to note the various component parts. Some of the ms are as follows: Sanitary District electrical energy, 1.30; carbons, $2.86; repairs to electric plants, $1.10; repairs lamps, $2.70; repairs to circuits, conduits and posts, $6.40; np trimming, $8.74; station labor, $3.52. These and some aller items make a total of $40.71, to which 54 cents is added superintendence and office expense.

Mr. Carroll expresses himself in favor of making the greatest ssible use of the electrical energy of the Sanitary District to ht the streets, and since his report was written an arrangent to carry this idea into effect has been entered into.

During the year the Bureau of Electrical Inspection issued 28,539 permits, an increase of 6993 compared with the preceding year. Mr. Carroll says that the subject of re-inspections of electrical wiring installations is one of the very greatest importance. An effort is made to perform part of the work of re-inspecting that should be done, and it is hoped that more re-inspections may be made in the future.

The following table shows the number of electric lighting stations and lamps in the City of Chicago under the jurisdiction of the department:

	Stations.	Arc Lamps.	Incandescent Lamps.
Commercial companies, central stations	22	20,519	2,914,318
Isolated plants	897	10,571	531,391
City plants, street lighting	7	11,592	
City plants, isolated, including water works	13	80	3,215
Totals	939	42,762	3,448,924

The number of electric signs in the city at the end of 1909 was 5231.

The horse-power rating of motors in Chicago supplied with electric energy by central-station companies is given as 159,244

Edison Sault Plant May Be Condemned.

Proceedings are now pending in the United States Circuit Court for the Western District of Michigan for the condemnation of certain property at Sault Ste. Marie, Mich., including the water-power plant of the Edison Sault Electric Company. The property of the Edison company is a part of the property north of the Canal Grant and on the American side of the international boundary. The pending proceedings are taken in pursuance of the river and harbor act of March 3, 1909, by which all the lands and other property north of the present St. Mary's Falls ship canal throughout its entire length lying between the canal and the international boundary are to be acquired by the United States. This property is to be taken by the government for the purpose of facilitating the navigation of the Great Lakes. To this end a new lock and dam are to be built at Sault Ste. Marie and it happens that the property of the Edison Sault Electric Company stands in the way of this improvement; hence the condemnation proceedings.

Hydroelectric Development on the Desplaines River, Ill.

Testimony is being taken by a United States commissioner in Chicago in the suit of the United States government against the Economy Light & Power Company, of Joliet, Ill. The suit was brought a year ago on the claim of the government that the Desplaines River is a navigable stream and that, therefore, the company cannot lawfully construct a dam at Dresden Heights, near the confluence of the Desplaines and Kankakee Rivers, to form the Illinois, as the company started to do in making a new hydroelectric development at that place. The same question had previously come up in the Supreme Court of Illinois, and that tribunal upheld the company, finding that the Desplaines was not a navigable river.

If the river is navigable the permission of the Secretary of War should have been obtained before any obstruction to navigation was made in the river. The contention of the government, notwithstanding the decision in the state court, is that the stream is navigable. A number of witnesses have been heard in the pending proceedings, some of them testifying in relation to records 200 years old relating to the use of the Desplaines by the early explorers. In the meantime the company has discontinued work on the proposed Dresden Heights

development until a decision has been reached. Its main generating station utilizes the water-power of the Desplaines at Joliet.

For its fiscal year ended April 30, 1910, the Economy Light & Power Company reports gross earnings, $406,746; expenses, $217,654; net earnings, $189,092; bond interest, $75,743; balance, $113,349. The capital stock of the company is $3,000,000, and $1,546,000 in bonds has been issued. The total assets are given as $5,039,561 and the surplus stands at $413,075. On April 30, 1910, the connected load was equal to the equivalent of 266,220 16-cp lamps. The officers of the company are: President, Mr. Samuel Insull; vice-president, Mr. Charles H. Randle; treasurer, Mr. Charles A. Munroe; secretary, Mr. John F. Gilchrist.

Canadian Water-Powers.

The total available horse-power of the rivers of Canada is stated to be 25,682,907 on the basis of minimum flow development. Of this total only about 2 per cent (516,887 hp) is now developed. The distribution of the water-powers in the various provinces is as follows, the figures representing horse-power: Yukon, 470,000; British Columbia, 2,065,500; Alberta, 1,144,000; Saskatchewan, 500,000; Manitoba, 504,000; Northwest Territories, 600,000; Ontario, 3,129,168; Quebec, 17,075,939; New Brunswick, 150,000; Nova Scotia, 54,300.

In January there will be submitted to the Dominion Parliament a bill respecting the water-powers of Canada. The objects of the law come under seven heads as follows:

1. Water-powers to be alienated for stated period only. 2. Reference of the application for water-powers is to be made to the Conservation Commission before alienation. 3. Determination of the development to be made, and the right of entry and the annual rental calculated on the horse-power used. 4 Time within which proposed development is to be made, and forfeiture in case of non-observance and revision of rentals at expiry of each period. 5. Indemnification of lessee in case of failure to agree after each period. 6. Control of rates at which the public at large is to be supplied with electric power by the lessee. 7. Jurisdiction to determine differences between the government and lessees in case of failure to agree in some independent tribunal.

Dangers of Gasoline Lighting.

Colorado Springs, Col., has adopted an ordinance directed at the danger incident to gasoline lighting. In order to install a gasoline lighting outfit it is necessary to obtain a municipal permit, the application for which shall contain a description of the machine or system to be installed. It is the duty of the city electrician to determine if the system and apparatus comply with sections of the ordinance which specify in detail the requirements, and thorough inspection is directed with respect to installation and use. Following are the requirements as to allowable systems, their installation and use:

Only such gasoline vapor gas lighting machines and systems as have inside carburetors, outside carburetors and flame-heated generators shall be permitted.

All carburetors, generators or other devices of whatsoevere name used for the purpose of vaporizing or gasifying gasoline for use in connection with gasoline vapor gas lighting machines and systems shall, if located inside of the building walls, be inclosed in an extra cabinet constructed of at least No. 14 sheet steel, and all parts of the machine or system containing liquid gasoline shall be inclosed in this cabinet.

All tanks used for the storage of gasoline in connection with gasoline vapor gas lighting machines and systems shall be located outside of the building and if over 6 gal. capacity shall be buried under the ground in an approved manner. All tanks of 6 gal. capacity or less shall be inclosed in a cabinet constructed of at least No. 20 galvanized iron with door securely locked.

All lamps used in connection with gasoline vapor lighting machines and systems shall be rigidly supported at least 2 ft. from the ceiling and shall not be located within 3 ft. of any inflammable goods, shelving or other combustible material.

All gasoline vapor gas lighting systems having inside flame-heated generators shall be equipped with a shut-off valve, securely fastened to the inside of the cabinet inclosing generator.

All valves used in connection with gasoline vapor gas lighting machines and systems shall be constructed of non-corrosive material.

The rules and requirements pertaining to Class A, Class B and Class C of the National Board of Fire Underwriters for the construction, installation and use of gasoline vapor lighting machines and systems are included in the ordinance, and no gasoline vapor gas lighting machine or system will be permitted to be installed which is not listed with them.

Interference with Telephone and Telegraph Lines by Single-Phase Railway Operation.

A decision handed down on Nov. 19 by the Indiana Appellate Court in the case of the Lake Shore & Michigan Southern Railroad Company, the Postal Telegraph-Cable Company and the Western Union Telegraph Company against the Chicago, Lake Shore & South Bend Railway Company is of general interest because it upholds the right of the defendant to operate a single-phase, high-tension alternating-current railway even though there is interference with the successful working of adjacent telephone and telegraph lines by inductive effect.

About two years ago the railroad company and the telegraph companies brought suit against the defendant, which operates a single-phase interurban electric railway between Chicago and South Bend, Ind., with a trolley voltage of 6600. The case was brought in the Superior Court of Laporte County, Ind., and the plaintiffs sought to restrain the defendant from operating its single-phase trolley lines on account of interfering with their telegraph and signal wires owing to excessive inductive effect. The lower court decided against the complainants, and the case was taken to the Appellate Court. Here argument was made at Indianapolis early last summer, and the court has now handed down its decision. In substance the judges refuse the petition of the railroad and telegraph companies and say that the electric railway company has a right to operate its high-voltage single-phase transmission and trolley lines. In delivering its opinion the court says:

"In the absence of any charge or showing of negligence, unskilfulness or malice on the part of the defendant, an interurban railroad cannot be enjoined from using in the operation of its cars on the right-of-way belonging to it an electric system known as the single-phase, alternating-current system and the high-tension current of electricity required to operate cars thereby, even though the use thereof may greatly interfere with the maintenance and use by plaintiff of its electric telegraph lines and signals necessary in the operation of plaintiff's railroad on its property adjoining the defendant's right-of-way. The use of the single-phase alternating current of electricity to effect a lawful purpose on one's own premises does not constitute a nuisance even though the electricity may escape and interfere with the operation of electrical devices on adjoining property. In the absence of negligence any damage caused thereby is *damnum absque injuria*.

"In the absence of any physical injury to plaintiff's property or the actual taking of any of it the mere interference by induction with a use which the plaintiff desired to make of such property caused by the use to which defendant devotes its own property in the operation of its cars by electricity does not constitute a wrong which can be enjoined, even though defendant threatens to extend such use to the degree of entirely destroying the value of plaintiff's telegraph lines.

"As between the two parties, both using electricity, but for different purposes, under public franchises granted by the Legislature, and both conducting business in which the public is concerned, priority of use does not give an exclusive right."

It appears to be the opinion of the court that the railroad and telegraph companies cannot successfully maintain a monopoly of the earth or of the atmosphere. Apparently if their systems of communication are interfered with by reason of induced currents it will be necessary for them to apply such devices and remedies as may be had to overcome the difficulty. Perhaps the case will be appealed to the Supreme Court of the State, although it is said to be a rare thing for the Supreme Court to reverse a decision of the Appellate Court, as the latter in Indiana is practically a part of the Supreme Court. It is reported, however, that the case may be carried to the United States Supreme Court.

Mexican Rubber.

The enormous profits that are being made in the guayule rubber industry in Mexico and the upper border region of Texas are causing European investors to give the matter their attention. Advices have been received here that an English syndicate with a capital of $5,000,000 has purchased the large crude-rubber factory of Adolfo Marx at Saltillo, State of Coahuila, and several smaller guayule manufacturing plants in that part of the country. Mr. Marx is one of the pioneers in the industry. He started in it a few years ago with small capital and has made a fortune which is said to run up into the millions of dollars. Another interesting development will come from the sale of extensive guayule interests of the Maderos to this new English syndicate. Everisto Madero & Sons are, next to the Intercontinental Rubber Company, the largest producers of crude rubber in Mexico from the guayule shrub. They own a number of large factories, scattered over their broad landed estates, and these have an aggregate output nearly equal to that of the Intercontinental Rubber Company, which is a subsidiary of the United States Rubber Company. In addition to their rubber factories the Maderos own more than 4,000,000 acres of the best guayule shrub land in Mexico, and have several other million acres leased at low rental for a long period of years.

The Intercontinental Rubber Company has been negotiating for several months with the Maderos in an effort to purchase their extensive holdings. It was reported last May that the deal was consummated and the consideration announced was $5,000,000 gold. A hitch arose at the last moment and the transaction was declared off. Everisto Madero, the head of the house, is eighty-four years old and it is said that he is anxious to be relieved of the business cares that his enormous holdings impose upon him. The recent action of his grandson, Francisco Madero, in joining the revolutionary element of the country is a source of much worry to the senior Madero. It is charged by Francisco I. Madero's father that the federal government has placed an additional heavy burden of taxes upon their property because of the political imbroglio.

The official statement of the national Treasury Department showing that during the fiscal year ended June 30, 1910, the exports of crude rubber and guayule shrub from Mexico aggregated in value $26,228,189 Mexican currency, which is equivalent to $13,114,094 gold, gives some idea of the extent of the new industry. These figures include the rubber-tree product, but as there was so little of this it is hardly worth considering in the total exportations. The production of crude rubber from the guayule shrub is constantly increasing, notwithstanding the recent depression in prices. It is estimated that the exportations from Mexico of this product and the shrub for the current fiscal year will be upward of $20,000,000 gold. Last fiscal year the value of the shrub that was exported to factories in the United States and Europe for treatment was $9,468,121.

The total value of all exports from Mexico for the fiscal year ended June 30, 1910, was $260,056,228 Mexican currency. The guayule rubber and shrub exportations had an aggregate value of a little more than 10 per cent of the total exportations of the country. This is a remarkable showing when the fact is considered that the industry was unknown in the commercial world ten years ago.

Refuse Destructor Plants.

Mr. Étienne de Fodor, general manger of the Budapest General Electric Company, recently delivered a lecture before the Municipal Council and the Hungarian Society of Engineers upon the generation of electricity from refuse destruction. The various English and foreign systems of refuse destruction plants were explained and illustrated by means of 150 colored lantern slides, and figures and tables given showed the advantages that a modern destructor plant offers in connection with central stations.

The following table gives data as to the fuel value of refuse in some of the cities which Mr. de Fodor cited in connection with steam generators. The figures represent the evaporation in pounds per pound of refuse:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Barmen	1.30
Mainz	1.30
St. Petersburg	1.16
[illegible]	[illegible]
Kiel	1.05
Frankfort	[illegible]
Copenhagen	0.92
Hanover	0.91
Amsterdam	[illegible]
[illegible]	[illegible]

As a general average one may assume 1 lb. of refuse to evaporate 1 lb. of water, while some plants have been able to produce 50 kw-hours of electricity from 1 ton of refuse.

The lecture included descriptions of the interesting plants constructed by Heenan & Froude, the well-known English constructors of refuse destructors, among which are those erected in London, Glasgow, Gloucester, etc. Interesting features were also brought out concerning plants in operation in Munich, Frankfort, Kiel, Brussels, Wiesbaden, Brünn, Vienna, etc.

Mr. de Fodor has been studying the question of refuse destruction for some years, gathering actual facts and results obtained from nearly all modern and up-to-date destruction plants, as the City of Budapest is contemplating the erection of a modern plant in place of the primitive one that it now possesses. In the present plant nothing is destroyed, but the refuse is picked over and assorted and the rags, bones and other things found are neither disinfected nor sterilized, but are baled or bundled up and freighted away in railroad cars that also carry the usual goods of commerce. In this plant, moreover, myriads of flies and other insects have found a happy Eldorado and the offensive odors are an affliction to the surrounding cottagers. The question of refuse destruction has become acute lately in Budapest, and Mr. de Fodor's lecture was received with great applause.

Resistor for Incandescent Lamps or Heating Units.

A patent was granted Nov. 22 to Prof. Herschel C. Parker and Walter G. Clark on a filament or resistor for heating units or lamps, the date of the application being May 20, 1909. The resistor is in filament form, composed of a solution of carbon in carborundum in which the ratio of carbon and silicon is always greater than one atom of carbon to one atom of silicon. To produce the resistor a mixture of approximately 2 per cent of olefiant gas and 98 per cent of hydrogen is passed through a proper vaporizer containing silicon tetrachloride and into a flashing jar containing a carbon filament through which an

electric current is passing; the current through the filament causes the decomposition of the gases and the deposition of SiC_2 on the heated filament. The resistor filament thus made is, when cold, a conductor of electricity throughout its mass and will glow continuously at incandescence in the open air upon the passage of an electric current through it and maintain continuously in the open air a temperature of about 1500 deg. C.

Welsbach Osmium Lamp Patents.

Four patents were issued Nov. 22 to Carl Auer von Welsbach, of Vienna, relating to the manufacture of the osmium metallic-filament lamp, the application for each of the patents having been filed Aug. 9, 1898. The first patent in order of number relates generally to the manufacture of the osmium filament. It is stated that while osmium was known to be a good conductor of electricity it was not known that it was non-volatilizable when in vacuo or in certain reducing gases at temperatures at which platinum volatilizes, which discovery is utilized as one of the bases of the invention. In making an osmium filament a stiff uniform paste is prepared of osmium or suitable salts, including a binding material, which, under the influence of heat, will resolve itself practically into carbon. The threads made from this paste, after drying, are subjected to dry or destructive distillation, during which the volatile constituents are driven off, so that the filament then comprises a mixture of carbon and osmium. The carbon is then removed by subjecting the incomplete filament to the influence of a moderate heat obtained by an electric current in an atmosphere of gases capable of taking up or removing the carbon without oxidizing the osmium. The osmium particles are partially fused or cemented together by then continuing the current to the development of a heat at which platinum would volatilize. The filaments thus produced are free from carbon, extremely dense and coherent, have the necessary flexibility and elasticity and depend upon osmium not only for their conductivity but for the incandescence which is produced at the temperature at which platinum would be melted. Twelve of the fifteen claims of the patent relate specifically to the use of osmium in producing a metallic filament. The remaining three claims refer to the production of filaments for incandescent lamps, consisting in forming a thread-like body from a paste containing a refractory metal and an agglutinating material, eliminating the latter in a protecting environment, thereby leaving a corresponding thread-like body of particles and progressively consolidating and uniting said particles into a compact, coherent, elastic final filament by the passage therethrough of an electric current at a heat finally reaching a dazzling incandescence. The other two general claims are variants of that just noticed.

The second patent relates to a method in which an inner carrier or fillet is used upon which osmium is deposited, after which the fillet is removed by the heat of an electric current in the presence of suitable gases. Three of the five claims refer specifically to osmium. Of two general claims, one is on associating an organic thread with a metal having a point of fusion higher than that of platinum, subjecting the same to dry distillation, placing it in a suitable atmosphere wherein the carbon is eliminated, and, by the action of an electric current at a temperature at which platinum is volatilized, uniting the metallic particles into a dense, compact, coherent filament suitable for electric incandescence. The second general claim is on a dense, coherent, metallic film for incandescent electric lamps, consisting of metallic particles fritted together and which incandesce at a temperature above that at which platinum volatilizes.

The third patent relates to a means for attaching the filament to the leading-in wires. Four of the nine claims are general in character and refer to an incandescent electric lamp having a metallic filament connected to its leading-in wires by a body or bodies, the metallic base of which is substantially the same as the metallic base of the filament, which latter has an incandescing temperature beyond that at which the metal of the leading-in wires would fuse; a connecting metallic fuse joint uniting the filament and leading-in wires, the metal of the fuse joint being substantially the same as the metal of the filament; a mounting whose fusing point is sufficient to withstand the temperature of the filament and protect the metal of the leading-in wires from fusing or alloying with the filament; the passage of a welding current through the leading-in wires, mounting and filament, thereby completing the joint, the mounting of which is such as to increase the cross-section of the ends of the filament, thereby reducing the resistance, and consequently the temperature at the point of contact of the leading-in wires with the connecting medium.

The fourth patent relates to the use of a platinum wire upon which to deposit fumes or vapors from a volatile osmium compound, after which the platinum core is volatilized by the action of an electric current. Of eight claims of this patent two are general in character, one covering an incandescent filament formed of metal infusible at the temperature at which platinum volatilizes and arranged in a plurality of superimposed minute layers or laminas all rendered compact and coherent. The other is on a process of forming incandescent filaments consisting in depositing intermittently upon a fillet a series of layers of metal infusible at the temperature at which platinum volatilizes and uniting the several layers into a compact and coherent, flexible, elastic filament by raising it above the said temperature.

Recent Progress in Electrical Science.

Dr. R. A. Millikan, professor of physics at the University of Chicago, was the speaker at the luncheon of the Electric Club of Chicago on Nov. 23. His subject was "Recent Electrical Discoveries." Professor Millikan began by saying that he felt that there ought to be a larger understanding between the two main groups of workers who are largely responsible for the progress of mankind. These two groups consist of the men working on fundamentals and the men working on applications. Men engaged in pure research and commercial men are inclined to look askance at one another. Nevertheless the two fields of study are almost identical, and there is continual interchanging and overlapping between the two fields. Practically there is no difference in the problems considered and methods of solving them except that the commercial men stop when they see that the work they are engaged in is not going to pay dividends. But who can tell when and where the work of the pure scientist will result in commercial applications? Modern science began in astronomical studies apparently as purely academic as anything could be; but the work of Copernicus and Galileo started a chain of ideas that made the work of Newton and all successors possible. Any fundamental principle, as in electricity for instance, was at one time an academic problem.

In the last twenty-five years the contributions to electrical progress from the academic side may be classified, perhaps, under four headings:

(1) The discovery of the existence of electromagnetic waves by Hertz. This has had a very practical application in "wireless," but it was the direct result of Maxwell's mathematical philosophizing, which was purely academic.

(2) The discovery of X-rays and radio-activity. This discovery has had a limited practical application, but it gives a suggestion, for it is now known that there are enormous stores of energy locked up in this world if they could only be made available.

(3) The discovery that matter and electricity are in some way allied. What we call mass or inertia may be of electrical origin. The conjecture is a most interesting one, but it is purely a speculation to assume that electricity and matter may be identical. As a matter of fact we do not know any more about matter than we do about electricity.

(4) The discovery of the atomic structure of electricity. 'his was not the result of any one man's work. Professor Iillikan said that the neutral molecules of the air are continuusly being broken up into charged particles called "ions." 'hese ions again unite, and in ordinary air this process of disssociation and association is being carried on all the time.

Dwelling on the fourth discovery mentioned, the speaker escribed his recent interesting experiments at the University f Chicago in which droplets of oil between the plates of an lectrical condenser are subjected to the action of an electrical eld of a strength between 1000 and 10,000 volts. The plates re 20 cm in diameter and are 16 mm apart, and there is a inhole in the upper plate. If the droplet receives a charge f the proper sign and strength, as it is blown out through ıe atomizer, it is pulled up by the electrical field, against gravy, toward the upper plate. Before the droplet strikes this late the field is thrown off, the plates are short-circuited and ıe time required by the drop to fall under gravity the distance orresponding to the space between the cross hairs of an ob-rving telescope is accurately determined. Then the rate at hich the droplet moves up under the influence of the field is easured. This operation is repeated a number of times, or ntil the droplet catches an ion from among those which exist ormally in air, or which may have been produced in the space tween the plates by an ionizing agent like radium. When an n is caught there is a change in the speed of the droplet ıder the influence of the field. From the sign and magnitude this change in speed, taken in connection with the constant eed under gravity, the sign and exact value of the charge rried by the captured ion are determined. It is absolutely monstrated that electric charge gets on the droplet in always e same amount.

These experiments show that electricity has a granular strucre. Other experiments with the same apparatus also confirm e kinetic theory of molecular agitation. A subject which will on be taken up is the question of valency in ionization.

In the discussion Mr. F. B. Badt said that the researches of e speaker would seem to contradict the theories of at least e older text-books, instancing particularly the earlier writings S. P. Thompson. Professor Millikan was quick to explain ıt he did not understand that his work conflicted with the ıclusions of Dr. Thompson. Professor Freeman, of Armour stitute, said that the researches of Professor Millikan were be commended in the highest terms. He also emphasized needs of two kinds of men in electrical research—the workon the theoretical side and those who are engaged in pracıl applications. Others who spoke briefly were Messrs. K. B. ller, E. N. Lake, George P. Nichols and A. A. Gray.

Surging of Synchronous Machines.

At a meeting of the Electrical Section of the Western Society Engineers at Chicago Wednesday evening, Nov. 23, Dr. nest J. Berg, professor of electrical engineering at the Unisity of Illinois, read a paper on the "Surging of Synchroıs Machines" which was similar in title and contents to his ent discussion of the same subject before the Rock Island ıvention of the Illinois Electrical Association. After exining the causes which lead to the exchange of current been paralleled alternators, causing them to hunt, Dr. Berg e an enumeration of the electrical remedies which may be lied to correct the trouble where the defect cannot be traced k, as in the majority of cases, to the prime mover or its ernor mechanism. These alternatives are:

. Reducing the resistance of the leads between machines.

. Excluding external reactances and installing field-damping ices on machines of quick magnetic circuit, especially if chronous impedance is great.

. Adding extra reactance in high-speed machines having od mutual induction between field and armature and slugı magnetic circuits.

. Changing the natural period of the air-gap or by adding a vheel.

In closing Dr. Berg remarked that he had never met with a case of surging or hunting, however troublesome, which could not be solved by one of the remedies above suggested.

Following the presentation of Dr. Berg's address several Chicago electrical engineers recounted their own difficulties in paralleling alternating-current machines early in the history of the art. Messrs. James Lyman, Peter Junkersfeld, D. W. Roper and W. B. Jackson took part in this recital of the troubles accompanying the first introduction of each successive type of alternating-current apparatus, but all agreed in saying that they had met with no case in their individual experiences where the hunting was not cured when proper study was made and the indicated remedy applied. Messrs. J. L. Hecht, G. W. Cravens, Dudley, Bardlee and Seymour also spoke briefly on the points brought up in the paper.

American Physical Society at Chicago.

The program of the Thanksgiving meeting of the American Physical Society, held at the Ryerson Physical Laboratory of the University of Chicago, Nov. 26, comprised twenty-six tenminute talks briefly describing results of recent work and experiments of members. A number of the subjects discussed were of electrical interest.

Mr. F. C. Brown, of the State University of Iowa, gave an account of his recent study of light-negative silenium and proposed an explanation for the remarkable resistance changes of this material, which are the reverse of those usually noted with high-sensibility silenium. The sensibility of light-positive silenium is a function of its resistance. A certain specimen having a resistivity of 1,000,000,000 ohms changed its resistance in the ratio of 300 to 1 when exposed to intense illumination, while a Giltay cell having a resistivity of 500,000 ohms showed a sensibility of 30 to 1. But the light-negative silenium has a resistivity of only about 100 ohms and displays its resistance changes in the opposite direction. Mr. Brown also showed that its resistance changes due to temperature and moisture are the reverse of those met in high-sensibility silenium. The light-negative silenium is very unstable, a slight jar or quick temperature change causing it to go into another light-positive form; but when put away in the dark for two months one specimen returned to its original condition. The speaker offered, as a hypothesis for the light action of silenium, the explanation that the element as prepared for photo-sensitive cells is made up of three kinds of allotropic modifications, *A*, *B* and *C*, one of which is a small or zero conductivity, and the other two of lower resistivity, the three forms passing back and forth into each other with changes of light intensity. Mr. Brown also experimented with the results of electrical and mechanical pressure on silenium.

Mr. A. W. Smith, of Ohio State University, reported his experiments with the antimony alloys of bismuth, cadmium and zinc, which he investigated for resistivity, temperature coefficient of resistivity, thermo e.m.f., change of resistance in magnetic fields and the Hall, Nernst and Peltier effects, many of which phenomena showed striking changes in value of the alloy ratios where crystallization and chemical combination take place.

Mr. Robert F. Earhart, of Ohio State University, discussed experiments for measuring the energy necessary to maintain electric discharges through gases, which he found to be independent of the temperature, below a temperature of 1000 deg. for hydrogen, air and carbon dioxide, the gases studied.

Mr. Gordon S. Fulcher presented evidence to show that the "canal" rays of the vacuum tube produce light by molecular collision, the molecule struck setting up the ether vibrations and the light intensity produced being proportional to the number of collisions. However, no light is developed unless sufficient energy is present to cause ionization. Prof. R. A. Millikan, of the University of Chicago, discussed the increase in positive potentials of metals exposed to ultra-violet light, showing that the photo-electric potential produced is proportional

to light intensity. Mr. J. R. Wright, also of Chicago, referred to the relation between electrification and luminous frequency and reported on the potentials reached by exposing an electrode to intermittent zinc sparks, rich in the ultra-violet wave length.

Mr. W. F. Lent, of the University of Wisconsin, presented a method in conjunction with Prof. C. F. Mendenhall for measuring magnetic susceptibility from which highly accurate results have been obtained. Mr. E. H. Williams, of the University of Illinois, reported some experiments with transverse planed joints in magnetic circuits, showing that while in the case of iron the magnetic resistance was increased above that of the unbroken section in nickel, under certain conditions it might be decreased.

Mr. C. Nusbaum, of Ohio State University, exhibited some diagrams prepared with a potentiometer and curve tracer, recording the first and the successive anode and cathode flows through an aluminum-magnesium and carbon rectifier cell. Critical values were pointed out, at one of which the primary discharge occurs at a higher potential than those following, while at another point the reverse is observed. Mr. Nusbaum had also experimented with varying ratios of aluminum and magnesium in his electrode plates.

Mr. W. E. Forsythe, of the University of Wisconsin, showed curves of luminous efficiency of tungsten, tantalum and carbon lamps. In these tests the tungsten lamp showed an absolute or luminous conversion efficiency of 4.5 per cent at 2300 deg., the carbon-lamp curve extended showing that the carbon lamp would have even a higher efficiency at this temperature. Mr. George O. Weimer, of the Ohio State University, reported the break-down results of tests on porcelain insulators at high temperatures, in which a 250,000-volt, 150-kw transformer and an electric furnace and oil bath were used. After a temperature of 500 deg. is reached he found that porcelain ceases to be an insulator and apparently becomes an electrolytic conductor.

Mr. F. W. Pote, with Mr. Earhart, of Ohio State University, had investigated the total current and distribution of a discharge between a plane and a point, using concentric insulated rings of brass for the plane surface and a platinum point. The experiments were made under pressures from 0.4 mm to 10.0 mm of mercury, and showed that the quantities investigated were functions of the distance, voltage, gas pressure and polarity of the point, although the distribution of discharge may not vary with the intervening gas, as does the current.

Massachusetts Commission News.

The joint board consisting of the Massachusetts Railroad and the Boston Transit Commissions has recently been studying the problem of extending the Cambridge subway from its forthcoming Boston terminus at Park Street to the South Station, South Boston, and Andrew Square, Dorchester. The joint commission will present a report to the next Legislature with special reference to the extension of this subway under Winter and Summer Streets to the South Station, including elaborate engineering studies of the cost and best methods of doing the work.

The Massachusetts Gas & Electric Light Commission has issued a decision modifying the prices charged for gas and electricity by the Newburyport Gas & Electric Company in the petition of the Mayor of the city to the board. The decision is of special interest on account of the variety of questions with which it deals, practically every branch of the company's service being taken into consideration. The petitioners desired reductions in the prices charged for street and commercial lighting, gas lighting, and in connection with motor-service rates the issue of discrimination was raised. The company has supplied gas and electricity in Newburyport since 1889, the net price for gas being $1.40 per 1000 cu. ft. The existing prices for electricity are: For commercial lighting, 20 cents per kw-hour, with a discount of 25 per cent for prompt payment; for motor service, 10 cents, with discounts from 5 per cent to 65 per cent, varying according to the monthly bill, and for street lighting operated upon a moonlight schedule to 1:15 a. m., $73.50 per arc lamp and $30 per incandescent lamp per year.

The decision discusses the question of discounts as follows: "In accordance with the practice common throughout the State, it is the custom of this company to make a discount from its gross rate to a net price for prompt payment of its monthly bills. The purpose and only justification for this practice is that it enables the company to make prompt collection of its accounts and to conduct its affairs with greater economy and efficiency. It appears, however, that the difference between the gross and net prices for electricity is much greater relatively than in the prices for gas. Since in the latter case the difference made has proved ample to accomplish the main purpose of the arrangement, the company may well afford to lessen the amount of its electric discount by a lowering of the gross price charged."

Regarding the charges of discrimination, the board states that "in the present development of the electrical business, especially in cities the size of Newburyport, it seems unlikely that electricity can be sold for lighting at prices which will be attractive to those who desire to use it for motor service, and the prices which the public are willing to pay for the latter use seem to be largely determined by the cost of other available forms of power. This company has a very considerable investment, made primarily for the purpose of supplying the community with light. If employed for this purpose alone the daily use of the investment would be brief and the cost per unit of electricity sold correspondingly high, but the sale of electricity for motors almost invariably increases the volume of output without necessarily increasing the investment, thereby reducing the average cost per unit sold and thereby making possible a lower maximum price. Because of such considerations and because such increased efficiency in the use of the investment should lead to reductions in the maximum net price, the board has been reluctant to interfere with certain differentials in price, especially those applying to motor service. In this course it has sought rather to benefit the many who must pay the maximum price than the few in whose interest differentials are apparently made. These propositions indicate that the maximum net price for electricity cannot be determined solely with reference to the average cost per unit of all the electricity which a company may supply. During the last fiscal year the company's output for motor service exceeded its output for lighting; its motor load was nearly one-half its yearly peak, and it received for this energy scarcely more per unit than the bare cost of producing the electricity itself without any substantial provision for expenses of distribution, management, taxes or investment return."

The commission finds that discrimination exists between two of the motor users in the same line of business. It points out that there may have been some justification for making a special contract some years ago when the company was trying to introduce the use of energy for motors by means of a flat rate, but condemns the renewal of the contract in 1909. The company had refused to quote the same rates to a rival customer. The board finds that the special contract should be discontinued if, and as soon as, the company can relieve itself of the obligation. It also appears that the company is making a special rate to motor customers with installations of 100 hp and over. The board recommends that such rates be included in the published schedules of the company. In conclusion, the board recommends that the offer of the company to supply street lighting on a five-year contract basis be applied on a yearly basis as well. The company is now supplying 173 inclosed arc lamps of nominal 1200 cp and twenty-four incandescent lamps of 32 cp used on an average twenty-six nights per month and six hours per night. Save for some increase in number, the equipment appears to be the same as when the present management came into control of the company. The company made a price for these arc lamps for all night and every night of $95 each on a one-year contract, $92 on a three-year contract and $90 on a five-year contract, and the petitioner requested the board to make a reduction in this price. There

was no offer of any change in equipment or service in the consideration of a contract longer than one year and no reason other than length of time shown for a difference in price. The board says that "while the price at which the company voluntarily offers to furnish these arc lamps is not conclusive as against the city that such price is reasonable, it may properly have its effect as against the company * * *," and having in view the fact that no new equipment is offered or required, the board is of the opinion that the prices hereinafter named are reasonable and fair for all-night and every-night service for the type and rating of the lamps now installed, even though a contract for the same is made for one year only. The board recommends that on and after Jan. 1, 1911, the net price for gas shall not exceed $1.35 per 1000 cu. ft., and that the net price charged for electricity shall not exceed 14 cents per kw-hour with such minimum monthly charges to its lighting customers as it now employs, but not exceeding $1 per month, and that the price for street lamps used all night and every night shall not exceed $90 per arc lamp or $30 per incandescent lamp per year.

The Railroad Commission recently sent an inquiry to all transportation companies operating electric cars asking what progress, if any, has been made in the installation of devices by which arc headlight rays can be confined more closely to the track. Practically all the replies received, which include the larger as well as many small companies, state that no practicable apparatus for this purpose appears as yet to have been developed.

Canadian Hydroelectric Commission News.

The London Electric Light Company has appealed to the Hydroelectric Commission to prevent the city corporation of London lowering rates for Niagara energy to such an extent that there will be a deficit. Mayor Beattie has advocated an increase in the discount rate from 10 per cent to 25 per cent, in order to undersell the London Electric Company and put it out of business, and this action on the part of the Mayor was made the basis of an appeal by the company to the commission.

The light committee of Berlin, Ont., the first city to receive Niagara energy from the Hydroelectric Commission, has fixed the rates for residential lighting. There will be a fixed rate or charge per 100 sq. ft. of the area lighted of 5 cents per month, and, in addition, a charge per kw-hour of 4 cents. The bills are subject to a discount of 10 per cent if paid within a month, and a further discount if paid within ten days after receipt.

A flat rate for residences of $6 per month for all purposes was decided upon. The rate for service to the factories has not yet been named. It is expected that during the third week of November a continuous twenty-four-hour power service will be furnished from Niagara Falls.

The town of Mitchell has voted in favor of utilizing power from the commission. Nine thousand dollars worth of debentures will be issued to provide the funds for purchasing the necessary equipment. The power is expected to be ready in February.

It has been announced that Niagara power will be available for use in Toronto about Dec. 15.

Wisconsin Commission News.

The commission has taken testimony in the matter of the application of the Kenosha Electric Railway Company for a certificate of convenience and necessity. The Kenosha Gas & Electric Company is doing business in Kenosha at the present time and this is the first case where a competing company has applied to the commission for a certificate. The applicant is now doing a street railway business exclusively, but claims that the evidence in the case introduced by both the municipality and the petitioning company shows that in general the existing conditions make it a public necessity that the Kenosha Railway Company be permitted to conduct a regular electric lighting and power business in the City of Kenosha and that it is apparent from the testimony that not only is the service rendered by the present company poor and inadequate, but that little effort has been made or is now being made to improve and extend the business. The major part of the territory is very poorly covered in comparison with other cities under similar circumstances.

In the Supreme Court case of the Kenosha Electric Railway Company now pending the constitutionality of the Public Utility Law has been attacked. The company's attorneys charge that the right of the commission to decide whether a new public utility can be started in any city where there is one at present is unconstitutional because it involves a legislative function. The State argues that the function is administrative.

Commissioner Roemer, sitting for the commission, has taken testimony at La Crosse in the matter of the application of the La Crosse Gas & Electric Company for an increase in rates. The bulk of the testimony concerned the valuation of the property for rate-making purposes.

The present company was formed through the consolidation of four competing companies whose stockholders were in the main the same. The stock and bond issues of the past, which were assumed by the present company in the consolidation, are in excess of the physical valuation. The company now has three plants and a considerable duplication of machinery, buildings and transmission systems. The city objected to the company's claim that it should be allowed to earn interest upon machinery and property not actually necessary for the use of the public. Furthermore, the respondent company in arriving at its contended valuation resorted to the method advocated by the commission in its decision of the Madison Gas & Electric Company, in which the failure to earn a given fair percentage was considered year by year in arriving at an equitable present value. This method makes allowances for the cost of building up a business. The city objects to the use of this method in the present case because during the times immediately preceding the several consolidations when the present parent company was trying to force the newer company out of business by cutting the rates energy was sold at less than cost, and these losses would be capitalized. Further testimony will be taken at a later date. The city was represented by J. F. Doherty. Woodard & Lees appeared for the company.

The commission has approved the application of the Monroe Electric Company for authority to issue $1,200 of stock of par value $100 per share and $4,000 par value of bonds in denomination of $500 each. The funds to be derived from the sale are to be used in paying outstanding indebtedness incurred by additions and extensions to the plant.

The commission has handed down a decision in the case of the Woodmont Country Club vs. the Milwaukee Electric Railway & Light Company. The petitioner is a social organization and maintains a club house and golf grounds in the town of New Berlin, Waukesha County, near a line of the respondent, such line being the only means of transportation to and from the grounds. It appeared that during the season about 5000 people visit the grounds and that the station of the respondent nearest the club house is distant about 4180 ft. over a road constructed by the petitioner. The petitioners prayed that cars be ordered stopped at a point near the grounds. The respondent objected to stopping cars at the proposed point for the reason that the grade at such point is heavy and also that the policy of the respondent is to establish stations only at highway crossings and about one mile apart. The commission did not think that the former objection was tenable, for the grade at the point in question is only 1.2. It also commended the policy of the company in limiting the number of stations on its line and stated that it ought not to be interfered with except for good causes. But this case was regarded as an exceptional one, inasmuch as at no other station excepting the municipalities were so many people served as at County Line station, the station now used by the Country Club.

The commission finds that the service rendered by the respondent in the particular complained of is inadequate and that to render the same reasonably adequate it will be necessary for the respondent to stop its cars at the proposed point. It was so ordered, provided the petitioner first obtains a concession from the Northwestern Railway Company to cross its right-of-way and construct a subway so that persons will not be obliged to cross the steam railroad tracks at grade.

New Jersey Commission News.

The Board of Public Utility Commissioners for the State of New Jersey approved the petition of the Public Service Gas Company for the proposed issuance of $500,000 of its capital stock. The petitioner recited that it is a corporation organized and existing under the laws of the State of New Jersey; that its authorized capital stock is $10,000,000; that at the date of the petition there are issued, sold and outstanding $6,000,000 par value; that the issue of $500,000, of which approval is asked, is to be sold for cash at par, the proceeds to be used for extensions and betterments of plant. In its certificate of approval the board expressed itself as satisfied that the issuance sale and delivery of the stock for cash at par is to be made in accordance with the provisions of law relating thereto. The board requests that the company file with it semi-annually a statement setting forth the amount of capital stock issued, sold and delivered under the certificate of approval and the extent to and purposes for which the proceeds thereof have been disbursed.

The board has also approved the application of the Newark & Bloomfield Railroad Company for a proposed issuance of 29,923 shares of its capital stock for cash at not less than its par value. The board notes that the error in the application previously made, approval of which application was withheld, has been corrected; that a copy of the certificate has been laid before the board, showing that the increase of capital stock was formally assented to in writing by the stockholders and that copies of resolutions have also been filed providing that the holders of authorized capital stock of the company now outstanding be permitted to subscribe for the proposed issue in proportion to their respective holdings. The board in approving the application has made a request similar to that made of the Public Service Gas Company as noted above, that the company file with it semi-annually a statement setting forth the amount of capital stock issued, sold and delivered under the certificate and the extent to and purposes for which the proceeds thereof have been disbursed.

Maryland Commission News.

It is claimed that the United Railway & Electric Company, of Baltimore, violated its provisions when it summarily discontinued sale of the 7½-cent commutation books to its patrons living in the suburbs just outside of the 5-cent fare zone. Mr. Victor J. Bloede, who is prominently allied with the Patapsco Electric Light & Power Company, and who secured the 7½-cent rate for the Catonville residents about seven years ago, called a meeting of the residents last week, and as a result a case will be presented to the commission for its consideration in the near future. As the result of a meeting of the United Improvement Association of Woodlawn, a committee has been appointed to wait on the officers of the United Railways & Electric Company and urge the restoration of commuters' books and the establishment of some other schedule of car service than now exists between Woodlawn and city points.

Mr. James M. Ambler, chairman of the Maryland Public Service Commission, states that in the order passed by the commission relative to the reduced fares on certain routes of the United Railways Company it was pointed out that the sale of such tickets to some patrons of the road and not to all patrons was discrimination in favor of a certain class of passengers. Discrimination is forbidden by the law. The United company, however, discontinued the sale of residents' tickets, though it could have made such sale general and complied with the law. It has been previously stated by members of the commission that while the Public Service law permits them to sanction the sale of commutation and excursion tickets, it does not permit them to require public-service corporations to sell such tickets.

In the face of the rulings of the commission on the points involved it would seem that those making the protests would find difficulty in establishing their claims. It has been suggested, however, that the hearing will result in opening up the whole question of street-railway fares. While the commission may not be able, under the law, to order the continuation of the sale of residents' tickets, it can, it is said, exercise its powers in regulating the width of the company's fare zones and fixing the fares to be collected over them, giving everyone an equal privilege. Dec. 13 has been set by the Public Service Commission as a time limit during which the United Railways may answer the complaints of the various civic leagues which have filed their protests with the commission. If the company fails to answer satisfactorily the commission will then set a date for a public hearing.

New York Commission News.

All of the members of the Public Service Commission, Second District, will be in New York this week to take up various complaints in that city claiming that the interborough toll rates charged by the New York Telephone Company are excessive and unreasonable and that in many cases there are discriminations in charges and practices. The hearings will be held at the rooms of the Engineering Societies' Building, 29 West Thirty-ninth Street. Complaints generally are against the 10-cent charge between boroughs in the greater city and the commission is asked to reduce the charge to 5 cents for each message.

Among the complainants, all of whom it is expected will be represented at the hearings, are the Board of Aldermen of the City of New York, Prospect Park South Association of Brooklyn, the Flushing Association, the Ditmars Park Association, Jamaica Citizens' Association, New York Board of Trade and Transportation, Flatbush Taxpayers' Association, Down-Town Interborough Association, South Midwood Association of Brooklyn, Brooklyn Board of Real Estate Brokers, W. L. Perrin & Son, Paul E. Lindbald & Company and Charles H Davids, of the Bronx.

AMERICAN ELECTRICAL ENGINEERS.

R. F. Schuchardt.

Rudolph Frederick Schuchardt was born Dec. 14, 1875, in Milwaukee, Wis., where he received his primary and secondary education in private and public schools. In 1893 he entered the electrical engineering course of the University of Wisconsin, from which he was graduated four years later. In order to gain practical experience, college vacations were spent in the shops of the E. P. Allis Company at Milwaukee.

Upon graduation Mr. Schuchardt entered the central station at Janesville, Wis., but soon after went to Chicago, joining the staff of F. B. Badt & Company, consulting engineers and manufacturers' representatives. In June, 1898, he entered the employ of the Chicago Edison Company as night operator in the new storage-battery substation on Adams Street, and shortly after was sent to Omaha to take charge of the company's exhibit at the Trans-Mississippi Exposition.

Upon his return to Chicago at the close of the exposition Mr. Schuchardt entered the statistical department of his company, and a year later was transferred to the testing laboratory. When in 1903 the pioneer 5000-kw turbo-generators in the Fisk Street station of the company were started, he was assigned to take charge of the electrical operating force there. In

order to assist in making correct connections in the construction work he devised and patented a phase rotation indicator which has since been found a valuable help and time-saver in construction work, as well as on the distribution system. Mr. Schuchardt was in charge of engineering testing in 1905 and 1906, and in November of the latter year he became engineer of electrical construction. In July, 1909, he was appointed electrical engineer of the company, succeeding Mr. P. Junkersfeld, who was appointed assistant to the second vice-president.

In the past twenty-two years' history of the Commonwealth Edison Company and its predecessors, Mr. Schuchardt is the third man to receive the appointment of electrical engineer, the first being Mr. Louis A. Ferguson, now second vice-president. Mr. Schuchardt as electrical engineer is in charge of the engineering department, the most important work of which at this writing is the design of all electrical features of the new Northwest Station, comprising six 20,000-kw turbo-generators and the necessary extensions of the company's transmission and substation system.

Mr. Schuchardt has contributed a number of papers to the *Transactions* of engineering and central-station societies and

R. F. Schuchardt.

the technical press, beginning with a paper on "Electricity ters of To-day," read at the 1897 convention of the Northwestern Electrical Association. A notable article on "Transformer Testing" appeared in these columns in the issue of ... 17, 1902, the data of which were later used in Prof. F. G. ...'s work on "Transformers." Among other papers are one "The Rotary Converter Substation," read before the Western Society of Engineers in 1907, and another on "The Protection High-Tension Transmission Systems," read before the Chicago Branch of the A. I. E. E. in 1908.

Mr. Schuchardt was a contributing editor of the "Cyclopedia Engineering" of the American School of Correspondence ... and was the first editor of the *Edison Round Table*, ... in its third year, a monthly publication of the Commonwealth Edison Company. He served as president of the Chicago Electrical Association in 1901, and was one of the engineering experts in the notable street-lighting arbitration case Colorado Springs in [illegible].

Mr. Schuchardt is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society and the Western Society of Engineers; also of the University Club Chicago and of the City Club, being a member of the committee on traffic and transportation of the latter.

CURRENT NEWS AND NOTES.

Naval Wireless.—Mr. Julius Martin, naval expert electrical aid at the Brooklyn Navy Yard, will read a paper before the Wireless Institute, New York, on Wednesday evening, Dec. 7, on "Sidelights on the Navy Department Wireless Telegraph Specifications."

Isolated Plants in Chicago.—According to the annual report of the Department of Electricity of the City of Chicago there were 897 isolated plants in that city on Dec. 31, 1909, having an aggregate capacity of 10,571 arc and 531,361 incandescent lamps. The corresponding figures for commercial companies were 20,519 arc and 2,914,348 incandescent lamps.

Display Street Lighting in New York.—The Harlem Board of Commerce has appointed a lighting committee, of which Mr. William J. Meara is chairman, for the purpose of improving the illumination of 125th Street, New York City. A demonstration is being made of flaming-arc lamps placed in pairs about 100 ft. apart between Fifth and Madison Avenues.

Pennsylvania Electric Trains Under Hudson.—Since Sunday, Nov. 27, all through passenger trains of the Pennsylvania Railroad have arrived at and departed from the new station in the heart of New York City instead of the old ferry terminal at Jersey City, N. J. Electric locomotives of the 600-volt, direct-current type haul the trains 8.6 miles between the station through tunnels under the Hudson River and the steam locomotive terminal at Harrison, N. J. The service was inaugurated without a hitch, the electrical equipment operating with thoroughly satisfactory results.

Ohio Engineers.—The Ohio Society of Mechanical, Electrical and Steam Engineers has chosen the following officers: President, Mr. Oscar S. Rabbe, of Toledo, re-elected; vice-president, Mr. H. L. Patterson, of Youngstown, succeeding Mr. W. C. McCracken, of Columbus, whose term expired; manager, Mr. John J. Hoppes, of Springfield, succeeding Mr. W. E. Haswell, of Columbus; manager, Mr. Daniel Delaney, of Cincinnati, succeeding Mr. L. G. Kaiser, of Cincinnati. The next convention will be held at Youngstown, May 18 and 19, 1911.

Liability of Telegraph Company.—Because the Western Union Telegraph Company failed to transmit a message from Detroit, Mich., to Kansas City, Mo., after accepting it, the Supreme Court of the United States, on Nov. 28, held the telegraph company liable for more than $300 damages. The message was written on a telegraph blank, which contained an agreement that in case of non-delivery the telegraph company would be liable for only the amount received for sending the message. The trial court awarded a judgment of several hundred dollars in favor of the sender, holding that the contract was invalid because it was in conflict with a State law that regulated the liability.

Municipal Street-Lighting Plant Voted for Milwaukee.—At the recent election in Milwaukee it was voted to appropriate $550,000 for the installation of an electric generating plant and distribution system to light the city streets, public parks and municipal buildings, $300,000 of this amount to be raised by mortgage certificates and $250,000 by issuing bonds. The present plan for the erection of this station is said to contemplate the use of waste steam from the city garbage-destructor plant on the lake front, where tests made some time ago showed that 21,000 lb. of steam at 70 lb. per square inch pressure is available each hour during the operation of the incinerating apparatus. There are 3000 street-arc lamps needed for Milwaukee, but the plant it is expected to build with the present appropriation would be able to operate only about one-third of this number. A number of city water-works pumps in various parts of Milwaukee may also later provide a day load for the municipal electric plant.

Electric Signs in Chicago.—On Dec. 31, 1909, there were 5231 electric signs in Chicago.

Incandescent Street Lighting Under Test in Washington.—The Commissioners of the District of Columbia are making rather extensive experiments in the use of high-candle-power incandescent electric lighting units to replace arc lamps. Temporary poles have been put up on Pennsylvania Avenue, in Washington, and a record will be kept of comparative costs and volume of useful light.

Proposed Government Transatlantic Cable.—A proposal is said to be under consideration for a government-owned cable between Great Britain and Canada. The route was surveyed in 1860. It runs from Scotland to Faros Island, thence to Greenland and thence to Hamilton Inlet, Labrador. The estimated cost is $4,250,000, which, it is figured, would permit a charge of 9 cents a word for ordinary and 5 cents for press messages.

Vast Deposits of Lignite in Texas.—The latest estimate of the fuel deposits of the State of Texas, made by Mr. W. D. Phillips, director of the bureau of economic geology at the State University, indicates that 31,000,000,000 tons remain after the removal of nearly 20,000,000 tons since mining commenced in 1884. Of the existing beds, 8,000,000,000 tons is reported to be in bituminous coal and 23,000,000,000 tons in lignite. The workable coal area of the State is nearly 10,000 sq. miles.

Electric Radiators for Crane Cabs.—A manufacturer of electric heating apparatus reports that a large sale has been made during the present season of electric radiators to the steel companies and other operators of outdoor electric cranes for heating the cabs in cold weather. The electric heater is convenient and compact, since electric energy is delivered directly to the crane cab and the consumption of the resistance units is small compared with the energy taken by the crane outfit.

International Refrigeration Association in America 1913.—The International Association of Refrigeration, comprising manufacturers of refrigerating apparatus from all over the world, will hold its next convention in the United States in 1913. Mr. Theodore O. Vilter, president of the Vilter Manufacturing Company, Milwaukee, has just returned from the last convention of the association, held at Vienna, at which 740 delegates were present. There he urged the selection of this country as the next meeting place, and his invitation was accepted by the association.

New York Branch of the N. E. L. A.—On Nov. 10 a New York branch of the National Electric Light Association was organized, membership in which is open to employees of all the electric lighting and motor service companies of Greater New York. Dr. Charles P. Steinmetz made the principal address of the evening, brief speeches also being made by Messrs. W. W. Freeman, T. C. Martin and H. H. Scott, of the National Electric Light Association. Although this was a meeting preliminary to organization, nearly 400 members have already joined. The first regular meeting will be held on or about Dec. 10, subject to the call of the temporary chairman, Mr. J. W. Lieb, Jr.

Burglar "Ads" Criticised.—One advantage of the use of electric light in residences is that it is instantly available and may be controlled from a distant point in case a burglar gets in the house. This contingency is perhaps rather remote in the ordinary household. Nevertheless, the possibility is there and the usefulness of electric light in this respect has been advertised not infrequently by central-station companies. Advertisements of this character have been used in Chicago, but now an "Old-Timer" writes to the papers to say that these ads are "no credit to the fair name of our city." The "burglar" signs should be removed at once, he declares.

Fourteen-Thousand-kw Turbine Units for Minneapolis.—The Twin City Rapid Transit Company, operating the electric railway systems in Minneapolis and St. Paul, Minn., is reconstructing its power plant at Minneapolis and is now arranging to install the first of several 14,000-kw, 25-cycle vertical-type turbine-generator units. Two 5000-kw turbine units have recently been rebuilt and fitted with forced draft, making them available for generating 9000 kw each. Four 3500-kw vertical-type, engine-driven generators are being removed to make way for the 14,000-kw turbines to be installed in their places. The company is also rebuilding its boiler-room, adding to the steam-producing equipment. These changes are being made under the direction of Mr. E. H. Schofield, engineer of the power and equipment department of the company.

A Flyball Recording Frequency Meter.—For recording the actual periodicity on the 30,000-volt, 25-cycle transmission lines of the Great Northern Power Company entering the terminal substation at Duluth, a recording frequency meter employing the principle of the flyball-governor has been installed near the switchboard. This instrument was devised by Mr. W. N Ryerson, manager of the Great Northern Company, and comprises a small synchronous motor energized from the station buses, which drives an engine-type flyball governor. The sliding collar of the governor is arranged to move a syphon pen over a ribbon record which is advanced at constant speed. Any change in the line frequency thus affects the speed of the synchronous motor, in turn raising or lowering the flyballs and sliding collar to which the curve-drawing pen is attached

Delays to Telephone Construction for Automatic Service in Chicago.—Through their attorneys, the receivers for the Illinois Tunnel Company have made a complaint to the Mayor and Commissioner of Public Works of Chicago that they have been delayed in line-construction work for the new automatic telephone system for Chicago by the action of city officials. It is alleged that the company's chief engineer has made repeated application for permission to erect poles and open streets and that the city has delayed taking action in the matter. The receivers say that they are anxious to have the automatic system in operation by the time limit of the ordinance, but that allowance must be made, of course, for the hindrance to their work by the delays in granting permits. The city officials say that there is no desire to hamper the company, the only desire being not to issue permits unless the company is ready to begin work at once.

Spring Convention of New England N. E. L. A. Section.—The annual meeting and convention of the New England Section of the National Electric Light Association will be held at the American House, Boston, on Wednesday and Thursday, March 15 and 16, 1911, including a banquet on the evening of the 16th. At a meeting on Nov. 12 the executive committee decided upon a program of three papers and in addition will make the question of central-station rates the dominant note of the convention. A committee will study the rate problem and make a report to the convention after the banquet on the 16th. The subjects of the papers are as follows: "Development and Application of Electricity to Domestic Purposes," "Rotary Condensers," "The National Electric Light Association System of Accounting as Applied to Small Plants." In order to permit full discussion one paper will be read at each session and the limitation of the number of papers to three has been purposely planned in order to enable justice to be done to each topic. The first annual convention of the New England Section, which was held last spring in Boston, was generally voted the most successful and profitable meeting of electrical interests ever held in New England, and it is anticipated that the 1911 convention will be still more enthusiastic.

STATION OF THE EMPIRE DISTRICT ELECTRIC COMPANY.

Steam Turbine Plant Equipped for Storing Coal Under Water and Operating in Parallel with Hydroelectric and Gas-Engine Stations.

By M. K. [illegible]

THE development of the electric central station for the supply of electrical energy to the lead and zinc mines of the so-called Joplin district of Missouri, Kansas and Oklahoma has been worked out on a comprehensive scale by the acquirement of the existing properties in the district and the erection of a central generating station with an initial installation of 15,000 kw.

The Empire District Electric Company was organized in October, 1909, by Henry L. Doherty & Company, of New York City, and acquired all of the property of the Consolidated Light, Power & Ice Company and the Joplin Light, Power & Water Company, which properties controlled the electric business in Joplin, Webb City and Carterville, Mo., and Galena, Kan. The Empire company also acquired the majority control of the Spring River Power Company, which company supplied energy to motor circuits in the mining district from a hydroelectric station of 4000 kw normal rating and an auxiliary steam plant of 2500 kw rating.

Immediately after the organization of the Empire District Electric Company contracts were entered into for the erection of a modern 15,000-kw steam-turbine station. This type of plant was selected after careful consideration of the fuels available, namely, coal, natural gas and fuel oil. The location selected is at Riverton, Kan., where railroad facilities and water supply are most convenient. The plant is located on the storage reservoir of the hydroelectric development, where ample water supply is always available for condensing and boiler-feed purposes

STEAM EQUIPMENT

The steam equipment of the plant consists of 10 500-hp Stirling boilers, each equipped with superheaters and with Green chain grate stokers fed from hoppers running lengthwise of the boiler-room between the two aisles of boilers.

COAL SUPPLY.

Coal is received on a double switch graded to bring the full cars to one end and deliver the empty cars to the other end. From the switches the cars are pulled up an incline by a motor-driven hoist and hauled over the coal storage on a steel trestle. The coal shed consists of a concrete structure 50 ft. by 150 ft. with side walls 34 ft. in height and with solid concrete floor. The structural framework above is designed to carry a monorail, grab-bucket hoist of 1½ tons capacity and operated by electric motors. This hoist is suspended from an 18-in. I-beam and by means of a switch can be run out directly over the cars or at either side of the cars to deliver to or take coal from the storage space beneath the railroad trestle. The monorail extends directly into the boiler-room and over the bunkers in the boiler-room and in regular service will deliver coal from the cars or storage to the boiler-room bunkers. It can also be used to unload cars when dump cars are not available. The trolley motors are designed for a speed of 400 ft. per minute along the monorail and the hoist motors for a lifting speed of 120 ft. a minute. Water and drain connections are installed so that coal may be stored under water.

ASH-HANDLING EQUIPMENT.

The ashes drop from the chain grates into hoppers which are sloped toward a center aisle in the basement. The ashes are handled through a double line of suction pipe with openings opposite the doors on the ash pits. The suction equipment, designed and installed by the Darley Engineering Company, New York, consists of the double line of 8-in. suction pipe leading to an overhead tank of 40 tons capacity located outside the boiler-room. Ashes can be discharged from this tank into railroad cars or wagons as desired. The suction apparatus consists of a special Sturtevant exhauster direct-

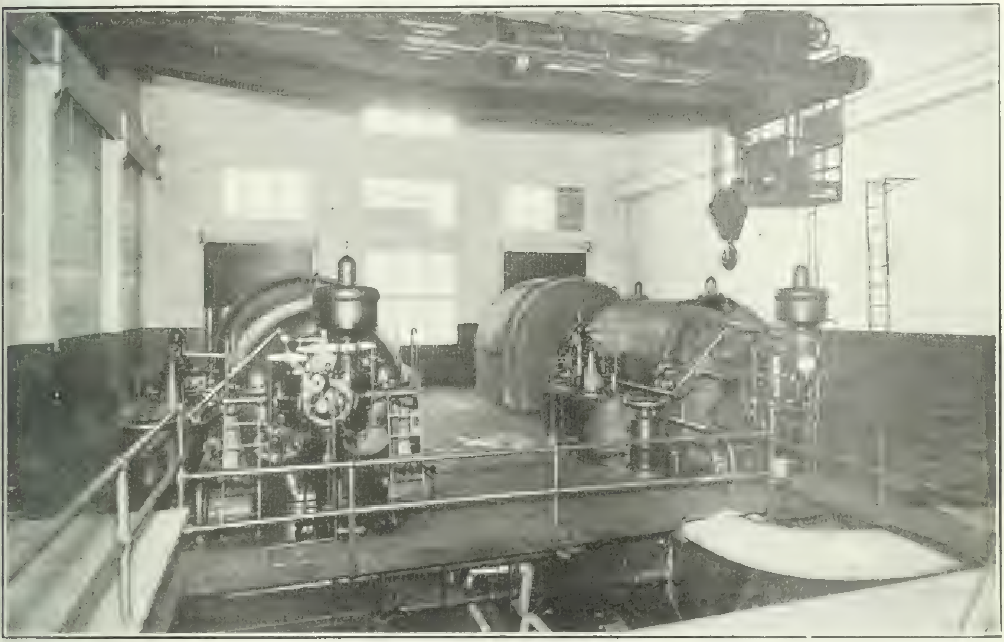


Fig. 1.—Interior of Generating Station.

coupled to a 50-hp General Electric steam turbine which runs at 3600 r.p.m.

STEAM PIPING.

The steam header consists of a complete loop of 15-in. steel pipe extending around the boiler-room. The pipe is made in extra lengths and all joints are of the Van Stone type with

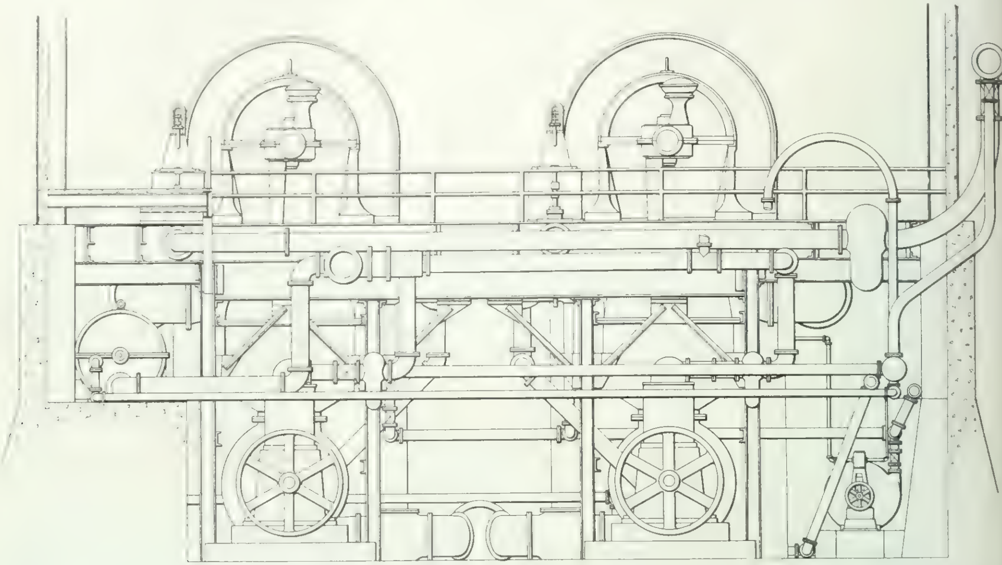


Fig. 2—Arrangement of Turbines and Auxiliaries.

wrought-steel flanges. All boiler connections to the header are made through nozzles 6 in. in diameter welded into the main header.

AUXILIARIES

The auxiliaries consist of three Westinghouse duplex boiler-feed pumps, two engine-driven, single-stage pumps for lifting water into the heaters, two 5000-hp Cochrane open feed-water heaters and purifiers and a 30,000-gal. storage tank. The exhausts from the boiler-feed pumps, stoker engines, ash-fan

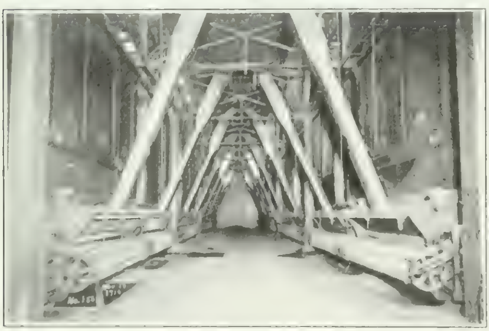


Fig. 3—Boiler Equipment.

turbine, pump engines and condenser engines empty into the feed-water heaters.

STACKS.

There are two Custodis radial brick stacks each 14 ft. inside diameter and 250 ft. high. Each of these stacks is connected by means of overhead steel breechings to eight boilers.

BUILDINGS.

The buildings consist of a boiler room 80 ft. by 150 ft., a turbine-room 50 ft. by 80 ft. and a transformer room 30 ft. by 80 ft. and have been designed with the view of extending the turbine and transformer rooms when additions are made and a duplicate boiler-room unit would then be constructed. The buildings are all self-supporting steel structures with reinforced-concrete walls, rolling-steel doors and steel-truss roofs. The boiler-room roof is of concrete tile built up on expanded metal and the turbine and transformer roofs are of book tile covered with composition roofing.

GENERATING EQUIPMENT.

The present generating equipment consists of two Westinghouse double-flow, horizontal turbine units. The generators are three-phase, 25-cycle, 1500-r.p.m., 6600-volt machines with

Fig. 4—Ash Tank.

a normal rating of 6000 kw at 80 per cent power-factor, but guaranteed to carry 25 per cent continuous overload at that power-factor and 50 per cent overload for one hour. The exciters consist of a turbine-driven 125-kw set and a motor-driven set of the same rating.

Each turbine is equipped with a Westinghouse Leblanc condenser mounted directly beneath the turbine and suspended from its bed plate. The steam enters the condenser through

special Y-casting which contains the condenser head. The pump unit, consisting of the circulating pump and the special centrifugal, dry-vacuum pump mounted on the same shaft, is suspended from the condenser chamber and is driven through a flexible coupling by a 150-hp Westinghouse high-speed engine. By this method of mounting the entire condensing equip-

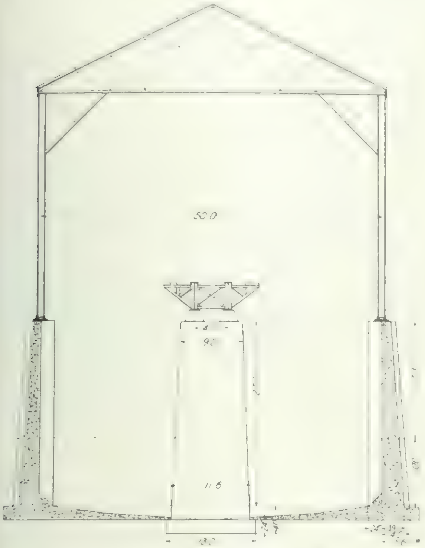


Fig. 5—Section of Turbine Room.

ment is under the turbine bed plate and only the engines extend beyond the lines of the bed plate. These engines could have been kept inside the lines, but the shaft was extended to locate the engines more conveniently for operation and repairs.

SWITCHBOARDS.

All main switches, both on 6600-volt and 33,000-volt leads, are electrically operated from the board, which consists of eight standard panels as follows: Two exciter panels, two generator panels, three high-tension control panels and one

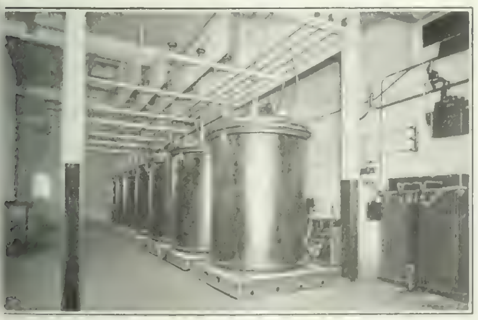


Fig. 6—Transformer Equipment.

house service panel. The panels are of black marine enameled slate and the instruments are all of the round switchboard type.

SWITCHING AND TRANSFORMING APPARATUS.

Each generator is controlled through a Westinghouse electrically-operated oil switch and circuit-breaker and a second set of these breakers controls the connections to the transformer buses. The transformers consist of two banks of 2000-kw water-cooled, oil-insulated transformers with one spare transformer that can be connected to either bank. These transformers are delta-connected for 6600-33,000 volts. The high-tension leads from the transformers to the buses and each of the three outgoing lines are controlled by electrically operated oil circuit-breakers, each leg of which is inclosed in a separate steel tank. Each of the three outgoing lines is protected by elec-

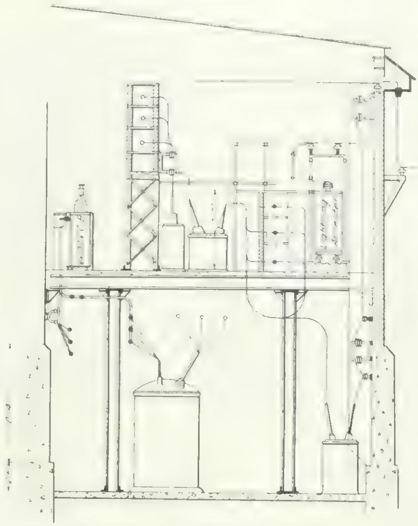


Fig. 7—Section of Transformer Room.

trolytic lightning arrests and by oil-immersed choke coils.

The bus compartments, which are mounted on a steel superstructure, are built of pressed brick and Vermont slate. Barriers between all high-tension wiring are built of asbestos board to cut down the weight.

OPERATION.

The new plant will be operated in parallel with the water-power plant and with an auxiliary gas-engine plant containing

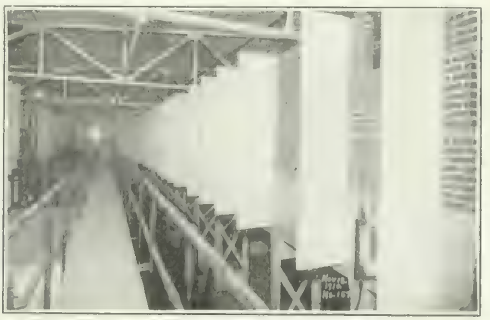


Fig. 8—High-Tension Bus Compartments.

two 500-kw gas-engine units about twenty-five miles from the main station. The gas-engine plant will be used for emergency service and to help the voltage regulation on heavy peaks.

The water-power has a maximum output rating of about 3000 kw and sufficient water-storage capacity so that it can be operated over the peaks at times of average or low water. It will also be used to advantage to carry a small percentage of the total load and to take the wattless current off the main

steam plant and thus in effect increase the capacity of the steam plant.

CONSTRUCTION

Excavations for foundations were started Nov. 4, 1909; the first concrete work was started Dec. 15; erection of steel work for buildings began Jan. 27, 1910; boiler and stack erection was commenced Feb. 26, 1910, and turbine and switchboard erection started March 28, 1910. The first unit was ready to start June 15, but operation was delayed on account of a coal strike. The first unit was therefore started July 14, and connected to the lines Aug. 11, 1910, the delay again being caused by coal shortage.

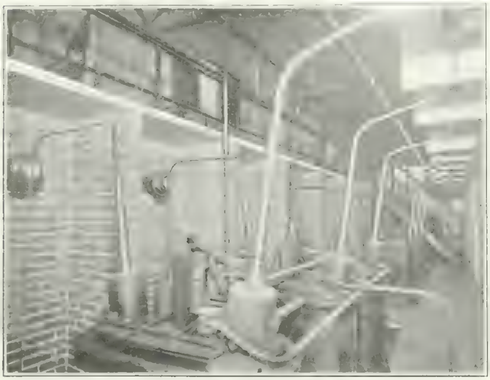


Fig. 9—Oil Switches.

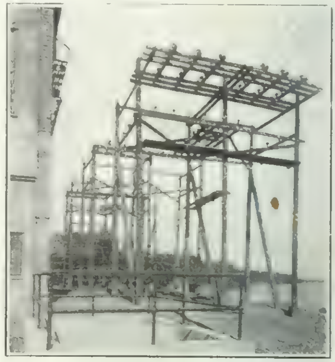


Fig. 10—Wooden Terminal Pole Structure.

TRANSMISSION LINES.

Two of the lines leaving the station connect to the two ends of a belt line sixty-four miles in length, forming a complete loop around the district. The third outgoing line connects the plant with the old Spring River transmission line, which forms an almost direct line through the center of the new belt. The transmission lines are carried on Idaho cedar poles spaced 150 ft. apart. The standard poles are 35 ft. high with 8-in. tops. Two standard arms are used on the top arm, one of the three transmission wires is mounted on one pin and a galvanized-iron ground wire on the other pin. The second arm carries the other two transmission wires. A telephone line is carried on brackets and transposed every second pole and a second ground wire is mounted on brackets between the telephone wires and the high-tension wires. Both iron wires are grounded every second pole with independent grounds. The transmission wires are transposed every two miles on an average. All right-ang bends are made on special four-pole constructions.

Figs. 11, 12 and 13—Wooden-Pole Corner, Steel Tower Line and Wooden Anchor Poles.

SUBSTATIONS.

The standard substation buildings are portable steel stru tures covered with galvanized, corrugated iron. The standa high-tension equipments consist of a high-tension oil swit for opening the main belt line in case of trouble, a high-tensi oil switch on the leads to the transformers, and a set of ele trolytic or low equivalent lightning arresters. The transforn ers are all 250-kw, delta-connected, 33,000-2300-volt, oil-ir mersed, self-cooled units.

SECONDARY DISTRIBUTION.

Electrical energy for motor circuits is distributed and so at 2300 volts and practically all motors above 25 hp in ratin are 2300-volt machines. The principal field for the sale of th energy is the lead and zinc mines of the district. The si of mining installations varies from 30 hp to 2000 hp in tot requirements. The average installation requires about 400 h divided approximately as follows: For driving the concen trating plant, 100 hp to 150 hp, operated at full load from ten t twenty hours a day; for driving compressors for air drills, 10 hp to 150 hp, usually operated eight hours a day; for operatin hoists and trams, 60 hp to 100 hp. The hoisting is all done i cans weighing from 800 lb. to 1200 lb., and the hoisting spe varies from 600 ft. to 1500 ft. per minute, according to th depth and the number of cans required. The average dept of a shaft is about 200 ft. The motors used are special 220 volt hoist machines varying in size from 20 hp to 60 hp. Fo

mping the horse-power required [illegible] from 10 to 120 and ese motors operate every hour in the year at practically con ant load.

Lighting service is supplied to the various towns through equency changers which generate current at 2300 volts, 60 cle, two-phase.

The field for motor circuits [illegible] thirty miles square

g. 14—High-Tension and Low-Tension Circuits at Substation.

ıd a canvass of this district shows installations of private ants in excess of 130,000 hp, of which not less than 80,000 hp in daily service. Furthermore, this field is growing rapidly ıd the growth will probably be not less than 10,000 hp per ınum. Other industries in the district include the Picher

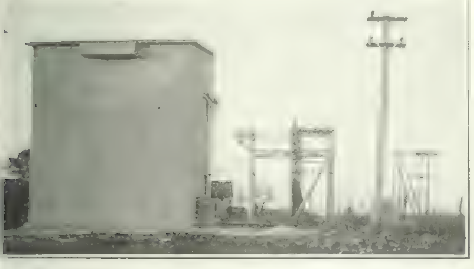


Fig. 15—Substation Circuits.

ead Works, the largest litharge and paint pigment manufacturing plant in the world operated throughout by electricity; 50 miles of street and interurban railways with 30 miles of extensions under way; flour mills, foundries, manufacturers f mining machinery, structural steel and bridge works, smelters, the Carthage limestone quarries, etc.

The field for lighting business includes Joplin, Webb City,

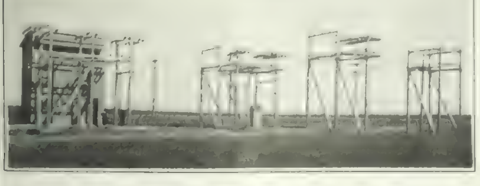


Fig. 16—Special Wooden Pole Line Structure.

arterville, Galena, Oronogo, Prosperity and other smaller owns having a combined population of over 100,000. A new usiness campaign inaugurated about ten months ago has increased the sales of electricity for lighting 50 per cent in that time and a new business campaign for the sale of energy for motors was recently inaugurated and has already added 4000 hp in commercial motor load.

WATE POWER AND COMBINATION STEAM PLANTS AT JANESVILLE, WIS.

The system of the Janesville Electric Company, supplying electrical energy for lighting, motor and railway service in the City of Janesville, Wis., presents an interesting combination of four low-head water-power plants, two of them combination steam plants and one a gas-engine auxiliary station. The four water-power plants in their order, descending the Rock River, on which they are situated, are: The 150-kw Fulton station (1), generating and transmitting at 6600 volts two miles to the Indian Ford plant (2), where 2300-volt generators are installed, besides a 50-hp auxiliary gas engine used during periods of low water. At this station transformers are installed stepping up to 6600 volts for the ten-mile transmission to Janesville. The main generating plant at Janesville (3) contains a combination of steam, water-wheel and alternating-current motor-driven units for supplying the direct-current Edison service and street-railway load. The other combination steam plant feeding into the Janesville station is the Monterey plant (4), developing energy from the Rock River, near the city limits. This Monterey station contains a 275-kw, 2300-volt alternator which can be driven by either four 100-hp water-wheels or a 350-hp compound Corliss engine. It transmits back to the main plant at the distribution pressure 2300 volts. The City of Edgerton also derives its lighting over a 2300-volt line, three miles in length, from the generator buses of the Indian Ford plant. Messrs. D. C. and W. B. Jackson were the consulting engineers for the several plants.

Fig. 1—Map of Transmission System, Showing Location of Plants.

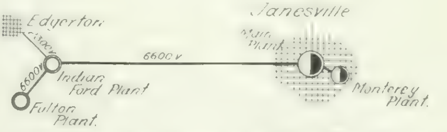


Fig. 2—Water-Power and Combination Steam-Plant System at Janesville (Wis.)

The Janesville plant is interesting in the arrangement for driving its direct-current generators by either four 150-hp water-wheels, a 350-hp Corliss engine, a 113-hp, 6600-volt alternating-current motor or a 200-hp, 2300-volt alternating-current motor. Or, in case the other alternating-current generators at Fulton, Indian Ford and Monterey are shut down, the synchronous motors can be driven as generators by either the water-wheels or the engine supplying alternating-current energy to the system. The arrangement of these machines, belted to a long shaft running at 215 r.p.m., is shown in an ac-

companying sketch. The two 75-kw, 125-volt generators are connected in series across the three-wire lighting system, to the outers of which both the 85-kw, 250-volt belt-driven generator and the 113-kw high-speed, engine-driven generators may be connected. The two 100-kw, 250-volt generators are connected in series to serve the trolley system, although either may be withdrawn and connected to the outers of the three-wire system.

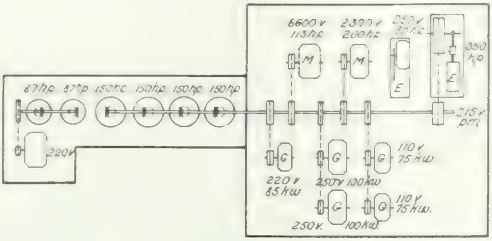


Fig. 3—Arrangements of Water-Wheels, Motors, Engines and Generators in Main Plant of Janesville Electric Company.

During normal stages of the Rock River, with all the plants generating their rated output of the alternating-current energy transmitted into Janesville, part is distributed as such in the outlying alternating-current district of the city, while the remainder is utilized by the alternating-current motors at the main plant to assist the water-wheels in driving the direct-current generators. When the Fulton and Indian Ford plants are shut down during periods of light local load the alternating-current service is supplied by the synchronous machines, driven as generators by the water-wheels, or during low water by the engine. The main-line shaft to which all of these machines are belted, or geared in the case of the water-wheels, is sectionalized by clutches so that portions of the plant can be operated separately if desired.

Fig. 4—Upper Dam, Janesville, Wis.

Fig. 5—Lower Dam, Janesville, Wis.

The system at Janesville is also notable for its large day load, a recent census among local manufacturers having shown that 85 per cent of the power developed in the city is sold by the electric company to motor-driven plants. Mr. P. H. Korst is secretary and general manager of the Janesville Electric Company. Other articles on the Janesville plant have appeared in the issues of Dec. 31, 1904, and March 10, 1906.

CENTRAL-STATION NOTES FROM PORTLAND, ME.

Electrical supply in the City of Portland, Maine, has been put upon a centralized basis during the past year by the establishment of the Portland Electric Company, which lately assumed the management of the Consolidated Electric Light Company and the Portland Electric Light & Power Company. The new organization has business headquarters in a building of its own in the heart of the city, at 121 Center Street, in sight of all eastbound and westbound traffic passing through Monument Square. Under the present administration a comprehensive system of electric generating plants and distributing services is being worked out, and the different properties are being handled upon a unified basis. The population of Portland is about 60,000 people, and the company serves in addition the towns of Sanford and Springvale, Maine.

The present electrical generating system consists of three generating plants, two being located outside the city. The city station is a steam plant which is used to supplement the service rendered by the outside stations, both of which are hydroelectric in type. One of the hydroelectric stations is located at North Gorham and the other is at West Buxton, Maine. Each station is connected with the Portland city station by a double transmission line, two low-tension tie lines being installed between step-down suburban substations and the steam-generating station, which is located on Plum Street in the marine district of Portland. There are no interconnecting transmission lines between the two hydroelectric plants except through the Plum Street station.

The North Gorham plant is located at Great Falls, on the Presumpscott River, and the dividing line between the towns of Gorham and Windham passes through the center of the stream. The station contains four 500-kw, 10,000-volt, three-phase generators driven by 33-in. Stilwell-Bierce water-wheels mounted on the generator shafts and operating under a head of about 40 ft. The power house is a one-story brick building connected with the water supply by steel penstocks carried upstream to the further side of a stone masonry and timber crib dam 35 ft. high, which crosses the river between the two towns named above. Each penstock is provided with a separate head gate, and the dam provides for the temporary storage of water discharged from Sebago Lake, 2.5 miles above. The lake and its tributaries have an area of about 100 sq. miles and the drainage area feeding the system is estimated at about 470 sq. miles. The daily discharge at the lake outlet is about 925 cu. ft. per second, and the flow from the lake is controlled by a stone dam below White's Bridge, which is owned by the Sebago Power Company, the latter being an organization of the owners of the riparian rights along the Presumpscott River. The water-wheels in the station are of the horizontal type, and two units are installed for each generator. Each generator is equipped with a 30-kw belted exciter and is wound for 10,000-volt service, there being no step-up transformer equipment in this plant. Energy is transmitted to the Deering district of the City of Portland over three three-phase circuits of No. 2 copper, the line being about fifteen miles long. The e.m.f. is lowered in two substations, one of which is fed with energy through each line, and each substation is connected with a third distributing center in the Deering district, which is further connected with the Plum Street power plant by two three-phase tie lines of No. 4-0 copper built for 2500-volt service.

The West Buxton station is located on the Saco River, which

divides the towns of Hollis and West Buxton at the plant. It contains four units of 750-kw rating each, operating under a normal head of 28 ft. The generators are directly driven by horizontal turbines of the double-flow, center-discharge type, each wheel being 48 in. in diameter and of S. Morgan Smith make. The yearly average discharge of the river provides for the delivery of about 574[illegible] hp [illegible] plant, the [illegible] minimum discharge giving a flowage capable of developing 15,967 hp and the minimum of 1440 hp. About 84 sq. miles of lake storage is utilized above the plant at present. The stream is crossed at West Buxton by a dam 300 ft. long which provides the necessary head for the turbines. The e.m.f. is increased from the generator value of 2300 volts to 22,000 volts for transmission to Portland over two lines, each of which consists of a three-phase circuit of No. 2 hard-drawn copper, the wires being spaced 30 in. apart in equilateral triangles. The length of the lines is about 17.5 miles. Lightning protection on the transmission lines is provided by guard wires of phonoelectric copper 0.11 in. in diameter run on the side blocks on the tops of the poles and grounded at every tenth pole. A private telephone line is installed 6 ft. below the transmission line on 10,000-volt porcelain insulators. The spacing of wires on the North Gorham line is 18 in. The transformer equipment at West Buxton consists of six General Electric water-cooled 500-kw units. The potential is reduced at a substation in the outskirts of Portland by six transformers of the same rating and make, oil-cooled, which deliver energy at 2500 volts for local distribution and service in connection with the steam plant. There are 1800 kw in transformers in service in the Deering substations in connection with the incoming North Gorham lines, so that the hydroelectric plants when running at normal rating deliver approximately 4500 kw to the city system for local consumption.

The Plum Street station is a two-story brick and concrete structure housing equipment rated at 2470 kw, 1660 kw being in machinery of the direct-current type and 810 kw in alternating-current machinery. The system of the old Consolidated company was mainly of the direct-current type. The Plum Street plant now contains six direct-current generators supplying energy to an Edison three-wire system in the business district of the city and two 2300-volt alternators delivering three-phase, 60-cycle energy to the local lighting and motor-service system. There are also three 500-kw, 250-volt, three-wire generators in this station, each being driven by a synchronous motor. By means of these motors the power-factor of the system has been raised to about 90 per cent. The boiler installation at Plum Street includes one 400-hp, two 250-hp and four 350-hp units, all being of the Babcock & Wilcox type, hand-fired and operated at 140 lb. per square inch steam pressure. The engine equipment consists of one McIntosh & Seymour, two Armington & Sims and five Ball & Wood outfits, with appropriate condensing apparatus.

Electric lighting rates to all new customers are 9 cents per kw-hour with a minimum of $12 per year per residence. For summer-residence lighting, which is a considerable portion of the company's business in the harbor and shore resorts near Portland, a rate of 15 cents per kw-hour is charged, with a minimum charge of $1.50 per month. The connected lighting load amounts to about 127,000 16-cp equivalents. Free renewals of carbon lamps of 8-cp rating and over are made in exchange for burned-out units. An allowance of 15 cents apiece is made for burned-out tantalum lamps of any size. The company's prices on tungsten lamps vary from 70 cents for the 25-watt size to $2.50 for the 250-watt units. For tantalum lamps the company charges 40 cents for 25-watt lamps, 50 cents for 40-watt lamps and 75 cents for the 80-watt lamps. The price of reflectors runs from 60 cents to $1. Frosted lamps are sold to customers at an extra charge of 5 cents each, and turn-down lamps at 45 cents and $1. The residence lighting returns average from $20 to $25 per installation per year. The service supplied by the company includes both 110-volt and [illegible]-volt direct current and [illegible] current. The company has put out 1100 flatirons in the last eighteen months on thirty days' trial and it is estimated that 95 per cent of the irons were retained. The work was done chiefly through newspaper publicity. There are about 6000 customers on the company's books at the present time.

The base rate for electric motor service is 6 cents per kw-hour. A flat charge of $1 per month per horse-power is made for motor installations rated at 50 hp and above, in certain cases, with the addition of an energy charge of 2 cents per kw-hour. Up to 50 hp connected motor load the minimum charge is 50 cents per horse-power per month. The company also has a non-peak motor-service rate running downward from 7 cents per kw-hour on a sliding scale, the hours of non-service being from 4 to 11 p. m. between Sept. 1 and April 1. The discounts on the sliding scale run from 44 per cent to 75 per cent according to use. The connected motor load is about 7000 hp. In the shops of the Portland Company, general machinists, a motor installation rated at about 1000 hp is in service. The local street-railway company purchases 700 hp and the Sanford mills have recently contracted for about 2200 hp. Many miscellaneous applications of electric motors are made in Portland, including printing plants, binderies, grinding establishments, shoe shops, hotels, elevators and department stores. A few small refrigerating plants are also in service in the city. The company has ceased to do electric wiring and free repairing.

The office building of the company is a renovated structure into which the various departments moved a few months ago. It is provided with large display windows on the street level and the exterior is decorated with 284 front and cornice border lamps of 4-cp rating. Each window is lighted by six 100-watt tungsten lamps. A new-business department room, 45 ft. long and 20 ft. wide, is provided with a handsome counter for the renewal of lamps, below which are bins for lamp storage and on top of which is an installation of test outlets. Two meters are wired in the new-business department so that the comparative power consumption of different styles of lamps can be exhibited to prospective customers by means of plugs connecting the lamps with the meters. The latter are provided with glass fronts. In the upper part of the building are an assembly hall, operating offices, electrical laboratory and meter-testing department. The accounting and executive offices are on the street floor opposite the new-business department.

The officers of the company are: President, Mr. C. O. Bancroft; treasurer, Mr. Wilbur Tusch; assistant treasurer, Mr. P. H. Burrowes; general manager, Mr. J. A. Fleet, and superintendent, Mr. H. W. Eells.

SPECIAL USE OF ELECTRIC HEAT IN LACQUER SHOP OF LARGE BED FACTORY.

At ordinary room temperatures only a single coat of lacquer can be successfully applied to polished brass surfaces, because the alcohol solvent of each successive coat would, unless instantly evaporated, cut or dissolve the preceding coat, wiping it off and producing marking. Consequently, a single coat of thick consistency is usually applied, but at best such a single coat will be thin when dry, and will lack durability. A better way is to employ a number of successive coats of a thin durable material like English lacquer, keeping the part to be covered heated during the operation, so that each coat is instantly dried as applied, while those beneath remain unaffected.

For heating such parts, as in the manufacture of brass beds, where the lacquering of the polished surfaces is important to the satisfactory service of the product, gas-heated ovens have heretofore been employed. In these ovens the parts were heated from ten to thirty minutes, quickly transferred to the lacquering table, and a coat applied before the temperature fell below that needed for drying the lacquer as applied. This operation had to be repeated for each of the ten or fifteen coats

[illegible] to the next work. Besides the time [illegible] the pieces and in transferring them from the ovens to the tables temperatures higher than those actually required for drying the lacquer had to be employed to allow for the cooling of the brass parts in transit to and during the lacquering operation. This excessive temperature tended to bake the lacquer, causing

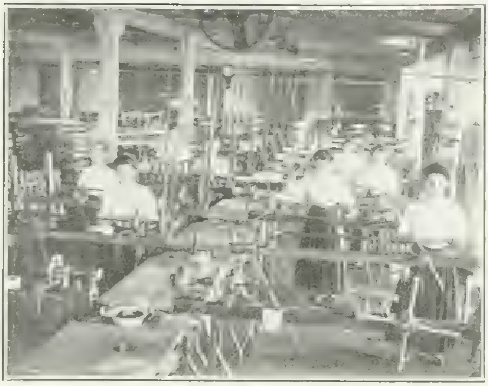


Fig. 1—Lacquering Brass Parts While Electrically Heated.

it to darken and so detract from the appearance of the brass surface.

A method of keeping the brass parts heated electrically while being lacquered is in use at the plant of the Simmons Manufacturing Company, employing the invention of Mr. W. W. Vincent, general superintendent of the company. The method consists in traversing the metal parts with large currents of electricity at low potentials, delivered from step-down transformers. More than 100 machines employing this principle are now in use at the Simmons factory. These machines are variously designed for handling the differently shaped parts encountered in the manufacture of beds, of which the company builds several thousand daily. The low-tension currents employed range from 500 amp to 2000 amp, depending on the shape and cross-section of the pieces to be heated.

Fig. 2—Method Formerly Used for Lacquering with Gas-Heated Ovens.

Fig. 4 shows a typical machine of the kind developed for the Simmons installation, as used for the lacquering of long straight rods, tubes or parts. The design follows generally that of a wood-turning lathe driven by a belt and pulley, except that the center tools are replaced by special contact mandrels which fit snugly over the brass section when the tail stock is pressed up tightly by means of its handwheel rack-and-pinion. Each of the contact pieces is provided with large cylindrical surfaces on which V-shaped copper brushes bear, relieving the mechanical bearings of carrying any current. Supported on the I-beam which forms the shears of the machine is a copper busbar extending throughout the length of the tail-stock travel,

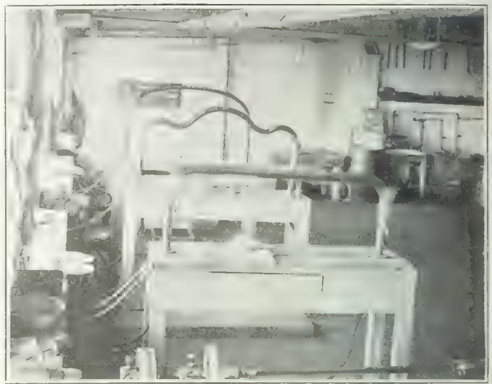


Fig. 3—Brass Bed Head and Foot Pieces Electrically Heated for Lacquering.

which is borne upon by a brush leading to the mandrel contact before mentioned. This conveys current to the movable tail-stock mandrel at any position on the shears.

Near the pulley of the machine is the energizing switch, inserted in the 440-volt side of the step-down transformer. The secondaries of these transformers are provided with 1.5-volt, 2.5-volt and 5-volt taps for various lengths and cross-sections of brass parts. In the practical use of these machines it is found that the current need be turned on only for a few seconds at a time, the part being almost instantly heated. Then, while it is rotated slowly by the belt pulley or hand wheel, the lacquer is quickly applied. The required number of coats can thus be given in quick succession, without returning the part to an oven to be reheated before each coat, as was formerly necessary. Another illustration (Fig. 3) shows the adaptation of the same principle to the brass head and foot pieces of beds. Here special expanding contacts are used which clamp the interior surface of the hollow tubing.

The expense of operating these machines, compared with the high labor cost and time taken with the old ovens, is slight. The current demands of the 440-volt primaries of the transformers are reported to be so small as not to be noticeable

Fig. 4—Machine for Electrically Heating Brass Bed-Post While Being Lacquered.

among those of the large number of motors operated at the Simmons factory. Each machine is turned on only momentarily and, as few are in demand simultaneously, the aggregate tax upon them remains small. The saving in cost is proportional to the great economy of time made possible by the electric-heating method over the old gas ovens.

ESTIMATED COST OF AN INDUSTRIAL ELECTRIC PLANT.

An interesting estimate of the cost of installing and operating an industrial steam-electric power plant was presented recently in Massachusetts in the case of the Otis Company vs. the Ludlow Manufacturing Company. It appeared in evidence that the Ludlow company had, by building a new dam, encroached upon a water-power privilege owned by the Otis Company, and, as claimed, impaired its value to the extent of an average of 1247.6 hp, this impairment being estimated at about 782 hp in the driest month and 1435.5 hp in the wettest month of the year. The normal available power which the Otis Company could have developed at its own dam averaged 1694.9 hp, with an estimated yield of 1032.5 hp in the driest month and 2020.7 hp in the wettest. One question at issue was the cost of installing upon

[illegible] I.—[illegible]

[illegible]	$4,000
[illegible] R R [illegible]	7,500
Engine house, boiler house and stack	[illegible]
[illegible]	11,794
[illegible]	14,700
[illegible]	350
[illegible]	[illegible]
" setting flues, dampers, etc	1,500
Feed pumps and foundations	550
Feed water heater and foundations	450
[illegible]	[illegible]
[illegible]	32,500
Foundations for engines..................	3,500
[illegible]	[illegible]
[illegible]	21,000
[illegible]	[illegible]
Switchboard, wiring, etc..	3,500
[illegible]	2,500
Engineering and superv[illegible]	9,951
Total	$155,534

the premises of the Otis Company an independent steam and electric plant that should be capable of supplying, for the same purposes and to equal advantage in their use, sufficient electric current for replacement of the power diverted.

The engineering experts in the case, Messrs. Lockwood, Greene & Company, of Boston, replied to this inquiry by stating that in locating an independent steam and electric plant to supply diverted power it is not necessary to install it at or near the water-power station, which was situated about 4500 ft. down stream from the Palmer Mill, to secure the maximum fall of the river, since such a location for the steam plant would entail an unnecessary loss in electrical transmission to the mill and [illegible] The engineers assumed for the proper location of the independent plant a site behind the existing boiler house of the mill, which site was about the only place where sufficient area could be secured for it convenient to railroad lines for coal delivery and also accessible to a condensing water supply. In order that the new steam plant should meet the power demands under the varying conditions of supply from the impaired water-power, the engineers estimated on an engine plant of two units of 750 hp each, and it was pointed out that by varying the steam pressure these units could be made to yield power as needed in amounts varying from 782 hp to 1435 hp. It was noted that the power diverted from the water-power plant was effective power at the wheel-shaft and it was pointed out that an equivalent power from the steam plant would have to be figured as so-called brake-hp on the engine shaft. Hence, in fixing the size

[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	750
[illegible]	[illegible]
[illegible]	1,440
[illegible]ation allowances:	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Annual cost of operation and depreciation. .	[illegible]

of the engines to be used an allowance was made for engine losses, thus taking the mechanical efficiency into account. This was estimated at 93 per cent of the load, although it was recognized that it would vary somewhat with the loads. Hence the engine plant had to meet conditions of load ranging from 841 hp to 1544 hp with an average of 1342 ihp. This independent plant required electric transmission lines to carry power into the mill buildings in the same manner as the hydraulic plant, but without transformers and with less line loss from the shorter distance, since the plan proposed located the steam plant opposite the mills where the power is required and not as remote as the water station.

The total estimated cost of such a plant is given in Table I and the estimated cost of operation and maintenance in Table II.

DISTRIBUTING SUBSTATION AT MINNEAPOLIS.

The Minneapolis General Electric Company is erecting attractive transformer substations, of the type shown in the accompanying illustration, in outlying districts of the city, for reducing its 13,200-volt intramural transmission potential to the distribution pressure, 2300 volts. The substation shown is that recently completed at the corner of Garfield Avenue and Thirty-third Street and was designed for containing two 500-kw banks of step-down transformers, one of which is already installed.

The building is of brown pressed brick trimmed with Bed-[illegible]

Transforming Substation of Minneapolis General Electric Company.

is carried by steel beams. Along the sidewalls of the first floor provision is made for the two banks of oil-insulated, water-cooled transformers, stepping down to the 2300-volt busbars, from which three single-phase lighting feeders, one three-phase motor feeder and four magnetite-arc rectifier outfits are served. On the second floor, over the transformers, are two 50-lamp and two 100-lamp rectifier sets for the metallic-flame arcs, while facing the gallery hatchway, through which the stairway ascends, is the switchboard, with lever and bell-crank control of the oil switches mounted behind it and on the floor below. Along the rear wall are installed the automatic induction feeder regulators, whose relays are compensated to keep the voltage constant at the ends of the lines they feed. The 13,000-volt lead-covered transmission cable connecting the main downtown station with the Garfield Avenue substation is carried part of the way under ground and the remainder of the distance, more than a mile, overhead, hung from a steel messenger cable.

The new substation was designed by the engineering department of the Minneapolis General Electric Company, of which Mr. C. H. Harris is chief engineer.

HOW HYDROELECTRIC ENERGY DISPLACES COAL.

[illegible]

Success of great hydroelectric systems depends in large part on the extent to which they are able to displace coal.

A number of the important conditions under which the energy of falling water is being substituted for coal are indicated below.

Hydroelectric supply in bulk goes to public-service corporations and to private plants and the number of consumers, average power and rates for each of these classes have much bearing on the results. The accompanying table of consumers on hydroelectric systems shows the number of public-service corporations and private plants supplied with energy and their average loads in various instances:

[illegible]

[illegible] Public [illegible] Corp.	[illegible] Private Plants.	Trans- [illegible] Rating per Con- [illegible] Kw.	Average Kw per Public Service Corp.	[illegible] Private Plant.	Kw Hours [illegible] Plant.
6	26		[illegible]	1,336	12,380,183
2	370		5,338	17	152,047
[illegible]	1[illegible]	1,213	[illegible]	229	2,011,093
[illegible]	72	458			
[illegible]	10	1,140			
[illegible]			[illegible]		

*Includes private plants.

Four of these hydroelectric systems supply energy over large areas, but the one with a total of 372 consumers is confined to a single city, which accounts in part for the number of private plants served. In only one instance is the number of private plants less than the number of public-service corporations using the hydroelectric energy.

The 72 private consumers shown on one system are all cotton mills, and this system supplies energy also to an unknown number of private plants in other lines of work.

Among the public-service plants supplied with energy by these hydroelectric systems are those distributing energy for lamps, motors, electric railways and sections of steam roads electrically operated.

For each of three hydroelectric systems the approximate average rating of substation or service transformers per consumer runs from 458 kw for the public-service and cotton mill load in the South to 1213 kw for the more even mixture of public-service plants and factories in the North.

Each of three hydroelectric systems has the average load in kilowatts of its public-service plants and also of its private consumers determined. This average is found by the division of the total kw-hours sold to each group of consumers during the year by the number of consumers in that group and by 8760, the total hours per year. For two of the three hydroelectric systems the public-service plants furnish the greater average load, and the exceptional average of 5338 kw is for one electric lighting company and one electric railway company in a great city.

The average load of 1336 kw is probably greater than can be found for as many as 26 private consumers on any other hydroelectric system. This load results from the extensive use of energy in the electrochemical industry. A great variety of manufacturing plants and some mercantile buildings go to make up the average load of 17 kw for 370 private plants in or near a single city.

Another view of the loads of private consumers on these hydroelectric systems is obtained by the statement of the average kw-hours per year for consumers of this class. Leaving out the system with the great electrochemical load, the other two show 152,000 kw-hours and 2,000,000 kw-hours per private consumer on an average respectively. These figures for average loads and energy consumption among private consumers on hydroelectric systems have additional interest because of the government regulation of such service in Massachusetts at points where hydroelectric systems are permitted to compete with central stations. In some cities and towns of this State the hydroelectric company may not sell energy to a private consumer "in a quantity less than 100 hp at any time," as provided by a special statute.

Under another special act and under orders of the Gas and Electric Light Commissioners of Massachusetts the hydroelectric company may not sell energy to any private consumer "whose motors and apparatus connected for use shall be of an aggregate rating of less than 300 electrical hp and whose annual consumption shall be less than 450,000 hp-hours."

As 300 hp corresponds to 225 kw and 450,000 hp-hours to 337,500 kw-hours the regulations in Massachusetts fall between the figures for the loads of hydroelectric systems in the service of private consumers elsewhere. The 337,500 kw-hours amount to an average load of 38.4 kw during 8760 hours.

For two of the above hydroelectric systems the kw-hours sold to public-service corporations and to private plants respectively in each of two successive years are given in Table II, as are also the average rates per kw-hour, and the corresponding figures of two other systems are given for one year. From 1908 to 1909 the two systems show an increase of output to both public and private consumers and also a reduction of average rates, except that only the sales to railways are included under the heading of public service for one system in the latter year and the railway rate is higher than that to all public service.

[illegible]

[illegible] on Hydro-[illegible] System	Year.	Million Kw-Hours to Public Service Corp.	Average Cost per Kw-Hour to P. S. Corp. Cents.	Million Kw Hours to Private Plants.	Average cost per Kw-Hour to Private Plants. Cents.
[illegible]	1908	40	0.38	321	0.26
[illegible]	1909	[illegible]	(*0.41)	422	0.24
[illegible]	1908	71	0.58	26	0.58 approx
[illegible]	1909	108	0.57	50	0.45
372	1908	93	0.61	56	0.84
[illegible]	1908	34	0.83	19	0.67

*Sales to railways only.

For the six years of operation representing two hydroelectric systems during two years and two other systems in one year the average rates to public-service corporations ran from 0.38 cent to 0.83 cent per kw-hour, while the averages to private plants were 0.24 to 0.84 cent per kw-hour. In only one instance was the average rate to private plants greater than that to public-service corporations, and in this case two of the corporations took 93,000,000 kw-hours, while 370 private plants used only 56,000,000 kw-hours. For two of the hydroelectric systems representing three years of operation the average load per private plant was less than the average per public corporation.

Whatever the reasons assigned for the fact the above figures go to show that large private plants secure lower rates from hydroelectric systems than do public-service corporations.

Further light on the conditions that regulate rates for hydroelectric service is given by Table III, showing sales to public-service corporations:

These sixteen companies are supplied with energy by a single hydroelectric system that transmits over a maximum distance of more than 150 miles from the hydroelectric station. The supply of water power is constantly available and the hydroelectric system uses no steam power.

Sales are made to electric lighting and motor service and to railway companies, and these sales range from 234,300 kw-hours to 20,391,176 kw-hours per year to the respective plants. The rates per kw-hour for the several companies range from 0.30 cent to 1.44 cents, but there is no regular increase of rates with decrease of consumption. Thus the railway that used 20,300,000 kw-hours paid a rate of 0.53 cent, while the railway

[illegible] used 1,000,000 kw-hours [illegible] kw-hour [illegible] also one electric lighting company paid a rate of 0.31 cent [illegible] 9,200,000 kw-hours and [illegible] cent [illegible] 8,100,000

[illegible]

Kind of Public Service Corporation.	Kw-Hours	Average Cost per Kw-Hour.
[illegible]	20,391,176	0.53
[illegible]ectric light	9,217,888	0.31
[illegible]ailway.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	5,495,346	0.597
[illegible]otor load...	[illegible]	0.30
[illegible]ectric light	3,036,183	0.77
[illegible]ectric light.	[illegible]	1.00
[illegible]	2,344,792	0.69
[illegible]	1,442,466	[illegible]
[illegible]	1,088,057	[illegible]
[illegible]ectric light	[illegible]	0.71
[illegible]	936,654	0.84
[illegible]	741,247	0.96
[illegible]	628,320	0.99
[illegible]	[illegible]	1.44

As far as known the sixteen railway [illegible] lighting [illegible] [illegible]ere not under the same financial control as the hydroelectric [illegible]stem so that the rates paid represent the competition of the [illegible]ansmitted energy with production in local plants.

Some factors that bear on this competition are the cost of [illegible]al and the use of local water power. In the strip of terri[illegible]ry about 150 miles long where this hydroelectric energy is [illegible]ansmitted and sold the price of boiler coal runs from $2.25 [illegible] $3.00 per long ton, the lower prices applying in places nearer [illegible]e generating station. The sale of 20,300,000 kw-hours at [illegible]e rate of 0.53 cent was made to a railway in a city where [illegible]iler coal costs about $3.00 per ton, after the energy had [illegible]en transmitted fully 150 miles. In this same city the light[illegible]g company purchased 8,100,000 kw-hours of the transmitted [illegible]ergy at the rate of 0.70 cent.

A railway and lighting company in a city about eighty miles [illegible]om the hydroelectric plant paid a rate of 0.597 cent for [illegible]00,000 kw-hours of the transmitted energy, and this company [illegible]so used a variable local water power as well as a steam [illegible]ant. The railway that used 1,000,000 kw-hours at the rate of [illegible]88 cent starts at a point about 20 miles and ends 80 miles [illegible]om the hydroelectric plant. The lowest among the rates to [illegible]hting companies was that of 0.31 cent for 9,200,000 kw-hours [illegible] a point about twenty miles from the hydroelectric station, [illegible]ere the price of boiler coal was less than $3 per ton. The [illegible]ectric light company that purchased this 9,200,000 kw-hours [illegible]ns steam engines of 550 hp and water wheels of some 600 hp [illegible]ting.

Incomes of hydroelectric systems are large per consumer [illegible]d small per kw of load, as shown in Table IV of loads, [illegible]nsumers and incomes. Each load and income represents [illegible]nt year of operation for one system.

[illegible]

[illegible] Load	[illegible] of Load	Number of Consumers	Income per Consumer	Income [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	25,471	16.5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	16.6

The load stated represents the maximum at the generating [illegible]ation for one system, the transformers on transmission lines [illegible] three other instances, and in one case the nature of the [illegible]d is uncertain, but it may be the rating of the connected [illegible]paratus. The other two figures are for connected loads.

Loads vary from 18,800 to 60,660 kw per system and the [illegible]responding numbers of [illegible]

[illegible] is $4,450 and the least is $2,837. Per kw of load the largest income is $22.2 and the least is $10.1 annually.

Lighting and railway plants and motors in factories made up most of the load of 18,800 kw among nine consumers. Electrochemical furnaces to a greater extent than motors gave 54 consumers a load of 30,705 kw.

The transformer loads of 37,620 kw and 50,700 kw respectively were connected to the same hydroelectric system in successive years, and this power was used by lighting and railway companies and for mechanical purposes.

A unique feature of the transformer load of 41,750 kw among 91 consumers was that 72 of the consumers were cotton mills with an aggregate rated load of more than 30,000 hp. The income per consumer and per kw of load on this hydroelectric system was probably lower than the $9,003 and the $19.6 given in the table, because the 41,750 kw of transformers was connected in the year previous to that for which the income is given and meantime the rating of transformers in service no doubt increased. For this same system the stated number of 91 consumers is incomplete and applies a year earlier than the income figures.

While the connected load of 55,869 kw was operated for 370 comparatively small lighting and motor-service consumers in a city and for a lighting and a railway company, the load of 60,660 kw was made up largely of electrochemical furnaces and was operated for 32 consumers.

PURIFICATION TREATMENT OF TRANSFORMER-COOLING WATER MADE NECESSARY BY SCALE IN COILS.

Artesian-well water is used for cooling purposes at Substation A of the Minneapolis General Electric Company, where 15,000 kw of water-cooled, oil-insulated transformers are installed for stepping down from the 50,000-volt transmission potential of the Taylor's Falls line to the 13,200-volt pressure employed within the city limits. For a year or more trouble was noticed from excessive temperature rise in some of these transformers, but the true cause of the difficulty was not discovered until it was observed that the cooling coils seemed to be clogged and would not allow their rated quantities of water to pass. On examining these coils they were found to be lined with a thick coating of hard, flinty deposit from the well water which could be chipped only with difficulty. This material had incrusted the tubing with a solid, stony lining almost closing the orifice and preventing the transfer of heat from the transformer to the small stream of water that found its way through the coil.

A number of methods were tried for removing this deposit from the coils, and at last a 10 per cent solution of acetic acid was successfully employed, attacking the scale and dislodging it effectively. This acetic-acid solution was run through the coil and into a large tub, to the bottom of which the entrained scale was precipitated, so that the clear acid solution could again be drawn off and used from the top of the tub. After the transformer-cooling coils were again restored to serviceable condition analysis was made of the water and a purification plant was ordered capable of treating 1000 gal. daily. The artesian-well water showed a total of 49 parts of solids to 100,000, the ingredient proportions being as follows by parts: Calcium carbonate, 20.25; magnesium carbonate, 12.6; sodium chloride, 6.9; calcium sulphate, 3.4; silica, 2.16; iron and aluminum oxides, 0.18. The transformer-cooling water will be used over again and again after passing through a cooling tower, as before, while, as necessary, make-up water to take the place of that lost by evaporation will be added from the treated-water tank of the purifier outfit. The formation of scale in transformer-cooling coils is unusual and the installation of water-treating apparatus to relieve this condition is thought to [illegible]

ELECTRIC DRIVE IN A WATER FILTRATION PLANT.

[illegible] tion plant of the municipal water system of Wilmington, Del. In filtration plants one of the chief considerations is the cleaning of the sand used in the filter. This is accomplished at Wilmington by the use of the Blaisdell filter-sand washing machine. In this machine an inverted open box is sunk under the water of the filter to the sand surface and is held in position and operated electrically from a crane platform. The whole machine runs on rails the whole length of the filter over the water which is being filtered, which in turn is superimposed on the sand of the filter. A transfer table enables the machine to be shifted from one set of rails to another so that the whole area of the filter may be covered.

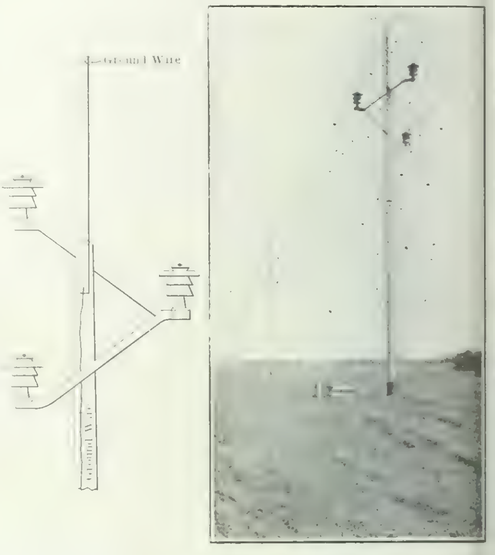
The box contains a revolving hollow axle terminating in a hollow head resting on the sand. From this head hollow fingers or stirrers extend down into the sand. As the axle and head revolve, stirring the sand by means of the fingers, clean water under pressure is forced through them and passes into the sand through small holes in the fingers. A suction pump draws away the dirty water, taking away just a little more water than is supplied by the pressure pump. In this way all the dirt which has been stirred and washed from the sand is discharged into a sewer. A little water comes into the box under its edges, through the sand, and as the suction is a little stronger than the water pressure applied none of the dirty water escapes from the box into the filter. While the operation is proceeding the whole machine moves slowly ahead over the sand, and, as stated, it is adapted to reach every portion of the filtration bed.

Electrical energy is conveyed to the machine by an overhead double trolley. Six 220-volt direct-current motors are employed, as follows: Side travel, 7.5 hp; chamber hoist (used in lifting and lowering the box), 7.5 hp; stirrer-wheel spindles, 20 hp; crane travel, 20 hp; discharge pump, 10 hp; pressure pump, 25 hp. All of these are variable-speed reversible machines, except that the discharge-pump motor is non-reversible and the motor for the spindles or fingers is constant-speed and non-reversible. A switchboard, provided with a controller for each motor, is mounted on the machine at the operator's position. The main switch is designed to carry 300 amp at 220 volts and is provided with no-load and overload release. The motors installed are purposely of large size to prevent heating in the confined locations in which they are placed. The total amount of energy required to operate the machine under normal conditions is from 20 hp to 45 hp. The longitudinal speed of travel of the machine is from 2 ft. to 12 ft. a minute and the filter sand may be stirred up to a depth of 24 in. The amount of wash water required is from 120,000 gal. to 180,000 gal. per acre of filtration bed.

NEW CROSS-ARM CONSTRUCTION FOR TRANSMISSION POLES.

A cross-arm construction which avoids the use of braces or gains, reduces the required height of poles, number of bolts, tree trimming, etc., and is within itself braced and balanced for vertical and longitudinal stresses, has been employed in building the 60,000-volt transmission line of the Northern States Power Company, to connect Cannon Falls with Mankato, Minn. Two sections of the line, from Cannon Falls to Faribault and from Mankato to Rapidan, are already completed and will be placed in service when the new water-power developments now under construction at these points begin operation. The improved type of cross-arm was designed by the engineers of the H. M. Byllesby Company, and upon its features of novelty a United States patent has recently been granted.

As shown by the accompanying illustrations, the "wishbone" arrangement of the cross-arms consists of two steel angle-sections, bent and bolted together, making an angle of 60 deg. between legs. The ends of the arms are bent into horizontal position, and to the flat web surfaces at these points the cast insulator pins are bolted. The arms are bolted to the pole at points two-thirds of the distance from the crotch or single-wire side. The moment of the single wire with its long arm thus balances the moment of the two wires at their short arms,



Cross-Arm Construction on Cannon Falls (Northfield, Minn.) 60,000-Volt Transmission Line.

nullifying any tendency to rotation about the pole due to unequal span lengths. Such rotation is also braced against by the interlinked mounting of the cross-arm pieces, one shank passing on one side and the other on the opposite side of the pole. The top cross-arm is mounted squarely transverse to the line of transmission, while the lower arm receives a slight lateral bend, sufficient to allow it to pass on the other side of the pole, so that when in position its horizontal projection makes a small but hardly noticeable angle with that of the upper arm. The resulting bracing action secures the arms against rotation caused by unequal span stresses, a provision practically impossible with other single-arm constructions. The "wishbone" arms are also mutually braced, as levers of the third class, against vertical stresses due to the weight of the wires, without employing the brace pieces ordinarily used.

Only two bolts are required to assemble the arms, and two through bolts are needed to attach them to the pole. Under the nut of the bolt holding the upper arm a vertical angle ground-wire support is clamped, being held rigid by another through-bolt transfixing the pole just below. The steel work is bolted to the pole without cutting gains for its reception.

In the 60,000-volt line referred to the delta distance between wires is 6 ft., but the horizontal width of the transmission triangle is only 4.8 ft., reducing the amount of clearance required by the old type of horizontal-arm construction. When erected along roadways the arms are mounted with the single-wire or longer side toward the road, reducing the necessity for cutting foliage bordering the highway. With this "wishbone" type of construction the poles used may be shorter than before, since the inclined arm carries the topmost wire several inches above the peak of the pole.

SOME NOTES ON GROUND CONNECTIONS.

By Edgar H. [illegible]

The writer does not intend what follows to be a systematic discussion, but merely a record of some methods of making ground connections and of some performance data. Much of the information has been taken from the writer's notebook, the rest has been acquired through conversation with and by reading the reports of operating and erection men.

It is quite well established that it is of the greatest importance that ground connections be well made. It has been the experience of men that have investigated lightning arrester troubles that many are caused by imperfect earth connections.

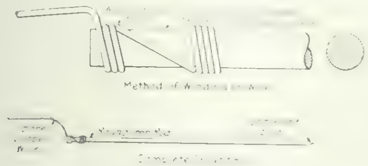


Fig. 1—Wrought-Iron Ground Rod.

The best arrester equipment purchasable may be installed, but if the earth connection is not good the arrester cannot be expected to do its work properly. The cost of the earth connection is usually but a fraction of that of the arrester. Money spent in arranging a good earth connection is very well spent and it is just as important that a lightning arrester have a good ground as it is that the arrester itself be good.

In Fig. 1 is illustrated a good method of constructing a ground rod. It is one that has been used by telephone and electric lighting companies to a considerable extent. The rod is of commercial rolled iron, and a diameter of ½ in. or ⅝ in. is usually chosen. Wrought-iron pipe, either plain or galvanized, can be used instead of iron rod. A length of copper wire is soldered to the upper end of the rod, as indicated in Fig. 1, and the lower end is pointed. Such a rod should be from 5 ft. to [illegible] ft. long. It will be found most economical to solder the lengths of wire to the rods at the station, where the proper appliances usually are available. At best, it is not easy to solder to iron, so that for satisfactory results the operation should be performed under favorable conditions.

In soldering, the upper end of the rod should first be filed until it is quite clean and bright. All traces of scale and [illegible] must be removed. Then it must be heated in the flame of a blow-torch until solder will melt when applied to it. The hot rod should now be rubbed in a pile of powdered sal-ammoniac, which will clean it chemically, and solder wire applied simultaneously. The end will "take" the solder readily and soon become "tinned." The end of the length of copper wire can now, after being well cleaned with sandpaper, be wound around the tinned portion in the manner indicated in Fig. 1 and solder again applied. Solder will flow over the wire and effect a good electrical connection between it and the pipe or rod. The completed joint can be cooled quickly with a piece of wet waste.

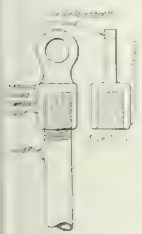


Fig. 2—Commercial "Eye-End" on Pipe.

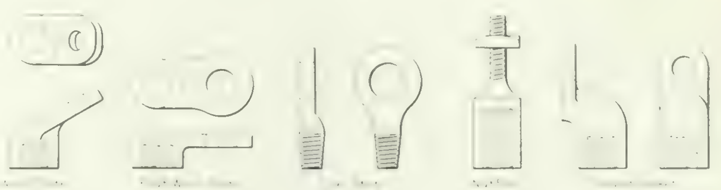


Fig. 3—Forms of Commercial Awning Fittings.

Ground rods are installed by merely driving them into the earth. The ground wire from the lightning arrester or other device to be grounded is connected and well soldered to the length of copper attached to the ground rod. There is never much difficulty in soldering two pieces of copper wire together. When a ground rod is being driven the blows from the driving hammer tend to make it vibrate transversely. The effect of such vibrations is to push the earth away from the rod and to make the connection between them poor. Therefore, after driving it, the earth around a ground rod should be well tamped.

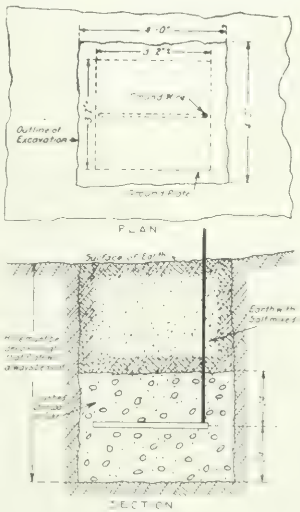


Fig. 4—Copper-Plate Ground.

In the following table are shown some ground-rod resistance values—the resistance in ohms between driven ground rods and a town water-pipe system—which indicate the effect of thorough tamping.

Resistance Before Tamping.	Resistance After Tamping.
[illegible]	[illegible]
[illegible] ohms.	[illegible]
[illegible]	[illegible]
[illegible] ohms.	[illegible]

These results are from some tests made on Long Island, New York. The formation was about 2 ft. of dark soil above a thick layer of sandy gravel. These resistance values, even after the ground had been tamped, are rather high. A good rod or pipe ground should, under favorable conditions, have not more than from [illegible] ohms to [illegible] ohms resistance.

In Fig. 2 is illustrated a [illegible] rod with a terminal. The terminal is a commercial awning pipe fitting known as an "eye-end." This fitting is made in all standard pipe sizes from ¼ in. to 1 in., inclusive, and is tapped with a standard pipe thread. This arrangement is convenient where it is desirable to disconnect the ground lead from the pipe so that the ground can be tested. A terminal lug should be soldered to the end of the ground lead. The lug is tightly bolted to the "eye-end." Then tinfoil is wrapped about the connection to exclude moisture and the whole thoroughly taped. A bolted connection, made as suggested, will remain in excel-

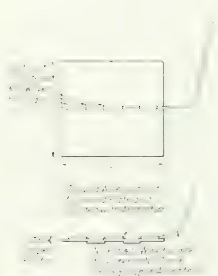


Fig. 5—A Copper Ground Plate.

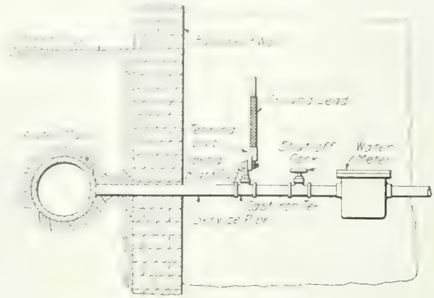


Fig. 6—Ground on a Water Pipe.

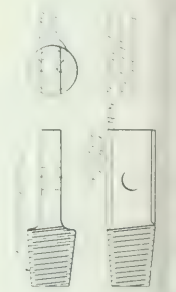


Fig. 7—Brass Ground Plu

lent condition for a surprisingly long time. It should, however, be inspected when the ground is tested. It is necessary to disconnect the lead from a ground pipe to test the ground resistance when the pipe forms one of a group, such as is used in a multiple-pipe ground. A diagram of a multiple-pipe ground is shown in Fig. 15.

Other forms of awning fittings that sometimes can be utilized in arranging pipe grounds are shown in Fig. 3. All of these can be obtained in either black or galvanized finish, and all have standard pipe threads. The commercial name by which each fitting is known is given under it in the engraving.

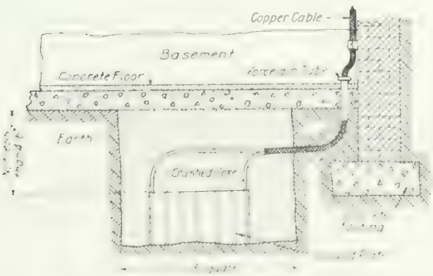


Fig. 8—Ground Made with a Copper Spiral.

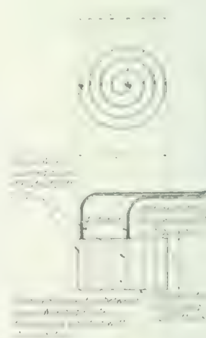


Fig. 9—Details of Copper Spiral.

In Fig. 4 is indicated the method of preparing a station ground for lightning arresters as recommended by one of the large electrical manufacturing companies. The ground plate is of sheet copper, tinned, and should be about 1/32 in. thick. The ground wire, which should be equal in conductivity at least to No. 0 B. & S. gage wire, is soldered on the entire width of the plate. An old iron casting having a superficial area at least equal to that of the copper plate can be used if copper is not available. For a terminal a copper strap can be riveted to the plate. It is recommended that when the hole is being filled in plenty of water be used for settling the earth.

A great many grounds are made by the telephone companies for the telephone-station lightning arresters. Where possible a connection is made to a water or gas pipe with one of the many types of commercial ground clamps. In rural districts either ground rods or ground plates are used. Some companies use ground rods such as that shown in Fig. 1. Other companies prefer plates. Fig. 5 shows the ground plate used by one of the largest Eastern telephone companies. It is very much cheaper to install rods than plates because a rod can be driven into the ground in a few minutes, while it may take one hour or several to dig the hole for a ground plate. Plates like that of Fig. 5 are, for telephone work, buried from 4 ft. to 6 ft. deep directly in the soil without any coke packing at the bottom of a hole.

Telephone central-office grounds must be good ones. As a rule, a connection is made to both gas and water pipes when the two are available. Fig. 6 shows the method of effecting a connection with a water pipe that has been used by some of the largest telephone companies. A special brass plug (see Fig. 7 for details) is turned into a tee in the pipe system and a terminal lug on the end of the ground lead is sweated and bolted to it. Such a connection is always made on the street side of the shut-off cock and of the meter so that the removal of either of these members cannot affect the continuity of the ground connection. Sometimes a connection to a water pipe is made by soldering a copper strap around the pipe and then connecting the ground lead to the strap. It is extremely difficult and not always altogether safe to solder to a pipe that is full of water.

Another form of ground that has been used by some of the big telephone companies is detailed in Figs. 8 and 9. A ground of this type is sometimes arranged under the basement floor of a central office, as shown in Fig. 8. This procedure appears to be satisfactory where there is every assurance that the earth surrounding the copper-ground spiral will always be moist. The writer has been given to understand that, even when this type of ground is installed out of doors, a layer of concrete 1 in. in thickness is placed at the surface over the spiral to maintain the ground lead in position and to prevent any tamper

with the lead or with the [illegible], which is shown in Fig. 9.

Common salt mixed with the earth surrounding a ground pipe or plate decreases the resistance of the ground considerably below that of a similar but unsalted one. The curve reproduced in Fig. 10 brings out this fact. The ground from

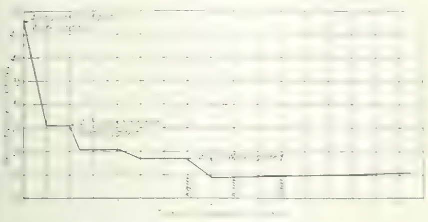


Fig. 10—Curve Showing Effect of "Salting."

which the values plotted were obtained was made by driving a pipe 5 ft. into the earth. At the surface the soil was scooped out around the pipe. In this cup-shaped depression 4 lb. of salt

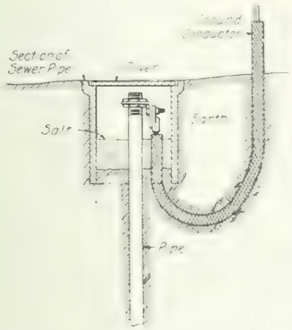
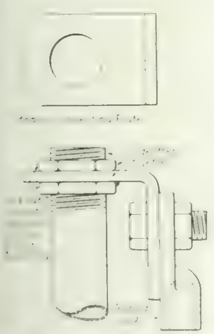


Fig. 11— A "Salted" Pipe Ground Unit.

was dumped. Salt and water were subsequently added as indicated on the curve. It will be noted that the original resistance of the unsalted ground was about 48 ohms, but that it



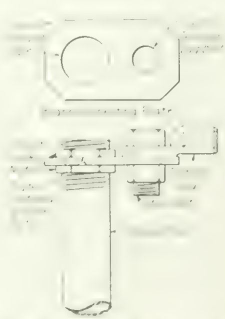


Fig. 12—One Method of Connecting to Ground Pipe. Fig. 13—Another Method of Connection.

was reduced by the addition of salt and water to something less than 15 ohms. As the salt is washed out of the surrounding soil by rain the resistance of the ground will gradually increase.

To take advantage of the property of salt in decreasing ground resistance a form of pipe-ground unit similar to that shown in Fig. 11 has been suggested. A ground pipe having a nominal diameter of about 1 in. is driven into the earth a distance of about 6 ft. and a length of sewer pipe arranged around its top, as shown in Fig. 11. A wooden cover fits in the shoulder on the sewer pipe. The ground lead is connected to the pipe by means of the arrangement illustrated in Fig. 12. This permits of the lead being readily disconnected so that the ground may be tested. A supply of salt, which will soak into and saturate the surrounding earth, is maintained in the sewer-pipe chamber. Where the ground lead is not of heavy wire and can be easily bent, a simple connecting arrangement, outlined in Fig. 13, can be used. It can also be used where the

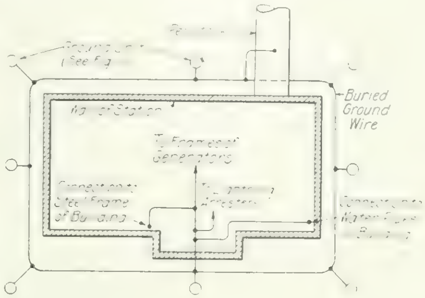


Fig. 14—Ground Units Around a Generating Station.

ground lead leaves the pipe in a horizontal direction instead of in a vertical one, as in Fig. 11.

It was suggested above that the ground pipe should be driven to a depth of about 6 ft. Experiments show that little is to be gained by exceeding this depth. The resistance of a pipe ground does *not* vary inversely as the depth in a simple ratio. For the first few feet driven the resistance decreases rapidly for each additional foot of depth, but as the depth increases the resistance decrease is less rapid. The resistance is almost constant for depths greater than 7 ft. or 8 ft.

At present the practice of making multiple-pipe grounds is largely followed. A multiple-pipe ground (Fig. 15) consists of a number of pipe-ground units, similar possibly to that of Fig. 11, connected in parallel. The resistance of such a group is considerably less than that of any single unit in it. In arranging ground units one should be located as near as possible to the lightning arrester and the others grouped, as in Fig. 14, around the building. Auxiliary ground leads should be con-

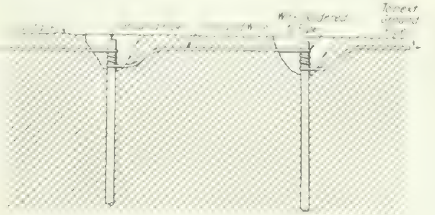


Fig. 15—One Method of Making Multiple-Pipe Ground Connection.

nected to the metal frame of the building, to any available water and gas pipes and to the penstock or pipe line if the plant is operated by water-power. Ground connections are also made to the frames and cases of apparatus to be protected.

A method of connecting multiple-pipe grounds together less elaborate than that illustrated in Figs. 12 and 13 is shown in Fig. 15. In this simple method the ends of the ground pipes are tinned, as described in connection with Fig. 1, before they are driven. After driving the bare copper ground wire that is to connect the pipe ends together is wrapped around each pipe in succession and soldered thereto.

LETTERS ON PRACTICAL SUBJECTS

EMERGENCY STRAIN INSULATORS MADE FROM GLASS INSULATORS.

A strain insulator that gives entirely satisfactory service when used with ordinary good judgment can be made as indicated in Fig. 1 by knocking the end out of a commercial glass insulator. Obviously a strain insulator made in this way is not as good either mechanically or electrically as many standard types that are readily obtainable. It is recommended only for emergency or temporary installations. Some applications are shown in Figs. 2 to 7.

Any heavy tool having a portion of suitable diameter and long enough to enter and reach the bottom of the glass insulator may be used for altering the insulator instead of the screwdriver shown in Fig. 1. The insulator to be altered is held with the left hand and with the tool a sharp downward blow is given into the threaded cavity of the insulator and against the

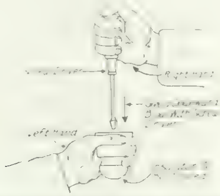


Fig. 1—Method of Altering Insulator.

bottom. Occasionally the insulator will break into many pieces and be lost, but usually only its top is cracked off on a reasonably regular plane. Linemen use their connectors or their pliers in altering insulators. The blow is given with one of the legs or sides of either of the tools.

Fig. 2 shows one of the many methods of making up the

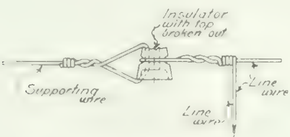


Fig. 2—Altered Insulator in Use.

wires about an altered glass insulator. In the illustration the line wire is shown in the groove and the supporting or pull-over wire is shown threading through the hole. This arrangement need not necessarily be followed. The relative locations of the two wires are often made the opposite of those shown. In

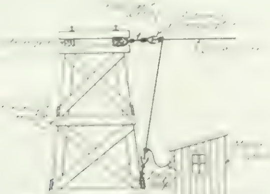


Fig. 3—Line Wiring for a Motor.

Fig. 3 an application is shown of the combination detailed in Fig. 2. A motor had been installed for a contractor's plant in a shed (Fig. 3) which was close to a railway trestle. It was imperative that the motor should be connected immediately to conductors on a pole line a short distance, possibly 150 ft., away. Wire and insulators were available, but no other electrical material and it was desirable so to make the installation that it would be reliable and capable of operating for several months

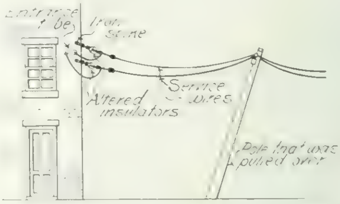


Fig. 4—An Emergency Application of Altered Insulator.

The outside wiring was insulated and supported with altered insulators as suggested in Fig. 3.

Another emergency application is shown in Fig. 4. In this case altered insulators were used to restore electric lighting service

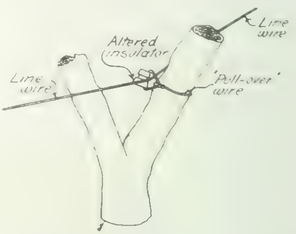


Fig. 5—An Improvised Tree Insulator.

to a building. When the electric lighting company's emergency man arrived at the building he found that the pole from which the service wires to the building were taken had been pulled partially over through the breaking of a guy wire, that the

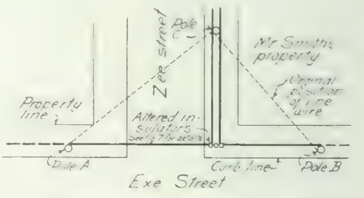


Fig. 6—The Solution of a Right-of-Way Difficulty.

service wires had been broken, and that the iron brackets and the wooden cleat which supported them had been pulled down. It was impossible to replace the cleat and bracket with the tools the man had and he could not pull the pole back into normal position, so he restored service temporarily by driving spikes at the corner of the building and supporting the service wires on the spikes with altered insulators. (See Fig. 4.)

Altered insulators can be used for tree insulators as suggested in Fig. 5. Where a line wire is in contact with the limb or branch of a tree it is usually possible to eliminate the con-

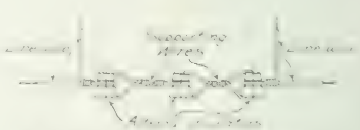


Fig. 7—Plan View of Insulator Arrangement.

tact by placing the line wire in the groove of an altered insulator and pulling and tying it away from the offending member with a pull-over wire. (See Fig. 5.) The line wire is sometimes tied in the groove of the insulator, but, as a rule, this is not desirable because if the line wire is tied the swaying of the

ree may break the conductor. Tree insulators especially formed rom glass or porcelain are made and are preferable for perma-ient work to the altered type of Fig. 5.

A right-of-way difficulty was solved with altered insulators n the instance pictured in Fig. 6. Wires of a series circuit panned, as shown by dotted lines, from poles *A* and *B* to pole ; and one of them crossed property. To the presence of this vire the owner objected and insisted that it be removed. The eavy lines show how the wires were rearranged to meet the roperty owner's demands without setting a pole. Fig. 7 shows n detail the arrangement used and wiring of the altered insula-ors. The wiring was made up on the ground, after careful ieasurements had been taken, and was then raised to its aerial osition before the original wires, shown by dotted lines, were emoved. The new work was then spliced to the portion of the ld that was to remain and the useless part of the old installa-ion was cut down.

Swissvale, Pa. HARRY L. BEARDSLEY.

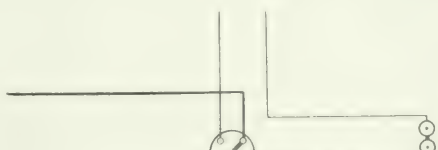
A WATERPROOF MACHINERY FOUNDATION.

Recently the necessity arose for making a waterproof founda-on to sustain a steam engine and electrical generator and to erve as a retaining wall, also to carry a portion of the building ı which the generating machinery was to be placed. Various iethods of waterproofing were discussed, including the coating f the bottom and outside of the foundation with asphalt and arred paper. Finally it was decided to attempt the construc-on of an impervious, monolithic concrete foundation. The uilding was located on inclined ground, in fact, about midway p a side hill, half a mile or so from top to bottom. The soil 'as gravel with clay underneath and rock underneath the clay. . stream of water coursed down the gravel strata on top of the ay during the greater portion of the year. For diverting this nderground stream of water the waterproofing of the founda-on became necessary. The footing of the foundation had to e placed in the clay about 15 ft. underground, hence there was o danger from frost. The excavation was made and rows of rain tile were placed underneath where the foundation was to e built. A ditch was dug around the entire up-hill side of the oundation and the down-hill slope of the ditch was inclined bout 45 deg. to the level of the foundation footing. This side f the ditch was covered with cement mortar and troweled nooth, then three lines of drain tiling were laid in the ditch nd covered with broken stone, coarse gravel, brickbats and ny coarse material available which was free from sand or loam. . layer of cement mortar was spread over the clay underneath ie drain tiling where the foundation was to be located. The tiles 'ere then put in place, the rows being about 2 ft. apart and ex-nding laterally along the side of the hill with drainage inclina-on of about 1/16 in. to the foot. The tiles were not pointed irectly up and down the side hill, but laterally or crosswise, as tated before. A layer of coarse material was then placed on p of the drain tile; this material was similar to that in the itch above mentioned and was from 8 in. to 12 in. thick. This iaterial was well rammed with a maul having a head 12 in. quare. It was made large for the purpose of driving the coarse iaterial down rather than spreading it apart. Two men used the ammer. A 2-in. layer of concrete made from run-of-bank ravel was then spread over the broken stone and coarse gravel nd the foundation proper was then placed upon the drainage oot above described. As the foundation was to be monolithic, he usual forms were built of wooden scantlings, plank and oards. The next step was to secure a concrete mixture which vould be waterproof. The available material was glacial gravel vhich would assay about 50 per cent through the ¼-in. mesh, and he 50 per cent of tailings which would not pass the screen con-isted of egg-shaped pebbles ranging from 6 in. downward, but ontaining a large proportion of stone 1 in. and 2 in. in diam-ter. The next problem was to secure sufficient material to do he work. The cubical contents of the foundation were care-ully calculated and enough gravel screened out to give the ubic yards required by the foundation. No account was taken of the sand which passed the ¼-in. screen, but the needed quantity was secured from the large pebbles. A box 12 in. wide and 12 in. deep was nailed up watertight and fitted with a tight bottom. This box was filled with large pebbles as they came to hand, no attempt being made to select them or to avoid very large or very small ones. The pebbles were packed into the box by tamping slightly and when the box was full the water, previously weighed, was poured in. It was found that nearly 17½ lb. of water was required to fill the interstices of the gravel. The next step was to find material for filling these interstices as full as possible. Had it been possible to separate the pebbles into large and small sizes a more dense concrete might have been obtained, but that not being possible, the engineer cast about for material which would fill the voids in the gravel as full as possible. A quantity of roof gravel was at hand and he tried the experiment of mixing 28 per cent of that with 1 cu. ft. of the pebbles. He found, however, that the mixture would not go into the box, showing that the roof gravel could not fill all the voids which existed in the large material, but would increase the volume considerably. He succeeded in mixing in 15 per cent of roof gravel without increasing the volume. He then tried the experiment of mixing mortar sand with the pebbles and roof gravel. Thirteen per cent of the sand screened out originally was mixed in again, but the mixture would not all go into the box. A lot of fine sand was found near by which would pass a No. 20 sieve; 13 per cent of this sand was mixed in and it was found the cubic foot box would easily contain the 72 per cent of pebbles, 15 per cent of roof gravel and 13 per cent of No. 20 sand. Here was 100 per cent of material; the box was apparently full, but no cement was yet in the mixture. The engineer now commenced mixing dry cement with the box full of material and succeeded in placing therein between 12 per cent and 13 per cent of Portland cement and could still place the entire mixture in the cubical box. The foundation was built of this material, mixed as above, and from 8 per cent to 9 per cent of water was added, when the concrete was gaged. It may be added that the mixture thus experimented with was manipulated in the cubical box while that receptacle was placed on the platform scales so that the weight could be sent at any time. It was found that the resulting mixture was so dense that it weighed upward of 124 lb. to the cubic foot before any water was added. After curing it weighed about 160 lb. to the cubic foot, and no water of any consequence has ever found its way through the foundation or the retaining wall portion of the structure. It was a perfect success.

South Bend, Ind. JAMES F. HOBART.

AUTOMATIC CONNECTION OF EXTENSION BELL.

Recently the writer had occasion to make the following good use of a two-way switch when called in to install a telephone extension bell in a small factory building. It was desired to



Automatic Cut-Out for Extension Bell.

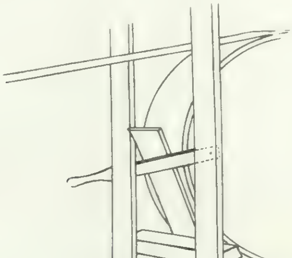
have the extension bell ring out in the shop when no one was in the office to answer it, but some means was also required for cutting off the bell when the office was occupied. The office was on the ground floor in a corner so dark that artificial light was needed all day. As it seemed safe to assume that the bookkeeper or his assistant would turn on the lamps

while they were in the office and switch them out of circuit when they left, both the lighting circuit and the bell circuit were connected through the two-way switch as shown, with the result that when the lamps were lighted the bell was out of circuit and when the lights were extinguished the bell was connected. Of course, the lamp and bell circuits are entirely independent and insulated from each other, and the arrangement has proved an entire success so far as the automatic disconnection of the bell is concerned.

Tallahassee, Fla. W. H. Johnson.

A SIMPLE WATER-WHEEL BRAKE FOR LEAKING HEADGATES.

The headgates of our water-wheel installation do not close so tightly but that there is sufficient leakage to keep the two 150-hp wheels turning over at a slow rate of speed when the generator is shut down. The station attendant has used various nondescript means which came to hand for stopping the wheels



A Simple Water-Wheel Pulley Brake.

under this condition, but found the most effective method was to apply a board as a brake against the face of the pulley. We have now arranged a permanent wooden brake, as shown in the accompanying sketch, which has proved very useful. The construction is crude but simple; the hand lever moving against the inclined guide forces the board against the pulley face with the multiplied advantage of the leverage obtained.

[illegible] Gallahad Jones.

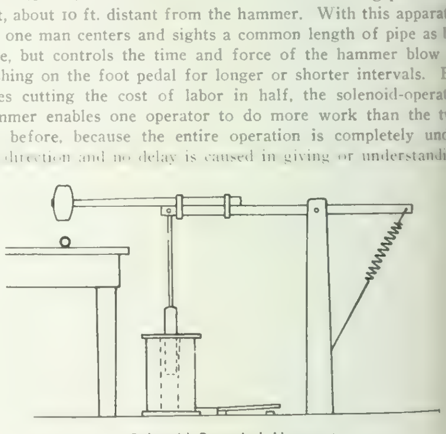
INCREASING THE OUTPUT OF A WATER POWER INSTALLATION.

In a water-power plant installed four years ago a 3090-hp turbine was placed in service under an average head of 163 ft. The water contained fine silt held in suspension and in a few months it was found that the silt acted like the finest emery powder upon the gates and runners, so that the output of the wheel in less than four years was cut down to about 1100 hp. It recently became necessary to install a new wheel, and in spite of the comparatively low head it was decided to utilize the impulse type of prime mover in order to escape the deleterious action of the silt. The generator was designed in the original installation for 200 r.p.m., and in order to obtain the requisite power at such low head and low velocity it was necessary to make up the deficiency in the ideal diameter of the runners and use more runners than would be required in a normal installation. In the unit now in service the wheel is of the Pelton type with six runners on a shaft 32 ft. long, each runner being provided with water by two nozzles leading from a common header. The lower nozzle is plain and impinges the water in a horizontal direction, the other nozzle being set on top of the runner and pointed slightly backward, the regulation being accomplished by a needle valve. The governing is done by balanced deflectors, one of which deflects the stream from each nozzle. These deflectors are so designed that the deflector over the needle nozzle comes into action first and after the deflector is well into the stream the larger deflectors on the lower or horizontal nozzles come into action. The deflectors are governed by a Lombard water-wheel governor equipment. The load on the wheel is fluctuating, often varying from 400 kw to 1600 kw in thirty seconds or less, but at no time has the speed of the wheel varied more than 2.5 r.p.m. in each direction. On account of the great length and size of the wheel it was necessary to enlarge the building to accommodate it. A concrete casing was used to inclose the greater part of the wheel in place of steel which made its operation less noisy and also lowered the cost of installation. The switchboard was raised to the level of the wheel top, making operation much more convenient in view of the frequent adjustment required to secure good efficiency during low-water periods.

Boston, Mass. K. S. Howard.

SOLENOID OPERATED SLEDGEHAMMER FOR STRAIGHTENING PIPE

A large Western manufacturing concern which uses large quantities of common iron pipe, 0.5 in. to 2 in. in diameter has installed a number of solenoid-operated sledgehammers to straighten the pipe before utilizing it for structural purposes in its manufactured products. This process of straightening a piece of pipe was formerly carried out by two laborers, one to sight along the line of the pipe and turn it to bring the bends upward and the other to swing the sledge, striking the pipe on the flat table, under the direction of the first man. The second man has now been superseded by an electrical machine which does the work better and more accurately. As shown in the accompanying sketch, the "electrical Dago" (which is the local name for the device) comprises a pivotally mounted sledgehammer to which is connected the loose iron core of a powerful "sucking" solenoid. The head of the hammer is suitably centered over the pipe-straightening channel on the table and a pair of wires is carried back from the solenoid to a long pedal contact, about 10 ft. distant from the hammer. With this apparatus the one man centers and sights a common length of pipe as before, but controls the time and force of the hammer blow by pushing on the foot pedal for longer or shorter intervals. Besides cutting the cost of labor in half, the solenoid-operated hammer enables one operator to do more work than the two did before, because the entire operation is completely under his direction and no delay is caused in giving or understanding



Solenoid-Operated Hammer.

instructions. The solenoid used measures about 1 ft. in length and 8 in. in diameter, and on closed circuit takes from 10 amp to 15 amp. A common sledgehammer is used, strapped to the pivoted beam as shown, and the back-stroke is controlled by the spring attached to the far end of the beam.

Chicago. Edward Han[illegible]

THEATER DIMMERS

In the answer to C. H. G.'s inquiry in the November issue of the *Electrical World*, about the construction of a choke coil for use as a theater dimmer, I think you did not make clear to the questioner that inductive devices are little or not at all employed for dimming purposes in modern theater installations. The difficulty of avoiding the frequency hum and getting abso-

lutely noiseless operation, which is frequently so important in theatrical scenic effects—to say nothing of the greater cost of such an impedance coil [illegible] has put the choke coil practically aside as a stage-controlling device. Since most of the scenes during which the dimmers are used are comparatively short in duration, the loss of energy dissipated in the resistors is small and negligible, considering the superior adjustment and operation of the rheostatic device over the impedance coil or auto transformer. In several instances where continuous dimming service is required, as in church lighting, resistances have been used rather than impedances.

[illegible] J. B. [illegible]

A PERPLEXING METER PROBLEM.

A meter on a residence service in a small town after running accurately for several months began to register backward. The meter was removed, but the new one set in its place also gave negative readings. Moreover, a shop test of the old meter

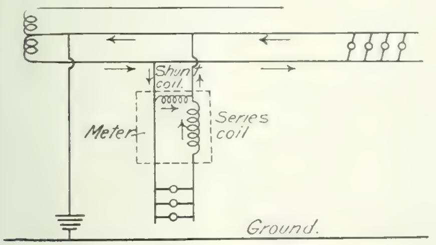


Fig. 1—Connections with Meter Rotating Forward

showed it to be correct. Repeated rough tests of the new one in service indicated nothing wrong and the mystery was deepening when on one occasion while examining the meter the disk suddenly began to turn backward at a rapid rate. Investigation showed reverse rotation took place whenever a kitchen lamp hung on a combination chandelier was lighted. On dropping the canopy the fixture was found to be hung without an insulating joint and when it was taken apart a bare place in the wire at a taped splice was found in contact with the gas pipe. Why the meter went backward puzzled every one to

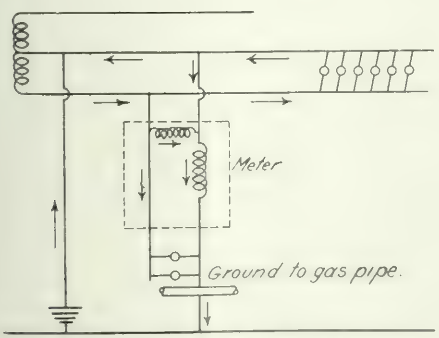


Fig. 2—Connections with Meter Rotating Backward.

whom the problem was presented for solution until the locations of the transformer, gas pipes and neighboring services were taken into consideration. The transformer was about two blocks distant from the residence in which the trouble occurred, and several other residences were supplied from it. The three-wire system of distribution with the neutral grounded to a water pipe was employed. The solution arrived at is best explained by reference to the accompanying sketches. With the normal instantaneous directions of the current, as shown in Fig. 1, the currents in the two meter coils are assumed to be in such relative directions as to cause the meter to rotate forward. Fig. 2 shows the directions which the current most probably took with the house wire grounded to the fixture. The two grounds together with the water and gas pipes and the house wires served as an auxiliary return to the transformer for the current from the several houses on the circuit. The current returning from the other services by way of this parallel circuit passed into the house with the defective fixture in a direction opposite to the normal current and, of course, gave the meter a reverse direction of rotation. Had the meter been connected properly—that is, with the series coil in the outside wire—the ground would have had practically no effect on the meter.

[illegible] Carl [illegible]

STARTING A SPLIT POLE ROTARY CONVERTER.

In an article in your first issue for November Mr. W. R. Sherwood describes the starting of a rotary converter from the alternating-current side in terms that are apt to leave the wrong impression. He says: "Then the other two starting switches are closed successively, allowing time between the closing of each for the rotary to pick up speed, and when the last one is closed the rotary is running on full voltage and in synchronism and is ready for service." Strange to say, the author made this comment immediately after describing the "synchronizing" of the machine on the first starting tap. Attention should be directed to the point that the use of several taps in starting is not to bring the machine "up to speed" in successive steps, but to minimize the starting current. Unlike an induction motor, a rotary converter in starting is always unloaded and it will accelerate to full speed if it starts at all.

In the plant with which the writer is connected there are two 1000-kw rotary converters of the split-pole type fitted with the usual squirrel-cage winding on the pole-pieces for starting from the alternating-current side. One machine is started by means of a two-point auto-transformer and the other is provided with a small switchboard mounted in front of the transformers located near the machine. Use is made of two low-tension switches giving about one-third voltage for starting. The operation of starting is as follows:

With the switches in the starting position, the high-tension alternating-current oil switch is closed. The rotary converter accelerates to full speed and the "break-up" field-circuit switch is closed in the running position. A voltmeter on the panel shows whether it has "come in right"—it can generally be "caught" by watching the voltmeter and closing the field-circuit switch at a positive reading. Should it be reversed, however, the switch is left in this position, thus holding the rotary in step, although reversed, and the right-hand double-throw switch on the panel is thrown down, thereby putting two-thirds voltage on the machine; then this operation is repeated with the left-hand one, giving full voltage. Bad arcing would occur if an attempt were made to throw these switches with the machine running as an induction motor, as a heavy current of low power-factor exists. However, with the machine in synchronism the current decreases to a small value. The field-circuit switch may now be thrown down momentarily and the polarity of the machine reversed. The "break-up" switch for the split-pole windings is now closed. Going to the operating switchboard the main field current is adjusted for unity power-factor, the main split-field-circuit switch is closed and the excitation is adjusted until the voltage equals the line value, when the machine is thrown on the buses. The load is raised by means of the "regulating" (split-pole) field.

I think this will make clearer the starting of a rotary from the alternating-current end. The other details of operation for a split-pole rotary were given as these machines are still a curiosity in many places.

[illegible] A. R. Haynes.

QUESTIONS AND ANSWERS

I wish to build a [illegible] transformer [illegible] from 110 volts to 25 volts and deliver about [illegible]. What size [illegible] wire should be used? How much iron should be in the core? H. J. H.

The primary could be wound with 110 turns of No. 12 double-cotton-covered wire properly insulated between layers and the secondary with twenty-five turns of No. 6 double-cotton-covered wire similarly insulated. The core, if built of fairly good iron sheets about 0.014 in. thick, should have a cross-section of about 10 sq. in. If a poor grade of iron is used the cross-section should be increased, while if the best grade of silicon steel is used the cross-section can be reduced to 6 sq. in. Each coil should be separately wound and separately insulated.

It is practicable to construct a series instrument transformer for use with a portable ammeter in such a manner that it can be inserted in the middle of a line? It is desirable to make use of a transformer that can be clamped around a leg of the circuit instead of being slipped on over the lead. R. D. C.

A transformer constructed as here indicated could be used with satisfactory results provided that the instrument were properly calibrated and that sufficient care were exercised when clamping the transformer in place. For a high degree of accuracy it is essential to keep the reluctance of the magnetic path at a low value and magnetic leakage should be minimized. High magnetic reluctance means proportionately large magnetizing current and hence incorrect current ratio. If possible to do so, it would be preferable to build the portable series transformer around a short length of conductor so arranged that it may be clamped to the lead as a shunt to a disconnecting switch which may be opened while readings are being taken on the ammeter.

I am redesigning a 0.07-hp direct-current motor with a two-pole laminated field core into an alternating-current motor of the repulsion type for operation at 110 volts. I have obtained very good results but am troubled with excessive sparking. Cannot the sparking be reduced by doubling the number of segments in the commutator, the slots in the armature remaining the same? What effect has the size of the winding of the armature upon the starting torque? R. O. S. A.

Neglecting the short-circuiting at the brushes, which produces the sparking, the performance of the plain repulsion motor is independent of the number of turns on the armature, provided only that the same amount of copper is used in each case. So far as concerns the commutating conditions it is desirable to use as large a number of commutator segments as possible and the fewest possible number of turns per segment. With a given motor frame the best results will be obtained when there is only one armature coil per commutator segment. One, two or even more coils can be used per armature slot. The commutator should be rather long so that the brushes need not be too wide.

What size wire should be used with a 50-hp, three-phase, 440-volt motor, the power-factor of which is 0.88 and the efficiency 0.90 at full load? The distance from the point of supply to the motor is 125 ft. C. G. W.

With 50 hp output at an efficiency of 0.90 per cent the input would be 55.5 hp, or 41.5 kw; at a power-factor of 88 per cent the apparent input would be 47.5 kw. At 440 volts the "equivalent single-phase current" would be 107 amp and the current per wire $107 \div 1.73 = 62$ amp. The National Electrical Code calls for a wire not smaller than No. 4 for this current. This wire has an area of 41,742 circ. mils and a resistance of 0.030 ohm per 100 ft. With 62.0 amp and a distance of 125 ft. the "resistance loss" would be 2.33 volts, which is 0.91 per cent of the e.m.f. to the neutral point, namely, 254 volts. The regulation would be satisfactory and the loss not excessive with this arrangement. Obviously a lessened loss with improved regulation could be obtained by using larger wire. The loss would be 0.355 per cent if use were made of No. 0 wire having an area of 105,592 circ. mils.

Would any trouble be experienced from inductive effects by drawing in two or more lead-covered cables into the same duct, each cable being the lead and return of a single-phase circuit operating at 2200 volts and a frequency of 60 cycles? Under what conditions would trouble be experienced in making use of steel conduit? It is proposed to run several steel ducts parallel and in actual contact with each other, each duct carrying a circuit as described above. B. C.

No trouble should be expected from using the lead covering of cables in the same conduit as the return circuit for the current in the conductors of the cables when single-phase current is used. In making the above statement it is assumed that the currents in the separate cables are obtained from the same single-phase system and are not derived from the separate phases of a polyphase system. On account of the inductive effects it is not advisable to place the outgoing and the return conductors of a single-phase circuit in separate iron conduits. However, trouble need not be expected from using single outgoing conductors in separate iron conduits used jointly as the return circuit provided the outgoing currents in the separate conductors are always in the same direction and not reversed. To sum up the above statements, it may be said that when one side of the single-phase system is completely grounded throughout all of the circuits it is permissible to use lead covering of cables, steel covering of conduit or any metallic material for the ground circuit. Care must be exercised, however, that only one side of the system is grounded, even when the separate parts of the system obtain their energies through different transformers.

A compensated repulsion motor operating at synchronous speed is said to exhibit zero voltage at all points along the commutator, which is short-circuited in one direction. Such being the case, why does not the machine more nearly resemble the single-phase induction motor with reference to its excitation? The latter motor consumes a certain amount of lagging wattless volt-amperes, and hence operates at all times at a low power-factor, while the former machine is said to operate at practically unity power-factor at synchronous speed. A. F.

It is not proper to assume that the performance of the compensated repulsion motor at synchronous speed is the same as that of an ordinary single-phase induction motor at the same speed, on account of the fact that all of the exciting volt-amperes for the single-phase induction motor are supplied in the primary circuit, while in a compensated repulsion motor the excitation at synchronous speed is supplied exclusively in the armature circuit. Tests have showed that the transformer circuit is composed almost exclusively of an apparent resistance, while the armature circuit represents almost exclusively an apparent reactance. At synchronous speed the apparent reactance of the armature reduces to zero, the total impedance of the motor circuits being confined almost exclusively to the transformer circuit, which consists almost wholly of apparent resistance. At synchronous speed the armature voltage in all directions reduces to zero. However, the magnetism has a very definite value, such as to produce the total counter e.m.f. in the transformer coil. This magnetism revolves synchronously with the armature. It is the motion of the armature conductors synchronously with the flux which causes the e.m.f. to reach zero value at synchronous speed. The current through the main armature circuit is just sufficient to produce this amount of field magnetism (alternating—not revolving) in line with the main brushes. The current in the short-circuit armature path is composed of two components, one of which is exactly equal to the current in the main armature circuit, but in time quadrature therewith, its value being such as to produce the (alternating—not revolving) flux in line with the short-circuited brushes so that no current whatsoever is needed in the transformer coil for the production of this flux. The two alternating fluxes in time and space quadrature combine to produce the revolving field.

Central Station

Management, Policies and Commercial Methods

WIRED HOUSES IN ST. PAUL, MINN.

From an estimate made by the commercial department of the St. Paul (Minn.) Edison Light & Power Company based on a study of electrical conditions in the city begun some time ago between 2000 and 2500 of the residences there are wired for electric light out of the 20,000 residential buildings which house St. Paul's population of 215,000. The city is spread over a territory unusual for this population, the corporate limits including fifty-nine square miles in area. Of the new houses built within the last year 35 per cent have been wired for electricity.

LARGE MOTORS REPLACE ENGINES IN MINNEAPOLIS FLOUR MILLS.

A number of large induction motors, ranging from 800 hp to 500 hp in rating, have recently been installed in the great flour mills at Minneapolis, to take the place of individual engine units formerly employed in the various buildings. Modern turbine-alternator steam plants have been completed by two of the milling companies to supply energy to these large motors, which are usually rope-connected to the shafts formerly driven by the engines. The mills also purchase energy from the St. Anthony Falls Water Power Company, which has a development in the Mississippi River opposite the milling district of Minneapolis.

OW-VOLTAGE TUNGSTEN SIGN HAS BURNED NEARLY 3500 HOURS.

The first low-voltage tungsten-lamp sign installed in Minneapolis, which was one of the pioneer cities to use these display illuminants, is still burning nightly after having operated continuously, five hours each night, from Feb. 2, 1909, to present time, a total of nearly 3500 hours. During this ne only one lamp has been replaced out of the total number 154, which are arranged in eleven series groups of fourteen mps in multiple each. For the purpose of repainting the sign lamps were recently removed by the workmen and restored ain without the loss of a single lamp, although no instructions had been given to the painters to use special care in ndling the lamps.

LACING AN IRON WITH EACH METER INSTALLED.

The battle of placing an electric iron in domestic service is lf won after the iron is once safely in the house and the wife's natural suspicion and curiosity are overcome by tting her to try it. A Wisconsin central-station company tes its customers in the right way, from the beginning of business relations with them, by having its meter setters rry irons to the new consumers' residences, leaving these on irty days' approval, which may be extended for an equal riod if desired. Most of the irons placed in this way remain the customer's property. In the town of 15,000, 300 irons ve been placed in this way already this year, without emying other solicitors. The company makes free minor reirs and replacements on irons brought into its office, but does t encourage this service, giving each customer the impression at his own case has received special and unusual attention.

ELECTRIC TRUCK GARAGE IN ST. LOUIS.

What is said to be the only garage exclusively for electric trucks outside of New York has been opened at Twentieth and Locust Streets, St. Louis, by the Union Electric Light & Power Company. The experience of the company with its garage for electric pleasure vehicles has been highly satisfactory, and it is said that the number of vehicles of this class in St. Louis has grown from 11 to 375 in four years. The number of electric trucks in that city is placed at 150. The central-station company is convinced that electric trucking is more economical than horse service, and its commercial engineers are prepared to give comparative estimates on trucking as applied to any kind of business.

ELECTRIC VEHICLES IN DULUTH, MINN.

In spite of the heavy grades ascending the bluffs surrounding Duluth, the thirty or more electric vehicles in use in that city give their owners the best of service. The Duluth Edison Electric Company has made a special rate to owners of electric automobiles charging their cars in their own garages. For this purpose a separate meter is installed, and a charge made of 5 cents per kw-hour for all energy consumed, with a minimum bill of $4 per month. The company's distribution lines are all alternating current, and to those requiring converting apparatus it offers to furnish and install an automobile mercury-arc charging outfit complete for $212. The rate for "boarding" a car at the public garages in Duluth is $25 a month, including care and delivery.

LARGE MOTOR-DRIVEN PUMPS FOR MINNEAPOLIS WATER-WORKS.

The City of Minneapolis is preparing to install two 1200-hp motor-driven centrifugal pumps in the municipal water-works pumping station on the Mississippi River, five miles north of the city, each pump to deliver 20,000,000 gal. per day to a 50,000,000-gal. reservoir 247 ft. above the intake. Tenders have been asked and received for these first two units, which will be installed at once, and later the motor-driven pumping capacity of the station may be increased to 4800 hp by duplicating the original installation. The Minneapolis General Electric Company has offered to supply electrical energy for the pumping service from its Taylor's Falls hydroelectric plant at the rate of $3.63 for each million gallons pumped.

The city's specifications for the first two 1200-hp pumping units, as prepared by Mr. E. P. Burch, its consulting engineer, describe two-stage, horizontal, centrifugal pumps, each capable of delivering 20,000,000 gal. per 24 hours against a combined hydrostatic and friction head equivalent to 275 ft. and driven at 590 r.p.m. by 1200-hp, 2300-volt, 60-cycle, three-phase induction motors. From motor terminals to pump delivery the units will be required to show a combined hydroelectric efficiency of at least 75 per cent, while in the hope of obtaining still greater efficiency a substantial bonus is offered for each per cent by which this figure is exceeded.

The City of Minneapolis recently appropriated $600 to be expended on tests of an electrolytic system of water purification, in which it is proposed to reduce the number of bacteria existing in the water by traversing it with direct current at 600 volts.

STREET LIGHTING IN FALCONER, N. Y.

The board of trustees of Falconer, N. Y., has accepted the proposition of Mr. Fred Sprague, proprietor of the Falconer electric lighting plant, to furnish an improved street-lighting system. The new equipment will consist of 150 25-watt tungsten lamps, supplied and operated at a cost of $13 per annum for each lamp. This makes a total cost of $1,950 per year, compared with $1,600 which the village now pays, but the present service is by 16-cp carbon lamps and the system is said to be in poor condition. Mr. Sprague also agrees to furnish a cluster of four 60-watt tungsten lamps at the center of the village and to make no charge for this service. He agrees further to allow the village $4 a month for electricity consumed in the village hall. A meter will be installed in this building and if the monthly reading does not amount to $4 in value there will be no charge. Over $4 worth the village will pay at the rate of 5 cents a kw-hour. In installing the new lamps the overhead-line construction will be greatly improved. At present Mr. Sprague buys electrical energy from the Jamestown (N. Y.) Lighting & Power Company, but he is considering the possibility of building a plant to replace the one in Falconer, which was destroyed by fire some time ago.

MUNICIPAL PLANT SEEKING COMMERCIAL DEVELOPMENT BY CONTRACT.

Jamestown, N. Y., has a municipal electric lighting plant and it has recently entered into a contract with the Alliance Development Company by which the latter will undertake to increase the sale of electrical energy supplied by the plant for commercial purposes. The contract provides substantially that the soliciting company is to receive the first month's receipts from any new commercial customers secured and also 25 per cent of the receipts during the next three months. It is provided that all the business secured must be satisfactory to the electric light commissioners—that is, good profit-paying business.

In the meantime there are many complaints of the poor service rendered by the municipal plant in lighting the streets. For instance, on the last Hallowe'en night, Oct. 31, when there was particular need for street illumination owing to the pranks of mischievous boys, the whole city was in darkness for nearly an hour in the early evening because of some trouble at the plant. It is not strange that the Jamestown *Morning Post* declares that "It is high time that the board of lighting commissioners investigate the failure of the city lighting plant properly to illuminate the streets."

IMPROVED BOULEVARD LIGHTING AT NEWTON, MASS.

The Edison Electric Illuminating Company of Boston has completed an installation of 6.6-amp magnetite lamps on the boulevards of the City of Newton, superseding alternating-current inclosed arcs of about 400 cp nominal rating. Automobilists entering and leaving Boston by the Commonwealth & Brighton Avenue routes now have the advantage of driving on one of the best illuminated motor boulevards in the country, there being a continuous line of magnetite lamps now in service from the center of Boston to West Newton and Norumbega Park, Auburndale, a distance of about ten miles, half of which is within the Newton city limits. The lamps have been placed in the middle of the grassed reservations, but are turned to give a maximum illumination upon the portion of the roadway which is devoted to motor cars. About 107 new magnetite lamps have been installed in Newton and approximately 1500 tungsten lamps of the 40-watt size have been placed in service elsewhere in the city, superseding either [illegible] widely scattered or carbon incandescents of inferior power. All the dark corners of the highways crossing the railroad bridges have been provided with tungsten lamps. The arc lamps burn on an all-night schedule, but the incandescents are still operated on a 12:30 a. m. basis. The Edison company has offered to operate these on an all-night schedule for about $4,700 more per year than the present price. In spite of the great improvement in the lighting of the two main boulevards, the cost to the City of Newton will not be greater than under the old system. The new installation borders the electric railway lines throughout its entire length.

ELECTRIC TRUCKS IN NEW ENGLAND GAS AND COKE PLANT.

Three electric trucks which have been in service for several months in the plant of the New England Gas & Coke Company at Everett, Mass., show the possibilities of electric fuel delivery within a radius of eight miles of a large manufacturing installation. Each truck is of three tons capacity and was supplied by the General Vehicle Company. In August, 1910, the three trucks worked every day and showed for 81 truck-days a total of 779 hours 35 minutes time, with a total loss time due to troubles of only 9 hours 40 minutes, or about 98.7 per cent efficiency. The average daily mileage was 32.9 per truck and the average of the distance out and return was 4.3 miles. The average number of trips per truck per day was 3.9 and the average load carried per truck per day was 23,189 lb. Each truck is provided with two batteries and a change can be made in four minutes at the company's garage. The average run on the first battery was 18.7 miles and on the second 17.9 miles per truck per day. The trucks are provided with three compartments each and are equipped with motor-driven winches by which the bodies are raised for gravity delivery. It is estimated that the saving over the cost of horse delivery is about 42 per cent, including all charges.

CONTROLLED FLAT-RATE LIGHTING AT SUPERIOR, WIS.

The Superior Water, Light & Power Company, which retails hydroelectric energy purchased from the Great Northern Power Company, of Duluth, for resale among lighting and motor customers in Superior, Wis., offers a controlled flat rate to those residential consumers who desire to use a certain number of lamps without restrictions, paying a fixed sum each month. The rate charged is 1 cent per month per watt of connected lamp demand, the minimum controller setting being four 25-watt tungsten lamps, for which the monthly cost would be $1. The maximum rate under this schedule is $3 for 300 watts connected demand.

This flat-rate offer has now been in effect for about a month and more than 100 consumers have adopted it, the majority of these changing from the metered schedule, at which energy is charged for at 10 cents per kw-hour, with a minimum of 5 cents per 55-watt lamp per month. Since a number of consumers had small monthly bills averaging 75 cents or more a month, it was desirable to change these over to the flat-rate $1 minimum schedule. Many were attracted by the offer of unlimited hours of burning, but some have made the mistake of contracting for too little demand and so embarrass themselves with interruptions during short periods when they exceed the rated demand. Six 25-watt tungsten lamps is the average controller setting contracted for. Electric irons are connected in behind the controller at a flat rate of 60 cents per month, allowing unlimited use, and in case of social affairs the company offers to disconnect the controller for 50 cents an evening, the fee charged merely covering the cost of labor for resetting the controller.

RESIDENCE LIGHTING IN TORONTO.

In the City of Toronto there are a great many houses com[pl]etely wired, but in which the electric light is not used owing [to] certain peculiar conditions applying in that city. In Toronto [a h]ouse is sold or rented without fixtures, wall paper, interior [fu]rnishings and other conveniences always provided in the typi[ca]l American city. All houses that are built in the newer or [ou]tlying districts of the city are wired for electricity, but com[in]g from an old house to a new one the tenant invariably [bri]ngs along his gas fixtures, and as many of the houses are [pip]ed for gas it is a simple matter to place the old fixtures in [the] new house.

To expedite the work of the salesman the Toronto Electric [Li]ght Company has maps made showing the houses that are [wir]ed and using electricity, those wired but not using, and those [usi]ng gas exclusively, and also the factories that are using [ele]ctricity, gas or steam power. The canvasser takes from the [ma]p the houses that are wired but not connected and solicits [the] occupants for business, thereby saving time and assisting [ver]y materially in finding the "shortest line between two points." [It] is assumed that it is easier to induce a man to buy fix[tur]es for a house that is wired than it is to secure a wiring [and] fixture order combined. The maps are kept up to date and [hav]e been found of great assistance.

[US]ES FOR ELECTRIC FANS THE YEAR AROUND.

[On]e central-station company operating in southern Illinois [is pu]shing its fan campaign into the fall and winter months. [Wit]h the aid of the following advertisement it shows how [usef]ul a fan can be even if the weather is not warm. In ex[plan]ation of the third paragraph it may be said that the com[pan]y is situated in a latitude where houses with basements are [com]paratively rare and consequently the lower rooms particu[larly] are very uncomfortable whenever unusually cold winter [wea]ther strikes the community. This condition applies to a [cons]iderable number of houses between the latitudes of St. [Loui]s and Memphis.

[OTH]ER USES FOR ELECTRIC FANS—YOU NEED THEM THE YEAR ROUND.

[1.] To keep frost from your store windows in winter. Blow [air a]gainst the window panes and no frost can collect.

[2.] To keep flies from entering your store. Especially needed [in c]ool fall weather. Blow air against the screen door en[tran]ces and flies will not light on the screen. Consequently a [swarm] of flies will not enter every time the screen door is [opened].

[3.] To keep you from cold floors and cold feet in winter. [If y]ou live in a house without basement, you know how un[comf]ortable it can be because of cold floors in winter weather. [Set a]n electric fan on the floor in one corner of the room and [poin]t it upward so as to blow air up along the walls in the [corne]r. This will draw the cold air away from the floor and [the] warm air down to take its place. The layer of cold air [alon]g the floor will disappear.

[4.] To heat up your steam-heated office more quickly on winter [mor]nings. Set your fan in front of the radiator with the [fan p]ointed up so as to blow air up through the radiator. The [rapid] circulation of air will bring your office up to comfortable [temp]erature in a small fraction of the time which would other[wise] be required.

[5.] To help your hot-air furnace heat the house more quickly [on w]inter mornings or to force air to rooms that are hard to [heat] on the windward side of the house. Let us put a special [fan m]otor in the cool-air intake of your furnace to force air to [th]e rooms of your house. If the house cools down during [the n]ight, you can bring it up to comfortable temperature very [quick]ly in this way in fact, in about ... the time that would be required if you did not use a fan. If you have some rooms which are hard to heat when the wind is blowing on their side of the house, you can heat them positively and satisfactorily in this way.

6. To dry your hair after a shampoo. Ladies especially appreciate this.

WELCOME ARCH AT MUSKOGEE.

The Muskogee Gas & Electric Company recently presented to the City of Muskogee, Okla., the arch shown in the accompanying illustration, with the understanding that the municipality would keep it illuminated for a period of years. As can be seen, it is of very substatial construction, and is built entirely of steel. It contains 1500 4-cp tungsten lamps. The letters in the word "Welcome" are 8 ft. high and those in the word

Electric Welcome Arch at Muskogee.

"Muskogee" 6 ft. high. The arch is 90 ft. wide and the top is 55 ft. from the pavement. The supporting columns are capped by devices representing flaming torches, operated by the usual flashing arrangement. The sign is double-faced and stands on a principal street leading from the Missouri, Kansas & Texas Railroad depot to the business district. This arch is by far the finest thing of its kind in the Southwest, and as a result has, of course, created favorable publicity and is a good thing both for the city and for the Muskogee Gas & Electric Company. This is one of the companies under control of H. M. Byllesby & Company.

PUBLIC-SERVICE PUBLICITY.

By C. W. L[EE].

The abandonment of the time-worn "public be damned" attitude of public-service corporations could have no better illustration than is found in the growing use of the newspapers by the public utilities for the purpose of placing their side of debatable questions before the people. It is significant of the extent to which the advisability and even necessity of properly conducted newspaper publicity have taken hold of the minds of utility managers that the past few years have developed men and corporations who make a specialty of showing the company's viewpoint to the people it serves.

It is conceded that the old-time publicity methods, which consisted to a great extent of the subsidized publication of so-called "news stories," have become ineffective and, in many instances, positively dangerous to the interests of the utilities. What may be termed inspired news is always recognizable and always reacts upon the company or individual inspiring it. Publicity men realize this fact and have departed from these obsolete methods. The new idea involves the publication in all newspapers of a city of display advertisements written by men of broad experience in the newspaper and public-service fields. These advertisements are numbered consecutively and

tell the utility company's story fully and frankly, bringing out each point in its logical sequence. Obviously this advertising matter must be well written and the typographical display must be somewhat out of the ordinary in order to attract the reader. Given these conditions, publicity men have found that the company never fails to hold the public attention and interest to the end.

There can be no question about the advantages of the modern method over the old. In the first place, by paying for its advertising space the utility company is in a position to say just what it chooses and is responsible for what it says. Then,

Gas Light Talks---No. 20.

A Ruinous System.

Overlooking the slight digression in yesterday's Talk, we shall return—for the time being, anyway—to the subject of municipally-owned lighting plants.

The great argument advanced in favor of municipal plants is that of cheaper rates. But we told you on Saturday, that these so-called cheaper rates were deceptive—

And that the tax-payer pays twice and even three and four times, for his service.

We demonstrated how this worked out and, in subsequent Talks, we shall go deeper into the matter.

Now, there is a common belief that privately-owned corporations charge "all that the service will stand." Let us look into that:—

Out of 56 electric companies in Massachussetts, according to a recent report, 24 failed to pay any dividends, four paid less than six per cent., 16 paid between six and eight per cent., and only nine paid over eight per cent.

We have told you that this company has paid no dividends in fifteen years, but has put its earnings into improvements and extensions **for the benefit of the city and the public service.**

A private plant can be operated more cheaply than a municipal plant.

You see, there is needed a combination of skill and experience in the operation of a gas or an electric plant. **Without this combination no plant can be made profitable.**

Now, a private plant secures this combination. It must. But a municipal plant **DOES NOT.**

The reason is that politics invariably enter into the operation of a municipal plant.

Of course, it is always intended to keep a plant out of politics, but somebody has a friend that must be taken care of and—

Sooner or later the entire plant is being run by "friends."

Municipal appointees to this kind of office are seldom capable men, and with very good reason.

The tenure of office is so short that it does not attract competent engineers and the inexperienced political appointees have no time to acquire even an elementary knowledge of the work they are supposed to do.

The result is ruinous alike to the city and the service.

(The above was written and in type before last night's meeting of the City Council [illegible] the ordinance providing for the [illegible] of the city for the purpose of establishing a lighting plant was withdrawn.)

Maysville Gas Co,

Horace J. Cochran, President.

A Newspaper Advertisement for the Maysville Gas Company.

again, and this is a most important point, the very fact that the company is paying for the space it uses and is doing its own talking makes for public confidence—the most necessary requirement of a properly conducted and successful publicity campaign.

A recent demonstration of the wisdom of talking to the people through the medium of newspaper advertisements is found in the case of the Maysville Gas Company, of Maysville, Ky. The company, which also owns and operates an electric station, was having considerable trouble with its public and especially with the city administration. A remarkable fact is that the company's service, both gas and electric, was far beyond the average in cities the size of Maysville, not only in efficiency, but in the matter of rates. There was, however, a strong personal element to the controversy, having its origin in legal and political differences between the company's managers and the Mayor and certain members of the present and former city administrations. This was intensified to some extent by the attitude of the company, which went about its own business, within its rights, regardless of the administration's attitude. Matters were brought to a head, however, by the adoption by the City Council late in September of an ordinance providing for the establishment of a munici[pal] lighting plant. Then the company decided upon publicity, a[nd] the firm with which the writer is connected was engaged [to] conduct the campaign. A series of daily "Talks," one [of] which is reproduced in this article, was prepared by a repr[e]sentative on the ground and published in the Maysville dai[ly] papers. It is interesting to note that the ordinance, which w[as] to have been submitted to a vote of the people at the Nover[m]ber election, was rescinded by the Council exactly two wee[ks] after the commencement of the publicity campaign.

The company told the people facts not only about its ow[n] business but about the city administration. These facts we[re] presented in conservative language, but in a manner that le[ft] no doubt in the public mind as to their genuineness. Th[e] administration was absolutely overwhelmed and withdrew th[e] ordinance in the hope of stopping the publicity campaig[n]. The "Talks" were continued for a full period of sixty day[s], however, and at the termination of the campaign the com[pany's] position in the friendly regard of the public wa[s] assured and, in the minds of the better class of citizens, th[e] administration was discredited.

NEW-BUSINESS DISCUSSION AT ILLINOIS STAT[E] CONVENTION.

At the convention of the Illinois State Electric Associati[on] held at Rock Island Oct. 26 and 27 several papers were pr[e]sented on the subject of promoting new business.

Mr. T. P. Pinckard, new-business manager of the Peoria G[as] & Electric Company, took a rap at some of the new-busin[ess] methods which have been indulged in by some central-stati[on] companies the past few years. He advised new-business ma[n]agers to judge well their own condition and be slow to atten[pt] a solution of their troubles by way of the complicated rou[tes] laid out by some business managers. Some new-business [de]partment enthusiasts with all their card indexes and simi[lar] impedimenta seem intent on making a big job out of a little o[ne]. He criticised the continuous practice of putting out on fr[ee] trial such current-consuming devices as toasters and iro[ns]. Referring to the efficacy of an iron or a toaster campaign, [he] said that one central station recently boasted of a 42 per c[ent] sales factor as a result of a free-trial plan. This figure [did] not impress him as being nearly high enough to warrant [the] continuance of the campaign on the free-trial basis unless [the] article is being newly introduced. He would like to see a ca[re]ful comparison of the profit and loss items under a sale c[on]ducted on this basis (including the expenses incidental to [the] scheme and the depreciation of the 58 per cent returned in [dol]lars and cents) compared with the results of a direct and dig[ni]fied "sold-to-stay-sold" plan energetically pursued. It is [not] to be denied that special periodical sales bring excellent res[ults] and should be conducted.

While the object of maintaining a display-room where vari[ous] appliances are sold is to assist the company in making mo[ney], almost the first step the new-business department takes is [to] lose money on this feature, while a good, sustaining profit sh[ould] be secured on the goods sold, and Mr. Pinckard said his [ex]perience is that increased current consumption will not su[ffer] because of this policy.

Mr. Max Heiliger, assistant manager of the Rockford E[lec]tric Company, also read a paper on "How to Get New B[usi]ness," in which he said that in conducting a successful campa[ign] five cardinal points must be considered: Advertising, pers[onal] solicitation, courtesy, enthusiasm and service.

Under advertising, newspaper advertising is naturally [the] most important and gives the greatest returns for the am[ount] expended, but it must be handled in a judicious manner or [the] money thus spent will be worse than wasted. The copy m[ust] be carefully prepared and the writer must be careful to s[tick] to his subject, using few words and these right to the po[int].

e heading and the first line or two of the advertisement will read by practically every newspaper reader, and whether the t is read or not depends entirely on the care and skill used arranging these lines. There is, he said, a subtle flattery in a sonal letter which appeals to the average man and makes h a letter effective in a new-business campaign. He recommended inclosing manufacturers' circulars with bills, receipts other pieces of mail going out from the office.

f the field is not large enough to warrant employment of or more solicitors, the manager or superintendent should ote a specific amount of time every day to solicitation. failing courtesy should be shown under all circumstances regardless of irritating conditions. There should be prompt ntion to complaints, defective lamps, etc. Frequently an consumer has a little grievance which can be rooted out and usted in a short friendly call, but which if related to a friend neighbor will nullify the effect of many hours of earnest rts.

r. O. C. Macy, superintendent of the Alton Gas & Electric npany, also gave a paper on "Some New-Business Ideas." said that when he took hold in a town of somewhat less 20,000 population he found a general lack of confidence in reliability of electric service and a tendency among consum- to reduce bills with tungsten lamps rather than increase nination. The company went to work to take up with each umer the matter of improving conditions. The idea was nsult with the consumer and advise him as to how best to re the illumination he desired.

the case of a new hotel building considerable difficulty was rienced with the architect in getting a modern illumination nt, and the matter was taken up with the operating manager, would have the bills to pay after the hotel was finished. As sult the company was allowed to make suggestions as to ts, etc., which reduced the minimum bill paid by the hotel $63 to $34 per month. The company also went after ine-lighting plants successfully by planning the customer's lation.

the discussion Mr. R. M. Howard, of Washington, said ne knew of a flatiron campaign two years ago that cost the any $2 for each iron put out. He does not believe in giv- ne customer anything, as it is a reflection on the company's t Mr. S. B. Cushing, of Chicago, said that if a company fford to give free lamp renewals, it can also afford to h flatirons free. No appliance consumes more energy in rtion to its first cost than a flatiron. Mr. T. W. Gregory, st St. Louis, said that from 75 per cent to 98 per cent of lectric irons put out on trial remained in use.

John G. Learned, of the North Shore Electric Company, go, told of the efforts of his company to get the wiring sidences on the instalment payment plan, taking twenty- months for payment. A flatiron is included in the price of uch job of wiring. Of 200 houses so wired the average as $80 each. It is the practice of his company if flatirons t of order to renew them free of charge. He believes in ee trial of any device which does not depreciate with use es not believe in putting the electrical supply dealer out of ss by making a low price. He thought it a good plan for ors to call on old customers as well as new or prospective ners.

sident Smith asked whether it is wise to let a contractor own continue to make 25 per cent to 40 per cent profit on r jobs. Mr. N. M. Argabrite, of Belvidere, said that in his he company and contractors agreed on a certain set sched- prices, and as long as these prices are maintained the ny does not interfere. Mr. Frank J. Baker, of the North Electric Company, Chicago, recommended a seven-day rial for electric irons as being about the right length of One of the country members objected to such a short ecause, he said, people frequently have wash day only n two weeks in the country towns.

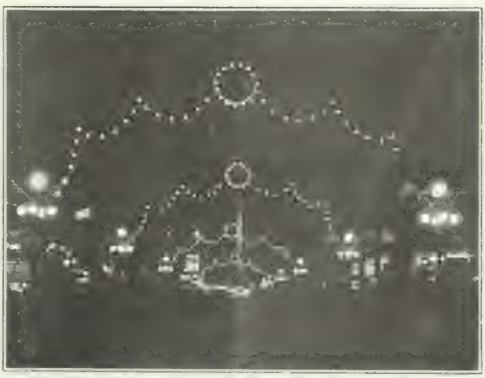
Argabrite said that he did not push electric irons in mber and December, for the reason that electric light bills are increasing in those months and the consumer is likely to blame the electric iron for large bills. Mr. Bass, of Farmington, said that from 90 per cent to 95 per cent of the electric irons put out on trial had paid. Mr. Pinckard said that he objected to the circus method sometimes used of taking out large quantities of irons on a wagon on trial. If the consumer comes into the office and asks for a free trial, the company will give it, although if he is met by a good salesman the salesman can sell him the iron outright usually then and there. Mr. Learned said that some of the circus methods Mr. Pinckard condemned had resulted in increased income.

Mr. E. W. Smith, of Kewanee, expressed the opinion that the iron would soon be such a staple article that there would be no need for putting it out on trial. Mr. L. D. Mathes, of Dubuque, Iowa, expressed the opinion that there was much "buncombe" in current "new-business" ideas. The man on the job is the important factor. He did not approve placing advertising matter in with bills, because when a man opens the letter he may see the advertising first and throw it in the waste-basket before he sees that a bill is also contained therein.

Wiring and Illumination

DECORATIVE FESTOON LIGHTING IN MINNESOTA TWIN CITIES.

Advocates of the curb standard or post arrangement of ornamental tungsten street lighting make the point against the arch system that when the transverse spans are installed the maximum effect is at once reached, so that it is impossible to add to the appearance of the street by any other form of decoration for special occasions. The post system is not subject to



Decorative Festoon Lighting from Tungsten Posts in St. Paul Minn.

this objection, for after the tungsten pillars are erected these lend themselves both artistically and electrically to the use of festoons or arches for gala lighting.

Minneapolis and St. Paul, Minn., have extensive systems of ornamental tungsten pillar lighting, but during the recent Conservation Congress conference at St. Paul both of the neighboring twin cities enhanced the night appearance of their downtown streets by hanging festoons of lamps from curb to curb, giving to the streets the appearance of tunnels of light.

The Minneapolis tungsten pillars are furnished with energy from the Edison three-wire system, alternate posts being fed from the two sides of the circuit to preserve a balanced condition. The other outer wire of the Edison system is also brought

p[illegible] a terminal block in the base of the post. [illegible] the festoon lighting permanent anchor-eyes are mounted in the walls of the buildings and the spans are slung and energized through loomed cables inserted through holes in the tops of the pillars and connected to the terminal blocks in the bases. The pillars thus provide a simple and convenient means of energy supply for the festoons, avoiding stringing bus lines along the faces of the building walls. For the special Conservation Conference illumination in Minneapolis eighty festoons were hung, each containing fifty 20-cp graphitized-filament lamps, half of each festoon, or twenty-five lamps, being supplied through the pillar at the base of the span. This special decorative lighting was held in position and illuminated during State Fair week at the expense of the merchants.

The sister city of St. Paul appropriated $6,000 to purchase and erect 150 festoons of the type shown in the illustration, each containing fifty-two 8-cp carbon lamps. These festoons were caught up at intervals by hangers producing a fluted outline, and at the center of the spans 4-ft. metal rings, each carrying sixteen lamps, were installed. The festoons and lamps are the property of the city, to be used on any appropriate public occasion, and the hollow rings studded with lamps were intended to provide niches for letters or designs relating to the occasions on which the festoons may be used. The energy to operate these lamps was paid for by the city and during fair week the merchants defrayed the cost of the lighting. These festoons were supplied with energy through wires connected to the post lighting, as was done in Minneapolis. The lamps, wire and cable are all public property and are stored in the City Hall awaiting the next occasion of public decoration.

PARK BOARD FURNISHED DOWNTOWN LIGHTING AT VIRGINIA, MINN.

From a decorative standpoint probably one of the most attractively lighted small-city public thoroughfares is Chestnut Street, Virginia, Minn., where the park board has just completed an installation of fifty tungsten lamp standards along five blocks of the business section. The population of Virginia is 10,000 and the cost of installing the lamp-posts was met from the fund for beautifying the little city which had accrued in the hands of the park board. The handsome iron posts of massive design are erected at 60-ft. intervals along each curb and each post carries four 60-watt lamps and one 100-watt tungsten lamp inclosed in frosted-glass balls. The 60-watt lamps are operated from dusk to midnight, the top 100-watt lamp on each post burning all night. For supplying the energy for this installation the Virginia Electric Power & Water Company receives $5.25 a month for each 340-watt post, the city making its own repairs and renewals. The cost of erecting the fifty posts, complete with underground construction, repaving, etc., [illegible]

Ornamental Tungsten Pillar Lighting, Chestnut Street, Virginia, Minn.

A SWITCHBOARD WIRING PIT.

By Edgar M. Thurber.

Wiring around switchboards in stations of small capacity not always as neatly and systematically installed as it mig be. Frequently the feeder conductors are brought to the boa from above and even if they are neatly arranged they obstru the light and constitute a lodging place for dust. Leads fro generators usually are carried in ducts beneath the station flo and rise to their lugs on the switchboard panels from belo This is a neat arrangement and it at once suggests to the smal station designer that, under favorable conditions, it is best bring all conductors to a switchboard from below rather th from above.

When circumstances are such that it is feasible to bri wiring to panels from below it can readily be arranged for buildings not having basements through the construction of "wiring pit" like that suggested in Fig. 1. The pit is excavat to a depth of from 4 ft. to 5 ft. at the time the building erected. It has, in the example shown, brick walls and a co

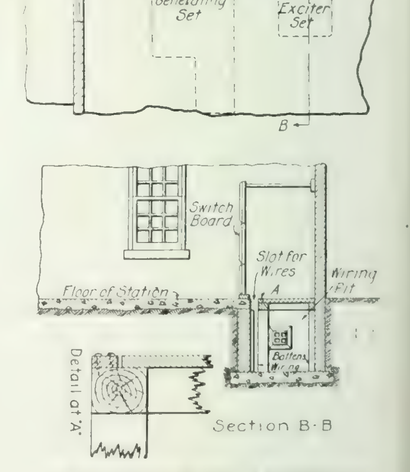


Fig. 1—Wiring Pit Back of Switchboard.

crete floor. In Fig. 1 the conductors from the generator the exciter sets are conveyed, in wrought-iron conduit, bene the floor, from the machine terminals to the wiring pit. F feeders (Fig. 2) enter the pit through vitrified undergro conduit and three more enter from above through vert wrought-iron conduits secured to the face of the station with pipe straps. Within the wiring pit all of the conduct are supported in porcelain cleats, held on wooden battens ranged on the pit walls, as illustrated in Fig. 3. The cl (see detail in Fig. 3) are of the single-wire, split type are clamped into position with wood screws. The battens secured to the pit walls with lag screws turning into woo plugs inserted in the brickwork.

A temporary floor, shown in Fig. 1, is provided over the It consists of sections of such size that they can be rea

andled. These sections are su[illegible] timber frame-ork (Fig. 1). A trapdoor is located in one corner, so that

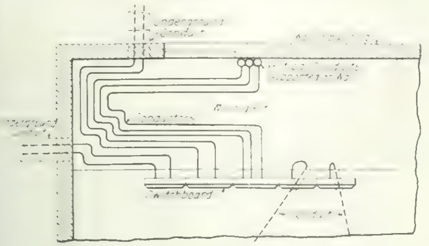


Fig. 2—Arrangement of Wiring in Pit.

e pit can be entered without the necessity of removing an itire floor section. A slot, extending the entire length of the t, at the side adjacent to the switchboard, permits the con-ictors to be carried vertically upward to their respective lugs 1 the panels. As indicated at detail "A", Fig. 1, a strip is iiled along the edge of the section-supporting timber to retain e floor sections in their proper locations.

In Fig. 4 is shown the method used in constructing the en-

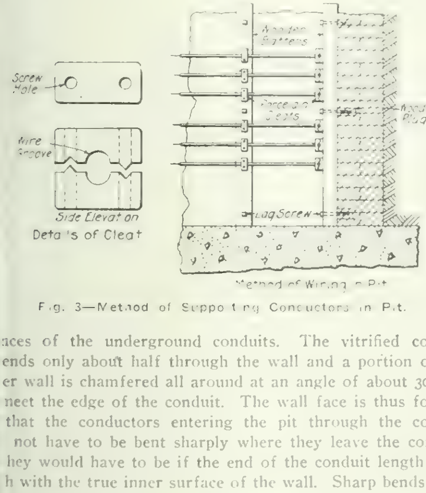


Fig. 3—Method of Supporting Conductors in Pit.

aces of the underground conduits. The vitrified conduit ends only about half through the wall and a portion of the er wall is chamfered all around at an angle of about 30 deg. neet the edge of the conduit. The wall face is thus formed that the conductors entering the pit through the conduit not have to be bent sharply where they leave the conduit, hey would have to be if the end of the conduit length were h with the true inner surface of the wall. Sharp bends must

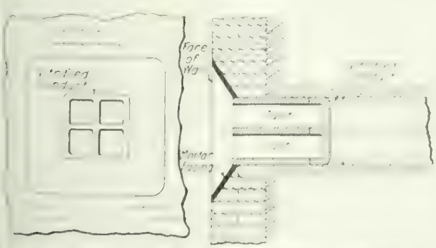


Fig. 4—Wall Face at Vitrified Conduit Entrance.

articularly avoided where lead-sheathed conductors are lved. Where the wrought-iron conduits conveying the rator and exciter leads enter the pit the wall is similarly sed, as detailed in Fig. 5.

arranging the wiring within the pit all conductors should arried around the walls, as shown in Fig. 2; none should ermitted to cross it, except at the ends. This procedure nvolve more copper than if the most direct route is selected in each case, but it will doubtless be the most economical in the long run, because it will insure ease of inspection and will leave practically the entire pit unobstructed. There should

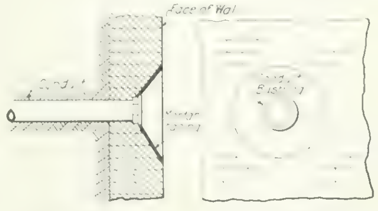


Fig. 5—Wall Face at Iron Conduit Entrance.

always be ample room in a pit for the wiremen and for the tackle used in drawing conductors into the conduits.

LETTER TO THE EDITOR.

The Design of Shunt Field Windings.

To the Editor of Electrical World:

SIR:—In Mr. Frank W. Merrill's article on "The Design of Shunt Field Windings" in your first issue of October an inexact formula appears to be deduced from an incomplete statement as to the effect of using two sizes of wire.

Taking the case of the addition of a smaller wire, if the given area A_1 is first filled by T_L turns of the large wire, then, adopting Mr. Merrill's symbols and the wires being assumed uninsulated as in Mr. Merrill's equations (1) and (2), the new total number of turns after the substitution of T_S turns of the small wire is

$$T_L \ \text{[illegible]}$$

$$= T_L\left(1 + \frac{T_S}{T_L}\ \text{[illegible]}\right)$$

The factor of change of the *turns* is, therefore, $1 + \frac{T_S}{T_L}$ [illegible]

but this is not the factor of change of the *ampere-turns.* For the same excitation the amperes will also have changed; they will be reduced and are now proportional to

$$\text{[illegible]}$$

instead of to $\frac{1}{T_L}$.

(The mean length of turn for the coil entirely wound with one size of wire is here also assumed to hold for each of the two portions—a condition which would exist if they were wound side by side to the full depth of the winding space.) The factor of change of the *amperes* is, therefore,

$$\text{[illegible]}$$

the factor of change of the *ampere-turns* is, then, the product of the two, and it is this which has to be equal to $\frac{1}{r}$, where [illegible] wires. Hence it follows that

$$\text{[illegible]}$$

a result which can be easily put to the test by actual trial.

If $D =$ the diameter of a wire when insulated and $d =$ the diameter [illegible] for small, large

and correct sizes, the true formula for equal mean length of turn is

$$T_S = T_L \cdot \frac{[illegible]}{[illegible]}$$

Lastly, if the small wire is wound below the large wire the varying length of the mean turn of the two portions forbids a simple solution which shall be rigorously true, but in practice it is only then necessary to remember that the above value for T_S is too small and that it should therefore be increased by about 10 per cent.

London, England. C. C. HAWKINS

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

[illegible]—A. SCHWAIGER.—The author investigates the gradual rise of the voltage at the terminals and of the exciting current of a self-exciting direct-current generator driven at constant speed when the excitation circuit of the machine is suddenly connected to the terminals of the armature or when the resistance of the excitation winding is suddenly changed. The author describes a graphical method giving the gradual rise of the voltage at the terminals and of the exciting current and states that the curves thus obtained agree well with curves obtained experimentally by means of an oscillograph. This is at least the case for machines with laminated poles. However, when the machine has solid poles the theoretical curves differ from those experimentally determined. This is due to the fact that the eddy currents in the iron are not taken into consideration in his theoretical method.—*Elek. u. Masch.* (Vienna), Oct. 30.

Maintaining Constant Voltage at Varying Speed.—E. SCHULZ.—An article on a method of keeping the voltage of a generator constant, while the speed varies, without the use of an automatic shunt regulator. The method requires the generator to be of liberal design, its magnetism curve to be practically a straight line within the limits of operation, and that a battery must be available and the generator be coupled with a small exciter. Let Z be the amp-turns required at lowest speed to produce normal voltage. With a straight-line magnetization curve the amp-turns required for double the lowest speed are $z = \frac{1}{2} Z$. The generator is provided with a double magnet winding, as shown in Fig. 1. The stronger of the two windings

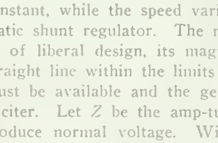


Fig. 1—Generator with Double Magnet Winding.

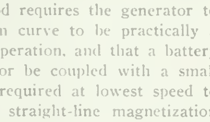


Fig. 2—Generator with Two Separate Magnet Windings.

is connected to the battery (x amp-turns, x being constant) and the smaller winding is fed with energy from the exciter. The magnet winding of the exciter is also connected to the battery. If the amp-turns of the second smaller magnet winding of the generator are y at lowest speed, they are $2y$ at double the lowest speed. The two magnet windings must be connected so as to oppose each other. From the equations [illegible] and [illegible] there are obtained [illegible] and $x = 3z$. That is, the amp-turns of the second smaller portion of the magnet winding at the lowest speed must equal the total effective amp-turns at double speed, and the amp-turns of the larger battery-connected portion of the magnet winding must be three times the total effective amp-turns at double speed. Under these conditions the voltage is the same at lowest speed and at double the lowest speed, but it is not the same at intermediate speeds. A numerical example is given in which there are voltage variations of [illegible] per cent above and below an average voltage while the speed is raised from its lowest value to double this value. The connections can also be made in a different way in which two separate magnet windings are not required. The method is shown in Fig. 2.—*Elek. Anz.*, Oct. 30.

[illegible] Coefficient of Induction Motors.—R. E. HELLMUND.—The conclusion of his mathematical article in which he gives a collection of formulas by means of which the different items making up the leakage coefficient of an induction motor can be calculated with an accuracy sufficient for practice. The formulas are not empirical, but are derived from theoretical considerations. They are, however, simplified for practical use. A numerical example is added.—*Elek. Zeit.*, Nov. 10.

Windings.—A continuation of the very long illustrated serial on windings of dynamo-electric machines. In the present instalment large direct-current machines are discussed with reference to the core, the coils, the armature cross-connections, the winding of the armature, banding and balancing.—*Elec. Journal*, November.

Transformer Tests.—E. F. COLLINS.—In a continuation of his very long serial on commercial electric testing, tests of three-phase air-blast transformers, oil-cooled transformers and oil and water-cooled transformers are dealt with.—*Gen. Elec. Review*, November.

Lamps and Lighting.

Flame-Arc Lamp.—A description of the Gallois flame lamp recently placed on the market in Great Britain. It is of the vertical-electrode type, as shown in Fig. 3, with regulating mechanism of the differential type. The shunt and series solenoids A and B are separate, and are provided with cores a suspended from a beam E by chains a^1, b^1, the beam being carried on knife-edges e. The ends of the cores are coned to give uniform pull, and the shunt core is ballasted with a weight in conjunction with the counterweight b^4. The electrode holders are carried by a flexible cord or chain passing over the pulley and the upper holder is heavier than the lower, so that the tendency is to run together. A train of gearing ending in a star-wheel F^1 controls the pulley, being coupled to the rocking beam by a link E^1; the frame carrying the train is mounted upon knife-edges eccentric to the axis of the pulley f, so that when the frame is tilted, the star-wheel being held from turning by the stop f^1, the pulley is rotated slightly and the arc is lengthened or shortened. The series core is provided with an air dash-pot C of special construction, the piston having holes c^3, and a light aluminum disk c^1 beneath it, supported by the screw c^2. On closing the circuit the series solenoid is strongly energized, and tends to cause an abrupt downward motion of the core, but the aluminum disk, acting as a valve, closes the holes in the piston and brings the dash-pot into play. The shunt dash-pot is similar, but inverted. On the cessation of the current, on the other hand, the electrodes are liberated by the free fall of the shunt core, and come together quickly. In normal working the dash-pots exert only a weak control, allowing the beam to respond to the least differences of pull of the two solenoids, and to keep the arc steady; and when the arc burns to too great a length the shunt core descends sufficiently to allow the star-wheel to rotate slightly, thereby feeding the electrodes, after which the shunt core rises and the star-wheel is again stopped. For continuous current the upper (positive

electrode is cored and the smaller negative is solid. The lamps can work three in series on 110 volts, or five on 220 volts. They are also made for alternating current, and work with either ordinary carbon or flame electrodes.—*Elec. Review*, Nov. 11.

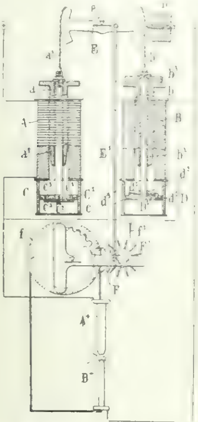


Fig. 3—Gallois Flame-Arc Lamp

Quartz Lamp.—M. LEBLANC, JR.—A review of the principle f the quartz-globe mercury-vapor lamp, giving some details f construction and results of tests.—*La Lumière Elec.*, Nov. 5.

Tungsten Filament,—A note on a recent British patent 23,437, Oct. 27, 1910) of E. Ruhstrat (Göttingen, Germany). n order to obtain finer and stronger filaments for processes ı which the tungsten is mixed in the form of a powder with binding material and then squirted the tungsten is reduced ı a very fine powdered state by first heating it to a temperature ıgher than its melting point in an arc and then suddenly cooling . The product is extremely brittle and can be ground so fine ıat it approaches the colloidal state.—Lond. *Elec. Eng'ing*, ov. 3.

Theater Lighting.—A note on the lighting equipment of the alladium Theater of Varieties in London. The fittings for the terior allow for an aggregate of approximately 1200 lamps, hile a large number of special signs and arc-lamp brackets ill be mounted on the exterior. Tantalum and "one-watt" mps and arc lamps will be employed exclusively for the lightg.—Lond. *Electrician*, Nov. 4.

Traction.

Switzerland.—Statistical data on the hydroelectric stations of vitzerland. The development of water-power began in 1886. t the end of 1890 there were in existence twelve hydroelectric ıtions, with a total rating of 4000 hp. The highest rating of single station was originally 1000 hp, but this had increased to ,000 hp and 16,000 hp in 1897, and works in course of erection ll have still larger ratings. The highest e.m.f. for transssion was 18,000 volts in 1901 and is now 50,000 volts. Engy is transmitted over distances of 100 km and 200 km (60 les to 120 miles). The use of some storage system is of eat importance. Of the 152 hydroelectric plants existing in 07 sixty-five had steam reserves with an aggregate rating of ,000 hp. Other low-pressure water-power plants use a waterrage system. An excellent method of utilizing all the water to combine a low-pressure plant with a high-pressure plant th storage lake. Data are given on some of the more imrtant plants, also of the financial returns of fifteen stock mpanies having a stock capital of more than $200,000 each. ıese figures show that interest on the capital is paid only after om two to six years. Last year the dividend for these fifteen mpanies varied between 3 per cent and 8 per cent, the average being 5.3 per cent. Data are also given on some municipal plants which appear to be in a good financial condition, since most of them have paid back the borrowed capital to the municipality and have written off considerable amounts for amortization. Some of them have also had a net gain, but most of the municipal works prefer to reduce the price of energy instead of making a net gain. The price of the kw-hour for lighting in eleven different municipal plants in 1909 varied between 1.6 cents and 13 cents, the mean value being below 10 cents. The rates charged for industrial purposes differ greatly in different cities. These hydroelectric developments have enabled Switzerland to become to a certain extent independent of other countries for supply of coal, or at least to keep the import of coal approximately constant since 1900, in spite of the enormous growth of the industries since that time. When the Swiss railroads become operated electrically the import of coal will be greatly reduced.—*Elek. Zeit.*, Nov. 3.

Electric Equipment of Coal Mines.—An illustrated description of the electrical equipment of the Oakdale navigation collieries in the South Wales and Monmouthshire coal field. There are two pits and the generation station is midway between them. There are two 1000-kw, 3300-volt, 50-cycle, 1500-r.p.m. mixed-pressure turbo-alternators. The turbo-alternators supply the whole of the energy for lamps and motors, both for the surface and for the sinking operations, and will ultimately supply the necessary energy for the fan motors for ventilating. Direct current is used in connection with the arc and incandescent lamps on the surface and in the various buildings. This is supplied by means of a 220-volt motor-generator set in the generating station. The energy for the surface, and also for the sinking operations, is obtained from a step-down transformer, which lowers the pressure from 3300 volts to 550 volts. This pressure has been adopted for all of the motors on the surface and also for the motor-driven air compressor and the sinking pumps.—Supplement to Lond. *Elec. Eng'ing*, Nov. 3.

Energy from Peat.—N. CARO.—The author and Frank have developed a method of utilizing peat by a process analogous to the Mond gas process. In a gas producer the peat is subjected to the action of air and steam and is thereby changed into a gas which can be utilized in gas engines. At the same time 85 per cent of the nitrogen in the peat can be recovered in the form of ammonia, which is transformed into ammonium sulphate and sold as a fertilizer. If the peat contains 1 per cent of nitrogen the ton of dry peat yields 40 kg of ammonium sulphate, and if the peat contains 2 per cent of nitrogen it yields 80 kg of ammonium sulphate. This "by-product" is stated to pay almost for the whole cost of the process. The producer gas obtained thereby contains from 1250 to 1350 calories per cubic meter, and per ton of dry peat from 650 to 750 electric hp-hours can be obtained from the gas by means of gas engines, and in continuous operation 900 hp-hours. Such a peat-fuel generating station is now nearing completion in the Dammermoor in the Province of Hanover, in Germany. This will have ultimately a rating of 4000 hp, but for the present only 2000 hp will be used. Energy will be supplied to the City of Osnabrück and neighboring villages. In peat districts where there are no towns the electric energy can be utilized for drainage, etc., since the development of the peat deposits should be carried out in such a way that when the peat is removed the ground will be ready for agriculture.—*Elek. Zeit.*, Nov. 10.

Gas and Oil Engines.—C. THONET.—An article on the use of gas engines, Diesel oil engines and Hornsby gasoline engines as prime movers in central stations. Statistical data are given to show that the gas engine operated with producer gas is more economical than any steam engine at a rating below 500 hp and can compete even with the Diesel engine when the price of crude oil is beyond a certain figure. However, in districts where oil is cheap the Diesel engine becomes preferable on account of its numerous technical advantages. This accounts for its great development in England.—*La Lumière Elec.*, Oct. 29.

Energy Required for Rolling Mills.—J. A. KNESCHE.—An account of tests of the energy required by a direct-driven plate

null. In the first instalment the author describes the arrangement of the tests and the influence of temperature in rolling steel and pyrometers suitable for such work. In the second instalment he gives the results of his tests in form of extended tables and diagrams. He discusses the influence of material and size of rolls on the energy requirement and the cost of energy in rolling mills and compares the accuracies obtained on steam-driven mills and electrically driven mills.—*Eng. Mag.*, November.

Installations, Systems and Appliances.

[illegible].—An illustrated description of the electricity supply in the City of Barcelona in Spain. There were two steam plants each of 900 hp in operation in the eighties, and a large new plant was erected in 1897. The latter plant contained originally five steam-driven direct-current generators each of 1000 hp, to which was added later a direct-current steam-driven set of 2000 hp. Including the storage battery the equipment rating is about 8000 hp, direct-current energy being supplied by the three-wire system with 200 volts between the outers for lighting and industrial purposes, besides energy at 500 volts for traction. Energy is distributed by means of a cable network with a bare middle wire, the total length being 550 km (330 miles). In order to supply energy to the outlying districts a three-phase plant was erected in 1906, originally with a rating of 4500 hp, which has since been increased to 19,000 hp. The plant contains three turbo-alternators, each of 1000 kw, two of 3000 kw and one of 3600 kw. Three-phase energy is generated at 6000 volts and transmitted to ninety-eight transformer stations, of which thirty-five are in public places and sixty-three in factories.—*A. E. G. Zeit.*, November.

Electric Energy from a Tug.—During the fitting out of the White Star liner *Olympic* the necessary electrical energy for lamps and motors is being supplied from a tug which is moored alongside the larger vessel. This tug has on board an electrical plant with a rating of 320 kw and has also been fitted with a powerful steam fire pump. It is, therefore, both a floating generating station and a fire station, in addition to being a tug. The *Jackal*, as the tug is called, was formerly a gunboat on the China station and has engines rated to 1500 hp. For the purpose of driving the electric plant the shafting connecting the propeller with the engine has been uncoupled to enable the latter to drive the electric plant.—Lond. *Electrician*, Nov. 11.

Distance Between Transformer Stations.—C. Schmidt.—The conclusion of his paper in which he discusses the considerations which determine the most favorable distance between transformer stations in electric distribution systems. He shows especially how an increase of the distance between transformer stations changes the cost of energy distribution and he also shows what voltage variations are caused by suddenly connecting a 5-hp motor to the mains. He finally makes definite proposals as to permissible voltage variations when such a motor is connected to the mains.—*Elek. Zeit.*, Nov. 3.

Wires, Wiring and Conduits.

Pin Insulators and Suspended Insulators.—G. Benischke.—An account of comparative experiments with pin insulators and suspended insulators under high tension and under the effect of artificial rain. For some types of suspended insulators consisting of a series of several insulators the perforation voltage was found to be considerably less than the sum of the perforation voltages of the single insulators. Moreover, with these same types of insulators it was found that the invisible discharge (characterized by noise without light and indicating that with increasing voltage visible discharges will be obtained) occurred at an earlier stage than with pin insulators. The author's experiments show that the cause of this is to be found in the capacity of the insulator.—*Elek. Zeit.*, Nov. 10.

Earth Return.—A note stating that for more than a year a committee of the Swiss Electrical Society has had under observation the use of earth as a return conductor between St. Maurice and Lausanne, and a report of the committee states that the system has worked satisfactorily without a single de- [illegible] ent from the moment when it was put in regular service. Direct current at 20,000 volts is used on the Thury system with a single line conductor, the second line conductor having been idle during the past fourteen months. No complaints have been made by the engineers of the federal railways, the compensating batteries installed at certain stations having absolutely prevented interference with the railway signals.—Lond. *Elec. Review*, Nov. 4.

Electrophysics and Magnetism.

The Nature of Electrical Discharge.—F. E. Nipher.—An abstract of a paper read before the Academy of Sciences in St. Louis. The writer presented photographic plates treated by electric discharges as follows: Pin-head terminals rest with their rounded heads upon the photographic film. One terminal is grounded, the other leads to a variable spark-gap at the negative terminal of an influence machine, the positive terminal being grounded. Pictures are taken for discharges with varying spark-gaps. A theory of the electric discharges is based on these pictures and the following application is made to the electric discharge in a vacuum tube. It follows the tube in all o its windings and bends, not because it is a convection column but because it is a drainage column. The conditions are different from those in a copper wire in that the parts of th atoms which constitute the conductor are in gaseous form an are capable of yielding to the force which urges them in direction opposite to that in which the negative corpuscles ar being urged.—*Science*, Oct. 28.

Electrons.—J. W. Nicholson.—The author has formerl considered the theory of the motion of a conducting spher the mass of which is purely electrical under the action of eithe a small uniform field of electric force or a small mechanic force. In the present paper the motion of such a sphere de void of the Newtonian mass is investigated, and it is shown t present none of the difficulties noticed in the case of the con ductor. He concludes that it may be preferable in any attem to treat the electron as not subject to deformation to endow with dielectric rather than conducting properties. The analys of this hypothesis presents no difficulty which does not appear t be shared by the other, and in consideration of initial motion it gives rise to great simplicity in the possible case of no New tonian mass.—*Phil. Mag.*, November.

Beta Particles.—A paper by A. F. Kovarik on the absor tion and reflection of the beta particles by matter; anoth paper of A. F. Kovarik and W. Wilson on the reflections homogeneous beta particles of different velocities; and a pap by J. A. Gray and W. Wilson on the heterogeneity of the be rays from a thick layer of radium E.—*Phil., Mag.*, Novembe

Electronic Theory.—H. A. Wilson.—A discussion of son difficulties which the electronic theory in its present form e counters in its application to the optical properties of metal —*Phil. Mag.*, November.

Magnetism.—A summary by D. Owen of the various r searches of the late Prof. Pierre Curie on magnetism.—Lon *Electrician*, Nov. 4.

Franz Neumann.—A lecture by P. Volkmann on the expe mental work in physics of the late Franz Neumann.—*Phy Zeit.*, Nov. 1.

Units, Measurements and Instruments.

Action of the Condenser in the Ruhmkorff Induction Coil. I. W. Waghorn.—The author describes experiments made f the purpose of determining what oscillations are set up in condenser bridging a spark-gap on a circuit arranged like t primary of an induction coil, more especially when the circ is made and broken by a mercury motor interrupter. It shown that there are two sets of oscillations in the "long a short circuits" of the condenser, respectively, and that b these sets may be present at the same time, the "short-circu oscillations having the greatest intensity at small and the "lo circuit" oscillations at large values of the condenser capa It is shown that the "short-circuit" oscillations are increased amount by increasing the inductance of the main circuit a

t with the mercury interrupt[illegible] sparking dis-ce of the secondary circuit occurs approximately when the ort circuit" current is [illegible] ov. 11.

Recording Instruments.—[illegible] illustrated paper recording electrical instruments made by the Paul Meyer mpany for both direct current and alternating current. Vari-s records of curves are reproduced. The paper deals espe-lly with the recording device. Its special feature is the ar-gement of the ink well separate from the measuring system. is determines the use of a relatively large ink well, simpli- attendance and reduces cost of maintenance.—*Elek. Zeit.*, [illegible] 3.

Oscillograph.—L. T. Robinson.—An illustrated description of principle and construction of the oscillograph with various ves taken by this instrument and illustrating especially tran-nt phenomena, for instance, first rushes of current on a rt-circuit, variations of the current of a lamp immediately er closing the circuit, etc.—*Gen. Elec. Review*, November.

Telegraphy, Telephony and Signals.

ong-Distance Telephony.—An account of the extended dis-sion on this subject at a recent Paris international con-nce of telephone and telegraph engineers. Lucas, one of reporters, said that experience and data, as shown in the er by Bela Gati upon cables with Pupin coils interposed in al lines, proved that in order to obtain the best results from ordinary cable it was necessary to regard the electric con-ts of the cable in conjunction with the constants of the al lines and of the apparatus connected to the cable. It d thus be theoretically decided whether or not to insert in coils. From Gati's second paper on microphones the fol-ng conclusions may be drawn: In comparing transmitters vocal efficiency it is necessary to ascertain that the electric itions of the circuit tested do not produce a false impres- owing to the resonance effects arising in the secondary its. In regard to the new transmitter of Egner and Hal-n it was shown that if the construction of telephone trans-rs be modified in order to obtain an instrument better re-ding than the present types to the superior frequencies of d, and permitting also the use of strong currents, the dis-s regarded to-day as easily practicable by the voice can be derably increased. Gati's third paper on telephonic relays practically the corollary of the former, all the more be- he recommends high-speaking transmitters in connection telephonic relays. Generally he suggests a relay in the ircuit so placed that sufficient intensity of current is avail- for line working and then the use of several relays on the point, each relay being tuned as perfectly as possible to tain frequency. The deductions in Martin's paper are as [illegible] (1) The best result is obtained by the use of lead-ed cables, the insulator being spiral paper wrappings. (2) e suitable interposition of Pupin coils upon these cables nission results can be increased 370 per cent, and with a uous and uniformly distributed inductance—that is, with tinuous spiral of iron wire on the copper conductor—trans-ility is increased 60 per cent, while 100 per cent can be ed under certain special conditions. (3) Telephonic relays ot yet sufficiently perfected for commercial use. (4) The equivalent in units of the standard cable of any number of circuits of different construction connected in series is to the sum of the various parts. Pleijel said the follow-onclusions could be drawn from the statement of Pet-: To obtain the greatest advantage from interurban lines ge diameter it was necessary to connect in the circuit only with high self-induction [illegible] less 8 km (5 miles). When the cable length does not exceed k (12 miles) it is found that with the same copper diameter [illegible] or 70 mils) speech transm[illegible] several iron spirals or Pupin coils. By using a pupinized with self-induction of 30 millihenrys per kilometer (48 nrys per mile) and by diminishing the copper to 1.5 mm (59 mils) diameter a cable is obtained without [illegible] at the extremities and of which the coefficient of attenuation is the same as that of the Austrian interurban cable. This cable would be cheaper and, for long distances, better than the Krarup cable with iron spirals. There is also reason to think that in aerial lines of great diameter the increased resistance of the coils due to Foucault currents may cause inferior articu-lation. Carty referred to two wires from New York to Chi-cago of 3.25 mm and 5.25 mm which form a "combined circuit" telephonically, while each wire is used for duplex telegraphy. In response to Breisig he said that this line has no special coils and that the apparent circuit (circuit fantome) is really the better. He replied to Hollos that there is to be no relay on the New York-Denver line, with which it is hoped to speak over 3540 km (2200 miles). O'Meara stated that in England cables are stranded in pairs and in fours, but tests do not show ap-preciable differences. Gill remarked that experiments in Eng-land upon combined circuits confirmed what Carty said. The improvement is manifest both in cables and in aerial lines. Carty, in reply to Luschen, answered that he had no definite data as to the pupinization of combined circuits. Devaux-Charbonnel said that in France several combined circuits are used without showing improvement, which can be explained by the doubling of the capacity, while resistance and inductance were halved. However, wires of large diameter have a greater effective resistance on account of the Thomson effect and may cause greater enfeeblement in combined circuits. Linninger explained that in Austria difficulties had been experienced with cables of 0.8 mm (32 mil) diameter and experiments had been made with several pairs laid parallel, but conversation became less distinct. Bela Gati said that in Hungary combined circuits had succeeded with aerial lines, but not with cables. Breisig, speaking on the subject of pupinized and Krarup cables, said that recently Sir John Gavey had not recommended cables with iron spirals. In his own opinion, the efficiency of a cable de-pends upon its construction. There is a great difference be-tween the results given by Petritsch and Martin. According to the former it appears that three times the efficiency can be ob-tained by using iron spirals. The improvement with a Krarup cable would thus be similar to that of a Pupin cable, and the choice between them is, therefore, an economic one. Germany possesses only Krarup cables, 400 m to 500 m (1300 ft. to 1600 ft.) long, interposed in the aerial lines in their passage through small towns. In this case Krarup cables have been found pref-erable, notwithstanding their higher cost. He asked the Eng-lish delegates to explain why their results with Krarup cables were so different from those in Continental Europe. O'Meara said that English officials invited by Krarup to Denmark to test his cables found the improvement obtained was 60 per cent. For the new Anglo-French cable the sole condition demanded was a coefficient of attenuation not exceeding 0.014 and manu-facturers have proposed pupinized cables to the exclusion of the Krarup type. Petritsch remarked that experience showed that cables with iron spirals have double the efficiency of those without, and that in all cases of cables with copper conductors of large diameter those with high self-induction are best. Where Pupin coils would not be used for any reason, as for short lines, copper conductors with iron spirals give the best result.—Lond. *Electrician*, Nov. 4.

Frequency of Telephone Currents.—At the recent interna-tional conference of Telegraph and Telephone Engineers in Paris the following resolution was passed: "In practical cal-culations telephonic current may be replaced by a sinusoidal current. As regards intensity, a mean vibration of 5000 may be adopted. Vibrations of 3000 to 7000 should be regarded, in addition, where questions of tone (timbre) are concerned."—Lond. *Electrician*, Nov. 11.

Telephone Exchange.—A description of the new telephone exchange in Hamburg which is to replace the former eight exchanges in Hamburg, Altona and Wandsbeck. The central-battery system is used and the exchange is at present equipped with [illegible] parties, which will be doubled [illegible] Nov. 3.

Book Reviews.

Railway Signaling in Theory and Practice. By James Brandt Latimer. Chicago: Mackenzie-Klink Publishing Company. 420 pages, 140 illus. Price, $2.50.

The fundamental theory and practice of signaling systems and apparatus for steam roads form the subject of this book. The electric railway man will find little which will interest him, as electric railway signaling differs considerably from steam road practice. The book covers manual, electric, pneumatic-electric and various other kinds of signal systems, and gives complete specifications for mechanical and power interlocking signal systems.

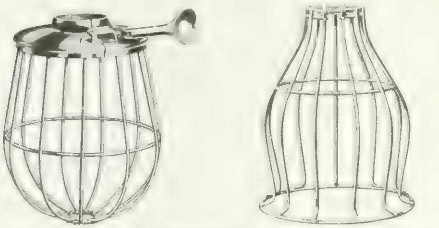
Handy Man's Workshop and Laboratory. By A. Ru Bond. New York: Munn & Company. 465 pages, 370 Price, $2.

This book has been compiled from the Handy Man's Dep ment of the *Scientific American*. It contains a large collec of kinks classified and presented with clearly made illustrat The classification of the kinks is as follows: Equipment workshop; constructional details and instructions in the us tools; soldering and preparation of solders; kinks for mac ists; experiments and experimental apparatus; directions building useful things about the house; directions for buil and repairing various kinds of sporting paraphernalia. The who uses tools and likes to make things and do repair w will find this book a regular mine of useful information.

New Apparatus and Appliances

ELECTRICALLY WELDED LAMP GUARDS.

One of the most valuable features of the lamp guards illustrated herewith is the electrically welded joints. The wires are welded at every place of meeting so that there is no need of tie wires, springs or catches to hold the guard together. The wires are so welded that they cannot be pulled apart, the weld



Figs. 1 and 2—Lamp Guards with Electrically Welded Joints.

being as strong as the wire itself. No part of the lamp is touched by the guard, but every part is evenly protected.

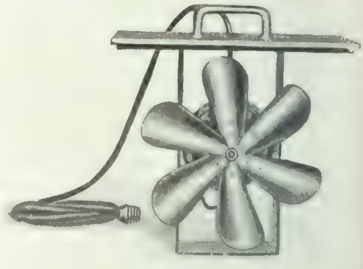
The locking guard shown in Fig. 1 is provided with a solid metal top which locks to the rib on the socket shell. It is locked by means of a key and cannot be removed without the key.

The guard that is shown in Fig. 2 is made of wire throughout, and is so proportioned as to nest perfectly, so that eight can be packed in a box that will hold only two non-nesting guards. This guard is provided with a wire-spreading bottom so that it will stand erect upon a bench or moving machine.

The above described guards are made by Harvey Hubbell, Inc., Bridgeport, Conn.

EXHAUST FAN BLOWERS FOR FURNACES.

At this season of the year, when hot-air furnaces are being put into use, good circulation of fresh air through the heating system and the rooms of a building is a subject deserving of a great deal of attention. Fresh air is more essential to good health than heat, and a good heating system must provide for the circulation of fresh air. Of the many schemes advanced the most practical seems to be a fan blower placed in the cold-air box. The Western Electric Company has just added to its list of well-known "Hawthorn" motors a line of exhaust-fan blowers. This device consists of a moderate-speed motor mounted on a supporting frame attached to a cast-iron cover plate driving a six-blade fan. This cover plate is provided with a lifting handle by means of which the blower can be easily removed from the cold-air box if desired. No starting or auxiliary equipment is necessary. A 10-ft. lamp cord socket are provided and connection can be made to any l socket. The motor, which requires no attention whatever, i simple construction and reliable. The exhaust-fan m

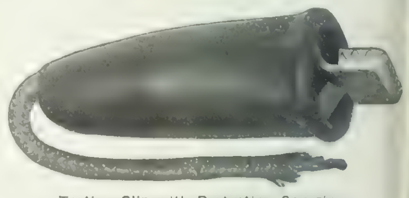


Exhaust Fan Blower.

blowers are made to operate on both 110-volt and 220-vol rect-current circuits and 110-volt and 220-volt single-p alternating-current circuits having frequencies of 60 cycle 40 cycles.

INSULATED TESTING CLIP.

The testing clip illustrated herewith is provided with a tecting covering of insulating material, which, however, i way interferes with the action of the clip. The nose which the connection is made is the only part that is exp The device is well suited for use with magneto and microp



Testing Clip with Protecting Covering.

testing sets and with voltmeter and in general lab work. It is intended for use by electric lighting and tra sion companies, telephone companies, wire manufacturer way-signal inspectors and general electrical manufacture has been placed on the market by R. S. Mueller & Co Cleveland, Ohio.

SPEED REGULATOR FOR SMALL MOTORS.

The type of controller shown in the accompanying illustra-ion is built for use with standard motors rated at from 0.05 hp ɔ 0.17 hp, 250 volts. The operation is by means of a simple liding lever with which seven contacts are made furnishing even running positions without an "off point" or six running ositions, with the seventh contact an "off point."

The resistor, which is the important feature of any regulator,

Speed Regulator.

moisture-proof and dustproof. It consists of a porcelain core which the resistance wire is wound and over which a special ment is applied which entirely incloses all portions.

These regulators are adapted for motors operating such de-es as fans, jewelers' and dentists' lathes and drills, copying ıchines, adding machines, washing machines, coffee mills, wing machines, small blowers, buffers, etc. In addition to con-lling the speed of motors it may be used for controlling ating circuits in connection with plating baths and as a field gulator for small dynamos.

The diameter of the regulator is 6 in., the depth of casting in. and the net weight only 2.5 lb. It is made by the Cutler-ımmer Manufacturing Company, Milwaukee, Wis.

COMPRESSION-TYPE BATTERY-CHARGING RHEOSTATS.

The American Electric Fuse Company, of Muskegon, Mich., s just installed a complete battery-charging outfit in the new lmar Avenue garage of the Park Automobile Company, St. uis, consisting of thirty charging rheostats. The service de-

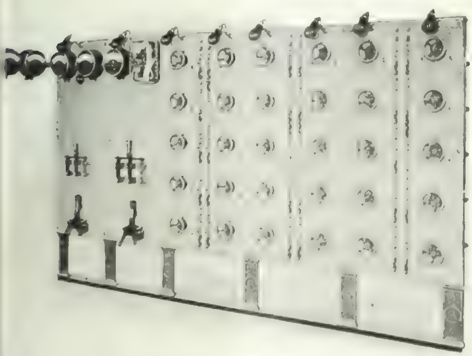


Fig. 1—Front View of Board

nnds rheostats which will charge twenty-four to forty cells a rate of from 0 amp to 30 amp from a 110-115-volt circuit. The features in the American Electric Fuse Company's aaratus which render them particularly adapted for this ess of work are the flexibility of the compression type of rheostat, which permits a single machine to operate through a wide range and affords very close regulation; the compactness of the type, the small amount of panel space occupied, the neat apearance of the apparatus and the saving in cost of installation. The installation is illustrated herewith.

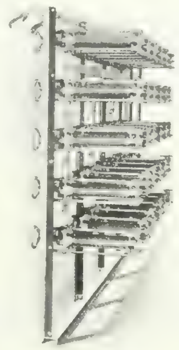


Fig. 2—Rear View, Showing Rheostats.

Another installation of the same rheostats was recently made for the Vandalia Railway at Terre Haute, Ind. It included complete equipment for charging the electric lighting plants on Vandalia cars and is now in successful operation.

THREE-WIRE GENERATORS.

For obtaining the neutral point for three-wire operation of the generator illustrated herewith, use is made of "balancing coils" consisting of three interconnected windings upon laminated iron cones. It is claimed that, even with heavy unbalanced loads, the machine operates with absolute sparklessness. Two or more of these generators can be operated in parallel with each other or with two-wire machines.

The two-voltage feature of three-wire distribution is particularly advantageous for buildings or shops where variable-

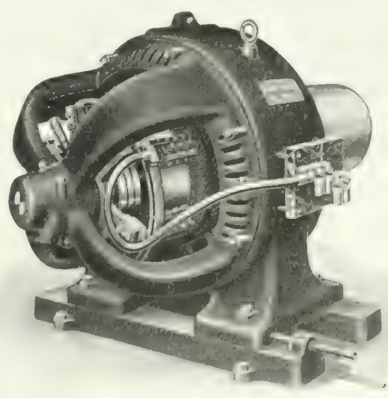


Fig. 4—Three-Wire Generator.

speed motors are in use. With field control a wide range of speed can be obtained on account of the flexibility of the system; at the same time the saving in copper is quite a considerable item. The three-wire generators are well suited for supplying energy to lamps and motors in large stores, office build-

ings, etc., and for general use in manufacturing establishments. The above-described machines have been placed on the market by the Triumph Electric Company, Cincinnati, Ohio, in all

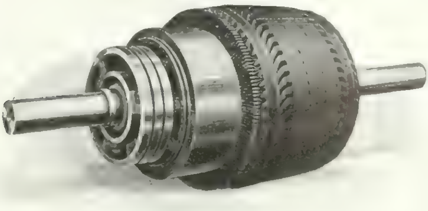


Fig. 2—Armature of Three-Wire Generator.

standard ratings from 25 kw up, wound for 250 volts, so that 125 volts can be obtained from either side of the three-wire system.

ELECTRIC LIGHTING OF AUTOMOBILES.

The Hartman Electrical Manufacturing Company, Mansfield, Ohio, has brought out an automatic system of electric lighting for automobiles consisting of, first, a 6-volt generator driven from the engine shaft by belt, chain or direct-connected gear drive; second, a battery which floats on the line and supplies current when the car is at rest or the engine is running below generating speed; and, third, a regulator, operating to maintain constant voltage at all engine speeds. The generator shown in Fig. 1 is of the four-pole, closed, iron-clad type with a field ring of special steel having a high permeability. The armature is built with closed slots with coils wound of a single large wire. Imported ball bearings are used, properly selected with reference to the work to be performed. At a speed of a little above twelve miles per hour it will generate about 9 amp, or sufficient to supply all the current needed for

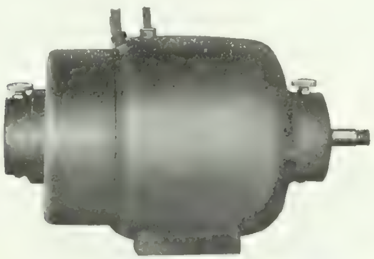


Fig. 1—Automobile-Lighting Generator.

head, side and tail lamps and ignition. The maximum output of 15 amp is reached when the car is going at a speed of about fifteen miles per hour.

As the engine speed varies from 0 r.p.m. to 2000 r.p.m. and as the speed of the generator will be proportional, it is obvious that some means must be provided for governing the output of the generator and maintaining a constant voltage at the lamps and battery. The regulating device for this purpose is contained in the iron box shown in Fig. 2, which contains also the terminal board, switches and fuses. Two relays are used, one for operating the main switch, which is placed between the generator and the battery, and the other for controlling the shunt field circuit. When the car is at rest or the generator is running below the speed necessary for charging and for maintaining the lamps at proper voltage, the main switch remains open, thus cutting out the generator and preventing the battery from discharging through the generator armature. Whenever the engine attains a speed sufficient to drive the car at about twelve miles per hour the generator picks up the load and the main switch is automatically closed. The lamps, if in use, are then carried by the generator and the surplus current is fed into the battery until it becomes fully charged. When the speed of the generator increases the second relay comes into action and by means of an ingenious device weakens the current to the fields, causing the voltage to drop instantly to the proper value. The result is a practically constant voltage at the battery and lamps, the variation being less than ¼ volt over a range of speed from 1200 r.p.m. to 6000 r.p.m. Ideal conditions for charging the battery are thus obtained, the current flow being greatest when the battery is low and tapering off

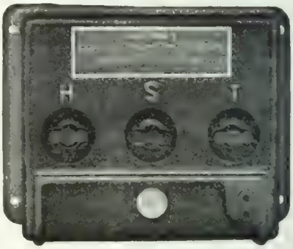


Fig. 2—Voltage Regulator.

gradually as the battery becomes fully charged. As the generator voltage remains constant at a point below the maximum voltage of the battery on charge, there is no possibility of overcharging the battery. Whenever the engine speed falls below approximately ten miles per hour the dynamo is automatically cut out, and the battery then carries the full lighting load. Three switches are used for the head, side and tail lamps. Sockets for plugging in a trouble lamp are also provided in the regulator box. A "turn-down" feature is provided in connection with the head lamps by means of which the lights can be turned down about one-third. The system is entirely automatic and requires no attention other than the occasional oiling of generator bearings.

NEW TYPE OF RECTIFIER OUTFIT.

The mercury-arc rectifier provides a very convenient and efficient means of transforming alternating current to direct current and is meeting with a wide application in this field. To meet the demand for a less elaborate outfit than its universal battery-charging one the General Electric Company has recently placed on the market a rectifier designated as the "Runabout type." This is made up without voltmeter or ammeter and is, therefore, recommended only for use with cars that are equipped with a first-class voltmeter and ammeter. It is designed to charge batteries consisting of from twenty to thirty-two cells at a maximum charging rate of 30 amp.

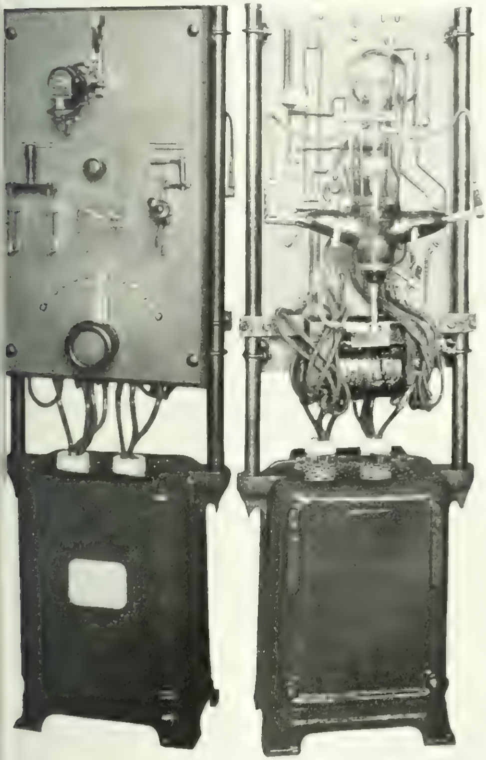
The "Runabout type" rectifier has one important advantage over the "Universal" type, namely, its extreme simplicity. As will be noted above, its range is limited to twenty to thirty-two cells, while the "Universal" type will charge from five to forty-four cells of lead-plate battery. The former thus does not require special and elaborate means of adjusting current and voltages, and has only one small dial switch, which gives a range of fine regulation sufficient for any battery from twenty to thirty-two cells. This will make a set appeal to the many men and women who want to charge their own electrics, but perhaps hesitate to tackle the apparently slightly more complicated "Universal" type.

Figs. 1 and 2 show front and rear views of the new rectifier

which is self-supporting. The panel pipe supports are screwed into suitable receptacles on the compensating reactance, which is of sufficient weight to hold up the rectifier panel and its equipment. The outfit consists of four essential parts, mercury-rectifier tube, compensating reactance, regulating reactance and panel with supports.

The tube is mounted in a holder located on the back of the panel. The shaft of the holder extends through the panel and is connected to a hand wheel on the front by means of which the tube is tilted when starting the outfit. Fig. 2, which shows the back view of the rectifier panel, illustrates the form of the tube holder. The manufacturers call particular attention to its simplicity and to the evident ease with which a tube can be inserted.

The function of the compensating reactance is to maintain the arc in the tube while the alternating current is passing through the zero point of the cycle. This reactance is so arranged that



Figs. 1 and 2—Single-Phase Mercury Arc Rectifier.

ne lead is a negative pole of the rectified current, while the ther leads are arranged so that the reactance can be used as compensator (thus its name, "compensating reactance") so nat by a few changes the outfit can be used on either 110-volt r 220-volt alternating-current supply circuits and be able to harge a maximum of thirty-two cells.

Fine regulation of the direct-current voltage is accomplished y means of a regulating reactance which is connected in the lternating-current line. This reactance consists of a coil round upon one leg of a rectangular laminated core. The coil as eleven taps, which are connected to studs on a dial switch ounted on the front of the rectifier panel. The latter is of atural black slate, 28 in. x 16 in. x 1½ in., and it is equipped ith all switches necessary for the operation of the rectifier nd the regulation of the charging current.

INFUSIBLE AND INSOLUBLE INSULATING MATERIAL.

The General Bakelite Company, of New York City, is the manufacturer of a certain synthetic product possessing many valuable characteristics for insulating purposes. Chemically the substance is known as oxybenzyl-methylenglycol-anhydride, but it has been given the trade name of "bakelite." It possesses some of the combined properties of amber, hard rubber and celluloid. It has not the flexibility of rubber or celluloid, however, but it is harder and stronger than either of them, withstands heat and is not attacked by any solvents nor by most chemicals. The substance is totally insoluble and infusible and does not soften even at a temperature of 572 deg. Fahr. It may be obtained either transparent or opaque and can be compounded with various filling materials, such as asbestos, clay, wood-pulp, minerals, etc., and shaped or molded with great accuracy to articles of unusual strength. It can be sawed, turned and polished and when used to impregnate wood

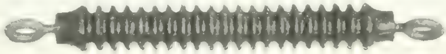


Fig. 1—Strain Insulator.

and other porous bodies renders them harder and more resisting to chemical and physical influences. Motors can be impregnated with the raw material and by a simple process of heating under pressure synthesis of bakelite takes place in and around the fibers which cover the wires of the coils and as a result the whole is transformed into a hard, infusible, insulated mass. Bakelite has been employed for making a variety of electrical insulating devices, a number of which are illustrated herewith. The material does not emanate sulphur like hard rubber nor nitrous products like celluloid. If heated

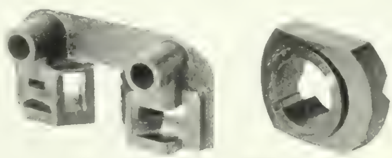


Fig. 2—Brush Holder.

in a flame it does not suddenly catch fire like celluloid nor melt like rubber; it simply chars, then burns with difficulty.

The bakelite process involves the utilization of three distinct and well-defined varieties of the substance, designated bakelite A, bakelite B and bakelite C. Bakelite C is the final product, whereas bakelite A and B are the transition products. Bakelite A is the initial raw material and exists in liquid, pasty or solid condition. All varieties of bakelite A are still soluble in alcohol, acetone or caustic soda and behave as true resins. Bakelite A which is solid at ordinary temperatures

Fig. 3—Weatherproof Socket.

melts if moderately heated. If stronger heat is applied it becomes infusible and insoluble and changes into bakelite B or C.

Bakelite B is an intermediate solid product characterized by the fact that although it is infusible it will soften under the action of heat and then be molded and welded together if pressed in a hot hydraulic press. Bakelite C is the final product resulting from the application of heat to forms A or B and

lacks all the chemical characteristics of a resin, although physically it may resemble amber. It has maximum strength and maximum resistance to chemical influence.

Aside from the molded insulators in which bakelite is employed as a binder, bakelite varnish is employed with consid-

Fig. 4—10,000 Volt Insulator with Bakelite as Binder.

erable success in the electrical industry as an improvement over shellac varnish. It is applied like the latter, but after drying it can be hardened and made infusible. For varnishing coils, coated wire and similar substances its advantages are obvious. Cotton-covered wire may be impregnated with bakelite varnish, then dried and wound into coils. If heat is afterward applied the bakelite is transformed into the infusible variety C. As long as this transformation has not taken place the wire has the usual flexibility, but after the change the protected wire does not lend itself readily to bending. Asbestos-covered wire

Fig. 5—Coil Impregnated with Bakelite.

protected with a thin layer of bakelite varnish produces a wire conductor which will withstand unusually high temperatures and which, furthermore, does not readily absorb moisture. The bakelite-prepared article has the great advantage over one made with shellac that it does not soften with heat and withstands better the action of oil in transformers. It has been used in transformer bushings for extra high potentials, withstanding tensions as high as 275,000 volts. The various forms of bakelite are applicable to such a variety of uses that it is necessary to specify exactly what use is intended to be made of it in order to obtain the proper variety.

SPECIAL FIXTURES FOR HIGH-CANDLE-POWER TUNGSTEN LAMPS.

The accompanying illustrations show some new fixtures made by the Federal Electric Company, of Chicago, for 500-watt tungsten lamps. These lighting units are designed for both outdoor lighting and where it is desired to illuminate large indoor areas. The fixture illustrated in Fig. 1, intended more particularly for indoor work, has a 20-in. inverted glass bowl shade, with 10-in. opening, and a spun-glass dome 10½ in. in diameter. A 6-in. white porcelain-enameled steel disk, wired, with a large-base socket, is also provided. The fixture is suspended from a 7-in. canopy by a chain attached to a 1-in. casing depending from the canopy. The standard finish for this fixture is brush brass.

Fig. 2 illustrates a less ornamental fixture, suitable for outdoor work. There is a 20-in. porcelain-enameled steel shade, black on the upper side and white on the inside. This is attached to a 12-in. black porcelain-enameled steel dome. As in

Fig. 1—500-Watt Tungsten-Lamp Fixture.

the former fixture, there is a 6-in. white porcelain-enameled steel shade, wired, with a large-base socket. The lamp is protected against theft or breakage by a clear-glass dome, with an opening at the bottom, and so attached at the top that there is

Fig. 2—500-Watt Lighting Unit with Outer Globe.

a good circulation of air. An iron stem, 18 in. long, connects the fixture to the canopy.

A street hood has been designed for large tungsten lamps used for street lighting, and it may be suspended with a chain and pulley combination in the manner shown in Fig. 3. The support is obtained from three equidistant points, making the

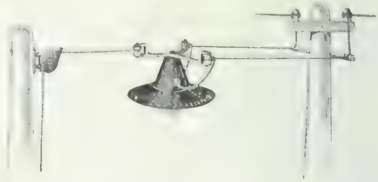


Fig. 3—Street Hood for 500-Watt Tungsten Lamp.

hood stable and level It is said that with this suspension the tungsten filament will not be broken by the highest wind. The steel cone is 7 in. high, and the shade is 15 in. in diameter. The three-arm support, or rigger, is of iron, fitted with three insulators. The wiring enters the hood through two porcelain

ushings, and a socket cap with special thread to fit the G.E. rge-base series socket is provided. This socket will auto-natically close the circuit in case the lamp burns out or is roken, so that all other lamps in the series will remain burn-ng. The two lead wires form one side of the support, and he third arm is supported by a chain or rope, which passes ver a pulley on a pole on the opposite side of the street. When he rope is tightened the hood is held firmly in position.

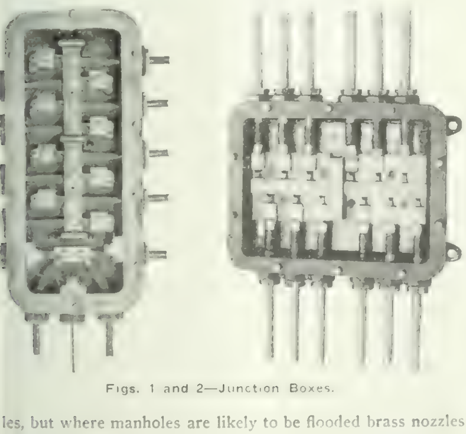
UNDERGROUND JUNCTION BOXES.

By W. E. Hazeltine.

The accompanying illustrations show a line of low-tension unction boxes made by the General Electric Company and esigned to meet all ordinary requirements of underground ork.

M. D. JUNCTION BOX.

The manhole distribution junction box (Fig. 1) is designed interconnect mains at street intersections or to serve as the nter of distribution at feeding points. It is made for two-ire circuits and for three-wire circuits where the neutral ble is grounded and not brought into the box. This type of ox is intended for single conductor cables in manholes, but ay also be used on poles or in cellars. It is substantially made cast iron with heavy arched covers and fitted with molded bber gaskets. All the nuts and exposed fittings are of a mposition metal that will not rust or stick even when the xes remain closed for long periods. The busbars are mounted non-combustible supports and the inner face of the cover and e ends of the box are protected by asbestos shields. The minals can be soldered on to the cables outside of the box. andard copper fuses are used with these boxes. Stuffing xes of the engine type are provided for the entrance of the



Figs. 1 and 2—Junction Boxes.

les, but where manholes are likely to be flooded brass nozzles recommended to which the lead sheath can be united by a ed joint. The boxes, designed to take both feeder and n cables, are fitted with special stuffing boxes for the intro-tion of a pressure wire cable if it is desired, and have taper s in terminals and busbars for jumper cable which is used hunt a fuse.

he box shown in Fig. 2 has three busbars and is intended for e-wire circuits where the neutral cables are brought into box and connected to a busbar without fuses, while the itive and negative cables are connected through fuses. The itive and negative terminals take cables of any size up to 0,000 circ. mils, and the neutral of any size up to 500,000 mils. The terminals and busbars have taper holes for iper cable the same as the B-2 type. The box may be fitted stuffing boxes or nozzles, as desired, for the introduction of the cables. They are designed for very heavy service and have the same substantial construction as the box previously described. While intended for three-wire circuits of a maximum potential of 300 volts they may be used for 500-volt systems with grounded neutral by the use of special fuses and the introduction of suitable barriers.

The Tailleur fuse boxes differ from the above types in that all cables enter at the bottom of the box instead of half

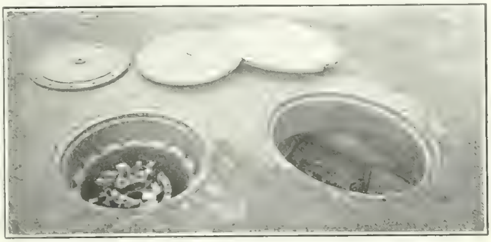


Fig. 3—Box at Street Surface.

at each side. Also, the Tailleur type of box may, in the two-wire style, be used with either single or twin cables, and in the three-wire style with either single or triple conductor cables, or part of the cables entering a box may be single conductor and part multiple. They are intended to serve the same general purpose as the M. D. type.

They are manufactured in three sizes, viz., four-way, six-way and ten-way, and each size is manufactured as a two-wire or a three-wire, i. e., with either two or three busbars, as may be specified. The terminals are below the busbars and are connected to it through all-copper fuses. The busbars are offset, the top bar being nearest the back of the box and the lower bars being stepped toward the front of the box, this giving clear space between the bars and insuring that moisture or any fuse metal or loose nut dropping from a bar will fall clear of the others. Busbars and terminals are rigidly supported.

The four-way box is designed to handle main cables only, of sizes up to 750,000 circ. mils. The six-way and ten-way boxes are designed to handle feeder cables of a maximum size of 1,500,000 circ. mils and main cables of 750,000 circ. mils. Provision for pressure wires is made in these two sizes. The box contains a socket wired up for a 110-volt lamp and is fitted with an automatic switch to light it whenever the cover is open. This does away with the use of a lantern in manholes.

Cables enter the box through cast-iron cup glands which are made watertight by means of rubber gaskets and sealed to the cable sheath by filling with hot insulating compound. The cover is fitted with a special molded rubber gasket to make the box tight when closed. The wing bolts and nuts securing the cover are of such a composition that no difficulty will be experienced through rusting.

The cable terminals are soldered on the outside of the box and are fitted with taper plug holes so that a flexible jumper cable or shunt cable can be connected to shunt any fuse and permit of its removal and replacement without interrupting the current on the cable connected to that terminal.

At times manholes of duct systems are inaccessible, due to flooding or to presence of illuminating gas, or a cable burn-out may be in progress. A junction box installed within a manhole under such conditions is inaccessible. The junction box shown in Fig. 3 overcomes this difficulty, for it is accessible at all times and affords the best method of interconnecting cables. The busbars and terminals can be arranged for almost any system of low-tension distribution and for any size and type of cable. Junction boxes of the accessible type have been installed for several years in manholes which are practically always flooded (under the most severe climatic conditions found in the United States) and have operated continuously since installation without trouble of any character.

The box has a strong, cylindrical, cast-iron casing designed to be set in the roof of the manhole. The cables enter the bottom of the box through composition nozzles to which the lead sheaths are united by a wiped solder connection, forming a permanent water-tight and gas-tight joint.

If desired, stuffing boxes may be substituted, doing away with the wiped joint and rendering the boxes suitable for use with unleaded or braided cables.

The busbar and terminal insulation are supported from brackets projecting from the shell of the box, thus providing air insulation between busbars. This allows of radiation from busbars and provides suitable insulation resistance between them. All-copper fuses are used and the arrangement of the box is such that fuses may be removed or renewed with the least

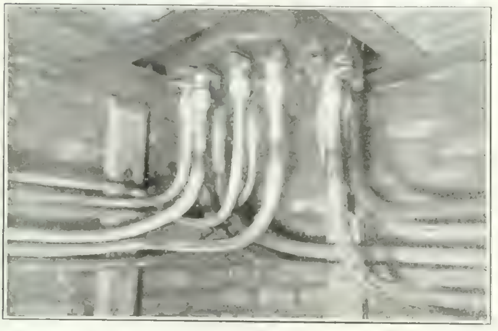


Fig. 4—Bottom of Box Viewed from Manhole Interior.

possible delay. A minimum amount of space is occupied inside the manhole, leaving the interior clear for through cable lines and manhole transformers.

The normal position of the distributing cables is in the upper ducts, so that they may be brought to the junction box without crossing other lines. Entrance nozzles for the cables are made from copper tubing, thus permitting a good wiped joint to be made between nozzle and cable sheath.

The wiped joints unite electrically the lead sheaths of all cables entering the box, and by connecting a single earth bond to the shell of the box all cable sheaths are solidly grounded.

Incombustible shields prevent the arc from a blown fuse making a ground connection to the shell or inner cover.

NEW ENGINEERING LABORATORIES OF THE NATIONAL ELECTRIC LAMP ASSOCIATION.

On the site of the old Brush electrical works, at the corner of Hough Avenue and East Forty-fifth Street (formerly known as Mason and Belden), in Cleveland, is located a new $250,000 three-story building of steel and brick mill construction in which are conducted the central engineering activities of that group of incandescent lamp manufacturers composing the National Electric Lamp Association.

An idea of the exterior architecture will be obtained from Fig. 1, which gives a close view of the East Forty-fifth Street entrance. Each of the big bronze lantern fixtures contains four 60-watt, high-efficiency lamps, which are shown illuminated in a later illustration.

The corridors and offices are all finished with quarter-sawed oak for the doors, ceiling beams, chair rails and other woodwork, as seen in Fig. 2, a view of the front corridor.

The laboratories are finished with hard-pine trimmings, since the liability of damage from movable photometric and electrical apparatus, as well as from chemical reagents, renders the more expensive finish economically undesirable.

An up-to-date time-saving feature possessed by this building, in common with many others, particularly factories, is an automatic call system, worked by the telephone exchange operator. For the purposes of this system the heads of departments are designated by numbers, an electric bell, forming a "station" of the call system, being located in each department. Should a man in charge of a certain branch of the work—for example the testing—be absent in some other department, the operator may summon him to the 'phone by means of the call system which automatically rings his number all over the building at regular intervals of time until he responds.

The principal interest in the Engineering Building, from an electrical standpoint, centers about the "burning racks," where lamps are constantly being tested for performance throughout life. These racks are located in a sort of "sky parlor," or glass-inclosed compartment on the roof—a construction which was adopted in order that the streams of radiant energy from

Fig. 1—Portal of Laboratories.

the lamps might pass out of the building with as little previous absorption as possible. At night a spectacle is presented by the blaze of light issuing from the glass-walled rackroom (see Fig. 3). As may easily be imagined, not only are the upper portions of all high structures in the immediate vicinity brightly illuminated by the intense light flux which they intercept, but the rackroom itself becomes a luminous object in the field of vision of observers within a considerable radius of the Engineering Building.

The test racks are operated twenty-four hours a day, seven days in the week. Their purpose is to enable the manufacturers to make sure, by means of actual test results obtained from sample lots of lamps selected every month from their regular output, that quality is being maintained. Also, when changes are contemplated in the construction of lamps or in the composition of their filaments, experimental lamps embodying such changes are here tested in order to determine in what way quality would be affected by the new departure.

Some of the lamps are burned on alternating current and some on direct current. Energy for the alternating-current racks is transmitted through small air-cooled compensators, of which there are 1000. The different transformation ratios of

iese compensators furnish the requisite means for obtaining ıy desired voltage at lamp terminals, while a Tirrill regulator revents the pressure from varying more than a fifth of 1 per ent above or below normal, barring accidents or shutdowns. hus the lamps are tested under as rigidly maintained condions as have hitherto been found practicable or necessary for is sort of work when conducted as a commercial proposition

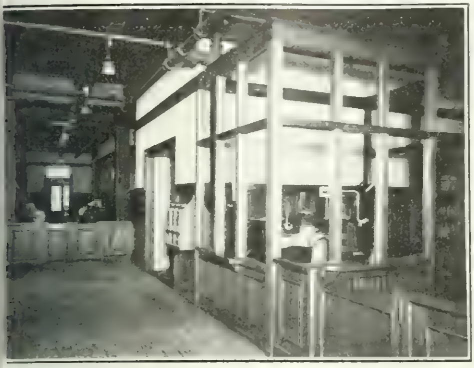


Fig. 2—Entrance Hall.

r a group of manufacturers. While such close voltage regulan would be unnecessary on central-station circuits, its deability is obvious in engineering tests the results of which e used as a numerical indication of lamp quality. Over 400 ts are perpetually on the racks, a "test" consisting of from e to ten lamps of the same type, which are being subjected the same conditions for the purpose of determining their erage performance under these conditions. Over 4000 candlewer measurements are made every week to determine the riation of light intensity with time, a large part of the floor ace of the engineering department being occupied by the apratus necessary for making these and other photometric easurements. The electric generating, or rather converting, uipment with its control apparatus, including a 40-ft. switchard, is located in the basement.

When the fact is considered that there are four distinct

Fig. 3—Inadequate Representation of Roof Night Spectacle.

isses of incandescent lamps in extensive commercial use toy, two of these classes having carbon and the other two ving metal filaments, and that these are further subdivided o more than 400 distinct types designed for nearly every class lighting service, the engineering problems connected with the intaining of present quality loom up almost as large as those connected with development work the purpose of which is to secure progressive improvement of quality. In this connection some data regarding the size of the Engineering Building will be of interest. Its length is 265 ft.; its width, 122 ft., and its height, exclusive of the rackroom on the roof, is 60 ft.; thus the volume is 1,940,000 cu. ft. In order to build a solid pile of this same size, to consist of wooden standard package boxes such as are used for the shipment of 40-watt, high-efficiency lamps by the member companies, 257,600 such boxes, representing 25,760,000 lamps, would be required. It is interesting to note that even this formidable figure is many millions less than half the total number of incandescent electric lamps of all types made and sold in the United States in a single year.

STERILIZATION OF WATER ON A LARGE SCALE BY MEANS OF ULTRA-VIOLET RAYS.

There are two problems of industrial water sterilization. The first one consists of obtaining water perfectly free from germs, that is to say, absolutely sterile. The second problem is that of obtaining water which is good for public distribution as drinking water and does not present any danger of acting as propagator for infectious maladies which, according to modern hygienic theories, are likely to be spread by certain microbes living in the water. Typhoid fever and cholera, which are supposed to be propagated by water, may be mentioned particularly.

It has been frequently demonstrated that sterilization by means of ultra-violet rays is not only safe but also much simpler and cheaper than by other methods. The quartz-tube mercury-

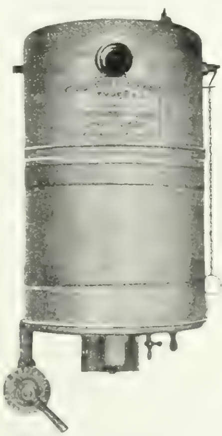


Fig. 1—Sterilizer.

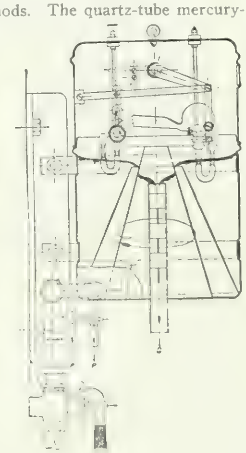


Fig. 2—Section of Sterilizer.

vapor lamp represents the first really convenient source of ultra-violet rays. The mercury arc has been studied particularly by Arons and by Mr. Peter Cooper Hewitt, the latter's work resulting in the development of the Cooper Hewitt mercury-vapor lamp. An advance was made in the design of mercury-vapor lamps when Schattner and Kuech inclosed the mercury arc in tubes of fused rock crystal whereby they obtained a very strong source of ultra-violet rays. The presence of these rays was, however, a disadvantage for an illuminating lamp, the rays themselves being injurious to the eyes. The tube of the Cooper Hewitt lamp is manufactured of glass, which is an absorbent of the ultra-violet rays which are produced in the interior of the tube. It is on this account that the light obtained from the glass-tube lamps is in no way harmful.

Quartz-tube mercury-vapor tubes were first applied exclusively to illuminating lamps, the tubes being inclosed in glass

globes so as to protect the public against the ultra-violet rays which pass through the fused rock crystal of which the tubes themselves are made. Such quartz mercury-vapor lamps are being made at the present time by the Westinghouse-Cooper Hewitt Company in London and Paris and by the Quartz-lampen Gesellschaft in Hanau. The former company has studied jointly with Messrs. von Recklinghausen, Henri and Helbronner the application of this mercury-vapor lamp (known as the silica lamp) to other than illuminating purposes. These studies began with the particular application of the ultra-violet rays to the sterilization of milk and water. This work has since been taken up in a good many other laboratories, it now being a matter of almost general knowledge that dangerous microbes contained in water are killed with quite remarkable speed by the means of the ultra-violet rays emitted. The work done in this matter has enabled the Westinghouse-Cooper Hewitt Company to produce water-sterilizing apparatus for different applications.

The first apparatus developed gives a continuous supply of sterile water at the rate of 130 gal. per hour, such quantity being quite sufficient for most medical uses. The normal illuminating lamp consuming 3.5 amp at 110 volts is suspended in the apparatus immediately above the surface of the water. The apparatus itself is enameled white, this finish inside having a

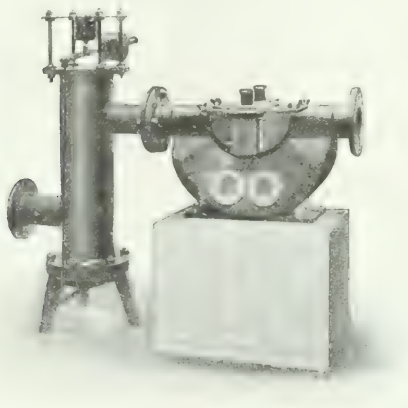


Fig. 3—Large Water Sterilizer.

good reflection coefficient, thereby increasing the efficiency.

The water in the apparatus is under violent agitation and is exposed for about five minutes to the influence of the rays from the lamp. The water is agitated by passing it through conical baffles which are placed inside the apparatus for submitting every particle of the water to the influence of the rays.

Another apparatus producing about the same quantity of sterilized water has been put on the market. But this operates differently in that the lamp is submerged, it being claimed that a greater number of rays emitted by the lamp are utilized for the purpose of sterilization. However, the normal working of the lamp is modified by the chilling effect of the water, so that there is a lower production of rays. The chief disadvantage, however, is that the luminous tube becomes gradually coated with scale from the salts contained in the water, which scale renders opaque the otherwise transparent tube and prevents the ultra-violet rays from entering the water, in consequence of which sterilization is arrested.

The sterilization of large quantities of drinking water for public water distribution has been the object of numerous tests. Experiments to test the efficiency of the apparatus for this purpose were made by artificially polluting the water which entered the apparatus. The lamps were suspended above the water, being maintained at a short distance from the surface by means of floats. These experiments also showed in a striking manner the importance of having the water violently agitated and this experience has been used in the construction of new apparatus. The early experiments showed that sufficient sterilization of drinking water could be obtained with an expenditure of 36 watt-hours per cubic meter.

For the efficient operation of the quartz lamp it is necessary that the luminous tube should be at a high temperature (about 800 deg. C.). If the lamp is artificially cooled either wholly or in part as is the case when it is submerged in running water such a high temperature cannot be obtained and the light efficiency of the lamp is seriously reduced.

For dealing with water sterilization on an industrial scale the Westinghouse-Cooper Hewitt Company has developed a single unit, such as is shown in Figs. 3 and 4, one or several of which may be set up according to the quantity of water demanded. This unit will sterilize at least 600 cu. m (132,000 gal.) in twenty-four hours and is fitted with one 3-amp, 220-volt lamp.

The unit consists essentially of three parts, namely, a cast-iron chamber in which the water comes under the influence of the ultra-violet rays; a box with cut-rock-crystal windows into which the lamp is fitted, and an automatic deviating valve which insures that no water shall pass through the sterilizing chamber at such times as the lamp is not in operation.

The chamber *E* through which the water passes is fitted with several baffles for directing the flow. These serve the purpose of stirring up the water, which, as already pointed out, is necessary for the proper treatment and brings the full quantity of water under the direct influence of the light on three distinct occasions.

The lamp box *I* makes a water-tight joint with the containing vessel *E*, being held in position by means of four bolts with

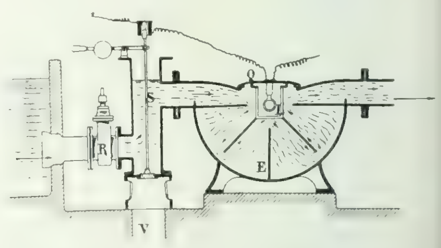


Fig. 4—Section of Water Sterilizer.

wing nuts, the box itself forming an obstacle in the path of the water. The three sides of this box in the path of the water are fitted with windows of cut rock crystal, which provide free passage to the ultra-violet rays emitted by the lamp through which they pass into the water flowing in the chamber.

The deviating valve *V* is placed between the supply and the sterilizer apparatus and consists of a double-T piece fitted with a mushroom valve at the lower end, this valve being held closed by means of a solenoid energized by the current in the sterilizing lamp. Should the current be cut off for any purpose this valve would be immediately opened and the water would cease to pass through the sterilizing chamber.

On entering the apparatus the water passes through the supply valve and over the deviating valve *V* into the chamber *E*. The flow as directed against the first window of box *I* by means of a baffle is then sent to the periphery of the chamber and back again to the second or horizontal window; thence it passes back to the periphery of the chamber, round further baffle to the third window, thus coming under the direct influence of the ultra-violet rays on three distinct occasions.

In the event of the lamp not being in operation the deviating valve *V* would be open, through which the water would pass; in this way it is assured that nothing but sterilized water can be distributed to mains.

Westinghouse sterilizer of this type has been in service a considerable time at the Competitive Exhibition for tilizing Apparatus at Marseilles.

ests with this apparatus have shown that with water pass- through the apparatus at the rate of more than 600 cu. m twenty-four hours and a consumption of less than 26 watt- rs per cubic meter the water leaving the apparatus was in majority of cases absolutely sterile—that is, it showed ntire absence of germs—and in no case did tests reveal e than ten germs per cubic centimeter. The water which been treated in apparatus of this description can, therefore, afely classified among the "perfect" waters, although water h was fed into the apparatus could scarcely be called po- e, it being far too rich in coli bacteria.

he above tests, which were carried out by independent ority, have demonstrated the possibility of producing per- drinking water for public distribution with a consumption 6 watt-hours per cubic meter in single apparatus capable of ing with fully 600 cu. m in twenty-four hours.

HE FLAME-ARC LAMP IN GREAT BRITAIN.

By J. A. Seager.

ithin a recent period the electric arc lamp has not been ciently appreciated as an illuminant by those whose duty to mark the progress of illumination matters, and this is ibly due to the fact that the metal-filament lamp has made phenomenal strides that problems of technical and financial rtance with regard to this mode of illumination have occu- attention, leaving the older means of lighting compara- y unnoticed.

the same time there has been in Great Britain a very ng movement in favor of the increased adoption of electric lighting, particularly in cases where large spaces can be ninated from points comparatively distant from one an- r.

is not proposed in this article to go very exhaustively into question of the different types of mechanism adopted in arc lamps at present on the British market, but rather to

Fig. 1—Arc Lighting of Cannon Street, London.

with the question from a general point of view in order to w the lines on which, given certain apparatus for producing it, the capabilities of this apparatus and the conditions re- red by the consumer have been co-ordinated. The first and st important feature of recent progress has been the recogni- n, practically universally, of the principles of scientific mination, and in this the Illuminating Engineering Society Great Britain has been very largely instrumental. From siderations of the distribution of illumination and the requirements of a good illumination in streets, factories and workshops, the arc lamp has been demonstrated to be a most useful means of general illumination, and considerable progress has been made in dispelling the idea that owing to the high candle-power of each unit and the consequent wide spacing of the lamps a largely uneven distribution of lighting would be obtained as compared with gas lamps. This particular cry was most energetically raised a year or two ago by the gas interests in Great Britain, and for some time carried a certain amount

Fig. 2—Arc Lighting in Church in Sunderland.

of weight in municipal undertakings, but the actual results in streets illuminated by means of arc lamps were quite sufficient to demonstrate their superiority, particularly where flame arcs were employed. As an interesting example of the way in which arc lighting has been adopted in the crowded London streets Fig. 1 shows the use of the Oriflamme arc lamp in Cannon Street, London. It will be seen that in place of the usual post a method of suspension from side to side of the street has been adopted without forming any obstruction to vehicular traffic. The number of important thoroughfares, both in the metropolis and in provincial towns in Great Britain, illuminated by flame-arc lamps can, of course, be reckoned in thousands at the present date, and a large proportion of this success is due to the adoption of the flame-arc lamp combined with the adequate perception of the value of reflecting surfaces in spreading illumination over a wide area.

The development of the flame-arc lamp since its very earliest days is by no means an uninteresting subject in this connection, this interest being increased by the fact that the development of the lamp has been more than usually rapid. In the early days the flame arc was always unsteady, the deposit was a drawback and retrimming was a constant necessity. This latter fact made its employment a nuisance inside buildings, while it practically could not be used in the streets, as the average winter's night was longer than the life of one pair of electrodes. Various ingenious methods of getting over this difficulty have been designed and put on the British market.

One method adopted for overcoming the inherent short life of the flame arc consists in the use of four electrodes placed

side by side and molded in one piece. This forms a plate of carbon and when fixed in position in the lamp makes with its extra pair two electrodes of four times the ordinary width. When the lamp is switched in circuit it is found that the arc strikes across the whole of the ends of the carbon plates, but almost immediately becomes confined to one particular point. As the carbon burns away the arc shifts to another point of less resistance and continues to do so in a forward and backward motion, gradually and evenly consuming the electrodes. In this way a total life of forty to fifty hours is obtained at one trimming without the lamp being extinguished as each pair of carbons comes into action, as is usual in most magazine lamps. This particular lamp exemplifies the type of developments which is now taking place in order to make the flame-arc lamp equivalent in long-hour capacity to the older form of lighting.

Reference was made above to the question of the deposit obtained from flame-arc lamp carbons, which for a long time presented a very serious difficulty. The deposit caused by the use of impregnated carbons usually settles on the globe of the

Fig. 3—Restaurant Lighting.

lamp in a very adherent form, and in one design an inner and outer globe are provided connected together at the top by a diaphragm, an inclosed air space thus being formed between the two globes. In the outer of the two is an ashtray through which air enters. The air is slightly heated in the space between the two globes, and, the inner globe being open at the bottom, the heated air rises upward to the arc. After being charged with the fumes and deposit from the arc it is then deflected sidewise toward the inner surface of the inner globe. As this is strongly heated, no deposit takes place, as the charged air is not cooled and the course of the air is maintained upward through the lamp, both the inner and outer globes being kept free from the deposit. The ashtray also acts as a wind trap, preventing any reversal of air current inside the globes even in a high wind. In the latest form of Excello lamp the inner globe is adapted so as to have dioptric or prism qualities in order to deflect the rays of light in a more horizontal direct than they would otherwise assume and thus spread illumination over a large area. The effect of this is a m nificently uniform sheet of light, which has found very gr favor both for public and private installations in Great Brit

Fig. 2 shows the way in which it has become possible utilize arc lamps even in interiors under most stringent c ditions, this showing flame-arc lamps in an Anglican church Sunderland. This innovation may be held to be a ne field for arc lighting in connection with interiors. Incident this disposes of the very greatly exaggerated statements wh have been made with regard to the poisonous gases genera by the impregnated carbons.

Another feature with regard to recent developments of fla arc-lamp lighting in Great Britain is the recognition that type of lamp is not suitable for every possible position situation. This became apparent even in outdoor light when the flame-arc lamp was used not only for the illuminat of thoroughfares from the height of a lamp-post, but also advertising display purposes outside shop windows. In London metropolitan area the disadvantage of having lamps high candle-power suspended so close to the pavement and

Fig. 4—Train-Shed Lighting.

a position such as to dazzle pedestrians caused the authoriti to issue restrictions regarding the use of such lamps, and it h been generally found that a smaller candle-power flame lan is desirable for such purposes. Their use has also brougl about a demand for a more ornamental type of lamp, and may generally be said that present-day designs are far advance of the early type of flame lamps as regards decorati features.

Reverting to the question of outside lighting, more partic larly in front of shop windows, a very notable factor of th development is the considerable attention which has been pa to shortening the over-all dimensions of the lamps. Former the chief aim of the designer was to offer facilities for a great a length of carbon rod as could be used conveniently order to reduce the number of trimmings as far as possible, bu the use of lamps in low situations has brought about a deman

for a lamp which when suspended from a bracket placed on or above the ordinary shop-window level will yet hold the actual flame at a sufficient distance above the heads of pedestrians and their umbrellas. These conditions have now been very largely complied with, and the result is a sweeping adoption of flame-arc-lamp lighting for the exterior illumination of shops and business premises. Fig. 3 shows a view of the Corner House, Piccadilly, a well-known London restaurant, which is lighted outside by means of flame-arc lamps of the Angold type and by tungsten lamps within. This restaurant is one of the most brilliantly lighted in London, and would compare favorably in this respect with any elsewhere.

Fig. 5—Factory Lighting.

Another indication of the adaptation of means to a definite end is the modification which has been made both as regards types of reflectors and composition of electrodes for interior lighting. One of the latest features in the large department stores, for example, in Great Britain is the use of the inverted pattern of reflector for throwing the rays of light upward on the white surface of a ceiling, giving as a result a beautifully subdued light with practically an entire absence of shadow. This has been used both with the ordinary open type or inclosed type of arc lamp and also with flame-arc lamps with very good effects, not only in shops, but also in such industrial locations as works' drawing offices, etc., and this method of lighting is becoming rapidly extended at the present time. Numerous attempts have also been made to eliminate the extreme redness of the flame-arc-lamp rays by the preparation of special electrodes giving a very light orange color and in some cases pure white. These electrodes are, of course, more expensive than the ordinary type, and the pure white carbon has been adopted in a good many cases, such as in drapery establishments where color-matching properties have been desired.

Fig. 6—Factory Lighting.

Reference has not yet been made in detail to an extremely important sphere of development of the flame-arc lamp in Great Britain in connection with industrial establishments. It is hardly surprising that it has met with such wide appreciation in this connection, inasmuch as there is no doubt of its value in illuminating machine shop bays, railway yards, wharves and similar situations. Little, therefore, need be said on this subject beyond drawing attention to certain typical installations of this nature. Fig. 4 shows the use of Oriflamme flame-arc lamps at the Paddington terminal station of the Great Western Railway in London. It is not beside the mark to say that this illumination was secured only after a spirited contest with the rival form of lighting by means of gas lamps. Figs. 5 and 6 show the lighting effects of Westinghouse Arcturus flame lamps at the Challenge Cycle Works, at Coventry, and show the applicability of this form of lighting to fitting shops and small repetition work generally. Figs. 7 and 8 are taken from the newly completed docks at Middlesborough. The former view shows the dock itself lighted by means of sixteen Westinghouse direct-current flame-arc lamps, while the latter shows the workshops attached to the dock lighted by eight similar lamps. These illustrations give a sufficiently varied indication of the way in which flame-arc lighting is being adopted for industrial purposes in Great Britain. Enough has been said to make it apparent that the flame-arc lamp has been thoroughly tested and tried in a great many different spheres and over a period of time. The results of experience in this form of illuminant show that, although much can be done with the older forms of arc-lamp lighting, the true solution of the problem of illumination over wide spaces undoubtedly rests with the flame-arc lamp.

Fig. 7—Dock Lighting.

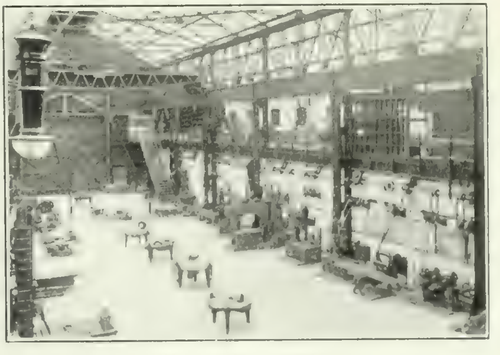


Fig. 8—Dock Lighting.

Industrial and Commercial News

The Week in Trade.

DEMAND for holiday goods is growing more prominent, and the development in this respect is about the only encouraging feature in the present condition of trade. Outside of this movement, trade continues to be irregular and in many respects unsatisfactory. Re-orders among the wholesalers and jobbers are rather scarce and not up to the average for the season. In addition to this, reports from retailers indicate somewhat less activity. The most encouraging reports last week came from the South, where the good movement of cotton at high prices has done something to stimulate buying. In the Northwest, save in North Dakota, where crops were short, the trade is fair. In the East and in the New England states the condition is distinctly disappointing. Among the manufacturing concerns the electrical companies all report fair business, and the wire manufacturers are also well supplied with orders. Aside from these two branches, the industrial world is rather dull. Quieter conditions have developed in markets for iron and steel, and the situation is not apparently so encouraging as when the reports for last week were made. The tonnage for railway equipment is not coming out as actively as was anticipated, and the railroads are spreading their orders over a longer period than was at first expected. It is said that some good-sized contracts for structural material are pending in the West, but these have not yet been placed. One leading producer of this class of material has reduced prices, and it is believed that manufacturers generally will make concessions in order to secure business. Negotiations for considerable quantities of steel rails are said to be pending, but they have not yet taken the form of definite contracts. It is said that one leading railroad has prepared specifications for 300 locomotives, and that the order will be placed within a few days. No orders for cars to any considerable amount have been placed within the past week. One bright spot in the situation is the fact that the lowering of commodity prices has stimulated export trade to a considerable extent, and has led producers to believe that after the beginning of the new year exports will largely increase. Collections are still rather slow, but of this little complaint is made. Business failures for the week which ended Nov. 24, as reported by *Bradstreet's*, were 212, as against 248 the previous week, 217 in the same week in 1909, 193 in 1908, 258 in 1907 and 174 in 1906.

The Copper Market.

COPPER prices closed last week a trifle higher than at the close of the week previous. The entire sentiment of the copper market may be pronounced as stronger, and the condition is somewhat improved. The sales of the week have not been particularly large, but there is a general belief that heavy consumers will soon be compelled to come into the market for substantial quantities. It is pointed out that all of the electrical companies which are large consumers of copper have

Standard Copper	Bid.	Asked	Settling Price
Spot	12.45	12.60	.....
November	12.45	12.60	12.52½
December	12.45	12.60	12.52½
January	12.50	12.60	12.57½
February	12.55	12.70	12.62½
March	12.60	12.80	[illegible]

The London market, Nov. 28, was as follows:

	Noon. £ s d	Closing £ s d
Standard copper, spot	57 1[illegible] 0	5[illegible] [illegible] 0
Standard copper, futures	58 13 9	[illegible]

Extreme fluctuations for this year

	Highest.	Lowest.
[illegible]	13.[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

recorded during the present year increases in their business. These increases taken together indicate about a 20 per cent growth in the domestic demand for copper. Under such circumstances present stocks held by consumers will not last very long, and if business after the first of the year shows signs of improving, it will be necessary for purchases of metal to be made. Another feature which has to some extent strengthened the market is the renewal of amalgamation rumors which practically sustained prices last winter and spring. There is also a great deal being said by producers concerning the effect of the curtailment policy, which it is now claimed has been operative long enough to show in the statistics of the Copper Producers' Association. All of these things have improved the tone of the copper market and slightly advanced prices, but have not brought about any very heavy sales. Imports continue to run at about the same figures as during the past three months. Exports are a trifle heavier, and since Nov. 1, including Nov. 28, have amounted to 24,974 tons. The daily call on the Metal Exchange Nov. 28 quoted standard copper as per the accompanying table.

Industrial and Commercial Notes.

Equipment Ordered by the New York Edison Company.—The General Electric Company has taken an order from the New York Edison Company for quite an important amount of equipment. The order includes three 20,000-kw vertical steam turbo-alternators, four 2500-kw rotary converters with statics and regulators, three 3000-kw, 3-phase, air-blast transformers, one 375-kw regulator, three 300-kw generator sets and a large equipment of high-tension oil switches, instruments and switchboards. The three 20,000-kw turbines are to be placed in Waterside Station No. 1 to replace four 4000-kw steam engine-driven units. The four units which are to be replaced are a part of the eleven units which were installed when this station was built. It is explained by an official of the New York Edison Company that this change is made in order to utilize the excess of boiler capacity which was installed in this station. By the substitution of these large turbines the total capacity of the station will be increased 44,000 kw without additional cost of buildings or boilers. The engine-driven units have proved entirely satisfactory, and are only replaced by the turbines in order to utilize the extra boiler capacity that is already installed. Deliveries of this apparatus will be made next year, beginning in the spring. The four 4000-kw units which have been taken out of the station were sold by the Edison Company to the John A. Stewart Electric Company, of Cincinnati, Ohio.

Transmission Lines for Sonora Mines.—The Central Mexico Light & Power Company, a subsidiary of the Guanajuato Power & Electric Company, has just completed a transmission line from its distributing station at Guanajuato to San Luis Potosi, a distance of 89 miles. The distance from Guanajuato to the generating plant in the State of Michocan makes the total transmission distance about 200 miles. The Central company purchased some months ago the lighting and distributing system of San Luis Potosi for $700,000. The large smelter belonging to Robert S. Towne will become a customer of the company and a number of mines in the San Pedro district will also receive energy from the new transmission lines. The Mexican government has recently granted a concession for a transmission line from the Copper Queen smelter at Douglas, Ariz., to the El Tigre mining district in Sonora.

American Carbon & Battery Company.—The American Carbon & Battery Company, of East St. Louis, Ill., has recently purchased the plant and business of the Doe Battery & Manufacturing Company, of Kent, Ohio, and will continue the manufacture of the dry cells made by the latter in connection with its own carbon and graphite products. The American company is in a favorable position to manufacture high-class dry cells owing to its close identification with battery work in manufacturing carbon elements. The dry cell now made by the company is known as the "American," and is put forth as representing several improvements over the "Victor" cell, made by the Doe company. Descriptive literature of the several types of "American" cells is furnished on request.

Fourteen-Thousand-kw Turbines for Milwaukee.—The Milwaukee Electric Railway & Light Company is installing two 14,000-kw and two 7500-kw Curtis turbo-generator sets in its Commerce Street station, which already had an existing equipment of 20,000 kw. Other important additions to the boiler and auxiliary equipment are being made at this plant.

General Electric Company's Business.—During the past week there has been a rapid advance in the price of General Electric Company's stock upon the New York Exchange. This movement, it is said, has been based upon the earnings in the current year and the prospective business for the next year. It has been accompanied by reports that the directors would be justified in raising the dividend rate. It is not likely, however, that anything will be done in this direction within the next six months. The General Electric Company on June 1 of next year will redeem $13,000,000 of 5 per cent bonds at par and 5 per cent premium. The holders of these bonds have the right to convert them into stock at par. The sales billed by the company for the year, it is said, will be close to $70,000,000, which is compared with $51,656,000 for the eleven months which ended Dec. 31, 1909. The net earnings for 1910 should be in the neighborhood of $8,400,000, which is equivalent to about 13 per cent on the stock. The growth of the company's business in the current year has not been due to large contracts received, but to the great increase in small orders. There has been a notable absence of large railroad and traction company orders. Should there be a revival of business of this character the plants of the General Electric Company, as well as other large electric companies, would hardly be able to supply the demand. While the business of the company for the current year will be practically as large as the best year in its history, the plants will not be operated at anything like full capacity. It is estimated that the company at the present time is able to take care of a business amounting to $100,000,000.

Allis-Chalmers Business.—The bookings of the Allis-Chalmers Company for the first two weeks of November, while not up to the same period of 1909, showed some improvement over October, and inquiries received indicate an upward trend in the demand for most lines of machinery. In one day last week the company closed contracts for crushing machinery for prompt delivery aggregating upward of $250,000. This shows an extraordinary demand for this line at this season, as the orders are usually placed in the spring. The record for the current fiscal year of the company is somewhat below that for the corresponding period of last year. July was the best month in the history of the company, but after that time there was a considerable decline in orders. Since April 1 the operations of the company's plants have been about on a level with 1907, but as a result of extensions made during the past three years the total capacity has been increased something like 25 per cent, so that, while the output for the past six months has been comparatively normal, the plants have been operated at only about 75 per cent of capacity.

The Jandus Electric Company Sold to Adams-Bagnall Electric Company.—The Adams-Bagnall Electric Company, of Cleveland, Ohio, has purchased the good will and assets of the Jandus Electric Company, of the same city, and will continue the manufacture of Jandus products, which will be marketed under the trade name "Jandus," as, for example, Jandus fans, Jandus luxolabra, etc. The Adams-Bagnall Electric Company has associated with it the former management of both the commercial and engineering departments of the Jandus company. With largely increased capital and greatly extended facilities, it is the purpose of the combination to insure improved service both to the former patrons of the Jandus company and the Adams-Bagnall company. The Jandus company has had a long and useful career, and while it will be missed from the field as a separate organization, it is gratifying to know that its work will be continued under most efficient conditions in the new combination.

Copper Consolidation Talk.—The copper market during the past week has been well supplied with rumors concerning the impending consolidation of great interests in the copper industry. No official announcement bearing on the subject has been made, but in a general way it is understood that the proposed merger will embrace properties in widely separated camps, and that there will eventually be organized a holding company of the type of the United States Steel Corporation, which will be designed to bring the bulk of the American copper output under one control. It is said that a conference of leading copper men was held in New York last week, at which the outline of such a combination was agreed upon. John D. Ryan, president of the Amalgamated Copper Company, is named as the active spirit in bringing about this consolidation. Although the Calumet & Hecla interests were mentioned in this connecton, an official of that company declares that it is not either directly or indirectly interested in any consolidation, and that there is no truth in the report so far as that company is concerned.

Pennsylvania Water & Power Company.—The total cost of the hydroelectric development of the Pennsylvania Water & Power Company at McCall's Ferry, on the Susquehanna River, up to the time of turning on power in October, has been $13,000,000. The Oct. 20 issue of the *Electrical World* contained a description of the plant and of the beginning of operations with two large generating units. This estimate of cost includes the transmission lines into Baltimore, which were constructed by the Susquehanna Transmission Company of Pennsylvania and the Susquehanna Transmission Company of Maryland. It also includes the cost of the substation in Baltimore. The officials of the company state that as fast as the generating apparatus can be delivered the additional units will be installed. It is expected to have five of these in operation by next spring.

Decision Against Independent Telephone.—The Appellate Division of the Supreme Court of New York City has affirmed the decision of the lower court denying the application of the New York Electric Lines Company for a mandamus compelling the Empire City Subway Company to grant space in its conduits for the plaintiff's wires. The ground upon which the decision is based is that the permission to operate telegraph and telephone wires in New York City claimed by the Electric Lines Company has been rescinded and did not at any time amount to a franchise. The Electric Lines Company is the wire-leasing corporation in connection with which the Great Eastern Telephone Company was planning to operate an independent system in New York City.

Stave Electrical Company.—A recently patented 150-hour flaming-arc lamp will shortly be placed upon the market by the Stave Electrical Company, 27 West Twenty-seventh Street, New York. When in Germany last September Theodore Stave, president of the company, secured the American rights to this lamp, which, it is claimed, will make street lighting by flame arcs sufficiently economical to be attractive. A project is on foot for the manufacture of these lamps in this country. The Stave company has recently taken quite a number of large contracts for flaming-arc installations. Among these are large orders from the General Motors Company and the Lozier Automobile Company.

Grenagle Electric Company.—Stockholders of the Grenagle Electric Company have voted to increase the authorized capital stock of the corporation from $50,000 to $75,000. The company has patented a new incandescent lamp which is intended to reduce the cost of illumination. James B. Grenagle, the president of the company, is the inventor. The company has its plant in Baltimore, but additional money was needed for the installation of new machinery. A portion of the additional $25,000 authorized stock issue will be sold to provide funds to equip the plant further.

Westinghouse Motors.—The Westinghouse Electric & Manufacturing Company has recently booked several large orders for small power motors. These include 1000 graphophone motors for the American Graphophone Company, 500 1/4-hp special alternating-current motors for the Electric Renovator Manufacturing Company, 500 1/8-hp, 110-volt, 60-cycle motors for the 1900 Washer Company, 450 1-15-hp motors for the Wayne Manufacturing Company and 624 1/2-hp alternating-current motors for the Hobart Electric Company, of Troy, Ohio.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Milwaukee, Wis.; Sherbrooke, Que., Can.; Clarion, Pa.; Jackson, Ohio; Albany N. Y.; Hagerstown, Md.; Black Mountain, N. C.; Grapeland, Tex.; Lovell, Wyo.; Mitchell, Ont., Can.; Valders, Wis.; Endeavor, Wis.; Duluth, Minn.; Garfield, N. J.; Orono, Maine; Rock Hill, S. C., and Prince Rupert, B. C., Can.

Allis-Chalmers Turbine for Madison (Wis.) Plant.—The Madison Gas & Electric Company has made additions to its electric plant amounting to $60,000, including two Sterling boilers of 500 hp each and a 1000-kw Allis-Chalmers turbo-generator with condenser. Automatic stokers have been installed under the boilers.

Financial.

THE WEEK IN WALL STREET.

IT WOULD be hard to imagine a Wall Street market that was less interesting or duller than that of last week. The Thanksgiving holiday was made the occasion for many of the regular traders to withdraw from the market, and on Friday and Saturday following the holiday the Street was almost deserted. The activities of professional traders have been much curtailed of late, and there seems to be practically no outside investment in the market and very little interest taken by the general public. The first break in this condition of apathy occurred Nov. 28, when there was an active selling movement and a sharp break. This was attributed to the pessimistic utterances of James J. Hill. At one time immediately succeeding

NEW YORK.

	Nov. 21.	Nov. 28.	Shares Sold.		Nov. 21.	Nov. 28.	Shares Sold.
All Ch.	[illegible]*	[illegible]*	—	Int. Met., pfd.	[illegible]	[illegible]	[illegible]
All Ch., pfd.	[illegible]	33	200	Mackay Cos.	[illegible]	[illegible]	[illegible]
Amal. Cop.	69½	67	[illegible]	Mackay C., pf.	74	[illegible]	[illegible]
Am. D. T.	[illegible]	[illegible]		Man. Elev.	[illegible]	[illegible]	[illegible]
Am. Loco.	40	37¼	[illegible]	Met. St. Ry.		[illegible]	
Am. Loco., pfd.	[illegible]	[illegible]	[illegible]	N.Y.&N.J.Tel.	130	130	—
Am. Tel. & C.	84*	84		Steel, com.	[illegible]	[illegible]	[illegible]
Am. T. & T.	[illegible]	[illegible]	[illegible]	Steel, pfd.	[illegible]	[illegible]	[illegible]
B. R. T.	78	[illegible]	14,850	W. U. T.	[illegible]	71	[illegible]
Gen. Elec.	156¼	[illegible]	11,300	West'h, com.	[illegible]	[illegible]	6,800
Int.-Met.	20⅞	[illegible]	5,300	West'h, pfd.	[illegible]	123*	100

PHILADELPHIA.

	Nov. 21.	Nov. 28.		Nov. 21.	Nov. 28.
Am. Rys.	43	43*	Phila. Elec.	[illegible]	[illegible]
Elec. Co. of A.	[illegible]	11¾*	Phila. R. T.	17⅝	[illegible]
Elec. St. B'ty	48	48	Phila. Trac.	83*	83
E. S. B'ty, pfd.	30*	30*	Union Trac.	41½	[illegible]

CHICAGO.

	Nov. 21.	Nov. 28.		Nov. 21.	Nov. 28.
Chi. City Ry.	[illegible]	170*	Chi. Tel. Co.	123*	123
Chi. Rs., Ser. 1	[illegible]	91	Met. El. Co.	21*	20
Chi. Rs., Ser. 2	22¾	25¼	Met. El., pfd.	62	65
Com. Edison	115½	116	Nat'l Car	123*	123
Chi. Subways	4⅞*	4½	Nat'l Car, pfd.	118¾	119*

BOSTON.

	Nov. 21.	Nov. 28.		Nov. 21.	Nov. 28.
Am. T. & T.	142½	140½	Mex. Tel.		5*
Cum. Tel.	145*	145*	Mex. Tel., pfd.	6	[illegible]
Edison E. Ill.	288	281	N. E. Tel.	137	138*
Gen. Elec.	156¼	157¾	W. T. & T.	18*	19
Mass. E. Ry.	20½	19¼	W. T. & T., pfd.	90½*	91
Mass. E. Ry., pfd.	88¼*	86			

*Last price quoted.
Shares sold for week Nov. 21 to Nov. 26.

the election it became apparent that the market had been oversold and that the short interest was considerable. This was responsible for the sharp decline which occurred at this time. It is now generally known that this short interest has been pretty thoroughly eliminated, and that there are not a great number of accounts being carried on either side of the market. One of the features of last week's transactions was the sharp advance which occurred in General Electric stock. Trading was more active in this issue than it has been for many weeks, and the advance was accompanied by reports of large earnings and a possible increase in the dividend rate. While there is much uncertainty felt in Wall Street as to the future of the market, the more hopeful of the traders are still predicting a December advance. It is not quite clear on what basis this prediction is placed. During the past week there have been large supplies of money placed at the command of Wall Street borrowers, but the demand has not been particularly active. Rates for call money are particularly low, and rates for time money are as easy as usual at this season of the year. Quotations Nov. 28 were: Call, 2¼ @ 2½ per cent; 90 days, 5 @ 5½ per cent. The quotations in the table are those of the close Nov. 28.

FINANCIAL NOTES.

North Shore Electric Company, Chicago, Acquires Oak Park Company.—The Oak Park Light, Heat & Power Company, of Oak Park, Ill., a suburb of Chicago, has been purchased in the interest of the North Shore Electric Company and new officers have been elected as follows: President, Frank J. Baker; vice-president, John F. Gulick; secretary and treasurer, E. D. Alexander. Mr. Baker is vice-president of the North Shore company, Mr. Gulick is secretary and treasurer and Mr. Alexander is assistant secretary and treasurer. The purchase is said to be a preliminary step toward the absorption of the Oak Park property into the system of the North Shore company, which supplies electric energy to the suburban territory around Chicago. The entire stock of the Oak Park company, of which $600,000 is outstanding, was acquired by the men representing the North Shore company. The comp has a bonded debt of $600,000, and is a reorganization of old Oak Park Yaryan Company.

Southern Power Company.—Preliminary papers h been signed at Charlotte, N. C., for the transfer to South Power Company interests of the holdings of the Charlotte E tric Railway, Light & Power Company. The transfer is m to the Charlotte Power Company, which is a subsidiary of Southern Power Company. The property sold includes an tensive street railway system, totaling about twenty-five mi The transfer was made by E. D. Latta, president of the Cl lotte Electric Company. For some time the Charlotte Po Company has been seeking a franchise in Charlotte, but eff of the interests represented by E. D. Latta proved embarrass to the promoters, and the matter is still in statu quo. The merger will give to the Southern Power Company control the street railway, light and power systems in Charlotte, N. Anderson and Greenville, S. C., the two last named hav been bought in during the past fifteen months.

Cumberland Telephone & Telegraph Company.—' monthly reports of the Cumberland Telephone & Telegr Company are showing very satisfactory improvements over same month last year. If the present record is kept up for rest of the year there will be available for dividends Dec. 31 an amount equal to about 11¾ per cent on the c pany's $19,680,150 dividend stock. The earnings last year v approximately 10¾ per cent. The balance available for c dends at the end of the year will probably be about $2,313, Since 1894 the company has steadily increased and develc its business. The capital stock in that year was $2,000,000 the capital stock at the present time is almost $20,000,000. 1894 the gross revenue of the company was $298,260; the mated revenue for 1910 is $7,060,000. The territory servec the Cumberland company has increased rapidly in popula and the company enjoys practically a monopoly in its field

Denver & Intermountain Railroad Company.—A re has been filed by the Denver & Intermountain Railroad C pany with the Colorado Railroad Commission, which shows the company is controlled by the Denver Realty Company which William G. Evans, F. G. Moffat and J. A. Beeler the directors. The Denver & Intermountain operates betv Denver and Golden. It recently secured a revocable franc from the City of Denver and took over the properties of Denver, Lakewood & Golden Railroad, which were sold receiver's sale several years ago. This sale included the pl cal properties but not the company's franchise. The Denv Intermountain is capitalized at $1,000,000 stock and $50 bonds, all of which are outstanding. Its officers are: W Smith, president; F. L. Butler, vice-president and general r ager; James H. Brown, secretary, and F. G. Moffat, treas

Rockingham Power Company.—The offering for sal the hydroelectric plant at Blewitts Falls, on the Pee Dee R near Wadesboro, N. C., Nov. 24, failed to bring out a bic This is the property of the Rockingham Power Company more than $2,000,000 has already been expended for const tion work. When it was offered for sale Nov. 1 with an u price of $1,000,000, no bid was received. The court ordered that the upset price be reduced to $750,000 and property again offered Nov. 24. It is now announced tha offer was received at this second attempt. The foreclo suit was brought by the Colonial Trust Company, of Bo trustee of the bonds.

Automatic Telephone Company.—The Automatic T phone Company, which was recently organized at Dallas, with a capital of $500,000, has taken steps to increase its to $1,500,000. The company is building a 50,000-line exch at a cost of over $200,000. It is stated that the additional tal will be used to establish exchanges in other cities and to in that section of Texas, and to conect them with long-dist lines. There are several hundred independent telephone changes and systems in Texas, and connection with these is templated.

Chesapeake & Potomac Telephone Company.—The h ers of the remaining $1,000,000 of 5 per cent first mort bonds of the Maryland Telephone & Telegraph Company been notified by the Chesapeake & Potomac Telephone Com that their bonds will be redeemed on Jan. 3, 1911, at par accrued interest. These bonds should be presented with th paid coupons at the National Marine Bank of Baltimore

Commonwealth Edison Earnings.—The gross earnings of the Commonwealth Edison Company for the fiscal year which ended Sept. 30, 1910, were $13,083,000, according to the official report, which was issued last week. This is an increase of $2,440,000, or about 23 per cent, over the gross of the previous fiscal year. The net earnings for the last fiscal year were $4,641,000, an increase of $645,000, or 16 per cent, over the preceding year. In his report to the stockholders Samuel Insull, president of the company, says: "In order to take care of the company's continued increase in business your directors have acquired 112 acres of land on the north branch of the Chicago River, north of Belmont Avenue, for the purpose of building a central power plant which will have an ultimate capacity of 360,000 hp. Work on the first section of this plant is now in progress, and it is expected that 60,000 hp of machinery will be installed and in operation by next autumn." The company's connected business (exclusive of electrical energy supplied to other public-service corporations) amounted at the end of the fiscal year to the equivalent of 5,915,612 standard 16-cp lamps. The extra expenses to which the company was put on account of severe weather last winter greatly increased the operating expenses.

Mexican Light & Power Company.—Substantial increases were shown in the October earnings of the Mexican Light & Power Company and the Mexico Tramways Company as compared with the corresponding period for last year. The former company shows a gain in gross of more than $158,000, or 30.67 per cent, and an increase in net of more than 23 per cent. The Mexico Tramways Company increased its gross earnings in October something over 16 per cent, and its net earnings at about the same ratio. The excellent showing made by the Mexican Light & Power Company thus far in the current year is attributed to the fact that since the beginning of the year practically no coal has been used. In addition to this, the Pachuca Light & Power Company, which was taken over by the Mexican company last year, is contributing liberally to the increase. The Mexican Light & Power Company has very materially increased its output of energy and within a short time will be selling 25,000 hp, as compared with 6000 hp less than two years ago.

Interborough Rapid Transit Profits.—Although the Interborough Rapid Transit Company carried 400,000 more passengers during last October than in the corresponding month of 1909, and in the four months which ended Oct. 31 carried 2,495,539 more passengers than in the corresponding period of 1909, the surplus for the four months which ended with October was $275,486 less than for the same period in the previous year. This difference is explained in a report which was issued last week by Theodore P. Shonts, president of the company, who declared that the falling off in net earnings was mainly due to the increased operating expenses. This increase is attributed to the expenses incident to the lengthening of the subway platforms and other physical betterments in preparation for the operation of ten-car express and six-car local trains. It is promised that these changes in the subway stations will be completed early next year. The gross earnings of the company for the four months mentioned were $8,968,020, an increase of $144,028 over the previous year.

General Motors Company.—More changes have taken place in the directory of the General Motors Company. In our issue of last week we stated that all of the old directors, excepting W. C. Durant, had retired and an entire new board of directors had been elected. Since that publication E. W. Clark, M. J. Murphy, Thomas Neal and A. H. Green, Jr., all of Detroit, have been elected directors to succeed directors temporarily chosen the week before. The new board of directors organized by electing J. J. Storrow, president; W. C. Durant, W. J. Mead, vice-presidents; C. P. Hathaway, secretary and treasurer.

Electric Traction Activity Near Chicago.—Three electric railway companies are competing for the right to build lines connecting the cities of Hammond, East Chicago, Indiana Harbor, Gary and Whiting. The Gary & Interurban Railway of Chicago has made a proposition to the City Council of East Chicago, promising to build a line running within a block of every industry and office building in the entire region. The Hammond, Whiting & East Chicago company also wants to build a loop in the district. The third company is the Northern Indiana Gas & Electric Company, financed by C. H. Geist, of Philadelphia, which is seeking a franchise in the same territory.

Interstate Railways Company.—The stockholders of the Interstate Railways Company, of Philadelphia, have adopted a resolution authorizing the conversion of $1,000,000 of unused common stock held in the treasury into 6 per cent cumulative preferred. This is to be used to settle the overdue maturing coupons on the bonds and to liquidate the floating indebtedness of the company. Of this preferred stock $615,000 has already been subscribed by the holders of the bonds and of the common stock.

Massachusetts Electric Companies.—On Sept. 30 the Massachusetts Electric Companies closed the most profitable year in its history. The gross earnings for the period were $8,560,949, and the net earnings $3,200,654. The surplus available for dividends after paying fixed charges amounts to 6.3 per cent on the $20,557,400 preferred stock. During the year the operating ratio was materially reduced and the regular 4 per cent dividend on the preferred stock was re-established.

DIVIDENDS.

Mackay Companies, quarterly, preferred, 1 per cent; common, 1¼ per cent, both payable Jan. 3.

Manhattan Railway Company, quarterly, 1¾ per cent, payable Jan. 1.

Manufactured Rubber Company, preferred, quarterly, 1½ per cent, payable Dec. 1.

Pensacola Electric Company, semi-annual, preferred, 3 per cent, payable Dec. 1.

Safety Car Heating & Lighting Company, quarterly, 2 per cent, extra 3 per cent, payable Dec. 23.

REPORTS OF EARNINGS.

	[illegible]	Expenses.	Net Earnings.	Charges.	Surplus.
[illegible] Light & Power Company:					
[illegible]	[illegible]	[illegible]	[illegible]	$376,077	$648,882
[illegible]	,577,663	[illegible]	940,771	346,986	[illegible]
[illegible]					
[illegible]	[illegible]	8,441,883	[illegible]	[illegible]	3,374,923
[illegible]	[illegible]	6,642,693	[illegible]	[illegible]	2,814,246
[illegible]					
[illegible]	[illegible]	[illegible]	272,948	48,432	224,516
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	192,408
[illegible] United Railway Company:					
October [illegible]	[illegible]	523,058	286,397	[illegible]	[illegible]
[illegible]	[illegible]	471,500	239,976	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	193,806	[illegible]
[illegible]	642,239	[illegible]	[illegible]	175,293	[illegible]
[illegible]					
[illegible]	676,120	184,720	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]		
[illegible] Company (Mexican currency):					
[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	229,512		
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	148,939
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]		28,036		[illegible]
[illegible]	[illegible]		22,300		13,883
[illegible]rn Ohio Traction Company:					
[illegible]	[illegible]	[illegible]	[illegible]	43,367	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Year ended Sept. 30, 1909......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

General News

Construction News.

BIRMINGHAM, ALA.—The Tidewater Railway Company has been granted a franchise by the City Council over 500 blocks of city streets. A perpetual franchise for part of the proposed railway and thirty years for the remainder are granted.

DEMOPOLIS, ALA.—The contract for pumping the city water supply has been awarded to the Demopolis Electric Light & Power Company for a period of five years at a rate of $1,750 per year.

FOREMAN, ARK.—The business men of Foreman have organized a telephone company with a capital stock of $5,000. A. Goldsmith is president and John H. Hawkins is secretary and treasurer.

WALNUT RIDGE, ARK.—The business men of Walnut Ridge have raised funds for the construction of a rural telephone line eight miles northeast of this town, work on which will begin at once.

ALLEGHENY, CAL.—It is expected that the new electric lighting system will be in operation within a short time. The service will be supplied by the Middle Yuba Hydro-Electric Company.

COLUSA, CAL.—Arrangements are being made by the Pacific Gas & Electric Company for the erection of a new transmission line, carrying 15,000 volts, from Gridley to Colusa, to replace the one now in use.

LOS ANGELES, CAL.—The Board of Public Works has recommended to the Council that sixty-two lamps be installed in the Cahuenga district, recently annexed. The cost of maintaining the lamps for the remainder of the fiscal year is estimated at about $2,000.

OCEAN PARK, CAL.—The contract for the construction of the power house in Ocean Park for the Southern California Edison Company has been awarded to George D. Snyder at $3,841.

OROVILLE, CAL.—Notice of appropriation of 30,000 in. of water in the Middle Fork of the Feather River has been filed by Mrs. E. M. Lague, to be carried to a power house at the junction of Bear River and the Middle Fork. Filings amounting to 110,000 in. of water from Bear and Falls Creeks and the Middle Fork for the same power plant have been posted. A dam 275 ft. long, 80 ft. high and 40 ft. through will be built and the water carried by a ditch, twenty miles in length, to the power house.

SALINAS, CAL.—It is reported that the City Council has decided to call an election to submit the proposition to issue $125,000 in bonds for an electric light plant and water-works plant to a vote.

SAN BERNARDINO, CAL.—It is understood that the committee appointed by the Mayor to investigate the question of installing a municipal electric plant in San Bernardino will recommend establishing a municipal plant.

SAN FRANCISCO, CAL.—The Great Western Power Company has been awarded a franchise to extend its system through Albany to the north of Berkeley. The company's lines extend from Oakland through Albany to Richmond.

SAN FRANCISCO, CAL.—The Hydro-Electric Company, which has been temporarily enjoined from running a pipe line across the Mono National Forest Reserve without a permit from the Secretary of Agriculture, has notified the United States District Attorney that it would apply for a permit.

SAN FRANCISCO, CAL.—The Sacramento Valley Irrigation Company has purchased from the Westinghouse Electric & Manufacturing Company electric motors aggregating 1050 hp in three vertical units. The pumps are to be installed at the "Headgates," near Hamilton, where electrically driven pumps having a capacity of 500 hp are already in operation. The new equipment is to be used in connection with the Kuhn project, one of the largest irrigation and reclamation enterprises in California.

VENTURA, CAL.—Bids will be received by J. B. McCloskey, clerk of Board of Supervisors, until Dec. 8, for installing and maintaining electric lamps on Ventura Avenue.

BOULDER, COL.—The Boulder Electric Light & Power Company has submitted a proposition to the City Council asking for a twenty-year franchise in return for which the accompany agrees to build five miles of additional trackage within seven years and make immediate improvements to its system which will involve an expenditure of $10,000. The present franchise expires in 1913.

DENVER, COL.—It is reported that the Boston-Colorado Power Company will be reorganized under the name of the Boston-Colorado Power & Irrigation Company. The capital stock will be increased from $2,000,000 to $10,000,000 and a bond issue for $10,000,000 wil be authorized. The company claims to have secured control of eighteen natural lakes in the mountains west of Boulder and Loveland, southwest of Denver; acquired practically all the water rights of Jim Creek and Left Hand Creek and tributary streams and reservoir and power sites. It is proposed to build several power plants and irrigate a large area of land. McKnight & Henry are attorneys for the company. W. E. Renshaw, of Idaho Springs, F. D. Patterson and Richard Irvine, of New York, N. Y., are interes in the project.

FORT COLLINS, COL.—The City Council has granted the requ of the business men to place large tungsten lamps on the trolley po in the business district on College Avenue. Two lamps will be pla on each pole. It is proposed to carry out this plan on other busin streets.

FORT LUPTON, COL.—The Town Council has granted the Northe Colorado Power Company a franchise to supply electrical service wit the town limits. The company will also furnish many ranchers al its transmission line with electricity.

FRUITA, COL.—Carl C. Harding has applied to the Town Council a franchise to install an electric light system in Fruita.

LAFAYETTE, COL.—The Northern Colorado Power Company making an extension of its 44,000-volt feeder lines from the Lafay power house, via Brighton, Fort Lupton, Evans to Greeley. The ot loop via Longmont, Loveland, Fort Collins to Greeley has been service about four years.

TRINIDAD, COL.—The question of constructing an electric in urban railway connecting Trinidad with all the coal mining camps in section is under consideration. C. S. Weitzel, general manager of C. F. & I. Company, is said to be interested in the project. It understood that work will begin on construction of the proposed way early in the spring.

WASHINGTON, D. C.—The contract for furnishing and installing electric light plant for the temporary buildings of the workhouse, loc at Occuquan, Va., has been awarded by the Commissioners of District Columbia to the National Electrical Supply Company, of Washing D. C., for $3,430.

LIVE OAK, FLA.—The Union Investment Company is planning make improvements and extensions to the electric light system.

AUGUSTA, GA.—The City Council has appointed a committee to vestigate the question of improving the street lighting system and establishment of a "Great White Way." The construction of a munic electric light plant has been suggested, but no definite movement been made. The Augusta Railway & Light Company has the cont for street lighting.

MACON, GA.—The H. E. Lowe Electric Company, of Macon has secured the contract for the electrical equipment for the new b ing to be erected for the Macon *Telegraph*. The contract inc motors for the operation of presses and linotype machines.

STONE MOUNTAIN, GA.—The citizens of Stone Mountain endeavoring to persuade the Georgia Railway & Electric Compan extend its railway from Decatur, located six miles from Atlanta Stone Mountain, a distance of ten miles, making the total lengt the proposed branch sixteen miles in length.

POCATELLO, IDAHO.—The Commercial Club is considering question of installing an ornamental electric lighting system on principal streets in Pocatello. It is proposed to erect cluster lamps.

CHICAGO, ILL.—The North Shore Electric Company has purch the plant and holdings of the Oak Park Light, Heat & Power Comp The Oak Park Company is capitalized at $600,000, and has a bo indebtedness of $100,000.

CHICAGO, ILL.—Sealed bids will be received at the office of the ness manager of the Board of Education, 730 Tribune Building, Dear and Madison Streets, Chicago, Ill., until Dec. 7, for construction of tion to the Howe School, including telephones, bells, electric work, heating, ventilation, etc., in accordance with plans and specifications pared by A. F. Hussander, acting architect, and N. L. Patterson, chief engineer, which may be seen at the office of the architect, Room Tribune Building, Dearborn and Madison Streets, Chicago, Ill.

IPAVA, ILL.—F. R. Dennis, of Peoria, Ill., owner of the electric light plant, has submitted a proposition to the Village F offering to sell his plant to the town. The installation of an new plant is advocated.

MARSEILLES, ILL.—The Northern Illinois Light & Traction pany is reported to have awarded the contract for the constructio a hydroelectric power plant at Marseilles to the L. E. Myers Com Railway Exchange Building, Chicago, Ill., to cost about $300,000. proposed power plant will supply electricity for operating the ra system of the Northern Illinois Light & Traction Company in nor Illinois.

SAYBROOK, ILL.—The electric plant of the Saybrook El Light, Heat & Power Company was destroyed by fire on Nov. 17, ca a loss of $5,000. R. N. Cooper is president and manager.

COLFAX, IND.—Steps have been taken by the Town Counci the installation of a municipal electric light plant in Colfax.

CRAWFORDSVILLE, IND.—Work has been commenced by a bo appraisers for placing a valuation on the old municipal electric plant, which the City Council will soon advertise for sale. It i

pected that the new municipal [illegible] in a short time.

HUNTINGTON, IND.—Arrangements are being made by Orton & Steinbrenner, of Chicago, Ill., for the construction of a factory building at Huntington, 80 ft. x 160 ft., which will be equipped for electric motor drive. The company will manufacture locomotive cranes.

INDIANAPOLIS, IND.—C. J. Wheeler, custodian of the State House and grounds, has entered into a contract with the Merchants' Light & Heat Company for furnishing electricity for lighting the buildings and grounds at the rate of 3½ cents per kw-hour, not including globes. Under the new contract the price has been reduced from 10 cents to 3½ cents per kw-hour, which will reduce the cost about $7,000 per year.

LAFAYETTE, IND.—Preparations are being made by the Lafayette Telephone Company for the erection of a number of new cable leads and the installation of several toll lines.

PERU, IND.—Arrangements are being made by the Home Telephone Company for the construction of a new telephone exchange in Peru at a cost of $10,000. Automatic switchboards will be installed.

BONAPARTE, IA.—S. E. Irish, of Keosauqua, Ia., who recently purchased the Meek dam, is reported to be contemplating organizing a company to rebuild the dam and install an electric plant to develop about 1200 hp.

CHARLES CITY, IA.—Plans are being considered by the City Improvement Association for the installation of forty-two electroliers at a cost of $75.50 each.

DOWS, IA.—The proposition to grant a franchise to the Dows Electric Company will be submitted to a vote on Dec. 6.

FOREST CITY, IA.—The plant and holdings of the Forest City Electric Light & Power Company have been purchased by Frank Kellogg of Seymour, Ia. M. E. Barton, president and manager of the Forest City Company, will have charge of the plant.

WAPPELLO, IA.—It is reported that a project is on foot to utilize the water power of the old millrace to operate a hydroelectric plant. The cost of the proposed plant is estimated at about $300,000. Utt Brothers, of Chicago, Ill., are said to be interested in the project.

WATERLOO, IA.—An ordinance to fix the standard of street lamp posts in Waterloo is under consideration by the City Council. The proposed standards are to be 13 ft. 6 in. high, with top globe 16 inches in diameter, and four side lamps, all to be equipped with 100-watt tungsten lamps. The poles are to cost $55 each, to be paid for by the property owners, and the maintenance to be borne by the city.

WEBSTER CITY, IA.—The Fort Dodge, Des Moines & Southern Railroad Company is reported to have [illegible] the [illegible] Creek Railway, seventeen miles in length, and proposes to equip it for electrical operation, work on which will begin at once.

LOUISVILLE, KY.—Sealed proposals will be received at the office of the Board of Public Works, Louisville, Ky., until December 9, for the installation of a new magnetic controlled electric passenger elevator in the city hall. Plans and specifications can be seen at the office of the Board of Public Works. Cost of work is estimated at $6,000. Roger G. McGrath is secretary of board.

NEW ORLEANS, LA.—A new company has been formed by the business men of New Orleans for the purpose of purchasing the plant and holdings of the Consumers' Electric Company, which was recently placed in the hands of a receiver. The new company will be known as the Consumers' Electric Light & Power Company, and will be capitalized at $1,500,000. The court has ordered the plant to be sold on Dec. 17. The property is valued at $1,200,000. Samuel Insull, of Chicago, Ill., is receiver. The directors of the new company are: Charles E. Fenner, Walker B. Spencer, Bernard J. Mayer, Esmond Phelps and M. S. Hart.

ORONO, MAINE.—Preparations are being made by the Penobscot Realty Company, which has purchased the power site and most of the holdings of the James Walker Company, in Orono, for the construction of a large hydroelectric power plant. The proposed power plant will develop from 3000 to 5000 hp. and will cost about $300,000.

BALTIMORE, MD.—Proposals will be received by the Board of Awards at the office of J. Sewell Thomas, City Register, city hall, Baltimore, Md., until Dec. 7, for installing electric wiring at the sewage-pumping station, as per plans and specifications on file at the office of Calvin W. Hendrick, chief engineer of the sewerage commission. Plans and specifications can be obtained on application at the office of the sewerage commission, Room 904, American Building, Baltimore, Md. J. Barry Mahool is president, Board of Awards.

HAGERSTOWN, MD.—It is reported that Pierre O. Keilholtz, consulting engineer, Continental Building, Baltimore, Md., is preparing plans for a new power house for the Union Power Company, bids for construction of which will soon be called.

CHICOPEE, MASS.—The Electric Light Commissioners are considering the question of extending [illegible] view. It is proposed to purchase the equipment owned and operated by the South Hadley Falls Electric Light Company in Fairview, which has supplied electrical service in that village since 1895. The street lighting system includes about forty lamps.

HOLYOKE, MASS.—Plans are being considered to erect twenty-two tungsten lamps between Race and Main Streets on Dwight Street. The lamps will be furnished and main[illegible] the block.

MUSKEGON, MICH.—The injunction obtained by the Muskegon Traction & Lighting Company restraining the city from selling bonds for the municipal electric light plant has been dissolved. It is said that steps will be taken to construct a municipal plant at once.

BALATON, MINN.—The Village Council is reported to be considering the question of installing a street lighting system.

DULUTH, MINN.—Preliminary plans are being prepared by the Great Northern Power Company for the erection of an electric transmission line from Thomson direct to Superior, with a distributing station in Duluth, which will involve an expenditure of about $200,000. W. N. Ryerson is general manager.

FERGUS FALLS, MINN.—Owing to the low water in the river the Otter Tail Company is installing an auxiliary steam plant at a cost of about $25,000. The company has announced that it will be obliged to increase its rates for electricity, owing to the increase in cost of operating the steam plant. The company supplies electricity for operating the municipal electric plant, and it is expected that the city will be obliged to increase its rates to consumers temporarily. At the present time the company is able to supply only a ten-hour service, owing to the lack of water.

LOWRY, MINN.—The question of installing an electric light plant in Lowry is reported to be under consideration. Misenol & Leslie, it is stated, are interested in the project.

MINNEOTA, MINN.—The Village Council has granted a franchise for the installation of an electric light plant in Minneota.

ROCHESTER, MINN.—The Public Utility Board is reported to be contemplating extending the electric lighting system in the Kutzky's addition.

ST. CLOUD, MINN.—Sealed bids will be received by the State Board of Control, State Capitol Building, St. Paul, Minn., until Dec. 5 for the completion of part of the interior of the administration building of the Minnesota State Reformatory, St. Cloud, Minn., including the general contract work, plumbing, heating and electrical work; also a separate bid for plumbing, heating and electrical work for a new hospital building at the reformatory in accordance with plans and specifications furnished by Clarence H. Johnston, architect, 715 Capital Bank Building, St. Paul, Minn., and Charles L. Pillsbury Company, engineer, 805 Metropolitan Life Building, Minneapolis, Minn. Plans and specifications can be seen at the Builders' Exchange, St. Paul, Minn.; Builders' Exchange, Minneapolis, Minn.; office of the State Board of Control, and at the office of the superintendent of the State Reformatory.

VIRGINIA, MINN.—Sealed proposals will be received at the office of O. Halden, county auditor, Court House, Duluth, Minn., and also at the office of Bray & Nystrom, architects, Palladio Building, Duluth, Minn., until Dec. 6 for furnishing and installing electric fixtures in the Range District Court Building at Virginia, Minn.; also alternate bids, substituting black iron standards instead of the two solid bronze standards in front of the building, plans and specifications for which can be secured from the architects.

WINONA, MINN.—The City Council has granted the Tri-State Telephone Company permission to enter the city with its lines.

HATTIESBURG, MISS.—Application has been made to the Council by W. S. F. Tatum and W. O. Tatum for a franchise to construct and operate an electric light plant in Hattiesburg, Miss.

JEFFERSON CITY, MO.—Sealed bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C. until Dec. 22 for the installation of a conduit and wiring system and gas piping at the United States post office and court house building in Jefferson City, Mo., in accordance with plans and specifications, which can be secured at the above office or of the custodian at Jefferson City, Mo. James Knox Taylor is Supervising Architect.

ST. LOUIS, MO—The Union Electric Light & Power Company has recently opened a new electric automobile garage at Twentieth and [illegible]

CULBERTSON, MONT.—Application has been made to the Council by W. E. Pierce for a franchise to install an electric light plant.

ANSLEY, NEB.—Bonds to the amount of $5,000, the proceeds to be used for the installation of a municipal electric light plant, have been voted.

BEATRICE, NEB.—The contract for furnishing material and making improvements to water works has been awarded to the Matthews Construction Company, of Kansas City, Mo., for $57,000. The W. K. Palmer Company, Dwight Building, Kansas City, Mo., has charge of the engineering work.

OMAHA, NEB.—Sealed bids will be received by the Board of County Commissioners of the County Douglas, addressed to D. M. Haverly, County Clerk, Omaha, Neb., until Dec. 17, for furnishing and installing three direct-connected engines and generators, including foundations, immediate steam supply and exhaust connections, wiring from generators to switchboard and three generator panels in the Douglas County courthouse, in accordance with specifications on file in the office of the County Clerk and John Latenser, architect, 632 Bee Building, Omaha, Neb. Copies of specifications can be obtained upon application to the architect. Bids will also be received at the same time and place for the installation of a vacuum cleaning system for the Douglas County courthouse. D. M. Haverly is County Clerk.

PETERSBURG, NEB.—Bids will be received by J. W. [illegible], rector, Petersburg, until Jan. 3, for the installation of heating, lighting

... system in the school house of the St. ... Church of Petersburg. Plans and specifications are on file at the office of James C. Stitt, architect, Norfolk, Neb.

SILVER CREEK, NEB.—Application has been made to the Council by the Montoe Telephone Company for a franchise to extend its telephone lines into Silver Creek.

GARFIELD, N. J.—At a special election held recently the citizens voted to issue $25,000 in bonds, the proceeds to be used for the installation of a municipal electric light plant.

JERSEY CITY, N. J.—Contracts for the construction of the new power house of L. O. Koven & Brothers, located on the Paterson Plank Road, has been awarded to William Whyte and Robert Cook. The building will be 50 ft. x 75 ft., one story high, and will cost about $25,000.

RED RIVER, N. M.—The application of the Red River Land & Water Company for 629 second ft. of water of the Red River, to be used for the reclamation of 45,000 acres of land in Taos County has been approved by Vernon L. Sullivan, Territorial Engineer.

ALBANY, N. Y.—The Board of Contract and Supply will soon call for bids for lighting the streets of the city for a term of five years. The present contract expires June 21, 1911.

ALBANY, N. Y.—Sealed proposals will be received by F. C. Stevens, Supernitendent of Public Works. Capitol Building, Albany, until Dec. 21 for the construction and equipment of a hydroelectric power plant on the Erie Canal, near the east end of Crescent Dam, on contract No. 91, Erie Canal, section 1.

ALBANY, N. Y.—The Trustees of Public Buildings have approved plans and specifications submitted by Franklin B. Ware, State Architect, for the construction of the new power house and conduits for the Capitol and the State Education Building. The power house will be located on North Hawk Street, between Sheridan Avenue and Orange Street. The plans provide for a boiler room with sufficient space for the installation of ten boilers of 380 hp each, and an engine room of sufficient size to install five engines and generators with a rating of 1700 kw. At present only eight boilers will be installed. The cost of the building is estimated at $500,000. It is expected that bids for heating, lighting and mechanical equipment will be called for soon.

BUFFALO, N. Y.—The contract for the three steam turbines, having a rating of 5000 kw each, with jet condensers, for the new pumping and electric station at the foot of Porter Avenue has been awarded to the Westinghouse Machine Company, of Pittsburgh, Pa., for $248,180.

FREEPORT, N. Y.—The question of increasing the output of the municipal electric light plant is reported to be under consideration. It is proposed to install a new arc lamp system and furnish electricity for motors.

GLENS FALLS, N. Y.—The Hudson River Electric Company has applied to the Public Service Commission, Second District, for permission to enter into a contract with the village of South Glens Falls to supply electricity for public lighting.

JOHNSTOWN, N. Y.—The Common Council has taken steps toward the construction of a municipal electric light plant in Johnstown, providing it is deemed necessary at the expiration of the present street lighting contract in 1913.

NEW YORK, N. Y.—Bids will be received at the office of the Commissioner of Immigration, Ellis Island, N. Y., until Dec. 5, for furnishing material and installing electric tie lines between the power houses on No. 1 and 3 Islands, at the United States Immigrant Station, Ellis Island, New York Harbor.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Dec. 27 for furnishing and installing electric work, elevator work, interior finishings, fixtures, vacuum-cleaning plant and other work for the completion of a nurses' home building for the Children's Hospital, located at the north end of Randall's Island, Borough of Manhattan. Blank forms and further information may be obtained at the office of Raymond F. Almirall, architect, 185 Madison Avenue, New York, N. Y., where plans and specifications may be seen. Michael J. Drummond is commissioner.

PHELPS, N. Y.—The Geneva-Seneca Electric Company, of Geneva, N. Y., has applied to the Public Service Commission, Second District, for permission to purchase the plant and holdings of the J. Q. Howe Sons' Electric Company, of Phelps. It is understood that the sale price is to be $18,000. If the sale is ratified, it is reported that the Geneva-Seneca Electric Company will erect a transmission line from Geneva to Newark, via Phelps, and establish a twenty-four-hour service in this town.

SYRACUSE, N. Y.—The North Side Citizens' Association has appointed a committee to secure estimates of the cost of installing an ornamental street lighting system for the North Side and to make arrangements with the merchants in that district to install and maintain the same. Jacob Armbruster, F. X. Gefliger and Joseph Rees are members of the committee.

BLACK MOUNTAIN, N. C.—Preparations are being made by the Blue Ridge Association for municipal improvements, including the construction of a dam and electric light plant, water-works and sewerage system, etc. F. C. Abbott is secretary and treasurer.

CHARLOTTE, N. C.—The Southern Power Company is reported to have purchased the entire interests of the Charlotte Electric Street Railway Company, which is capitalized at $1,125,000, and the Charlotte Gas & Electric Company, capitalized at $225,000, thereby securing the street car system, comprising twenty-five miles of trackage and all equipment, and the gas, electric light and power systems of the city. It is understood that the price paid for the properties was not far from $2,000,000.

DILLSBORO, N. C.—An electric plant is being installed at the Harris Roller Mills in Dillsboro. The plant will supply electricity for Dillsboro, Sylva and the tannery.

BUXTON, N. D.—At the annual meeting of the stockholders of the Red River Valley Telephone Company, it is said, the proposition to increase the capital stock of the company to $200,000 will be taken under consideration, the proceeds to be used for extensions to its system.

COSHOCTON, OHIO.—The Coshocton Light & Heat Company is reported to have entered into a contract with James B. Clow & Sons to supply electricity to operate its mills, located just south of the city. The company will furnish 500 hp at first, which will be increased to 800 hp within a few months.

DEFIANCE, OHIO.—The Defiance Interurban Electric Railway Company, recently incorporated with a capital stock of $50,000, is planning to construct an electric railway from Defiance, Ohio, to Fort Wayne, Ind. It is understood that most of the right-of-way has been secured.

JACKSON, OHIO.—Bids will be received by W. A. Dallas, clerk of board of public affairs, until Dec. 19 for machinery in connection with improvements to the municipal electric light plant, the cost of which is estimated at $11,000. Bids were received Oct. 20 for the above work, but were rejected.

LIMA, OHIO.—Arrangements are being made by the Lima Telephone & Telegraph Company for extensive improvements to its system soon after the first of the year. The work will include the erection of a new exchange building and the installation of a new switchboard, and involve an expenditure of more than $100,000.

MOUNT VERNON, OHIO.—The Mount Vernon Electric Company has filed amendments to its charter with the Secretary of State increasing its capital stock from $10,000 to $300,000.

WARRENSVILLE, OHIO.—The contract for installing a steam and electric generating unit, switchboard and appliances for the Service Quadrangle, Colony Farm, Warrensville, has been awarded to the Brownell Company, of Dayton, Ohio, for $3,200. C. A. Marvin is secretary.

NELAGONEY, OKLA.—The Osage Manufacturing Company, of Joplin, Mo., is planning to erect a clay working and ice plant in Nelagony, for which machinery has been purchased. It is said that the company proposes later to install an electric light and power plant and water-works system. J. S. Roberts, of Joplin, Mo., is president.

OKLAHOMA CITY, OKLA.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 28 for the installation of conduit and wiring system and gas piping in the United States post office building at Oklahoma City, Okla., according to plans and specifications, copies of which may be obtained at the above office or at the office of the superintendent of construction, Oklahoma, Okla. James Knox Taylor is Supervising Architect.

HARRISBURG, ORE.—The Council has contracted with the Northwestern Corporation to furnish electricity for street lighting.

JUNCTION CITY, ORE.—The Council has entered into a contract with the Northwestern Corporation, of Eugene, for lighting the streets of the city. About seven arc lamps and forty incandescent lamps will be placed on the streets.

PORTLAND, ORE.—Announcement has been made that the United Railways Company and the Oregon Electric Railway Company will make extensive extensions to their systems in and around Portland during the coming year which will involve an expenditure of from $7,000,000 to $10,000,000. Work will begin at once on Tenth and Salmon Streets extension of the Oregon Electric Railway Company. John F. Stevens is president of both companies.

UNION, ORE.—Plans are being made for the construction of a municipal electric light plant, for which bonds to the amount of $71,000 have been authorized. L. C. Kelsey, of Salt Lake City, Utah, is consulting engineer.

VALE, ORE.—The plant and holdings of the Vale Light & Power Company have been purchased by the Telluride Power & Investment Company, of Salt Lake City. F. A. Boyd, of Provo, Utah, will have charge of the local plant.

CLARION, PA.—The Clarion & East Brady Electric Railway Company, of Clarion, Pa., is asking for bids for construction of power house and equpment for same, including three 500-kw turbo-generator sets, condensing, steam pressure, 200 lb., either vertical or horizontal; water-tube boilers; three surface condensers; vacuum pump; open feed-water heater; two boiler feed pumps, either duplex or multi-stage driven, driven by steam turbine; three 20-kw exciter sets; six motor-generator sets; three circulating pumps; hot well pump; transformers and substation equipment. Specifications will be furnished on application. Contract has been awarded for construction of the first six miles to Ridge Brothers, of Pittsburgh, Pa. The proposed railway will be thirty miles in length. For further information address T. S. Arnold.

CLYMER, PA.—The Clymer Light, Heat & Power Company is making rapid progress with construction of its new power plant at the Bar Slope, one of the Clearfield bituminous coal mines, near Dixonville. The plant when completed will supply electricity in Clymer, Dixonville, Marion ... and other towns in this vicinity. The Borough of Clymer

[h]entered into a contract with th[e] ... [for] street lamps. It is [ex]pected to have the system in operation early in December.

[L]ARIMER, PA.—The stockholders ... [Te]lephone Company [ha]ve voted to increase its capital stock for the purpose of extending its [lin]es through Wittenberg, Greenville and Southampton. It is expected to [hav]e the lines completed this fall.

[N]EW KINGSTON, PA.—The Kingst[on] ... Bell Telephone Company, [rec]ently organized, is planning to erect and operate a telephone line, five [mil]es in length, from New Kingston to Mechanicsburg, to connect with the [Be]ll system at the latter place. Charles Herrick, of New Kingston, Pa., [is a]gent.

[R]ENOVO, PA.—The Renevo Edison Light, Heat & Power Company is [ext]ending its transmission lines to Farwell to supply electricity in that [tow]n.

[G]REENVILLE, S. C.—The erection of a large plant for the manu[fac]ture of fine yarns in Greenville is being promoted, machinery for [wh]ich has been purchased. The plant will be operated by electricity, [for] which 1500 hp will be required. Contracts for construction of [bui]ldings will be awarded as soon as plans are completed. The equip[me]nt will include 50,000 spindles and 1200 looms. J. I. Westervelt [wil]l be manager.

[R]OCK HILL, S. C.—Owing to the refusal of the Rock Hill Water & [Ele]ctric Company to accept an offer of $100,000 for its holdings in this [cit]y, the City Council has authorized the Board of Public Works to pro[cee]d with the construction of a municipal electric light and water plant. [A s]ite has already been purchased. A. P. Maloney, of Philadelphia, Pa., [is p]resident of the company.

[B]ROOKINGS, S. D.—Sealed proposals will be received by the Board [of] County Commissioners of Brookings County until Dec. 28 for con[stru]ction of court house building, including heating, electric work and [plu]mbing, in the City of Brookings. Plans and specifications are on [file] at the office of C. E. Bell, Tyrie & Chapman, architects, Auditorium [Bui]lding, Minneapolis, Minn., and at the office of O. J. Otternes, county [aud]itor, Brookings.

[E]GAN, S. D.—The proposition to issue bonds for the installation of [an] electric light plant in Egan will be submitted to a vote.

[E]UREKA, S. D.—The Council has granted a franchise to G. A. Mc[Lau]ghlin, of Aberdeen, S. D., for the installation of an electric light sys[tem] in Eureka. It is expected to have the plant in operation by March 1, [1911].

[L]ETCHER, S. D.—The installation of an electric light plant in Letcher [this] winter is reported to be under consideration by the town officials.

[O]LDHAM, S. D.—The contract for installing a low-voltage storage [batte]ry light plant having sufficient capacity to provide for 1500 lamps has [been] awarded to the Battery Power Company, of Milwaukee, Wis.

[D]UCKTOWN, TENN.—It is reported that the Westinghouse Elec[tric] & Manufacturing Company has received the contract for the instal[latio]n of electrical equipment for the power plant now being built on [the] Ocoee River, near Ducktown. The cost of the machinery is esti[mate]d at about $[illegible].

[A]BILENE, TEX.—The City Council has adopted an ordinance re[quir]ing that telegraph, telephone and electric wires be placed in under[grou]nd conduits on certain streets of the city.

[A]USTIN, TEX.—W. C. Day, superintendent of public buildings and [grou]nds, has filed his report with the Governor, in which he asks that [appr]opriations be made for new machinery for the power house which [sup]plies electricity for heating and lighting the Capitol Building and [grou]nds. The cost is estimated at about $10,000.

[B]EEVILLE, TEX.—A deal has been closed whereby the Beeville Ice [& L]ight Company will take over the plant of the Beeville Ice Company. [The] new owners propose to install an electric light and power plant to be [oper]ated in conjunction with the ice plant.

[G]RAPELAND, TEX.—G. W. Johnson & Company, of Kansas City, [Mo.], are reported to have submitted a proposition to the Council to in[stall] an electric light plant in Grapeland.

[S]AN ANTONIO, TEX.—The Board of County Commissioners of [Bex]ar County has granted J. A. Logwood a franchise to build an elec[tric] railway from the terminus of the San Antonio Traction Company's [trac]k at Harlandale, south on the Corpus Christi Road, through a sub[urb] [illegible].

[T]EXAS CITY, TEX.—[illegible] ... [The] proposed railway will be about three miles in length and gasoline [cars] will be used.

[V]ICTORIA, TEX.—The Victoria Manufacturing Company has re[cent]ly installed a new electric light plant. The street lighting system [cons]ists of 150 tungsten lamps of 60 cp and seven 1200-cp arc lamps.

[R]UTLAND, VT.—The Rutland Railway, Light & Power Company has [petit]ioned the State Legislature for [illegible] ... [illegible] to it the privilege to build [illegible] ... [Mi]ddleton, Manchester and Dorset; also for the right to distribute [and] sell electricity in these towns. If permission is granted the company [will] begin work on construction of the railway in the spring, which will [even]tually be extended to Granville, N. Y. The company is now building [a ra]ilway from Fair Haven to Poultney, which is nearly completed.

[F]ORT MONROE, VA.—Bids [illegible] ... quartermaster, Fort Monroe, Va., until Dec. 10 for furnishing 520 electric fixtures, 300 ft. of cable, 200 lb. assorted nails, 40 lb. assorted tape and 3000 ft. rubber-covered wire. Captain Curtis C. Rorebeck is quartermaster.

BERLIN, WASH.—It is reported that arrangements are being made to increase the output of the Apex Gold Mine in Berlin. It is proposed to install a 6-drill air compressor, enlarge the electric power plant on Money Creek and reconstruct its railroad.

CHELAN, WASH.—The Chelan Land Company is contemplating the erection of a telephone line to connect its land holdings with Chelan.

CLARKSTON, WASH.—Contracts have been awarded by the Lewiston-Clarkston Improvement Company for the construction of a concrete power house and equipment, aggregating more than $100,000. The equipment will be supplied by the General Electric Company, of Schenectady, N. Y., and Charles C. Moore & Company will erect the building. The new plant will be erected adjoining the present steam plant and will have an output of 2000 hp.

NORTH YAKIMA, WASH.—Preparations are being made by the Pacific Power & Light Company for extending its transmission lines through Selah and Wenas valleys. It is proposed to eventually extend the lines through the Ahtanum, Cowiche and other valleys. George C. Arrowsmith is general manager.

SEATTLE, WASH.—It is reported that the Seattle-Everett Traction Company will soon apply to the County Commissioners for a franchise to construct an electric railway to Lake Burien, seven miles south of Seattle.

SEATTLE, WASH.—At an election held recently five bond propositions were approved by the voters, aggregating $2,678,000, of which the proceeds of $1,400,000 will be used for the extension of the municipal electric light plant, including the construction of a dam on Cedar River.

SPOKANE, WASH.—It is said that the Council fire, water and sewer committee will recommend that the municipal electric power plant be located on the Pend Oreille River, near Metaline, where it is estimated that from 5500 to 6000 hp could be developed and delivered in Spokane by a 100-mile transmission line. The cost of the plant complete is estimated at $5,000,000.

STANWOOD, WASH.—L. F. Query has been granted a franchise by the Snohomish County Commissioners to erect and operate an electric light system in Stanwood.

TACOMA, WASH.—Announcement has been made that the Pacific Telephone & Telegraph Company is planning to erect two new telephone exchanges in Tacoma, one in the north end of the city and the other in the south. The improvements contemplated will involve an expenditure of about $300,000.

CARBONDALE, W. VA.—The Sunday Creek Company is reported to have placed a contract with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for one 200-kw., 250-volt, direct-current, engine type generator.

ENDEAVOR, WIS.—The Endeavor Electric Light & Power Company, it is reported, is planning to install an electric generating plant in the spring. William H. Burwell is manager.

MILWAUKEE, WIS.—At an election held recently the citizens voted to appropriate $550,000 for the installation of a municipal electric light plant to supply electricity to light the streets, parks and public buildings. It is proposed to utilize the waste steam of the city garbage destructor plant on the lake, where tests made some time ago showed that sufficient steam is available to operate the proposed plant. There are now 3000 street arc lamps needed for the city, but the proposed plant would only be able to provide electricity for about 1000 arc lamps.

NEILSVILLE, WIS.—Arrangements are being made by the Wisconsin Furnituring Company for the construction of a new plant to replace the factory of the Reliable Furniture Manufacturing Company, burned some time ago. The proposed plant will be equipped for electric motor drive. It has not been decided whether to install a steam-driven plant or to purchase energy.

VALDERS, WIS.—The Oslo Lighting & Power Company is reported to be planning to install a power plant in Valders, and will soon be in the market for equipment for a steam generating plant, including boilers.

WAUSAU, WIS.—The installation of a municipal electric light plant in Wausau is under consideration.

CHEYENNE, WYO.—The Police and Fire Board has recommended two ordinances to the City Council governing electric wiring and gasoline lighting installation. Both resolutions are supported by the Underwriters and the Northern Colorado Power Company.

LOVELL, WYO.—At an election held recently the citizens voted to [appropriate] $[illegible] for the [installation of an] electric light system and $5,000 for the extension of the water-works system.

COQUITLAM, B. C., CAN.—The ratepayers have voted in favor of the bylaw granting the Western Canada Power Company a franchise to erect its transmission lines through Coquitlam and supply electricity [illegible].

PRINCE RUPERT, [B. C.]—[illegible] ... Alexander Johnston, Deputy Minister of Marine and Fisheries, Department of [illegible] ... [const]ruction at a ... Prince Rupert, B. C., including the erection of a reinforced-concrete wharf, timber approach trestle, power house, with [illegible].

[illegible] system. Plans and specifications [illegible] ten- ders can be procured at the above office and at the office of the agent of the Department of Marine and Fisheries, Victoria, B. C.; Halifax, N. S.; [illegible] Rupert, B. C., and at the custom house, Winnipeg, Man., Can. Only bids for the entire work will be considered.

VANCOUVER, B. C., CAN.—Inducements are being offered to the British Columbia Electric Railway Company by the property owners along Nanaimo Street to construct an electric railway along that street. It is said that a bonus of $55,000 may be offered the company.

VERNON, B. C., CAN.—Bids will be received until Dec. 19 by the Public Works Department, Ottawa, Ont., for electric light fixtures, wiring, etc., for public buildings at Vernon. R. C. Descrochers is secretary.

BERLIN, ONT., CAN—The light committee has fixed the rates for service for residential lighting from the Hydro-Electric Power Commission. There will be a fixed rate of 5 cents per month for each 100 sq. ft. area lighted, and a charge of 4 cents per kw-hour for electricity used. A discount of 10 per cent is allowed if paid within a month and a further discount if paid within ten days. A flat rate of $6 per month for all purposes has been decided upon. The rates for power service have not yet been decided upon.

BRANTFORD, ONT., CAN.—The Grand Valley Railway Company is contemplating the erection of a 40,000-volt transmission line through Paris from Brantford to Galt. The company now purchases electricity from the Cataract Power Company to operate its railway between Brantford and Paris, and proposes to extend the service from Paris to Galt. It is proposed to discard the steam-driven power plant which supplies energy for operating the railway between Paris and Galt. It is also proposed to furnish electrical service to towns and villages along the route of the railway. W. P. Kellett is general manager and electrical engineer.

MITCHELL, ONT., CAN.—The citizens have voted in favor of the by-law to issue $9,000 in debentures, the proceeds to be used to install equipment in the municipal electric plant to utilize electricity supplied by the Hydro-Electric Power Commission. It is expected to have the new system ready for operation by February.

NORTH TORONTO, ONT., CAN.—A by-law to authorize the Town Council to install an electric plant at a cost of $18,000 to furnish electricity for lighting the streets and residences of the town will be submitted to a vote on Jan. 1.

MONTREAL, QUE., CAN.—The City Council at a meeting held Nov. 14 adopted a resolution to prepare by-laws providing for the borrowing of $10,000,000 for public improvements, of which $1,000,000 will be used for a municipal electric plant, and $1,000,000 for underground conduits. The Council has awarded the contract for a motor-driven centrifugal pump to the John McDougall Caledonian Iron Works Company, of Montreal, Que., for $7,716.

SHERBROOKE, QUE., CAN.—Preparations are being made by Messrs. Ross & Holgate, of Montreal, Que., for the construction of a power plant on the Magog River, bids for which will be received until Dec. 29. The cost of the work is estimated at about $60,000.

DURANGO, MEX.—The Compania de Madera de la Sierra, which operates lumber mills near Llano Grande, in this state, is planning to install a hydroelectric power plant in the San Vicente district, to furnish electricity to operate its mills and other industrial plants in this section.

GUANACEVI, DURANGO, MEX.—E. Schondube, of Mexico City, Mex., has been granted a concession by the government of the State of Durango for the installation of a large hydroelectric plant and the erection of transmission lines in this section of Mexico. The proposed plant will be located near Guanacevi. Electricity will be transmitted to the mines in this section and the districts of El Oro, Tepehuanes and Inde. Under the terms of the concession Mr. Schondube is to supply electricity to the state government for lamps and motors for a period of five years free of charge, and after that time at 50 per cent less than to other consumers.

MEXICO CITY, MEX.—The National Congress has passed a bill authorizing the Mexican Tramways Company to construct two new electric railways. One of the proposed roads is to extend from Mexico City to Puebla, a distance of about 125 miles, and the other to Toluca, forty-five miles long, for which preliminary surveys have been made. The proposed railway will give both passenger and freight service.

New Industrial Companies.

THE AMERICAN ADVERTOGRAPH COMPANY, of Newark, N. J., has been incorporated by J. Weener, S. W. Gordon and J. Einwachter, of Newark, N. J. The company is capitalized at $150,000 and proposes to manufacture automatic advertising devices, weighing machines, etc.

THE AMERICAN & FOREIGN OPERATING COMPANY has filed articles of incorporation with a capital stock of $1,500,000. The incorporators are: J. G. Gray, S. S. Adams, Jr., and M. B. F. Hawkins, of Wilmington, Del.

THE CASE PATENT METAL BOILER CLEANER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $300,[illegible] by W. McLaughlin, of Philadelphia, Pa.; M. H. Haskin and G. Kren[illegible] of New York, N. Y. The company proposes to manufacture compou[nds] for cleaning boilers, etc.

THE ELECTRIC APPRAISAL & INSPECTION COMPANY, Cleveland, Ohio, has been incorporated with a capital stock of $10,00[0] W. H. Hasselman, T. T. Quick, E. M. Fisher and J. J. Shipley.

THE ELECTRIC HEAT STORAGE COMPANY, of New York, N. [Y.] has filed articles of incorporation with a capital stock of $1,500,[000] by F. Murtha, P. B. Hanson and P. H. Zornow, of New York, N. Y. [The] company proposes to manufacture and deal in electric heating and [heat] storage apparatus.

THE CLYDE CONSTRUCTION COMPANY of Detroit, Mich., [has] been chartered with a capital stock of $52,000 by Henry R. Adams, [of] Grand Rapids, Mich.; Frank W. Wheeler and George H. Sweet, of Det[roit,] Mich. The company proposes to construct water power plants, ste[am] power plants, and build and equip railroad, telephone and telegraph li[nes].

THE H. MUSSO COMPANY, of New York, N. Y., has filed artic[les] of incorporation with a capital stock of $10,000 for the purpose of ma[nu]facturing telephone and telegraph instruments. The incorporators a[re] Charles V. Paterno, Northern Avenue and 182d Street; Giuseppe Mu[sso,] 440 Riverside Drive; John M. Stoddard, 135 Broadway, all of New Yo[rk,] N. Y.

THE IMPERIAL ENGINEERING COMPANY, LTD., of Montr[eal,] Que., Can., has been incorporated with a capital stock of $100,[000] and proposes to do a general engineering and contracting business, incl[ud]ing street railway work, hydroelectric work, etc. Lawford Grant, of M[on]treal, Que., is reported to be interested in the project.

THE ISLAND PARK COMPANY, of Plainfield, N. J., has been inc[or]porated by H. O. Coughlan, L. H. Guenther and John R. Turner. [The] company is capitalized at $50,000 and proposes to engage in a gen[eral] electrical business and also deal in lumber and real estate.

THE KING PHONE DISTRIBUTING COMPANY, of Pittsbu[rgh,] Pa., has been incorporated with a capital stock of $2,000 by Raymond Kaufman, Karl J. Kaufman and Chester Kaufman, all of Pittsburgh, The company proposes to deal in telephones.

THE MILLAR ELECTRIC COMPANY, of Springfield, Ill., has b[een] chartered by John J. Offield, Charles J. Schmidt and Frank R. Belkr[illegible] The company is capitalized at $10,000 and proposes to manufacture [and] deal in electrical devices and machinery.

THE MOTORS ENGINEERING & SALES COMPANY, of [New] York, N. Y., has been incorporated with a capital stock of $200,000 by Griswold, W. S. Jewell and J. L. Beese, Jr., of New York, N. Y. [The] company proposes to manufacture and deal in motor vehicles, engines,

THE ROSS-SCHOFIELD COMPANY, of New York, N. Y., has b[een] chartered by Robert D. Jeffreys, George Surand, 39 Cortlandt Street, N[ew] York, N. Y., and Charles I. Friedman, 104 Ten Eyck Street, Brook[lyn,] N. Y. The company is capitalized at $5,000 and proposes to manufact[ure] boilers, mechanical implements, etc.

THE SANITARY VACUUM CLEANING & POWER COMPANY, [of] Brooklyn, N. Y., has been incorporated with a capital stock of $100,[000] for the purpose of manufacturing vacuum-cleaning apparatus, etc. [The] incorporators are: J. A. Marshall, R. G. Barclay and A. W. Stevens, Brooklyn, N. Y.

THE SIMMONS AUTOMOBILE COMPANY, of New York, N. [Y.,] has been incorporated with a capital stock of $10,000 by John G. S[im]mons, 2138 Westchester Avenue; George L. Lewis, 42 Broadway, both [of] New York, N. Y., and Daniel E. Wing, of Hackensack, N. J. The c[om]pany proposes to manufacture and sell motors, engines, automobiles,

THE UNIVERSAL CARBON COMPANY has filed articles of in[cor]poration under the laws of the State of Delaware with a capital stock [of] $500,000. The incorporators are: F. L. Palmer, E. L. Kirkham and E. Taylor, of Hartford, Conn.

THE VOHR SALES COMPANY, of Chicago, Ill., has been charte[red] with a capital stock of $2,500 by Dwight B. Cleaver, George L. Cragg [and] Max I. Rosenberg. The company proposes to manufacture electrical [ma]chinery and supplies.

New Incorporations.

LEESBURG, IND.—Articles of incorporation have been filed for [the] Leesburg Light & Water Company, with a capital stock of $10,000, [by] Frank Bortz, W. H. Stanley, W. A. Kohler, H. E. Kunz and Char[les] Gawthrop. The company proposes to construct and operate water [and] light plants.

PINE CITY, MINN.—The Eastern Minnesota Power Company [has] been incorporated with a capital stock of $200,000 by J. J. Flynn, J[.] C. Carlson, of Rush City, Minn., and others.

MEXICO, MO.—The St. Louis, St. Charles & Northern Tract[ion] Company has been chartered with a capital stock of $900,000 by R. Race, of Mexico, Mo.; R. M. Hendershott and C. Pearson, of Mid[dle]town, Mo. The company proposes to construct and operate an elec[tric]

ay to extend through St. Charles, Lincoln, Pike, Montgomery and ain Counties. The proposed road will be seventy-seven miles long.

MAHA, NEB.—The Omaha & Western Iowa Traction Company has chartered with a capital stock of $250,000 for the purpose of tructing an electric railway, ninety miles in length, from Omaha, , to Sioux City, Ia., by the way of Council Bluffs. The cost of truction is estimated at $20,000 per mile.

ANSOMVILLE, N. Y.—Articles of incorporation have been filed the Ransomville Electric Light, Heat & Power Company by F. D. ormick, J. W. Thompson, A. H. Hoffman and G. E. Hubble, of omville, N. Y. The company is capitalized at $25,000, and oses to supply electricity and gas for lamps, heat and power. The any is located at Porter, N. Y., not a post office.

EFIANCE, OHIO.—The Defiance Interurban Railway Company has articles of incorporation with a capital stock of $50,000 to build lectric railway to extend from Defiance, Fort Wayne, Ashwood, ett, Cecil, Paulding, Antwerp and New Haven. The officers are: . Haymaker, of Defiance, Ohio, president; Charles E. Bennett, of en, vice-president; T. C. Jacks, of Defiance, secretary and general ger, and Robert C. Holgate, of Defiance, treasurer.

IZABETH, PA.—The Glassport & Elizabeth Railway Company has incorporated by Jacob Ulrich, of McKeesport, Pa.; W. T. Fuether, Altman, H. G. Altman and C. A. McGrew, all of Glassport, Pa. company is capitalized at $18,000, and proposes to construct an ic railway, three miles long, to connect Glassport and Elizabeth.

TA, UTAH.—Articles of incorporation have been filed for the & Jordan Valley Railway Company, with a capital stock of $200,000, he purpose of constructing an electric railway from Sandy to Alta, ance of sixteen miles. The incorporators are: B. F. Cummings, . Cummings, M. A. Williams, D. J. Williams and E. W. Cummings.

Personal.

HENRY G. REIST, of the General Electric Company, Schely, will deliver on Dec. 2 the address at the fourteenth anniversary unders' Day of the Thomas S. Clarkson Memorial School of Tech-, Potsdam, N. Y.

R. I. JONES, formerly with Allegheny Light Company, and later interests of the Excess Indicator Company, at Altoona, has taken ion as contract agent for the Lewistown district of the Penn Central & Power Company.

F. F. W. SPRINGER, director of the electrical engineering labora- at the University of Minnesota, at Minneapolis, has received a leave of absence from his university work to visit technical and ering colleges in Germany and France, where he is now studying ory methods, and will give the Minnesota school the benefit of his ations on his return next year.

LYNN A. WILLIAMS, a Chicago patent lawyer with a wide itance among electrical men, was elected president of the Univer- Wisconsin Club in Chicago at the recent annual dinner of that ation. This gathering took the form of an "aviation meet," and mni, among whom the engineers are particularly active, enjoyed lves to the top of their bent.

H. G. CHATAIN, of the General Electric Company, will on De- 2 address the Electrical Engineering Society of Columbia Uni- on the subject of "Gas-Electric Cars." The meeting will be held Engineering Building of the university.

[illegible] BERG, professor [illegible] of Illinois, presented a paper entitled "Surging of Synchronous ies" before the Western Society of Engineers, at Chicago, on No- 23.

H. W. CHASE has resigned as manager of the "New Business" nent of the Union Gas & Electric Company, of Cincinnati, to e Central Station Development Company, Cleveland. Mr. Chase d long and varied experience in "new business" departments of stations, having first entered this line of work with the American & Traction Company, of Binghamton, N. Y., conducting a gas gn. Shortly after he was employed by the Henry L. Doherty ny, taking up work at Lebanon, Pa. While there Mr. Chase ed the idea of arranging a display of gas appliances in each of ree city market houses, and giving demonstrations each market This plan proved very beneficial and a large number of gas ces were sold as a result. Later, at Denver, he acquired his al education and experience. He then took up the work of ing a "new business" department in the Union Gas & Electric ny of Cincinnati, and was later appointed manager of one of the s of that company. Shortly afterward he was employed by the Lighting Company, of Dayton, Ohio, in charge of its "new busi- department, and in a very short space of time, through his sive business methods, sold 1600 electric irons at a profit. He the Dayton Lighting Company [illegible] ain took up the work of the Union Gas & Electric Company of [illegible], in charge of its "new business" department, and remained at company until his appointment by the Central Station Develop- ompany. Mr. Chase will probably have charge of the Central Development Company [illegible]

Obituary.

MR. E. A. BECK, general superintendent of the Pacific Light & Power Company, Los Angeles, Cal., died on Nov. 11. Mr. Beck had been identified with the upbuilding of Southern California for many years. Twelve years ago, when the San Gabriel Electric Company was formed, he engaged actively in the construction of its first lines.

MR. OCTAVE CHANUTE, a distinguished civil engineer, who has been styled "the father of aviation," died at his home in Chicago on Nov. 23, aged seventy-eight. He was born in France, but was brought to the United States by his parents when he was six years old. For many years he was engaged in engineering work for railroads, and in 1889 he established himself as a consulting engineer in Chicago. In 1891 he was president of the American Society of Civil Engineers, and ten years later served as president of the Western Society of Engineers. He was also a member of several other engineering societies. He made a study of methods of wood preservation and engaged in the business of preserving ties on a commercial scale. He became interested in the study of mechanical flight as long ago as 1874, but as this "side issue" interfered with his regular professional work, he laid it aside until 1888, when he was in a position to give more time to it. Several years later he conducted a department in the *American Enquirer* in the interests of aviation, contributing practically all of the matter contained, which was reprinted in book form in 1894. He was wont to call flying the hobby of his old age, but persons conversant with the development of aviation give credit to him more than to any other man for hastening the conquest of the air.

Trade Publications.

WATT-HOUR METER CALIBRATORS.—Portable watt-hour meter calibrators for use with alternating-current instruments are described fully in Bulletin No. 1124, of the Fort Wayne Electric Works, Fort Wayne, Ind.

ICE MACHINERY.—The Triumph Ice Machine Companies, Cincinnati, Ohio, have issued, as a souvenir of the inspection trip of Cincinnati's Commercial Organization to their plant, a well-illustrated booklet, giving numerous views of the buildings in which is manufactured ice machinery for industrial and domestic purposes.

DIRECT-CURRENT GENERATORS.—Bulletin No. 1121 of the Ft. Wayne Electric Works, Fort Wayne, Ind., gives an outline of the construction of direct-current generators, ranging in rating from 1 kw to 75 kw. These machines are provided with either shunt or compound windings and are of either the open or inclosed type.

BLOWERS FOR HOT-AIR FURNACES.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has developed for the market an electric-motor-driven blower for use with hot-air furnaces. By means of such a blower the hot air may be driven to any portion of the house, quite independent of the external air pressure. These blowers are described in Bulletin No. 3310.

MOTOR INDUSTRIAL APPLICATIONS.—Messrs. Dick, Kerr & Company, of Abchurch Yard, Cannon Street, London, have just issued an interesting pamphlet showing their electric motor as applied to various industries. It is illustrated in use on various types of pumps, driving paint mixers, machinery in textile mills, on various forms of machine tools, printing presses, compressors, etc. The book is well illustrated and the motors thoroughly well described.

WATT-HOUR METERS.—An instructive pamphlet (Circular 1137) on the principles of construction and operation of watt-hour meters has just been issued by the Westinghouse Electric & Manufacturing Company. Though in the form of a descriptive circular, the pamphlet goes at some length into the question of rates and the theory of meters, and points out the importance of the various features and adjustments of modern meters, both alternating and direct-current. The pages on "Selection of Watt-hour Meters," for example, bring out useful points often lost sight of. Descriptions are given of the latest style of Westinghouse induction watt-hour meters, with micrometer light-load adjustment and permanent magnets so arranged as to be really permanent, both in position and strength. The "ball and jewel" type of bearing and other features are described and illustrated, and also a method of meter testing without the use of a stop watch.

BUSINESS NOTES.

THE ROYSE ELECTRIC COMPANY, of Indianapolis, Ind., has recently reorganized and changed its name to the Indianapolis Electrical Supply Company.

THE TUNGSTOLIER COMPANY has moved its offices from Cleveland to Conneaut, Ohio, following the purchase of the Conneaut Fixture Company. The Tungstolier Company has now united in its organization, in addition to the above company, the Cleveland Gas & Electric Fixture Company and the Pennsylvania Gas & Electric Fixture Company.

ROSSITER, MACGOVERN & COMPANY, 90 West Street, New York, have not moved their offices to Claremont and Mallory Avenues, Jersey City, as stated in a recent note in these columns. Nor has there

been any change in the location of the warehouses of the company, which are at West Side Avenue station, C. R. R. of N. J., Jersey City.

THE PITTSBURGH ENGINEERING AGENCY has formed a business company to take over the foreign and domestic work of the Associated Bureau Service, comprising bureaus of technical reference, engineering research, industrial commissions and American trade catalogs. Offices will be opened in the Investment Building, Pittsburgh, Dec. 1. The aim of the organization is to develop an effective central clearing house of technical intelligence and service.

RAILWAY SWITCHBOARDS.—The General Electric Company is building for the Galveston-Houston Electric Railway Company (Stone & Webster, constructing engineers) four switchboards, complete with the entire equipment, including meters, instruments, electrolytic lightning arresters, disconnecting switches and oil switches. One board of ten panels will go in the main station and one of six panels in substation No. 2, which is located in the main station. In substations No. 1 and 3, which are each fourteen miles distant from the main station, there will be a switchboard of six panels. The power will be generated at 2300 volts, transmitted at 33,000 volts and used in railway work at 600 volts af going through rotaries in the substations.

TRIUMPH ELECTRIC COMPANY.—Among the recent sales of t Triumph Electric Company of Cincinnati are the following: One 600-k direct-connected generator, Factory Power Company, Oakland, Ohi one 175-kw and one 125-kw, 2300-volt alternator, Cincinnati Universit one 200-kw direct-current generator, Breese Trenton Coal Compan one 150-kw generator, one 100-hp and one 50-hp and several smal motors, Marrowbone Coal & Coke Company; two 150-kw, three-w generators, Bay View Hospital; one 100-kw and one 50-kw three-w generator, Westinghouse, Church, Kerr Company; one 125-hp variabl speed motor, A. C. Spalding Bros.; one 100-kw and one 50-kw, thre wire generator, Missouri Pacific Railroad Company; one 150-hp, variabl speed motor, H. T. Lloyd, Spokane, Wash.; one 150-hp motor, Bell view Mines, Alberta, Can. The company has also sold quite a lar amount of apparatus of smaller sizes than those mentioned above. reports an increased number of inquiries and a decided improvement the small motor business.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, Engineering Societies Building, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next semi-annual meeting, New York City, April or May, 1911.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

AMERICAN STREET & INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, Little Rock, Ark.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John Farrington, Steubenville, O.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago. Next meeting, Boston, Mass., June, 1911.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago. Next annual meeting, Chicago, November, 1911. Semi-annual meeting, Washington, 1911.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allen H. Royce, 48 King St., W., Toronto, Ont.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Indianapolis, Ind. Next meeting, Dayton, Ohio, Dec. 1, 1910.

CHICAGO ELECTRICAL SHOW. Manager, H. E. Niesz, 150 Michigan Boulevard, Chicago. Next show, Jan. 7-21, 1911.

CLEVELAND ENGINEERING SOCIETY. Secretary, F. W. Ballard, 413 Chamber of Commerce Building, Cleveland, Ohio. Regular meetings second Tuesday of each month, except July, August and September. Annual meetings second Tuesday of June each year.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Acting Secretary, F. D. Morris, 323 Hagerman Building, Colorado Springs, Col.

EASTERN STATES INDEPENDENT TELEPHONE ASSOCIATION OF PENNSYLVANIA, NEW JERSEY, MARYLAND AND DELAWARE. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York.

ELECTRIC CLUB, CHICAGO. Secretary, F. S. Hickok, 824 Marquette Building, Chicago. Meets every Wednesday noon, 303 Wabash Ave.

ELECTRIC CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Next meeting, Albany, N. Y., Jan. 17, 1911.

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secreta Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, C Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electri Credit Association). Secretary, Franz Neilson, 80 Wall St., New Yo Board of directors meets second Thursday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. Chapin, Engineering Societies Building, 29 West 39th St., New York

ENGINEERING SOCIETY OF WISCONSIN. Secretary, W. G. Kirchoffer, Vroman Building, Madison, Wis.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secreta C. H. Lembower, Reading, Pa.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., A 4 and 5, 1911.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbu Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, E neering Societies Building, 29 West 39th St., New York. Sections New York, New England, Philadelphia and Chicago. Annual conventi Chicago, 1911.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER N YORK. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Se tary, E. W. Landgrebe, Huntington, Ind.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, dianapolis, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kra 416 W. Indiana St., Chicago. Meetings, second Friday of each mont

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secret C. R. George, Houston, Tex. Next meeting, St. Paul, Minn., 1911.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body resenting various national electrical engineering societies contributin its support). Secretary, C. le Maistre, 28 Victoria St., Westmini London, S. W., England.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque. Next meeting, Davenport, Ia., April 19, 20 and 21, 1911.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. T 208 Des Moines Life Building, Des Moines, Ia. Annual meeting, se Wednesday in March each year.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mat Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, Ja D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., 21 and 22, 1911.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in Octo each year.

MAINE ELECTRICAL ASSOCIATION. Secretary, Fred D. Gordon, Aub Maine.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charle Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. P. Biggs, Det Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, B. W. Cowperth Faribault, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jac Railway & Light Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. S tary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. Schweer, Windsor, Mo. Next meeting, St. Louis, May, 1911.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Ma Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Ga Greenville, Ohio.

National Electric Contractors' [illegible] the United States. Secretary, W. H. Morton, 41 Martin [illegible], Utica, N. Y.

National Electric Light Association. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

National Electrical Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn. Next meeting, New York, March, 1911.

National Electrical Credit Association. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

Nebraska Electrical Association. Secretary, Frank McMaster, Beatrice, Neb.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Section, National Electric Light Association. Secretary, L. D. Gibbs, 39 Boylston St., Boston, Mass.

New Orleans Electrical Contractors' Association. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

Northwest Electric Light & Power Association. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Columbus, Ohio.

Ohio Society of Mechanical, Electrical & Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Next meeting, May 18 and 19, 1911.

Oklahoma Public Utilities Association. Secretary, Galen Crow, Guthrie, Okla.

Old Time Telegraphers' & Historical Association. Secretary, F. J. Scherrer, 195 Broadway, New York. Next reunion, Atlantic City, N. J., 1911.

Order of Rejuvenated Sons of Jove. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Building, Chicago, Ill.

Pacific Coast Electric Vehicle Association. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal.

Pennsylvania Electric Association. Secretary, Van Dusen Rickert, Pottsville, Pa.

Pennsylvania Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

Pittsburg Electric Booster Club. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburg, Pa. Meetings, fourth Monday of each month.

Railway Electric Supply Manufacturers' Association. President, A. C. Moore, Safety Car Heating & Lighting Co., Chicago.

Society for the Promotion of Engineering Education. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

Society of Wireless Telegraph Engineers. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

South Dakota Independent Telephone Association. Secretary, E. R. Buck, Hudson, S. D. Next meeting, Redfield, S. D., Jan. 11 and 12, 1911.

Southwest Electric & Gas Association. Secretary, E. T. Moore, Dallas, Tex.

Street Railway Association of the State of New York. Secretary C. G. Reel, Kingston, N. Y.

Underwriters' National Electrical Association. Secretary Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1911.

Vermont & New Hampshire Independent Telephone Association. Secretary, Lena M. Owen, St. Johnsbury, Vt.

Vermont Electrical Association. Secretary, A. B. Marsden, Manchester Center, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill.

Western Society of Engineers. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Wireless Institute. Secretary, Sidney L. Williams, 42 Broadway, New York.

Wisconsin Electrical Association. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association. Secretary, Johs S. Allen, Lake Geneva, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS, ISSUED NOV. 2[illegible], 1910.
[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

[illegible]. SECONDARY BATTERY; W. Morrison, Des Moines, Ia. App. filed May 26, 1909. A reversible battery with alkaline electrolyte with negative electrode containing zinc and mercury in contact with the zinc, the zinc being in excess of what the electrolyte will consume and being oxidized in the working of the battery.

[illegible] ELECTRICAL SYSTEM OF DISTRIBUTION; R. N. Chamberlain and M. R. Shield, Lancaster, N. Y. App. filed Dec. 17, 1909. Train lighting system with generator and booster in series and charging circuit with batteries and work circuits and switches actuated by the current strength of the generator.

[illegible] CONDUCTOR STRIP; H. B. Collier, Prairie Grove, Ark. App. filed Sept. 15, 1909. For burglar alarms in which conductor strips extend across the glass door or window and gum strips are pasted thereover, the conductor strips being [illegible]

[illegible]. ELECTRICALLY OPERATED SIGNALING HORN; E. M. Lormin, Newton, Mass. App. filed July 6, 1909. A horn with a casing on the inner end, a diaphragm between the horn and the casing, a hollow electro-magnet containing a plunger adjacent to the diaphragm.

[illegible] LOCOMOTOR FOR USE IN CONDUITS; G. C. Fryer and F. Pfleiderer, Syracuse, N. Y. App. filed Aug. 11, 1906. A frame and motor with switch and cord to operate the switch from the outside of the conduit.

[illegible] TROLLEY WHEEL; E. K. Harris, Canandaigua, N. Y. App. filed May 26, 1909. Grooved trolley wheel whose perpiphery consists of non-conducting resilient material with two ridges separated by a groove.

[illegible] SERVICE METER SYSTEM; G. A. Joy, Chicago, Ill. App. filed April 6, 1908. A service meter with a cord circuit in the line, which meter is actuated after a conversation is terminated.

[illegible] SUBSTATION CIRCUIT; J. J. Lyng, East Orange, N. J. App. filed March 11, 1909. Harmonic ringers are used with a condenser normally in the signaling circuit, but which may be connected to the talking circuit so that when the receiver is removed the capacity of the transmission circuit is altered.

[illegible] FILAMENT OR RESISTOR FOR HEATING UNITS OR LAMPS; H. C. Parker, New Y[illegible], N. Y. App. filed Ma[illegible], 1909. A non-metallic filament which is a conductor when cold and glows in the open, or consisting of carb[illegible] in [illegible] a certain proportion.

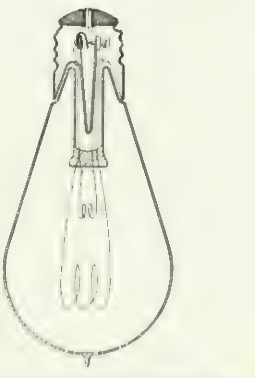
[illegible] ELECTRICAL RELAY; F. Ritchie, Acton, Eng. App. filed Dec. 16, 190[illegible]. The action of [illegible] is reinforced by a local [illegible] current so that it may be [illegible] a primary impulse being produced after the [illegible] which induces a secondary impulse in the same direction as the initial impulse.

[illegible] TELEPHONE RECEIVER; [illegible], Newark, N. J. App. filed June 9, 1909. [illegible] in which the receiver include[illegible] has [illegible] sound chamber [illegible] from the diaphragm through the hole in the side of the chamber in a direction along its path of movement.

976,241. TELEPHONE TRUNKING SYSTEM; C. S. Winston, Chicago, Ill. App. filed Nov 17, 1906. A telephone trunk circuit, a source of ringing current, a periodically actuated relay for connecting the source with the talking strands, the relay being controlled from the outgoing end of the trunk and made inoperative automatically, depending upon the condition of the telephone of the called subscriber.

976,248. INCANDESCENT LAMP; G. F. Atwood, Newark, N. J. App. filed Jan. 3, 1910. The filament has its ends coiled around the supports and united thereto.

976,277. ELECTROLYTE FOR ALKALINE BATTERIES; W. Morrison, Des Moines, Ia. App. filed May 6, 1909. A reversible battery with a zinc negative pole and an alkaline electrolyte containing an oxygen compound which renders the zinc insoluble.



976,297.—Automatically Flashing Electric Lamp.

976,27[illegible]. PROCESS OF MANUFACTURING MATERIAL FOR ALKALINE BATTERIES; William Morrison, Des Moines, Ia. App. filed September [illegible], 190[illegible]. Combines suitable quantities of zinc oxide, [illegible] and an alkaline solution from which a compound of zinc and [illegible] is precipitated.

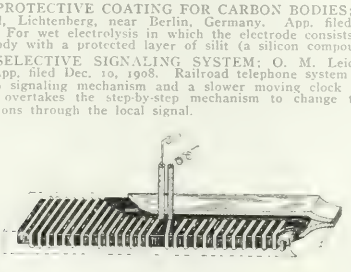
976,279. PROCESS FOR MAKING MATERIAL FOR ALKALINE BATTERIES; W. Morrison, Des Moines, Ia. App. filed Oct. 10, 1910. Produces electrolytically a compound containing zinc chromate in an alkaline electrolyte.

976,297. AUTOMATICALLY FLASHING ELECTRIC LAMP; W. J. Phelps, Detroit, Mich. App. filed July 16, 1903. Two filaments of different candle power in series and a thermostat operated by the heat of the filaments to control the short circuit around the low-power filament.

976,298. SELECTIVE PARTY LINE TELEPHONE SYSTEM; H. J. Roberts, Evanston, Ill. App. filed Sept. 18, 1902. A pair of line wires from central through the subscribers' stations, one line in section and the other continuous and a bridging connection between the sectional line and continuous line at each substation, together with a relay in a grounded branch at each substation to restore the line connections.

976,319. PROTECTIVE COATING FOR CARBON BODIES; Hermann Viertel, Lichtenberg, near Berlin, Germany. App. filed May 26, 1910. For wet electrolysis in which the electrode consists of a carbon body with a protected layer of silit (a silicon compound).

976,380. SELECTIVE SIGNALING SYSTEM; O. M. Leich, Genoa, Ill. App. filed Dec. 10, 1908. Railroad telephone system with step-by-step signaling mechanism and a slower moving clock mechanism which overtakes the step-by-step mechanism to change the circuit conditions through the local signal.



976,404.—Electric Heater.

976,404. ELECTRICAL HEATER; M. H. Shoenberg and G. T. Marsh, San Francisco, Cal. App. filed Jan. 28, 1909. A single conducting core of solid metal, with a conducting resistance coil wound about the core, with insulation between core and coil and a closed, seamless tube compressed upon the outside of the insulation, the coil at one end connecting to the core and at the other with the terminal.

976,405. ELECTRIC HEATER; M. H. Shoenberg, San Francisco, Cal. App. filed June 1, 1910. A casing open at both ends, with a tubular handle at right angles and a tubular spool within the casing, a cavity between the spool and casing closed at both ends and a high resist- [illegible] the spool.

976,420. DYNAMO ELECTRIC MACHINE; R. B. Williamson, Milwaukee, Wis. App. filed April 17, 1909. Turbo-alternator cooled by forced draft, the housing having ribs with ventilating openings and separable adjustable dampers with blowers on the rotor.

996,422. ELECTRIC SWITCH; J. H. Wooll, San Francisco, Cal. App. filed Oct. 29, 1909. A double-throw switch with contacts and independently mounted blades on insulating supports with an insulating structure connecting the blades operated by an independent level.

976,445. TROLLEY HEAD; E. E. Duff, Seattle, Wash. App. filed Aug. 11, 1909. A spring-pressed fork to surround the wheel and embrace the trolley wire should the wheel leave the wire.

976,454. ELECTROLYTE FOR DEPOSITING COPPER; W. G. Grey and W. Griffith, Pittsburgh, Pa. App. filed Feb. 23, 1910. Comprises a solution of copper sulphate, cyanid of potassium and bi-sulphite of soda.

976,457. TELEPHONE MOUTHPIECE; J. A. Hall, Oakland, Cal. App. filed Feb. 10, 1910. Disinfectant mouthpiece including a shell with a flared intermediate portion upon a straight outer end, a contracted inner end carrying fingers; the outer ends are perforated and surrounded by a circular path.

976,500. WIRELESS TELEGRAPHY; F. G. Sargent, Graniteville, Mass. App. filed Aug. 26, 1905. A coherer in which the tube is an elastic non-conducting tube with electrodes in the opposite ends.

976,501. TROLLEY POLE; P. Schnell, Philadelphia, Pa. App. filed Feb. 11, 1910. The trolley pole is kept upright by two side guy wires containing springs.

976,519. ELECTRIC LAMP SOCKET; J. S. Stewary, New York, N. Y. App. filed March 19, 1910. A cap and shell with bayonet joint connection. Details.

976,524. AUTOMATIC TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed March 6, 1909. Makes use of first selectors, second selectors and connectors proportionate to the numbers of simultaneous calls to be expected with automatic means for interconnecting the first selectors interchangeable with the calling lines, which are divided into groups of one hundred.

976,526. MANUFACTURE OF ELECTRIC FILAMENTS; C. A. Von Welsbach, Vienna, Austria-Hungary. App. filed Aug. 9, 1898. A filament consisting of osmium in a dense coherent and elastic condition incandescing at a temperature at which platinum volatizes.

976,527. MANUFACTURE OF ELECTRIC FILAMENTS; C. A. Von Welsbach, Vienna, Austria-Hungary. App. filed Aug. 9, 1898. A metallic filament consisting in associating an organic thread with osmium, then giving a dry distillation, then eliminating the carbon by the electric current in a suitable atmosphere.

976,528. MANUFACTURE OF ELECTRIC FILAMENTS; C. A. Von Welsbach, Vienna, Austria-Hungary. App. filed Aug. 9, 1898. The filament is connected to leading-in wires by a connecting body of osmium cement, which stands a high temperature.

976,532. ELECTRIC CONNECTING DEVICE; H. C. Wirt, Schenectady, N. Y. App. filed April 28, 1908. For joining the ends of conductors to contacts on cut-outs by means of a terminal connector engaging the wire at one end and extending into the space between the arms of the contact slip at the other end.

976,537. TELEGRAPH TRANSMITTER; J. C. Barclay, Montclair, N. J. App. filed March 22, 1909. A rotary member with the projecting studs occupying different paths of rotation and distributed angularly, the studs having plugs screwed into the member, the plugs being stepped and beveled, together with finger keys which operate mechanism to stop the rotary member, the latter controlling circuits.

976,549. SWITCH; H. W. Cheney, Norwood, Ohio. App. filed October 22, 1906. Oil switch for high voltage and large amperage without [illegible] moving the oil tank, which is operated by screw bolts to shift the tank.

976,562. ELECTRIC ALARM AND CALL BELL SYSTEM; J. H. Field, Victoria, B. C., Can. App. filed Jan. 25, 1909. An indicator and switch with line wires, one line wire open and an auxiliary line wire and translating device in the latter whereby the switch may close the normally open circuit without affecting the translating device of the closed circuit.

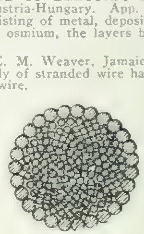
976,578. POLICE SIGNAL DEVICE; E. J. Kingsley, J. Greene and William G. Sadleir, Salt Lake City, Utah. App. filed Dec. 13, 1907. For signaling from central police station to the beat by means of a signal arm and driving mechanism controlling a source of current and light.

976,586. RELAY MAGNET; J. F. McElroy and J. E. Macomber, Albany, N. Y. App. filed May 15, 1910. A magnet with a sheet metal armature carrying a sheet metal loop to which a contact piece is loosely secured.

976,615. ELECTRIC RADIATOR; J. A. Tupper, Montpelier, Ia. App. filed Aug. 31, 1909. Resistance coils in circuit heat the liquid in the heater.

976,616. MANUFACTURE OF ELECTRIC FILAMENTS; C. A. Von Welsbach, Vienna, Austria-Hungary. App. filed Aug. 9, 1898. A filament for a lamp consisting of metal, deposited upon a filet in a series of layers, particularly osmium, the layers being united by raising the temperature.

976,617. RAIL-BOND; E. M. Weaver, Jamaica, N. Y. App. filed July 20, 1910. A main body of stranded wire has an outer armor of larger wire than the inner wire.



976,617.—Rail-Bond.

[illegible] ELECTRICAL FIRE ALARM SYSTEM; J. H. Field, Victoria, B. C., Can. App. filed Feb. 3, 1909. An alarm bell and battery in series therewith, with thermostats in circuit with battery and bell and a master thermostat making the other thermostats inoperative when a general rise in temperature occurs.

976,654. ELECTRICAL SWITCH; J. D. Hilliard, Albany, N. Y. App. filed July 26, 1907. An oil switch in which the shock due to the initial formation of gases and pressure on the walls of the chamber containing the fixed electrode is absorbed by means of an oil pot with two chambers, one containing the fixed electrode with expansible walls.

976,670. END RING FOR INDUCTION MOTORS; H. Maxwell, Schenectady, N. Y. App. filed Feb. 28, 1910. Squirrel-cage induction motor with a cast end ring, with integral connecting members, each member doubled back on itself.

976,728. TROLLEY FOR ELECTRIC CARS; A. Del Valle, New York, N. Y. App. filed July 5, 1910. A finder for trolleys consisting of a fork pivoted near the upper fork of the trolley with a weight between the sides near the lower ends for stability.

976,743. LIGHTING AND BATTERY CIRCUITS; J. F. McElroy, Albany, N. Y. App. filed April 29, 1910. A normal circuit for car lighting with a battery and switch with a relay in the normal circuit controlling the switch and a charging switch, so that the battery may be thrown in the normal circuit for charging without interfering with the relay which controls the lamp circuit.

976,747. BATTERY TEMPERATURE CONTROLLER; F. W. Schmidt Philadelphia, Pa. App. filed Jan. 13, 1910. For controlling current during the charging of a storage battery, so as to discontinue the charge by an automatic switch, controlled by a thermostat circuit when the temperature of the battery reaches a predetermined point.

976,748. CONTROL FOR CHARGING STORAGE BATTERIES; F. W. Schmidt, Philadelphia, Pa. App. filed May 4, 1910. For cutting out the charging circuit when the storage battery reaches a given temperature by means of a thermostat, having an electrically conducting acid-resisting metal casing and an appertured insulating jacket in closing the casing.

976,749. THERMOSTAT; F. W. Schmidt, Philadelphia, Pa. App. filed Aug. 8, 1910. For charging storage batteries dependent upon the temperature in which the thermostat is inclosed with an acid-resisting casing and immersed in the solution of the apparatus.

976,750. CONTROL FOR CHARGING STORAGE BATTERIES; F. W. Schmidt, Philadelphia, Pa. App. filed Aug. 8, 1910. For cutting out the charging circuit on rise of temperature by means of electromagnetic retainer, together with a thermostat, the latter being immersed in the battery solution.

976,778. APPARATUS FOR PRODUCING AND UTILIZING ELECTRIC CURRENTS OF HIGH PERIODICITY; S. G. Brown, London, Eng. App. filed Dec. 17, 1906. An arc between carbon poles when shunted by a capacity and inductance is used to give oscillations of several thousand per second.

976,779. APPARATUS FOR TREATING SUGARCANE AND SIMILAR SUBSTANCES; G. D. Burton, Boston, Mass. App. filed Oct 17, 1906. An revoluble receptacle with mixing devices, an electrode at each end, and a tank in which the receptacle is revolved, supplied with a solution by a pipe, and also steam heated.

976,780. PROCESS OF MANUFACTURING ICE CREAM, SHERBET ETC.; G. D. Burton, Boston, Mass. App. filed Oct. 9, 1906. Places the ingredients in a revolving tank containing a freezing compound and subjects them to the action of an electric current.

976,791. STORAGE BATTERY ELECTRODE, T. A. Edison, Llewellyn Park, Orange, N. J., and J. W. Aylsworth, East Orange, N. J. App. filed April 28, 1905. A tubular perforated, non-active, inclosing pocket, made from metal of high tensile strength with flattened ends and active material compressed therein under pressure.

976,792. STORAGE BATTERY; T. A. Edison, Llewellyn Park Orange, N. J. App. filed May 24, 1910. A conducting plate with pockets consisting of perforated tubes, side by side, of thin metal wound in opposite directions, and containing expansible highly compressed material.

976,824. GRID FOR REVERSIBLE GALVANIC BATTERIES; W. Morrison, Des Moines, Ia. App. filed Sept. 26, 1910. A pressed or stamped grid for electric batteries, using an alkaline electrolyte in which a plurality of plates hold the material between them and conducting [illegible] extend into the material.

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EXPORT GAINS IN OCTOBER.

He would indeed be a pessimist who was not cheered and encouraged by the large gains in electrical exports listed for October. In face of a general trade movement notably slow and restricted, in view of what seems to be dulness in home conditions, electrical exports have increased steadily. The shipments of heavy electrical machinery for last October were valued at $514,184 as compared with $443,388 in the same month of 1909. In like manner, the foreign demand for electrical instruments and apparatus jumped from $683,819 to $780,233. The two items added together show a total of $1,127,207 as compared with $1,294,317, or a gain of $167,110 in the one month, and if maintained an increase in a year of just about $2,000,000. In fact, there seems no good reason why even that figure may not be bettered, for world trade appears to be expanding and getting into a more active state. The ten months' totals, for example, in light electrical goods are $5,797,726 and $8,133,929 respectively, while in heavy goods the figures are $5,031,910 and $5,898,042. At such a rate of increase as that the improvement in electrical exports in 1910-11 over 1909-10 may easily run between $4,000,000 and $5,000,000 and carry the grand total beyond any precedent.

ELECTRICAL VEHICLE TO THE FRONT.

As announced on another page, an energetic and well-financed campaign will shortly be started in favor of the electric vehicle, the movement being under the auspices of the recently formed Electric Vehicle Association of America and having the cooperation of some of the leading central-station men of the country. As the results of this campaign should be highly beneficial to the central station, it deserves the warmest encouragement and strongest material support from all connected with that industry and, as a matter of *esprit de corps,* of electrical men in general. The character of the men who have interested themselves in the work insures that it will be conducted along proper lines, and the financial resources available are such that the plans adopted will not be hampered in execution. By its initiative in this matter the Electric Vehicle Association of America has, in the first few months of its existence, justified the faith of its founders in the service that can be rendered by such an organization in a field luxuriant in neglected possibilities. For several years past this journal has been insistent on the value of the electric vehicle in its present state to the central station as an off-peak charging proposition, and it is gratifying to us to announce the movement now being started to drive this lesson home. Doubtless no small part of the indifference shown by the majority of central-station men to the electric vehicle had its rise in the unfortunate experience of ten years ago, when a somewhat sudden movement toward its general introduction had an unpleasant result in many central-station quarters. The present [el]ectric vehicle has, however,

little in common with that of the earlier period. The exact limitations of the storage-battery automobile are now recognized and observed, its electrical design is practically standardized, and several types of storage batteries have been developed to a high and apparently almost final state of efficiency for vehicular service. Further evidence of the vast change in conditions is offered by the warm advocacy to-day of the electric vehicle by men whose early experience with it created a prejudice that only irrefragable evidence as to its present commercial status could overcome. The present movement is thus not one in the interest of something of apparent merit commercially untried, but has to do with an opportunity no longer involving risk coupled with a situation dead ripe for development.

EXPERT TESTIMONY.

The expert witness has been subjected to a good many hard knocks and of late their severity has increased rather than diminished. We have commented on the matter from time to time and, in view of some recent and unusually severe strictures of the court on expert testimony, it seems appropriate again to point out some of the difficulties of the situation. The expert witness is in theory supposed to tell the plain unvarnished truth regarding the technical matters which are brought to his attention, but in point of fact his employer demands of him strictly *ex parte* testimony. That there are shady experts, just as there are shady lawyers, admits of no dispute, but it is as manifestly unfair to condemn experts as a whole as it would be to denounce the entire bar as similarly crooked. The real root of the trouble seems to lie, not in the personal or professional characteristics of the expert witnesses, but in the precedents which have come to govern the introduction and use of expert evidence. If one listens attentively to the taking of expert testimony, two facts stand out with unpleasant prominence. The first is that the witness, having to give his answers under oath in direct response to certain definite hypothetical questions, is not at liberty to go outside the range of the hypothesis, true or untrue, propounded. The second is that the hypothetical question as a rule represents not the actual issue concerning which technical information is wanted, but rather only such an approximation to it as may serve the purposes of counsel. Often a hypothetical question is ingeniously devised in such fashion that if it is answered truthfully the facts stated are far from those which would be elicited if the real issue were placed before the witness. Similarly, in cross-examination the questions asked very often lead directly away from the real issue toward some hypothesis which suits the convenience of opposing counsel. Then any effort on the part of the witness to bring his testimony straight back on the issue involved is denounced as irresponsive, and the witness is accused of attempting to pose as counsel.

It is little wonder, therefore, that expert testimony is often valueless and even misleading, not because it is incorrect or intended to deceive, but because it must, from the nature of the questions, bear upon fictitious issues. It is this feature of the matter which is most serious in limiting the value of expert testimony and to which is due much of the obloquy heaped upon the expert witness. As a rule, the witness goes into the case with a genuine desire to tell "the truth, the whole truth and nothing but the truth"; but the practice of introducing expert evidence is such as usually to forbid the whole truth being told, so that the witness with the best of intentions and with scrupulous regard for the obligation of an oath may yet have to answer questions in a way which leads to entirely wrong conceptions on the part of his untechnical hearers.

In view of some severe criticism of expert testimony from the bench it may not be improper to suggest that at least a partial remedy rests with the bench itself. Now and then when the real issue is becoming befogged the court exercises its prerogative of questioning the witness with very satisfactory results so far as the obtaining of justice is concerned. While there is as yet no provision for summoning experts by the court except under very unusual circumstances, there is no adequate reason why the court should not very much oftener than at present take a hand in the examination and thus clear up dubious points. Many an expert struggling to answer a misleading question without creating a false impression would be thankful to respond to pertinent questions from the bench. Habitual examinations of this kind might not be quite so satisfactory as summoning the expert directly by the court, but they would certainly tend to keep technical testimony from wandering away from the real issues of the case under the adroit leadings of counsel. We think that a judge who made a practice of asking a few questions on his own account would very soon come to take a more friendly view of expert witnesses than is now common, and would go far toward putting technical testimony in the way of fulfilling its proper function. When an employer pays out his good money to expert witnesses he expects good testimony—from his standpoint—in return; and under the present system the court only can check such a misuse of expert evidence.

THE MAGNETIC FIELD OF THE INDUCTION MOTOR.

When two reactors having an equal number of turns are connected in series in an alternating-current circuit, evidently the current in one is equal to that in the other, while the total e.m.f. is divided between the two coils in inverse proportion to the reluctances of the magnetic paths of the reactors. When the same two reactors are connected in parallel evidently the voltage on one is equal to that on the other, while the total current is divided between them in direct proportion to the reluctances of the two magnetic paths. These well known facts have a direct bearing on the distribution of magnetism around the air gap of an induction motor, but it is not permissible to ignore other facts which may be of equal importance in this connection. A considerable portion of the coils of each phase-winding on an induction motor is connected in series, and the coils can in many respects be considered reactors similar in every respect except as to the reluctances of the individual magnetic paths. The currents in the separate coils of a series circuit must necessarily be of equal magnitude and hence the active m.m.fs. tending to produce flux along the magnetic paths must likewise be equal. When there is no opposing or disturbing m.m.f. the fluxes along the different paths will vary inversely as the several reluctances, so that inequalities in the air-gap reluctances must result in unequal distribution of flux around the air-gap when the secondary of an induction motor is on open circuit. However, many inaccurate conclusions would be derived by assuming the existence, under operating conditions with closed secondary, of the flux distribution found with the secondary open.

In a paper recently presented before the British Institution of Electrical Engineers, and noted in the Digest in this issue, Mr. C. F. Smith reported the results of an investigation of the irregularities in the rotating field of polyphase induction motors in which use was made of special search coils wound on the stator of two motors so as to embrace portions of the air-gap flux. In one case the author found pulsation e.m.fs. of volt per turn where no voltages would have existed had the field been distributed sinusoidally in both time and space. In view of the fact that these e.m.fs. would have been in a position to produce numerous local currents in a squirrel-cage secondary, whereas in a coil-wound secondary the several pulsation e.m.fs. would have such time values that the resultant would be considerably less than the arithmetical sum of the separate e.m.fs., the author strongly intimated that the squirrel-cage motor would experience considerably more local heating by reason of such pulsation e.m.fs. than a motor having a coil-wound secondary. The fact of the matter is that a very small amount of local secondary current in the conductors of a squirrel-cage rotor is sufficient to eliminate largely the irregularities in the flux to which the e.m.f. producing the local current may be attributed. This local current cannot be considered as true transformer secondary current, for it has almost no effect upon the total flux produced by the primary exciting current; it acts, in fact, almost wholly as the source of a local m.m.f., tending to wipe out the irregularities in the distribution of magnetism around the air-gap. Since to this particular m.m.f. there is almost no opposing m.m.f., the local current required for smoothing out the irregularities in the field is small in value. It is greatly to be doubted if the extremely slight reduction in the local currents in a coil-wound secondary over the currents in a squirrel-cage secondary could be considered as showing any advantage whatsoever of the former over the latter. To the extent that any extra currents do exist, the field of the squirrel-cage motor is more nearly regular than is that of the machine with a coil-wound secondary, and this condition is advantageous rather than disadvantageous.

GRAPHICAL SOLUTION OF PROBLEMS INVOLVING PLANE-SURFACE LIGHT SOURCES.

The distribution of illumination over the surfaces of the floor, walls and ceiling in a room lighted by a single point-source of light, such as a pendent single incandescent lamp, is well understood by illuminating engineers. The equilux lines are concentric circles on every such internal plane surface of a rectangular room. If the room were spherical with the point-source at the center, the incident illumination would, of course, be everywhere the same, and there would be no equilux lines. If, as in the ordinary practical case, the single pendent lamp can be considered as giving equal luminous intensities in different azimuths or to the different points of the compass, but unequal, although known, luminous zonal intensities, the illuminating engineer has well-known rules for determining the incident illumination on floor, walls and ceiling, although they are of course, more complex than those pertaining to the ideal luminous point-source. In general, in such a case with a vertical lamp the equilux lines are circles on the floor and on the ceiling, but on the walls they are either non-circular loops or segments of the same. Moreover, when a room is directly lighted by a plurality of such varying zonal-intensity lamps, in ... [illegible] time-consuming task, to find the distribution of illumination incident all over the room from each lamp in turn, and then sum up these individual distributions in order to arrive at the resultant total distribution. But when, as is coming into practice, a large room has been lighted by a circular opalescent area in the ceiling, this area having approximately uniform luminous intensity, there have been no engineering methods available for treating the case. That is, the only known methods have been physicist's methods or mathematician's methods, which are too complex for the engineer ordinarily to employ and which belong to a different intent and category.

A distinct step in advance is made, therefore, in illuminating engineering by the graphical process contained in Dr. A. S. McAllister's article on this subject, appearing on page 1356. It will be seen that, starting with the beautiful proposition that the normal illumination within any spherical surface containing a uniform luminous disk is uniform and inversely proportional to the square of the distance from the edge of the disk to the point on the sphere opposite the center of the disk, the engineering solution of the case is presented by a very simple graphical process. The equilux lines, if the room were a true sphere of this description, would disappear as in the point-source case. With a rectangular room the equilux lines on the floor are all concentric circles. The equilux lines on the walls are eccentric circles with their centers regularly displaced along a vertical straight line, like the lines of magnetic force around each of a pair of long, straight, parallel active conductors. On the ceiling, however, there are no equilux lines of incident illumination, or, stated in another way, the dispersive properties of the ceiling, so useful with pendent lamps, are here dispensed with as regards direct illumination in favor of the dispersion of the rays incident from the luminous disk occupying a part of the ceiling. In many practical cases the light-giving surface in the ceiling, usually a plate of translucent glass illumined by incandescent lamps supported in a space above the ceiling, is not circular, but square or rectangular. In such a case, of course, the graphical construction given no longer strictly applies. Nevertheless, in most cases likely to arise in practice the departure from the circular form will not be so great but that a satisfactory degree of approximation can be obtained by substituting in the diagram a truly circular disk of the same area and total luminous flux as the actual rectangular area.

Over and above the distribution of directly incident luminous intensity as given by this method is superposed the reflected and scattered illumination. If the walls and furniture in the room are dark and absorptive, the extra amount of illumination derived from incident light reflected and returned in this way will be small, but if the walls and furniture are light and non-absorptive, the ceiling or that part of it outside the light-giving area will come prominently into play and will add materially to the total illumination, just as in other problems of interior lighting. The illuminating engineer usually satisfies himself that the direct illumination is adequate for the purposes of the chamber under consideration and then trusts to the scattered additional illumination for a bonus over and above the common stock. Just as in the industrial world, it is remarkable how much the magnitude of the bonus depends on the local conditions. In some cases if the bonus of scattered and re-incident illumination compensates for the depreciation of the luminous intensity of the light-sources during the term of their natural existence, the illuminating engineer is ... [illegible]

Electric Vehicle Campaign.

A complete and comprehensive plan for the further development and extended use of the electric vehicle has just been formulated under the auspices of the Electric Vehicle Association of America, which has appointed a publicity and advertising committee for the purpose indicated. Mr. N. F. Brady, first vice-president of the New York Edison Company, is the chairman of this committee, which includes in its membership the following leaders in the electric lighting industry:

Messrs. N. F. Brady, Samuel Insull, J. B. McCall, C. L. Edgar, W. W. Freeman, Charles R. Huntley, Alexander Dow, George H. Harries, Samuel Scovil, F. W. Frueauff, H. M. Byllesby, J. G. White, A. H. Ford, T. N. McCarter, Thomas Dolan, R. F. Pack, Arthur B. Lisle, Marcy L. Sperry, R. M. Searle, John B. Miller, John A. Britton, Alton S. Miller, G. W. Brine.

This committee held a meeting Saturday morning, Dec. 3, in New York, at which it was decided to undertake a publicity campaign along broad national lines, and that in order to make such a campaign effective on the scale contemplated it would be necessary to expend a minimum of $50,000 annually for at least three years. The general idea is to utilize the magazines and trade papers of national circulation. It was felt that very much more than the sum mentioned could be used to advantage, but that the amount specified was the least with which such a campaign could be inaugurated. Practically half this amount was subscribed by those present at this meeting.

A sub-committee was appointed to present the matter to all those interested and solicit definite subscriptions. This committee consists of Messrs. W. W. Freeman, Brooklyn, chairman; Frank W. Frueauff, Denver; Alton S. Miller, St. Louis; Arthur B. Lisle, Providence, and R. M. Searle, Rochester. The sub-committee held a meeting immediately after the general committee adjourned and decided to begin at once the solicitation of subscriptions from central stations on the basis of 1/25 of 1 per cent of the gross income of each company. It was felt that this would give all the electric lighting companies a definite basis of subscription in proportion to the benefits to be received from such a campaign.

The well-founded expectation is that the total amount of subscriptions from central stations will be substantially duplicated by the manufacturers and others interested in the sale of apparatus.

Water-Power Development Policy.

A plan to bring together the advocates of federal regulation of water-power and those who stand for State regulation on a water-power policy upon which both can agree is being considered by the executive committee of the National Conservation Association, of which Mr. Gifford Pinchot is president.

The object of the plan, which was drafted by Mr. Philip P. Wells, counsel for the association, who, as former law officer of the Forest Service, had a large share in devising the system of water-power regulation in national forests, is to afford a water-power platform on which both sides of the water-power controversy may unite to protect the public interest, and at the same time encourage the development of the many millions of horse-power now going to waste in the mountain streams of the far West and the great rivers of the central and eastern parts of the country.

The proposed plan, which is stated to be the result of long and careful study of the water-power question, has, it is announced, been laid before competent engineers of wide experience in water-power development and officers and managers of hydroelectric power companies, who have criticised it and approved it.

The basis of the plan is development without delay, waste or the sacrifice of other and higher uses of flowing water. For this, the plan holds, private capital must be aided by the state or nation through corporate franchises, condemnation of priva property and licenses to use public lands and obstruct publ waters, etc. Under the plan the power companies are to hav certainty of tenure for a reasonable time and a chance f generous profits upon their actual investment. For the publ the plan promises good service, fair prices, full publicity as cost, honest capitalization and fair rentals for public proper used by the companies.

It is conceded in the plan that the federal government h no jurisdiction unless its land is to be occupied or navigab rivers are affected. Even in such cases the regulation of servi and prices is to be the function of the state, leaving to th national government the duty of securing prompt, full ar orderly development, a reasonable time limit for the lease publicity as to financing, and fair rentals for federal proper used, perhaps paying a part of the proceeds to the state.

The plan includes logical development in order that t future may not be handicapped by ill-advised partial ear development and compulsory development in cases where wate powers are held for speculative purposes. Among other poir are authority to acquire private lands by application of t principle of eminent domain; to assess the cost of water stora upon lands and power sites benefited thereby; when desirab public construction and ownership of storage reservoirs a transmission lines; irrevocable leases and franchises during fixed period; adjustment of rental values; court adjudicati upon forfeitures and other penalties for breach of the con tions of a franchise, privilege or lease; fair compensation f property at end of lease; equal service to all consumers witho discrimination; capitalization on the basis of cost and public of accounts; continuous operation of plant to prevent artific limitation of output to raise prices or restrict service.

Canadian-American Hydroelectric Power Conflict.

The town of Fort Frances, Ontario, has given notice that will apply to the Dominion Parliament at the present sessi for an act to repeal certain powers given to the American C tario & Minnesota Power Company. The town wants its rig to be more clearly defined in respect to the quantity and char ter of power or electrical energy to be supplied by the pow company from the development on the Rainy River to the F of Fort Frances, and to fully determine the rights of users power on the Canadian side of the international boundary, well as prices and conditions under all circumstances.

The town of Fort Frances took opportunity at the time Premier Sir Wilfrid Laurier's recent visit to western Cana to urge cancellation of the Ontario & Minnesota Power Co pany's charter on the ground that the company was not liv up to the terms thereof and that it was preparing to export the United States the energy developed on the Canadian side the river to the detriment of the interests of the town of F Frances. A review of the controversy was given in our is for Sept. 22, 1910.

St. Lawrence River Power Development.

The project for the development of additional power Beauharnois, Que., brought to Ottawa on Nov. 30 represe atives of the Canadian Light & Power Company, the Montr Light, Heat & Power Company, the Montreal Cotton Co pany and the Richelieu & Ontario Navigation Company bef a committee of the Dominion government consisting of H Dr. Pugsley, Minister of Public Works; Hon. George Grah Minister of Railways and Canals, and Hon. L. P. Brode Minister of Marine. Opposition to the project was listened plans were required, and the matter was held over for a f ther study by the engineers.

The plans of both the Beauharnois and the Canadian Pov

[co]mpanies provide for the enlargement of the intake and [the] consequent withdrawal of more water from the St. Law[ren]ce River. Mr. Francis King, representative of the Dominion [Ma]rine Association, declared that if the plans were carried out [the] Richelieu boats would touch bottom in the Coteau Rapids. [Mr]. C. J. Smith, general manager of the Richelieu Navigation [Co]mpany, stated that there was little enough water at present [an]d navigation was so difficult that only two pilots were able [to] take the boats through. Last summer the boats rubbed bot[tom], and the loss of water would be very serious. Hon. Dr. [Pu]gsley said the government's resident engineer had reported [tha]t navigation would to some extent be affected by the carry[ing] out of the proposed plans, and the committee decided that [fur]ther study should be made and the matter taken up at a later [tim]e for further consideration.

Ohio Telephone Situation.

[A]ccording to reports in circulation in Ohio at present the [ne]w General Assembly, which will convene early in the year, [wil]l undertake to solve a complex telephone problem. It is [exp]ected that a bill will be presented providing for the segrega[tion] of the local and long-distance systems and the merger of [the] former under the ownership of one large company. [Thr]ough this arrangement the long-distance lines will also be [bro]ught under a single ownership, but no legislation is needed [for] this, as it will be of the nature of interstate business and [will] come under the control of the Interstate Commerce Com[miss]ion.

[Fo]r some time the tendency has been to merge Bell and [Inde]pendent local companies in the various towns of the State [on c]ondition that the wires of the American Telephone & Tele[grap]h Company be given connection with the consolidated ex[chan]ge, as well as those of the United States Telephone Com[pany]. For years this move was fought by the Independents [unti]l a court decision was handed down opening the way for [it]. Following this shortly came the announcement that J. P. [Mor]gan & Company had secured a controlling interest in sev[eral] of the largest Independent local companies in the State, [as w]ell as in the United States Telephone Company. Several [suits], instituted by minority stockholders, were filed in an [ende]avor to prevent the transfer of stock, but it is understood [that] they are well out of the way. For many months seemingly [no o]pposition has been made to the consolidation of local ex[chan]ges of the opposing forces, and it would appear that this [is be]ing done in preparation for greater things to follow.

[Th]e opinion has been expressed that the Bell companies have [foun]d it impossible to finance both long-distance and local [servi]ce for the entire country with the companies now in ex[isten]ce and that the management has concluded to divide the [busin]ess so that the Bell companies can take the long-distance [busin]ess and place the burden of financing the local exchanges [on] those now interested in the independent work and others [who] may be induced to invest. This plan, it is said, was worked [out b]y J. P. Morgan & Company, and, while this firm will thus [make] good its word that no giant merger of the Independent [and] Bell interests would result from the acquisition of control [of a] number of Independent companies, it seems now that two [s]ystems will be the outcome, one of which will at least [fi]nally be controlled by the Independents or by local people, [and] the other will still be owned by the original Bell com[panie]s.

[It i]s believed by many that one company will be organized to [le]ase all the local exchanges in the State, both Bell and [Indep]endent, and that in all towns and cities where a dual [servi]ce exists the exchanges will be consolidated. The argu[ment] will be that a better and more extended service can be [given] through the operation of this plan, and that on an average [the e]xpense to the subscribers will be lower. But in order to [carry] this out and be free from litigation the Legislature must [pass] laws that will legalize the plans, and it is believed that the proposed law will place the business under the control of a State commission similar to the commission provided for in the Elson bill which was defeated last winter. It is possible that, with proper safeguards as to rates and quality of service, there would be no objection to making a single system possible, but should there be opposition to such restrictions the fate of the move would be in doubt, as the spirit of the people of Ohio just now seems to be toward curbing the freedom of public-service corporations, even to the point of forcing bad service.

Considerable preparation has already been made toward some step in the telephone field. Audits and appraisements have been made in many cases, and no doubt an immense collection of data is now in the hands of someone that can be utilized quickly in case the issue is successful in all its various features.

A number of conferences have been held in Columbus within the past few months by telephone men, the last one having taken place less than three weeks ago. While it is not known what the purposes of these meetings were, the supposition now is that the forces were being marshaled in readiness to push the proposed bill through the Legislature. Leaders among telephone men realize that they will have a hard task, because of the bitterness engendered a year ago and the fact that it has been decided that rules regarding the lobby in legislative halls will be more strict than ever during the coming session. This should not hinder a bill honestly presented, with all its purposes clearly shown, nor is it believed that a bill handled in any other way will be successful, since suspicion once awakened will not down easily within a short space of time.

Should such a plan be worked out in Ohio it would doubtless be extended to all States where Independent telephony has gained a foothold. Besides Ohio, this would include eastern New York, eastern Pennsylvania, West Virginia, Kentucky, Indiana, Michigan, Missouri and a number of other Western and Southwestern States. Ohio would be the pattern for the others and similar laws would probably have to be enacted in all the States before the plan could be executed. This would probably require several years, so that the service under the plan would be extended gradually.

Cooper Hewitt Light-Transforming Reflector.

Combined with the many highly advantageous features of the mercury-vapor lamp is the lack of red rays in the light emitted therefrom, which renders the lamp unsuited for use where accuracy of color vision is an essential feature. In industrial establishments the lamp has been found thoroughly satisfactory, but in many other locations the lack of red rays has precluded its exclusive introduction. Good results have sometimes been obtained by using with the mercury-vapor lamp some other lamp giving light rich in red rays, and many schemes of a somewhat similar nature have been proposed for overcoming the color defect. The "filter-screen" plan, which can be used with certain types of lamps to change the resultant color of the light, has been tried with the mercury-vapor lamp, but the results could not be other than disappointing. A color screen absorbs all rays except those of the color desired. Evidently, therefore, a red glass screen used with a mercury-vapor lamp would absorb all of the visible rays except red and, there being no red rays emitted by the lamp, would appear black. That is to say, the colored glass screen subtracts certain rays from the light, but it cannot add other rays which do not already exist in the light. A more promising field for investigation resides in the addition to the mercury vapor of some substance the spectrum of which is rich in red so that the resultant light from the composite vapor may possess all of the colors of the spectrum. However, not much progress has been reported along this line.

An entirely different scheme that bids fair to overcome the deficiency in the color quality of the light from the mercury-vapor lamp is one involving the use of a so-called light-transforming reflector. This reflector has been evolved as the result of investigation carried on by Dr. Peter Cooper Hewitt.

While it is being developed for the market primarily for use with the Cooper Hewitt mercury-vapor lamp it can be employed equally well with other types of lamps for the purpose of adding red rays to the light emitted therefrom.

The reflector differs only slightly in shape from those usually employed with the lamp, but it performs an important function which strongly differentiates it from other reflectors, namely, it acts as a secondary source of light radiation. That is to say, the light falling upon it is not wholly "reflected," but a part is absorbed, while light of a different frequency, that is, different color, is produced and emitted from the surface at which the initial light was absorbed. The reflector surface itself is formed of white light-diffusing material, upon which is placed a thin layer of florescent material; it is the latter material which acts as a "frequency transformer" to absorb certain of the rays from the lamp and deliver lower-frequency rays in place thereof. When used with a mercury-vapor lamp the florescent material emits red rays to supply the deficiency in these rays in the light coming directly from the lamp.

In the form of reflector now being prepared for the market for the near future the florescent material is placed on sheets of cardboard paper so mounted that they may be removed readily in case deterioration takes place while the lamp is in service.

The Garaging of Electric Vehicles.

In a paper read before a meeting of the Electric Vehicle Association of America in New York on Nov. 29 Mr. C. L. Morgan, manager of the maintenance department of the General Vehicle Company, read a paper devoted to the proper garaging of commercial electric vehicles. The author stated that unless an owner possesses at least five vehicles he should keep his vehicles at a public garage, where the labor cost is relatively smaller and energy can be purchased at a more favorable rate than at a private garage.

In any garage the keynote of the installation should be simplicity, and the equipment should be as nearly "fool-proof" as possible. It is essential to lay out an absolutely rigid program for the inspection and adjustment of the vehicles and charging equipment, and some one person should be held personally responsible for the execution of the program. Mr. Morgan cited one case where twenty-six machines are properly cared for and kept in excellent physical condition by three workmen, one being on duty during the daytime and two during the night. He claimed that any man of ordinary intelligence can properly care for and operate successfully a modern electric vehicle provided the battery is not overworked.

Mr. Morgan called attention to the garaging methods employed by the New York Transportation Company, which provides an adequate system of inspection of vehicles and batteries. Proper charging is attended to and the batteries are regularly flushed and equalized. A room is provided for drivers and this is the only place where they are welcome, but to insure perfect co-operation and harmony a system of drivers' complaints is in operation. Each driver makes out his complaint in duplicate. These are turned over to the night foreman and later the driver is obliged to certify to the elimination of the trouble because parts have been replaced or because adjustments have been made. The night inspectors on finding work necessary within the next few days report the fact to the superintendent, who hands to the driver a slip requesting authority to make the needed adjustments or repairs. In nine cases out of ten the driver is authorized to order such work; and, as in the case of complaints, later certifies in duplicate to the work having been done. If the driver does not authorize the work the necessary repair is at once called to the attention of the owner with a brief explanation of the need for the work, with the result that it is ordered done and finally certified to by the driver. These various duplicate records are attached to the monthly bill, thereby eliminating once for all discussion regarding services rendered.

Tantalum Lamps for Car Lighting.

As the result of an exhaustive investigation the Chic Railways Company has satisfied itself of the marked econ to be effected by the use of tantalum lamps for car ligh compared with carbon lamps. This is particularly true in case of a company which, like the Railways Company, chases its energy from a central-station supply.

The company has installed tantalum lamps in nearly large pay-as-you-enter cars. The investigations show an a age saving of 5 cents a day per car on the basis of 1800 h of illumination per year. This means a present saving $18,000 a year, and fully $35,000 a year will be saved when tantalum lamps have been placed in all of the 2000 cars t finally operated by the company. The greater cost of the ta lum lamps compared with carbon lamps, including interes found to be balanced at the end of the first year by the lo life of the former lamp. The saving, of course, is in the duced cost of electrical energy consumed.

Twenty-seven lamps are used in each car; seven are lamps and twenty are of the 16-cp size. Twenty-one l are used for interior lighting of the car and the remainder used for platform lighting, head lighting and illuminating sign boxes. The platform and headlight lamps, as well as placed in the ceiling of the car, are of the 32-cp size, a the others being 16-cp lamps. After extensive testing a st ard tantalum lamp rated at 35 watts for 16-cp sizes an watts for 32-cp sizes was installed on nearly 1000 of the cars of the Chicago Railways Company. These lamps manufactured by the Bryan-Marsh Company. Records cov a large number of cars show that the renewals per car month range from 1.72 to 2.59. Comparing the amount of trical energy required for a car using twenty-seven tant lamps with a similar equipment of carbon lamps a savin 1301 kw-hours on the basis of 1800 hours' lamp burning d the year is shown at the switchboard. Furthermore, duri test of 600 car-months the renewals with carbon lamps found to be 4.27 per car-month and with tantalum lamps per car-month.

Proposed New York Subway Construction.

Mr. Frank J. Sprague has submitted to the Board of mate and Apportionment of the City of New York a s communication relating to the subway situation, with s reference to certain financial considerations. The present munication is supplementary to an earlier communi noted on page 1226 of our issue for Nov. 24. Mr. Sp claims that if the action of the Public Service Commission be as contemplated it will become the duty of the addressed to assume the responsibility of deciding the f ing nineteen problems:

1. Whether the natural nucleus of a system owned b city but, under administrative and supervisory city c temporarily operated by a tenant, which has cost $63,0 and against which the city has issued a total of $50,400, bonds (or, if the Steinway tunnel project should material proposed by the Public Service Commission, a system will have cost, exclusive of equipment, $72,500,000, with standing city bonds of only $52,000,000), shall under any sible conditions have its operation extended with a singl over sections competitively built wholly or in part wit funds and with city participation in profits.

2. Whether in lieu of such operative extension a se system shall be constructed by the city, and in such m that it cannot at any time be amalgamated with the the city already owns, either in the near future or termination of the present lease, no matter how necess advisable.

3. Whether routes and franchises shall be selected operator as an adjunct to any system, and sections a [illegible] excluded from operation

4. Whether in providing city money for construction any interest shall be debarred from equal rights in bidding for the same.

5. Whether if an independent line is to be built and operated it must accept the "tri-borough" route.

6. Whether the users of the subways of New York shall be limited in their need to a single fare, or to get to their destinations they shall often be called upon to pay two fares.

7. Whether there shall be established a disjointed system made up of three independent sections having no apparent relation with each other and affording no through traffic between the several boroughs of the city.

8. Whether an existing rapid transit route shall be duplicated to the exclusion of vitally needed demands elsewhere.

9. Whether the Borough of Manhattan shall be developed to the exclusion or long-time delay of its neighboring boroughs.

10. Whether under the misleading cry of a "$100,000,000 system" the city shall undertake a project which will finally cost it fully $90,000,000 more than this, exclusive of a private investment of nearly half as much more for cost of equipment.

11. Whether the system shall be constructed without an operative tenant in sight, or any knowledge whether such a tenant can ever be obtained under the terms and conditions governing the city's investment in the present subway.

12. Whether, in case any such operator cannot be secured on terms satisfactory to the city, it will be prepared to supply the $44,000,000 necessary to become its own operator.

13. Whether the city is to abandon its previous attitude with regard to the lease of a city-built road and permit private capital to have a prior lien upon net earnings.

14. Whether tunnel dimensions and unnecessarily elaborate station planning shall be approved which shall together impose at least $30,000,000 excess cost, in the hope of getting a foreign corporation for a tenant, unless such corporation is now prepared to make a firm bid agreement to pay the city 5 per cent on at least $27,000,000 of this excess.

15. Whether the sometime possible wishes of a Connecticut commuter shall take the place of the twenty-four-hour demand of the people of New York for more extended facilities.

16. Whether there shall be an unnecessary delay of two or more years in getting new subways into operation, on top of the time necessary to get a better and more convenient subway under operation.

17. Whether there shall be approved a system of operating trains on heavy grades and curves under conditions which are a constant menace to life.

18. Whether a short fat subway covering a limited territory shall be built within the limits of a given appropriation, or whether a subway of ample effective size shall for the same money be extended fourteen miles farther into territory vitally needing such extension.

19. Whether it is not the part of wisdom, while awaiting consideration and possible rejection of the present plans, to direct the energetic preparation of new ones on amended dimensions and with simpler station construction to meet the consensus of engineering criticism; also at the same time to plan for an alternative one-level route down Seventh Avenue, so that competitive construction and operative tenders can be asked for.

Mr. Sprague expressed the opinion that, following whatever general conclusion may be arrived at by an advisory committee, it is possible, with the advice of a competent engineering board, to arrive quickly at a satisfactory result.

Mr. William G. McAdoo, president of the Hudson & Manhattan Railroad Company, in a speech before the City Club on Dec. 3 warmly indorsed the plans of the Public Service Commission relative to the so-called "tri-borough" scheme. He approved of the increase in size of the tunnel, which he estimated would cost $10,000,000 and save $1,200,000 in operating expense.

In a letter to Chairman Willcox, of the Public Service Commission, dated Dec. 3, Mr. McAdoo stated that his offer to operate the subway to be [illegible] by the city would be withdrawn if not accepted on or [illegible]

Mr. Sprague, in commenting upon the speech and letter of Mr. McAdoo, said that the route proposed by Mr. McAdoo is not the so-called "tri-borough" route, but is made up of the best of the tri-borough elements and other new and more valuable routes not forming any part of the original tri-borough system. Mr. Sprague stated that if the city will abandon its demands of a guarantee of the interest and sinking fund against the cost of construction and permit private capital to have prior lien on the net earnings, and state that competitive bids will be accepted under seal at a specified date, he will guarantee that a better proposal than that of Mr. McAdoo will be made either for the line which Mr. McAdoo has proposed or for a better alternative route.

On Dec. 5 the Interborough Rapid Transit Company submitted to the Public Service Commission a proposal covering the construction and operation of certain subway extensions in Greater New York. The company offered to pay $75,000,000 of the total cost of $128,000,000 for the extensions. Of the net profits from operation the city is to take all for the first five years from the beginning of operation, after which the net profits are to be divided equally between the city and the company. The company proposes a 5-cent fare over the entire system.

Success in Electrical Engineering.

At a meeting of the New York branch of the National Electric Light Association, held on Nov. 10, Dr. C. P. Steinmetz delivered an address in which he outlined the requirements for success in the field of electrical engineering. In commenting upon the complaint of scarcity of opportunities at the present time Dr. Steinmetz said that there are now opportunities which did not exist before. There is a demand for good successful men and there is a very limited supply when it comes to those positions which command a high-salaried man, say between $4,000 and $10,000 a year. The prime requisite for success is knowledge, both theoretical and practical. It is not sufficient to have either practical experience or theoretical knowledge, but the two must be combined. The practical man is always limited to those spheres of work in which he has had previous experience. When anything comes up beyond what he has met before he necessarily must fail. On the other hand, theoretical knowledge alone is valueless. College graduates who have studied reasonably hard and have acquired a great amount of theoretical knowledge, but have no practical experience as they come from college, are useless. They have first to gain the practical experience, and the success they make depends entirely on their ability to gain this practical experience.

The acquiring of sufficient theoretical knowledge by the man of practical experience does not mean necessarily a college education. However, the college is the place specially devised for gaining this knowledge. The four years spent there acquiring knowledge is time well spent, for it is difficult to get at any other place an equal amount of theoretical knowledge in so short a time. Not all students receive benefit from the instructional staff who feed the knowledge to them. The students do not properly appreciate the knowledge and do not profit by it to the same extent as do men who have gained their theoretical knowledge by practice and by studying alone.

A person studying alone to gain knowledge should guard against wasting his time and effort in the details of the vast field covered by the industry; he should select topics that will broaden his knowledge. The man who works without the assistance of others is liable rather to be side-tracked; he works very hard, but seldom accomplishes anything that counts.

The successful electrical engineer must know a great deal about not only electrical engineering but everything else as well. It is difficult in an electrical engineering college to make the boys study subjects not connected with electrical engineering. They may be willing to study all phases of electrical engineering, but they cannot realize why they should know history, chemistry, literature or anything else that is not electrical.

The college graduate who has only theoretical knowledege makes a failure because he lacks common sense, which, after all, is nothing but the intuitive and instinctive judgment based on very broad experience and knowledge. Those men who have succeeded, who are esteemed by the world as great, are interested in everything, and they have succeeded because of the universal interest and broad view which they take. They have the common sense which makes them successful in applying their knowledge in chemistry or electricity or whatever it may be.

In commenting upon the education given by the college and the education acquired by a practical man Dr. Steinmetz said that the only field in which the college is superior is mathematics. It is desirable to have a systematic course in mathematics, such as is afforded by the college. Some college men may gain nothing from it, but those who really understand it have an advantage which is very hard for a practical man to overcome. Mathematics is very desirable, and it is absolutely necessary in calculating in some branches of medium-high electrical engineering, but it is not quite essential in all the highest fields of electrical engineering. The assistant designer of apparatus must have a knowledge of mathematics, but the chief engineer who directs the designer need not have such a great knowledge of mathematics. He must understand why things are so and why they are not so; he should know how things are done, but he can hire an assistant to do the calculating. It is more difficult to understand electrical phenomena without mathematical training, but it is not impossible to do so, and one need not be discouraged because he is not a mathematician.

City Electric Railways and Their Relations to the Public.

In a luncheon talk before the Chicago Engineers' Club, Nov. 30, Mr. Charles V. Weston, president of the South Side Rapid Transit Company, of Chicago, discussed the relations of the public with surface and elevated electric railways in cities. For comparison he described intramural transportation twenty-five years ago, when slow, dirty horse cars were in use, and contrasted these with the present high-speed, sanitary, well-lighted electric cars in which the same 5-cent piece purchases a ride. Meanwhile the costs of labor, materials, supplies, etc., have risen more than one-third, the lines have been extended for miles into suburban areas, involving longer hauls, and the equipment has grown heavier, necessitating more expensive apparatus throughout the system.

In all of this the citizen has been the gainer, being enabled to live at a greater distance from the center of employment amid more pleasing and healthful surroundings, while his time of travel to and fro has been greatly diminished. Indeed, said Mr. Weston, if each of the 10,000,000,000 people who rode on the street-car systems of the country during a single year has saved ten minutes each ride at an equivalent wage of 15 cents per hour, the economic saving would be $238,000,000; more than 2.5 times the entire income of the companies carrying this traffic. The average haul in Chicago is six miles per passenger for the elevated roads, and slightly less for the surface lines. No other expenditure of a nickel commands such vital and full service as does the city street-car ride, bringing the place of employment of tens of thousands of people close to their homes in the suburbs and outlying sections of the city. Mr. Weston recited the results of the Boston investigation of the division of a 5-cent car fare, and declared that approximately the same proportion would hold in any large city in America.

As proof of the extending influence of electric railways on the distribution of Chicago's population Mr. Weston cited the assessor's figures for the valuation of property in the Hyde Park section of the city during certain years. In the year of the cable-car system, 1882, this figure was $7,580,000; in 1890, $16,000,000; in 1900, $26,000,000, and in 1909, $78,611,000. This particular region has always had steam suburban-railway service, but it was the coming of the electric lines which contributed to its growth so enormously, as the dates show. The electric railways are cutting into the steam roads' traffic, for the former, both surface and elevated lines, offer more frequent service at relatively high speeds for short distances and deliver passengers virtually at the doors of their places of employment. Where the old horse-car speed sometimes reached four and one-half miles an hour, the modern elevated cars average twenty miles an hour in express service.

The elevated railways of Chicago represent an investment of $100,000,000 and the surface lines $107,000,000. Thus the industry locally means a physical property of more than $200,000,000, with its accompanying enormous redistributing power in the salaries of thousands of employees and in the large amounts spent for maintenance and renewals. This beneficent aspect of electric railways in promoting business prosperity is in addition to their important services in opening up vast suburban areas for habitation by city people, who are served with rapid, comfortable rides at minimum cost.

Mr. Weston spoke of the sometimes unpleasant attitude in which the public views corporation affairs, while the capitalists look upon electric railway investments as hazardous in view of the diminishing returns on capital caused by the rise of the prices of labor and material. The solution of this acute situation, he said, lies with the people in the granting of franchises which shall be fair to both themselves and the companies. Modern economists admit the natural monopolistic nature of street-railway service, most of them agreeing that such service can be more economically rendered on a non-competing basis, but under legalized control and regulation. Mr. Weston, therefore, advocated the granting of franchises in which the passenger rate should not be stipulated as in the past, but instead the capital invested should be assured a fair return, the fare being adjusted as the varying conditions of length of haul and density of population require. The return on the investment should be made proportional also to the hazard involved. Where service is demanded in sparsely populated districts part of the cost of building the lines should be assessed against the region benefited, as is already being done in New York State.

Such a franchise, assuring to investors a reasonable return on their capital, would not only react to render electric railway and public-service corporation securities more stable and secure, but would benefit the employees, providing them with more adequate remuneration and working conditions, and, in the end, the general public, through maintaining and operating the property at its highest efficiency, keeping its equipment apace with the art. By placing before the public the exact truth about the cost of operation its co-operation could be secured in the granting of fair franchises. Mr. Weston does not believe in the municipality sharing the profits of operation, declaring that adequate service for patrons is all that should be expected or asked from public-service companies. The problem of franchises will soon again be presented to Chicago, said the speaker, and the present surface-railway rehabilitation ordinances are but a step in the right direction.

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission has issued an order on the petition of the Foxboro Electric Company for an issue of additional capital stock of the par value of $43,500 to enable it to acquire a power station building, pond, land and equipment from the Standard Gage Manufacturing Company. The company has recently enlarged its business to include the generation and selling of steam and hot water. The company will issue 335 shares of additional stock at $100 each, the board's order reducing the amount asked by 100 shares. The company has connected its lines to the new station and is giving twenty-four hour service. The old station is to be dismantled. The board has issued an order authorizing the Norfolk & Bristol Gas & Electric Company to issue addi-

onal capital at $100 per share to the amount of $25,000 to able the company to acquire an oil gas plant from the Stand-d Gage Manufacturing Company. The Weymouth Light & ower Company has petitioned the board for authority to sue additional capital stock to the amount of $210,000 to pro-de for the extension and improvement of its plant and sys-m, and the Greenfield Gas Light Company has petitioned for e right to issue new stock to the amount of $50,000 at the par lue of $50 per share to pay the cost of enlargements of its ant. The Tyngsboro Electric Company has requested per-ission to issue new stock of the par value of $7,500 to enable to establish the supply of electricity in the town.

The Massachusetts Railroad Commission has issued two de-sions sustaining the companies in the petitions of the Select-en of Revere for fare reductions on the lines of the Boston evated Railway Company and the Boston & Northern Street ilway Company.

The commission gave a final hearing on Dec. 2 upon the peal of the Boston Elevated Railway Company from the fusal of the Cambridge Water Board to approve the com-ny's plans for pipe location in a section of Massachusetts enue. Each party submitted a plan of the pipe location it sires in connection with the construction of the Cambridge way. The company contended that the city's plan would ex-se it to an expense of about $40,000 for the taking of prop-y, while the city argued that under the company's plan the es would not be laid deep enough to avoid danger from ezing. The board took the case under advisement.

The Railroad Commission has authorized the Berkshire Street ilway Company to carry baggage and freight in the Town of -emont.

Maryland Commission News.

he matter of testing and approving electric meters was con-red last week by the Maryland Public Utilities Commission. eafter this task, along with that of testing the quality and ity of gas, will be done under the supervision of Mr. rles E. Phelps, the commission's chief engineer. Hereto-Lighting Superintendent McCuen has looked after the ting tests as a part of his official duties, but the Public ice Commission law requires that the commission shall do work. Use of electric meters will not be permitted any-re in Maryland until the commission shall have first made tests and placed upon the meter the seal of its approval. se tests will be made at the plants of the lighting companies ughout the State before the meters are installed and on the nises where they are being used after installation if there is reason to believe that they are not working properly. Tests already being made by Mr. Phelps of the quality and ty of gas, and arrangements have been made with Mr. Cuen whereby the State is to have the use of the city's ap-tus and the testing-room in the City Hall at Baltimore, h is especially equipped for such purpose. This plant has recently been installed under the authority of an ordi-e of the City Council. After a lapse of a few months. ng which time the commission is expected to complete its s, the plant will probably be installed in the old Builders' iange Building, where the commission now has its offices, tests will be continued there.

embers of the Old Frederick Road Improvement Associa-appeared before the Public Service Commission last week urged better street railway facilities for Ellicott City and nsville. They asked that the United Railways & Electric pany be required to continue its Frederick Road line from resent terminus at Stoddard's over the cut-off to the Elli-City line. A number of transfer privileges were also l for. The charge was made that the residents of Ellicott are discriminated against by the railway company in addi-to being made to pay an excessive fare for transportation. commission is holding the entire matter under advisement.

AMERICAN ELECTRICAL ENGINEERS.—XXII.

Rudolph E. Hellmund.

Rudolph Emil Hellmund was born Feb. 2, 1879, in Gotha, Germany, where he received his primary education. Prior to taking up technical studies and in order to gain some practical experience he spent a year as an apprentice in a factory at Gotha. His technical education was principally received at the Technical High School of Charlottenburg, Germany.

Mr. Hellmund's first professional position was with the Sächsische Elektricitätswerke, formerly Poeschmann & Company, in Heidenau-Dresden, Germany, as assistant to Mr. Julius Heubach, well known as the author of a book on alternating-current motors. His work there consisted chiefly in the mechanical design of alternating-current and direct-current machinery. Following this engagement he spent a year in the laboratories of the Land-und-Seekabelwerke Company, Cologne-Nippes, Germany, where he was chiefly occupied in investigations of cables, especially for high-voltage work, the company then being engaged in manufacturing its first cables for 20,000 volts, which were tested to 100,000 volts. Two and a half years were then spent in the electrical division of the Maschinenfabrik

Rudolph E. Hellmund

Esslingen Company, at Cannstatt, Germany, which were occupied in various ways, including the design of direct-current and alternating-current machinery, transformers and control apparatus and in expert service on trouble work, in which latter capacity a wide experience in field work was gained. During the last year at Cannstatt he was in charge of the testing department and also in supervisory charge of the generating station supplying electrical energy to the factory and to the tramways of Cannstatt.

In August, 1903, Mr. Hellmund came to the United States, originally with the intention of spending only a short time here. After traveling for several months throughout the country, however, he remained in New York, where a year was spent in consulting work of various kinds, such as the design of telegraph apparatus in connection with a system for transmitting drawings, the design of electrochemical apparatus to be used in the manufacture of camphor, and the design of circuit-breakers, switchboards and some other appliances. About the end of 1904 he accepted a position as assistant to Mr. William Stanley in Great Barrington, Mass. [illegible]

... with the design and test of the Stanley self-compounding alternator and its low-frequency exciter. In June, 1905, he became connected with the Western Electric Company, which was then taking up the manufacture of alternating-current apparatus. After assisting in an investigation of the patent situation he was put in responsible charge of all the alternating-current motor designing of the company and developed its lines of induction motors, as well as a line of synchronous motors.

In October, 1907, Mr. Hellmund accepted a position in the engineering department of the Westinghouse Electric & Manufacturing Company and received charge of the development of several new lines of induction motors for mill work and for crane, hoist and elevator service. Since October, 1909, he has been engaged in organizing and is now in charge of the section of the engineering department which has cognizance of all estimating work for electric power apparatus. He also acts in a consulting capacity in connection with three-phase railway and industrial projects.

To Mr. Hellmund have been granted a number of electrical patents in this country and abroad relating to circuit-breakers, oil switches, fuses, induction motors, etc. He has contributed largely to the technical press, both in Europe and this country, especially to the *Eclairage Electrique*, of Paris, the *Elektrotechnische Zeitschrift*, of Berlin, and the columns of this journal. The subjects cover a very wide range, including the theory and design of synchronous and induction motors, commutation, graphical treatment of higher harmonics, the rotating field, polyphase windings, etc. He has contributed two papers to the *Transactions* of the American Institute of Electrical Engineers, entitled, "Zig-Zag Leakage" and "Graphical Treatment of the Rotating Field," and a paper on "Graphical Treatment of the Zig-Zag and Slot Leakage in Induction Motors" to the British Institution of Electrical Engineers.

Mr. Hellmund is a member of the American Institute of Electrical Engineers, the Verband Deutscher Electro-Techniker and the Deutsch-Amerikanischer Technikverband.

CURRENT NEWS AND NOTES

Meter Tests.—Of 8098 tests of watt hour meters made during October by the New York Public Service Commission for the Second District 379, or 4.68 per cent, were fast; 6534, or 80.69 per cent, were accurate, and 1185, or 14.63 per cent, were slow.

Public-Utility Regulation in District of Columbia.—President Taft in his recent message to Congress recommended laws for the regulation of public utilities in the District of Columbia similar to those upon which the Public Service Commissions of New York and Massachusetts are based.

Break-Down Electric Service in New York City.—In New York City 25 per cent, or 185, of the isolated plants have a break-down connection with the mains of the Edison company. The minimum guarantee made by the break-down customers last year was $111,510 and the actual break-down revenue was $158,000.

Physics Department at Urbana.—On Nov. 19 the physics department of the University of Illinois gave the general public a special invitation to inspect its new building and to see the various laboratories in operation. In the evening all departments were in operation and members of the instructional staff were on hand in each room to explain the work done there. The guest of honor was Prof. A. A. Michelson, head of the department of physics at the University of Chicago.

Gasoline-Lighting Contract in Chicago.—On Nov. 14 the City Council of Chicago authorized the city electrician to enter into a contract with the American Development Company for furnishing and maintaining about 7000 60-cp gasoline street lamps in Chicago during the period from Sept. 1, 1910, to Aug. 31, 1911. The amount to be paid the company is not to exceed $2.20 a month for each of the lamps. The lamps, which are used on outlying streets where the electric or gas mains are not extended at the present time, are to be placed at locations designated by the city electrician. Deductions are to be made from the rated price for unsatisfactory service.

Conspicuously Colored Street Cars Suggested to Prevent Accidents.—Commenting on the fact that eight persons were killed and 284 injured in street-railway accidents in Chicago in November the city attorney says that ordinary care exercised by the public in crossing streets or in getting on or off of cars would reduce the number of accidents greatly. He suggests that the front of each street car be painted a bright yellow instead of dark green, to make it more conspicuous.

I. E. S. Meeting in New York.—The New York Section of the Illuminating Engineering Society will hold a meeting in the Engineering Societies Building on Dec. 8 at 8:15 p. m. A paper entitled *The Early History of Photometric Standards*, by Prof. Edward L. Nichols, will be presented in abstract. Mr. Bassett Jones, Jr., will present an extensively illustrated paper entitled *The Lighting of the Allegheny County Soldiers' Memorial Building in Pittsburgh.* This paper will treat of what is probably the most elaborately lighted building thus far erected in which practically all forms of electric illuminants have been used in unique ways.

Lewis Institute A. I. E. E. Branch.—At a recent meeting of the Lewis Institute Branch (Chicago) of the American Institute of Electrical Engineers Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, delivered an illustrated lecture on the "Generation of Electricity in the Largest Steam-Turbine Station in the World." Mr. Abbott showed the marked economy in space effected by the use of steam turbines, and spoke of the handling of the enormous amounts of coal passing through a large station like that of the Commonwealth Edison Company at Fisk Street, and also gave the efficiencies of the various agencies used in transforming the potential energy of the coal into electricity.

Corporation Tax.—The Chicago *Daily Tribune* of Nov. 27 gives some information in relation to the payments made under the special corporation tax by a few selected corporations. The corporations gave the information required by the new law, under oath of their officers, for the year ended Dec. 31, 1909. Upon the basis of these statements the government assessed a special excise tax of 1 per cent upon the net income. Each corporation then paid the assessed tax, but a formal protest accompanied the return, because the constitutionality of the law is being contested in the courts. Among the corporations mentioned by the *Tribune* are the People's Gas Light & Coke Company, which paid a tax of $32,129; Commonwealth Edison Company, $22,987, and Chicago Telephone Company, $21,866.

A. I. E. E. Meetings.—At a meeting of the American Institute of Electrical Engineers to be held in the Engineering Societies Building, New York, on Dec. 9 Messrs. E. D. Dickinson and L. T. Robinson, of Schenectady, N. Y., will present a paper entitled *Testing of Steam Turbines and Steam Turbine Generators.* On Dec. 8, at the same place, a paper entitled *Industrial Continuation Schools of Munich* will be presented by Dr. Georg Kerchensteiner, Superintendent of Schools of Munich, Bavaria. This meeting will be under the joint auspices of the National Society for the Promotion of Industrial Education, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers. A meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York, on Jan. 11, at which time a paper on *Corona* will be presented by Prof. Harris J. Ryan, of Stanford University, California.

Montreal Abolishes Gas Street-Lighting.—The superintendent of the Montreal city lighting department has announced that after Dec. 31 all street gas lamps will be superseded by tungstens, which latter will give twice the illumination at less cost per lamp.

Winnipeg Electric Railway Company Must Remove Transmission Line City Poles.—The Winnipeg Court of Appeals has decided that the Winnipeg Electric Street Railway Company has not the right to erect poles or wires in the City of Winnipeg for the transmission of electrical energy for any purpose other than for its electric railway.

Consolidation of Telephone Journals.—Our contemporary *Telephony*, of Chicago, announces the consolidation with it of the *Telephone Weekly* and *Telephone Securities Weekly*, both heretofore published in New York. Other journals previously absorbed by *Telephony* were the *American Telephone Journal*, *Sound Waves*, *Telephone Magazine* and *The Telephone*.

Transmission Line Tested at 250,000 Volts.—A test was made on Dec. 3 at London, Ont., at 250,000 volts of the transmission line of the Canadian Hydroelectric Commission between London, Ont., and Niagara Falls. The test is stated to have been very satisfactory, and the chairman of the commission, Hon. Adam Beck, stated that regular electric power transmission to London and Berlin would begin at once.

Wireless on Austrian Ships Compulsory.—The Austrian Ministry of Commerce has ordered all Austrian merchant vessels carrying passengers from Austrian ports to places beyond Gibraltar and the Suez Canal to be equipped with wireless apparatus at a minimum range of 100 miles and capable of communicating with ships and coast stations. Austria is the first country to adopt such a compulsory measure.

Pittsburgh A. I. E. E. Meeting.—The Pittsburg Section of the A. I. E. E. held a meeting Nov. 16, 1910, in the auditorium of the Engineers' Society at which papers were presented on *Mine Locomotives*, by Mr. G. M. Eaton, and on *Hoisting* by Mr. W. Sykes. Messrs. E. C. Wayne, H. L. Beach, L. C. Illsley, W. W. Miller, C. N. Van Slyke and W. A. Thomas participated in the discussion. The attendance at the meeting was about ninety.

Better Bridge Lighting Demanded in Chicago.—Resolutions have been adopted by the Cook County Real Estate Board urging that the bridges spanning the Chicago River and its branches be lighted better. The demand is made not only on the ground of greater safety to pedestrians and vehicular traffic, but because the lighting will add to the attractiveness of the city at night, while the lamps and their supports may be a material aid in the beautifying of the city.

Telegram and Foreign Letter Service.—The Western Union Telegraph Company has arranged a service whereby it will mail telegrams received at New York and addressed to a correspondent abroad. Such a letter will be received by the telegraph company precisely as a message would be received, transmitted at the usual tolls, and the copy at New York placed in a special sealed envelope, addressed as directed, and rushed to any available steamship. The only extra charge will be 5 cents for postage.

Large-Scale Use of Electricity in Farming.—According to reports from Helena extensive use will be made of electricity in farming throughout Sweet Grass County, Mont., on that large portion of it reclaimed by a local land company under the provisions of the Carey act. It is estimated that 2000 hp can be developed on Big Timber and Otter Creeks. The electricity thus produced will be used on the farms for lighting, heating, cooking, pumping, running cream separators and fanning mills, elevating hay and, in fact, almost anything to which the hand may be turned to advantage.

Institute of Industrial Research.—The Institute of Industrial Research has been formed at Washington to undertake the investigation of industrial problems. At first the work will be largely confined to metallurgical problems with especial reference to the protection and conservation of industrial metals; agricultural chemistry, including land and fertilizer problems; hydraulic cement; paint technology; electrochemistry and chemical engineering; road building and paving. Mr. A. S. Cushman, formerly with the Agricultural Department and well known for his investigations into the corrosion of steel fence wire, is director of the institute. Dr. N. Munroe Hopkins will have charge of the division of electrical engineering and electrochemistry.

Franklin Institute Elliott Cresson Gold Medals.—The Franklin Institute has conferred the Elliott Cresson gold medal, the highest award in the gift of the Institute, on the following gentlemen: Dr. Edward Weston, Sir J. J. Thomson, Mr. John Fritz, Prof. Ernest Rutherford, of the McGill University; Sir Robert A. Hadfield, the metallurgist; Dr. Harvey W. Wiley, of the Department of Agriculture, and Prof. John A. Brashear, maker of astronomical instruments. The medal was awarded to Dr. Weston for distinguished leading and directive work in electrical discovery and in the advancement of electrical application. The award to Prof. Thomson was on the grounds of distinguished work in the advancement of the knowledge of physical sciences, and that to Prof. Rutherford for his work in radioactivity.

Electromagnets for Recovering Torpedoes.—The Navy Department is planning to experiment with electric lifting magnets for recovering torpedoes which are fired in practice and which, through some fault of the controlling mechanism, go to the bottom after their energy is expended. These torpedoes are virtually small submarine vessels with self-contained power plant, steering mechanism, etc., and each one is worth a small private fortune. The points where they are lost will be marked by buoys and magnets then dropped down to grapple them and bring them to the surface. Owing to the buoyancy of the water magnets of relatively small lifting power may be used, but it will be important that these be constructed to withstand the severe conditions of moisture and temperature changes under which they will be operated. Electromagnets were recently used in a similar manner for recovering kegs of nails from a sunken barge in the Mississippi River, and this achievement suggested the new use of the magnets to the naval engineers.

Electrochemical Society Meeting.—The New York Section of the American Electrochemical Society will hold the first meeting of the season at the Chemists' Club, 108 West Fifty-fifth Street, on Dec. 16, 8:15 p. m. The program of the evening will be as follows: The meeting will be opened by a paper by Dr. E. F. Roeber. This paper will treat of the fixation of nitrogen and include a statement of the three principal commercial processes now in operation, and also introductory remarks regarding some later developments and the later uses that have been proposed for the products. It is expected that Mr. Charles S. Bradley, the pioneer of the industry in this country, will be present to participate in the proceedings. The Birkeland-Eyde and the Badische Company and Pauling processes will be represented, and the manufacture of cyanamide will also come under discussion. In conclusion Mr. John C. Clancy will present a paper on a very interesting modification of the cyanide process, employing cyanamide instead of cyanide in the treatment of gold and other ores. This method is of great interest to both metallurgists and electrochemists, as the process involves the use of electrolysis as a fundamental portion thereof.

Netherlands Patents.—The parliament of the Netherlands has adopted a bill granting State protection to foreign patents on payment of a small fee. Previously foreign inventions were not protected.

Winnipeg Municipal Hydroelectric Plant.—It is expected that the hydroelectric plant being erected by the City of Winnipeg at Point du Bois, Winnipeg River, Manitoba, will transmit energy to that city early next spring. The plant is seventy-miles distant from Winnipeg and will cost $3,500,000. There is available at Point du Bois 100,000 hp, of which 20,000 hp is now under development. A dam on the Winnipeg River creates a storage reservoir of 6000 acres.

Proposed Hydroelectric Commission for Alberta.—At a recent meeting of the City Council of Edmonton a resolution was passed asking the provincial government to develop and take under its control the water-power resources of the Province of Alberta, to be used for the benefit of the municipalities. The resolution was suggested by the work of the Ontario Hydroelectric Commission, which has operated in the Niagara peninsula for the benefit and advantage of the municipalities forming the union for the purpose of utilizing Niagara power. It is proposed that the question be brought to the attention of the different municipalities throughout the Province of Alberta, with a view to obtaining co-operation in an effort to induce the Alberta government to sanction and carry out the undertaking.

Shafts and Deep Tunnels for Underground Cables.—For carrying the electric cables and steam-heating pipes to the various buildings on the campus of the University of Minnesota, at Minneapolis, advantage has been taken of the peculiar geological strata to avoid expensive excavation. The new heating plant, which will also be the substation for the transmission line conveying hydroelectric energy from the federal plant at Fort Snelling, near by, is being erected on the river bank at the base of a 100-ft. cliff, on the top of which sit the university buildings and campus. For 90 ft. below the campus level this cliff is of solid, hard limestone, but is underlaid by a thin stratum of half-formed sandstone so loosely packed as to be easily excavated with a spade. From the heating plant tunnels are being constructed through this soft sandstone to points under the various campus buildings, from which vertical concreted shafts excavated through the limestone superstrata will be used to convey the cables and pipes to the buildings above.

British Columbia 65,000-hp Proposed Hydroelectric Development.—The International Electrical Company, Limited, with offices in Nelson, B. C., and Portland, Ore., has filed plans for the development of a large electric-power plant from the falls on the Pend d'Oreille River. The river runs from Canada to the United States, some fifty miles southwest of Creston, B. C., and for nine miles before reaching the boundary it is a series of rapids. At a point some six miles above, on the Canadian side, a site admirably adapted for the necessary development works has been staked, and it is expected that a city will be located in the vicinity, to be known as Falls City. Mr. W. E. Moore, hydraulic engineer, of Spokane, has made an investigation and report on the power sites of the river, in which it is stated that the upper site is capable of a total development of 65,000 hp, and that the cost will be about $60 per horse-power. The Sheep Creek and Ymir mining districts are only fifteen miles away, and the power sites are within 100 miles of Spokane.

Federal Dam in Mississippi River Near Minneapolis.—The 30-ft. dam which the federal government is planning to build in the Mississippi River near Fort Snelling, between Minneapolis and St. Paul, Minn., will make navigation possible up to Minneapolis and will create a water-power averaging 15,000 hp throughout the year. Hydroelectric energy thus developed will be used for lighting Fort Snelling and the Soldiers' Home near by, besides furnishing 3000 hp to the University of Minnesota [illegible] the remainder of the electrical output of the station it has been proposed to utilize for public and park lighting in Minneapolis and St. Paul, although at the low stages of the river only 5000 kw will be available in all. The present year has marked the lowest river stage of any season since 1863, and all of the water-power plants in Minnesota have felt the effect of the low water. The United States government will build the dam at Fort Snelling, but the federal right to operate a hydroelectric generating station selling energy to state and municipal bodies has been questioned

Eastern New York N. E. L. A. Section.—Although the territory of the newly organized Eastern New York Section of the National Electric Light Association has not yet been closely defined by the national committee, it is probable that the section of New York State between Poughkeepsie and Syracuse will be included with Plattsburg as the northern limit. Being the geographical center of the territory covered and the home of the General Electric Company, with so many men prominent in the commercial phase of the electrical industry, Schenectady was a logical choice as headquarters. The first general meeting of the season will be held at Schenectady on Dec. 13, at which President W. W. Freeman and Executive Secretary T. Commerford Martin will make addresses. The section has already 140 members and the membership committee, of which Mr. W. E. Brown, of Schenectady, is chairman, is making an active campaign among the central-station men in the large and thriving towns and cities of eastern New York. The officers of the new section are as follows: President, Mr. B. E. Morrow, Hudson River Electric Power Company, Albany; vice-president, Mr. M. O. Troy, General Electric Company, Schenectady; treasurer, Mr. T. A. Kenney, Hudson River Electric Power Company, Albany; secretary, Mr. R. H. Carlton, General Electric Company, Schenectady. The executive committee is composed of the following members: Chairman, Mr. B. E. Morrow, Hudson River Electric Power Company, Albany; Mr. C. D. Haskins, General Electric Company, Schenectady; Mr. M. Webb Offutt, Schenectady Illuminating Company, Schenectady (Mohawk Gas Company, Schenectady); Mr. A. A. Anderson, Albany Illuminating Company, Albany; Mr. J. C. DeLong, Syracuse Lighting Company, Syracuse; Mr. F. H. Gale, General Electric Company, Schenectady.

Johns Hopkins Lectures for Electric Light Men.—The first of a series of ten lectures arranged by the Consolidated Gas, Electric Light & Power Company, of Baltimore, for its employees was given on Nov. 29 at the Johns Hopkins University of Baltimore. Upon the initiative of the Baltimore Consolidated Section, N. E. L. A., the company has made arrangements to offer to its employees opportunities for scientific training. The entire expense of the course of lectures to be given this winter is borne by the company and the lectures are open to all of its employees. The ten lectures will be given on alternate Tuesday evenings by Dr. John B. Whitehead, professor of applied electricity at the Johns Hopkins University. From 1893 to 1896 Dr. Whitehead was designing engineer for the Westinghouse Electric & Manufacturing Company. During 1896 and 1897 he was operating engineer of the Niagara Falls Power Company. In 1899-1900 he was electrical engineer of the Rowland Telegraphic Company. From 1903 to 1905 he was research fellow of the Carnegie Institution. From 1906 to 1908 he was electrical engineer of the Baltimore & Annapolis Short Line. Perhaps the most important engineering work which he has done is the electrification of the Baltimore & Annapolis Short Line, which was designed by him and installed under his supervision. When the course of lectures was inaugurated Dr. Whitehead was introduced by Mr. Herbert A. Wagner, director of the electrical division of the Baltimore company, who outlined the purposes of the course of lectures and the opportunities offered by it. On the Tuesday evenings intervening between Dr. Whitehead's lectures meetings will be held of the Baltimore Consolidated Section, N. E. L. A., and addresses will be made by men connected with various departments of the [illegible] company and by men from companies in other cities.

SWEDISH GENERATING STATION.

The Extension of the Municipal Steam Electric Power Station of Stockholm.

By E. Andreason.

THE municipal electricity work of Stockholm, the capital of Sweden, dates from the year 1892, when the so-called Brunkeberg station was erected. This steam-driven, direct-current station supplied energy at 2×110 volts pressure to a limited part of the city, the business district. In order to meet the demand it has been gradually extended to its present equipment of about 1350 kw in generators, working together with a storage battery of 10,000 amp-hours rating. In the year 1903 a large addition to the equipment was installed. The underground direct-current distribution network was extended to all of the districts of the town. The old system with steam driven, direct-current stations not being considered economical, a three-phase, steam-driven station was erected at the Värta harbor, the energy therefrom being transmitted by means of underground cables to substations in the different districts of the town. The site of the Värta power station may be seen from the map in Fig. 2. The Värta harbor is located at a distance of about 3 km (1.8 miles) from the center of the city. The site of the power station is, therefore, favorable for coal and water supply. The Värta station generates three-phase current at a pressure of 6000 volts and 25 cycles. At first three 1500-kw, triple-expansion, engine-driven generators, running at a speed of 100 r.p.m., were installed. In the year 1907 two turbo-generators of the same rating and with a speed of 1500 r.p.m. were erected. The large extension which is to be described in this article was erected in the year 1909, containing two turbo-generators, each of 6000 kw rating, with boilers, economizers, switchgear, etc. At the same time the old coal-handling plant was altered and enlarged. A good idea of the development of the load on the stations of Stockholm is given by the curves on Figs. 3 and 4.

COAL HANDLING PLANT

The coal is unloaded from the ships by means of two electric cranes which can be moved along the quay wall, as seen in Fig. 5. The grabs of the cranes discharge the coal into a hopper fixed to the framework of the crane, from where it is dropped into cable-way cars which carry the coal to the coal yard located behind the power station, as indicated in Fig. 7. Each cable-way car takes 35 cu. ft. of coal, and the total number of cars is 86. The cable-way is guaranteed to be able to transport 110 tons of coal per hour. The coal yard, which is shown in Fig. 7, has a length of 340 m (1100 ft.) and a breadth of 35 m (115 ft.). The cable-way cars tip the coal on both sides of the yard. From there it is taken by an electric crane which runs on elevated rails in the middle of the coal yard. The grab of this crane unloads the coal into a large hopper running on the same rails. When the hopper is filled it is pushed by the crane to a funnel-shaped hole in the coal yard, into which it is tipped. Through this funnel the coal is carried to the crushers placed below the floor of the yard. The crushers deliver it on two inclined belt conveyors which unload it into automatic weighing apparatus placed under the roof of the boiler house. From here the coal is delivered to the horizontal belt conveyors, from which it is thrown off into the bunkers placed below for that purpose. All of the apparatus of the coal-handling plant is driven by direct-current motors which have a total rating amounting to 350 hp.

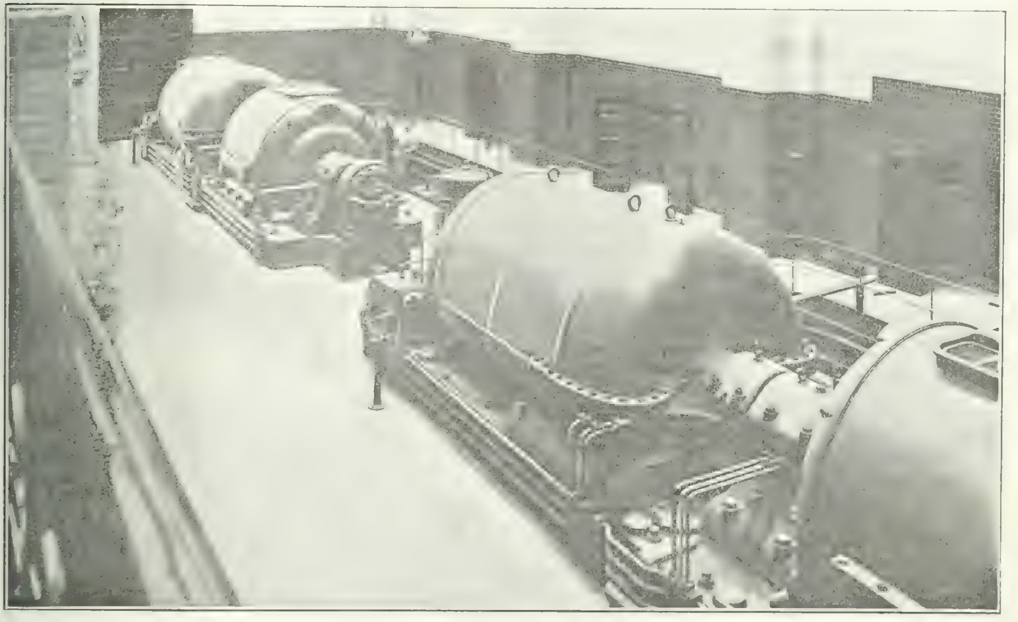


Fig. 1—Interior of Generating Station.

GENERAL ARRANGEMENT OF THE EXTENSION.

A plan view of the old power house, the 1909 extension and a possible future extension is shown in Fig. 8. This illustration shows the power house equipped with six turbo-generators of the same size as those recently installed. The new extension is a continuation of the old power house. The new machine-room is, however, considerably narrower than the old one by reason of the fact that the new turbo-generators are placed lengthwise in the machine-room, the width of which is only 14 m (46 ft.). This way of placing the turbo-generators gives also a better general arrangement, the space occupied by each turbo-generator lengthwise in the machine-room being practically the same as that taken in the boiler-room by the four boilers belonging to this turbine. The machine-room is spanned by a 40-ton electric crane. The condensers with auxiliaries are located in the cellar below the machine-room. In order to secure daylight in this cellar and to

make the apparatus placed in it accessible for the traveling crane of the machine-room large openings are made in the machine-room floor. Below this cellar are located the main circulating-water tunnels and also a cooling-air tunnel for the ventilation of the generators. Along the outer side of the machine-room there is a five-story building with a width of 8.5 m (29 ft.), the three upper stories of which contain the high-tension switchgear. The building along the outer side of the boiler-room accommodates the economizers, feed-water heater, feed pumps, etc. The extension is arranged according to the so-called individual system so that each group of one turbo-generator with the boilers, economizers and switchgear belonging to it may be run independently of the rest of the system.

BOILERS.

The arrangement of the boilers is shown by Figs. 8 and 11. For each 6000-kw turbine there are four Babcock & Wilcox boilers placed in two rows with a wide firing floor between them. The heating surface of each boiler is 550 sq. m (5900 sq. ft.). The boilers are equipped with B. & W. chain grate stokers, each having a grate area of 13 sq. m (140 sq. ft.). The steam pressure is 14 kg per square centimeter (200 lb. per square inch). The boilers are fitted with superheaters designed to give a superheat of about 100 deg. C.

The steam pipes from the four boilers belonging to each turbine convey the steam to a header placed on the reinforcements of the wall between the machine-room and the boiler-room. The headers for the different groups are connected to each other by means of a heavy steam pipe into which an automatic ball-safety valve is inserted. These pipes also contain valves so that each group of boilers, together with the turbine belonging to them, can be run independent of the others. From the headers steam pipes are taken to the turbines. The ashes from the furnaces drop into buckets, which run in the basement on a narrow-gage railway. There are two lines of railway, one for each row of boilers. The ashes are at present transported out to the power-house yard, where they are used for filling purposes.

Fig. 2—Map of Stockholm, Sweden, Showing Location of Power Station and Substations and High-Tension Network.

ECONOMIZERS AND CHIMNEY.

For each group of four boilers there are two Green economizers, each containing 320 tubes of 1 sq. m (10.7 sq. ft.) heating surface. The flues from the four boilers run together before the economizers to one main flue, in which are placed large dampers by means of which the waste gases from the boilers can be led either through the economizers or directly to the chimney. The chimney, which is common for the two groups of boilers belonging to this extension of the plant, is placed a little outside of the economizer house. The height of the chimney is 80 m (264 ft.) and its internal diameter at the top is 4 m (13.2 ft.).

FEED PUMPS.

The feed pumps are located on the second floor of the economizer house. There are two centrifugal pumps for each group of four boilers, the one driven by a steam turbine and the other by a direct-current motor. The latter serves as a reserve for the turbine pump. The condensed steam is taken from the condenser by an electric-motor-driven centrifugal pump placed beside the condenser and is delivered to the water meters, which are located on the upper floor of the economizer house. From here it passes through the feed-water heater, which delivers it into the storage tanks, placed on the floor below the meters. There are two such tanks, each having a volume of 25 cu. m (885 cu. ft.). In the heater the feed water is warmed up by the exhaust steam from the feed-pump turbine. The feed pumps take the water from the storage tanks, mentioned above, and deliver it to the boilers either through the economizers or directly without passing the economizers.

STEAM TURBO-GENERATORS.

The two new turbo-generators, which are shown in Fig. 1, were supplied by the Oerlikon Company, of Switzerland. The turbines are of the reaction type with thirty-four wheels, running at a speed of 750 r.p.m. The generators are designed for a normal output of 6000 kw and a pressure of 6000 volts at 85 per cent power-factor. The speed and load of the generators are controlled from the generator pedestals on the switchgear gallery by means of an electric motor working on the governor of the turbine. The exciting current is obtained from an 80-volt generator directly connected to the turbo-generator. The voltage of the generators is regulated by means of the exciter shunt-field resistor, controlled from the pedestals mentioned above. The generators are inclosed and self-ventilating. They receive the cooling air through an opening in the machine basement leading to the large cooling-air tunnel mentioned above. Each turbine is equipped with a surface condenser located in the cellar below the machine-room. The condenser auxiliaries are all driven by direct-current motors. The steam consumption of the turbines is guaranteed not to exceed 6.15 kg (13.5 lb.) per kw-hour when the output of the generator is 6000 kw at 85 per cent power-factor, the steam pressure at the turbine valve 12.5 kg per square centimeter (175 lb. per square inch), and the temperature of the circulating water 10 deg. C. The generators are designed to stand a short-circuit between the main busbars without taking damage.

HIGH-TENSION SWITCHGEAR.

The electric switching and controlling apparatus are placed on the three upper floors of the five-story gallery along the outer side of the machine-room, as seen in Fig. 8. The two

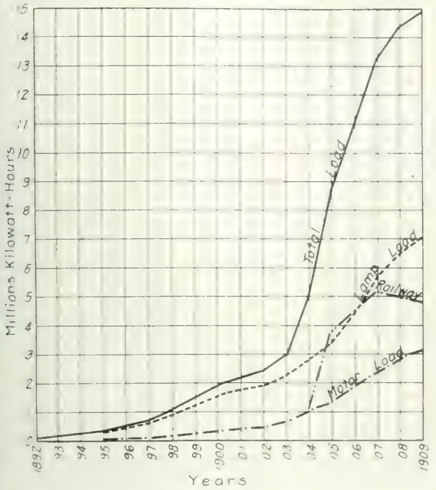


Fig. 3—Diagram Showing Annual Output During the Years 1892-1909.

lower floors of this building, below the engine-room level, are intended to be used as storage-battery rooms for the substation which is located in the power house. However, one part of

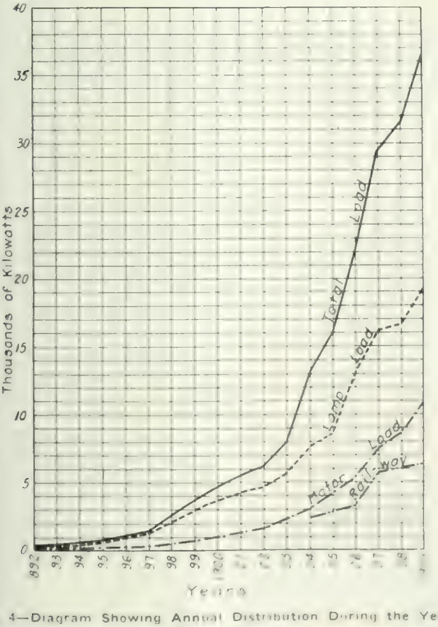


Fig. 4—Diagram Showing Annual Distribution During the Years 1892-1909.

the upper of these two floors is occupied by the switchgear for the five old generators, where these machines are connected by means of oil switches and two sets of busbars in two groups, with the three reciprocating-engine-driven generators in the one and the two turbine-driven in the other group. These two groups are connected up to the main switchgear in the same way as are the 6000-kw generators. The general scheme of the high-tension connections in the Värta station is shown by Fig.

Fig. 5—Traveling Crane and Coal-Carrying Structure.

9. Each generator or group of generators is provided with an automatic oil switch (generator oil switch) fitted with a differential relay which causes the switch to open the circuit as soon as the energy flow is reversed on account of a fault in the generator windings. This relay is a regular overload relay used

Fig. 6—Coal-Carrying Structure.

in connection with two series transformers, one on each side of the generator winding, in such a way that the tripping solenoid of the relay carries current only when the currents of the

Fig. 7—Coal Yard.

two series-connected transformers are different in strength or displaced in time-phase from each other, as in case of a short-circuit in the generator. There are provided two sets of main

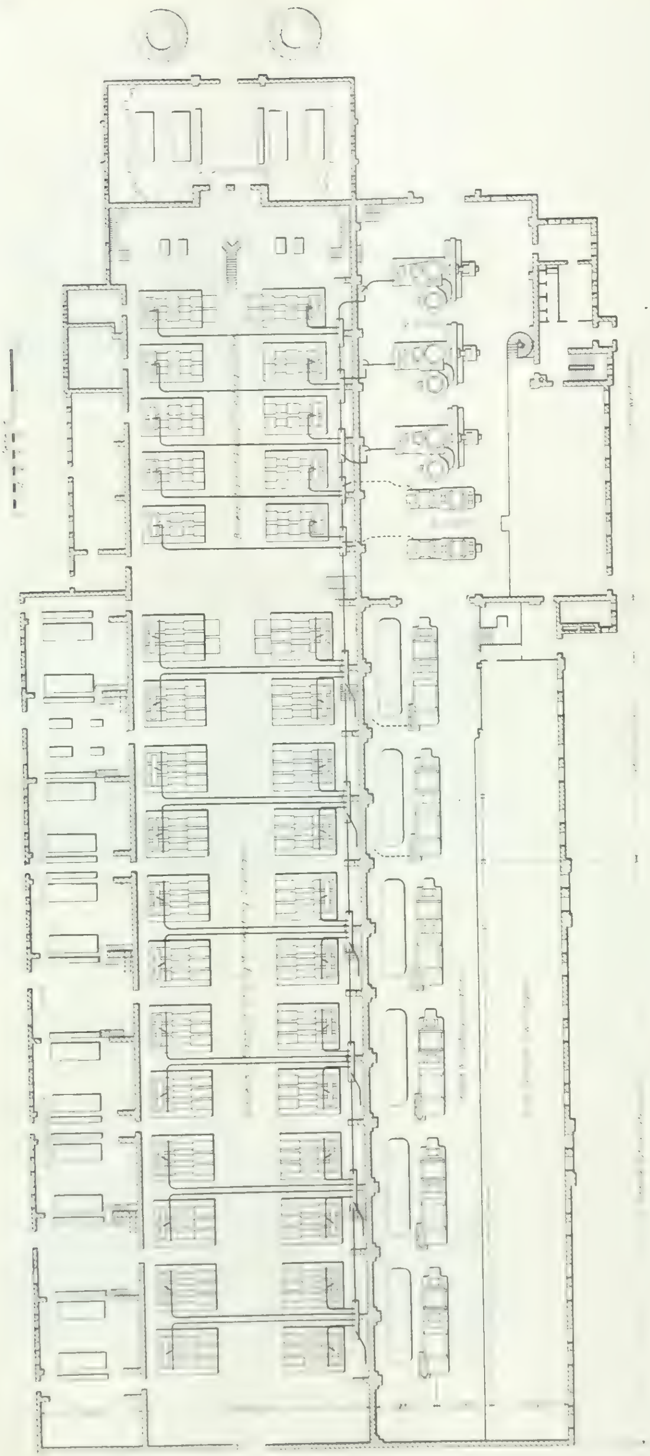


Fig. 8—Plan of the Power House.

busbars which can be divided in sections, one for each generator, by means of heavy, laminated, disconnecting switches. Beyond the generator switch the circuit is divided in two branches, each containing a selector switch by which the generator load can be thrown on either of the two sets of main busbars. These oil switches are not automatic. For each generator (or generator group) there are two cable-group switches, each one feeding energy to a section of the feeder busbars. Space is provided for the connection of four feeders to each one of these sections. The cable-group switches are equipped with overload relays, thereby causing the switch to open as soon as a short-circuit occurs in any one of the feeders connected to it. Should any one of the group switches be damaged, the two sections of the feeder busbars belonging to the same generator are connected together by means of the busbar sectionalizing switches, and thus energy is fed to both sections through the other switch group. Normally the groups are run separated from each other to reduce as much as possible the disturbance caused by any short-circuit in one of the feeders. The feeders contain the feeder oil switches by which they are connected to and disconnected from the feeder buses. These switches are not automatic. They are fitted with charging resistors for allowing the voltage to be raised or lowered gradually when closing or opening the switch, thus preventing the production of dangerous high potentials during the time these operations are being carried on.

On the upper floor are located the main busbars and all the large oil switches—generator switches, selector switches and group switches. Each phase lead of the buses and the switches is inclosed in a fireproof brick cellular compartment. The oil switches are electrically operated and are dimensioned for breaking a load of 30,000 kw, this being the highest amount of energy that will ever have to be handled within one system. In the bottom of the oil-switch cells 4-in. drainage pipes are inserted in order to lead away the burning oil that may be thrown out when the switch opens on a heavy short circuit. Fig. 13 shows the cellular construction of the oil-switch and the busbar compartments.

The feeder buses are located on the second floor. Brick compartments are provided for a second set of feeder buses which are to be used in the future when the Värta station will receive energy from a water-power station on the Dalecarlia River. Compartments containing apparatus

for connecting the feeders to either of these two sets of buses are built along the rear sides of the feeder bus compartments.

The third story contains the feeder oil switches, which are

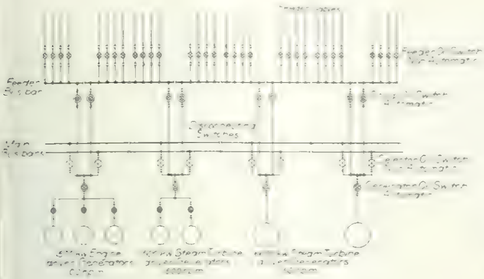


Fig. 9—Diagram of High-Tension Connections.

operated by hand from pedestals placed on the floor above. These switches are designed for a normal load of 300 amp and breaking load of 10,000 kw. This story also accommodates

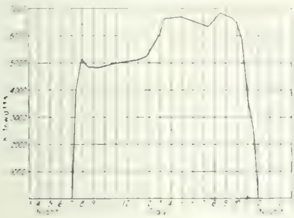


Fig. 10—Day Load.

the series transformers for the feeder ammeters, spark-gaps for the cable protection, series and shunt instrument transformers for the generator and generator group instruments, etc.

The operating apparatus and the instruments are mounted on control pedestals (Fig. 14) which are placed in two rows on a projecting balcony on the second floor so that the operator has a full view of the machine-room. The row nearest to the machine-room contains the generator pedestals, which carry the generator instruments, synchronizing plug contacts, push buttons for controlling the turbine-governor motor mentioned before, controlling switches and signal lamps for the generator and selector switches and a handwheel for operating the exciter-field rheostat, which is placed in the story below. Opposite each generator pedestal is placed in the other row one group pedestal carrying ammeters for the two feeder group circuits belonging to this generator and controlling switches and signal lamps for the two group switches.

The neutral wires of the generators are not grounded, but the neutral point of the system is nevertheless kept at earth potential by means of resistors of high resistance which connect the main busbars to ground and lead off static charges that may appear on the system.

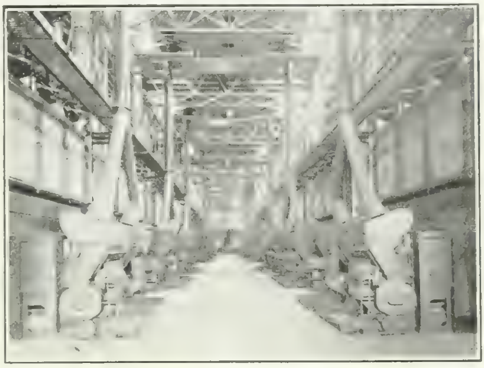


Fig. 11—Boiler-Room.

The iron framework of the switchgear cellular construction, the shells of the generators, oil switches, shunt and series instrument transformers and the instrument and controlling circuits are grounded by means of a heavy ground-wire system.

SUBSTATIONS.

The three-phase energy generated at the Värta station is transmitted by means of underground cables to the substations in the town. The number of these substations is at present five. Their location may be seen from the map in Fig. 2. In the substations the 6000-volt, three-phase energy is transformed to

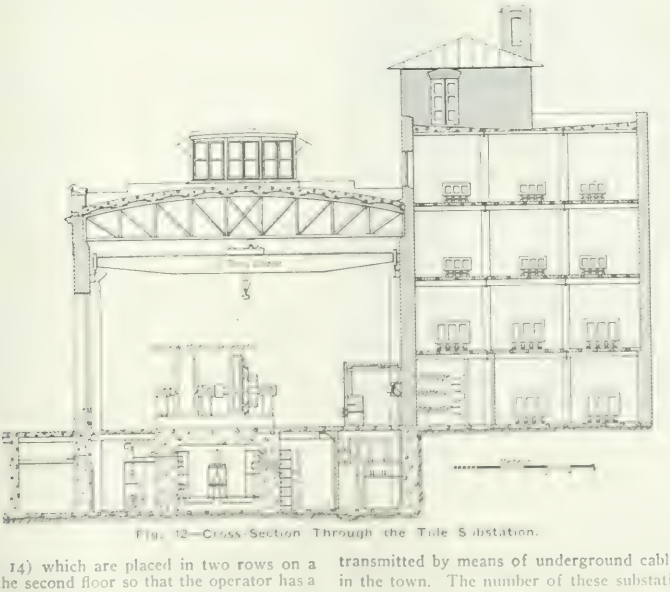


Fig. 12—Cross-Section Through the Tule Substation.

direct current by means of induction motor-generators. Each substation supplies energy to a three-wire, direct-current network at a pressure of 2 × 220 volts. The largest substation, the Tule station, supplies also direct-current energy at 600 volts for street-railway purposes. This station contains eight 1000-kw motor-generators. Fig. 12 shows a section through the Tule station. The substations are equipped with large storage bat-

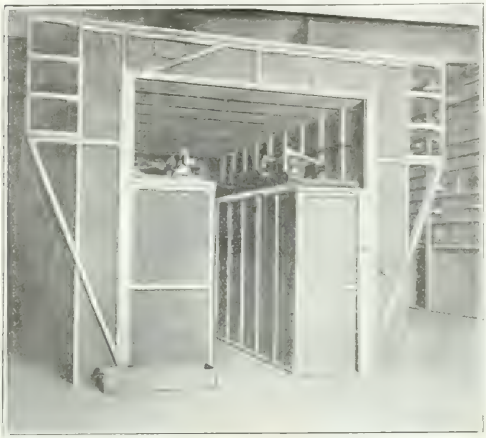


Fig. 13—Oil-Switch Compartment.

teries which carry the peak load and night load. On account of these batteries the Värta station does not run during the night, and its day load is a very favorable one, as may be seen from the curve of Fig. 10, showing the form of the day-load curve during the day of maximum output in the year 1909. The old Brunkeberg station is at present a combination of generator station and substation, containing, in addition to the old steam-engine-driven generators mentioned before, two 500-kw motor-genera-

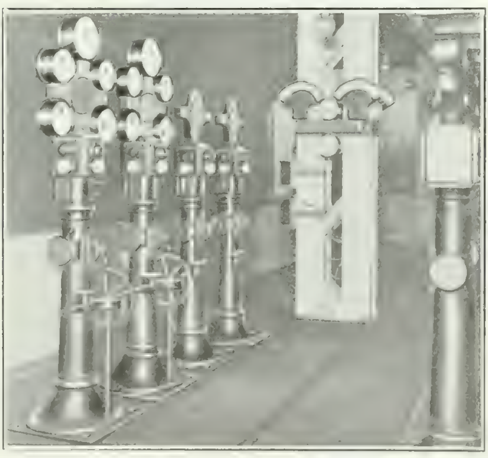


Fig. 11—Switches and Instruments Mounted on Pedestals.

tors, supplied with energy from the Värta station. In the near future the engine-driven generators will be displaced by motor generators, each of 1500 kw rating, thus changing this station to a substation. At the same time the voltage of the direct-current distribution network of this station will be raised from [illegible] By this doubling of the [illegible] the load rating of the network will be almost quadrupled for the [illegible]

GRAPHICAL SOLUTION OF PROBLEMS INVOLVING PLANE-SURFACE LIGHTING SOURCES.

By A. S. McAllister.

A PROBLEM in lighting the solution of which has usually involved the use of calculus is that relating to the illumination of the floor and walls of a room by a flat-surface souce in the ceiling. There is presented below a graphical solution of this problem for the case of a flat circular source which possesses the maximum of simplicity.

Although the solution of the problem in any practical case involves the use of only straight lines, circles and the lower branches of mathematics, it is not claimed that the proof of the accuracy of the method outlined can be given in such simple terms. However, even the proof is not complicated. It seems well to give first the simplest possible solution and subsequently to outline the proof of the accuracy.

EQUILUX SPHERES.

In Fig. 1 let $A\,C\,B$ represent an edgewise view of a flat circular surface lighting source, assumed to be in the ceiling of a room, having any given value of uniform surface illuminating density and any desired radius. If through the edges A and B there be passed an imaginary sphere of any chosen size—such as $A\,D\,B$—with its center at some point on a vertical line passing through the center C, the inner surface of this imaginary sphere below the lighting source will receive an illumination which will be uniform in intensity normal to the surface throughout the whole interior of the imaginary sphere. Evidently the density of the normal illumination against the inner surface of the sphere will bear to the illumination of the

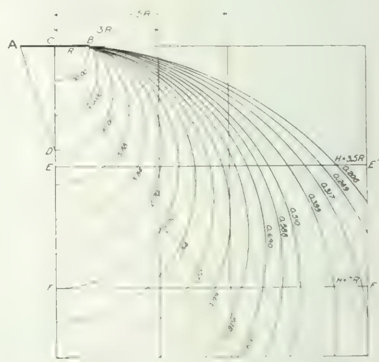


Fig. 1—Equilux Spheres, with Illuminating Values in Per Cent. for Spheres Passing Through Points 1, 2, 3, 4, etc., Length Units Below Source.

circular surface source the inverse ratio of the interior area of the exposed zone of the sphere to the area of the lighting source, since the lumens produced must equal those utilized. This ratio equals the square of the ratio of the radius $A\,C$ to the diagonal $A\,D$; when the radius of the circular source is taken as the unit of length for the measurement of all distances, and the unit of illumination is taken as the surface brilliancy of the source, then the percentage value of the illumination on the interior of the sphere is equal to 100 divided by the square of the diagonal $A\,D$.

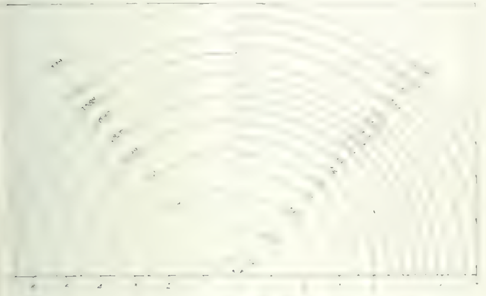
[illegible] and B, as just indicated, can be referred to as an "equilux" sphere. Equilux spheres of the proper sizes being employed one is enabled "to explore the whole region" illuminated by the source and to ascertain immediately for any desired point within the space explored the exact value of that component of the light flux which is normal to the particular equilux sphere passing through that point.

In Fig. 1 are indicated numerous equilux spheres and th[illegible]

points of intersection of these spheres with horizontal planes (floors) at distances of 3.5 units and 7 units of length (radii) below the light source, and with vertical planes 3 and 5 length-units distant from the center of the source.

ILLUMINATION OF HORIZONTAL PLANES.

Intersections of the two assumed horizontal planes (floors) with the equilux spheres are shown in Figs. 2 and 3; evidently the points of equal illumination lie on circles having as the common center the point on the floor immediately below the center of the circular ceiling lighting source. It is an interesting fact that at any point on the floor the component of the



Figs. 2 and 3—Equilux Illumination on Floors 7 Length-Units and 3.5 Length-Units Below Source.

flux normal to the floor is equal to the component normal to the equilux sphere at that point, so that the values of equilux density are simultaneously the values of light flux density normal to the horizontal plane (floor). Expressed in other words, the illumination along the floor at any point is known at once when one has determined the value of light flux density of the equilux sphere passing through that point: the whole problem of floor illumination density and distribution is completely solved when the equilux spheres in Fig. 1 and intersections in Figs. 2 and 3 have been constructed. One could not well wish for a simpler solution. It is especially worthy of note that the square of any diagonal such as [illegible] which is used in calculating the value of the [illegible]

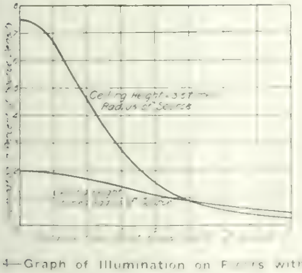


Fig. 4—Graph of Illumination on Floors with Two Ceiling Heights.

[illegible] each equilux sphere [illegible] quantity 1 plus the square [illegible] using whole numbers for assumed height values all of the numerical calculations are reduced to the simple processes of mental arithmetic; as noted above, the graphical constructions involve the use of merely straight lines and circles.

EXAMPLE OF [illegible]

In Fig. 4 are shown results obtained directly from Figs. 2 and 3. It will be noted that with a ceiling height equal to 3.5 times the radius of the lighting source the light flux density at a point on the floor immediately below the center of the source reaches a value of about 7.55 per cent of that of the source, while the density [illegible]

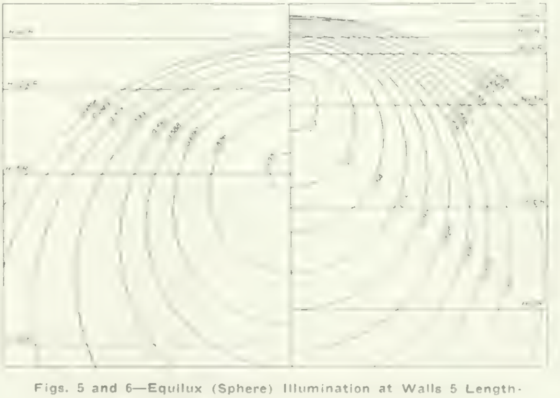
increase in the distance from the point of maximum density. With a ceiling twice as high as formerly the maximum light flux density is reduced to 2 per cent, but the rate of decrease with increase of distance from the point below the center of the source is much less; in fact, at distances greater than 5 units of length (radii) the light from the high source is greater than that from the low source. This fact will be appreciated when it is recalled that the "solid angle" subtended by the source when viewed from the floor at a great distance from the center is larger with the high ceiling than with the low ceiling.

ILLUMINATION ON VERTICAL PLANES.

In Figs. 5 and 6 are shown intersections of the equilux spheres with vertical planes (side walls) at distances of 3 units and 5 units (radii) from the center of the lighting source. The points of equal illumination—normal to the equilux spheres—lie on circles which are not concentric, but which have their centers on a straight vertical line. The method of locating these circles will be appreciated immediately from a brief study of Fig. 1.

Figs. 5 and 6 show directly the value of the equilux illumination at each point indicated, but they do not give the value of the flux density normal to the vertical plane at that point. However, this value can readily be calculated from each illustration by means of mental arithmetic. The process of calculation involves merely the multiplication of the equilux value at the point considered by the (constant) normal horizontal distance of the vertical plane from the center of the source and the division of this constant quantity by the vertical distance of the point below the ceiling.

At all points along a side wall at a distance below the ceiling equal to the normal distance of this wall from the center of the lighting source the vertical component of the flux density is equal to the equilux sphere value, being equal obviously to the horizontal component at these points; at points nearer the ceiling the illumination on the vertical plane is correspondingly greater than the equilux value at each point, while at lower points it is correspondingly less. For example, with a dis-



Figs. 5 and 6—Equilux (Sphere) Illumination at Walls 5 Length-Units and 3 Length-Units from Center of Source.

tance of 3 radii [illegible] the normal illumination on the wall is equal to the equilux values at a distance of 3 radii below the ceiling; at 1 radius it is three times as great as the equilux value at each point; at 1.5 radii it is twice as great as the equilux value at each point; at 6 radii it is one-half as great; at 9 radii it is one third as great, etc. From these relations one can easily determine the flux density values over the whole wall area by means of equilux circles such as are shown on Figs. 5 and 6.

[illegible]

Uniformity of Normal Flux Density on Spheres.—The method outlined above is based primarily on the "solid angle" [illegible]

when a surface source is viewed from two points so located that the "solid angle" subtended by the source in one case is equal to that in the other the light flux densities at the two points are equal; when the two angles are unequal the flux densities differ in the exact ratio of the angles. Referring now to Fig. 7, let $A\,B$ represent a surface source having a plane circular edge through which passes the imaginary sphere $P\,P'\,P''$. Evidently the "solid angle" subtended by the source when viewed from any point within this sphere would be the same whether the source be a plane or the internal zonal section of an imaginary sphere. The source would be seen as a circular plane when viewed from any point along a line passing through the center of the source and perpendicular to a plane passing through the edge of the source; when viewed from any

Fig. 7—Proof of Uniformity of Illumination on Sphere Surface.

point not on this line it may be assumed that the source would appear as an ellipse—the error involved in this assumption is of no importance so far as practical results are concerned. It is with the two axes of this ellipse that the present problem deals. In Fig. 7 one of the axes of the ellipse is the straight line $A\,B$, the other axis being perpendicular to this line. At a point, such as P', below the center of the light source the separate plane angles subtended by these two axes are individually equal to the angle α; the "solid angle" is proportional directly to the product of these two separate plane angles, so that the relative value of the solid angle is known when the values of the two plane angles are known. At any point, such as P, on a circle passing through the points A, B and P' the plane angle $A\,P\,B$ subtended by the axis $A\,B$ is equal to the plane angle $A\,P'\,B = \alpha$, and hence is constant without respect to the position of P along the circle $A\,P\,P'\,P''\,B$. The plane angle subtended by the axis of the ellipse at right angles to the axis $A\,B$ is greater for the point P than for the point P' because the distance from which its constant length $(= A\,B)$ is viewed is less at P than at P'. The ratio of the two distances indicated, $P\,O \div O\,P'$, is the cosine of the angle $P\,O\,P'$. Since the solid angle subtended by the lighting source when viewed at point P is proportional to the product of the two plane angles subtended by the axes of the source it follows that the solid angle at P is greater than the solid angle at P' in the ratio of unity to the cosine of angle $P\,O\,P'$. Now the flux density normal to the sphere at P bears to the maximum flux density along the line $P\,O$ the ratio of the cosine of angle $P\,O\,P'$ to unity. Hence the normal flux density at P is equal to that at P'; or the normal flux density is uniform over the whole inner surface of the sphere below the lighting source. The slight errors involved in the simplifying assumption used above are not cumulative; in fact, they cancel in the final results. The only error that can rightly be so designated follows from assigning a definite "direction" to the flux which is emitted by an extended surface source. Even this error is zero in so far as the "cosine" law is applicable. It would seem, therefore, that the equality of normal flux density along the inner surface of the imaginary equilux spheres can be treated as sufficiently well established without resort to the complications that a more complete demonstration would involve.

Value of the Equilux Illumination.—In determining the numerical value of the light flux density along each equilux sphere resort is had to the law of conservation. That is to say, it is assumed merely that all of the flux emitted by the source is utilized in illuminating the interior of the imaginary sphere below the source. Since the flux density is constant over the lighting source and that over the equilux sphere is also constant, it follows at once that the two densities bear to each other the inverse ratio of the two areas. It remains merely to determine the ratio of areas. Referring to Fig. 7 the superficial area of the zone of the sphere below the plane $A\,C\,B$ bears to the whole area of the sphere the ratio of $C\,P'$ to $O\,P'$. The whole area is $\pi\,(O\,P')^2$, and hence the lower zonal area is $\pi\,O\,P' \times C\,P'$. Now from similar triangles $O\,P' \div A\,P' = A\,P' \div C\,P'$, so that $O\,P' \times C\,P' = (A\,P')^2$, therefore the lower zonal area is equal to $\pi\,(A\,P')^2$. The area of the plane circular source is $\pi\,(A\,C)^2$, so that the ratio of the two areas is $(A\,C)^2 \div (A\,P')^2$. When the length $A\,C$ is used as the unit of length the ratio of areas becomes $1 \div (A\,P')^2$, as has been used above. It will be noted that this ratio is absolutely accurate. When use is made of this ratio in connection with the law of conservation relative to the production and utilization of flux, the apparent inaccuracies in the simplified proofs of the uniformity of illumination disappear.

Illumination on Horizontal Planes.—In the solution of the practical problems given above it was assumed that at any point below the lighting source the component of the flux (and hence flux density) normal to a horizontal plane is equal to the equilux sphere value at that point. Since such an assumption involves the conception of definite direction to flux coming from an extended surface source it is open to the objection noted above under "uniformity." However, in so far as any direction can be assigned to the flux from such a source the method here outlined is as accurate as any that can be employed. In Fig. 8 the line showing the mean direction of the flux reaching the point P is shown by the line $O\,P$; this line bisects the angle $Q\,P\,N$ and hence the component of the flux normal to $Q\,P$ is equal to the component normal to $N\,P$. The former component produces the equilux illumination at the point P, while the latter produces the floor illumination at the same point; hence the floor illumination at any point such as P, P' or P'' is equal to the equilux illumination at this same

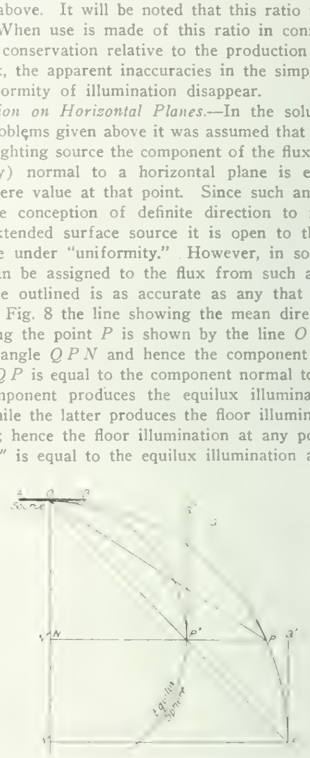


Fig. 8—Proof of Equality of Equilux Sphere and Floor Illuminations.

point. The inaccuracies involved in the simplified construction used in Fig. 8 are of no practical importance.

Illumination on Vertical Planes.—Having determined the horizontal or vertical component of a light flux at any one point and knowing the horizontal and vertical distances from the source to that point one can easily calculate the vertical or horizontal component by the ratio of these two distances. The component on the vertical plane thus found would be the value which would exist normal to a vertical plane passing through the point and perpendicular to a line joining the point and the source. On any other vertical plane passing through the same point the normal component at that point would be less in the ratio to unity of the cosine of the angle of deviation between the two planes. Since the constant horizontal distance from the source to any plane is in each case equal to the product of the cosine just noted and the horizontal dis-

tance to any chosen point on any plane it follows that at any point whatsoever the flux density normal to any vertical plane bears to the equilux illumination at that point the inverse ratio of the vertical distance of that point from the ceiling to the horizontal perpendicular (shortest) distance between the vertical plane and the center of the ceiling lighting source.

SURGES IN PIPE LINES.

By F. G. Baum.

In 1902 the writer read a paper before the Pacific Coast Transmission Association entitled "Surges in Transmission Circuits." The paper resulted from studying conditions found during switching, etc., on the Bay Counties Power Company's system, which was put into service some time before. The mathematical expression of what took place was so simple as to be almost startling—when one considered all the "higher mathematics" which had been wasted on the subject. Almost the same line of reasoning applies to pipe lines, and hence it may be well to review briefly the electrical surge phenomena when opening a line suddenly before discussing the surges in pipe lines.

Let L = self-induction of line; I = current carried; C = capacity of line; V = voltage rise due to interrupting current I.

The magnetic energy stored in the line of self-induction L carrying current I is $LI^2 \div 2$. When this current is suddenly interrupted the energy must change from the magnetic form to the static by charging the line as a condenser to a higher potential V. The energy stored in the line having a capacity C at the added potential V is $CV^2 \div 2$. These two must be equal, so that

$$LI^2 = CV^2$$

or

$$V = \sqrt{L \div C}\ I = KI$$

since $\sqrt{L \div C}$ is a constant for any line.

It was shown that this constant is about 200, and we have the very simple relation

$$V = 200\ I$$

or, the e.m.f. rise in volts is about 200 times the interrupted current in amperes. The periodicity of the surge voltage will be

[illegible]

The surge voltage is seen to be independent of the length of line, the reason being that each foot of line has magnetic energy stored, and each foot of line also has static capacity to receive the energy.

There are similar phenomena when the valve on a pipe line is suddenly closed. Referring to Fig. 1, let L_p = length of pressure pipe in feet; D = diameter of pressure pipe in inches; t = thickness of pipe at bottom in inches; V_p = velocity in pressure pipe in feet per second.

The energy stored in the column of water of length L_p is equal to $MV_p^2 \div 2$, in which M = [illegible]

This energy must be taken up by doing work on the pipe in enlarging it under the excess pressure, neglecting the elasticity of the water. Assume that the pipe has a uniform grade; hence, the thickness will be $t \div 2$ at the midsection and corresponding at other sections (Fig. 2). Let S = the increased strain per square inch in the metal due to the sudden stopping of the flow. It can be very easily seen that, since the energy stopped at the bottom is double the energy of water stopped before the middle section of the pipe, the expansion of the pipe will be the same at the bottom as at the midsection, or, in other words, the elongation of each ring of pipe will be the same from top to bottom, assuming the thickness to vary in proportion to the distance from the lower end. (This is not strictly true, since pipe grades are not uniform and the upper end must have an appreciable thickness in any event. The assumption, however, is [illegible]) in all sections will be the same, the added stress per square inch will be the same in all sections. Let S = added strain in pounds per square inch; $\frac{t}{2}$ = mean thickness in inches; e = elongation per inch; M = modulus of elasticity = 28,000,000; 62 = weight of 1 cu. ft. of water in pounds.

Then the work done on the pipe to elongate a ring section 1 ft. long and πD in circumference will be

$$12\,S\ \frac{t}{2}\ \frac{e\pi D}{12} \text{ in ft.-pounds,}$$

and since

$$e = S \div M,$$

the above result is equal to

$$\frac{S^2}{M}\,\pi D\,\frac{t}{2} \times L_p \text{ for a length of pipe } L_p.$$

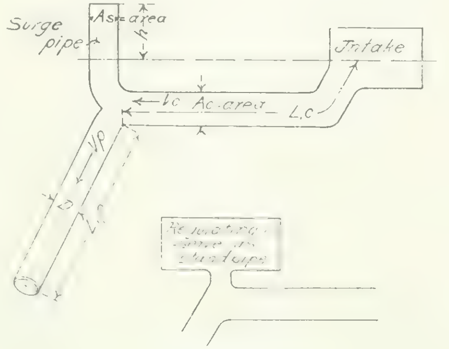


Fig. 1—Explanation of Symbols Used.

The equations of energy must equal, therefore,

$$\frac{S^2}{M}\,\pi D\,\frac{t}{2}\,L_p = \frac{MV_p^2}{2} = \frac{62\ [illegible]}{24 \times 144 \times g}$$

or

$$S = 307\,V_p\,\sqrt{D \div t} \qquad (1)$$

That is, the added stress per square inch, due to the sudden interruption of the water flowing under velocity V_p, is as given by equation (1).

For a given pipe, then, $S = KV$ is the same form as the expression for the increase in electrical pressure when current I is interrupted in a transmission line.

Fig. 3 shows the above equation plotted with S vertical and $D \div t$ horizontal. For various values of V there are series of parabolas as shown.

Example: In a 60-in. pipe, 0.5 in. thick at bottom, what is the excess fiber strain in the pipe due to the sudden stopping of the water flowing at a velocity of 5 ft. per second? $D \div t$ = 120, hence, following the vertical to curve for $V = 5$, there is found S = 17,000 lb. per square inch. If $V = 15$, S = 50,000 lb. per square inch.

The total strain in pipe will be the above added to the initial strain due to the static pressure.

By combining formula (1) with the ordinary formula connecting pressure, diameter, thickness and strain per square inch in pipe, that is,

$$pD = 2\,St \qquad (2)$$

in which p = pressure per square inch due to water; D = diameter of pipe; S = stress per square inch; t = thickness, there is obtained (after substituting 2.3 h for p) the equation for the excess pressure expressed in feet of head due to suddenly stopping the flow V. That is

[illegible] (3)

This equation is plotted in Fig. 4 for various values of V.

The application is the same as above illustrated, except that the feet-head value is obtained instead of the pressure per square inch.

The added pressure is independent of the length of pipe because each foot of pipe which adds to the energy of water also adds to the length of pipe on which work is done. The above curves are for instant closure and, of course, give the extreme case. It is seen that sudden closure is dangerous and it is necessary to give time to the closing of the gates.

In case the water flowing at a velocity V is stopped in T seconds, another method of determining the rise in pressure may be used. (It is not entirely accurate, as, in this case, the energy given up to the pipe is neglected.)

A body of water having mass M is moving at a velocity V; it is desired to bring the mass M to rest; that is, to decelerate the mass M at a rate $V \div T = a$. The force necessary to do this is Ma. If p represents the added pressure per square inch at

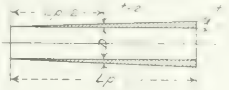


Fig. 2—Pipe Dimensions.

the lower end of the pipe, the opposing total pressure (to Ma) is p 144 A_p, A_p being the area of the pipe.

Therefore,

$$144\,p = Ma = (62.5 \div 32.2)\,A_p \times a$$

or

$$p = 0.0135\,L_p a \qquad (4)$$

In this case the rise in pressure is seen to be proportional to the length of the pipe and to the rate at which the water is brought to rest. Figs. 5 and 6 show the relations between p and L for rates of retardation varying from 1.0 ft. to 15.0 ft. per second per second.

Example: $L_p = 3500$; and the water is uniformly brought to rest from a velocity of 10 ft. per second to zero in two seconds. The retardation is 5 ft. per second per second, and the rise in pressure is seen from the curve to be about 230 lb. per square inch.

The actual rise will be less than the values given in Figs. 5 and 6, and hence they are on the safe side.

It will be necessary generally to allow a certain time for closing, and in turbine units safety generally requires by-pass gates, since standpipes will not afford entire relief and cannot

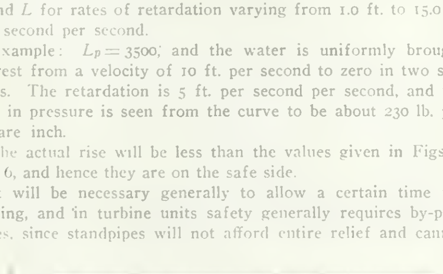


Fig. 3—Graphs of Equation (1).

generally affect the pressure pipe to make them safe. With the use of governor-operated by-pass gates (which will close slowly) entire safety can be had, as can also good speed regulation.

The above method takes account of only the water in the pressure pipe. There may be also a long conduit L_c from the intake to the pressure pipe. Unless there is some form of relief all the water in the conduit will add its energy to that in the pressure pipe. To reduce the strain on the pressure pipe as much as possible there is generally installed a regulating reservoir at the end of the conduit. This reservoir can take care of the sudden demands for more water, or can receive water not demanded by the power station for a short time.

In Fig. 1 let L_c = length of conduit, V_c = the velocity in the conduit and A_s = the surge pipe area. The valve x is closed suddenly on the pressure pipe. The water in the conduit must now find relief by rising in the surge pipe. The energy of the water $MV_c^2 \div 2$ flowing in the conduit must now be given up by raising the level of the water in the surge pipe

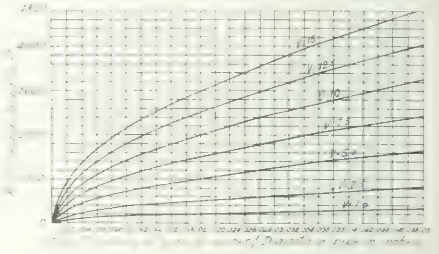


Fig. 4—Graphs of Equation (3).

until the work done on the water raised is equal to the energy of the water under velocity V_c. Let h = the height of the water in the surge pipe when all of the energy is given up; that is, when V_c is equal to zero. The balancing conditions are reached when

$$MV_c^2 \div 2 = Wh \div 2$$

in which W is the weight of water raised through a height $h \div 2$, giving

$$\frac{62.0 \times A_c L_c V_c^2}{2g} = 62.5\,A_s h \frac{h}{2}, \text{ or}$$

$$h = V\sqrt{\frac{L_c A_c}{g\,A_s}} \qquad (5a)$$

If $A_c = A_s$, then

$$h = V\sqrt{L_c \div g} \qquad (5b)$$

Equation 5*b* is plotted in Fig. 7 for $A_c = A_s$, the vertical scale being at the left. For $A_s = 100\,A_c$, h is divided by 10 and use is made of the right-hand vertical scale. When $A_c = 4\,A_s$, the left-hand scale of h would be multiplied by 2.

Suppose the conduit length = 10,000 ft. and $v = 10$, $A_s = A_c$, then $h = 175$ ft. When the surge pipe area is equal to one

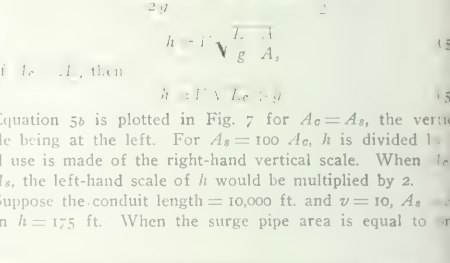


Fig. 5—Graphs of Equation (4).

fourth of the conduit area, $h = 350$ ft. When $A_s = 100\,A_c$, $L = 10{,}000$ ft. and $V = 10$, then $h = 17.5$ ft.

If A_s were equal to one-fourth of A_c the height to which the water would be raised would be 350 ft. for a conduit 10,000 ft long and the water moving at a velocity of 10 ft. per second. (If the length of the conduit were doubled, the head would be increased by $\sqrt{2}$ according to formula 5.) When the velocity is retarded from 10 ft. per second to, say, 7.5 ft. per second the surge head will be the difference in the vertical projection from the corresponding V curves; in this case the difference

between 2×175 and 2×132 [illegible] $350 - 265 = 85$ ft. (A_c = $4 A_s$.)

If $A_c = A_s$, then for the [illegible] in velocity h would have the value $175 - 132.5$ [illegible]

It is seen, therefore, that when the surge pipe is about equal to or less than the conduit area there is a large difference in elevation of the water in the surge pipe. This result is hard to take care of with the conditions usually found in installations. A very scientific and theoretical paper was presented by Mr. R. D. Johnson before the American Society of Mechanical Engineers in 1908. In this paper a method of reducing the surge and the pulsation was offered by the use of a differential surge pipe.

It is believed, however, that where possible a small regulating reservoir should be located at the end of the conduit. It was seen above that when the stand pipe area is 100 times the conduit area the surge height is reduced to one-tenth. Such a regulating reservoir would be quite small and could generally be used. It is believed that such a solution of the problem will prove much more satisfactory than the use of any type of surge pipe.

As a matter of fact the surge pipe (where it is nearly of the same area as the conduit) may be a source of danger and add to the difficulties of regulation. In Equation 5b if $A_c = A_s$, then [illegible] $V \sqrt{L_c \div g}$, and the height of the surge is shown by Fig. 7. Now, when the water reaches the height h the velocity in the conduit will be zero—or, if the velocity has been changed from [illegible] to, say, 7.5, then the velocity will be 7.5. There is now an unsupported column of water of height h and this now will act against the conduit head and produce a change of velocity until [illegible] is equal to the original. [illegible] This condition will tend to discharge the conduit water into the intake and it may result in breaking the water column between the conduit and the pressure pipe, and it will necessarily affect the pressure under which the water-wheels are operating and hence change the governing conditions and may result in demoralizing the entire regulating relations due to the repeated

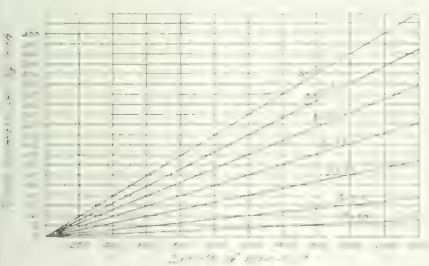


Fig. 6—Graphs of Equation (4).

[illegible]tion of the water and the resulting periodic changes in [illegible]ure.

[illegible]e oscillations in the water will continue until the friction [illegible]e conduit takes up the energy $MV_c^2 \div 2$. The time of a [illegible]ete vibration in seconds (one-half period) will be

[illegible]

[illegible]he same as a pendulum of length equal to the water col[illegible] under motion. (The development of this equation is given [illegible]nson in the paper referred to above.)

[illegible]

h [illegible]

If the surge pipe is shorter than h the water will spout out of [illegible] $= 350$ ft. Suppose the surge pipe is only 50 ft. high. There [illegible]

pipe, and the water will issue therefrom at a velocity four times the conduit velocity, in this case at 40 ft. per second. That is, there is a nozzle effect which must be taken into account. The instantaneous surge pressure will be larger than corresponds to the height of surge pipe, as there would be added the head $V^2 \div 2g$ (which in this case would be about 27 ft.) to the surge pipe height.

As stated above, a small regulating reservoir at the end of the conduit will, it is believed, prove a much more satisfactory solution than any surge pipe; a surge pipe should be used only where no other solution is possible.

In reviewing the above treatment it is to be noted that equations 1, 3 and 4 show that too sudden closure of gates may result in rupture of pressure pipes, and that where quick action

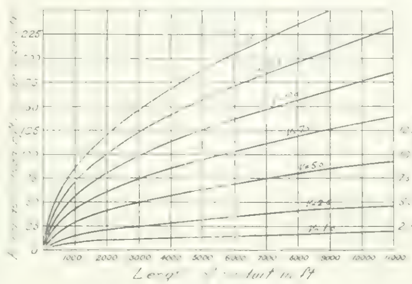


Fig. 7—Graphs of Equation (5b).

in closing gates is necessary for speed regulation, by-pass gates are necessary for the safety of the pressure pipes. Equation 5 shows that the surge height can best be limited by making the surge pipe a regulating reservoir, and it is believed that this solution of the problem is safer and better than the use of any kind of surge pipe. The results and the curves given, while not strictly accurate, are believed to be safe as a guide to avoid dangers and to insure satisfactory operating conditions where properly applied.

Electrolytic Detector for Wireless Telegraph.

Some of the earliest work done in this country in the development of wireless-telegraph receivers of the electrolytic type was carried on by Dr. Lee de Forest and Mr. Edwin H. Smythe in Chicago about ten years ago. At that time Dr. de Forest and Mr. Smythe developed the type of receiver or detector in which electrolytic action operated to build up a delicate metallic filament between the two electrodes of the receiver, the filament being broken by the wireless impulse and being immediately renewed by a local current. In June, 1901, during the development of this metallic-filament detector Mr. Smythe conceived and made a sketch of a type of electrolytic receiver, which, together with some subsequent improvements resulting from a long series of experiments, is illustrated and described in a patent issued to Mr. Smythe on Nov. 8, 1910, entitled "Receiving Apparatus for Electromagnetic Waves." The application for this patent was filed July 24, 1906. The device covered by the patent is of the type in which one of the electrodes of the detector has a minute contact surface which is polarized by the local current to stop the current flow, the wireless impulse acting to depolarize the surface momentarily and permit the passage of the current.

Referring to the accompanying illustrations, Fig. 1 shows the detector mounted on an insulating base and connected by connecting clips with two binding posts, to which the wires of the receiving circuit may be connected. Fig. 2 is a vertical section of the detector proper. This device is in the form of a small [illegible]

hollowed out to form a receptacle for the electrolyte. The lower part has an axial bore to receive the other electrode. A glass stem is introduced in this bore, with its upper end sealed about the lower electrode, which consists of a length of small platinum wire cut off short where it penetrates the stem, so that a very small area is exposed to the electrolyte. A larger wire is fused to the platinum electrode and extends through the stem to the metallic plate at the base of the detector, making contact

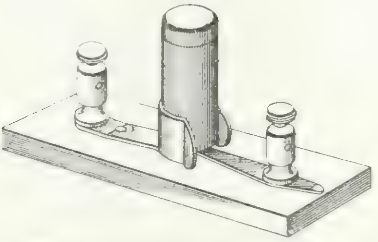


Fig. 1—Arrangement of Detector in Circuit.

with one side of the circuit by means of one of the connecting clips shown in Fig. 1. As stated, the spool itself is the other electrode and it is placed in contact with the other connecting clip, as represented in Fig. 1. Sulphur is used for sealing the glass stem into the base of the spool of graphite. The device is to be used in connection with a local-battery circuit, as is the case with other electrolytic detectors.

Eleven claims are allowed in Mr. Smythe's patent. Of these the first and the fourth show the scope of the invention, and are as follows:

"An electromagnetic wave detector comprising an electro-

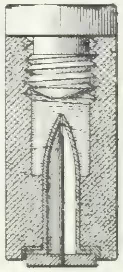


Fig. 2—Vertical Section of Detector.

lyte and a cathode and an anode having a very small area and a relatively large area, respectively, exposed to said electrolyte. An electromagnetic wave detector comprising a minute metallic cathode, a relatively large carbon anode and an interposed electrolyte."

Central Station
Management, Policies and Commercial Methods

RESIDENCE RATES IN TORONTO.

The City of Toronto Hydroelectric System, as it is popularly known (this being the name under which the municipality retails hydroelectric power purchased wholesale), has adopted a peculiar residence rate. This consists of a flat readiness-to-serve charge of 10 cents per room per month, to which is added 3 cents per kw-hour for all electrical energy consumed. Only the inhabited rooms of the house are counted. This rate is naturally one which appeals principally to owners of small houses. So far it has been in practical use only in one part of the city among the consumers of a small distributing system supplied by steam plants. It is intended, however, to apply this generally over the whole system as soon as the hydroelectric power service is begun.

EIGHT MILES OF CURB-POST TUNGSTEN LIGHTING IN MINNEAPOLIS.

The ornamental tungsten-standard street lighting of Minneapolis now comprises 510 posts in all, extending along both curbs throughout seventy-five blocks, or about eight miles of single-curb lighting in all. The posts, each carrying five 100-watt tungsten lamps mounted upright, are erected at 80-ft. intervals and represent a total connected load of 255 kw. This special street lighting was installed by adjacent property owners, who paid $2 a front foot, which amount was sufficient to set aside a small surplus to be used in paying for posts where the abutting merchants refused to share in the expense. The tenants or owners also paid $1.25 a front foot for the first year's operation of the posts, following which the city will take over and operate the system. The energy for this ornamental lighting is supplied by the Minneapolis General Electric Company, which receives $78 a year for each 500-watt post, including maintenance and renewals.

OLD-RESIDENCE WIRING CAMPAIGN.

The Menominee & Marinette Light & Traction Company has for several months past conducted a vigorous campaign for residence lighting, and to further this object has made an attractive offer for house wiring. Large space is taken in the local newspapers, in which are prominently displayed two offers, one under each of the respective heads: "We will wire your house for a song" and "We will light your house for $1 a month."

The first-mentioned offer is to wire six rooms complete and ready for lighting with individual switches, tungsten lamps and shades, all for $25 per month on easy monthly payments if desired. All wiring will, it is stated, be connected so far as possible and will strictly conform with the requirements of the National Electrical Code. More than seventy-five contracts have thus far been closed under this offer.

The offer to light a house for $1 a month applies to four 2[illegible] tungsten lamps, which may be turned on as long as necessary during lighting hours. For $1.25 per month the number of lamps may be increased to five, or to six for $1.50 per month. The company is protected in this offer by the installation of a flicker control.

The same company has been very successful in a campaign to displace gasoline commercial lighting with the electric light. Six months ago there were approximately 100 gasoline lighting installations in Marinette, while at the present time there are less than twenty. The company also devotes large newspaper space to this line of its activity, and displays in prominent type the names of the merchants and others who have abandoned gasoline in favor of the electric light.

SPECIAL STREET LIGHTING IN TORONTO.

The City of Toronto is soon to undertake the electric lighting of its own streets with power purchased from the provincial government. Considerable work has been done by Mr. W. Randolph Sweany and other engineers of the municipality, who have been carrying on experiments to perfect a satisfactory and substantial system for lighting the streets of the entire city. In the downtown district the use of ornamental iron posts carrying five 100-watt tungsten lamps in accordance with practice in many other cities has been adopted. For the residence streets, where the electric distributing lines are overhead, a system using concrete poles has been worked out. These poles are 24 ft. high, placed 4 ft. in the ground, and are, of course, provided with steel reinforcing in the center. The distribution-system wires are carried on top of the pole and part way down the pole are lanterns with cylindrical "Alba" globes surrounding a 100-watt lamp for each post. The wires from the top of the post to the lantern are carried inside of the post. The whole presents a very neat appearance. Mr. Sweany says that the cost of these posts has now been brought down to less than $4 each, which is considered a remarkably good figure for a reinforced-concrete post.

RESULTS OF ELECTRIC HEATING APPARATUS CAMPAIGN IN DULUTH.

In August the Duluth Edison Electric Company sent to 7500 of its consumers a blank form asking information about the electric heating or cooking appliances already owned or used by them and inquiring what other apparatus they would care to have demonstrated to them by the company's solicitors. As a reward for filling out this inquiry blank consumers were offered a special discount of 5 per cent on the current month's bill.

Of the 7500 customers addressed 1500 filled out the blanks giving the information desired. Among these, 200 expressed interest in some particular device not in use by them. Solicitors were employed to visit these prospects and succeeded in selling them fifty appliances in all, of which thirty-two were irons. The cost of the inquiry and campaign, including solicitors' time and rebate allowed on bills in return for answering blanks, was $125. The results of the campaign thus inaugurated, however, are not believed to end with the present sale of apparatus, as it is thought that the suggestions given the other 150 prospects will make heating-appliance consumers of some of them next year.

AN INTRODUCTORY POWER RATE.

To encourage the use of electrical energy among factories hitherto operated by isolated steam plants or other power the Chippewa Valley Railway, Light & Power Company, which supplies electric service in Eau Claire, Chippewa Falls and Menomonie, Wis., and Red Wing, Minn., has inaugurated an "introductory power" rate by which it refunds to manufacturers changing over to its electrical service part of the cost of making the motor installation.

The amount of this refund is 25 per cent of the cost of installation and it is paid to the manufacturers (who purchase their electrical equipment from the company and enter an agreement to use its service exclusively for three years) in the form of monthly instalments—virtually credits—each equal to the customer's corresponding monthly bill for energy consumed. If within the three-year period the customer chooses to cancel his contract for service he becomes liable for an aggregate amount equal to the sum of the refund payments or credits granted him.

This "introductory-power" rebate relates to the central-station company's wholesale power schedule, in accordance with which large users of electrical energy pay 1.2 cents per hp-hour at 20 per cent load-factor; 1 cent per hp-hour at 30 per cent to 40 per cent load-factor, and 0.75 cent per hp-hour at load-factors above 60 per cent. The minimum monthly bill under this form of contract is $150 and the minimum charge per kilowatt of demand is $1.50.

Thus the manufacturer who enters into the agreement, even when paying the minimum rate for his connected horse-power in motors, will shortly consume the equivalent of a quarter of the cost of his installation, after which he becomes a profitable consumer to the central station. The Chippewa Valley company now has about 2000 hp in connected-motor load at Eau Claire, part of which was secured through the operation of the introductory rate described.

CENTRAL-STATION HEATING TO CONSERVE THE NATURAL RESOURCES.

By F. H. Stevens.

Central-station heating has long since passed the experimental stage and is now on a substantial basis. Systems are being operated on a successful commercial basis in a great number of cities—many more than the majority of managers are aware—including some of the largest cities of the United States.

Many of the operators of electric generating plants are of the opinion that if they install a central-station heating system it will increase the cost of generating electric current to such an extent that it will not be offset by the revenue derived from the sale of heat. This is true in only a very few places where the electric load on any one engine far exceeds the total heat load.

In these days, when the matter of conserving the natural resources of the country forms one of the leading subjects of discussion by our federal government, it would be well for us to see wherein we may conserve one of the most essential of our natural resources, coal, by utilizing the greatest amount of the available heat units in each pound of coal that we burn and putting it to a commercial use instead of dissipating it through a condenser or throwing it away to the atmosphere in the shape of exhaust steam.

The possibility of economy in steam engines of any class lies almost entirely in the range on the thermometer scale through which the heat can be driven, or, in other words, the "heat head."

This range in the engine of early days was limited because the height of the head was limited on account of strength in construction. In the days of Watt's engine steam was generated at about 212 deg. in a boiler that would not stand pressure and exhausted into a condenser with a partial vacuum with a temperature of about 132 deg., giving a heat head of only about 80 deg. The amount of heat supplied to the engine, about 32 deg., was approximately 1146 pound-Fahrenheit heat units per pound of steam, and the amount thrown away in the condenser was 1122 heat units, leaving only 24 units per pound of steam actually turned into power.

With the modern power-station equipment boilers deliver the steam to the engines at as high as 200 lb. gage pressure with 1200 heat units per pound of steam, or 388 deg. Fahr. In the case of condensing engines they exhaust to a temperature of about 125 deg. Fahr. (26 in. vacuum) or 1120 heat units per pound of steam, giving a heat head of 263 deg., or absorbing 80 units per pound of steam which is utilized for power, but still dissipating or throwing away 1120 units per pound of steam; for the lower temperature on the thermometer scale has not materially changed from the days of Watt to the present time with Corliss engines and steam turbines. It shows that we are still wasting 1026 heat units per pound of steam (being the latent heat of vaporization) that are available for heating purposes at least part of the year.

The majority of non-condensing Corliss engines in use today in electric generating plants take steam at [illegible] lb. gage

pressure, corresponding to a temperature of 365 deg. Fahr., containing 1193 heat units per pound of steam, and exhaust to the atmosphere at 212 deg. Fahr., a thermometer scale range of 153 deg. Fahr., with the exhaust containing a total of 1146 units (above 32 deg.) per pound of steam. We thus have converted but 47 heat units per pound of steam into power, leaving approximately 1000 units per pound of steam available for heating purposes on a non-condensing basis, this being the latent heat plus the available sensible heat.

With coal having a thermal value of 12,000 heat units per pound and an average efficiency of 7 lb. of water evaporated per pound of coal burned, it will readily be seen that we utilize in our modern station equipment with so-called high-economy prime movers only about 4½ per cent of the total heat delivered to the engine which is actually turned into power.

Here is where we may assist in the conserving of the natural resources by utilizing the heat which is now dissipated through the condenser or thrown away in the exhaust to the atmosphere by conveying it to buildings which require artificial heat several months of the year.

The lowest point on the thermometer scale at which steam can be utilized for heating is governed by the fact that 70 deg. Fahr. is considered the temperature of ordinary personal comfort, and in order to produce this temperature by transferring heat from the surfaces of radiators and pipes a certain heat head must be maintained between the desired temperature of the rooms and the fluid used to convey the heat. We now come to the question of the most desirable method of conveying the heat expelled by the engine to the point where it is to be utilized, as in the heating of buildings, water for domestic or manufacturing purposes, the warming of water in swimming pools, etc. The conditions in the territory where heat is to be sold, and not those in the station, govern what system should be installed, steam or water.

In the case of a system circulating water as a means of conveying heat it is possible to change the condition under which the engine operates from that of exhausting at atmospheric pressure in the extreme cold weather to that of a partial vacuum in mild weather, which means that if the radiators are of the size usual in hot-water heating practice the vacuum on the engine can run as high as 26 in. if the heat load does not exceed the engine load.

In a large majority of cities and towns where the question of installing a central-station heating system is under consideration the number of buildings that are heated by steam far exceeds that of those heated by water. This is particularly true in the business district. Therefore, if a water system is installed, the buildings that are fitted for steam are not prospective customers, as their owners would not change the entire heating system, radiators and piping to accommodate hot-water service. Because of this the installation of a water-heating system in such cases is prohibited. On the other hand, if a steam system is installed the conditions are quite the reverse, for the buildings that are already fitted with hot-water radiation and piping can be heated with remarkable success and economy by heating the water in the building system with steam, continuing to circulate the water through the building system. This is done by substituting for the boiler in the building a water heater in which the steam heats the water. This method is very economical, if properly installed, as it allows of a low range on the thermometer scale at which the heat can be transmitted.

In the buildings that are heated by steam the range of temperature is between 72 deg. and the temperature at which steam can be delivered, or approximately 212 deg., giving a range of 140 deg. Fahr. With these conditions 966 heat units per pound of steam will be transmitted to the room. There can, however, be still a greater saving by the use of cooling coils to extract the heat contained in the water of condensation from the radiators, which still remains over 200 deg. If these coils are properly installed, approximately 100 more heat units per pound of water may be utilized, thus saving the customer about 9 per cent of his steam consumption and utilizing all the heat that is available in the steam, except what is wanted to temper water for domestic purposes.

From the foregoing it will be seen that with a system properly installed it is practical to utilize approximately 90 per cent of the heat supplied to the engine (less transmission losses) instead of 15 per cent, as in the case of a condensing engine with no heating combination.

The difference in the market price of heat sold as power and heat delivered for heating purposes only may give rise to argument as to the advantage of the combination of a power and heating plant, using the exhaust steam for heating and carrying a back pressure on the engine, as against using the steam in a high-efficiency engine with a condenser. It can, however readily be seen that if the steam required for the heating load equals or exceeds that required for the engine load on a non-condensing basis the revenue from the sale of heat will be considerably more than enough to pay the total cost of fuel for the combination.

Assuming that it takes twice as much steam to produce a horse-power running non-condensing as it takes to produce a horse-power running condensing there will be a gain in the combination whenever the amount of steam required for heating exceeds the amount required for power on a condensing basis; and whenever the amount of steam required for heating equals the amount required for power on a non-condensing basis the gain will be equal to the coal cost for such power.

The foregoing is assuming that the entire plant is being operated either on a condensing or non-condensing basis. In large central power plants the total amount of the output is divided into units, and a portion of the plant may be operated in connection with the heating system, while the rest would be operated condensing.

From the above it is seen that the general rule is that, regardless of the amount of steam required per hp-hour for the engine, the gain in the heating combination will at least equal the total fuel cost of generating the same amount of power in high-efficiency engines if all the exhaust steam is sold for heating at the cost of generating.

There are a great many companies whose heat revenue far exceeds the total fuel account for the twelve months of the year, while some also pay their boiler-room and engine-room labor, water, oil and waste account with the revenue from the sale of heat.

INSTALLING METERS ON PORCHES.

By James S. Wright.

The writer, who was compelled to read his own meters [illegible] becoming manager of his plant, was particularly impress[illegible] with the time spent in cleaning his feet, in waiting for th[illegible] front door to be opened, in passing through the house, an[illegible] possibly, climbing to the attic, incident to reading meters whe[illegible] installed inside residences. Very frequently the people we[illegible] not at home, the wait at the door was fruitless, and a sec[illegible] trip was necessary.

Then again there were frequent delays caused by inquisiti[illegible] housewives, who were never satisfied until their bills we[illegible] figured for them. The writer reasoned that in the one hu[illegible] and twenty times a meter would be read in ten years, at [illegible] average of five minutes per reading, and counting on not bei[illegible] able to get in on every twentieth trip, 600 minutes, or ten hour[illegible] time, would be required in reading a meter.

Frequently meters already located inside the house are chang[illegible] to an outside location. Sometimes this is done at the exp[illegible] of the consumer, who wishes to get away from the annoyan[illegible] sometimes the material is paid for and the company do[illegible] the labor, and possibly later on the company will change [illegible] more troublesome ones at its own expense.

At present about half of the 300 meters are outside. The[illegible] are usually set on the rear porches, otherwise on the fr[illegible] verandas, but always where rain or snow cannot get at the[illegible] The meters are of the glass-covered type and are practica[illegible]

moisture-proof. Some have been set two years, and so far no objections to their [illegible] [illegible] developed.

Two men read the 300 meters, scattered over a territory of about one square mile, in less than one day. The manager firmly believes he is saving one day per month of one man's time and is losing nothing.

Wiring and Illumination

ARC LAMP-POSTS OF NEW YORK.

Details of the Ornamental Standards Used for All Public Lighting on the Streets and Parkways of the City.

It is doubtful if in any other city of the Western Hemisphere as much care and thought have been bestowed in the design of arc lamp-posts as in the metropolis. As a matter of fact there are very few cities indeed where any effort at all has been made to develop standard posts which will at once fit in with their respective surroundings and measure up to the civic pride of the community and also be representative of its culture. Too often where attempts have been made in isolated cases the result has been all post; a cumbersome shaft wholly incongruous with its surroundings, ill suited as the bearer of a 50-lb. arc lamp and without credit to the city in which it is located.

Beauty of outline and appearance on paper are no criterion of what the finished product will look like when placed on the streets. Few, if any, satisfactory posts have been wholly so designed. Details and ornamentation [illegible] the post on the street, and regular curves oftentimes appear grotesque. After all, it is the eye which must judge, coupled with one's sense of proportion and the eternal fitness of things. The chief difficulty lies in obtaining a design of graceful proportions which will not be the main object to thrust itself into view and which will withal fit in as well in front of a monumental building as in front of a tenement house. Unfortunately the streets of every city are made up of a heterogeneous mass of brick and stone, typifying the architecture of the Greeks or Romans, or more often architecture so lacking in taste that it cannot be dignified by a name. A Corinthian column might well serve as a lamp-post to grace the portals of a Greek temple, or a gargoyle hold in its mouth the lamp which illuminates the street in front of a gothic edifice; but such buildings are exceptional and, besides, no lighting company can afford individual treatment of blocks, not to mention the unpardonable lack of symmetry which would result.

Fig. 1 — Bishop's Crook Post.

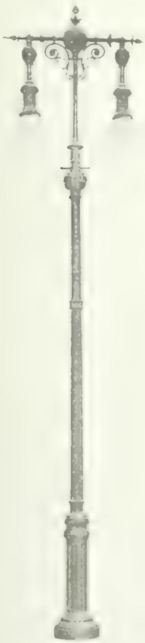


Fig. [illegible] Avenue Post.

Fig. [illegible] Lyre Type Post.

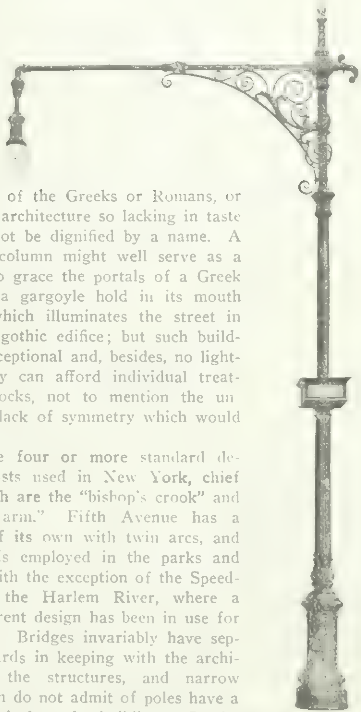


Fig. 4 — Mast-Arm Post.

There are four or more standard designs of posts used in New York, chief among which are the "bishop's crook" and the "mast arm." Fifth Avenue has a treatment of its own with twin arcs, and the "lyre" is employed in the parks and parkways with the exception of the Speedway along the Harlem River, where a totally different design has been in use for many years. Bridges invariably have separate standards in keeping with the architecture of the structures, and narrow streets which do not admit of poles have a bracket attached to the buildings. In the public squares where twin Blondel-type flaming arcs are employed 50-ft. wooden poles with iron ornamentation are used, while a bishop's crook type of post is used where flaming arcs with inclined electrodes are employed.

BISHOP'S CROOK POST.

This post was originally designed or evolved from a number of designs and photographs of posts in use in Continental cities. Before any posts were made a number of plaster and wooden models were prepared and assembled in the modeling shops of the J. L. Mott Iron Works.

The proportions and outlines were changed many times until the post as it now exists was evolved. The base is cylindrical in form, with graceful inward curve, surmounted by an ornamental cusp composed of a series of acanthus leaves to form a supporting member for the fluted column forming the shaft of the post. The shaft also shows considerable study, as the treatment of the decoration is entirely different from the regulation lamp-post. The flutings are of a delicate, refined character and the lower section is entwined with a festoon of oak leaves. The bishop's crook fixture on top is also worthy of notice, as it forms a logical ending for the long, graceful shaft, and the transition from the crook to the arc lamp is so imperceptible that the pole seems to be one complete whole. When standing at a distance of from 50 ft. to 100 ft. from the pole one can better appreciate the grace, beauty and tapering growth of the whole fixture. The Edison nameplate is cast in

one side of the base, while opposite it, in the door, is the coat-of-arms of the City of New York.

The post is made in three pieces: a base and a shaft of cast

Fig. 5—Detail of Lyre Top.

iron and a crook of steel with cast-iron ornamentation. The base is reinforced within and a rod is inclosed in the shaft above the base line so that should the shaft or crook break it will not fall to the street. The weight of the base is 900 lb., the weight

Fig. 6—Detail of Bishop's Crook Top.

of the shaft is 350 lb. and the weight of the crook is 125 lb., so that the post complete with a 50-lb. lamp weighs 1425 lb.

The base is set 3 ft. 4 in. below grade in an excavation 4 ft. ... are, and after the conduit bearing the lead-incased cables is inserted the excavation and base are filled with a 1:2:3 concrete. The shaft has a male joint at both ends, one end being dropped in an accurately fitting socket in the base for

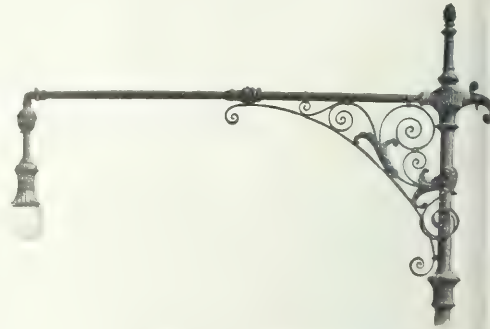


Fig. 7—Detail of Mast Arm.

a distance of 14 in., the crook fitting the other end and bein held in its proper relation to the street intersection or stree by three set-screws. The height of the post above grade i 22 ft. 4 in. and the lamp is suspended 18 ft. above the sidewalk Standard direct-current, inclosed arc lamps are employed, an fed with electric energy from the 120-240-volt undergroun three-wire system. A 3-in. iron conduit leads from service box in the street opposite the lamp-post to a switc in the base of the post opposite the door. Within the con duit are three lead-incased, 40,000-circ. mil cables terminatin at the switch base. The neutral is connected up directly wit

Fig. 8—Detail of Fifth Avenue Cross-Piece.

ne lamp terminal and a single-pole switch is used to conne one of the outer wires to the other lamp terminal. The thi wire is installed for emergency use. The switch is of the kni blade type specially designed for this service and is conne

Fig. 6—Typical Installations of Arc Lamp-Posts in New York City.

in series with a 15-amp link fuse. From the switch to the lamp twin No. 10 rubber-insulated, double-braided wire is used. The lamp is fitted with a clear outer and an opal inner globe, except in the parks and parkways, where a clear inner and an opal outer globe are employed. Each lamp is controlled individually. The door in the base is fitted with a special socket lock and the switch is closed and opened at specified times by lamp lighters in the employ of the company.

The lamps are trimmed and cleaned weekly by a patrolman equipped with a special 18-ft. ladder fitted with hooks engaging the ladder arm on the post. The ladder is made of wood and weighs 29 lb. Once a year the posts are painted with a standard, copper-brown color specified by the Department of Water Supply, Gas and Electricity. Approximately 12 ft. above the sidewalk provision is made in the shaft for attaching the city street markers. These consist of square boxes maintained by the city and equipped with reflecting porcelain-enameled plates bearing street designations.

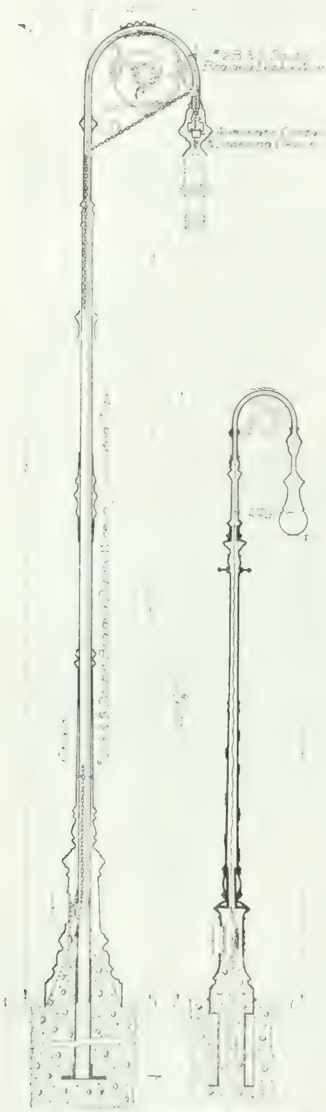


Fig. 10—Sectional Elevation of Flaming-Arc and Bishop's Crook Posts.

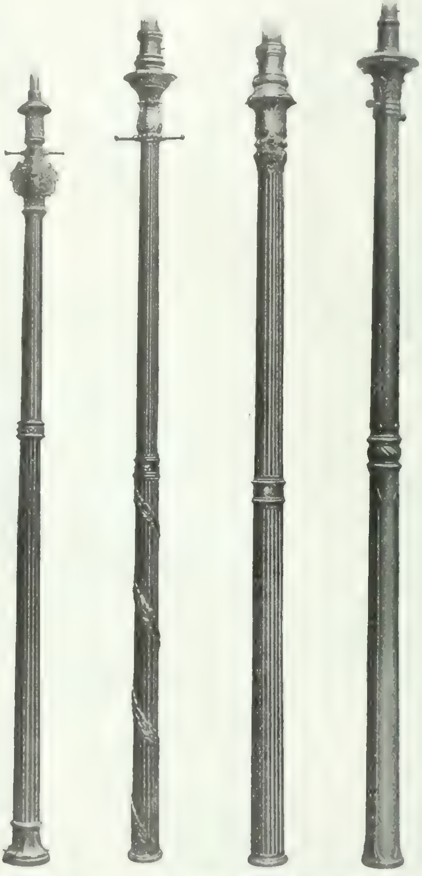


Fig. 11—Details of Shafts of Lamp-Posts in Various Designs.

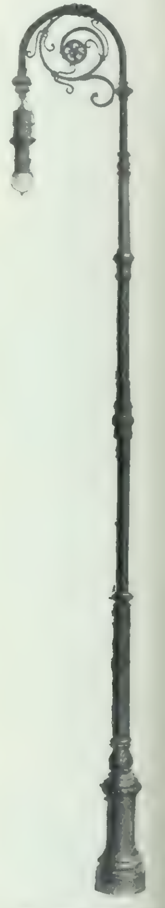


Fig. 12—Flaming Arc Post.

MAST-ARM POST.

Next to the bishop's crook the mast-arm post is the most widely employed. When considering the design of a mast-arm pole the officials of the New York Edison Company found many difficulties to contend with. Fundamentally, a mast-arm pole as commonly employed is an unsightly and ill-proportioned fixture. In this country there seems to have been no thought given to the design of this type of post, for it has always been constructed more from a utilitarian viewpoint than with any idea of beauty. Many sketches were made and skeleton poles rigged up with plaster models and wrought-iron scroll work so as to get an idea of the general proportions and the grouping of the various members which compose the present fixture. It took many months of study, changes of models and rearrangements of the decorations before the pole as it now exists was eventually completed.

For its sustaining member there is a steel tubular shaft of four sections swedge-jointed and 37 ft. over all. The two-piece 12-ft. extension arm is of similar construction and over both are applied, in the form of slip castings, the iron sections that go to make up the ornamental design of the post, the whole weighing

approximately 2000 lb. The base is a replica of the bishop's crook post, but on a larger scale, and the steel mast, which is necessary for strength, is ornamented with a fluted column which runs about half-way up the shaft. The bracket, to which most study was given and which required greater skill to design in order to get it away from the conventional bracket, is without doubt the most successful arrangement of scroll work and constructive lines that could possibly be designed. The scrolls, as will be noticed, radiate from a central husk which grows around the vertical shaft and is so designed that the scrolls appear to grow naturally from the central column. The main supporting member is composed of a reinforced wrought-iron scroll de-

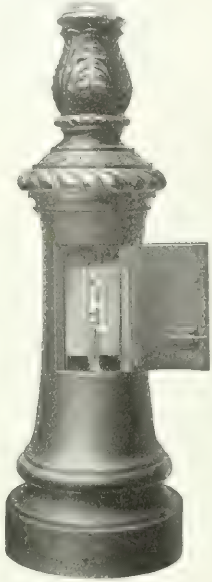


Fig. 13—Bracket. Fig. 14—Detail, Bishop's Crook Base.

ned so as not to appear too conspicuous and yet suitable for · work. The horizontal arm, as will be noticed, is carried ·ough the ornamental member by means of an ornamental · inder which ends in a husk of acanthus leaves, and the finial top member, an acorn surmounting the whole, gives the post .nished and well-proportioned appearance.

The usual unsightly wires, ropes and other devices for lower- arc lamps have been dispensed with in the design described. lamp being incorporated in the design of the post itself and pended from a concealed hanger. The steel supporting mber and arm can be reduced in size with a pipe cutter when pole is in place, or shaped before installation, giving a post flexible proportions and one that can be fitted to a selected ation regardless of the overhanging tree limbs and without riment to them. The ornamentation has been designed to apt itself to extensive changes either in the shaft or in the n, and to conform to them irrespective of change in their gth, height or shape. The post is set in an excavation 6 ft. p by 5 ft. square. In the special foundation of concrete is luded at the time of its building a collapsible core box, paper- pped and plumbed, which is knocked down and removed er the mass solidifies, leaving a clear entrance, with a slight rease for the shaft, through the concrete to a cast-iron re- ving flange at the bottom. The arm of the finished pole is 2 ft. above grade and the lamp is suspended 22 ft. above the dway. The post is fitted with the same type of lamp as the hop's crook, but these lamps are trimmed weekly and cleaned m a tower wagon, a single trimmer under these conditions caring for at least 200 lamps in a day. The individual control is exactly the same as that employed in the post previously described.

FIFTH AVENUE POST.

The poles along Fifth Avenue are made up of a fluted base and conventionalized Corinthian shaft with ornamental cap and double-arc lamp fixture composed of horizontal members supported by two decorative scroll brackets. The post is well proportioned and was specially designed for use on that thoroughfare. The base, which rests on a foundation similar to that for the bishop's crook post, rises 4 ft. 6 in. above grade and holds a 15 ft. 5 in. shaft surmounted by a crosspiece 6 ft. 3 in. high. The lamps are suspended 19 ft. above the sidewalk and each is controlled individually by its own knife switch. Direct-current lamps, fitted with clear inner and opal outer globes, are used. Looking down Fifth Avenue in the daytime one

Fig. 15—Typical Bridge Installation

cannot but be impressed with the uniformity and happy proportions of these posts, and this is yet more evident in the nighttime when the lamps are lighted. The vista of these double-arm lamp-posts, stretching out as far as the eye can see, is without doubt a most attractive one from an esthetic point of view.

LYRE-TOP POST.

The lyre-top post is installed in the narrow parkway dividing the roadway of New York's wide avenues. It is 23 ft. high, but is not of as massive proportions as the mast-arm post used on the same thoroughfares, and differs from it in that it is entirely of cast iron in three sections. The base and shaft are identical with that of the bishop's crook post, the only difference being in the top piece. This is of ornamental cast and wrought iron patterned after a lyre, in the center of which the lamp is suspended. The design of the lyre is complete only with the lamp and is of such proportions that it does not cut off any of the light. No direction is given to the lamp at its point of suspension and its location in the center of the parkway is of great advantage in that it has a distribution unaffected at any angle by intervening obstructions. The lamp is fitted with an outer globe of very light opal glass with a clear inner globe, this combination having been found to give the best diffusion and correction as to color without too large a sacrifice of illuminating efficiency.

FLAMING-ARC LAMP-POST.

The design of the flaming-arc lamp-posts is similar to that of the mast-arm post, with the exception that the shaft is longer

and fitted with a crook harmonizing with the rest of the design. The details of this post are given in one of the engravings. The lamp is lowered for cleaning and electrodes by the trimmer, who hooks a special rope to the chain fastened to the lowering device. Within the tube the wires are inclosed in a ½-in. loricated tube to protect them from abrasion by the chain. On poles of this type flaming-arc lamps with converging electrodes are employed. The twin flaming arcs shown in one of the engravings are of the Blondel type, and in both types of lamps flaming electrodes giving a white light are used.

The various details of ornamentation are clearly shown in the engravings reproduced herewith, and the general appearance of the posts on the streets of the city is shown in the group engraving, the center picture showing an isle of safety at Times Square. The illustrations portray better than words the actual appearance of the posts and how well they harmonize with their surroundings.

RECENT TELEPHONE PATENTS.

IMPROVED AUTOMATIC AND SEMI-AUTOMATIC SYSTEMS.

Originally automatic working required that all subscribers of any system be interconnected at a single central switching station. When a large territory was served this resulted in an excessive wire mileage. As a means of reducing this wire mileage to normal sub-switching stations have been introduced. At these substations a local group of subscriber lines is centered and sub-switching devices there associate the lines as required with trunks extending to the main switching center.

Mr. C. R. Austin, of Long Beach, Cal., has arranged a semi-automatic system along these lines. He provides a manual switchboard at the main center and automatic switches at the sub-centers. Upon the initiation of a call at any subscriber station, the automatic switches at the sub-center operate to select an idle trunk to the main center, there to be displayed in a lamp signal before the operator. The operator responds in the usual manner by means of connecting cords. Before the operator is the usual jack multiple, corresponding jack by jack to the line numbers of the system. Upon learning the desired number the operator completes the connection to the multiple jack. This automatically initiates operation of an automatic selector to select an idle trunk to the proper sub-center and there to select the desired line.

Three patents have recently been granted to Mr. A. H. Dyson, of Chicago, for automatic systems, all of which are assigned by him to the Kellogg Switchboard & Supply Company. All relate to that type of system wherein a master switch is employed. This switch serves to cause the operation of a line selector to seek out the calling line and connect it with a first selector preparatory to setting up the desired connection.

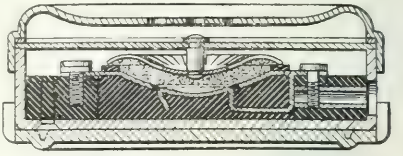
One of the patents provides for a printing attachment associated with the line selector. As this selector always assumes a fixed and different position for each calling line, it may readily be arranged to set up a type-wheel in position to print the calling number. The actual printing or impression occurs with the response of the called subscriber. It will be seen that a method of registering calls is thus provided, it being necessary to count the number of impressions of each number upon the various printed slips.

A second of these patents provides a master switch which will respond to successive calls one after the other without the necessity of awaiting the completion of one connection before responding to a succeeding call. Thus the master switch delays for each arriving call only sufficiently long to pick out and start the line selector.

The third Dyson patent provides a locking device for the line relays of the master switch. This is so arranged that when a call is initiated the line relay is locked until the call has proceeded to a point where none of the switches will be hung up if an attempt be made to stop it. Further, the control of the connection is left with the calling party until the called party answers. It is then shifted to the called party. This provides for knocking down a connection where the called party fails to respond.

NEW APPARATUS.

The accompanying illustration shows the section of a transmitter designed for the use of the deaf. The rear electrode is dish-shaped and consists of two insulated portions, a middle part and a surrounding ring. It will be seen that the front electrode is shaped correspondingly and it is made particularly flexible by being cut with numerous radial slits. The



Babcock Transmitter.

transmitter is designed to operate in any position. It is mounted upon a metal base plate which also provides a seat for the receiver or earpiece. A circuit closer is provided which maintains the circuit open whenever the receiver is placed upon the base plate. This apparatus is the invention of Mr. G. Babcock, of Rochester. The patent has been assigned to the Simplex Telephone Equipment Company.

A patent granted to Mr. B. F. Gardner, of Chicago, describes a novel disinfecting device. The disinfecting means consists of a series of electric sparks or discharges within the mouthpiece of the transmitter. Spark terminals project through the walls of the mouthpiece, being connected with a secondary coil wound upon the ringer frame. When the alternating ringing current is sent out on the line to ring the bells the secondary coils cause the generation of sparks.

A receiver holder has been patented by Mr. H. M. McAlarney, of Puritan, Pa. The novelty lies in a cam device, operated by a thumb nut, which serves to lock the hook lever when the telephone is not in use.

LETTERS TO THE EDITOR.

The Components of Alternating Current, Electromotive Force and Power.

To the Editor of Electrical World:

SIR:—In your issue of Nov. 24, page 1244, Mr. C. O. Mailloux emphasizes the desirability of uniformity in naming the two components of curent, e.m.f. and power, in an alternating-current circuit. The adjective "reactive" well designates one of these components, the so-called wattless component, as discussed in your editorial, page 1213, and has the advantage of consistent and continuous use since the term "reactance" was first defined. (See paper on "Reactance," by Steinmetz and Bedell, *Transactions* A. I. E. E., Vol. XI, page 640, 1894.) Furthermore, the term "effective" also designates very well the other component, the power component, and this word, too, was in early use. (See, for example, Figs. 14, 50 and 51, Bedell and Crehore's "Alternating Currents.") Unfortunately, however, the term "effective" is often used to designate the square root of mean square or virtual value of an alternating quantity, and if "effective" is to be permanently adopted in this latter sense it should not also be used to designate the power component.

A suggestive word to designate the power component is "active." Thus, active current, active electromotive and active power furnish the activity or useful power of a circuit as distinguished from the reactive current, reactive e.m.f. and reactive power, which do not furnish useful power. The words "active"

and "reactive" would no doubt appeal to French writers, since the term "reactance" originated in France, Prof. Hospitalier and Prof. Blondel both being instrumental in its introduction.

In regard to the word "apparent," its use in the way suggested in your editorial may lead to misunderstanding. The word is already overworked in technical writing; furthermore, it has a definite non-technical significance and it would be confusing to give it any other than its apparent meaning. "Apparent resistance" might, for example, be taken to mean impedance, or to mean the true resistance (measured by direct current) plus the increase due to skin effect, or the true resistance (as of a transformer primary) plus the apparent increase due to the secondary, or to mean the equivalent resistance of a combination of circuits, or to mean total copper (RI^2) losses divided by the square of the current, etc. In the case of power the combination of the active power and reactive power may correctly be termed the apparent power, as is now commonly done, for "apparent" then has its usual popular meaning. In the case of "e.m.f." and "current," however, no such qualifying word seems necessary, the combination of the active and reactive e.m.fs. being the total e.m.f., or merely *the* e.m.f., and the combination of the two components of current being the total curcurrent, or *the* current.

Ithaca, N. Y. FREDERICK BEDELL.

Voltage-Wave Distortion and the Life of Incandescent Lamps.

To the Editor of Electrical World:

SIR:—The article by Prof. Kinsloe in your issue of Nov. 17 points to conclusions which, if substantiated, are of very great practical interest. In view of the commercial and engineering importance which would necessarily attach itself to a definite discovery of an influence of wave form on the life of other lamps than tantalum lamps, it is unfortunate that Prof. Kinsloe's presentation of his results is not more conclusive. As you have said editorially, the results which he has found are contrary to expectation. For this reason it is very important that the presentation of the results should be full and complete, including every necessary datum to enable the reader to form his own judgment as to their reliability.

A number of data are omitted from Prof. Kinsloe's article which it seems to me are essential to forming a reliable judgment of the results. For instance, we know that comparative tests made on incandescent lamps are in general worthy of very little credence unless they are made upon a rather large number of lamps. The larger the number of lamps involved the more likely is the comparison to be a valid one. Prof. Kinsloe states that his tests were made with a large number of lamps, a statement which is entirely too indefinite, since Prof. Kinsloe's idea of what constitutes a large number of lamps may be quite different from that of those readers who, for instance as manufacturers or as central-station officials, are accustomed to dealing with lamps by the thousands or millions, and who are the ones whose interests are most closely concerned with any effect such as Prof. Kinsloe claims to have found. Those familiar with the unavoidable variation in life-test results, even when made by people with long experience in this class of work, under the best conditions, with closely regulated current and a high class of photometric equipment, realize better than anyone else that the comparative tests of an insufficient number of lamps are of negligible value, except as pointing out effects of such magnitude that they are unmistakable.

The conditions under which the tests were made are not sufficiently well explained. For instance, it is not stated whether the lamps were burned on life test at their normal voltage or normal watts, or just how. It is not stated whether the photometric measurements were made on alternating current or direct current and whether the lamps while being photometered were burned at normal volts, or under what other condition they may have been burned. Nor is it stated how the watts of the lamps were measured, whether on direct current or on alternating current, and, if the latter, with what kind of an instrument. Also, the frequency of the alternating current is not stated.

The statement is made that the tests were carried on until the filaments were broken or to the "smashing point." Here, again, Prof. Kinsloe does not state what he understands by the "smashing point"; whether it is the same as the point at which the filaments are broken and therefore measures the ultimate life of the lamp, or whether he means some other point, as is commonly the case. If some lamps were taken to the end of their ultimate life and others to an arbitrary "smashing point," it would seem that these two classes of lamps should be differentiated in the article.

Inasmuch as the results contain certain apparent anomalies, which to those who are accustomed to the more antiquated views regarding incandescent lamps are difficult to understand, all of the above data are of importance in enabling one to form a judgment of the results. As to the anomalies mentioned, it may be noted that in the case of all of the carbon, graphitized and tungsten lamps the initial candle-power was higher on the sine wave than on the peaked wave, and that the watts per candle of all were lower on the sine wave than on the peaked wave, with the exception of the 25-watt tungstens and the 100-watt tungstens, in which latter case the watts per candle were the same on both wave forms. In the lack of any more definite information, it seems right to infer that this is the difference which is referred to in Prof. Kinsloe's paper where he says, "A marked difference in the performance of the groups of lamps subjected to the two waves was at once observed and it continued throughout the tests." In Prof. Kinsloe's paper as printed in the Bulletin of the Pennsylvania State College the further statement is made: "In fact, the lamps of all types and sizes exhibited at the start a decided advantage in favor of those on the sine wave." It seems right to assume that these statements refer to the higher candle-power and lower watts per candle of the lamps on the sine wave.

Now, it is very hard to see what these statements mean. Certainly lamps can be burned at the same watts per candle on peaked wave that they can on sine wave. That is only a question of the voltage. Certainly lamps can be made to give as much candle-power on peaked wave as on sine wave. That is also a matter of the voltage. If two lamps which are supposed to be exactly alike, are operated one from sine wave and the other from peaked wave, and are found at the same voltage to give different candle-power and different watts per candle, the natural inference is either that the measurements are in some particular incorrect or that the lamps are not alike.

Prof. Kinsloe says that he used a large number of lamps in his tests, and presumably he divided his test lamps at random into two groups, one for the sine-wave tests and the other for the peaked-wave tests. If he did not do this, his results are not comparable. If he did do it, how is the fact that the candle-power of the lamps in one group was persistently high and their watts per candle persistently low to be explained? Until this important point is cleared up the results of the life test are necessarily under suspicion.

Let us now look at some of the collateral evidence regarding the existence of this effect which Prof. Kinsloe's results point to. There would seem to follow as a necessary corollary the statement made in your editorial in which you say, "However, it is difficult to conceive of any effects attributable to the substitution of a peaked for a sinusoidal e.m.f. wave that would not be found when either an alternating e.m.f. was substituted for a unidirectional e.m.f. of the same effective value, or a high frequency e.m.f. was substituted for an equal low frequency one."

Tests to determine the relative life of carbon lamps on direct current and on 25-cycle and 60-cycle sinusoidal current were made at the Electrical Testing Laboratories in 1905. In these tests a total of [illegible] lamps were used which were divided

into three groups of fifty lamps each, every effort being made to secure groups which would be comparable in point of date of manufacture, voltage, candle-power and efficiency. The results of these tests were as follows:

Taking the average effective life of the 60-cycle lamps as 100 per cent, the life of the lamps on 25 cycles was 104 per cent and that on the direct current was 94 per cent. These results were at that time, and are still, considered as inconclusive as far as pointing out differences in the life of carbon lamps on direct-current and alternating-current circuits is concerned, the observed differences being attributed to the differences in individual lamps and to the necessarily somewhat different regulation of the different generators. Howver, what difference between direct-current and alternating-current tests is shown is directly contrary to what would be expected from Prof. Kinsloe's results.

Another experiment made by the Electrical Testing Laboratories may have some bearing on this question. At one time the life-testing arrangements were changed from a 133-cycle peaked-wave generator to a 60-cycle sine-wave generator. An attempt was made at that time to establish any systematic differences in the life of the lamps produced by this cause. The results gained were inconclusive. The wave form of the peaked-wave generator showed a third harmonic 20 per cent of the fundamental, whereas the sine-wave generator showed a third harmonic 4.7 per cent of the fundamental. The peak of the one machine was 18 per cent higher than that of the other for the same mean effective value. Unless it can be urged that the higher frequency of the peaked-wave machine masked the effect of the peaked-wave form, this test would seem to furnish negative evidence with regard to Prof. Kinsloe's results. That the frequency does not seem to have an influence on the life of carbon lamps is indicated by the results of the previously cited test.

Tests made on the earlier makes of tungsten lamps on direct current and on alternating current indicated quite positively that no difference in their life was to be expected. These indications were so clear that, in the absence of anything to arouse suspicion to the contrary, the Electrical Testing Laboratories has not made similar tests on modern tungsten lamps. The ordinary squirted tungsten filaments which have been burned for 1000 hours on alternating current do not show under the microscope any obvious cause for failure such as the faulting which is so characteristic a feature of tantalum filaments which have been burned on alternating current. This piece of negative evidence indicates that if the life of the tungsten lamp is really shorter on alternating current than on direct current the shortening is for some other reason than that which affects the tantalum filament. In the case of tantalum lamps the effect of alternating current is well known, having first been demonstrated, I believe, at the Electrical Testing Laboratories. The greater destructiveness of the peaked wave may be due to the triple-frequency harmonic. The destructiveness ought to be practically the same, if the phase of the triple-frequency harmonic were reversed. A test made in this way would undoubtedly be very interesting, since it would differentiate between the frequency effect and the temperature effect.

In view of all the facts of the case, the necessity for the strongest direct and collateral evidence to substantiate any such unusual results as Prof. Kinsloe has presented is clearly apparent, and the necessity for suspending judgment as to these results until more complete data are at hand cannot be too strongly urged.

New York. Clayton H. Sharp.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Field of the Induction Motor.—C. F. Smith.—A paper read before the Manchester Section of the (British) Institution of Electrical Engineers on the irregularities in the rotary field of the polyphase induction motor. The author describes a number of experiments to determine the extent of this irregularity by measurements of the e.m.fs. induced in special search coils wound on the stators of two induction motors, so as to embrace portions of the air-gap flux of the motors. These search coils were disposed in various positions round the stator and were wound so as to embrace different numbers of stator teeth. One of the results is that the resultant voltage induced by field irregularities in several windings connected in series bears very little relation to the voltages of the individual windings and is in general much smaller. This effect can be shown to be due to the fact that there are always voltages induced in some coils which are in direct opposition to those being simultaneously generated in others. This result is not without practical importance, since it has a direct bearing on the question of wound rotors versus squirrel-cage rotors for short-circuited induction motors. For example, in one case a pulsation e.m.f. of 9.5 volts was induced in the coil wound in a pair of slots having a pitch equal to that of the poles of the motor. This corresponds to nearly 1 volt per turn at the normal voltage. If such a coil were directly short-circuited on itself, as would virtually be the case in a squirrel-cage motor, probably a considerable current of high frequency would be obtained which would not contribute to the torque of the motor. By connecting in series the conductors in several slots, the resultant voltage due to irregularities of the field is much decreased, while at the same time the impedance of the circuit in which this voltage acts is largely increased. The pulsating currents and the heating due to them may thus be reduced to a relatively small value in a wound rotor. On short-circuiting the rotor winding of the induction motor under consideration, while driven at synchronous speed, the slip-ring current was found to have a value of less than 1 amp, although the open-circuit slip-ring e.m.f. was over 4 volts. The damping out of high-frequency voltages in the rotor winding depends less on the number of slots per phase than on the relation existing between the spans of the several coils. The same consideration will govern the extent to which the effects of "cogging" will make themselves felt when full speed has been obtained.—Lond. *Elec. Eng'ing,* Nov. 17.

Commutator Alternators.—R. van Cauwembeghe.—If a shunt-wound commutator motor for single-phase current (Fig. 1) shall be able to excite itself and to work as a generator it must be possible, by connecting it to an alternating-current network of suitable frequency and voltage and by mechanically driving it, so to regulate the speed and the number of excitation turns *bc* that the current in the network becomes exactly zero. The author made this experiment with a small motor and was able to reduce the current in the network to a sharply defined minimum for a certain number of excitation turns and for a speed near synchronism, but he could not reduce the cur-

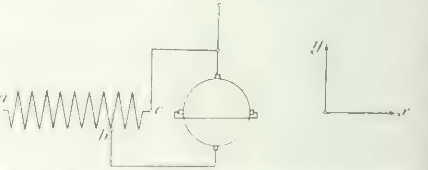


Fig. 1—Shunt-Wound, Single-Phase Commutator Motor.

rent in the network to zero. This is explained by the fact that the voltage curve in the network contained higher harmonics. With these the motor did not run in synchronism when the current was a minimum. The motor was, so to speak, short-circuited for these higher harmonics and, therefore, consumed relatively high short-circuit currents. This was proved to be true by means of the oscillograph and it was shown that the current consisted of higher harmonics only and that the fundamental wave had really been reduced to zero. This proves that the machine is able to generate its own exciting current for the fundamental wave, but not for the higher harmonics. Thus the conclusion may be drawn that when the generator is disconnected from the network its voltage curve would be a pure sine wave free from higher harmonics. This was, indeed, found to be true by experiment. The author investigates this property of commutator alternators mathematically and discusses the conditions when the generator is loaded and when it is unloaded. The behavior of the commutator alternator when loaded shows the necessity of compounding. This may be easily accomplished if in each exciting circuit an additional voltage is produced which compensates the ohmic voltage drop.

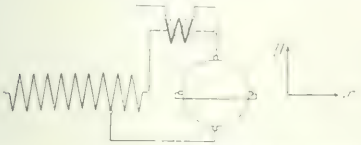


Fig. 2—Compound-Wound, Single-Phase Motor.

Fig. 2 shows the arrangement used by the author for a single-phase machine. The x current (load current) passes through the primary of a transformer provided with an air-gap, the secondary of which is inserted in the y rotor phase. The compounding voltage is displaced by 90 time-degrees against the load current, but it does not act directly on the x phase of the rotor, but on the y phase. The latter transmits the voltage to the x phase with a displacement of 90 time-degrees. A test of this machine from no-load to full-load showed a voltage drop of 1 per cent for unity power-factor and a voltage drop of 6 per cent for a power-factor of 0.3. The frequency remained exactly constant. The generator was very little saturated. Finally the author sums up the advantages and disadvantages of the commutator alternator as follows: The disadvantage is the commutator. Advantages are that no outside exciter is required; that only a few more ampere-turns are required on the rotor than on the stator (instead of twice or three times as many); that the rotor need not be highly saturated; that there is no possibility of such enormous short-circuit currents as occur with turbo-generators of ordinary construction where they may become twenty or even thirty times the normal current; that a simple and exact compounding method is available; that the voltage current is sinusoidal for any load; that no difficulty is experienced in parallel connection.—*Elek. u. Masch.* (Vienna), Nov. 6.

Interpole Converter.—P. M. [illegible].—A comment on the A. I. E. E. paper by Messrs. Lamme and Newbury, noted in our issue for Nov. 17, with special reference to the use of commutating poles with high-voltage synchronous converters. It has been found by actual experience that the voltage between adjacent bars in the synchronous converter should be kept below a certain value, which is dictated not so much by commutating conditions as by a tendency toward flashing on heavy loads and short-circuits and by the fact that the insulation between bars is apt to be injured if a certain maximum voltage between bars is exceeded. Having fixed a maximum allowable voltage between bars, the maximum direct-current voltage that it is possible to obtain from a given synchronous converter is merely a matter of the frequency applied to the converter, and the minimum possible width of the commutator bars and the maximum possible commutator speed that can be used successfully. A [illegible] commutator bar [illegible] the [illegible] adjacent one in half a cycle. Assuming, for example, a commutator speed of 5000 ft. per minute, this consideration makes the distance between adjacent brush arms 20 in. in a 25-cycle converter and 8 1/3 in. in a 60-cycle machine. If it be assumed 3/16 in. is the minimum that can be occupied by a commutator bar and its insulation, the limit is at once placed at 106 bars betweent adjacent brushes in the 25-cycle converter and forty-four bars for the 60-cycle. Assuming further that 15 volts is the limiting e.m.f. between bars, the conclusion is reached that 1590 volts is the limiting e.m.f. for a 25-cycle converter and 660 volts for a 60-cycle machine. The only way to increase the direct-current voltage is a higher commutator speed, a thinner bar or a higher voltage between bars. Previous practice has shown that the limits mentioned above cannot be very much exceeded. Further, from the necessity of limiting voltage between bars for reasons other than commutation, it follows at once that the commutating characteristics of the high-voltage converter will in general be even better than those of the low-voltage machine because there is less current to be reversed in the coil passing under the brush and the self-induction of the coil will not be materially increased for the reason just mentioned. Apparently, therefore, there is no necessity of using interpoles on synchronous converters simply because they are high-voltage machines. It is questionable, therefore, whether the interpole will ever be used in synchronous converters to the some extent that it is used on direct-current machines, and, further, the conditions which demand its use, such as higher speeds, larger outputs per pole, etc., must exceed anything demanded at present before it will be used at all.—*Elect. Journal*, December.

Train-Lighting Generator.—A note on a recent British patent (16,447, Nov. 10, 1910) of A. H. Midgley and C. A. Vandervell. A reversible, self-regulating generator has the brushes in the normal position relatively to the main poles, which are not excited. Auxiliary wound poles are provided in the commutating zone, and induce heavy currents for the short-circuited coils. These local currents set up a cross-magnetizing flux which distorts the inducing flux into the main poles and thus causes an e.m.f. to be generated in the working part of the armature winding. The distortion will be in one direction or the other, according to the direction of rotation, and consequently the current taken from the brushes will always be in the same direction. As the reaction of the working current is exactly opposed to the inducing poles, the output of the generator will remain practically constant at all speeds.—Lond. *Elec. Eng'ing*, Nov. 17.

Frequency Changer.—A note on a recent British patent (24,126, Nov. 10, 1910) of the British Thomson-Houston Company (General Electric Company of this country). A synchronous double-current alternator or frequency changer comprises a machine with a single armature and field system. The armature has coils forming two windings of different pole numbers, and the field system has two component m.m.fs. corresponding in pole numbers to the two pole numbers of the armature. The voltages of the two currents generated may be varied independently. When running as a frequency changer with a constant voltage on the motor side, the voltage on the generator side may be varied.—Lond. *Elec. Eng'ing*, Nov. 17.

Compounding of Alternators.—P. Noel.—The conclusion of his article on different methods of compounding alternators. In the present instalment brief descriptions are given of the following methods, together with diagrams: Boucherot, Delamont and Herdt, Rice, Blondel, Union Electric Company, Roth, Leblanc, Heyland, Walker, Dolivo von Dobrowolsky, Crompton, Seidner, La Tour. Finally the regulators of Blathy, Dick, Thury, Dalemont and Herdt, Thieme, Routin, Tirrill and Schwaiger are described and illustrated.—*L'Industrie Elec.*, Nov. 10.

Polyphase Commutator Motor.—L. Dreyfus and F. Hillebrand.—The conclusion of their paper on the theory of the three-phase commutator shunt motor. In the present instalment the authors discuss the arrangements for self-compensation and finally give a numerical example.—*Elek. u. Masch.* (Vienna), Nov. 6.

Lamps and Lighting.

Anti-vibration Support for Metallic Filament Lamps.—A note on a recent British patent (23,980, Nov. 3, 1910) of H. T. Harrison. In an anti-vibration support for metallic-filament lamps in street and other lanterns the lampholder is provided with a metal flange, and this is supported inside an insulating hood of inverted cup shape by means of three or more spiral springs arranged radially and horizontally between the flange and the hood. Two or more such supports may be fixed together to form a group fitting.—Lond. *Elec. Eng'ing*, Nov. 10.

Generation, Transmission and Distribution.

Bulk Supply from Large Generating Plant.—S. Z. de Ferranti.—His presidential address before the (British) Institution of Electrical Engineers. He proposes to transform all the energy of coal into electrical energy and to use this electrical energy for all purposes for which coal is used at present. To make this an effective system the heat conversion efficiency should be at least 25 per cent. This is possible with gas engines fed from gas producers. The by-products should be recovered at the same time. The scheme would be carried out in a comparatively small number of large generating stations. He figures the capital cost of generating works at $35 per kilowatt and the cost of the distribution system at $65 per kilowatt. Capital costs taken at 8.5 per cent would amount to 0.1552 cent per kw-hour and works costs are figured at 0.072 cent, bringing up the total cost to 0.2290 cent per kw-hour. The average price of the coal is assumed as $2.50 per ton. Further, it is assumed that one ton of coal will yield fixed nitrogen equivalent to 1 cwt. of sulphate of ammonia. He suggests the average price at which energy would be supplied throughout the country would be 0.25 cent per kw-hour, and sketches the effect which such a low cost would have on electric lighting and electric traction and on the use of the electric furnace for the manufacture of pig iron, aluminum, etc. He finally outlines the uses of the by-products, namely, fixed nitrogen in the form of sulphate of ammonia, together with tar and oils.—Lond. *Electrician*, Nov. 11.

Hydroelectric Plant in Baden.—An account of the proposed development of the Murg water-power in Baden, Germany. According to the plans of the railroad department of Baden there will be twelve turbo-generators, six of 4400-hp and six of 5000-hp maximum rating. Three-phase currents are to be generated at 10,000 volts. This e.m.f. is to be employed for distribution in the neighborhood. For transmission to greater distances the e.m.f. is to be raised to 70,000 volts. The power plant is to be built, operated and maintained by the railway department, which has already three steam-driven plants having an aggregate rating of 7800 hp.—*Elek. Zeit.*, Nov. 17.

Energy for Rolling Mills.—J. A. Knesche.—An article on the energy required for the rolling of iron and steel based on experimental tests. In the first instalment arrangement of the tests is described and the influence of temperature on the rolling of steel is discussed, with notes on pyrometers suitable for such work. In the second instalment the test data are tabulated and analyzed.—*Eng. Mag.*, October and November.

Traction.

Direct-Current Versus Single-Phase Traction.—H. M. Hobart.—A paper in which the author gives in considerable detail an estimate of the cost of a direct-current and a single-phase system for a typical case of railway. His final result is that the total cost per train-mile would be 37.6 cents for continuous current and 44.6 cents for single-phase. "The less frequent the trains the lower the speed, and the greater the distance between stops the less unfavorable to the single-phase system will be the results of such a comparison, but the less also is then the desirability of employing electricity, and by the time the point is reached where the single-phase system as at present developed is more economical than the continuous-electricity system the conditions are such that (except for very special cases) steam-locomotive operation constitutes the most economical system."—Lond. *Elec. Eng'ing*, Nov. 10.

London Underground Railways.—A detailed analysis of the cost of operation and earnings of the different underground railways of London during the past twelve months. With one exception there is a very satisfactory increase in the number of passengers, but the average revenue per passenger on all the tube lines shows a tendency to decrease. The Central London Railway shows a considerable increase in total working expenses, which are now 11.0 cents (against 10.20 cents last year) per car-mile—forty-eight passengers per car. This increase is distributed over a number of items, but repairs to permanent ways and cars, lift working, general charges and rates and taxes show an increase of 0.74 cent per car-mile. The last-mentioned item—namely, rates and taxes—appears to become an increasing handicap. Thus, these charges now amount to no less than 2.12 cents per car-mile. The cost of electric energy per car-mile has decreased by 0.2 cent. The City and South London tube has the low expense of 5.8 cents per car-mile (thirty-two passengers per car), which result is only surpassed by the 10.7 cents per car-mile (sixty-three passengers per car) of the Great Northern & City Railway.—Lond. *Electrician*, Nov. 11.

Gearing for Automobiles.—F. W. Lanchester.—His presidential address to the (British) Institution of Automobile Engineers. He thinks that the change-gear box is the weakest point in the chain of the mechanism of the modern automobile. The most promising alternatives to mechanical change gear up to the present proposed or utilized are: (a) hydraulic transmission, (b) electrical transmission and (c) electrical auxiliary. When one of the first two is employed it may either be arranged as a direct substitute for the change-gear box or may be made to operate direct from motor to road wheels, thereby doing away with the right-angle drive (bevel or worm) and even the differential. Both arrangements possess advantages and corresponding disadvantages. But the hydraulic system is superior to the electrical one, especially with respect to efficiency. He thinks an electric transmission system could never come into use except in exceptional cases, but that there are much better prospects for the third alternative, the electric auxiliary. He concludes that whether the gasoline-electric auxiliary system shall have a wider application than is now in contemplation must rest largely with the question of accumulator weight, not the weight per hp-hour—that is, the energy content—but rather the horse-power output—that is, the rate of doing work.—Lond. *Electrician*, Nov. 11.

Installations, Systems and Appliances.

New Home of British Institution of Electrical Engineers.—An illustrated article giving some details of the electrical equipment of the new home of the (British) Institution of Electrical Engineers on the Victoria Embankment in London. The lighting equipment of the lecture hall is divided into two main sections, that above the lay-light and that on the cornice. The former consists of four mercury-vapor lamps and the latter of 220 25-watt osram lamps fixed in channels of fluted glass round the cornice. These illuminate indirectly. Each alternate plug on this series is supplied from a separate circuit, there being ten circuits in all. The lighting of the hall is controlled by two sets of three two-way switches.—Lond. *Electrician*, Nov. 11.

Electrical Equipment of Post Office.—An illustrated description of the new generating station of the General Post Office in London, which supplies three-phase energy at 6600 volts to substations in the main post-office buildings in the city where the e.m.f. is lowered for lighting and motor service and for charging telephone batteries.—Lond. *Electrician*, Nov. 18.

Auto-Transformers.—W. W. Lewis.—The author first discusses with the aid of diagrams the fundamental principle of the auto-transformer, sometimes called a "compensator." He then discusses briefly house auto-transformers and auto-transformers for signs, arc lamps, mercury-arc rectifiers and motor starters.—*Gen. Elec. Review*, December.

Balancers for Three-Wire ...—... SALZMANN.—A [ma]thematical article illustrated by diagrams discussing the [fun]damental principles on which a motor-generator balancer [op]erates in a three-wire system.—*La Lumière Elec.*, Nov. 12.

Wires, Wiring and Conduits.

[S]tress and Sag in Overhead Wires.—R. WEIL.—According to [th]e standardization rules of the German Association of Elec[tric]al Engineers the determinations of stress and sag in over[hea]d wires require a double calculation. One calculation is [bas]ed on a temperature of — 20 deg. C. without any additional [loa]d. The second calculation is based on a temperature of — 5 [deg]. C. and an ice load. In the latter case the weight of the [ice] is assumed as 0.015 q kg per meter, where q is the [cro]ss-section of the conductor in square millimeters. In some [cas]es the maximum stress is found by the first calculation, in [oth]er cases by the second. The present author gives simple [for]mulas which show for which of the two calculations the [ma]ximum stress will be obtained. The calculation of the [ma]ximum sag is also given. The chief figures needed in the [calc]ulation of overhead wires are compiled in the form of [tabl]es, and the results are explained by means of diagrams [and] examples.—*Elek. Zeit.*, Nov. 17.

Electrophysics and Magnetism.

[Hi]gh-Tension Discharge.—E. W... and W. H. W...—A paper read before the London Physical Society on a new [met]hod for producing high-tension discharges. The method is [the] same as that described by the authors in their British Asso[ciati]on paper, recently noticed in the Digest. According to [this] method energy is taken from an alternating-current or [cont]inuous-current source and is stored in a magnetic field by [an i]nductance; it is then permitted to surge into a condenser [whic]h, with the inductance, forms a low-frequency oscillating [circ]uit. When the energy is stored in the condenser the latter [is m]echanically bridged across the primary winding of a spark [coil] with which it forms a high-frequency oscillatory circuit. [The] energy is then transmitted by the secondary winding of [the] spark-coil to the work circuit in the well-known manner.—[Lond]. *Electrician*, Nov. 11.

[Diel]ectric Properties of Pure Vaseline.—An experimental [treatme]nt of dielectric anomalies during change of state of an [insul]ating medium. Pure vaseline, which is an insulator at [ordi]nary temperatures and a conductor when in the liquid [state], acts at intermediate temperatures as a medium charged [with] free ions of opposite signs, whose mobility, which is noth[ing] when the substance is semi-fluid, is only indicated when [liqui]d portions appear.—Lond. *Electrician*, Nov. 18.

Electrochemistry and Batteries.

[Heat]ing and Cooking Apparatus.—A note on a recent British [paten]t (23,818 and 23,819, Nov. 3, 1910) of G. G. Bell and J. V. ... These patents relate to cooking apparatus in which the [heat] is stored up in an isolated body of material and con[veye]d away when required. According to the first specifica[tion] water pipes are embedded in the heat-storing body and [form] a closed circulating circuit with pipes placed in an oven [eithe]r inside or adjacent to the body. The latter pipes are ar[range]d helically to form one or more hot plates on which the [cooki]ng utensils can be placed. The heating element is em[bedde]d in the heat-storing body, but an additional element may [be plac]ed in the oven. The second specification describes an ... oven with a vent pipe for allowing the products of ...[io]n to escape. Special utensils are employed, each hav[ing a] pipe or vent in the lid communicating with the outlet.—[Lond.] *Elec. Eng'ing*, Nov. 10.

Units, Measurements and Instruments.

[Elec]tric Testing of Water.—An article on an electric appa[ratus] designed by Digby and Biggs for the testing of water. [It is] based on the fact that the conductivity of water is a good [indic]ation of the degree of its hardness. The apparatus con[sists] of a glass U-tube, the bend of which is connected with a drain pipe of rubber closed by a pinchcock, and to a third vertical tube ending in a funnel for filling. An electrode consisting of a ring of platinum strip is fixed at the top of each arm of the U-tube. The tube, after being washed out, is filled with the water to be tested and the electrodes are connected by a twin-flexible and plug to a sealed box containing a direct-reading conductivity meter and a hand-driven direct-current generator. This machine generates at 100 volts, when the speed of turning is such that the clutch is felt to slip and the meter then reads directly in conductivity units (the reciprocal of megohms). By giving the electrodes a large surface and using a long tube variations in conductivity due to gas bubbles on the electrodes are practically eliminated. The back e.m.f. of polarization (about 2 volts) is allowed for in making the scale. As the conductivity varies with the temperature, the temperature is measured, and the readings are corrected by means of a table. A chemical analysis is necessary in the first case to determine the nature of the impurities in the water, as this apparatus does not discriminate between the different dissolved substances. It indicates and measures as a percentage any change in hardness, however, showing that alternations are required in the softening process. The actual degree of hardness in grains per gallon may be deduced at any time from a curve which is plotted at the time the chemical analysis is made. One important application of the apparatus is for the testing of surface condensers. As any leakage of the cooling water (which generally contains dissolved matter) into the condenser increases the conductivity of the hot well water, a test of the latter will indicate the slightest leak. Taking the conductivity of distilled water at 2, the addition of 1 per cent of London tap water will raise it to 7 while 1 per cent of sea water will raise it to 620. Boiler priming is detected in a similar manner. —Lond. *Elec. Eng'ing*, Nov. 17.

Meter.—The official communication of the Reichsanstalt by which a direct-current motor meter of the Felten-Guilleaume-Lahmeyer Company is admitted for calibration. Two different types are described, one with a single armature and the other with an astatic double armature. Both types can be used for two-wire and three-wire networks. The construction and method of calibration are described.—*Elek. Zeit.*, Nov. 17.

Alternating-Current Potentiometer.—H. TINSLEY.—A complicated vector diagram is given showing the accuracy with which the phase differences and magnitudes of alternating currents in complex circuits can be measured by C. V. Drysdale's alternating-current potentiometer, the angles being read on a dial.—Lond. *Electrician*, Nov. 18.

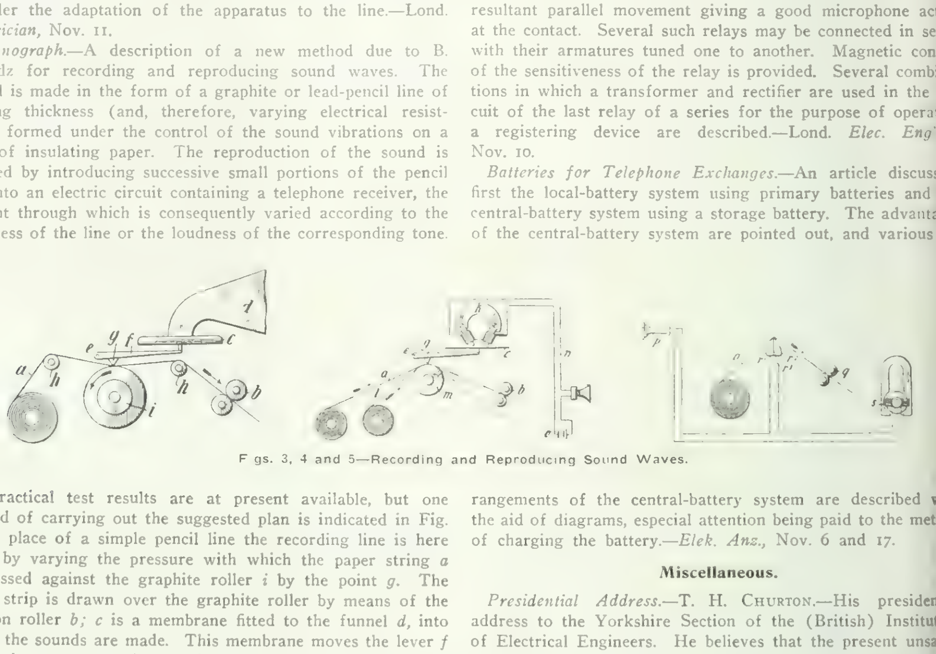
Localizing Faults.—H. E. CANN.—An article on the localization of partial faults in submarine cables by means of Cann's triple test to true zero. A numerical example from practice is added.—Lond. *Elec. Review*, Nov. 18.

Telegraphy, Telephony and Signals.

Long-Distance Telephony.—At the recent Paris conference of telegraph and telephone engineers Breisig discussed some theoretical questions regarding cables loaded with inductance coils according to the Pupin system. Reflection and distortion are important points theoretically. To study fully the former it is necessary to examine the variable condition of telephonic currents—a very difficult task, which had not yet been done. Distortion is produced by the inequality in the attenuation of currents of varying frequency which modifies the tone (timbre). Experiment indicates, however, that distortion is not so important as has hitherto been thought. If this is so, it should be possible to construct telephonic lines more cheaply, especially as regarded the Pupin coils, which cost more because in the past the endeavor has been to give them a resistance more independent of the frequency. Holmstrom stated that the microphone of Egner and himself for long distances, in which a tightly stretched diaphragm is used, does not accord with Bela Gati's theory that it is the highest fundamental sound of the diaphragm which gives the loudest reproduction to the highest frequencies of the human voice. Their diaphragm has

a note of 200 vibrations per second. It is stretched for quite other reasons. By stretching it and fixing the electrode firmly to its center they cause each point of the surface of the electrode in contact with the carbon granule to vibrate exactly with the same phase and the same amplitude. For comparative tests they have used an artificial cable of the British Post Office with a coefficient of attenuation of a little less than 1 per ten miles and an undulation of 5000. With such a cable they had been able to speak over a distance of 130 miles. Breisig said that when the islands in the North Sea were telephonically connected with Germany transmission was very weak because of reflection in the apparatus. Six years ago the secondary of the induction coil and the winding of the receivers were altered so that the whole gave only 20 ohms and the self-induction was increased from 1 to 4 or 5. Speaking then became loud and clear. It was worth while, therefore, to consider the adaptation of the apparatus to the line.—Lond. *Electrician*, Nov. 11.

Phonograph.—A description of a new method due to B. Gwozdz for recording and reproducing sound waves. The record is made in the form of a graphite or lead-pencil line of varying thickness (and, therefore, varying electrical resistance) formed under the control of the sound vibrations on a strip of insulating paper. The reproduction of the sound is effected by introducing successive small portions of the pencil line into an electric circuit containing a telephone receiver, the current through which is consequently varied according to the thickness of the line or the loudness of the corresponding tone.



Figs. 3, 4 and 5—Recording and Reproducing Sound Waves.

No practical test results are at present available, but one method of carrying out the suggested plan is indicated in Fig. 3. In place of a simple pencil line the recording line is here made by varying the pressure with which the paper string *a* is pressed against the graphite roller *i* by the point *g*. The paper strip is drawn over the graphite roller by means of the friction roller *b*; *c* is a membrane fitted to the funnel *d*, into which the sounds are made. This membrane moves the lever *f* about the center *e* and so varies the pressure of the point *g* against the paper. In place of the graphite roller, of course, an actual pencil point might be used or a carbon sheet, such as is employed in the typewriter. The membrane also need not be influenced directly by the sounds. It can be arranged—as in Fig. 4, for instance—to be vibrated by means of an electromagnet *k* actuated by the currents passing into the battery and microphone circuit *n*. In this diagram the graphite roller is shown replaced by a metal roller and a strip of carbon paper *l*. Fig. 5 shows one form of the reproducing apparatus. A circuit is formed leading from some current source *s* to a telephone receiver *p* and to the two metal prisms r_1 r_2, which are separated by the thin insulation strip r_3. The paper strip *a* with the graphite record on it is run, face downward, over the point of the prisms, as shown, thus closing the circuit at each instant by means of a short piece of the record line and allowing a current to pass through the telephone depending on the thickness of the record line at that spot.—*Der Mechaniker*, No. 6; abstracted in Lond. *Elec. Review*, Nov. 11.

Detectors for Wireless Telegraphy.—W. H. Eccles.—A paper read before the London Physical Society on the energy relations of certain detectors used in wireless telegraphy. The author describes the results of experiments on the properties of electrolytic, carborundum, zincite-chalcopyrite and graphite-galena detectors, small quantities of energy of the same ord as in practice being employed. The author shows that the en ergy in the telephone is linearly connected with that in the d tector and suggests that all detectors are fundamentally the mal in action. The latter conclusion differs from that of oth experimenters, perhaps owing to the latter employing larg quantities of oscillation energy.—Lond. *Electrician*, Nov. 11.

Relay for Wireless Telegraphy.—A note on a recent Britis patent (10,210, Nov. 3, 1910) of W. P. Thompson (Gesellscha für Drahtlose Telegraphie, Berlin). In order to be able t receive very weak signals use is made of an oscillating rel in combination with a local telephone circuit. The relay co sists of a light oscillating armature supported on two stretch wires and having fixed to it one electrode of a sensitive ca bon microphone contact. The armature is tuned to t periodicity of the received signals and resonates to them, t resultant parallel movement giving a good microphone acti at the contact. Several such relays may be connected in seri with their armatures tuned one to another. Magnetic contr of the sensitiveness of the relay is provided. Several combin tions in which a transformer and rectifier are used in the ci cuit of the last relay of a series for the purpose of operati a registering device are described.—Lond. *Elec. Eng'in* Nov. 10.

Batteries for Telephone Exchanges.—An article discussi first the local-battery system using primary batteries and t central-battery system using a storage battery. The advantag of the central-battery system are pointed out, and various a rangements of the central-battery system are described wi the aid of diagrams, especial attention being paid to the meth of charging the battery.—*Elek. Anz.*, Nov. 6 and 17.

Miscellaneous.

Presidential Address.—T. H. CHURTON.—His president address to the Yorkshire Section of the (British) Instituti of Electrical Engineers. He believes that the present unsat factory state of the electrical industry in England is due to t productive capacity of its factories exceeding the demand the market that is open to them more than to anything el He outlines some of the directions in which modern desig of machinery are tending and emphasizes the value of standar ization within the factory, although he is not so much in fav of attempts to bring about universal uniformity of detai There is, however, good and sufficient reason for an endeav to establish agreement as to the definitions of terms used a for the adoption, by general consent, of certain standard spe fications respecting the performance of electrical machine qualities of materials and other such matters. He does not co sider the attempts of the Engineering Standards Committ in this direction altogether satisfactory. He does not ag with the six-hour run as a test for continuous rating nor t one-hour run for intermittent rating on account of the ve different time-constants of different-sized motors. Nor a the standard speeds suggested for each horse-power of mo use. The standardization of voltages and frequencies is, ho ever, of great importance.—Lond. *Electrician*, Nov. 18; a stracted in Lond. *Elec. Eng'ing*, Nov. 17.

Brussels Exhibition.—G. SCHLEE.—The first parts of an illu trated article on exhibits of the German electrical industries the world's fair in Brussels. In the first instalment light

[eq]uipment, generators, motors and electric hoisting plants are [di]scussed, and in the second instalment measuring instruments [an]d meters are dealt with.—*Elek. Anz.*, Nov. 13 and 17.

Ferranti.—A biographical sketch with portrait of Sebastian [Zi]ani de Ferranti, the new president of the (British) Institu[tio]n of Electrical Engineers.—Lond. *Elec. Rev.*, Nov. 11.

Technical Education.—C. F[illegible] presidential [ad]dress to the Newcastle Section of the (British) Institution of [E]lectrical Engineers. He said that In England a more practical [fo]rm of education is required. The present systems tends to re[ga]rd the successful passing of an examination as a proof of the [sc]holar's knowledge, but it only proves his ability to pass ex[ami]nations, while the true proof of the efficiency of his educa[tio]n is his ability to earn a good living for himself and a social [po]sition somewhat better than that which he would inherit [fr]om his parents. He points out how rapidly a good engineer[in]g draughtsman or architect can take in the whole of a de[si]gn and point out errors before the quickest readers could pos[si]bly understand a tenth part of it if described in writing, yet [ho]w very few people are able to make even a tolerably good [sk]etch. Drawing should be generally learned in schools. The [au]thor refers to the "often rather openly shown want of ap[pr]eciation exhibited by the theoretical student for his practical [as]sociates either in the college or works, this resulting in the [br]each between the practical and theoretical sections of works [wh]ich so often leads to the want of efficiency, especially in the [th]eoretical departments. It is this breach between the theoreti[cal] and practical departments that accounts for the inefficiency [of] much of our present work." He gives some examples from [pr]actical work in a factory. Attention was once called by him [to] the importance of having the platinum leading-in wires of [th]e lamps thoroughly clean. Several times attention had been [dra]wn to this trouble, but it had not been stopped. "The [hig]hly trained scientist is apt to consider such matters as dirt [on] a piece of wire as something that the foreman should [see] to, and frequently he is satisfied that his work is done as [soo]n as he has censured the foreman. It is, however, this sort [of] thing that causes the damage, for by a more judicious [pro]cess it was found that it was possible to get the wires [act]ually sealed into the glass perfectly clean and yet when the [lam]p was finished the wires in some cases were dirty or at [lea]st black. By following the matter up it was discovered that [the] glass was being decomposed and the oxide of lead in it [bei]ng converted into metallic lead on one pole." The matter [was] still further pushed and indications were obtained of gas [giv]en off at the opposite pole. "Education must consist of two [prim]ary processes, namely, impressing on the brain a picture, [and], secondly, the cultivation of the brain in such a way as to [ena]ble it readily to receive the pictures and to be able to call [the]m to mind at will. Profitable education must consist of the [oppo]rtunities given to the brain of obtaining records and the [...]ice and permanency of the records obtained." The over[cro]wding of the brain with records seems to crowd out the [fac]ulty of putting together the various ideas, or maybe the [imp]ression gets so permanent that the mind can only see [the] thing exactly as it was. As to the importance of clearly [unde]rstanding a problem, "America is a most striking example. [The] success in America is the clear view of what might be [call]ed the meeting point of every problem—namely, does it [pay]?" As to the success of industrial developments, "the secret [is s]imply a good, or real, combination of capital and labor, of [theo]ry and practice, backed, of course, by good commercial [abil]ity." Mr. Proctor finally referred to the "ridiculous and [com]plicated system of weights and measures used in this [cou]ntry, for which system all are individually responsible to [som]e extent." In this connection he indorsed the very practical [sug]gestion that those desirous of aiding progress should fol[low] the example of the American Electrochemical Society, the [Illu]minating Engineering Society and the American Institute [of] Electrical Engineers in insisting that all papers containing [En]glish measures must have the corresponding metric values [to] a like degree of numerical precision inserted immediately [th]ereafter.—Lond. *Electrician*, [illegible]

Book Reviews.

Einführung in die Technische Elektrochemie. Erster Band Elektrothermie. Dr. Paul Askenasy. Braunschweig: Friedrich Vieweg & Son. 251 pages, 69 illus. Price, 10 marks.

This is a practical treatise on applied electrochemistry written for chemical engineers and electrochemists. The principal subjects treated are: (1) The electric furnace in relation to calcium carbide and ferrosilicon. (2) The refinement of iron and steel in electrical furnaces. (3) Carbide of silicon. (4) Zinc refining. (5) Nitric acid. (6) Ozone. The text is illustrated by pictures and diagrams of furnaces and other electric installations. Accounts are given of the results obtained in these various installations. There is no algebraic and very little chemical symbolism in the book. The descriptions are clear and simple. Some historical outline of the processes is given, The book will be of interest to students of electrochemical engineering, especially to those inquiring into German practice.

La Practica della Costruzioni Elettromeccaniche. Second edition. By G. Pardini. Milan: E. Bignami & Company. 500 pages, 346 illus., 12 folding plates. Price, 4 lire.

The standard types of construction used in generators, motors, converters and transformers built on the Continent of Europe are described in detail in this volume. The subject is treated in accordance with the following outline: General discussion of electric machines and their classification; materials used in construction and their properties; effect of losses on the construction; practical limiting factors of design; the magnetic circuit; windings and insulation; mechanical parts (frame, bearings, etc.); accessories (commutators, collector rings, brushes, etc.); testing of materials used in construction; testing of machines; calculation of the mechanical parts; calculation of the electrical constants. The book is profusely illustrated and at the back twelve folding plates of designs are inserted. It is bound in paper covers and is printed on a cheap paper, which partly accounts for the low price of the book.

Arbeiten aus dem Elektrotechnischen Institut der Grossherzoglichen Technischen Hochschule Fridericiana zu Karlsruhe. 1908-1909. Edited by E. Arnold. Berlin: Julius Springer. 310 pages, illus. Price, 10 marks.

This is a collection of six experimental researches undertaken during the year 1908-09 at the Karlsruhe Electrotechnical Institute. The reports refer to the following subjects:

Commutation in Direct-Current Machines; The Friction of Dynamo Brushes; The Single-Phase Compensated Repulsion Motor; Alternating-Current Series Motor with Compensating Poles; Interpole Magnetic Leakage; Commutation Phenomena; Contact Resistance Between Commutator and Brushes as Affected by Temperature.

The work has been carefully edited by Dr. Arnold, the well-known designer and electrical machinery specialist, and the book will be of great interest and utility to designers of direct-current and alternating-current machines.

L'Électricité Considérée comme Forme de l'Énergie. By E. Aries. Paris: Hermann & Sons. 176 pages. Price, 5 francs.

A theoretical dissertation upon electrostatic and magnetostatic energy following the analogies presented by thermodynamics. The laws of Kelvin, Ohm, Joule, Coulomb, Gauss, Faraday and other writers are reviewed and collated mathematically. The author deals with the fundamental laws of the distribution of electric and magnetic energy in the space surrounding an electrified or magnetized body. The book will be of interest to advanced students in physics, but is not adapted to the needs of the engineer.

Edison: His Life and Inventions. By Frank L. Dyer and Thomas Commerford Martin. New York: Harper & Bros. 2 vols., illus, 989 pages. Price, $4.

There is altogether too little of electrical biography, and a year in which we receive excellent and adequate studies of two such men as Kelvin and Edison is to be marked with pleasure. In the case of Kelvin there was the opportunity to present a rounded and finished career; and the treatment of his great subject by Prof. S. P. Thompson was perfect. In the present instance it is not possible to tell the full story, for, altogether aside from certain unavoidable limitations always to be encountered when the subject of a biography is alive, Edison happens to be, at the age of sixty-three, in the full tide of activity and productiveness. A man who is improving all his earlier apparatus in light and power, trying to operate steam railroad cars by storage batteries, and building cement villages has not altogether brought his life to a close.

Yet the method adopted in this book is satisfactory, for outside of the personal matter dealing with Edison's boyhood, his successive laboratories, his adventurous youth and toilsome middle age, and his home life, the story is made a record of electrical development during the past fifty years. In other words, with Edison's own work in a given field as the core each chapter is a vivid and complete discussion of the art upon which Edison directed his tremendous energies and in which he made his splendid achievements. Hence, while the book is replete with anecdote, and has no dull pages, it is a serious effort to present our times from an electrical standpoint and to acquaint the public with what has actually been done up to the moment in developing practically all the great electrical inventions. And while the effort has been successful, and while the narrative as a whole has sustained interest and fascination, the technical description of specific inventions has been carried further in a series of appendices based on Edison's patents in each field or group of inventions. In this way the progress of the story is relieved, while the more studious reader can look deeper into the theory and principles involved.

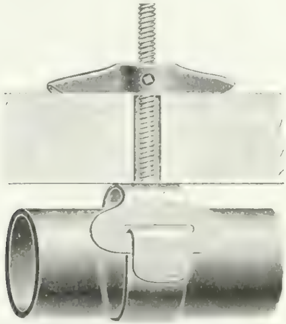
The life of Edison is a rare opportunity for any biographe The authors of this book have been equal to it and have mac a most notable contribution to electrical literature, well writte eminently readable, authentic in its details and authoritative its data. It not only has Edison's express approval, but em braces a large amount of autobiographic material of an in tensely valuable nature from the light it throws on himsel Edison has been called our greatest living American. The is nothing in this book to lessen such an attribution, but mu to strengthen the belief that in him we have a unique figure an extraordinary period of invention and industrial expansio In the story of his really heroic struggles to conquer natu and learn her secrets there are stimulus and encouragement f all who desire to serve their day and generation.

Owing to the limitations pointed out above this cannot considered the definitive life of Edison, though a critical bio raphy, when written, will almost necessarily fall far short the present work in human interest. The future biograph will have a worthy task in analyzing the intellectual process by which Edison has produced so much for the world; f aside from his utilitarian accomplishments Edison is also man of powerful intellect and wide range of thought, whi facts have been obscured by his wizard-like achievements and t fascination of his very human personality. We hope that in future edition the technical descriptions in the text will be vised in order to correspond more nearly to the limitations the average reader. While these passages will satisfy the tech cian accustomed to the exactitude of the patent specificati they are seldom of the kind that enables one to picture read in the mind the object described. Another improvement wo be in the substitution of good engravings for the abomina half-tones that disfigure the present edition. The work is, ho ever, vastly superior to any of the preceding books on Edis and should be on the bookshelf of every electrical man, not o on account of its direct subject, but also because its pages cidentally include an admirable epitome of the electrical during its greatest period.

New Apparatus and Appliances

CONDUIT HANGER.

The clamp illustrated herewith has been designed especially for use in suspending electric lighting conduit from hollow-

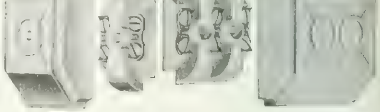


Conduit Hanger.

tile ceilings. Use is made of only one toggle per fastening and only one hole is drilled therefor. It is claimed that the construction is more substantial than one involving the use of two toggle bolts, because the latter construction necessitates the drilling of two holes so close together as to weaken the tili The hangers are made of zinc and are entirely rust-pro They are well adapted for use in fireproof buildings. They made by the Yonkers Specialty Company, Yonkers, N. Y.

WIRE-SPLICING BLOCKS.

The two-wire and three-wire blocks shown herewith h been designed for "straight-away work" where splicing w formerly necessary. These blocks are arranged to meet



Two-Wire and Three-Wire Splicing Blocks.

requirements of the Underwriters, according to which joi and taps are not allowed in molding unless protected by fitti The blocks have been developed for the market by the Tru Electric Manufacturing Company, Plainfield, Conn.

A LARGE SOLENOID-OPERATED BRIDGE LOCK.

The Havana (Cuba) Electric Railway Company has had built by the Cutler-Hammer Company, Milwaukee, several very large solenoid-operated bridge latches to be used on one of its new interlocking bridges at Havana. The solenoid is designed for operation at street-railway trolley voltage and takes initially about 10 amp, exerting on its 4.5-in. core a pull of 350

Solenoid-Operated Bridge Lock.

), through a distance of 4 in. When the core reaches the end f its travel a switch is operated which automatically inserts ıe protective resistance. This is wound on the electromagnet ›il itself, and though reducing the current, acts to increase the ffective ampere-turns about the core, providing a powerful olding action on the bolt. The solenoid winding is entirely ıclosed against the entrance of moisture and the lock can be ounted on the bridge without respect to external conditions.

PACKARD LOW-VOLTAGE TRANSFORMERS.

Ever since the tungsten lamp was placed on the market there ıs been a demand for low-voltage transformers to supply cur-

Low-Voltage Transfor...

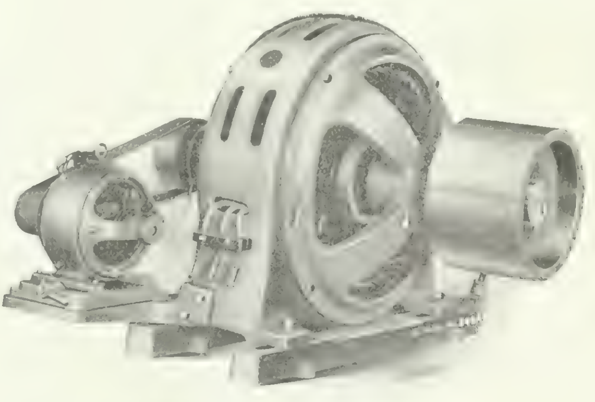
ıt at from 10 volts to 30 volts. While these have been built a variety of forms a transformer for this purpose de-·ves better care in its design and manufacture than it has ıally received. Its efficiency should be high, since it is supply high-efficiency lamps. Its insulation should be thor-ıgh, though it is built for low voltages, for it very likely mounted indoors when there is a fire risk. For the same ıson it should be mounted in a substantial case of good pearance. Realizing all of the above points, the Packard Elec-: Company, Warren, Ohio, has lately improved and amplified its line of "Mazda" transformers, and while the type it has been selling for two years has given good satisfaction, the manufacturer believes that the present type is the superior of anything before attempted. The case is cast iron of exceptionally neat design. The insulation and general construction are the same as for higher voltages, and the efficiencies are said to be high. These transformers are furnished in 1/10 kw, 1/8 kw, 1/4 kw, 1/3 kw, 1/2 kw, 1 kw and 1 1/2 kw sizes for either 110 volts or 220 volts primary and for secondary voltages of 10 to 30, the lower voltage being for sign lighting.

DIRECT-ATTACHED BELTED EXCITERS.

The modern electric light plant in cities of moderate size generally contains belted alternators of capacities of 200 kw or less, which are generally excited by a small direct-current belted exciter installed on a separate foundation driven by a belt from a pulley on the alternator shaft. An objection to this method is that the operator experiences difficulty in maintaining proper belt tension, the adjustment of the main alternator belt disturbing the exciter belts and frequently resulting in a hot box on the exciter.

To overcome this and other objections the Electric Machinery Company, of Minneapolis, Minn., has recently put on the market moderate-sized alternators with direct-attached belted exciters, as shown in the accompanying illustration. This type of alternator with exciter mounted on a cast-iron bracket, which is attached directly to the alternator frame so as to move with it, eliminates the difficulty experienced by operators in maintaining proper belt tension on both the main belt and the exciter belt, so as not to endanger the exciter bearing in case the exciter belt is too tight, or, on the other hand, allow the exciter belt to slip off and interrupt service if it is too loose. These alternators are furnished in sizes from 30 kva to 180 kva, 600 r.p.m. to 1200 r.p.m.

The belt centers are shorter than in the case of separately mounted exciters, but the two pulleys are made amply large and of generous width of face. The exciter and the alter-



Alternator with Direct-Attached Belted Exciter.

nator are of the standard spherical design. Each alternator rail has its own ratchet head and the two ratchets are locked together by a cross bar so as to be operated simultaneously by a single lever. The machine may be pushed or pulled by these ratchets by simply throwing the little pawls to the right or to the left.

It is stated that the cost of this arrangement is less than that of an exciter on a separate foundation with a long belt, while it will also secure to the exciter a good deal better attention from the operator and also require much less floor space

than the usual way. In case of trouble with the direct-attached belted exciter it can be replaced instantly by any belted exciter while the trouble with the regular exciter is being repaired. In case of trouble with a direct-connected exciter it is much more difficult to install a temporary exciter.

MOTOR-STARTERS, MILL AND CRANE CONTROLLERS.

A line of direct-current and alternating-current motor-starters and mill and crane controllers has recently been placed upon the market by the Allen-Bradley Company, of Milwaukee, Wis. These devices are of the carbon-compression type, the resistance element being in the form of two columns of prepared graphite disks. As is well known, the contact resistance of such columns varies with pressure, and resistance changes

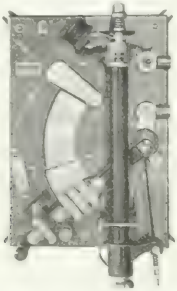


Fig. 1—Direct-Current Motor-Starter.

are caused by subjecting the columns to various degrees of compression. The columns are inclosed within an insulated steel tube which is provided with suitable terminals and a plunger for transmitting the pressure to the disks contained therein. The graphite disks are well adapted for rheostatic service, as they will not crush or break, are not affected by any temperature encountered in rheostatic service, cannot be fused, will not corrode and are not changed materially by years of service.

Whatever switching is necessary in combination with these devices is accomplished by suitable contacts attached to the compression mechanism. A 35-hp Allen-Bradley direct-current motor-starter is shown in the accompanying illustration (Fig. 1). The tube containing the resistor columns is mounted on the front of the slate panel. The operating lever is of the ordinary form and the compression of the resistor column and the consequent cutting out of the resistance are brought about by

Fig. 2—Starter for Slip-Ring Induction Motors.

raising the lever as is done in the ordinary type of starter. Owing to the gradual change of resistance the starting of the motor is accomplished without jerks or flashing.

The mill and crane controller, shown in Fig. 3, embody the described compression resistor and are built to withstand the most severe controller service. In the alternating-curren motor-starters for slip-ring and squirrel-cage induction motor the mechanical pressure exerted upon the resistors in the sev eral phases is equalized by means of suitable mechanism so that the resistance in each of the phases is always the same a any instant and unbalancing is thereby prevented.

The squirrel-cage starter is so designed that when the switc is thrown into the starting position the elongation of the re sistance columns, due to heat expansion, is retarded in such manner as gradually to compress the resistor columns, whic results in automatically reducing their resistance until the mo tor starts. After the motor has reached its normal speed th switch is thrown into the running position, at which point th running fuses are brought into circuit. Fig. 4 shows th

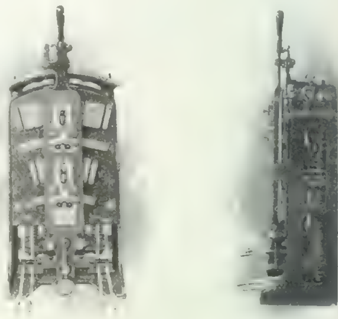


Fig. 3—Mill Controller.

squirrel-cage starter with a conventional switch, but differe types of switches can be employed to meet varying condition It is claimed that the even and gradual current flow when star ing the motor, the increased torque when the motor is accelera ing, together with its simplicity and ruggedness, make this ty of rheostatic starter in many cases, as when the motors a small or medium-sized, a more serviceable device than th complicated auto-starter.

The manufacturers state that while these rheostatic starte require in their operation about 15 per cent more power fro the line than is demanded of the auto-starter, the actual curre supply to the motor is no greater and oftentimes less, as t starter automatically prevents more current from flowing th is absolutely necessary to start the load, even though the lo may vary at different starting periods. As the wattless co ponent of the line current is less with the rheostatic starter, t disturbance to the line voltage is no greater than with the aut

Fig. 4—Starter for Squirrel-Cage Induction Motors.

starter. It will be noted also that the running fuses are p tected during the acceleration of the motor, so the greater l current is seldom an objection. This type of starter is made capacities up to 25 hp.

The slip-ring starter, shown in Fig. 2, is equally simple and urable in its construction. The starting of the motor is done ıanually by means of the operating lever, there being no autoıatic action in connection with this device. Among its good eatures the most notable is that of causing even acceleration f the motor without flashing or destruction. It is made in our sizes, varying from 1 hp to 100 hp.

TELEPHONE SYSTEMS IN MINES.

The past few years have witnessed quite a few installations f telephone systems in underground shafts. When the Legisture of Illinois, following the disaster of last year in the herry mine, passed a law requiring the adoption of protective evices in mines one of the results was an increased interest telephones in all the mining sections of the country. New pes of iron-clad telephones have been developed by manufacrers to meet the augmented demand. In the coal fields of ennsylvania considerable attention is now being paid to underound telephone systems. Mine operators have recently come realize that the telephone system, reaching every important rt of the mine and placing the most remote shaft or gallery instant touch with every other important point, is an indisnsable feature of the mine equipment. An installation in the ine-room of a coal mine near Pittsburgh is the subject of accompanying illustration, taken from a photograph obned 12,000 ft. from the entrance to a shaft. The Western

Telephone in a Mine.

tric instrument has its inner parts protected by two metal , only one of which, as can be seen in the picture, is open n the telephone is in use. Electric lamps have been placed the telephone to keep the air surrounding the instrument ry as possible. In shaft mines the telephones are sometimes ected with wires maintained primarily for other purposes. circuits are not insulated, and miners traveling about in tunnel are able to bridge across the circuit at any point and ive signals from any part of the mine. A few weeks a telephone system had been installed in one mine in the burgh district the telephone was instrumental in checking rious underground fire. An employee detected the smell moke and, running to the nearest telephone, informed the ite-branch exchange operator at work in a building near mouth of the mine. The operator called each telephone [illegible] for the blaze. At the same time the superintendent, who was at his home, was notified by telephone. In this way the fire was reached and extinguished through the timely warning given over the telephone

WIRING ENTRANCE BOXES.

The entrance box illustrated herewith is provided with bushing holes at the top and the bottom large enough to accommo-

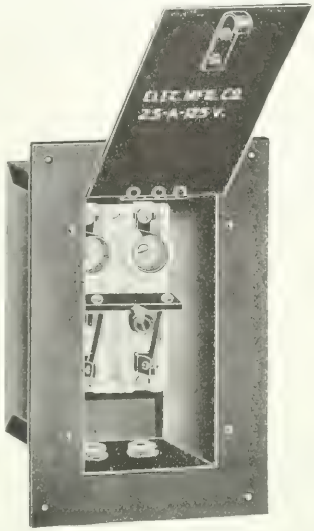


Fig. 1—Two-Pole Type of Wiring Box

date either bushing or ½-in. conduit so that the box is interchangeable for either open-type or conduit wiring. The box

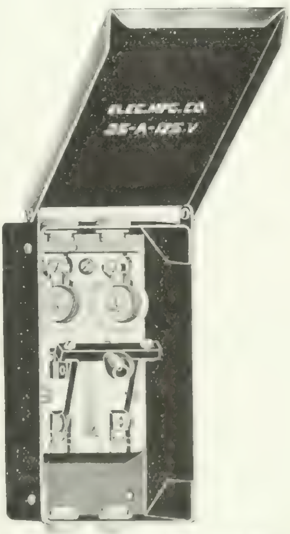


Fig. 2—Two-Pole Type of Wiring Box

has been placed on the market in both the two-pole and threepole type by the Electric Manufacturing Company, New Orleans, La

Industrial and Commercial News

THE WEEK IN TRADE.

THERE was some revival in business last week, due to the stimulating effect of the holiday trade throughout the country. With few exceptions, the jobbers reported this trade as being very good. Especially excellent reports are received from the South, where the high prices for cotton have had a beneficial effect, and from the Northwest, where the cereal crops were marketed early. Retail trade in the industrial centers is not so active and is hardly satisfactory. The general spread of cold weather has also had the effect of increasing the demand for heavy wearing apparel. In the industrial lines there is little change to be noted, and the iron and steel mills are only operating at about one-half of capacity in most sections. The coal trade shows some activity, but pig iron is still dull and prices are uncertain. The advance of the season has checked building operations, and structural iron and lumber are quieter in consequence. During the past week the Pennsylvania Railroad Company placed its order for 150,000 tons of steel rails. While this tonnage is somewhat larger than was expected, it is less than that placed last year. The allotments of the orders of the company have not yet been accepted by all of the steel companies with which they were placed, and it is intimated that there will be considerable discussion regarding specifications before the order is finally booked. The New York Central Railroad is reported to be figuring on an order of 100,000 tons. These are the only rail orders of any importance in sight. The railroads do not appear to be disposed to order cars or other equipment unless they can get them at lower figures than have as yet been quoted. In fact, throughout the entire industrial and traction world there is a feeling that the country is approaching a period of moderate activity. Collections, which are quoted as from slow to good, are relatively best in the South. Business failures for the week which ended Dec. 1, as reported by *Bradstreet's*, were 217 as against 212 the previous week, 230 in like week of 1909, 234 in 1908, 272 in 1907 and 216 in 1906.

THE COPPER MARKET.

ELECTROLYTIC copper declined during the past week about ⅛c. per lb. in the local market and from 10s. to 15s. per ton in Europe. The reaction in the price of standard and other grades of copper was equally pronounced. It is beginning to be generally realized that, in spite of the many optimistic publications that the copper producers and their selling agents are making, the statistical position is not at all favorable. This realization has led to the liquidation of some standard contracts and to the freer offerings of electrolytic for shipment. The demand from consumers, both here and abroad, has been light. Although the activity in the electrical industry has been so pronounced that copper dealers have believed that the stocks in the hands of manufacturers must be running low, no evidence of such depletion has yet been shown in the market. It is not improbable that most of the large users of copper are covered to February or March. The market is now anxiously awaiting the figures of the Copper Producers' Association, which will be made public at the end of the present week. If the production figures at this time show any considerable effect of the promised curtailment, the copper market will immediately feel the result in an improvement of tone and possibly in a strengthening of prices; but if the production figures still show that the output is running at something near the figures that have been given out during the summer and fall it will be taken to mean that the surplus stock has largely increased. This will be understood whether the increase of surplus shows in the actual figures or not. Exports of copper during November were 29,097 tons, according to the Custom House figures. Exports of November a year ago were 24,028 tons, and in November of 1907 were 34,087 tons. This indicates that the shipments of copper are a trifle better than last year, but not so good as in the prosperous days of 1907. The total exports of copper since Jan. 1 up to the end of November have been 268,965 tons, as compared with 273,553 tons in the same period last year, and 268,353 tons in 1908. From this it can be seen that the general consumption of copper abroad has varied very little within the past three years. Imports of copper during the month are estimated to have been between 12,000 and 15,000 tons. Since the first of December exports have been 3,787 tons. The daily call on the Metal Exchange Dec. 5 quoted standard copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.40	12.50	....
December	12.40	12.[illegible]	12.4[illegible]
January	1[illegible].45	12.[illegible]	[illegible]
February	12.[illegible]	12.[illegible]	12.[illegible]

The London market [illegible] was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	[illegible]7 3 9	[illegible]
Standard copper, future	[illegible]8 0 0	57 [illegible]

Extreme fluctuations [illegible]

	Highest.	Lowest.
Standard	13.[illegible]	11.[illegible]
London, spot	[illegible]	[illegible]32 15 [illegible]
London, futures	[illegible] 18 [illegible]	[illegible] 7 6
Best selected	6[illegible] 10	[illegible]

INDUSTRIAL AND COMMERCIAL NOTES.

Oil Engines for Wireless Equipment.—Mietz & Weiss manufacturers of oil engines, New York, have recently taken an order from the United States government for eight 3-cylinder 12-hp, self-starting oil engines, to be used on warships for operating the wireless equipment. These engines will be direct connected with the Siemens-Halske generators. The wireless equipment will be furnished by the Telefunken Wireless Telegraph Company. This is the second order of this kind the same manufacturers have received from the navy. The first order which was referred to in our issue of July 14, 1910, was for engines of 7-hp. Mietz & Weiss report that the demand for oil engines for service in small central stations and isolated plant is very active. There has also been a large sale of this class o machinery to small water companies and pumping plants for irrigation purposes.

Westinghouse Electric & Manufacturing Company.—The Republic Iron & Steel Company has closed a contract with the Westinghouse Electric & Manufacturing Company for seventy nine crane and mill motors, aggregating about 5000 hp. These motors will be used in the plant of the steel company at Youngstown, Ohio, and will replace most of the shafting and belts now used by the company. The contract also includes magnetic controllers for the large motors and manually operated controllers for the smaller motors. The Westinghouse company also closed a contract with the American Graphophone Company for 1000 small motors.

Allis-Chalmers Company.—A contract has been placed with the Allis-Chalmers Company by interests identified with the Telluride Power Company of Provo, Utah, for an 8000-h water turbine generator set with transformers, switchboard etc., to be utilized at the Grace plant, on the Bear River. Energy from this plant will probably be transmitted to western Idaho and eastern Oregon. The Telluride Power Company has now in operation four hydroelectric plants, the total output of which is about 43,000-hp. It is estimated, however, that there is 60,000-hp still undeveloped at the Bear River site.

Price of Gas in Chicago.—A Seventy Cent Gas League has been formed to aid in securing a reduction in the price of gas in Chicago, as the result of pending negotiations between the City Council and the People's Gas Light & Coke Company from 85 to 70 cents a thousand feet. By the aid of tungsten lamps many of the residence customers of the Commonwealth Edison Company find electric lighting more cheap than gas lighting. A large number of bills are sent out by the central-station company every month to houses and apartments where the b is less than a dollar.

Cleveland May Increase Street Railway Fares.—The period for the trial of the 3-cent fare plan by the Cleveland Railways Company terminated Nov. 30, and President John Stanley of the railway company has announced that, under the present plan of operation, the 3-cent fare has been found inadequate. Street Railway Commissioner Dahl, representing the city, says that nearly 200 more cars are needed for immediate service. In the event that it is decided that the 3-cent fare has been a failure a 4-cent fare will be given a trial for a reasonable period.

North Shore Electric Company.—During the twelve onths which ended Sept. 30 the North Shore Electric Company, f Chicago, showed a very satisfactory increase in both gross id net earnings. The balance available for dividends at the id of the year was equal to 5.36 per cent on the $4,964,000 of ock outstanding. The gross revenue of the company was ,386,062, an increase of about $380,000 over the previous year. resident Samuel Insull says that during the year the comny's connected load showed an increase of more than twice much as in any previous year. This improvement was acmplished, notwithstanding the fact that the full benefits from e new properties acquired during the year were not entirely alized. The connected load, exclusive of railway power sines, during the fiscal period was increased to the equivalent 453,238 16-cp lamps, as compared with 309,786 the previous ar. During the year the company extended its high-tension insmission lines into new territory and built additional subtions for use in connection therewith, permitting an extension the system to the lake district of northeastern Illinois. The tire territory now served approximates 1284 square miles. the annual meeting of the stockholders, Nov. 28, the old ard of directors was re-elected as follows: Samuel Insull, 'ward P. Russell, Charles H. Randle, William A. Fox, Solon A. Smith, Louis A. Ferguson and Frank J. Baker. Offis were re-elected as follows: President, Samuel Insull; vicesident, Frank J. Baker; secretary and treasurer, John H. lick; assistant secretary and assistant treasurer, E. D. Alexder.

Norsk Electric & Brown Boveri Company.—The new nt at Sköier of the Norsk Electric & Brown Boveri Comny is now the largest electrical works in Norway. This conn was founded in 1908 and is a consolidation of the Norsk ctric Aktiebolag (Norwegian Electrical Company) founded 1873 and the Norwegian branch of Brown Boveri Cie, estabied in 1901. The old plant of the former company at Sköier been largely extended, and while the old Brown Boveri plant Sagene is retained it will be used exclusively for the manuture of motors of from ½ hp to 100 hp. The main factory Sköier has two departments, the electrical and the menical. The electrical department makes all kinds of elecal machinery, transformers, apparatus, instruments, etc. At sent the company has on hand contracts for six transformof 3000 hp and 50,000 volts, two 3000-hp generators, one 0-hp generator and one 1200-hp rotary converter. The menical department manufactures transmission line equipments, nes, transportation equipments, etc. Among other large tracts this department has one for the complete installation the combined unloading and transportation system for istiania harbor, one 25-ton traveling crane and one 15-ton jib ne. The company has facilities for molding single pieces arge as fifteen tons. The company employs 500 men. The tal is 1,400,000 kroner ($380,000). The general manager is Feddersen.

yllesby Annual Convention.—The second annual contion of the managers and department heads of H. M. esby & Company and affiliated companies will be held at the gress Hotel, Chicago, Jan. 17-20. As is well known, the pany, which has headquarters in Chicago, operates and ages a considerable number of electric, gas and street way properties in the West and South. Since the first vention held last year several properties have been added he list and the former attendance of 200 will probably argely increased. At a recent meeting of a committee of agers preliminary arrangements were made for a four days' gram to be devoted to technical and professional subjects. the belief of President Byllesby that the annual meetings interchange of ideas among managers and department heads mplish much toward improving the service offered the ic in the various cities where utilities are operated by this nization.

oint Traction Rate Ordered.—The Public Service Comion of the First District of New York has denied an exion of time to the receivers of the Metropolitan Street Rail Company in which to put into effect the joint rate between Metropolitan Company and the Central Park, North & East r Railway Company. The order for this joint rate was e by the commission Aug. 2, 1910. The time in which the panies were ordered to put in effect the joint arrangement red Dec. 5. Under the new order passengers transferring one of these lines to the other will be given a transfer slip for an extra three-cent fare. Since receivers were appointed there has been no transfer arrangement, two fares being charged.

New Long Island Traction.—The Public Service Commission of the First District of New York has ordered a hearing on Dec. 15 on the application of the Brooklyn & Jamaica Bay Railway Company for a certificate of public convenience and necessity for the construction of a street railroad from Montauk and Liberty Avenues, Brooklyn, to the shore of Jamaica Bay, near the mouth of Mill Creek. It is proposed to construct a single-track trolley line. The Brooklyn & Jamaica Railway Company was incorporated in June, 1910. Horace J. Subers is president of the company.

Union Switch & Signal Company.—The Illinois Traction System has awarded a contract for the installation of automatic block signals on 100 miles of its line to the Union Switch & Signal Company, of Pittsburgh. The fact that the traction company intended to install such signals was published in our issue of Nov. 17. This contract is said to be the beginning of the installation of automatic signals on the entire 550 miles of track of the system.

United Wireless Telegraph Company.—A contract has been closed by the United Wireless Telegraph Company of New York with the Merchants & Miners' Transportation Company of Baltimore for the installation of wireless apparatus aboard twenty-three of the company's steamships. When these installations are completed the entire fleet of the Merchants & Miners' Company will be equipped with wireless service, two of the ships having been previously furnished with outfits. The ships of this company ply between Baltimore and Philadelphia and the Atlantic seaports.

Electrical Construction.—Among the items printed under Construction News in our pressent issue are announcements of proposed new plants or considerable extensions to present plants at Portland, Ark.; Point Richmond, Cal.; Pueblo, Col.; American Falls, Idaho; Sioux City, Ia.; South Framingham, Mass.; Big Rapids, Mich.; Akron, Ohio; Schuylkill Haven, Pa.; Carbonate, S. D.; Waco, Tex.; Brigham City, Utah; South Boston, Va.; Whitewater, Wis.; Calgary, Alta., Can.; Port Arthur, Ont., Can., and Sherbrooke, Que., Can.

No McCall Power for Baltimore Railways.—It is reported that the directors of the United Railways & Electric Company of Baltimore have decided, upon the recommendation of Engineer Stillwell, not to make a contract with the Pennsylvania Water & Power Company for 17,000 kw of current to be generated at the McCall's Ferry dam. It had been previously announced that the contract was completed.

Electrical Credit Association of Chicago.—The fifteenth annual meeting and dinner of the Electrical Credit Association of Chicago was held at the University Club, Dec. 7. Officers were elected for the ensuing year.

Financial.

THE WEEK IN WALL STREET.

WALL STREET presented an uncertain and irregular market during the past week, with the distinct tendency toward lower prices. While in many quarters this particular movement is attributed to the pessimistic expressions of James J. Hill, it is generally recognized that his plain-spoken prediction of slack business during the ensuing year was only the final push which started the downward movement that was already overdue. For several months industrial and commercial conditions have not been satisfactory, and this fact was thoroughly understood. It merely needed some prominent authority to call public attention in an emphatic manner to this situation to cause a selling movement. For some time past the stock market has been artificially upheld, and this was no secret to the majority of Wall Street traders. It is now the opinion of many of the wisest men in the financial district that this movement toward lower prices will be of distinct benefit to the market. It will remove the labor and danger of artificially maintaining prices at a higher level than conditions warrant. One of the results of last week's decline is the re-awakening of the bear element in stocks, which has been afraid as long as manipulators were in charge of the market to undertake any dealing. These bearish influences are not strong enough to create any

serious demoralization, but unless the powerful money interests again take hold of the market the bears will succeed in holding prices on a level nearer to the present commercial status of business. Following Mr. Hill's expression came the statement from Judge Gary, of the steel trust, in which he plainly said that the bookings being taken at the present time by the big corporations were only averaging 50 per cent of capacity. Deliveries are probably 15 per cent higher, but these represent bookings taken in the summer and early fall. The present low rate of orders indicates that deliveries will not be very heavy during the early

NEW YORK.

	Nov. 28.	Dec. 5.	Shares Sold.		Nov. 28.	Dec. 5.	Shares Sold.
[illegible]	[illegible]	[illegible]	300	Int.-Met., pf..	52¾	[illegible]	15,800
[illegible]	[illegible]	[illegible]	1,000	Mackay Cos..	92⅝*	90*	400
[illegible]	[illegible]	[illegible]	[illegible]	Mackay C., pf.	75*	[illegible]	225
[illegible]	[illegible]	[illegible]	——	Man. Elev....	140	[illegible]	450
[illegible]	[illegible]	[illegible]	[illegible]	Met. St. Ry..	[illegible]	15*	——
Am. Loco., pf.	106¾*	105⅛	325	N.Y.&N.J.Tel.	139¼	[illegible]	——
Am. Tel. & C.	84*	80*	[illegible]	Steel, com...	[illegible]	[illegible]	[illegible]188,720
Am. T. & T..	140¾	139½*	[illegible]	Steel, pfd.	[illegible]	[illegible]	10,650
[illegible]	[illegible]	[illegible]	22,930	W. U. T....	71	[illegible]	2,900
Gen. [illegible]	[illegible]	[illegible]	9,200	West'h. com.	[illegible]	67	6,300
Int.-Met.	[illegible]	[illegible]	[illegible]	West'h. pfd.	[illegible]	[illegible]	100

PHILADELPHIA.

	Nov. 28.	Dec. 5.		Nov. 28.	Dec. 5.
Am. Rys...........	43*	[illegible]	Phila. Elec........	[illegible]	[illegible]
Elec. Co. of A.....	11¾*	[illegible]	Phila. R. T.........	[illegible]	[illegible]
Elec. St. B'ty.......	48	47	Phila. Trac........	[illegible]	83*
E. S. B'ty, pfd......	30*	30*	Union Trac....	[illegible]	[illegible]*

CHICAGO.

	Nov. 28.	Dec. 5.		Nov. 28.	Dec. 5.
Chi. City Ry..........	170*	170*	Chi. Tel. Co........	123	123
Chi. Rs., Ser. 1.....	91	92*	Met. El. Co........	[illegible]	[illegible]
Chi. Rs., Ser. 2.....	25¼	[illegible]	Met. El., pfd.	[illegible]	65
Com. Edison........	116	[illegible]	Nat'l Car..........	123	[illegible]*
Chi. Subways	[illegible]	[illegible]*	Nat'l Car, pfd.	110*	110*

BOSTON.

	Nov. 28.	Dec. 5.		Nov. 28.	Dec. 5.
Am. T. & T........	140½	140	Mex. Tel..........	5*	5
Cum. Tel............	145*	145*	Mex. Tel., pfd.....	6	6¼*
Edison E., Ill......	281	280*	N. E. Tel....	138*	138
Gen. Elec..........	157¾	152	W. T. & T. ..	10	10½
Mass. E. Ry........	19¼	18*	W. T. & T., pfd....	91	90
Mass. E. Ry., pfd...	86	85*			

*Last price quoted.

Shares sold for week Nov. 28 to Dec. 5.

spring. Judge Gary's statement, however, gave the distinct understanding that steel manufacturers, independent as well as the trust, were acting in harmony, and indicated very clearly that there were not likely to be any serious reductions in price or competitive wars. It is clearly shown by this statement that the great railroads of the country, which as a rule purchase one-third of the tonnage of the steel mills, are not taking one-tenth of their usual amounts. Developments in the money market during the week all favor a better bond market after the first of the year. Rates continue to be very easy, and supplies in the banks were heavy. Quotations Dec. 5 were: Call 2½ @ 2¾ per cent; 90 days, 4 @ 4½ per cent. The quotations in the table are those of the close Dec. 5.

Financial Notes.

Westinghouse Machine Company Financing.—The creditors' committee of the Westinghouse Machine Company has mailed a letter to the holders of the $6,473,000 outstanding three-year collateral notes. The circular proposes a plan for refunding these notes. In addition to these notes, which are due Jan. 2, 1911, the company has outstanding $140,000 first mortgage bonds, $800,000 of bonds out of an authorized issue of $1,000,000 and $825,000 of prior debenture bonds, making a total of $8,238,000. It is proposed that the company issue a $10,000,000 three-year first mortgage and refunding issue of notes bearing 6 per cent, of which $1,765,000 will retire the bonds above mentioned, and then the $6,473,000 of notes will be extended for three years, with the new bonds given as security at a collateral value of 90 per cent. The right is given to the holders to exchange the notes for new bonds on the basis of 97½ per cent. It is said that note holders representing $3,000,000 have already agreed to the extension, provided the unanimous consent of the remaining holders is obtained. It is also stated that New York, Philadelphia, Boston & Pittsburgh bankers who are interested in the notes have agreed to the plans. Further provision for the extension will be the creation of a voting trust, which will control the election of directors during the life of these notes. The committee will also require the payment of a minimum amount of $150,000 into the sinking fund, and in addition thereto 25 per cent of the earnings of the corporation, after expenses and fixed charges have been deducted, for the further security and retirement of the bonds from time to time.

Western Telephone Merger.—It has been reported in Columbus, Ohio, that the Bell telephone interests in that State, the so-called Morgan interests and the remaining independent telephone concerns in Ohio, Indiana, Michigan and western New York are negotiating plans for the formation of a consolidated company with $50,000,000 capital. A conference was held in Columbus two weeks ago and financiers representing all of these important interests have recently been conferring in New York City. No official information will be given out by any of the interests mentioned. It is said that a public utilities bill is being prepared which will enable the telephone companes in the State of Ohio to merge, and will give the State Railroad Commission power to regulate the business. This bill, it is said, will practically embody all of the provisions now demanded by the Oho people, the telephone interests conceding this much in order to get a provision in the law that will enable them to eliminate competition. The argument to be made to the Legislature is that under the federal law at the present time telephones are controlled by the Interstate Commerce Commission and are practically on the same basis as railroads.

Commonwealth Edison Company.—The annual meeting of the stockholders of the Commonwealth Edison Company was held in the Edison Building, 139 Adams Street, Chicago, on Nov. 28. The old board of directors was re-elected as follows: Henry A. Blair, Edward L. Brewster, Benjamin Carpenter, Samuel Insull, Joseph Leiter, Robert T. Lincoln, John J. Mitchell, Byron L. Smith and A. A. Sprague. The executive committee consists of Messrs. Brewster, Sprague, Lincoln, Mitchell and Insull. The following officers of the company were re-elected: President, Samuel Insull; first vice-president, Robert T. Lincoln; second vice-president, Louis A. Ferguson; secretary and treasurer, William A. Fox; assistant secretary, Robert L. Elliott; auditor, John H. Gulick; assistant to the president, John F. Gilchrist.

Kings County Electric Light Bonds.—At the auction of securities in New York last week $50,000 of the 5 per cent bonds of the Kings County Electric Light & Power Company were sold at prices ranging from 100⅝ to 100⅞. Two similar lots of these bonds were sold the previous week, the top price at that time being 101¾. There has been an excellent demand for these bonds for some months owing to the increased earnings shown in the company's monthly reports. The company issued last March $2,500,000 6 per cent debentures convertible into stock at par and has now pending before the Public Service Commission an application to issue $2,500,000 more of the same kind. The first issue of these debentures was fully subscribed by the stockholders.

Detroit United Railway Company.—It is estimated that the gross earnings of the Detroit United Railway Company for the calendar year will amount to more than $9,400,000, which will be an increase of more than $1,300,000 over the previous year. The monthly reports of earnings show that the surplus at the end of the year will be in the neighborhood of 12 per cent on the outstanding capital stock. It is not believed, however, that the company will resume dividends in the near future. The failure of the stockholders to respond to the offer of bonds which was recently announced will act as a deterrent in the matter of dividends.

Michigan Interurban Light & Power Company.—The property and franchise rights of the Interurban Light & Power Company, of Mason County, Mich., have been purchased by a syndicate headed by F. R. McMullen, of Chicago. It is proposed by the new owners to develop the extensive hydroelectric properties of the company by the construction of three dams and to supply energy for lamps and power in the region adjacent to Hamlin Lake. It is also proposed to construct an electric railway from Muskegon to Manisteo.

Public Service Corporation of New Jersey.—At a meeting of the directors of the Public Service Corporation of New Jersey last week Horatio G. Lloyd and J. Horace Harding were elected members of the board of directors to fill vacancies. Mr. Lloyd is a member of the firm of Drexel & Company, of Philadelphia, and Mr. Harding of the firm of Charles D. Barney & Company, of New York. Edgar B. Ward had previously been chosen as a director to succeed the late Dr. Leslie D. Ward.

Edison General Electric Company.—The Edison General Electric Company of Schenectady certified to the Secretary of State of New York last week that it had been dissolved with the consent of the stockholders. This company was a subsidiary of the General Electric and the fact that the stockholders had voted to dissolve was published in our issue of July 21, 1910. The General Electric Company held 140,020 shares out of a total of 150,000.

Western States Gas & Electric Company.—H. M. Byllesby & Company, of Chicago, have filed articles of incorporation at San Francisco for the Western States Gas & Electric Company. The new corporation will have a capital of $15,000,000, of which $10,000,000 is preferred. The company will immediately take over the Stockton (Cal.) Gas & Electric Company and the Richmond Light & Power Corporation in Contra Costa County, California. Other properties, it is understood, will also be taken over, although no definite announcement in regard to any others has been made. It is reported that negotiations are pending for control of the American River Electric Company, which transmits energy to Stockton, and the Humboldt Electric Light & Power Company, which has a sixty-five-mile transmission line from Trinity County, Cal., to Eureka.

Chicago Traction Sale.—The bondholders' reorganization committee of the Consolidated Traction Company, of Chicago, through Andrew Cooke, bought in the entire property at the foreclosure sale last week for $1,425,000. The Electric Railways interests now practically control the entire situation, and it is said that the consolidation plans will proceed smoothly. The second injunction suit by the Yerkes estate against the disposition of the securities held by that estate, it is claimed, will not in any way delay the reorganization plans. The committee claims that these securities have already been transferred. The Chicago Consolidated Traction Company reports a deficit for August of $4,038 and for the three months which ended Aug. 31 a deficit of $606,691.

Westchester, Kenneth & Wilmington Railway Defaults.—The Westchester, Kenneth & Wilmington Electric Railway Company, of Kenneth Square, Pa., having failed to pay the Dec. 1 interest on its $420,000 issue of 5 per cent bonds, two bondholders' committees have been formed in Philadelphia. One of these committees wants the bonds deposited with the Integrity Trust Company, of Philadelphia, under a plan which contemplates the cancellation of the defaulted coupons as well as those which will be due next June, and the reduction of the interest rate to 4 per cent. The other committee is headed by George B. Atli, of Philadelphia, who seeks to put the property "in the hands of experienced street railroad men." The company passed through a receiver's hands in 1905.

Long Acre Electric Light & Power Company.—The Public Service Commission of the First District of New York has called a hearing for Dec. 7 on the application of the Long Acre Electric Light & Power Company for authority to issue $10,000,000 of preferred stock and $50,000,000 of bonds to be secured by a mortgage on its property. This hearing was held in pursuance of the mandamus of the appellate division of the Supreme Court, which on certiorari proceedings annulled the former determination of the commission in denying this application and referred the matter back to the commission for further consideration.

Boston Elevated Railway Company.—The Railroad Commission of Massachusetts has granted the petition of the Boston Elevated Railway Company for authority to sell at auction 1,049 shares of an unsubscribed issue of 27,800 shares of the West End Street Railway Company of Boston. The gross receipts of the Boston Elevated for November show an increase of only about $10,100, which is the smallest gain for any month, with the exception of June, in the present calendar year.

DIVIDENDS.

Buffalo General Electric Company, quarterly, 1½ per cent, payable Dec. 15.

Continental Passenger Railway Company, semi-annual, 6 per cent, payable Dec. 30.

Duluth-Superior Traction Company, preferred, quarterly, 1 per cent; common, quarterly, 1¼ per cent, payable Jan. 3.

Indianapolis Street Railway Company, semi-annual, 3 per cent, payable Jan. 1.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable Jan. 3.

Massachusetts Electric Companies, preferred, semi-annual, 2 per cent, payable Jan. 2.

Muskogee Gas & Electric Company, preferred, quarterly, 1¾ per cent, payable Dec. 15.

Oklahoma Gas & Electric Company, quarterly, 2 per cent, payable Dec. 15.

Providence Telephone Company, quarterly, 1 per cent, payable Jan. 2.

San Diego Consolidated Gas & Electric Company, quarterly, 1¾ per cent, payable Dec. 15.

South Jersey Gas & Electric Traction Company, semi-annual, 4 per cent, payable Jan. 1.

South Side Elevated Railroad Company, quarterly, ½ per cent, payable Dec. 30.

Standard Gas & Electric Company, Chicago, preferred, quarterly, 1¾ per cent, payable Dec. 15.

Twin City Rapid Transit Company, quarterly, preferred, 1¾ per cent; common, 1½ per cent, both payable Dec. 16.

REPORTS OF EARNINGS

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Baton Rouge Electric Company:					
October, 1910	[illegible]	$5,828	$3,370	$1,944	$1,826
October, 1909	[illegible]	[illegible]	3,325	1,951	1,374
Blackstone Valley Gas & Electric Company:					
October, 1910	92,366	[illegible]	[illegible]	30,23[illegible]	14,640
October, 1909	93,867	47,91[illegible]	[illegible]	[illegible]	16,527
Buffalo General Electric Company:					
10 months ended Oct. 31, 1910	867,525	[illegible]	336,431	[illegible]	[illegible]
10 months ended Oct. 31, 1909	[illegible]	[illegible]	287,839	[illegible]	[illegible]
Columbus (Ga.) Electric Company:					
October, 1910	[illegible]	[illegible]	[illegible]	17,932	[illegible]
October, 1909	[illegible]	18,636	[illegible]	[illegible]	[illegible]
Edison Electric Illuminating Company of Brockton:					
October, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fort Wayne & Wabash Valley Traction Company:					
October, 1910	[illegible]	67,366	[illegible]	[illegible]	18,165
October, 1909	[illegible]	70,386	[illegible]	[illegible]	10,135
Galveston-Houston Electric Company:					
October, 1910	[illegible]	[illegible]	47,539	[illegible]	[illegible]
October, 1909	[illegible]	64,652	[illegible]	[illegible]	[illegible]
Jacksonville Electric Company:					
October, 1910	48,367	[illegible]	[illegible]	[illegible]	[illegible]
October, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Shore Electric Railway Company:					
October, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] General Electric Company:					
October, 1910	[illegible]	39,410	[illegible]	[illegible]	[illegible]
October, 1909	[illegible]	37,520	[illegible]	[illegible]	[illegible]
[illegible]k & Portsmouth Traction Company:					
October, 1910	166,776	[illegible]	[illegible]	[illegible]	4,68[illegible]
October, 1909	[illegible]	[illegible]	[illegible]	[illegible]	6,15[illegible]
[illegible] Texas Electric Company:					
October, 1910	[illegible]	[illegible]	[illegible]	[illegible]	62,594
October, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]cola Electric Company:					
October, 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October, 1909	[illegible]	12,579	[illegible]	[illegible]	[illegible]
[illegible] Company, [illegible]:					
[illegible]	[illegible]	988,597	[illegible]		
[illegible]	[illegible]	979,208	[illegible]		
[illegible] Railway:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Company:					
October, 1910	469,033	[illegible]	[illegible]	[illegible]	119,480
October, 1909	[illegible]	326,200	[illegible]	[illegible]	[illegible]
[illegible] Electric Company:					
October, 1910	[illegible]	[illegible]	35,362	[illegible]	[illegible]
October, 1909	[illegible]	[illegible]	26,353	[illegible]	[illegible]
Twin City Rapid Transit Company:					
October, 1910	[illegible]	[illegible]	[illegible]	140,321	196,294
October, 1909	596,963	[illegible]	[illegible]	[illegible]	[illegible]

General News

Construction News.

[illegible] and electric light plant, is reported to have recommended improvements [illegible]

IMBODEN, ARK.—The Smithville Rural Telephone Company, of Imboden, has purchased the telephone line from Strawberry to Black Rock from Mizer and Peacock, which has been connected with the local system. The company is erecting a new line from Smithville to Black Rock, via Denton, which will soon be ready for operation.

JAMESTOWN, ARK.—The engine-room, coal tipple, electric light plant and other machinery was destroyed by fire at the plant of the Penn Central Coal Company on Nov. 11, causing a loss of about $75,000.

PORTLAND, ARK.—The City Council has engaged Dickinson & Watkins, of Little Rock, Ark., to supervise the construction of the proposed electric light plant, water works and sewer system. The cost of the work is estimated at about $35,000.

CORTE MADERA, CAL.—At a recent election the citizens voted to issue bonds to establish lighting and fire districts in Corte Madera.

LOS ANGELES, CAL.—The Southern California Edison Company has awarded the contract for the erection of the superstructure for its large power plant at Long Beach to the F. O. Engstrom Company, of Los Angeles, for $160,000.

OAKLAND, CAL.—The City Council has granted the Great Western Power Company a franchise to erect and operate an electric light system on the streets in Oakland.

PALO CEDRO, CAL.—Arrangements are being made by Herbert Bass, of Montgomery Creek, president and lessee of the Redding, Ingot & Wengler Telephone Company, for extension of the telephone line

POINT RICHMOND, CAL.—Announcement has been made by H. B. Kinsey, manager of the Richmond Light & Power Corporation, that the company proposes to reconstruct its system in Point Richmond. The work will include the construction of a new transformer station on the east side of the city, the installation of heavier wire and poles and larger transformers to meet the rapidly increasing demand for electrical service.

RED BLUFF, CAL.—Notice of appropriation of 7000 in. of water in Deer Creek has been filed by Charles L. Crowder, to be used for generating electricity for commercial purposes. The water will be diverted at a point about fifteen miles southeast of Red Bluff.

REDDING, CAL.—The Noble Electric Steel Company expects to resume the production of pig ore at its Heroult electric smelter plant as soon as the Northern California Power Company completes the extensions to its power system.

ROSEVILLE, CAL.—The Roseville Home Telephone Company has applied to the Village Trustees for a fifty-year franchise in Roseville. The company has leased the system of the Pacific States Telephone Company and proposes to improve the service. D. M. Hamish is president and A. W. Dickinson is manager, both of Roseville.

SAN FRANCISCO, CAL.—Owing to the controversy concerning the franchise of the Equitable Light & Power Company in regard to laying pipes in the streets of the city for the transmission of steam heat, the Board of Supervisors has instructed the Board of Public Works to stop all work until the matter has been settled by the courts. The company operates a steam-heating plant in connection with its electric light system

STOCKTON, CAL.—The Western States Gas & Electric Company, recently organized with a capital stock of $15,000,000, it is reported, will take over the properties of the Stockton Gas & Electric Company, of Stockton, and the Richmond Electric Company, in Contra Costa County.

BOULDER, COL.—The Tungsten Mines Company is contemplating the installation of a motor-driven air compressor. Additional machinery will be required by the company as work progresses on the tunnel that it is now driving.

DENVER, COL.—The Larimer Street Improvement Association is contemplating the installation of an ornamental street lighting system on Larimer Street.

FOWLER, COL.—The Pueblo & Suburban Traction & Lighting Company has applied for a franchise to supply electricity for lamps and motors in Fowler.

PUEBLO, COL.—The Pueblo & Suburban Traction & Lighting Company is planning to erect a 2000-kw power plant, contracts for which will be awarded during the next three months. For further information address T. C. Roberts, of Pueblo, superintendent.

ROCKY FORD, COL.—The Pueblo & Suburban Traction & Lighting Company is reported to have taken an option on the electric light plant in this city, owned by the Rocky Ford Electric Company. It is understood that the company contemplates the construction of a suburban electric railway to the east to connect with La Junta.

BRIDGEPORT, CONN.—It is reported that the Baird Machine Company, of Oakville, Conn., is planning to erect a new plant at Bridgeport, plans for which are being prepared by the Fletcher Engineering Company, of Bridgeport, Conn. A power plant will be erected in connection with the proposed works.

GEORGETOWN, CONN.—The Housatonic Power Company is extending its transmission lines from South Norwalk to Georgetown to supply electricity for lighting the streets and residences of the town. Incandescent lamps will be used for street lighting. It is expected to have the service ready in about three months.

GROTON, CONN.—The New London Ship & Engine Company is contemplating the erection of a new boiler house in connection with the new machine shop at its plant.

PLAINVILLE, CONN.—The Housatonic Power Company has been awarded the contract for lighting the streets of the town for a term of five years. Under the terms of the contract the company will supply 60-watt Mazda electric lamps at $20 each per year.

WASHINGTON, D. C.—The contract for installing lighting and clock system in the Western High School has been awarded to Kluckhuhn & Brother, of Washington, D. C., for $3,115.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 14 for furnishing and installing lighting fixtures in the United States buildings at Beatrice, Neb.; Clifton Forge, Va.; Jackson, Mich.; Belfast, Maine; Bristol, Tenn.; La Crosse, Wis.; Moscow, Idaho; Owensboro, Ky., and San Angelo, Tex.

ATLANTA, GA.—The Augusta-Aiken Railway & Electric Company is contemplating increasing the output of its local power house by 3000 hp.

CEDARTOWN, GA.—George Cooper, of Dallas, Ga., is reported to be interested in a project to develop the water power of Terrapin Creek.

COLUMBUS, GA.—The Columbus Manufacturing Company has recently installed a 1340-hp motor to operate the new addition recently erected at a cost of $500,000.

CUTHBERT, GA.—It is reported that the Cotton Belt Telephone Company contemplates issuing $100,000 in bonds, the proceeds to be used for improvements and extensions to its system.

WAYCROSS, GA.—Announcement has been made by T. H. Calhoun, of Beach, that he will soon apply for a franchise for an independent telephone system in Waycross. If the franchise is granted connecting lines will be erected into Jacksonville, Savannah and other important points in Georgia. Application will be made for a charter at once.

AMERICAN FALLS, IDAHO.—Arrangements are being made for increasing the output of the American Falls plant of the Idaho Consolidated Power Company from 3000 to 30,000 hp, work on which will begin as soon as the weather permits. The plant now provides electricity for lighting the towns of Rockport, Blackfoot and American Falls and other small places in southern Idaho. When the plant is completed it is proposed to extend the service in the southern part of Idaho and also into Utah. James H. Brady, of Pocatello, Idaho, is president of the company.

ATHOL, IDAHO.—The Athol Water & Light Company, recently organized, is reported to be contemplating the installation of a public service plant.

ALBANY, ILL.—S. B. Dimand, J. W. Dinnun, C. E. Peck and James Beach are reported to be interested in a project to build an electric railway through Albany from the tri-cities.

CHICAGO, ILL.—Sealed proposals will be received by the Board of Trustees of the Sanitary District of Chicago, Ill., until Dec. 15 for the following equipment: Division A—Alternating-current generator and rheostat. Division B—Switchboard panels and oil circuit-breaker switches. Division C—Generator and transformer connections. Division D—Transformers. Division E—Turbine water-wheel unit. Plans and specifications are on file at the office of the electrical engineer, 1500 American Trust Building, Chicago, Ill., where blank proposal forms can be obtained. Robert R. McCormick is president of the Board of Trustees

COAL CITY, ILL.—The McComber & Whyte Wire Rope Company is reported to be making arrangements to operate its factory by electricity, which will be supplied by the Illinois Valley Light & Power Company.

KANKAKEE, ILL.—Sealed proposals will be received at the office of the County Clerk, Kankakee, Ill., until Dec. 21 for furnishing and installing lighting fixtures in the Kankakee County courthouse, in Kankakee in accordance with plans and specifications, which will be furnished on application to Zachary T. Davis, architect, 1009 Steinway Hall Building, Chicago, Ill.

KEITHSBURG, ILL.—Sealed bids will be received by the Commissioners of the Keithsburg Drainage District, Keithsburg, Ill., until Dec. 9 for furnishing one 18-in. centrifugal pump, one 12-in. centrifugal pump together with steel plate, rivets, suction and discharge piping, two constant speed induction motors of sufficient rating to operate the pumps, Morse or other equally satisfactory chain drives and all auxiliary appliances, including motor-driven vacuum pump for priming the main pumps, and also machinery foundations. Jacob A. Harman, of Peoria, Ill., is engineer.

MATTOON, ILL.—The Big [illegible] is reported to have awarded contract for the construction [illegible] to the Murphy Construction Company, of St. Louis, Mo. It is proposed to increase the output f the present plant to enable it to supply light, power and heat for all epartments. The company is contemplating operating its machinery by lectric motors.

STREATOR, ILL.—Plans [illegible] Light & Traction Company for the construction of an extension of its system rom Ridgefarm to Sharon.

TAMAROA, ILL.—The Town [illegible] W. [illegible], of Ashley, Ill., a franchise to install a telephone system in Tamoroa.

EAST CHICAGO, IND.—C. H. Geist, of Philadelphia, Pa., president [illegible] Northern Indiana Gas & Electric Company, is reported to be interested in a project to construct an electric railway from Chesterton to [illegible], thence [illegible] [illegible] the Northern ndiana Gas & Electric Company at East Chicago is nearly completed. he company is also erecting a substation at Chesterton.

FORT WAYNE, IND.—The Home Telephone & Telegraph Company is anning to replace its present telephone wires with cables on Spy Run venue.

INDIANAPOLIS, IND.—The Big Four Railroad is operating 1243 iles of its system radiating from this city by telephone and proposes to xtend this service over its entire system.

INDIANAPOLIS, IND.—The Cedar Rapids & Iowa City Railway & ight Company is reported to be contemplating the installation of an tomatic track-circuit block signal protection.

INDIANAPOLIS, IND.—Plans are being considered by the Central [illegible] Telephone Company for the erection of two new exchanges in Indianapolis, one to be known as the "Circle" exchange and the other the "West." A large number of telephones in the central part of the [illegible] be transferred to the "Circle" exchange.

INDIANAPOLIS, IND.—E. V. Hubbard, consulting engineer, of Indianapolis, Ind., who was engaged to make an estimate of the cost of heat, [illegible] and power [illegible] University [illegible] of Medicine and the [illegible] a report to Governor Marshall, in which he states that installation such a plant would cost $105,346. It is said the report will be subitted to the Legislature without recommendation.

LINTON, IND.—The Linton Home Telephone Company is building a w exchange building. New equipment will be installed and other imovements will be made, involving an expenditure of about $20,000.

MOORESVILLE, IND.—The plant of the Public Service Company, B. Mowery, receiver, was recently sold at auction to Harry J. Stoops, of icago, Ill., for $19,500, the amount of the bonds, which were held by r. Stoops. It is understood that the new owner proposes to make exsive improvements to the system.

SEYMOUR, IND.—The Baltimore & Ohio Southwestern Railroad mpany is rebuilding its roundhouse and shops in Seymour and installg a large amount of new machinery, which will be equipped for electric otor drive. The company has placed a contract for electricity to operate machinery in the shops and the large turntable at the roundhouse.

WABASH, IND.—The Citizens' Telephone Company, recently organd, is planning to erect telephone lines in both the city and county. L. [illegible] is president of the [illegible]

KEOKUK, IA.—The Mississippi Valley Telephone Company, operating [illegible] in Keokuk, Burlington, [illegible] Madison, [illegible] and a numr of smaller towns in Iowa, was sold at a foreclosure sale to Webster [illegible], of Minneapolis, Minn., for $[illegible]. The company has a nded indebtedness of $175,000.

ODAIR, IA.—At an election to be held Dec. 20 the proposition to issue [illegible]000 in bonds, the proceeds to be used for the installation of an elec light plant, will be submitted to a vote.

RED OAK, IA.—The Red Oak Electric Company is contemplating exding its transmission line to Stanton, Ia., to supply electricity for ps and motors in that town.

SIOUX CITY, IA.—The City Council has engaged F. W. Capelen. Minneapolis, Minn., to prepare plans and estimates for the installation an electric plant to supply electricity for lamps and motors for the city ldings, fire and police stations, the proposed Morningside subsidiary ter station and for pumping from the new wells that are being in [illegible]

WEBSTER CITY, IA.—The Commercial League is promoting the conuction of a dam across the Boone River, as recommended by A. C. [illegible]

HUTCHINSON, KAN.—The Medora Telephone Company has pur[illegible] for [illegible]ly owned by the Burns [illegible] Medora, are interested in the Medora company.

MANHATTAN, KAN.—Plans are being considered by the Manhattan [illegible] & Interurban Railway [illegible] Riley, a distance of [illegible]

PAOLA, KAN.—The People's [illegible] with a capital stock of $[illegible] The power house [illegible] will be installed [illegible] to have the plant in operation about Jan. 1, 1911.

SALINA, KAN.—The Salina Street & Interurban Railway Company is contemplating extending its railway in Salina. H. C. Smithers is president.

TOPEKA, KAN.—A special committee has been appointed by the Commercial Club to take steps to secure a new lighting system for the business section of the city. It is proposed to erect lamp standards carrying clusters of 500-cp tungsten lamps at intervals of 50 ft. on both sides of Kansas Avenue in the district between Gordon and Tenth Streets, the business men and property holders to provide the equipment and the city to supply electricity for same.

TURON, KAN.—The Commercial Club is reported to be interested in a project to install an electric lighting system in Turon.

CALHOUN, KY.—The Green River Light & Water Company has increased its capital stock from $10,000 to $20,000.

CLAY CITY, KY.—Arrangements are being made by the Clay City Telephone Company for the erection of an independent telephone line from Clay City to Hazel Green, via Rothwell, a distance of twenty-five miles, work on which will begin within thirty days.

CORNETTSVILLE, KY.—The Big Leatherwood Telephone Company is contemplating the erection of a telephone line from Cornettsville to Banks, via Line Fork, twenty miles in length.

INDIAN BOTTOM, KY.—The Lower Rockhouse Telephone Company, recently organized, is planning to erect a telephone line from Indian Bottom to Gourd, via Isom. James Brown is manager.

LEXINGTON, KY.—A. G. Morgan, 244 North Broadway, Lexington, is reported to be contemplating the construction of an electric light plant.

PADUCAH, KY.—Preparations are being made by the Paducah Traction Company to extend its railway to Tyler, Mechanicsburg and Fisherville. Application for franchises in the different cities have been made.

PIKEVILLE, KY.—The Eastern Kentucky Home Telephone Company is reported to be planning the erection of telephone lines from Pikeville to Brush Creek, a distance of eighteen miles. N. Starkey, of Pikeville, is manager.

DONALDSONVILLE, LA.—It is reported that the Lafourche Valley & Gulf Railroad Company is planning to install telephone and telegraph systems for train dispatching.

BALTIMORE, MD.—Arrangements are being made by the Consolidated Gas, Electric Light & Power Company for the construction of a large addition to its substation on McClellan's Alley, near Baltimore Street.

BALTIMORE, MD.—Plans are being considered by Booz Brothers for the improvements to their ship repair yard, including the installation of a special electric double-chain lifting device, having a lifting capacity of 2000 tons, for service in connection with their marine railway.

BALTIMORE, MD.—Plans have been prepared by Otto G. Simonson for the erection of a manufacturing plant for the Simpson-Doeller Company, Patuxent and Preston Streets, Baltimore, Md., for which, it is said, estimates are now being received. A power plant to provide both steam and electricity will be installed.

BALTIMORE, MD.—It is reported that plans have been submitted to contractors for the construction of a new factory building for Becker Brothers & Sons, Frederick and Lexington Streets. The mechanical equipment will include engines, boilers, electric lighting plant, elevators and conveyors. A sprinkler system will be installed.

BALTIMORE, MD.—Bids will be received by the Board of Awards until Dec. 14 for furnishing both pole type and subway type oil-cooled transformers for the public parks and squares of Baltimore, in accordance with specifications, which can be obtained at the office of the board of Park Commissioners, Druid Hill Avenue entrance to Druid Hill Park, Baltimore, Md. William S. Manning is general superintendent.

FREDERICK, MD.—Announcement has been made that the control of the Frederick Gas & Electric Company has passed into the hands of the Frederick Railroad Company. Emory L. Coblentz is president of the railroad company.

PITTSFIELD, MASS.—Announcement has been made by the Pittsfield Electric Company of a reduction in the price of electricity for lamps from 17 cents per kw-hour to 14.4 cents per kw-hour, beginning with Jan. 1, 1911. No reduction will be made in the rates for power service.

SOUTH FRAMINGHAM, MASS.—The Ames Plow Company has acquired a site in South Framingham, near the New York, New Haven & Hartford Railroad, on which it will erect a plant for the manufacture of plows, agricultural vehicles and wheelbarrows and other farming implements. A power plant will also be erected to provide electricity for operating the plant, which will be equipped for electrical operation. Complete electrical equipment will be required, including motors and transmission for electric driven units. Between $30,000 and $40,000 will be expended for the new equipment. The company's factory is now located in Worcester, Mass., and the main offices are in the Quincy Market, Boston, Mass.

STERLING, MASS.—At a special town meeting held recently the citizens voted to authorize the Selectmen to install an electric light system in Sterling, the cost not to exceed $6,000.

BIG RAPIDS, MICH.—[illegible] superintendent of the municipal water works plant, has been authorized to secure plans and estimates

... an auxiliary ... case of accident to the hydroelectric equipment.

MARQUETTE, MICH.—Plans are being considered for extensive improvements to the municipal electric light plant, including the rebuilding of the Silver Lake dam.

MUSKEGON, MICH.—A syndicate, headed by F. R. McMullen, of Chicago, Ill., is reported to have purchased the property and rights of the Interurban Light & Power Company in Mason County. The company, it is said, proposes to construct three dams in connection with its extensive hydroelectric development to supply electricity for lamps and motors in the region around Hamlin Lake, and for an electric railway to be built from Muskegon to Manistee. Plans, as yet, have not been completed.

CLOQUET, MINN.—The Cloquet Electric Company has been granted a franchise to extend its transmission line from Cloquet to Moose Lake.

ELBA, MINN.—An electric light plant is being installed in Elba. L. Todd is reported to be interested in the project.

FAIRMOUNT, MINN.—Contracts have been awarded by the City Council for improvements to the municipal electric light and water plant amounting to a little more than $30,000, as follows: To the Minneapolis Steel & Machinery Company, of Minneapolis, Minn., for 400-hp engine, at $21,985; for pump, motor, etc., to the Allis-Chalmers Company, of Milwaukee, Wis., for $2,885, and for the erection of new tower and tank, to the Des Moines Bridge & Iron Works, of Des Moines, Ia., for $5,372. Electricity for operating the pump will be supplied from the electric plant.

LONG PRAIRIE, MINN.—The municipal electric plant was recently damaged by an explosion of the boiler, causing a loss of about $1,500. The business men are urging the installation of a plant to provide for a twenty-four-hour service.

MINNEAPOLIS, MINN.—The Council water committee has awarded the contract for two electrically driven centrifugal pumps of 20,000,000 gal. daily capacity for the northeast pumping station to Henry R. Worthington, of New York, N. Y., for $28,612.

MINNEAPOLIS, MINN.—An appropriation of $250,000 for the high dam between Minneapolis and St. Paul is recommended by the chief engineer in his annual report to Congress. This is in addition to the unexpected balance in the treasury in January, 1910. It is proposed to expend the amount appropriated for the fiscal year of 1912 toward completing the lock to height required to commence work on construction of the dam.

PIPESTONE, MINN.—It is reported that George R. Griffith, who has been granted a twenty-year franchise and contract for street lighting, will install a plant, work on which will begin immediately.

SANTIAGO, MINN.—The Santiago-Blue Hill Telephone Company is building a branch line to Glendorado.

ST. PAUL, MINN.—Surveys have been completed by the St. Paul Railway Promotion Company for the construction of an electric railway, which will connect St. Paul, Mankato, Eagle Lake, Faribault, Northfield and other southern Minnesota cities. W. L. Sontag, 810 Metropolitan Building, St. Paul, Minn., is general manager.

THIEF RIVER FALLS, MINN.—Plans are being considered by the City Council for the construction of a dam across the Red Lake River, four miles south of the city, in the spring. An electric light and power plant will also be installed.

BUTLER, MO.—S. W. Dooley, A. H. Culver and associates are reported to be interested in a project to build an electric railway through Butler.

IRONDALE, MO.—It is reported that James P. Ward, construction engineer, is contemplating the construction of a hydroelectric power plant in connection with an electric railway.

JEFFERSON CITY, MO.—The contract for the construction of the proposed electric railway, which will cover the entire city, has been awarded to Waddell & Harrington, of Kansas City, Mo. C. W. Thomas, of Jefferson City, Mo., is interested in the project.

JOPLIN, MO.—The Southwest Missouri Electric Railroad Company, of Webb City, Mo., is building a substation in Joplin. The cost of the plant including machinery will be about $20,000.

MEXICO, MO.—Contract has been awarded by the Mexico, Santa Fe & Perry Traction Company to the Heintz-Young Construction Company, of St. Louis, Mo., for the construction of its proposed railway from Mexico to Hereford, a distance of twenty miles. Mathias Crum is president.

SEDALIA, MO.—Plans are being considered by the Home Telephone Company for the reconstruction of its local system, including the erection of a new telephone exchange.

DILLON, MONT.—The Gillmore & Pittsburg Telephone Company is reported to be erecting a metallic telephone line to connect Salmon, Leadore and Gilmore, Idaho, and Armstead, Mont. A switchboard will be installed in each of the towns and ranchers along the lines will be given connection with the main line. About 300 miles of wire will be erected.

GREAT FALLS, MONT.—Plans are being considered by the Regal Mountain Coal Mining Company, of Great Falls, for the construction of an ore concentrating mill and cyanide plant on People's Creek. It has not yet been decided whether to install steam pump equipment or to secure electricity from a hydroelectric power plant recently established in this vicinity.

MUSSELSHELL, MONT.—Handel Brothers are reported to be interested in a project to install an electric light plant in Musselshell.

PLENTYWOOD, MONT.—The Montana Star Telephone Company is contemplating the construction of an exchange building in Plentywood.

DAVID CITY, NEB.—James Bell, owner of the local electric light plant, has secured a temporary injunction against the Mayor and Council of David City restraining them from proceeding with the construction of a municipal electric light plant. When the citizens voted bonds for the construction of a municipal electric light plant Mr. Bell offered to sell his plant to the city, the value to be determined by arbitration. His proposition did not meet the approval of the city authorities. The matter will now be settled by the courts.

PALISADE, NEB.—It is reported that work has commenced on the construction of the power house for the new electric light plant in Palisade.

WYMORE, NEB.—The proposition to issue $57,000 in bonds, the proceeds to be used for the installation of a municipal electric light plant and water works system, will soon be submitted to a vote.

GARFIELD, N. J.—At an election held Nov. 15 the citizens voted to issue $125,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant in Garfield.

MENDHAM, N. J.—The citizens have decided to install an electric light system in Mendham. It is expected to have the streets lighted by electricity within a short time.

NEWARK, N. J.—Work has commenced on the installation of electric light and power plant at the court house, contract for which was recently awarded by the Board of Freeholders to the Watson Flagg Company for $[illegible].

PLAINFIELD, N. J.—Bids will be received by the Common Council until Dec. 19 for furnishing and erecting two pumping plants, complete, including motors, compressors and ejectors in duplicate, air receivers and pipe connections, erected complete, for the sewage pumping plant. Plans and specifications can be seen and forms of proposals and specifications can be obtained at the office of Andrew Gavett, city surveyor, 115 North Avenue, Plainfield, N. J.

WASHINGTON, N. J.—The Easton & Washington Traction Company has awarded the contract for the construction of the extension of its railway from Port Murray to Hackettstown, N. J., to M. P. McGrath.

ROSWELL, N. M.—The Roswell Gas & Electric Company has agreed to extend its transmission line to the entrance of the South Park Cemetery, a distance of about one and one-fourth miles. The cost is estimated at from $1,[illegible] to $1,600.

ALBANY, N. Y.—Sealed proposals will be received by the Trustees of Public Buildings, Capitol, Albany, N. Y., until Dec. 21, for construction and plumbing and conduits for the New York State Capitol and Education Building at Albany. Drawings and specifications are on file at the office of Franklin B. Ware, Albany, N. Y., where plans and specification may be obtained on application before Dec. 16.

BROOKLYN, N. Y.—Sealed proposals will be received by the State Commission in Lunacy, Capitol, Albany, N. Y., until Dec. 14 for alterations in main building construction, including plumbing and electric work, at the Long Island State Hospital, Brooklyn, N. Y. Plans and specifications may be seen and blank forms of proposals obtained at the Long Island State Hospital, Brooklyn, N. Y.; at the office of the State Commission in Lunacy, No. 1 Madison Avenue, New York, N. Y., and at the office of Franklin B. Ware, State Architect, Albany N. Y., where plans can be obtained on application. T. E. McGarr is secretary of the State Commission in Lunacy.

MIDDLETOWN, N. Y.—Work on the addition to the West Main Street power plant of the Orange County Lighting Company is nearly completed. Two 320-hp Babcock & Wilcox boilers have been installed, together with a Jeffrey coal conveyor and Maris traveling crane. A 650-hp Ball & Wood engine, together with a General Electric generator, is now being installed. The generating capacity of the power plant will be increased to 1300 hp. The company will hold the plant on Monhagen Avenue, formerly operated by the Consumers' Light & Power Company as an auxiliary plant, for use in emergencies. Electricity can also be secured from the plant of the Neversink Power Company at Cuddebackville.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Dec. 12, for the installation of an electric motor and pump at Public School No. 4, located at Fulton and Third Avenues and 173d Street, Borough of the Bronx.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, until Dec. 12 for alterations and additions to the electric equipment in Public School No. 36, 710 East Ninth Street, and Public School No. 47, 225 East Twenty-third Street, plans and specifications for which may be seen at the office of the Board of Education, Park Avenue and Fifty-ninth Street.

NEW YORK, N. Y.—Bids will be received by Calvin Tomkins, Commissioner of Docks, Department of Docks and Ferries, Pier "A," foot of Battery Place, North River, New York, N. Y., until Dec. 12 for furnishing materials and labor required for changing the present arc lighting system to a tungsten lamp system on the recreation piers. Blank forms and other information may be obtained at the office of the Dock Department.

ROCHESTER, N. Y.—Plans are under consideration for making further improvements to the street lighting system in Rochester.

ROCHESTER, N. Y. [illegible] Rochester Railway & Light Company is planning [illegible] more illuminated fire alarm boxes by next spring. At present there are about 100 in the city.

ROME, N. Y.—The Rome Home Telephone Company has applied to the City Council for a franchise to build a subway on Washington Street with branches for the purpose of placing its wires underground. The company contemplates extensive improvements to its system, including the erection of a new building, placing its wires underground, etc., which will involve an expenditure of from $50,000 to $65,000.

SILVER LAKE, N. Y.—Preparations are being made by the village of Silver Lake for the construction [illegible] plant and water works pumping station for artesian well supply in Silver Lake.

SILVER SPRINGS, N. Y.—The proposition to authorize the Village Board to issue $6,000 in bonds, the proceeds to be used for the installation of an electric light system, was carried at a recent election.

SALUDA, N. C.—The Saluda Telephone Company has been chartered with a capital stock of $1,000.

GRAHAM, N. C.—It is reported that the River Falls Cotton Mills Company is planning to build its proposed plant at River Falls, N. C. The equipment will include 10,000 spindles and 240 looms. A hydroelectric power plant will be installed to furnish electricity for lighting and operating the mill. It is understood that contracts have already been awarded. J. W. Menefee, of Graham, N. C., president and treasurer.

BERTHOLD, N. D.—John I. Moore, of Minot, N. D., is reported to have been granted a franchise to construct and operate an electric light plant in Berthold. It is expected to have the plant ready for operation early in February.

AKRON, OHIO.—Plans have been completed by the Northern Ohio Traction & Light Company for the construction of a new power plant to be located on what is known as the Gorge Bridge, on the Cuyahoga River, which will include the construction of a dam. It is expected that work will begin on the new building during 1911. The cost of the proposed plant is estimated at $1,500,000.

AKRON, OHIO.—Steps have been taken by the directors of the Northern Ohio Traction & Light Company toward the organization of the Northern Ohio Power Company, which will control the new power plant to be erected in the near future, at a cost of approximately $1,500,000. The new company will be capitalized at $3,000,000 and bonds to the amount of $3,000,000 will be issued. It will be controlled by interests connected with the Northern Ohio Traction & Light Company. Plans are nearly completed for the power plant to be located in the vicinity of Cuyahoga Falls.

ASHLAND, OHIO.—The Star Telephone Company has filed amendments to its charter increasing its capital stock from $100,000 to $150,000.

CANTON, OHIO.—Sealed bids will be received by the Director of Public Service, Canton, Ohio, until Dec. 14 for furnishing and installing one double triplex power pump having a capacity of 2,000,000 gal. per twenty-four hours, direct-connected to a 150-hp alternating-current motor set on foundation furnished by the city. Bids will also be received for horizontal centrifugal pump in one or in two units. Bids will also be received at the same time [illegible] compound condensing steam engine direct-connected to a 150-kva, alternating-current generator and exciter with [illegible] for engine, and also for a 325-hp engine and 200-kva alternating-current generator. Bids will also be received for gas engines and generators of same rating as [illegible] Ray F. Harbert is director of public service.

CLEVELAND, OHIO.—The [illegible] of the Hardie-Wyandot Lighting Company has been increased from $10,000 to $500,000.

GALLIPOLIS, OHIO.—Negotiations are about completed for the consolidation of the exchange of the Gallipolis Telephone Company with the system of the Central Union Telephone Company. The former company has been in the hands of [illegible]

LANCASTER, OHIO.—Sealed proposals will be received by the Board of Trustees of the Boys' Industrial School, Lancaster, Ohio, for installing additional compressor piping, etc., for the light, heat and power plant at the Boys' Industrial School. F. C. Gerlach is secretary of the board.

MT. VERNON, OHIO.—The Mt. Vernon Electric Company, recently incorporated, and which has taken over the plant and holdings of the Mt. Vernon Railway & Light Company, is reported to be contemplating extensive improvements to the system.

TOLEDO, OHIO.—The Council committee on public improvements has approved an ordinance repealing a grant made to the Harrison Telephone Company in May, 1894, to lay conduits in the business section of the city. The ordinance provided that if an attempt was made to turn the rights over to a competing company the ownership of the conduits would at once revert to the city. The rights and use of the conduits have been turned over to the Bell Telephone Company. The conduits are said to be worth $75,000, and the city authorities demand at least an annual rental of [illegible] for the property.

ALTUS, OKLA.—The Alfalfa Irrigation Company, which is planning to install an extensive irrigation project in this region, will require power machinery, pumping units, etc.

[illegible] OKLA.—The [illegible] bonds, the proceeds of $20,000 to be used for the installation of a waterworks system and $5,000 for electric lighting. As yet the bonds have not been sold. For further [illegible]

STILLWELL, OKLA.—The question of issuing $40,000 in bonds, the proceeds to be used for the construction of an electric light plant and water works system, will soon be submitted to a vote.

ADEL, ORE.—The contract for constructing a telephone line from Adel to Plush, a distance of twenty miles, has been awarded to the Lake View-New Pine Creek Electric Company. It is proposed to install a switchboard at Adel for the use of the branch lines. A system will soon be installed in Bidwell and an exchange established there.

BEND, ORE.—The electric plant of the Bend Water, Light & Power Company has been completed and placed in operation. The initial installation provides for about 260 hp. Arrangements have been made for installing additional units as required. The city has contracted for ten arc lamps to be placed on the streets in the business section. Provision will be made for lighting the residence districts in the near future. The plant is located on the Deschutes River.

PORTLAND, ORE.—The Portland Railway, Light & Power Company is planning to erect a new substation in the Mount Tabor district, and the purchase of three 3300-kw, 60-cycle generators for the Estacada plant. F. I. Fuller is vice-president.

THE DALLES, ORE.—Work has begun on the construction of an electric railway in The Dalles. The proposed railway will reach all parts of the city and extend into the surrounding country in every direction. Frank P. Phillips has the contract for construction of the road. W. Thomas is interested in the project.

ERIE, PA.—The installation of a pumping engine of 20,000,000 gal. daily capacity is under consideration by the city officials. The water commissioners will visit plants in other cities with a view of deciding upon style of equipment to purchase.

FREELAND, PA.—The new plant of the Harwood Electric Heating & Power Company has been completed and put in operation. The company will supply electricity for operating the machinery in the mines and industrial plants in the vicinity.

LANCASTER, PA.—The C. H. A. Dissinger & Brother Company, of Wrightsville, Pa., is reported to be erecting a plant in Lancaster, including a foundry, pattern shops, cleaning-rooms, etc. The company proposes to manufacture its Capital line of gas and gasoline engines. An electric generating plant will be installed to provide electricity for operating the plant, which will be equipped for electric motor drive.

PHILADELPHIA, PA.—It is reported that plans and estimates are being prepared by Irwin & Leighton for the erection of a power house for the Chalfont Brothers, at Forty-fourth and Thompson Streets.

PITTSBURGH, PA.—The West Penn Railways Company is making extensive improvements to its Connellsville power house, which will double the output of the plant. The company, it is reported, will eventually build a new power station near Speers.

SCHUYLKILL HAVEN, PA.—Bids will be received at the office of the County Controller of Schuyler County, Pottsville, Pa., until Jan. 17 for construction of a building for the insane at Schuylkill Haven, Pa., including increased water supply, sewage disposal plant, power plant, elevator, heating, ventilating, plumbing and electric wiring complete, in accordance with drawings and specifications, copies of which can be obtained at the office of the County Commssioners, after Dec. 16, on payment of $30 to cover the cost of printing the same. Charles T. Straughn is County Controller.

WOMELSDORF, PA.—George W. Bright, secretary, writes that it is proposed to install new water wheel in the borough electric light plant.

WOONSOCKET, R. I.—It is reported that the Stone & Webster Engineering Corporation, which operates the property of the Woonsocket Electric Machine & Power Company, is contemplating the construction of a concrete dam in Woonsocket next spring.

YORKVILLE, S. C.—Plans and proposals will be received by the town of Yorkville, S. C., until Dec. 15 for mechanical gravity filtration plant with a capacity of from 250 to 300 gal. per minute, including loss of head gages, controllers, pump and motor belts, pulleys, etc.

CARBONATE, S. D.—Plans are being prepared by the Black Hills Development & Financial Corporation for the construction of a 300-ton ore reduction plant, including smelter, at Carbonate S. D., next spring. It is also proposed to install a large electric power plant in the coal fields of Wyoming, just across the State border.

PHILIP, S. D.—Arrangements are being made by the Great Western Telephone Company for reconstructing its exchanges in Philip and Midland. The company may erect exchanges in several small towns between those places. It is now building a toll line out of Fort Pierre.

KNOXVILLE, TENN.—The Appalachian Marble Company, which is constructing a plant in Lonsdale, it is said, will require considerable new machinery, including a large electric crane.

CLARKSVILLE, TEX.—Preparations are being made by the Clarksville Light Company for rebuilding its plant, recently burned. It is understood that bids for installation of machinery will be received about Dec. 16. E. C. O'Neil is manager.

COLORADO, TEX.—Arrangements are being made by the Colorado [illegible] concrete and steel construction, plans for which have been prepared by Sanguinet & Staats, Fort Worth, Tex. The equipment will include industrial track and coal cars and elevator to hoist industrial cars, loaded, twenty-five feet. [illegible] Colorado Salt Company.

[illegible] its railway from Corpus Christi to the Epworth League grounds.

QUANAH, TEX.—The Southwestern Telephone Company is planning to make improvements to its local system, including the installation of a common battery system, at a cost of about $12,000.

SAN ANTONIO, TEX.—It is reported that A. Y. Walton, Jr., Terrell Bartlett, Willis Ranney and Duval West, of San Antonio, Tex., are interested in a large irrigation project. It is said that they have filed on all the unappropriated waters of the Medina River and its tributaries in Texas, comprising a watershed of about 700 square miles. It is proposed to irrigate about 150,000 acres of land, for which a large amount of pumping machinery will be required.

WACO, TEX.—The Citizens' Railway Company is planning to increase the output of its power plant by the installation of a 1500-kw steam turbine with condensing apparatus, bids for which, it is said, will be received through the National Light & Improvement Company, Pierce Building, St. Louis, Mo. Judson H. Boughton, of St. Louis, Mo., is secretary.

BRIGHAM CITY, UTAH.—Plans are being considered by the City Council for the installation of a hydroelectric power unit, consisting of a hydraulic turbine of the reaction type and an alternating-current generator.

BOWLING GREEN, VA.—The capital stock of the Caroline County Telephone Company has been increased from $15,000 to $20,000.

HERNDON, VA.—J. Harrison Yates is reported to be interested in a proposition to install an electric light plant of sufficient output to supply electrical service to a population of about 1000. As yet no machinery has been purchased.

PETERSBURG, VA.—The Virginia Railway & Power Company has awarded the contract for remodeling the library building for a substation to G. B. Keeler & Son. The cost of the work is estimated at $17,000.

SOUTH BOSTON, VA.—The South Boston Electric Light & Power Company is reported to be negotiating with New York capitalists for the development of Hyco Falls water power, on Dan River, thirty-five mi s east of South Boston. The present plans include the construction of a dam and power house to develop 14,000 hp for transmission to South Boston, Henderson, Durham and Roxboro in North Carolina. Stanford B. Lewis, 27 William Street, New York, N. Y., is reported to be interested in the project.

BELLINGHAM, WASH.—A new electric elevator is to be installed in the addition to St. Joseph's Hospital, in Bellingham, at a cost of $2,000.

BELLINGHAM, WASH.—H. A. Whitney, city engineer, is advocating the establishment of a municipal electric light plant, to cost about $200,000.

BELLINGHAM, WASH.—The Bellingham Manufacturing Company, it is reported, is planning to install a plant for manufacturing berry crates, boxes and baskets. An electric plant will be installed to supply electricity for lighting and operating the plant.

CONCONULLY, WASH.—It is reported that the Okanogan Irrigation & Improvement Company is contemplating extensive development work in this vicinity, which will include the installation of electric-driven pumping units.

CONCRETE, WASH.—Plans are being considered for enlarging the plant of the Washington Portland Cement Company. The proposed improvements will cost about $300,000 and include the erection of six steel and corrugated iron buildings, extensions to the power plant and installation of new units in the main grinding and tube mills.

COWICHE, WASH.—The Cowiche Telephone Company, it is reported, will extend its telephone line to the Tieton tunnel, a distance of six miles, and then to the south several miles. Anson S. White is president and general manager.

EVERETT, WASH.—The Everett Business Men's Association has recommended that a system of cluster lamps be installed in the business district.

EVERETT, WASH.—The Everett Railway, Light & Water Company has been granted permission to install a system of cluster lamps on Hewitt Avenue.

MUKILTEO, WASH.—The Crown Lumber Company is reported to be installing an electric light plant at its mills in Mulkilteo.

RENTON, WASH.—The Renton Independent Telephone Company has been granted a franchise to erect a telephone line from O'Brien to Orilla.

SPOKANE, WASH.—Investigations are being made by Prof. I. F. Elsom in the old Placer field in Idaho for the Puget Sound, Chelan & Spokane Railway Company, with a view of extending the electric transmission line to a point near Elk City, Idaho. W. W. Shent is president

SPOKANE, WASH.—The Spokane, Portland & Northern Railway Company, recently incorporated, is reported to be preparing to begin work on the construction of its proposed electric railway, which will extend from Spokane to the international boundary near Nighthawk, about the first of the year. A. M. Dewey, of Spokane, Wash., is interested in the project.

TACOMA, WASH.—The contract for building the upper portion of the Nisqually power system has been awarded to Messrs. Savage & Nichols, which includes the construction of a dam in the Nisqually River and a 10,000-ft. tunnel. It is understood that the contract for the erection of the transmission line will soon be awarded.

BAYFIELD, WIS.—Plans are being considered for the construction of an extension to the boiler house of the municipal power and pumping station in Bayfield, Wis., work on which will begin in the spring. It is understood that two new boilers will be installed.

GRAFTON, WIS.—The Grafton Light, Heat & Power Company, recently incorporated, is reported to be making arrangements for the installation of an electric light plant in Grafton, and is in the market for equipment for same.

MADISON, WIS.—The Wisconsin Power Company has increased its capital stock from $1,000,000 to $3,000,000. The company owns a large water power dam at Kilbourn City.

MAIDEN ROCK, WIS.—Steps have been taken by the Village Council for the installation of a municipal electric light system in Maiden Rock.

MERRILL, WIS.—The Wisconsin Telephone Company is planning to install a new switchboard and make improvements to its local service.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company is making extensive additions to its Commerce Street station, including the installation of two 14,000-kw and two 7500-kw Curtis turbo generator sets, additions to boiler plant and auxiliary equipment. The plant has an output of 20,000 kw.

WHITEWATER, WIS.—The Badger Railway, Light & Power Company which proposes to construct an electric railway to connect Whitewater and Lake Geneva, also proposes to establish an electric generating plant at Whitewater, to supply electricity for lamps and motors in this village.

WILTON, WIS.—The Wilton Light & Power Company, recently incorporated, has been granted a franchise to construct and operate an electric light plant in Wausau.

CALGARY, ALTA., CAN.—Bids will be received by the City Commissioners until Dec. 22 for furnishing one 1500-hp synchronous motor-generator, one motor generator exciter set, including switchboard instruments, etc. W. D. Spence is city clerk.

ROCHE POINT, B. C.—The Red Fir Lumber Company is planning to build a new cedar mill in Roche Point, at a cost of about $100,000, which will be equipped for electric motor drive.

WINNIPEG, MAN., CAN.—Under a decision handed down by the Court of Appeals the Winnipeg Electric Railway Company must remove all poles on the city streets, other than those used for its electric railway. The Court of Appeals also found that the company had not violated its charter right by generating electricity at Lac du Bonnet for its street railway lines, but the company cannot supply energy from the Lac du Bonnet plant for other purpose than operating its railway lines without permission from the city.

BROCKVILLE, ONT., CAN.—The municipal electric light and gas plant has been operated by the municipality for ten years. According to the report of the commission the city has received $59,158 since 1900, during that time $27,348 has been written off and $14,901 expended for repairs. The net surplus for the ten years has been $11,402.

HAMILTON, ONT., CAN.—The City Council has decided to ask the Hydro-Electric Power Commission to extend the time in which the City of Hamilton may take a co-operative contract with the commission and other municipalities, instead of a limited contract for 1000 hp from Dec. 31, 1910, to Dec. 31, 1911. Last year the Council decided not to bind the city completely to the Hydro-Electric Power Commission, but only to the extent of 1000 hp, reserving the right to contract for power with other companies. The commission, however, gave the city until Dec. 31, 1910, to decide whether it would come entirely into the project of the commission, along with other municipalities, or stay out entirely.

LONDON, ONT., CAN.—The London Electric Light Company, Ltd., has submitted three propositions to the City Council offering to sell its property to the city. The sub-committee of the City Council has passed a recommendation that the Council prepare and submit to the ratepayers a by-law authorizing the purchase of the plant submitted under proposal No. 3, under which the company offers to sell the city all rights, franchises, plant and equipment (excepting meters, transformers, lightning arresters, arc lamps, etc.) for $100,000, the city assuming the bonded indebtedness of the company. It is expected that the by-law will be submitted to the ratepayers in January. The transmission line of the Hydro-Electric Power Commission has been completed to London and it is expected to utilize the service within a short time.

NIAGARA FALLS, ONT., CAN.—W. D'Arcy Ryan, electrical engineer, has submitted a report to the committee in charge of the Cataract illuminating project, in which he estimates the cost of installing a plant at $70,000. He states that 700 hp would be required for the project. All the batteries will be installed on the Canadian side.

PORT ARTHUR, ONT., CAN.—The Port Arthur & Fort William Railway Company is contemplating the purchase of a 500-kw motor generator set during the next six weeks.

PORT ARTHUR, ONT., CAN.—Electricity is now being received in Port Arthur direct from Kakabeka Falls from the transmission line built by the Ontario Hydro-Electric Commission, under a contract made about ten months ago. At present 600 hp is being received. It is expected to have the substation completed by Dec. 15, when energy from the hydroelectric system will be supplied throughout the city.

PRESTON, ONT., CAN.—The transmission lines of the Hydro-Electric Power Commission have been extended to Preston and are supplying electricity for operating the local system. The street lighting system consists of 200 incandescent street lamps.

TORONTO, ONT., CAN.—The Board of Control has instructed the City Solicitor and City Engineer to prepare plans, specifications, estimates, etc., to enable the city to advertise for tenders for the construction and operation of an underground railway along Queen Street, from the city hall to Sunnyside, with any underground, elevated or surface extensions which they consider would be immediately practicable.

MONTREAL, QUE., CAN.—Arrangements are being made to remove all gas lamps in the city streets and replace them with electric incandescent tungsten lamps. In certain district the gas lamps will be replaced with electric arc lamps. It is expected to have the gas lamps removed by Dec. 31.

MONTREAL, QUE., CAN.—The Montreal Light, Heat & Power Company has secured an interlocutory injunction against the town corporation of Maisonneuve and the Dominion Light, Heat & Power Company, enjoining the latter from maintaining electric transmission lines within three feet of the Montreal company's wires in Maisonneuve.

MONTREAL, QUE., CAN.—The East Canada Power & Pulp Company has awarded the contract for the construction of a large water-power development and pulp mill on the Malbaie River, above Murray Bay, eighty-seven miles east of Quebec, to the Bishop Construction Company, of Montreal, Que. The cost of the work is estimated at $500,000.

MONTREAL, QUE., CAN.—The Montreal & Southern Counties Electric Railway Company has taken over the old Central Vermont Railway, operating between Chambly and Richelieu, and is now equipping the railway for electrical operation. It is understood that the Montreal & Southern Counties Electric Railway Company has applied for permission to operate its cars on the tracks of the Montreal Street Railway Company from the city limits into Victoria Square in the business section. The railway company has made arrangements to secure electricity from the Timothée plant of the Canadian Light, Heat & Power Company.

SHERBROOKE, QUE., CAN.—The City Council has decided to erect a power plant on the Magog River, where it is estimated that about 2600 hp can be developed, at a cost of about $70,000. The Council has also decided to call for tenders for the purchase of the water rights, which the city owns on the St. Francis River, at Westby.

SHERBROOKE, QUE., CAN.—Bids will be received by the City of Sherbrooke until Dec. 28 for the construction of a concrete dam and power house in the Magog River, near Rock Forest. Plans and specifications may be seen at the office of F. J. Griffiths, secretary and treasurer, or at the office of Ross & Holgate, engineers, 80 St. Francis Xavier Street, Montreal, Que., Can.

New Industrial Companies.

THE AUTOMATIC APPLIANCE COMPANY, of Boston, Mass., has been incorporated with a capital stock of $300,000 for the purpose of manufacturing and dealing in all kinds of mechanical and electrical machinery. The directors are: F. H. Whitman, president; Adams D. [illegible]flin, treasurer, and R. L. Whitman.

THE AUTOMATIC SPARK ARRESTER COMPANY, of Buffalo, N. Y., has filed articles of incorporation with a capital stock of $50,000. The company proposes to manufacture machinery, tools, etc. The incorporators are: [illegible]bacher, R. J. [illegible] and A. [illegible], all of Buffalo, N. Y.

THE COLUMBUS ELECTRIC COMPANY, of Columbus, Ohio, has been incorporated by W. S. Smith, W. F. Felton, G. W. Wolfly, J. M. Davis and E. B. Taylor. The company is capitalized at $125,000 and will manufacture and sell an electrical scale, which heretofore has been manufactured by the Columbus Electric Scale Company. The old company will still own the patents and receive a royalty from them

THE [illegible] ELECTRIC RHEOSTATS COMPANY, of Portland, Maine, has been incorporated with a capital stock of $10,000 for the purpose of manufacturing and dealing in electric apparatus. The officers are: E. Roy Monroe, of Portland, Maine, president, and Philip A. Hanson, of Portland, Maine, treasurer.

THE LEONARD ENGINEERING COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 for the purpose of doing a construction engineering business. The incorporators are: J. [illegible], of Brooklyn, N. Y., and J. R. Swan, of New York, N. Y.

THE M. & L. MACHINERY & ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing machinery, etc. The incorporators are: P. Wohistetter, S. A. Fuchs and A. Felger, of New York, N. Y.

THE [illegible] AMERICAN [illegible] MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing electrical machinery, etc. The incorporators are: John T. Milligan, 248 Emerson Place, Brooklyn, N. Y.; Percival E. Wye, 164 Front Street, and Henry M. Kidder, 38 West Ninth Street, New York, N. Y.

THE PREMIER VACUUM CLEANER COMPANY, of Cleveland, Ohio, has been organized for the purpose of manufacturing a portable electric suction cleaner. The officers are: Charles A. Kolp, of Canton, president; R. E. Hyde, secretary; F. J. Miller, treasurer, and E. L. [illegible], manager. The office [illegible] Building, Cleveland, Ohio.

THE SISTERSVILLE BOILER WORKS, of Sistersville, W. Va., has been incorporated with a capital stock of $25,000 by E. A. Ryan, J. P. Ryan, H. W. McCoy, S. G. Messer and A. C. Jackson, all of Sistersville, W. Va.

THE WARD MOTOR VEHICLE COMPANY, Borough of Bronx, New York, N. Y., has been incorporated by C. A. Ward, W. B. Ward and L. S. Kafer, of New York, N. Y. The company is capitalized at $200,000 and proposes to manufacture engines, motors, machinery, etc.

THE WOODS ELECTRIC VEHICLE COMPANY, of St. Louis, Mo., has been chartered with a capital stock of $25,000 by Louis E. Burr, Thomas Clements and A. B. Schaeffer.

New Incorporations.

MARION, ALA.—The Marion Electric Company has filed articles of incorporation with a capital stock of $10,000 by T. J. Krouse, E. L. Krouse, R. H. Cox, R. S. Ellis and others.

SAN FRANCISCO, CAL.—The Poulsen Wireless Company has been incorporated with a capital stock of $100,000 by G. H. Russell, C. K. Melrose, A. J. Freuler and A. J. Chalmers.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Levy Electric Company, with a capital stock of $25,000, by L. E. Norris, Louis and P. Levy.

SAN FRANCISCO, CAL.—The Owens River Valley Electric Railway Company has been chartered with a capital stock of $200,000 to build an electric railway in the Owens River Valley. The directors are: Curtis Hillyer, E. A. O'Brien, G. Carter, R. C. Pardoe and T. W. Forsyth, all of San Francisco, Cal.; M. R. Jones, of Oakland, Cal., and D. D. Oliphant, of Berkeley, Cal.

ATHOL, IDAHO.—The Athol Water & Light Company has been organized to establish a public service plant in Athol.

KAMIAH, IDAHO.—The Harrisburg Telephone Company has been incorporated with a capital stock of $10,000 for the purpose of erecting a telephone line from Kamiah to Pardee, a distance of sixteen miles. The incorporators are: E. L. Gallaher, Frank Finney, L. B. George, Anders Bolander and F. E. Harris.

RAYMOND, IDAHO.—The Raymond Telephone Company has been incorporated with a capital stock of $10,000 by Thomas H. Munford, George Hall and others.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the Porter, Chesterton & South Shore Railway Company by C. N. Wilcoxen, F. J. Lewis Meyer, F. M. Childs and J. M. Chilas, all of South Bend, Ind. The company is capitalized at $40,000 and proposes to build an interurban electric railway between Porter and Chesterton to a junction with the main line of the Chicago, Lake Shore & South Bend Railway near Baileytown.

MOORESVILLE, IND.—Articles of incorporation have been filed for Mooresville Water, Light, Heat & Power Company, with a capital stock of $100,000, by Everett L. Duepree, Clarence Duepree and Edwin H. Emrick. The company proposes to supply water, light and heat in the towns of Mooresville, Brooklyn and Monrovia.

PAOLA, KAN.—Articles of incorporation have been filed for the People's Electric Light Company with a capital stock of $15,000. The company is constructing a power plant and will supply electricity for lamps and motors in Paola. It is expected to have the plant completed by Jan. 1, 1911.

DONALDSONVILLE, LA.—The Lafourche Valley & Gulf Railway Company has been incorporated with a capital stock of $1,500,000 for the purpose of building an electric railway from Donaldsonville to Leesville, on the west bank of Bayou Lafourche, a distance of ninety miles. Telephone and telegraph lines will be erected for dispatching trains. The officers of the company are: F. M. Welch, president; J. Numa Colomb, vice-president; Charles Maurin, secretary and treasurer.

SHERMAN, MICH.—The Iosco & Arenac Telephone Company has been organized to install and operate a mutual telephone system. The officers are: John Jordan, president; Robert Wilkins, vice-president; Walter Pringle, secretary and treasurer.

BLOOMING PRAIRIE, MINN.—Articles of incorporation have been filed for the Blooming Prairie Farmers & Merchants' Telephone Company with a capital stock of $50,000. The officers are: Carl B. Campbell, president; Paul P. Moffett, vice-president; Leonard Virtue, secretary, and E. W. Cooley, treasurer, all of Blooming Prairie, Minn.

ST. LOUIS, MO.—The Denverside Connecting Railway Company has been incorporated with a capital stock to construct and operate a belt railway in East St. Louis, Ill. The incorporators are: H. S. Kramer, Arthur W. Baltz and George C. Keller, all of East St. Louis, Mo.

ATKINSON, NEB.—Articles of incorporation have been filed for the Sheridan Telephone Company with a capital stock of $2,500 by M. Gunderinger, W. T. Hayes, Peter Goff and others.

SEWARD, NEB.—The Blue River Power Company has been incorporated with a capital stock of $100,000 by Burdette Boyes, C. E. Boyes, [illegible] and others.

CAMDEN, N. J.—The South Penn Railway & Light Company has [illegible]

[illegible] The incorporators are: V. A. M[illegible], D. Billinger and J. R. Bradley, of Pittsburgh, Pa.

[illegible], N. [illegible]—The Spray Utilities & Terminal Company has been chartered with a capital stock of $500,000 by S. H. Marshall, E. V. Hobbs and N. H. McCollum. The company proposes to construct and operate water power electric plants and railways, etc.

KENTON, OHIO.—The Hardin-Wyandott Lighting Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: W. B. Whiting, C. C. Owens, Sterling Newall, Ellis R. Diehm and Donald McBride.

KILBOURNE, OHIO.—The Kilbourne Mutual Telephone Company has been incorporated by Charles F. Rodenfels, Claude S. Van Sickle, Charles W. Humes and William W. Tegley.

HYDRO, OKLA.—The McCool Telephone Company has been chartered with a capital stock of $500 by Frank M. Saunders, L. N. Cody, W. E. Inlow, C. E. Cole and F. R. Arnold, all of Hydro, Okla.

PORTLAND, ORE.—The Stein Mountain Power & Irrigating Company has been chartered with a capital stock of $25,000 by A. O. Jones, G. G. Jones and T. Burns.

BOSWELL, PA.—The Boswell Electric Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are: C. J. Gundelfinger, 900 Pittsburgh Bank for Savings Building, Pittsburgh, Pa.; Lucien Hill and Floyd B. Lockhart, all of Pittsburgh, Pa.

HARRISBURG, PA.—Charters have been granted by the Secretary of State to the Antis Electric Light, Heat & Power Company, the Snyder Electric Light, Heat & Power Company, the Valley Electric Light & Power Company and the Warriorsmark Electric Light, Heat & Power Company. Each company is capitalized at $10,000 and the directors are: Walter W. Perkins, of Philadelphia, Pa., treasurer; C. L. S. Tingley, of St. Davids, Pa.; Frank J. Pryor, Jr., Joseph M. Walsh and John Armstrong, all of Philadelphia, Pa.

LAKE COMO, PA.—The Northern Wayne Telephone Company has been granted a charter with a capital stock of $5,000.

PITTSBURGH, PA.—The Woodlawn & Southern Street Railway Company has been incorporated with a capital stock of $75,000 to construct an electric railway seven and one-half miles in length in Beaver County. The incorporators are: J. B. Shepherd, of Pittsburgh, Pa., president; John L. Moon, Ralph E. Reyner, John W. Adams and Walter L. Copeland, of Pittsburgh, Pa.

GOUDYVILLE, S. D.—The Union Telephone Company has been formed with a capital stock of $1,000 by L. F. Bogeurief, of Goudyville, S. D., president; John Endfield, of Dunsmore, S. D., and John Kozel, of Zeigler.

DALLAS, TEX.—The Dallas Automatic Telephone Company has been incorporated with a capital stock of $500,000 to construct an automatic telephone system in Dallas. The incorporators are: F. X. Eberle, J. C. Casier, H. D. Eberle and others.

PORTLAND, TEX.—The Portland Rosita Telephone Company has been chartered with a capital stock of $1,500 by D. C. Rachel, E. A. Rachel and P. A. Hunter.

ROYSE CITY, TEX.—The City Mill & Light Company has been incorporated with a capital stock of $12,000 by J. N. Miller, E. M. Paug, J. D. Miller and W. H. Adams.

POAGES MILL, VA.—The Fruit Growers' Telephone Corporation has been chartered with a capital stock of $5,000. The officers are: J. T. Henry, president; J. D. Willett, vice-president, and W. C. Wertz, secretary and treasurer.

STRASBURG, VA.—The Strasburg Light & Manufacturing Company has been granted a charter with a capital stock of $50,000 for the purpose of establishing an electric light plant in Strasburg.

EATONVILLE, WASH.—Articles of incorporation have been filed for the Mount Tacoma Telephone & Telegraph Company with a capital stock of $3,000 by A. E. Dye, I. Dye and others.

ORCHARDS, WASH.—The Orchards Telephone Company has been organized by G. J. Mitchel and E. C. Curtain.

SEATTLE, WASH.—The West Coast Light, Power & Water Company has filed articles of incorporation with a capital stock of $500,000. The incorporators are: Albert N. Moughin, Alfred P. Dobson and S. F. Bradbury.

SEATTLE, WASH.—Articles of incorporation have been filed for the Commercial Wireless Telephone & Telegraph Company with a capital stock of $1,000,000 by Fred H. Shoemaker, Lumber Exchange Building, Seattle, and John B[illegible].

CREWE, W. VA.—The Crewe Electric Light Company has been incorporated with a capital stock of $25,000 for the purpose of operating an electric light plant. The officers are: W. L. Willis, president; C. E. Wilson, vice-president; S. E. Moore, secretary and treasurer.

GRAFTON, W. VA.—Articles of incorporation have been filed for the Grafton Light, Heat & Power Company with a capital stock of $200,000 by John T. McGraw, A. S. Wardner, Jr., Charles R. Durbin, A. Hood Phillips and John T. McGraw, Jr., all of Grafton, W. Va. The company proposes to operate street railways, water, light and power plants.

MELLEN, WIS.—Articles of incorporation have been filed for the People's Water, Light & Power Company with a capital stock of $50,000 by Robert Johnson and others.

MOSINEE, WIS.—Articles of incorporation have been filed for the Mosinee Electric Company, with a capital stock of $15,000, by Neal Brown, C. S. Gilbert and M. C. Ewing.

OCONTO FALLS, WIS.—The Morgan Telephone Company has been incorporated with a capital stock of $1,200 by C. F. Meyer and Adolph Peterson.

Personal.

MR. H. G. STOTT, who has been quite ill from an attack of typhoid fever, is now on the way to recovery of health.

MR. WILLIAM H. NEVILLE has opened an office in the Audubon Building, New Orleans, for practice as a contracting electrical engineer.

MR. THOMAS J. WALSH, formerly of the Stone & Webster Corporation, Boston, has taken up consulting work as a mechanical and electrical engineer, with offices at 140 Milk Street, Boston.

MR. W. R. WHEATON, formerly of the United States Forestry Department, is in charge of a creosote pole-treating plant being established near Fresno, Cal., by the San Joaquin Light & Power Company.

MR. W. L. KIMBALL, who has been the treasurer of the American Transformer Company, of Newark, N. J., since its organization, has disposed of his interest and resigned his position, his resignation having taken effect on Dec. 1.

MR. JULIUS MARTIN, expert electrical aid, Brooklyn Navy Yard, read a paper entitled "Side Lights on the Navy Department Wireless Telegraph Specifications" at a meeting of the Wireless Institute, New York, on Wednesday evening, Dec. 7.

MR. J. B. ADAMS, formerly in charge of the Colgate power plant of the Pacific Gas & Electric Company, of San Francisco, has been made superintendent of the De Sabla power division, vice I. B. Adams, who has resigned to go to South America. The Colgate hydroelectric plant is now in charge of Mr. Joseph Mini, Jr.

MR. C. M. RAY, formerly assistant general manager of the California Gas & Electric Corporation, and who has been identified with the electrical industry in California for the past twenty-five years, has presented a lengthy argument in the *California Weekly* in favor of a State public service commission for the regulation of public utilities.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company, of Chicago, has been appointed a member of the Forest Preserve Commission approved by the voters of Chicago at the recent election. This commission, unless some legal obstacle intervenes, will establish a belt of outer parks surrounding Chicago—a subject in which Mr. Insull is greatly interested.

MR. W. R. BONHAM, representing in Chicago the Sterling Electrical Manufacturing Company and the Triumph Electric Company, is ill at his home, with a severe attack of typhoid fever, from which at this writing he is reported, happily, to be recovering. Mr. Bonham attended the recent illuminating engineering convention and lectures in Baltimore, and his illness appears to date back to that time.

MR. WILLIAM H. BRYAN, until recently a consulting electrical engineer in St. Louis, has accepted formal appointment as chief engineer of the Chicago public school system, and has removed to Chicago to enter upon his new duties. Mr. Bryan was appointed after a civil service examination, in which he led all the other candidates. The position pays [illegible] a year. Mr. Bryan's office will be at the headquarters of the Board of Education, 143 Dearborn Street.

Obituary.

MR. CHARLES JOSEPH DE BERARD died suddenly at his residence in Norwood Park, Chicago, on Nov. 28. He was born in Racine, Wis., on Aug. 17, 1849, and for twenty-five years he was associated with Mr. Robert Tarrant in the machine-shop business. At the time of his death he was a director in the Tarrant Foundry Company and also secretary and treasurer of the Felt & Tarrant Manufacturing Company, the latter manufacturing the comptometer. Mr. de Berard was a man of the highest character, and his manliness and transparent integrity endeared him to his friends. He is survived by a widow, three daughters and two sons.

Trade Publications.

REGULATORS.—The General Electric Company has issued bulletin No. 4602-B, a new edition of its publication on automatic voltage regulators for direct-current generators.

CHRISTMAS TELEPHONES.—As a suggestion for a Christmas present, the Stromberg-Carlson Telephone Manufacturing Company, Rochester, has issued a circular illustrating a box in Christmas trappings containing a set of magneto telephones.

COMPRESSOR COILS.—With the title "A Word About Compressor Coils," the Henry Fire-Proof Company, 1733 Broadway, New York, has issued a circular presenting the advantage of Heany fireproof wire for use in electric railway air-compressor coils.

MOTOR-DRIVE ELEVATORS.—The Westinghouse Electric & Manufacturing Company has just issued section 3103 of its perpetual catalogue 3002-A on the subject of motor-driven elevators. The section contains a number of illustrations of typical installations.

VENTILATING FANS.—The American Blower Company, Detroit, Mich., has issued as bulletin No. 284 a forty-eight page publication giving complete descriptions of its Sirocco fans and blowers, which are of the turbine type.

ATTACHMENT PLUGS.—In a neat folder entitled "A Word to the Wives," Harvey Hubbell, Inc., Bridgeport, Conn., is distributing to the trade an attractive mailing folder showing the various uses to which the Hubbell attachment plugs can be put. The plugs are shown used with reading lamps, chafing dishes, ventilating fans and flatirons.

MINIATURE LAMPS.—The General Electric Company has issued booklet No. B-3004, describing miniature decorative incandescent lamps. The amps are illustrated in color and various designs representing fruits and flowers are shown. These lamps are used for decorating Christmas trees and also in connection with set pieces of artificial shrubs, trees, etc.

STORAGE BATTERIES.—The Electric Storage Battery Company, Philadelphia, Pa., has issued Bulletin No. 126, devoted to oil insulators for supporting storage cells. Bulletin No. 127 of the same company contains a well-prepared description of the carbon regulator for use in connection with the charging circuits of storage batteries.

EXCITER PANELS.—Bulletin No. 4782 of the General Electric Company illustrates and describes exciter panels for use in connection with alternating-current generator panels, when for any reason separate control of the exciter is desired. The bulletin contains a complete description of these panels, as well as diagrams of connections and dimensions.

AUTOMOBILE LIGHTING.—The Ward-Leonard Electric Company, Bronxville, N. Y., has issued an illustrated mailing folder giving a brief description of its automatic generator automobile lighting system. The automobile is equipped with a storage battery, and when the car is run at a speed exceeding ten miles per hour the generator supplies energy both for the lighting devices and for charging the battery.

BLUE-PRINT MACHINERY.—[illegible] Ill., has issued a handsome 96-page catalogue in which is described and illustrated in detail its line of automatic blue-printing machinery. The blue-printing machines are, of course, run by electric motors and equipped either with arc lamps or mercury vapor lamps. The machines are made for papers from 24 in. to 54 in. wide, and for ordinary blue prints, as well as for direct white prints and negative and black line prints.

GARVIN MACHINES.—The Garvin Machine Company, Spring and Varick Streets, New York, has issued circulars No. 135 and 152, the former illustrating and describing its No. 2A universal milling machines, and the latter its No. 2 hole-grinding machines. The former is adapted for machine shop tool rooms, tool making, gear cutting shops and as a special tool for manufacturing fluted shafts, spiral gears and twist drills with constant angles. The hole-grinding machine has a capacity for 7/8 to 4-in. holes by 4 in. long.

IGNITION CATALOG.—The Connecticut Telephone & Electric Company, of Meriden, Conn., has issued a 1911 catalog [illegible] the well-known automobile and motorboat ignition specialties. The catalog describes the new Connecticut magneto in detail and gives a clear and concise account of the various systems for which this is made. Other new types for 1911 illustrated are the new Connecticut shock absorbers, hinged pocket spark coils, magneto lock switch, steering-wheel switch, pocket [illegible] and Connecticut auto lock.

SIGNALS.—In Bulletin No. 4786 issued by the General Electric Company a description is given of a [illegible] a signal mechanism suitable for either two or three position operation in either the upper or the lower quadrant. This standard mechanism is [illegible] applicable to either top or bottom [illegible] modifications. The bulletin contains nearly ninety pages of information, including exterior and interior views of the signal and a detailed description of the signal and apparatus used in connection with its operation.

ARC LAMPS.—The General Electric Company has issued as pamphlet B-3006 a reprint of a paper read by Mr. W. D'A. Ryan before the [illegible] Electric Light Association [illegible] This pamphlet compares the results obtained from the use of luminous and flame arc lamps with those resulting from the use of open and inclosed carbon arc lamps. The subject is treated from the standpoint of the illuminating engineer [illegible] contains half-tone illustrations, showing street illumination by luminous arcs in various cities. [illegible] subject is treated exhaustively and should be of assistance to all interested in this branch of engineering.

MAGNETO TELEPHONE SETS AND ACCESSORIES.—The Western [illegible] Company has just issued [illegible] telephone sets and accessories. The bulletin, which contains forty pages, [illegible] illustrated [illegible] of wall and desk [illegible] with attention to the smallest details. It is stated that $10,000 [illegible] the set has a record of [illegible] has been made the standard [illegible] the [illegible] cut shows the characteristic features of this telephone. The bulletin [illegible]

ing posts, buzzers, condensers, cords, desk set boxes, desk stands, flexiphones and flexiphone arms, generators and generator boxes, gongs and gong mountings, hand sets, induction coils, number plates, protectors, protector blocks, fuses, micas and mats, receivers, ringers, switch hooks, test sets, transmitters and transmitter arms and brackets.

PANELS AND CABINETS.—The Crouse-Hinds Company has issued what deserves to be called an "édition de luxe" catalog of its line of panels and cabinets. The catalog, which has flexible covers and handsome end-papers, is 9 x 12 in. in size and is profusely illustrated in two colors. The copper, slate, black-enameled steel and grained-wood parts of the different articles illustrated are shown in fidelity of detail and coloring. Color is also used to good effect in the rule work, the soft shade employed being a relief from the solid black and guiding the eye unconsciously across or down the tabulated pages. Each detail of construction is described concisely, and listings and prices of individual and assembled parts are presented so clearly that no reason can be found for a misunderstanding. Panels and cabinets are listed both separately and together, which is a convenience appreciated by contractor and jobber alike. In fact, the entire catalogue, aside from its artistic qualities, is as near perfection in orderly arrangement and presentation of facts as has yet been attained. From cover to cover it reflects many months of intelligent and conscientious labor devoted to its production and is the worthy representative of a concern noted for the excellence of its products. Anyone in a position to make use of this catalogue can secure a copy by addressing a request to the Crouse-Hinds Company, Syracuse, N. Y.

BUSINESS NOTES.

THE NOVELTY INCANDESCENT LAMP COMPANY has removed its general offices from Emporium, Pa., to 1733 Broadway, New York.

THE CHICAGO FUSE WIRE & MANUFACTURING COMPANY, formerly at 215-223 South Clinton Street, has moved to 1014 West Congress Street, Chicago.

THE SHELBY ELECTRIC COMPANY, of Shelby, Ohio, manufacturers of all types of incandescent electric lamps, has just opened a branch office at Room No. 1102, Candler Building, Atlanta, Ga. This office will be in charge of Mr. H. G. Scott.

THE MASSACHUSETTS CHEMICAL COMPANY, manufacturers of liquid electrical insulation, tapes and splicing compounds, is moving into the extensive additions to its plant at Walpole, Mass., which comprise a new four-story manufacturing building, a four-story reclaiming building and a new power plant, together aggregating about three acres of floor space.

WILLARD STORAGE BATTERY OFFICES.—The Willard Storage Battery Company announces that Mr. F. S. Gassaway, formerly manager of the New York branch, has been transferred to the main office, Cleveland, Ohio, where he will act as general manager of sales. In addition to the New York office, the Willard company has branches in Detroit, Chicago and in Mexico City.

MOORE TUBES.—Weidmann & Company, the big silk dyers of Paterson, N. J., and the oldest and leading dyers in the United States, selected the white Moore tube lamp to illuminate their display of silk dyed in the skein at the recent Industrial Exposition at Paterson, N. J. The white Moore tube lamp is now being used by nearly fifty of the biggest dyeing concerns in the United States, leaders in all branches of the textile industry.

H. W. JOHNS-MANVILLE COMPANY MOVES TO LARGER QUARTERS.—Owing to greatly increased business the H. W. Johns-Manville Company announces the removal of its offices now located at 85 Shelden Street, Houghton, Mich., to more commodious and convenient quarters at 96 Shelden Street. As in the past, Mr. S. T. Harris, who has been associated with the company for a number of years, will be in charge of the offices at the new address.

THE YORK MANUFACTURING COMPANY reports quite an active business in ice-making and refrigerating machinery during the past two months. Among these are a five-ton ice-making plant for the Edna (Tex.) Ice & Light Company; twenty-ton, complete ice-making plant for the Houma (La.) Light & Ice Manufacturing Company, and one fifteen-ton machine for the Kennett (Mo.) Ice & Electric Company. Among the sales were quite a number of machines of more than 100-ton capacity.

THE WAGNER MANUFACTURING COMPANY of St. Louis, has appointed Mr. L. C. Bassett as its sales representative for the western part of New York State with headquarters in Buffalo. Mr. Bassett has for some time been the manager of the apparatus department of Messrs. McCarthy Bros. & Ford who have represented the Wagner Company in this territory. McCarthy Bros. & Ford will continue their representation of the Wagner Company in the counties of Erie and Niagara and Mr. Bassett will make his office in their building, 41-43 East Eagle Street.

NEWARK'S DISASTROUS FIRE DESTROYS ELECTRICAL PLANT.—The fire in Newark, N. J., last week, which resulted in the loss of more than twenty lives, destroyed the plant of the Anchor Lamp Company and the Ætna Electric Company, which occupied the third floor [illegible] company was cleaning an electric light fixture in a gasoline bath, and the gasoline took fire and trickled in a little rivulet of flame on the floor, where stood a full can of gasoline. The can exploded, the burning liquid flew far and wide, and the fire spread rapidly to every part of the building.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NO[illegible]

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. [illegible] City.]

976,836. ELECTRIC ANNUNCIATING APPARATUS; H. J. Alther, Boston, Mass. App. filed March 18, 1909. Hotel annunciator to show whether the room is occupied by circuits controlled from the lock by the presence or absence of a key.

9[illegible]. CIRCUIT OPENER; C. C. Badeau, Swissvale, Pa. App. filed April 27, 1905. A fixed and movable contact, an electromagnet and pivoted armature for releasing the member and a roller journaled in the operating member.

976,839. TROLLEY-GUARD; E. Eisele, West Carrollton, Ohio. App. filed N[illegible] [illegible] The lower [illegible] of the guard has [illegible] and rollers are mounted on the trolley rod to engage the flanges.

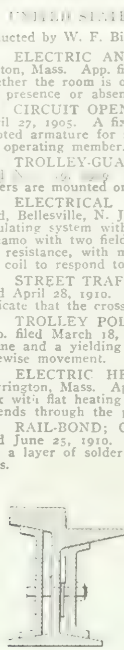
976,878. ELECTRICAL SYSTEM OF DISTRIBUTION; A. G. Hubbard, Bellesville, N. J. App. filed June 19, 1908. A storage battery regulating system with resistance across the circuit and a regulating dynamo with two field coils, one of which is connected to a point in the resistance, with means for causing the magneto motive force of the coil to respond to changes in load.

976,939. STREET TRAFFIC SYSTEM; E. E. Sirrine, Chicago, Ill. App. filed April 28, 1910. Changeable sign for controlling traffic, so as to indicate that the cross streets are either open or closed to traffic.

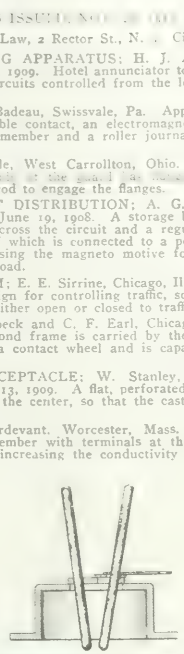
976,942. TROLLEY POLE; C. M. Speck and C. F. Earl, Chicago, Ill. App. filed March 18, 1909. A second frame is carried by the main frame and a yielding arm carries a contact wheel and is capable of sidewise movement.

976,944. ELECTRIC HEATING RECEPTACLE; W. Stanley, Great Barrington, Mass. App. filed May 13, 1909. A flat, perforated metal disk with flat heating unit, cast in the center, so that the cast metal extends through the perforations.

976,947. RAIL-BOND; Chas. R. Sturdevant, Worcester, Mass. App. filed June 25, 1910. A flexible member with terminals at the ends and a layer of solder thereon for increasing the conductivity of the ends.



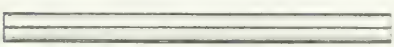
976,947.—Rail-Bond.



977,[illegible]—Electric Arc Lamp

976,961. COMBINED TELEPHONE AND SERVICE SYSTEM; H. G. Webster, Chicago, Ill. App. filed Jan. 6, 1908. A central source of current with means for transmitting special impulses by steady current and preventing interference with the telephone service currents thereby.

976,962. WALL SET; A. H. Weiss, Chicago, Ill. App. filed June 17, 1908. Telephone wall plate with back plate and ringer and bell posts extending from the ringer and spaced from the plate and a box cover opening downwardly to expose the apparatus of the set.



976,990.—Electrode.

976,990. ELECTRODE; J. T. H. Dempster, Schenectady, N. Y. App. filed July 20, 1905. An electrode consisting of metallic oxids with an easily fusible compound at its arcing end.

977,008. TELEGRAPH SYSTEM; G. E. Hines, New York, N. Y. App. filed April 13, 1907. A main line grounded at each end with closed transformers with secondaries in series with the line and key controlled primaries and relays with polarized armatures in series with the line restrained against movements due to stray currents and an adjustable self-induction device in series with the conductor.

977,022. ELECTRIC-ARC LAMP; W. Legel, Berlin, Germany. App. filed Feb. 2, 1910. The electrodes converge and an economizer is provided with aperture for the electrode which is sealed by two guy plates each pivoted to the next lower plate.

977,058. ELECTRIC CUT-OUT; B. M. Walpole, Providence, R. I. App. filed March 18, 1909. An insulating tube with conducting ends and spring plates on the ends with a fused linked strip extending through the casing beyond the ends into the contact plates and held in place by fuse blocks.

977,061. MEANS FOR MEASURING CURRENT IN THREE-PHASE SYSTEMS; C. Wiler, Chicago, Ill. App. filed Jan. 7, 1909. A transformer in two of the mains, an electrical measuring instrument, and spring jaw switches normally connecting the transformers in parallel to the instrument with a plug for separating the jaws.

977,067. CENTRAL STATION CALL SYSTEM FOR TELEPHONE LINES; W. E. Butler, David City, Neb. App. filed Feb. 15, 1909. A rotatable pole changer is driven by a direct-current motor with means for coupling the source of current to the motor and to the pole changer and then to the line, with a transformer connected to the source of current through the pole changer.

977,073. LOCKING MECHANISM FOR CONTROLLING HANDLES; A. S. Cunitt, Schenectady, N. Y. App. filed Nov. 9, 1905. The handle carries and conceals a pawl which engages a notched member to stop it at points in the forward movement. The pawl is released [illegible] movement of the handle.

977,074. VOLTAGE REGULATED ELECTRIC LIGHTING SYSTE[M] FOR RAILWAY AND OTHER CARRIAGES; James Dalziel, Derb[y], Eng. App. filed Sept. 27, 1904. A main generator, a motor, a variab[le] potential generator on the shaft of the motor which may be connect[ed] as a booster or counter electromotive force in circuit with the exciti[ng] coils of the main generator when it reaches a predetermined potent[ial] to vary the excitation.

[illegible],086. ELECTRICAL ELEMENT; A. T. K. Estelle, Fliseryd, Sweden. App. filed May 20, 1909. Positive electrode for alkaline ba[t]teries consisting of nickel hydrate as active material mixed with conductor, i. e., powdered graphite and cadmium oxide.

977,111. MAGNETIC BRAKE DEVICE; J. N. Mahoney and O. S. M[c]Curdy, Wilkinsburg, Pa. App. filed April 20, 1908. Magnetic bra[ke] operated by a magnet to throw it against the rail.

977,114. RELAY; R. H. Manson, Elyria, Ohio. App. filed June 1, 19[illegible] Spring contact relay with an annular armature pivoted to the f[illegible] bar, which latter carries contact springs with points accessible fr[om] the front, which springs are spaced apart.

977,123. PANEL BOARD; R. H. Olley, Syracuse, N. Y. App. filed Ju[ne] 27, 1908. A section of insulating material with a busbar groove [illegible] the rear and a recess in the front on the same plane as the groo[ve] and joining it.

[illegible]. APPARATUS FOR CONTINUOUS ELECTROLYSIS [OF] AQUEOUS SOLUTIONS; A. Pietzch, Triberg, German and Ew[illegible] Steinbuch, M[illegible], Switzerland. App. filed Nov 17, 19[illegible] T[illegible] superposed electrodes in different compartments with means for ca[us]ing the electrolyte to flow from the upper to the lower electrode w[ith] a support of permeable non-conducting material between them [to] receive the salt.

977,140. ELECTRIC SWITCH; P. L. Sibole, Wilkinsburg, Pa. A[pp.] filed Sept. 20, 1909. An electric switch with two movable swit[ch] elements mutually engaging, and connections between the switch e[le]ments and an actuating element.

977,142. TELEPHONE SYSTEM; F. X. Staub, Fort Wayne, Ind. A[pp.] filed April 8, 1910. The receiver has a soft iron core with a [illegible] winding in the line and a non-inductive shunt about the receiv[er] winding in series with the transmitter.

977,145. PRIMARY BATTERY PLATE; A. O. Tate, Toronto, On[t.], Canada. App. filed Feb. 25, 1908. Interleaved positive and negati[ve] sections separated by porous material, the positive sections connect[ed] together at one end and the negative at the other, the parts secur[ed] by insulating bolts.

977,156. ELECTRIC TRUCK; A. F. Batchelder, Schenectady, N. [Y.] App. filed April 7, 1906. Electric truck with truck frame and mo[tor] armature on one axle and field magnet upon the end member of t[he] frame.

977,187. SWITCH BOX; G. Gut, Seebach, near Zurich, Switzerla[nd]. App. filed July 6, 1910. The box with its cover and switching sh[aft] on the cover and auxiliary shaft in the box wall. When the cover [is] closed the two shafts are coupled.

977,193. OIL BREAK SWITCH; H. J. Hunsicker, Albany, N. Y. A[pp.] filed May 29, 1907. Switch with oil pot and pressure pot and sin[gle] insulator supporting one pot upon the shoulder and the other up[on] its head.

977,198. COOLING VANE FOR SECOND-CLASS GLOWER LAMP[S]; A. Kusebauch, Pittsburgh, Pa. App. filed Nov. 11, 1908. An incl[os]ing shell for the lamp, with a ballast tube and resilient cooling var[ies] surrounding the tube between it and the shell.

977,219. ELECTRICAL SIGNALING SYSTEM; C. H. Pool, New Yo[rk], N. Y. App. filed Ma[illegible] 1910. A signal translating device w[ith] transmitter for sending impulses, loops in the circuit and means operating on a brake or ground in a loop to control the transmit[ter] in sending impulses.

977,220. DYNAMO-ELECTRIC MACHINE; W. H. Powell, Norwo[od], Ohio. App. filed July 30, 1906. A dynamo with core having tooth[ed] laminæ, some being thicker at the end of the group than the rest a[nd] with successively shorter teeth.

977,224. TROLLEY POLE; R. F. Robinson and H. A. Owen, Whiti[ns]ville, Mass. App. filed Nov. 30, 1909. A trolley pole having paral[lel] springs, a trolley head at the upper ends of the springs and a l[ink] connecting the upper part of the pole with the head.

977,250. INCLOSED DYNAMO-ELECTRIC MACHINE; A. H. Wo[ld]ers, Norwood, Ohio. App. filed March 1, 1907. High-speed mach[ine] with air ventilation.

977,262. INSULATING HANGER; N. J. Bigham, Detroit, Mich. A[pp.] filed April 28, 1910. A pair of hanging hooks with the noses turn[ed] toward each other and a belaying projection carried thereby.

977,294. ELECTRICAL FLASHER; A. S. Gibbs, Scranton, Pa. A[pp.] filed Dec. 21, 1908. A rotary cylinder containing mercury and cont[act] blades in different compartments.

977,295. ELECTRICAL THERMOSTATIC ALARM SYSTEM; A. Go[ld]stein, New York, N. Y. App. filed May 2, 1910. A case with diaphragm operated by air expansion, the diaphragm making, [then] breaking, then making the circuit and sounding an alarm after [the] second make.

977,296. CENTRAL ENERGY ELECTRICAL TEMPERATURE ALA[RM] SYSTEM; A. Goldstein and C. H. Pool, New York, N. Y. A[pp.] filed June 3, 1910. A line circuit connecting distant stations with translating device at one station and a transmitter at the other wh[ich] is controlled by a certain frequency current.

977,303. ELECTRIC FURNACE; J. Harden, London, Eng. App. fi[led] May 7, 1909. Induction type of furnace the walls of which con[sist] of a mixture of a refractory material and a suitable conductor.

977,328. ELECTRICAL EQUALIZING SYSTEM; R. Richter, Grun[ewald], near Berlin, Germany. App. filed May 16, 1910. An alternati[ng] current circuit, a dynamo therein, one of the members of wh[ich] rotates continuously and the magnetic axis of one of the memb[ers] being shifted in accordance with the load.

977,335. MEANS FOR FILTERING AIR AND PRODUCING OZON[E]; S. C. Shaffner, Chicago, Ill. App. filed May 10, 1909. A casing, screen therein, a step-up transformer, a connection from one termi[nal] of the high tension winding to the screen and means for passing air through the screen, the core of the transformer heating the air.

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A NOTED INNOVATION IN LIGHTING.

The paper presented by Mr. Bassett Jones, Jr., before the Illuminating Engineering Society on the lighting of the Allegheny County Soldiers' Memorial, an abstract of which appears elsewhere in this issue, marks what must in a measure be considered a new epoch in architectural lighting. For it is the first example, so far as we are aware, in which the full resources of the illuminating engineer in the matter of colored lights have been marshaled to aid the architect in carrying out his designs. Moreover, so far as we are aware, this is the first important building in which the architect and the illuminating engineer have gone hand in hand and the design of the illumination has been a part of the fundamental plan of architecture and decoration. From the architectural standpoint the building will doubtless provoke discussion, since modern architects have been uniformly somewhat fearful of utilizing color effects at their full value. Most of the attempts at such work have been half-hearted and some of them characterized by bad taste; but there can be no reasonable doubt that color is as legitimate a part of architectural effects as is form, and, as Mr. Jones points out in this very interesting paper, the free use of color is only a reversion to the classic period, in which color was lavishly used, not only upon interior decorations, but even upon the statues of the best periods of Greek and Roman art. More than this, color was very freely employed by Saracen and Moor and in the days of the Italian Renaissance. It is only in comparatively recent times that the architects became timid, perhaps from painful consciousness of their own limitations, and public taste was so changed as to repress the use of striking color schemes in architecture. Yet the canons of taste vary from generation to generation by some mysterious sort of periodic law that in turn lauds as harmonious and damns as garish the same structures and effects.

Perhaps we may be coming now to a period in which another Alhambra will be possible and are forgetting the monochromatic severity of the decadent Middle Ages. At all events the structure here under discussion is notable not only from the free use of color in decoration, but even more for the ingenious and harmonious way in which Mr. Jones has made the illumination a fundamental part of the decorative scheme. To do this he has resorted very freely to indirect lighting and has employed not only colored screens, but colored illuminants. It is in this latter feature that his work presents the most striking innovation upon ordinary practice. It is a simple enough conception to realize that when one wants yellow light it can be obtained readily from the flaming arc, just as one can obtain other tones from ordinary incandescents, from the mercury arc, and from the vacuum tube, but it took no small amount of daring to strike boldly out and utilize the full resources of modern illumination in giving color where color was needed. To apply colored lights harmoniously required the solution of some very tough problems in diffusion. The experiments carried out to obtain suitable uniformity, color and brilliancy in illumination

hidden behind translucent elements in the ceiling were very thorough and ingenious and are fully described in the paper. Eventually specially shaped reflectors coated with zinc oxide paint met the difficult requirements and were variously adapted to the purposes they were to serve. For a mellow golden tone a combination of tungsten lamps and amber glass was found the steadiest and most efficient source of illumination. Elsewhere yellow flame arcs were employed for their decorative effect in combination with nitrogen tubes, shedding a pale pinkish glow, and with mercury arcs toned to a soft sky-blue by colored glass. These latter illuminants were used solely for effect, since the particular results sought could not be obtained for certainty and brilliancy in any other way. The sum total, however, is by no means an inefficient illumination, particularly from the standpoint of first cost, since in the main auditorium, where this combination was used, the expense of suitable fixtures would have been exceedingly high had a more conventional method been selected. The total flux efficiency reached of about 25 per cent is far from bad, particularly when one considers the necessarily elaborate reflecting system and relatively high efficiency of the sources which could be employed.

One of the extremely interesting problems which were met in the course of the work was the adjustment of the illumination to secure the proper degree of relief in the decorative elements of the interior. It was found, for instance, that when the lighting in some respects was at its very best the architectural results were far from satisfactory and it became necessary to work the problem over and over until the lighting was finally made to reinforce the decoration and bring out the full value of the architectural features, and so the work went on until the illumination and decoration became a unified whole in final result as in original conception. It is essentially a new type of illumination, not merely a convenience or adjunct, but an integral part of the decorative whole. There may be and probably will be difference of opinion among architects as to the value of the precedent thus established; but given the fundamental idea of full use of color effects in a great interior its logical outcome is necessarily unity as between the illumination and the architecture, and this Mr. Jones seems to have secured in a highly ingenious and very remarkable manner.

REGENERATIVE CONTROL ON DIRECT-CURRENT RAILWAYS

An inviting problem for the electric railway engineer is that relating to the return of energy to the line when descending grades or coming to rest under normal conditions. Many solutions have been offered to the problem, and not a few have reached the experimental stage, yet the fact remains that the accepted railway equipment is one in which no attempt is made to restore energy to the system. The polyphase induction motor, being inherently a constant-speed machine, has proved well suited for regenerating control while descending grades, but its use for energy restoration during retardation involves such complications that the extra equipment for this purpose is usually omitted. The direct-current equivalent of the polyphase induction motor—that is, the shunt-wound motor—has been used to a limited extent for traction but the results have not been highly encouraging. A much more promising machine for regenerative-control purposes is the adjustable-speed motor. As noted in the Digest in this issue, the so-called B. V. D. adjustable speed motor has been developed especially for traction purposes. The motor is provided with cert[ain] series coils occupying a portion of the main field core so [as] to overcome the distortion of the main field by the armat[ure] m.m.f. It is not apparent in what respect the motor wo[uld] operate more satisfactorily than the commutating pole mot[or] provided with armature-compensating field coils, such as ha[ve] been in use for many years for driving machine tools.

VOLTAGES AND CURRENTS IN THREE-PHASE CIRCUITS.

The interlinked three-phase, three-wire system, as used widely in industrial practice, would be a relatively simple s[ys]tem to analyze, both graphically and arithmetically, if the ge[n]erator or generators supplying the system were star-wound a[nd] if the load on the system were also connected in star. But [it] usually happens that the connections are made in delta with t[he] system, at either the receiving or the generating point, or [at] both. This introduces some complication into the distributi[on] of currents, voltages and powers, but even then the complicat[ion] would not be serious if the system remained balanced both [as] to voltages and currents. When, however, such a mixed st[ar-] delta system is unbalanced, the complication introduced [by] having the supply and load in delta, with the currents along [the] mains in star, becomes considerable. The problem has c[er]tainly presented itself in a large number of cases and engine[ers] have found various methods of solving it at different tim[es]. We print this week two articles bearing on this subject. O[ne,] by Mr. B. F. Jacobsen, on "Currents in Delta-Connected C[ir]cuits," discusses the currents in the sides of a delta-wound g[en]erator supplying certain observed line-currents to the syst[em]. The other, by Mr. Chesley H. Johnson, on "The Solution [of] Problems in Star-Connected Unbalanced Three-Phase C[ir]cuits," treats of the vector diagrams of unbalanced star loads [of] known impedance connected to a given delta-triangle of thr[ee-] phase line voltages. These two articles are in some respe[cts] mutually supplementary.

In dealing with the three observed line currents Mr. Jacob[sen] constructs from them a current-triangle. Within this trian[gle,] assuming that the three delta supply currents differ 120 d[eg.] in phase, he finds, by the superposition of a three-pointed s[tar] on tracing paper, a particular point such that the three [dis]tances thence to the vertices measure the three required d[elta] currents. If the phase displacement of the three unkn[own] delta currents is not uniform, then, as the article po[ints] out, the method fails, except that, as an upper limit, [no] delta current can exceed the greatest observed line curr[ent]. What is needed for solving the problem with unbalanced de[lta] phases is a pair of wattmeter readings and a pair of voltme[ter] readings. The tracing-paper method for assigning the bra[nch] point within the triangle is similar to one published in our c[ol]umns a few years ago. In order to solve the vector diagram [of] an unbalanced star load, Mr. Johnson first lays off three de[lta] line voltages and arbitrarily assumes one of the three requir[ed] star-branch voltages. With this assumed branch voltage as a sta[rt]ing point he determines the other two in order that the combi[na]tion of the three shall equilibrate the given line delta-voltage sy[s]tem. He then plots the vector currents in the star branch[es] from the known admittances of the loads in the same and fin[ds] a certain result, which, in order to be self-consistent, requir[es] the first assumption of star voltages to be correspondingly mo[di]fied. The modified system is then the required system.

ther words, the method starts off with an arbitrary hypothesis, f which the error is unknown, but which when followed up gically leads to a certain result inconsistent with the facts. he assumption is then modified so as to make the inconstency disappear, whereon the required solution is attained. he method is interesting not only because of its arriving at e goal by a flank attack, but also because it separates the curnts into two groups, the active and the reactive respectively, ranch by branch. A method of frontal attack on the problem as devised by Dr. A. E. Kennelly and published in our columns 1899. The delta triangle of voltages having been drawn, e three star-branch admittances are attached to the proper spective corners of this triangle as "masses" of the comex or vector type. The center of gravity of the triangle us loaded is then found by the methods of statics interpreted ctorially, assuming the triangle itself to be without mass. he center of gravity point is then connected with the vertices three straight lines, which are the three vector drops in the spective branch loads whence the three star currents follow Ohm's law.

SCUSSION ON VECTOR-POWER IN ALTERNATING-CURRENT CIRCUITS.

We have received from Dr. C. P. Steinmetz a reprint copy his interesting discussion on the paper "Vector Power in ternating-Current Circuits" read before the American Insti- te of Electrical Engineers at the Jefferson convention last ne. As was pointed out in that paper, two methods of pre- nting alternating-current vector diagrams are in vogue, side side, in the technical literature of this country and of Europe. me writers draw a lagging-current vector as a straight line king a negative angle with the vector of driving e.m.f., ile others use a positive angle with a graphical construction erwise the same. Dr. Steinmetz is a stanch advocate of latter method. The dissension is not of recent development. has existed since 1889 at least. Dr. Fleming used the negative gle for a lagging current as early as 1887, and Mr. Blakesley lowed suit in 1889, if not earlier. Dr. Kapp took the positive gle for a lagging current in 1889, and Dr. Steinmetz fol- ved Dr. Kapp, although for somewhat different reasons. nilar divergences occurred among European writers. The ult has been that the whole world of alternating-current hnologists is to-day split up into two schools of opposing phical delineation and mode of thought, as unrelenting in ir attitudes as were the Big-endians and Little-endians in an Swift's story of the nation that resorted to civil war over question whether eggs at the breakfast table should be bro- open at the big end or at the little end. About two-thirds of textbooks follow the Fleming-Blakesley school and about -third the Kapp-Steinmetz school, althoubh these numbers not of prime importance in the discussion. There is a like fusion in the technical literature of Germany, France, Aus- , Italy, Sweden, Denmark, Norway, Switzerland and prob- y of other countries also.

Infortunately, it is not a matter of indifference which hod of vector representation is adopted. Some men in ting the date on a letter put the day number before the nth number and others the month number before the day nber. Whichever way we personally adopt we rarely feel amed with righteous indignation at the Philistines who use the degraded opposite practice, because the inversion is so easy in the process of apprehension, and the worst that can happen is an occasional misunderstanding. But vector diagrams are stepping stones for the mind to travel over in order to avoid deep-water mathematics, and we unconsciously base our reasoning upon the particular graphical constructions that we visualize when thinking of an alternating-current phenomenon; and few men are so ambidextrous in their mental operations that they can visualize readily in either direction of vector rotation. Doubtless some men refuse to read papers employing vector diagrams of the unholy type opposite to that they are familiar with, thus creating an artificial ignorance of the whole subject. Moreover, the algebra of the subject is involved in the confusion, because one school uses the complex term $(r + jx)$ to represent the impedance of a choking coil and the other school necessarily uses the same term to represent the impedance of a condenser in series with a resistance. This divergence runs through the whole complex alternating-current algebra, so that sometimes it is hard to tell, when taking up a paper or book, which method the writer uses, and there is no way of settling the algebra confusion until the geometry confusion is settled.

In view of the above regrettable state of affairs the American Institute of Electrical Engineers voted at the above-mentioned Jefferson convention to appeal to the International Electrotechnical Commission to consider the question of standardizing the direction of the alternating-current vector rotation and to pronounce a decision upon the matter. It was felt that such a decision, emanating from an international body of such high standing, would surely lead to subsequent international unification. The American delegates presented this vote to the Brussels conference of the commission last August, and the conference voted in favor of taking up the question with a view to reaching a decision at the meeting in 1911, if possible. Meanwhile, briefs on this question are to be sought for and interchanged. We should be glad to open the matter to discussion in our correspondence columns. We think that the more the question is studied the more it will appear to be essentially one of pure convention, as distinguished from scientific necessity or axiom. Each school claims to be based upon a fundamental mathematical basis. Thus the crank-diagram school points out that it uses a trigonometrical basis, while the polar-diagram school points out that it uses the well-known polar-co-ordinate method of plane geometry. It is certain, on the one hand, that as long as we employ rectangular-co-ordinate diagrams to represent wave-forms we shall connect them with their rotating and projecting crank-vectors. On the other hand, it is certain that some engineers will always continue to make polar diagrams of alternating-current vector properties. It will, therefore, be necessary to select one and only one international standard direction of vector rotation and to bring both the crank diagram and the polar diagram into conformity with the same. This can be done without difficulty either way. The important and sole desideratum is, therefore, an international agreement one way or the other. It is much more important for all to agree on one method, even if the choice is not the best, than to continue in the present incongruous confusion. The difference between the two is relatively small, and either plan can be taken as correct. Certain advantages pertain to the method of each school and it is a mere question of a balance of advantages.

The Inventors' Guild.

[illegible] part of [illegible] several [illegible] along the line of invention and who, in developing and patenting their inventions, had come to realize the difficulties and disadvantages under which the inventor labors instituted a movement for the formation of a society looking toward the betterment of these conditions. The result of this movement was the formation and incorporation in New York City of the Inventors' Guild, the object of which is briefly outlined in the following quotation from the constitution of the society:

"The object of the guild is to advance the application of the useful arts and sciences, to further the interests and secure full acknowledgment and protection for the rights of inventors, to foster social relations among those who have made notable advances in the application of the useful arts and sciences."

Some of the handicaps to which the inventor is subject, other than the proverbial one of never having any money, are the delays in the Patent Office and the ineffectiveness of its work, due to overcrowding and lack of proper facilities in that office; the expense and tardiness of litigation, and the possibility that a rich and powerful corporation, by delaying and prolonging a suit, may increase the expenses to a point which makes such suits prohibitive for a poor inventor; the disadvantage to which the American inventor is subject in foreign patent offices, as compared with the liberality of the American Patent Office toward the foreign inventor, and many other conditions militating against the American inventor which should be remedied.

The membership of the Inventors' Guild is limited to fifty. The reason given for limiting the membership is that with a small society of this sort it is easier to accomplish real results than with a larger organization, hampered as it must be by unwieldiness and red tape. Further, with a small organization each man will feel that he is a working unit and that he will be depended upon to do real work, whereas in a large organization the general feeling is that there will be planty of other men to do the work and that lack of assistance from any particular member will make little if any difference. The result is that in the large organization the work, if any, is usually done by even a smaller number of members than that provided for in the Inventors' Guild.

It is proposed to select the membership of the Guild carefully and to this end a member must be formally proposed by a member of the Guild, must be personally known to five members of the Guild, must pass the membership committee and board of governors, and finally must be voted upon by the whole membership, 4 per cent of the votes cast being sufficient to reject a candidate. The object of such discrimination is to include among the members of the Guild men who not only have made inventions, but who have achieved some measure of success in connection therewith and who will therefore be capable of exerting some influence, and also that no one shall be admitted who will not be congenial to practically the entire membership. The annual meeting of the Guild is fixed for the third Wednesday in March, the place of meeting being New York City.

The officers of the Inventors' Guild are as follows: Mr. Ralph D. Mershon, president; Mr. Chas. W. Hunt, first vice-president; Mr. Chas. S. Bradley, second vice-president; Mr. Thomas Robins, secretary, and Mr. Henry L. Doherty, treasurer. The board of governors are: Messrs. Ralph D. Mershon, Leo H. Baekeland, Chas. W. Hunt, Chas. S. Bradley, Michael I. Pupin and Peter Cooper Hewitt.

The professional committee are: Messrs. F. L. O. Wadsworth, chairman; Thomas A. Edison, Chas. S. Bradley, Peter Cooper Hewitt, Michael I. Pupin and Bion J. Arnold.

At the present time the Guild has twenty-nine members, as follows: Messrs. Bion J. Arnold, Dr. L. H Baekeland, W. H. Blauvelt, Chas. S. Bradley, Alex. E. Brown, Henry L. Doherty, Thomas A. Edison, Carleton Ellis, Stephen D. Field, James Gayley, Edward R. Hewitt, Peter Cooper Hewitt, Chas. W. Hunt, Dr. John F. Kelly, T. S. C. Lowe, Ralph D. Mershon, Ambrose Monell, Prof. Edwin F. Northrup, Prof. G. W. Pierce, Chas. E. Pope, Prof. Michael I. Pupin, Thomas Robins, Dr. F. Schniewind, C. H. Smoot, Prof. Carl Thomas, F. L. O. Wadsworth, Arthur West, Dr. W. E. Winship and B. F. Wood.

Underwriters' National Electrical Association Loses Its Identity.

The National Board of Fire Underwriters has transferred to the National Fire Protection Association the work of the Underwriters' National Electrical Association and the committee of consulting engineers of the national board, the former body being now known as the electrical committee of the National Fire Protection Association. The national board considers that the National Fire Protection Association is the logical organization for the assumption of all important codification work, its work in recent years in fire prevention, as well as protection, having entitled it to a high place among the engineering bodies of the country. Moreover, it is a public body with its membership open to any individual, firm or corporation upon payment of $5 per year. All interests affected may, through membership, have a voice in the compilation of underwriters' codes, all of which will hereafter be issued under the authority of the larger body. The membership of the newly formed electrical committee of the association is as follows: Messrs. F. E. Cabot, Ralph Sweetland, J. E. Col[illegible] C. M. Goddard and H. O. Lacount, of Boston; George I[illegible] Bruen, J. C. Forsyth and Charles Lum, of New York; William S. Boyd, Dana Pierce and B. H. Tousley, of Chicago; Washington Devereaux and C. H. Hill, of Philadelphia; A. M[illegible] Paddon, of Syracuse; A. M. Schoen, of Atlanta, and R. [illegible] Strong, of New Orleans. The committee will also include [illegible] representative of the American Institute of Electrical Engineers, the American Street & Interurban Railway Association, the National Electrical Contractors' Association and the National Electric Light Association. All electrical men will regret the disappearance of the Underwriters' Electrical Association and the subordination of its work in the larger and electrically unrelated body. The Electrical Association, which held honorable rank with the national electrical organizations, has a record of accomplishment that invited a better fate.

Brooklyn Edison Employes' Profit-Sharing Plan.

On Monday, Dec. 12, the directors of the Edison Electric Illuminating Company of Brooklyn announced a profit-sharing and pension plan which will go into effect at once and app[illegible] to the year 1910. While the plan is adopted for the current year only, it will be continued from year to year if the board of directors approves. The distribution of profits and pensions will be in charge of a committee to be known as the provident committee, consisting of two directors, the general manager, general superintendent and treasurer. Any matters upon which this committee is not unanimous will be determined by the executive committee of the company. Following are the details of the profit-sharing and pension allowances:

All credits will be paid in cash to the trustees of the Brooklyn Edison Investment Fund. Employees of two years' service will receive annually a percentage of their salary or wages equivalent to one-quarter of the rate of dividend paid on the capital stock during the year. This is increased to one-half of the dividend rate for three years' service, to three-quarters of the dividend rate for four years' service and to the full dividend rate for five years' service or more. Money credited in any year account cannot be withdrawn within three years, except with the consent of the provident committee or to make payment upon the purchase of a home, or because of the death of the employee or of necessity in the opinion of the committee. A[illegible] moneys or credits accruing will revert to the company or to th[illegible]

investment fund in the event of an employee being discharged for misconduct, or who leaves the company without giving one month's notice in writing, unless the necessity of this notice is waived, or if an employee without the consent of the committee assigns to anyone any interest he may have in the money, or if an employee becomes insolvent or bankrupt. The committee may also withhold a part or all of the share of profits to which an employee might otherwise be entitled if it wishes. In case of the forfeiture of an employee's profits the committee may give the money to his family. After three successive annual sums have been credited to any employee the committee on request will deliver a stock certificate at a price equal to the average cost price of the stock held by the Brooklyn Edison Investment Fund. Upon the death of any employee his profits may be immediately withdrawn by his family, next of kin or legal representative. No restrictions are placed upon he withdrawal of dividends declared by the investment fund upon the profit-sharing investment of employees.

According to the pension regulations any employee who has attained the age of sixty-five years and been at least ten years ontinuously in the service of the company may be pensioned either at his option or that of the company; or an employee who has been at least ten years continuously in the service of he company and has become unfitted for full duty may be etired and pensioned. The pension allowance is for each ear of continuous service not less than 1 per cent nor more than 2 per cent of the average pay received for the five years ext preceding retirement, provided that no pension shall exeed 50 per cent of the wages paid at the time of retirement, xception being made in the case of employees whose annual alaries exceed $2,500, whose pensions shall be fixed by the xecutive committee of the company. The directors reserve he right to establish a new and lower basis of pension allownces if at any time it shall be found that the basis adopted will reate demands in excess of $25,000 a year. The pension allownces are to be paid monthly in the life of the beneficiary, but n case of misconduct the allowance may be withheld or disontinued. No assignment of pensions will be binding.

Street-Lighting Tables.

With the present issue there is given, in the form of a supplement, our annual street-lighting schedules prepared in conformy with a plan followed continuously since June 28, 1890, when he schedule devised by Mr. W. H. Frund was first published. ur issue for May 31, 1890, contained the announcement of he Frund schedule, which is an ingenious compromise between he so-called Philadelphia or moonlight system and the "allght and every-night" lighting schedule. The tables as preared by Mr. Frund were published monthly until March, '95, when a complete table was prepared for the remainder that year. Since 1895 the tables have appeared annually as upplement to an issue in December. A copy will, as usual, forwarded gratis to any central station upon application.

According to the table designated as No. 1 the lamps are [illegible] one-half hour after sunset and are extinguished one [illegible] before sunrise. By such a plan the lamps are in service [illegible]out 3830 hours per year. An "all-night" lighting schedule [illegible] a total of about 4000 hours could be obtained by lighting [illegible] minutes earlier and extinguishing fifteen minutes later [illegible] shown.

Table No. 2 is the "Philadelphia Moonlight Schedule" rerred to above. This schedule differs from that of Table 1 that advantage is taken of moonlight, beginning with the [illegible] night after new [illegible] ached its first quarter. On moonlight nights the lamps are [illegible]nguished one hour after moonrise and lighted one hour [illegible] moonset, with the exception of the night before, the [illegible] of, and the night after full moon, when the lamps are not [illegible]. This schedule involves the use of the lamps for about [illegible] hours per year.

Table No. 3 is calculated according to the well-known system of Mr. Frund, and ignores the moon until midnight throughout the year. After midnight the lighting hours are the same as in Table No. 1 except that the lamps are not used on the three nights before full moon. According to this schedule the lamps are used for about 3000 hours per year.

All of the tables are based on mean local time and are calculated for latitude 40 deg. north. They may be considered correct within ten minutes for any place in New York, Connecticut, Pennsylvania, Rhode Island, New Jersey, Ohio, Indiana, Illinois, Iowa, Delaware, Maryland, Virginia, West Virginia, Kentucky, Missouri, Kansas, Nebraska, Utah, Colorado, Nevada and northern California. They are also correct within ten minutes for all places within the United States proper during the months of March, April, September and October. The maximum disagreements are reached in June, when the nights are shorter in the Northern than in the Southern States, and in December, when the reverse is the case. During these months the disagreement along the northern border of the United States and as far south as Charleston, Birmingham and Los Angeles will not exceed twenty minutes. A maximum disagreement of one-half hour may be assumed for Jacksonville, Fla., and Houston, Tex.

Chicago Sanitary District Plans and Report of Operation.

At its meeting of Nov. 23 the Board of Trustees of the Sanitary District of Chicago, on the recommendation of President McCormick, authorized the president to appoint a commission to investigate and report to the board a comprehensive plan of developing the increased water-power which will be created by the widening of the Chicago River and by the construction of adjuncts and additions to the main drainage channel. Further, the commission is to report on methods of disposing of the electrical energy of the Sanitary District to all municipal bodies within its boundaries, and to investigate and report upon the proper methods of keeping the water supply of Chicago pure by the treatment of sewage by methods other than by the system of dilution now in use.

The commission, as appointed later by Mr. McCormick, consists of Mr. G. M. Wisner, chairman; Dr. W. A. Evans, Mr. E. B. Ellicott, Mr. C. D. Hill and Mr. Martin C. Schwab. Mr. Wisner is the chief engineer of the Sanitary District; Dr. Evans is the health officer of Chicago; Mr. Ellicott is the electrical engineer of the District, and Messrs. Schwab and Hill are independent engineers. The sum of $12,000 has been appropriated for the purpose of making this investigation, and it is provided that the two independent engineers shall receive not to exceed $1,000 each for their services. The commission is empowered to purchase materials and supplies and to employ such assistance as may be needed in the pursuance of its investigations.

With the North Shore channel of the drainage canal completed, and with the permit of the Calument-Sag channel obtained, it is believed that the greatest problem before the District is the most effective use of the water-power now created and to be created, and also a comprehensive study of the sewage-disposal problems of Chicago and the smaller municipalities embraced within the Sanitary District.

The present generating equipment at the drainage-canal power house at Lockport, Ill., consists of six 4000-kw units. Work is soon to be started on the foundations and draft tubes for the seventh unit. As this work will involve the construction of a cofferdam on the downstream side of the power house and the pumping of the water out of the space underneath the proposed unit, it can be done only at such times and under such conditions as the operating of the generating plant will permit. It is not considered practicable to endeavor to do this work by contract, and on the recommendation of the electrical engineer of the District the District will do the work itself. An appropriation of $5,690 has been made for this purpose and the work will be carried on under the supervision of Electrical Engineer Ellicott.

Mr. D. M. Deininger, comptroller of the Sanitary District, has submitted a report to the Board of Trustees of the financial operation of the electrical department during the nine months ended Sept. 30, 1910. The total cost of the plant and equipment of the hydroelectric department of the Chicago Drainage Canal is shown to be $4,375,720. The largest item entering into this investment cost is $1,881,408 for dams, canals and bridges. The next largest is $439,413 for power-plant building, while $420,191 has been expended for "miscellaneous transmission lines," $370,819 for electrical generator equipment, $222,245 for distribution system, $203,466 for terminal-station equipment, $140,-828 for other substations and equipment, and $146,989 for turbines and water-wheels.

The income of the electrical department for the nine months was $409,960, showing an increase of $132,211 over the corresponding period for the preceding year, or 47.6 per cent. The operating expenses, including the amount set aside for depreciation for the nine months, were $171,068 and the net earnings $238,892, an increase of 83 per cent compared with the preceding year. From the net earnings $126,049 is deducted for interest on cost of plant, taxes and rentals, leaving $112,843 carried on profit and loss account.

Mr. Deininger says that with only a few exceptions all expired contracts with consumers have been renewed, while the others are being held in abeyance temporarily pending adjustment of contingencies. Only occasional minor complaints have been received, and these have been confined wholly to the lighting service. During the nine-month period sixty-five lighting and three motor-service consumers discontinued the use of the service and 130 new lighting consumers and fifty-seven motor consumers were connected. The sixty-eight consumers shown as having discontinued the service were lost, Mr. Deininger says, for various reasons, such as moving of plant, going out of business or inability to pay bills. The comptroller says that, with allowance made for depreciation, the net earnings from operation for the nine months ended Sept. 30, 1910, were at the rate of 6.153 per cent per annum. The rate of depreciation given is 1.681 per cent per annum.

Wisconsin Telephone Taxation.

The taxation of telephone companies on the ad valorem basis, instead of on their gross earnings, as is now the system in Wisconsin, is recommended by State Treasurer A. H. Dahl in his annual report. Mr. Dahl shows that fifty-eight telephone companies escaped taxation completely during the past year, while their property amounted to $70,000, which would furnish about $8,000 of taxes under the ad valorem system. A total of $19.26 is paid by forty-five other companies, whose property valuation is $85,000, in amounts varying from 1 cent to 9 cents. These companies would furnish $9,000 of taxes on the ad valorem basis. Mr. Dahl adds: "The American Telephone & Telegraph Company has benefited by this extremely unfair method of taxation by approximately $70,000 in the last eleven years." Mr. Dahl says in the report: "It would seem that this example and the results obtained in increased revenue through the ad valorem system from railroads, street railway and telegraph companies are sufficient proof of the advisability and fairness of extending this system to all companies in the State."

Commercial Motor Vehicle Association Formed in Boston.

Twenty-five dealers in commercial vehicles held a meeting at the Hotel Lenox, Boston, on Dec. 6 and organized the Commercial Motor Vehicles Association of Boston. Mr. L. B. Butler was elected president, and the electric vehicle interests are represented by Mr. Day Baker, of the General Vehicle Company, secretary. The principal topic of discussion was the question of holding a motor-truck show in Boston during the late winter, and a committee was appointed to confer with Mr Chester I. Campbell, manager of the Boston Automobile Show in regard to the expediency of carrying out such a plan. It is expected that in the near future all the motor-truck associations in New England will be co-ordinated into a single organization.

President Taft on Federal Water-Powers.

In his message to Congress President Taft recommend that federal water-power sites be directly leased by the federal government, after advertisement and bidding, for not exceeding fifty years upon a proper rental and with a conditio fixing rates charged to the public for units of electric energy both rental and rates to be readjusted equitably every te years by arbitration or otherwise, with suitable provision against assignment to prevent monopolistic combinations; o that the law shall provide that upon application made by th authorities of the State where the water-power site is situate it may be patented to the State on condition that the Stat shall dispose of it under terms like those just described, an shall enforce those terms, or upon failure to comply with th condition the water-power site and all the plant and improvement on the site shall be forfeited and revert to the Unite States, to the President being given the power to declare the forfeiture and to direct legal proceedings for its enforcemen Either of these methods would, the President states, accomplish the proper public purpose in respect to water-power sites but one or the other should be promptly adopted. He sai that the question of conservation is not a partisan one, an expressed the hope that even in the short time of the presen session consideration may be given to those questions whic have now been much discussed, and that action may be take upon them.

Ohio Telephone Situation.

The annual meetings of the Cuyahoga Telephone Company and the United States Telephone Company, both of Cleveland Ohio, have been delayed by the fact that the litigation preventing the transfer of the securities to J. P. Morgan & Company has not been entirely cleared away. When this is done and th voting trusts have been reorganized the meetings can be properly held. It is said that the Cuyahoga Telephone Company will be reorganized and the official headquarters of the Unite States Telephone Company will be moved to Columbus, wher the operating department is now located. These conditions ar standing in the way of all plans that may have been made fo the Independent companies of Ohio for the future.

Councils of many Ohio cities and towns have responded t the request of the Cleveland City Council with a promise t exert all the influence possible for the enactment of a law tha will give cities the right to supervise and regulate the telephone service within their limits. The Cleveland Council is now investigating the service furnished by the two companies for a second time, and will furnish data for the use of the members of the Legislature. In all probability a hard fight will be made for a law of the nature mentioned.

A new automatic system has been installed by the Independent company at Bucyrus and a contract has been made under which all the subscribers of the Central Union will eventually be turned over to it. The lines of the American Telephone & Telegraph Company have been connected with the new exchange and will receive its portion of the business. The local rates have been advanced about 50 per cent.

The City Council of Toledo, Ohio, at its last meeting passed an ordinance declaring forfeited the franchise granted the Harrison Telephone Company in May, 1894, to build and maintain conduits in a number of the principal streets in the business section of the city. The Mayor is directed to notify the company of this action and five days are then given to remedy

.e alleged breach of conditions of the ordinance. The city uthorities claim, however, that nothing can be done to remedy e matter. The ordinance contained a condition that the Harrison Telephone Company, if it sold out to a competing company, would forfeit its franchise for the conduits. The mpany finally did sell and transfer its business to the Central nion Telephone Company. The Postal Telegraph Company is w paying the Central Union a rental of $5,000 a year for the rivilege of occupying a portion of the space with its lines. he city took action in order to secure proper rentals from operty which it considers has reverted to it. If the Mayor the ordinance the city may bring mandatory injunction ceedings to compel the company to remove its wires or, on e other hand, it may begin to tear out the wires and compel e company to seek an injunction to test the question of wnership.

Ballinger on Federal Water-Powers.

In his annual report Secretary of the Interior Ballinger recmmends the passage of legislation which will retain the fee tle of water-power sites in the people, invest the power of gulation and control in the State or in the federal government and not result in limiting prompt and economical development or permit monopolization or extortion. There is now ithdrawn from disposition, pending legislation concerning ater-power sites, approximately 1,450,000 acres of the public omain. In the various public-land States and Territories conining water-power resources, in so far as there is present market for these powers, the title to areas greater in extent than ose remaining to the government has long since passed to ivate ownership. Secretary Ballinger says it must be realized at any radical or burdensome restriction imposed by the deral government upon water-powers will operate as a reriction upon the public lands and discourage their development and use. Since the States own the waters in the streams d have public power to supervise and control public utilities, believes that a direct and effective method of control would to trustee the power sites to the States in some such manner proposed by a bill now pending in Congress.

Municipal Ownership Defeated at Haverhill, Mass.

By a vote of 4780 to 1420 the citizens of Haverhill, Mass., at regular city election on Dec. 6 killed the project of municipal nership of the plant of the Haverhill Electric Company, ich has been the center of popular interest for some months. Haverhill company is one of the public utilities managed by Tenney interests, of Boston, a well-known syndicate of ressive central station and gas administrators. Under the assachusetts laws a city cannot acquire a plant until it has so authorized by a two-thirds vote of each branch of the ty Council passed in two consecutive years and thereafter ed by the voters at an annual or special city election. The ent referendum sustains the Massachusetts precedent of using to authorize a municipal plant in any community where rvice is of high quality, the rates are reasonable and the rating company is on a sound business basis.

The agitation in favor of a municipal plant at Haverhill apars to have grown out of a desire in certain quarters to make tical capital by attacking the existing company. A feature the campaign, which has been won by the company entirely its record for square dealing with its customers, was an estigation by the Haverhill Board of Trade of the desirability municipal ownership, which resulted in an emphatic veto the project. The committee of this organization quoted the port of the National Civic Federation, which concluded that municipal ownership of public utilities should not be exnded to revenue-producing industries which do not involve e public health, public safety, public transportation or the permanent occupation of the public streets or grounds. It emphasized the necessity of investigating each case upon its own merits and pointed out that the real point at issue in Haverhill was whether the users of electricity or the taxpayers would be benefited by the city's purchasing the electric plant. The cost of acquiring the plant as a going concern was estimated at $1,000,000. The gross assets of the company on June 30 last were $968,000, and under the existing laws the company is entitled to recover from the city more than the cost of the plant's reproduction, namely, the value of the plant as a going concern. The committee pointed out that under Massachusetts laws the electric department of a municipality is obliged to pay the interest on its bonds, a sinking fund and 3 per cent depreciation on all its physical property, exclusive of land, out of its earnings. In case the earnings are insufficient to meet these expenses, then the difference must be made up from the tax levy. With an interest charge of 4 per cent on $1,000,000 and a depreciation charge of 3 per cent on $700,000, there would have been an additional sum of over $60,000, which the city must get either from the consumers of electricity or from nonusers through taxation. The company's gross income for the year ended June 30 last at the rates then in force (a reduction has since been made to 12 cents per kw-hour) was $172,436. Its operating expenses, exclusive of depreciation, were $113,361, leaving a net return of $59,075. The balance sheet of June 30 showed the cost of the property, exclusive of land, to have been $725,879, upon which the city would have to charge off 3 per cent for depreciation, or $21,776. To this would have to be added $40,000 (interest at 4 per cent on assumed cost of plant to the city), leaving a deficit of $2,700 upon the city's hands at the old rate. At the present 12-cent rate the company's net operating revenue would be still further reduced by about $15,000, so that the city would have to make up a deficit of $17,701 per year.

The committee pointed out the futility of making a comparison between Haverhill and the Holyoke municipal plant, or between that of any other city and Haverhill. Among its power customers Holyoke has two which pay $56,000 per year for power, whereas only two customers of the Haverhill company take more than 100 hp, one taking 113 and the other 184 hp. An application of the Holyoke rates to the Haverhill business would have reduced the income of the company by $55,839, leaving a net deficit of about $58,000 per year. The committee pointed out that the rates charged by the Holyoke company for lighting, power and street illumination compare favorably with the varied rates charged by all private as well as municipal plants in Massachusetts. The company has offered to reduce the streetlighting rates from $100 to $86.40 per year at the expiration of its contract and plans progressive reductions in the maximum net price of electricity to a 10-cent rate when the business reaches a volume of $250,000 per year. Like all other Massachusetts companies, the Haverhill organization is subject to the jurisdiction of the Massachusetts Gas & Electric Light Commission in matters of rates, service and capital issues. The committee concluded that increased taxes might result from the purchase of the plant.

At the meeting of the Board of Trade on Nov. 30 the report of the committee was accepted by the organization and a number of additional points against municipal ownership were brought out. Mr. F. G. Gordon, Lewiston, Maine, pointed out that the city has in reality lost by municipal ownership in Cumberland, Ohio; Taunton and Holyoke, Mass. Advocates of municipal ownership cited the city plant at Jacksonville, Fla., as a shining example of its benefits, when a telegram was received from William Bostwick, Jr., chairman of the bond trustees in Jacksonville, which stated that under the conditions named at Haverhill municipal ownership was unwarranted by the expenditure necessary to attain it, with the further statement that Jacksonville has only $171,000 in bonds, pays no taxes or bond interest, and depreciation is carried as a book entry only. Mr. Gordon showed that the wages paid at Jacksonville are 30 per cent to 40 per cent less than at Haverhill and soft coal is cheaper. A certain merchant purchasing prac-

tically the same amount of electricity from the private plant at Springfield, Mass., and from the Holyoke municipal plant pays less in Springfield. Judge Ryan, of Haverhill, recalled the erroneous impressions of the cost of arc lighting in Chicago several years ago, it being found later that the actual cost was $100 per lamp-year instead of $60. A. Shirley Ladd also spoke of the absence of storage facilities for electricity and the need of reserve investment.

The Haverhill Electric Company was greatly hampered in the presentation of its case to the public at large by Chapter 581 of the Acts of 1907, which prohibits the expenditure of money by electric light and other companies for the purpose of influencing public sentiment on any question submitted to the voters. The company desired to place before the public in the advertising columns of the daily press a complete record of its work in Haverhill, including a résumé of the investments in late years in plant and underground equipment, adoption of more efficient street lighting and reductions in rates. After a well-rounded campaign of this kind had been planned it was found that it could not be carried out and the company was obliged to depend almost entirely upon its history in the community in securing the decision of the voters. The resulting defeat of municipal ownership in a distinctly socialistic city by a vote of nearly three and one-half to one is therefore a most gratifying indication of the company's standing in the community.

Electrical Credit Association of Chicago.

With a number of visitors from Western and Southern cities the fifteenth annual business meeting of the Electrical Credit Association of Chicago was held on the afternoon of Dec. 7. President Frank M. Pierce, of the Manhattan Electrical Supply Company, in his annual report reviewed the history of the last fifteen years, showing that the association has grown from eighteen members to the present number of 210. The report of Mr. Frederic P. Vose showed the total number of claims handled since the organization to be 27,931, aggregating $2,129,459.81, and that of this number 17,153 had been settled, aggregating $1,408,749.84. The average amount collected during the year per each member was $1,075.82. The finances were shown by the auditing committee to be in a healthy condition.

Officers for the ensuing year were elected as follows: President, Frank M. Pierce (re-elected); vice-president, A. O. Kuehnsted, the Gregory Electric Company; members of the executive committee, E. R. Gilmore, Western Electric Company, and Ivar Hennings, Westinghouse Electric & Manufacturing Company. Amendments to by-laws were made in accordance with notices previously sent. These amendments, however, do not materially change the workings of the association as long in vogue. Papers were read by Mr. Thomas I. Stacey, Electric Appliance Company, on "The Executive Committee"; Mr. W. S. Thomas, Wagner Electric Manufacturing Company, on "What Does the Association Mean to Me?" Mr. C. F. Koepge, the Tungstolier Company, on "The Inside Workings of Our Association"; Mr. Fred B. Uhrig, Kansas City, on "Credits and Collections" (read by Mr. Gilmore); Mr. Hennings, Westinghouse Electric & Manufacturing Company, on "The Moral Risk Club of Chicago"; Mr. Clyde C. Miner, Robbins & Myers Company, on "The Way It Strikes Me." An open parliament of free discussion on nearly every subject relating to the association service and to credit and business conditions followed. The business meeting adjourned at 6:15 p. m.

In the evening the annual dinner of the association was held in College Hall at the University Club. Mr. Frank M. Pierce, the president, presided, and after proposing a toast to the absent turned the management of affairs over to Mr. John F. Gilchrist, Commonwealth Edison Company, who performed the duties of toastmaster most acceptably. The first toast was responded to by Mr. Merritt Starr, whose subject was "The Field of the Voluntary Association." He remarked that the two principles characteristic of a voluntary association of any sort were mutual need and free choice. An association such as that which he was addressing is established for the mutual benefit of its members and their customers. If the purposes of the association are legal, if its means are lawful and are also reasonably adapted to the objects of the association, the will of the majority of the members governs all the members of the association. If they wish, the members of such an association may boycott delinquent debtors, but they must not induce other bodies who have no direct interest in these debtors to take like action. That would be coercion, or the secondary boycott, which is unlawful. In an eloquent peroration Mr. Starr, who is a leading member of the Chicago bar, pictured the beneficent effect of trade and commerce on the progress of the world.

Rev. Dr. E. A. Paddock, president of the Idaho Industrial Institute, had for a subject "Humbugs I Have Met." He made a good speech to the effect that while Idaho has many advantages his hearers must be on their guard against wild-cat mining schemes and fraudulent land projects.

Judge Marcus Kavanagh had for a subject "Reminiscences of the Bench," and in the course of a speech which was listened to with deep attention he advocated certain reforms to remedy the law's delay—a subject in which the speaker, in common with other occupants of the bench of Cook County, is greatly interested.

Mr. W. G. McKitterick, of the National Electric Lamp Association of Cleveland, spoke on the "Relation of the Sales and Credit Departments." He gave a sensible business talk and commented on the aggressiveness, co-operation and good-fellowship manifested by the association. He favored a liberal credit policy in the case of first orders and closed, following a suggestion of Mr. Gilchrist, with a description of the beautiful island in Lake Ontario, near Henderson Harbor, which is the summer headquarters of the lamp association.

Mr. H. A. Antram gave some recitations and earlier in the evening there was lusty singing of popular songs, led by Warren Ripple. An excellent dinner, fine orchestral music and the setting of one of the stately halls of the University Club all contributed to make the fifteenth annual dinner a success. The menu and list of toasts contained many clever scraps of poetry and mottoes that were apropos, and no doubt this was largely the work of Secretary Vose, who was conspicuous in the arrangements both for the annual business meeting and the dinner in the evening. The attendance at the dinner was over 100.

Electrical Men at National Commercial Gas Association Convention.

The sixth annual convention of the National Commercial Gas Association was held at Boston from Dec. 6 to 9, inclusive, President E. N. Wrightington being in the chair. Representatives of public-utility organizations from many parts of the country attended and the presidency for 1911 was given to Mr. C. N. Stannard, of the Denver Gas & Electric Company. Among the papers by representatives of combined gas and electric companies were the following: "Compensation of Representatives," by Mr. J. D. Shattuck, general manager Philadelphia Suburban Gas & Electric Company; "Service," by Mr. C. W. Hare, new-business manager, United Gas Improvement Company, Philadelphia; "Rates," by Mr. Henry L. Doherty, New York; "Relation with Customers," by Mr. V. ... Henderson, Merchants' Power Company, Memphis, Tenn.; "Office and Accounting Methods," by Mr. Harry Hughes, Denver Gas & Electric Company, Denver, Col.

MR. H. L. DOHERTY ON RATES.

Mr. Doherty suggested the desirability of reform in the methods of charging for gas. He stated that perhaps no other one factor has contributed so much to the success of the electrical business as the study of the rate problem. Even the electrical business has only reached the point of what might be termed acute interest. Discussion of the rate problem has generally resolved itself into one of scientific cost analysis and ha

given the electrical men a much keener knowledge of their costs and a much better idea of what constitutes profitable and unprofitable business, and has worked a radical change for the better in their commercial methods. Taking up telephonic analogies as useful in studying rate problems, Mr. Doherty showed how inequitable charges will curtail the volume of business done and cause the community to pay more for service as a whole than would be the case if a rational system of charging was used. He further showed that a system of charging which permits any business to be carried on at less than the cost to the company and prevents the acquisition of business which might be had on a profitable basis means that the community pays more for service than would be required under a rational system of charging. Inequity of charging tends to discourage development of business or to curtail it, whereas equitable rates tend to give the community the maximum service for the least cost. Scientific charging methods are applicable to almost every business, and it is a common error to justify inequities in one business by pointing out similar errors in other lines. Mr. Doherty said that he believed that the development of the science of charging and its universal application would do more to reduce the cost of service to the public than if it were possible for them to confiscate half the profits from all of the business enterprises. The public frequently looks for reduction in the cost of service from the wrong standpoint.

Aggressive commercial methods will doubtless do more for the development of sales than a reduction in price. The cost of service can be reduced to the consumer more by highly efficient appliances and good service than would result from cutting the price, hence the rate charged by the company is not identical with the cost to the consumer. Mr. Doherty reviewed the importance of a high load factor in gas work no less than in electrical service, and stated that the load factor, or ratio of average to maximum, in the gas meter is about 3 per cent; that of a gas service is about 1 per cent; that of distributing mains is about 10 per cent; that of feeder mains is about 15 per cent, of transmission mains 20 per cent, and of the gas works about 60 per cent.

Mr. Doherty explained the fundamental elements of cost in the supply of electric service, classifying them under consumer expense, demand expense and energy expense, and showing that this is the final basis upon which the reasonableness of rates is properly determined. The importance of making a reasonable profit from the business of each customer was reviewed and the point made that if a company is not compelled to do business at a loss with any customer, it tends to make it possible to supply the profitable customers at a lower rate. This will probably be the rate method toward which the industry will eventually work. In conclusion the author touched upon the history of electrical rate-making, pointing out the results of the work of Hopkinson, the Wright demand system and the Doherty "readiness-to-serve" methods of charging. Mr. Doherty stated that Dr. Hopkinson was the pioneer of the science of rate-making and that if he had dealt with present conditions he would have included the consumer charge. This is a negligible factor when electricity or gas is being supplied in large quantities, but under modern conditions it has become a factor of more importance than the demand charge. As the electrical business has developed the simultaneous maximum demand per consumer has greatly diminished. The well-developed central stations of to-day seldom have a simultaneous maximum demand of more than 0.4 kw per consumer, and in some cases it is below 0.3 kw. We can approximate the fixed charge of a central station at about $60 per kilowatt, if all fixed charges are appo[illegible] demand basis. Where the consumer charge is used it has become necessary to fix this charge at about $12. Hence if the maximum demand is 0.4 kw per consumer it amounts to $30 on a demand basis. In other words, $12 per [illegible] per kilowatt of maximum demand would yield the same revenue as if no consumer charge was made as against a $60 charge per kilowatt of maximum demand; and in the case of 0.3 kw per simultaneous maximum demand the consumer charge at $12 would enable service to be sold at $12 per consumer plus $24 per kilowatt of maximum demand. The author concluded with an exhaustive bibliography of recent articles and books on the rate problem.

One feature of the convention was an address by President James L. Richard, of the Boston Consolidated Gas Company, upon the benefits of co-operation with the public, good service and publicity.

The Testing of Steam Turbo-Generator Sets.

In a paper by Messrs. E. D. Dickinson and L. T. Robinson presented before the American Institute of Electrical Engineers in New York on Dec. 9 an outline was given of the precautions that should be observed in testing steam turbo-generator sets.

The authors stated that the one positive method of testing a turbo-generator is to measure the steam that goes in through the throttle valve and the electric energy delivered at the terminals of the generator. The surest method of determining how much steam enters the turbine is to collect and weigh all the steam after it has been condensed. This necessitates the use of a condenser of the surface type. In making such a test it is essential that all the steam used on the turbine be condensed and measured and that no steam or water not used in the turbine be allowed to enter the condenser. The most accurate method of ascertaining the amount of steam condensed is by the use of tanks so arranged that all the water can be weighed at equal time intervals during the test.

When the turbine operates non-condensing or the condenser is of the jet type it is usual to weigh the water fed to the boiler. The liability to error is very great, and every precaution must be taken in order that the results may be considered reliable within any degree of accuracy. The leakage may amount to as much as 12 per cent and has been known to reach 20 per cent.

The method of test by heat balance, based on measuring the amount of heat transferred to the cooling water from the condensed steam, is extremely inaccurate and unreliable because of the difficulty of measuring the quantity of cooling water and its true average temperature change.

The only "efficiency" of any particular commercial value is the net over-all value as indicated by the ratio between the kw-hour output and the available energy in the steam. To determine the available energy in 1 lb. of steam it is necessary to know the pressure in pounds per square inch, the quality and the temperature of the entering steam; also the pressure at the turbine exhaust. To measure the exhaust pressure or vacuum a gage should not be relied on. The most accurate means is to use a full-length mercury gage and subtract the readings given by this from the atmospheric pressure at the time the test is made. If the steam be superheated, since there is some difference of opinion concerning the specific heat of superheated steam, the figure assumed must be specified. In testing turbines consisting of several stages, the pressures in the different stages should be measured. This affords a check and should show any abnormal conditions existing in the interior which might not otherwise be observed. The output should be net; that is, the kilowatts for excitation sould be subtracted from the generator output.

Whenever possible turbines should be tested under the conditions for which they were built to operate. Correcting for different conditions is always liable to throw some doubt upon the accuracy of the test. Different machines will have different correction factors for varying conditions, and for this reason it is impossible to fix arbitrarily the allowances that should be made. In general, the corrections for steam pressure, moisture or superheat are less liable to be misleading than that for varying vacuum, for the reason that comparatively large changes in any one of the first three will but slightly affect the conditions in the machine, whereas a slight change in the vacuum

makes an enormous change in the available energy and volume of the steam in the low-pressure end of the turbine.

Under suitable circumstances thoroughly accurate tests may be made by measuring the steam flow with a meter. Such tests will be more convenient than those made by any other method. Certain precautions are necessary, but there should be small expense in providing conditions that will insure reliable results with the best meters. Even where other methods of measurement are used the steam-flow meter will always be a valuable adjunct, since its readings are accurately proportionate to flow and show the conditions instantaneously.

For measuring the electrical output use should be made of indicating instruments rather than watt-hour meters. Single-phase indicating instruments for polyphase service are to be preferred for precision work to polyphase instruments, for the obvious reason that indications of a polyphase instrument are made up by the two elements in such a way that it is not possible to apply corrections to either element to get the true total result unless the division of load is known by single-phase instruments; if the single-phase instruments are required for this purpose they may as well be of the precision class and used for the actual determinations and the polyphase instruments omitted.

Discussion.

Mr. Gano Dunn remarked that the paper dealt principally with over-all efficiency determinations largely for the purpose of acceptance tests. Of equally great importance from an engineering point of view, and of even greater importance scientifically, are the detail tests of the separate machines making up the turbo-generator unit. It is important to know the proportion of losses chargeable to each machine. This is especially true when the turbine is made by one company and the generator by another.

Mr. W. L. R. Emmet stated that the losses in the generator portion of the unit can be determined by the retardation test in which observations are made of the rate at which the stored rotative energy is dissipated during retardation. He said that the losses in high-speed generators are much greater in many cases than generally supposed, by reason of the windage, leakage fluxes and eddy currents. The existence of the numerous losses that are difficult to calculate or measure separately makes it desirable to test the turbo-generator unit as a whole. In such tests a steam-flow meter is a valuable device; results obtained with it should be accurate within 2 per cent and can be made within one-half of 1 per cent.

Mr. Francis Hodkinson claimed that when the test of a turbine is based on the weight of steam condensed one hour is sufficient time for making the test run. A hydraulic brake provides a convenient means for observing the output.

Prof. W. L. Robb stated that not only should the steam conditions be the same under test as during normal operation, but the electrical load should be at the same power-factor. Neither a steam-flow meter nor a wattr-hour meter should be used as a basis for the final calculations, but both instruments should be in service at the time of the test for detecting irregularities in the operating conditions. Although a run of one hour after the conditions have become constant will give sufficient data for calculation of the efficiency, provided a surface condenser is used, a much longer test would be required if the steam consumption were ascertained from a measurement of the feed water.

Mr. E. D. Dreyfus presented data to show that consistent results can easily be obtained in testing steam turbines.

Mr. W. C. L. Eglin expressed the opinion that an acceptance test to be of any value should be made in the manufacturer's plant, where the conditions are under proper control and enough trained observers are available.

Mr. C. O. Mailloux called attention to the fact that when the turbine of a set is made by one company and the generator by another each company blames the other for all troubles arising in the set.

Mr. A. H. Pikler remarked that since the test of a turbo-generator unit is a duration test the time-integral of the output should be measured and not the rate of output. Thus use should be made of energy as well as power meters; that is, watt-hour meters as well as wattmeters.

Dr. E. B. Rosa said that electrical testing instruments now on the market give highly accurate results when properly calibrated. In all cases they should be calibrated before the test to prevent the use of any instrument found unsuited for the purpose; a subsequent calibration is desirable, but not so necessary as the prior calibration.

Mr. Robinson explained that many of the precautions listed in the paper might seem only too obvious, but observation has shown that the suggestions are necessary. The usual test is run by either a steam engineer or an electrical engineer; the former makes an accurate test of the turbine, but ignores many important details of the generator set, while the latter tests the generator properly, but neglects important features of the turbine test.

Steam-Consumption Tests of Large Turbines.

At the annual meeting of the American Society of Mechanical Engineers, held in New York, Dec. 6-9, two papers relating to tests of large steam turbines were presented and discussed.

Mr. F. H. Varney described tests on a 9000-kw vertical Curtis turbo-generator installed by the City of Oakland, Cal., in 1908. This installation, consisting of turbo-generator, boilers, steam piping and auxiliaries, building, crane and everything necessary for a complete steam plant, excepting land, cost $51 per kilowatt. Only 171 days elapsed from the beginning of the plans and specifications to the successful operation of the station.

When operating at 175 lb. gage pressure, 125 deg. Fahr. supertemperature, 28-in. vacuum, the steam consumption in pounds per kw-hour was guaranteed not to exceed 16.75 at an output of 5000 kw, 16.40 at 7000 kw and 16.40 at 9000 kw. Under test at a load of 6922 kw the consumption was found to be 16.06 lb. per kw-hour, while at a load of 8775 kw it was 15.95 lb. With corrections based upon 1 per cent for each 10 per cent change in pressure, or for each 12.5 deg. supertemperature, and upon 1.08 lb. per kw-hour for each inch change in vacuum, the corrected consumption was 15.42 lb. per kw-hour at the load of 6922 kw.

Mr. Sam L. Naphtaly outlined the design and operation of a complete-expansion, double-flow horizontal Westinghouse turbine of 10,000 kw normal rating installed in 1909 in the main generating station of the City Electric Company, San Francisco, Cal. The guarantee stated that the consumption should not exceed 16.2 lb. per kw-hour at 5000 kw, 14.3 lb. at 10,000 kw and 15.3 lb. at 15,000 kw when operating at a steam pressure of 175 lb. gage, 100 deg. Fahr. supertemperature and 28-in. vacuum. The generator was a 60-cycle, three-phase, 11,600-volt machine having an electrical efficiency of 92.2 per cent at one-fourth load, 97.6 per cent at full load and 98.2 per cent at one and one-half load. The tests showed the following steam consumption at the loads indicated: 15.655 lb. per kw-hour at 5333 kw; 14.572 at 9173 kw. When corrected for changes in vacuum, supertemperature and pressure the values become 15.21 and 13.88 at the loads recorded. The corrections were based on 1 per cent change in steam consumption per 10 deg. in supertemperature, ½ per cent for 10-lb. change in pressure and 3 per cent at full load and 6 per cent at half load for each 1-in. change in vacuum.

Discussion.

Mr. I. E. Moultrop commented upon the speed of erection and low cost of the 9000-kw station. He said that although the performance was better than the guarantee it was not especially creditable to the Curtis turbine. The vacuum could well have been improved and the supertemperature increased, thereby lowering the steam consumption; the increased cost of the installation would probably be fully justified by reason of the saving in operating expense. In view of the low supertemperature and vacuum used with the 10,000-kw turbine its efficiency

can be considered quite high. Mr. Moultrop reported the results of tests on a 3500-kw horizontal Curtis turbine which showed a steam consumption of 13.62 lb. per kw-hour and on a 5000-kw five-stage Curtis turbine unit which showed a consumption of 12.71 lb. per kw-hour with highest supertemperature and test vacuum but 13.57 under normal conditions.

Mr. E. D. Dreyfus stated that the new addition provided for the installation of the 10,000-kw turbine cost the City Electric Company $33.94 per kilowatt, including everything from the real estate up to and including the switching gear. By employing a speed of 1800 r.p.m. instead of 900 r.p.m. the unit has been reduced in length by about 17 per cent, the area needed being only 0.18 sq. ft. per kilowatt of rating.

Mr. G. A. Orrok presented a table showing the actual steam consumption of various steam turbines ranging from 11.95 lb. to 15.95 lb. per kw-hour. The power was for a machine operating at 29.19 in. vacuum, 289.3 deg. supertemperature and 179 lb. steam pressure, as compared with 28.03 in. vacuum, 72.95 deg. superheat and 194 lb. steam pressure for the latter.

Dr. D. S. Jacobus remarked that the indicated consumption of 15,000 heat units per kw-hour would correspond to about 22,000 units in the fuel at a boiler efficiency of 70 per cent. He stated that the value seemed very low, since the lowest figure on record, which was made at Oakland with oil fuel, is 25,000 heat units per kw-hour.

Mr. Francis Hodgkinson stated that it is incorrect to assume that a turbine designed, for example, for a 25-in. vacuum would necessarily be higher in efficiency than one designed for a 26-in. vacuum. Conditions other than the vacuum must be considered.

Mr. R. J. F. Pigott outlined the economical features of high-pressure turbines compared with reciprocating engines used with exhaust-steam turbines and expressed the opinion that no one is likely to build a large station having reciprocating engines and turbines.

Mr. W. L. R. Emmet called attention to the mechanical details of the 10,000-kw machine, and claimed that it should be rated at about 7000 kw instead of 10,000 kw.

Mr. W. L. Naters claimed that the mechanical features of the 10,000-kw turbine unit had been carefully designed, and the machine, which is the first of its kind, has proved so successful that it will doubtless prove a forerunner of an able line of high-speed units.

Energy Consumption of Passenger Elevators.

In a paper presented by Mr. Reginald P. Bolton before the annual meeting of the American Society of Mechanical Engineers in New York on Dec. 8 much information was given concerning the service performed by passenger elevators in buildings used for various purposes. In all elevators, particularly those electrically operated, the energy consumed per car-mile increases in proportion to the number of starts and stops. This is a natural result of the use of the electric motor, in which the largest part of the energy is required for the process of first motion and acceleration, the next largest for electrical and mechanical retardation, and a less amount for the actual running speed, with a small proportion devoted to the continuous excitation of the field. It, therefore, follows that in this form of elevator, which is now so widely used, the main part of the consumption of energy is directly related to the number of stops and starts which accompany and result from the number of persons carried. The diversities in results which have been reported from time to time as to the consumption of energy by electrical elevators may be attributed to variations in traffic conditions.

The author reported the results of a series of tests of an electric traction elevator in the ten-story office building of the Edison Electric Illuminating Company of Boston. With a total travel up and down of 203 ft. the consumption varied from 2.18 kw-hours per car-mile with only the operator as load to 2.93 kw-hours per car-mile with a total load of [illegible] lb. When a total of sixteen stops was made during a return trip the consumption varied from 7.95 kw-hours for the operator alone to 7.97 kw-hours with a total load of 2010 lb. The elevator is rated at 2500 lb. and is designed for a speed of 550 ft. per minute. It is driven by a 200-volt direct-current motor.

Wisconsin Commission News.

The Railroad Commission has authorized the Wisconsin River Power Company to issue stock and bonds as follows:

Three million dollars par value of bonds, dated May 1, 1911, and bearing interest at the rate of 5 per cent. The denominations are to be $500 and $1,000. These bonds are to be issued for money only, for not less than 75 per cent of the par value, and in accordance with the terms of a certain mortgage or trust deed issued to the Continental and Commercial Trust and Savings Bank and Frank H. Jones, trustee, both of Chicago, Ill.

Twenty thousand shares of common stock of the par value of $100 each, being an issue of $2,000,000. This stock is to be issued for money only and for not less than par value.

The funds to be derived from the sale of the stock and bonds are to be used to supply the company with funds for the construction of a dam and hydroelectric power plant at a point on the Wisconsin River, near the City of Prairie du Sac, Sauk County, Wis., and for the construction and equipment of the necessary hydraulic and electrical works and the transmission systems.

The commission has dismissed the petition in the case of Timothy L. Harrington and others vs. the Milwaukee Electric Railway & Lighting Company. The petitioners alleged that the respondent company had made unreasonable charges for the power used in charging automobile batteries and that a minimum bill of $5 per month was excessive. The petitioner further alleged that the capacity charge of $1 per horse-power per month was based upon the capacity of the mercury-arc rectifier; that the rectifier would have been unnecessary had the respondent extended its direct-current lines so as to cover consumer's premises.

The commission did not deem it necessary to investigate the merits of the contention, for the reason that since the presentation of the above complaint the respondent company has filed additional optional schedules of rates designed to give concessions to off-peak users. The schedules referred to are the so-called "off-peak" and the "ten to seven" schedules. In the former a demand charge of $21 per kilowatt per year is made, where the service is not utilized during peak hours, plus an energy charge of 4½ cents for the first 100 hours, 3½ cents for the next 900 hours, etc.; in the latter but one-half the demand charge is assessed where the consumer contracts to utilize the company's service only during the hours of from 10 p. m. to the following 7 a. m.

Under these optional schedules, which the petitioner is in a position to take advantage of, the cost of power is materially reduced. The commission found, moreover, upon an investigation of the cost of service, that unless the consumer uses his current for more than three hours daily the cost of serving him is greater than the revenues that would be derived from these services under the optional schedules given above and that consequently no reduction in rates could be considered.

The petition in the case of the Mt. Horab Electric Light Company for authority to increase its rates has been dismissed by the commission. The case arose out of an application to increase rates for municipal incandescent lighting service. As no attempt had been made to keep the company's books in compliance with the "Uniform Classification of Accounts," as prescribed by the commission, or in any complete manner whatsoever, it was impossible to make a complete financial analysis of the company's business. However, the facts, meager as they were, seemed to indicate that the municipality is contributing its just share to the earnings of the company; that a readjusment of commercial rates, apparently justifiable, may well be postponed until such time as the company's accounts and station

records are in shape to substantiate other conclusions. In the comparison made between the rate at Mt. Horab and other communities of similar size it was noted that the charge that the petitioners sought to have increased, namely, 0.658 cent per lamp per hour, was already somewhat above the average of 0.488 cent per lamp per hour.

The commission has approved the application of the Greenwood municipal light plant for authority to put into effect a minimum rate of 40 cents per month. The minimum charge should yield a return equal to the consumer cost and an additional amount to cover the value of the smallest amount of energy used by any class of consumer. Inasmuch as the petition called for a certain definite minimum charge the commission did not concern itself with the determination of a minimum charge based upon total costs as outlined above, but confined itself to the question as to whether a 40-cent minimum charge was excessive or not. That it was not was clearly shown by the following table made up of the items of depreciation and interest from average figures representing the usual value in the smaller plants and the items of maintenance, consumer's premises expense and collection expenses, which costs represent the average for all Class B electric utilities reporting these items.

Interest on meters and services @ 7% on $14.00	$0.98
Depreciation on meters and services @ 7% on $14.00	0.98
Maintenance of meters	0.50
Consumer's premises expense	0.34
Collection expenses	0.73
	$3.53

The meter expense amounts to roughly 30 cents per month, and although this value may not represent the actual cost to the applicant it is fairly representative of costs per meter consumer for smaller electric utilities.

As the difference between 40 cents and 30 cents very obviously is less than the value of the smallest amount of energy used by any class of consumers, the 40 cents minimum charge could not be excessive.

New Jersey Commission News.

The Board of Public Utility Commissioners of New Jersey has decided that an electric light company has the right to exact a minimum charge. The opinion was rendered on the complaint of a consumer that the Dover (N. J.) Electric Light Company had submitted a contract by the terms of which a monthly minimum charge is exacted of $4.50, based upon a charge of 5 cents for each 16-cp lamp or equivalent. The board referred to a New York case, Gould vs. Edison Electric Illuminating Company, in which it was held by the court that a minimum monthly charge of $1.50 was not illegal, but compensatory for that part of the service which is at all times being rendered in the maintenance of the apparatus and connections through which electricity is made available to the consumer. Two points in the Dover case were held over for consideration, namely, to what extent, if any, the right of the company to make a minimum charge is affected by the terms of any contract between it and the municipality; and whether the charge of 5 cents per 16-cp lamp is reasonable.

The board recently received an inquiry from the City Clerk of Ventnor City asking whether, under the public utilities act, a telephone company seeking a franchise is restricted from furnishing free telephone service at public buildings, such as fire house, city hall, police department and public schools. The act recites that no public utility shall give, grant or bestow upon any local, municipal or county official any discrimination, gratuity or free service whatsoever. The board requested an opinion from the Attnorney-General as to whether furnishing free telephone service at public buildings would conflict with this provision of the law. The Attorney-General has advised the board that "the language of the statute quoted has regard merely to such discrimination, gratuity or free service as may be granted or bestowed upon the class of officials described by its terms. The discrimination and gratuity forbidden is purely personal in its scope. In my opinion this provision of the act would not prevent the granting of a franchise to a telephone company by a municipality when, by the terms of the franchise, free service was to be furnished the fire house, city hall and other public departments within the confines of the municipality. Such free service might well be one of the moving considerations in the granting of the franchise and does not, in my opinion, fall within the evil which the statute just quoted sought to eliminate."

New York Commission News.

The commission will hold a hearing during the present week on the application of the Hoosac River Electric Light & Power Company for permission to construct its lines in the Town of Pittstown, Rensselaer County, and to issue capital stock.

The Middleport Gas & Electric Light Company has been authorized to exercise franchises granted for the furnishing of electric lighting to the Town of Royalton, Niagara County, N. Y.

Maryland Commission News.

Formal protest was filed with the Maryland Public Service Commission last week by residents along the Emory Grove car line against the action of the United Railways & Electric Company in suspending at once all commutation fares on that and all other lines and especially in abolishing the 7½-cent rate to nearby suburban points. Demand is made that the commission shall compel the Railways Company to return to the tariff schedules filed with the commission Sept. 16 of this year. The petition charges that the company acted hastily in abolishing all commutation rates, following a protest from residents of Ellicott City, with regard to alleged discrimination in favor of residents along the Catonsville-Irvington line.

The hearing before the commission last week on the protest against the proposed new schedule of rates of the Chesapeake & Potomac Telephone Company was slimly attended. While there are more than 800 holders of limited service contracts in the city, all of which will be affected by the proposed change in rates, and thousands of persons more or less interested in the contemplated action of the telephone company, there were but very few subscribers present at any one time while the hearing was in progress and of these there were scarcely two who agreed fully as to what was required of the company. Some favored unlimited service, while others seemed positive that limited service was the only cure for the evils that the telephone user is said to endure. Early in the session it was evident that those in attendance came each to present individual complaints, not so much against the contemplated change in rate schedules as against the alleged delinquencies of the company in rendering service, and it was this note that was continually sounded throughout the whole hearing.

Mr. W. W. Varney, an attorney who appeared in his own behalf as a subscriber, questioned the right of the Public Utilities Commission to sit in the case in a judicial capacity and quoted legal references to show that the Public Utilities Commission lacked jurisdiction to fix tolls and rates, not having had that power conferred on it by legislative act, and that, in consequence, the commission was powerless to act as a judicial body in passing upon the proposed rates of the Chesapeake & Potomac Telephone Company. Chairman Ambler ruled that Mr. Varney's challenge of authority was not in order; that, as the commission believed that it was vested with authority to control public-service corporations and as the commission would continue to act in accordance with this belief, the contention of Mr. Varney was a matter for the courts to settle.

Preliminary plans providing for the construction of an ele-

tric railway from Salisbury to Nanticoke Point, a distance of thirty miles, were filed with the commission. The charter for the road was passed by the Legislature of 1908. The commission is asked to approve the plans, so that the work can be begun. The application was filed by former State Senator Marion V. Brewington, and while several Marylanders are interested in the project New York and Philadelphia capitalists are expected to furnish the bulk of the money to finance the enterprise. The line, which will haul both passengers and freight, will pass through Jesterville, Bivalve, Tyaskin, Quantico, Hebron and other towns.

The commission heard the protest made against the plan of the Frederick Street Railway Company to acquire the majority of the stock of the Frederick Gas & Electric Company. Some weeks ago the railway company filed with the commission an application for acquiring control of the lighting company. A number of the stockholders of the street-car company are opposed to the plan and they were represented at the hearing by Mr. Charles H. Freuauf, of New York. Mr. Robert P. Graham represented the street-car company. The commission has the protest under consideration.

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission has authorized the Plymouth Electric Light Company to issue new capital stock to the amount of $30,000 at par value, the price being $100 per share. The proceeds are to be applied toward paying the cost of power plant improvements made since a fire which destroyed the company's generating equipment in part about a year and a half ago.

The Railroad Commission has issued a finding sustaining the Old Colony Street Railway Company in the petition of the Selectmen of Abington relative to reduction in rates between Abington and Brockton. In its decision the board points out that it is practically impossible, in view of local conditions throughout the State, to determine the reasonableness of rates for street railway fares exclusively upon the proposition of mileage.

The Selectmen of Weston, Wayland and Sudbury have petitioned the Railroad Commission to fix the route of the Boston & Western Electric Railroad Company in these towns following the granting of a certificate of necessity to the company by the board. The Northampton Street Railway Company has petitioned the board for authority to issue $300,000 in additional capital stock for the purpose of paying indebtedness incurred in retiring bonds maturing in the past two years. The directors have fixed the price of the stock at $100 per share.

The various state commissions are making final arrangements to report to the incoming Legislature early in January, 1911, upon a large number of matters assigned by the General Court of 1910. Among the more important questions to be discussed are the electrification of railroads at Boston, the laws bearing upon electric power transmission, acquisition of stock, control of outside companies by the Boston Elevated Railway Company and various Boston subway extensions.

Canadian Hydroelectric Commission News.

In an address to the members of Middlesex County Council at London, Ont., on Dec. 8 Hon. Adam Beck, chairman of the Hydroelectric Commission, announced that the commission would supply "hydro power at cost" to every community that wants it. Mr. Beck stated that the commission would, in supplying the smaller communities, operate on the same principle as the municipal telephone system. Whenever twenty farmers went to a county council and requested the erection of a distribution line the commission would erect the low-tension lines tapping the main transmission high-voltage lines and construct the low-tension feeders to the residences of the farmers, who would pay off the cost of construction of the low-tension lines in the same manner as paying for a local improvement, retiring the indebtedness at the end of fifteen or twenty years.

The offer of the City Council of London, which has contracted for hydroelectric power, to purchase the stock of the London Electric Light Company for $100,000 and assume the bonded indebtedness (referred to in the issue of Dec. 8), was refused by the directors of the company at a meeting held in Toronto the following week. Subsequently the management of the company at London announced that there will now be severe competition between it and the city plant for the business of the consumers in London. The company has reduced the rate for lighting from 9¼ cents to 5 cents per kw-hour, with a discount of 10 per cent, making the rate 4½ cents net per kw-hour.

The Water and Light Commissioners of the city, on the other hand, say that the company cannot afford to do business at these rates very long, and they have decided not to lower their rates beyond the figures announced on the Saturday previous, when they published a reduction in the house-lighting rates for Niagara power from 4 cents to 2 cents for a fixed charge on the floor-space basis. The average consumer of electricity in London has 600 ft. of floor space, and at 2 cents per 100 ft. he would pay a fixed rate of 12 cents per month. It is also figured out that he would use 8 kw-hours of energy at 4 cents per kilowatt, making a total charge of 44 cents for the month, less 10 per cent discount, making the net rate 40 cents per month.

Commenting on the refusal of the directors of the London Electric Company to accept the city's offer of $100,000 for their company, the press states that as the control of the company is in the hands of the same interests that control the Toronto Electric Light Company, which is now in negotiation with the Toronto city corporation looking toward the purchase of that plant by the City of Toronto, the directors of the London company acted as they did having before them the fact that their action in the case of the London company would have an influence on their negotiation with the Toronto City Council in the sale of the larger Toronto Electric Light Company's plant and business.

As a result of a conference between General Manager H. H. Macrae, of the Toronto Electric Light Company, and Corporation Counsel H. L. Drayton, for the City of Toronto, an understanding has been reached whereby Engineer R. A. Ross, of the Hydroelectric Commission, and Engineer Expert Alex. Dow, of Detroit, for the city corporation, will be permitted to make an inspection of the physical assets of the Toronto Electric Light Company at an early date for the purpose of submitting a valuation to the City Council as a basis to enable the Council to formulate an offer for the purchase of the Toronto Electric Light Company.

AMERICAN ELECTRICAL ENGINEERS.—XXIII.

Valere A. Fynn

Valère Alfred Fynn, of County Galway, Ireland, was born at Krasno on April 11, 1870. He was sent to Switzerland at the age of ten, where he went to school first in Geneva, then in Lausanne and Grenchen and finally in Zürich. In 1887 he entered the mechanical engineering department of the Swiss Federal Polytechnic in Zürich, where he completed the regular three and one-half-year course of mechanical engineer, including practical shop work, and remained another year making a special study of electrotechnics under Professor H. F. Weber.

From 1892 to the end of 1895 Mr. Fynn was employed by Messrs. Brown, Boveri & Company, of Baden, Switzerland, doing testing, designing and erecting work. He was intrusted with some of the firm's most important work at the time, as, for instance, the erection of the three-phase plant at the Gerlafingen steel works, of the two-phase hydraulic central station in Aarau and the well-known single-phase steam power plant in Frankfort-on-Main. In [illegible] he accepted the post of [illegible]

electrical engineer to Messrs. Easton, Anderson & Goolden, Ltd., of Erith, Kent, England. While occupying this position he redesigned all of the company's line of direct-current machines, discarding the smooth-core armature, so very popular in England at the time, and introduced slotted armatures throughout and also developed a line of alternating-current machinery. While in Erith he patented a number of improvements in direct-current and alternating-current machinery which were widely used in England for a number of years by various firms.

In February, 1899, Mr. Fynn joined the firm of Rosling & Appleby, of Bradford (Yorkshire), as chief electrical engineer and shortly after became a partner. Rapid progress was made and it soon became necessary to build new works, which were erected by a newly formed company of which Mr. Fynn was a director. In 1898 he designed his unity power-factor, single-phase commutator motor, but the overhauling soon after of the

Valere A. Fynn.

designs of the above-mentioned firm delayed the immediate development of this invention. It was not until 1902 that he was able to build and test the machine, and thereafter most of his time was devoted to the study of the single-phase motor.

In 1903 Mr. Fynn abandoned manufacturing and began work on his own account as consulting engineer, making a specialty of supplying designs to various firms and advising them in special work. His single-phase motors were taken up by the Electricitäts Gesellschaft Alioth, which manufactures them in Switzerland and France, and also holds the patents for Germany, England, Italy and Spain. His machines are also built by the General Electric Company of London.

Since 1895 thirty British patents have been granted to Mr. Fynn, of which eight relate to single-phase commutator motors, five to commuted windings, three to the protection of electric circuits, two to methods for improving the power-factor of alternating-current motors, two to direct-current generators, and ten deal with dynamo-electric machines, electromagnetic couplings, variable-speed single-phase shunt motors, alternating-current generators, motors and converters, split-phase motors, and single-phase railway motors. Twenty-four United States patents granted to Mr. Fynn since 1897 may be divided into six groups. One group covers starting and phase-compensating arrangements for single-phase induction commutator motors having a "shunt" characteristic and includes what is said to be the first United States patent for phase compensation in such motors. The second group relates to the methods for adjusting the speed of single-phase induction commutator motors with "shunt" characteristics. The third group covers single-phase conduction commutator motors having a "shunt" characteristic and means for adjusting their speed, improving the power-factor and regulating the starting conditions. The fourth group discloses means for compensating polyphase commutator motors with "shunt" characteristics and adjusting their speed. The fifth group relates to means for improving the starting characteristics of single-phase squirrel-cage induction motors, and the sixth group deals with constructive details of alternating-current and direct-current motors and generators. Those of his United States patents which have been issued have been acquired by the Wagner Electric Manufacturing Company, of St. Louis, for which he has been acting as consulting engineer since 1908, spending some months each year in St. Louis.

Mr. Fynn has presented papers before the (British) Institution of Electrical Engineers entitled: "A New Single-Phase Commutator Motor" (1906), for which the institution premium was awarded, and "Torque Conditions in Alternate-Current Motors" (1907). Among articles contributed to the technical press are the following: "The Design of Direct-Current Machinery" (*Electrical Review*, London, 1903 and 1904); "A Contribution to the Theory of the Single-Phase Induction Motor" (*Electrical Review*, London, 1906); "The Classification of Alternate-Current Motors" (*Electrician*, London, 1907); "No-Load Conditions in Self-Excited Single-Phase Shunt-Induction Motors" (*Electrical World*, 1909); "Factors Affecting the Design of Self-Excited Single-Phase Shunt-Induction Motors" (*Electrical World*, 1909); "Characteristics of the Asynchronous Single-Phase Shunt-Induction Generator with Mixed Excitation" (*Electrical World*, 1910); "Characteristics of the Asynchronous Single-Phase Shunt-Induction Generator with Self-Excitation" (*Electrical World*, 1910).

Mr. Fynn is a member of the American Institute of Electrical Engineers and the (British) Institution of Electrical Engineers.

CURRENT NEWS AND NOTES.

Philadelphia Section Meeting, I. E. S.—The Philadelphia Section of the Illuminating Engineering Society will hold a meeting on Dec. 16, at which time a paper entitled *The Lighting of a Large Stable Building* will be presented by Mr. L. B. Eichengreen.

Turbo-Generators for Naval Use.—In the report of the Bureau of Equipment, the work of which is now merged in other bureaus of the Navy Department, it is stated that experience with turbo-generators for ship lighting plants has confirmed the intention not to purchase reciprocating engines for this purpose except in special cases.

New Mexico Hydroelectric Plant.—Steps are being taken by the Water Users' Association, composed of land owners in the Rio Grande Valley, New Mexico, to erect a hydroelectric plant in connection with the Elephant Butte dam and land reclamation project. Mr. W. E. Anderson, engineer of the association, has reported the cost of the hydroelectric plant and transmission lines as $325,000. The main object in view is to provide electric power for operating irrigation pumps.

Naval Electric Cooking.—The Bureau of the Navy Department which has had cognizance of cooking appliances states in its annual report that extensive tests with electric baking and cooking appliances have demonstrated the superiority in many respects of electric ranges and bake ovens over the ordinary type using coal and provisions have been made for installing them on battleships and submarines building. It has also been found advantageous in some cases to replace steam heaters by electrical heaters on board large vessels.

Automobile Feeder to Railway.—It is stated that the Boston & Maine Railroad Company will employ automobiles as feeders for its summer-resort business in the White Mountain region. The automobile service will cover about seventy miles.

Storage Battery Lecture.—Mr. Walter E. Holland, of the Edison Laboratory, will deliver a lecture on the subject of "The Edison Storage Battery" before the Electrical Engineering Society of Columbia University at 8:15 p. m., Friday, Dec. 16. The meeting will be held in the Engineering Building of the university.

Electric Club of Chicago.—Capt. William Brooke, U. S. A., addressed the Electric Club of Chicago on Dec. 7, on "The Needs of the Service," dwelling on the need of enlarging the regular army establishment of the United States. Messrs. F. B. Badt, O. D. Steele, H. W. Fowzer, F. J. Postel and others took part in the discussion of an interesting non-electrical meeting.

Fixation of Atmospheric Nitrogen.—A paper will be presented by Dr. E. F. Roeber on "Fixation of Atmospheric Nitrogen" at a meeting of the New York Section of the American Electrochemical Society to be held at the Chemists' Club on Dec. 16. The paper will treat of the general status of the development, the three principal commercial processes and the uses proposed for the products. Dr. Charles S. Bradley, one of the pioneers in the art, will participate in the discussion.

Gas Rates.—At the recent meeting of the Commercial Gas Association Mr. Henry L. Doherty presented a paper on "Rates" in which he advocated a differential system of charging for gas service, based on a charge uniform for all consumers, a demand charge of a uniform amount per unit of demand and a charge for gas of a uniform amount per unit of gas. The paper is accompanied by an extensive bibliography of papers and articles on the subject of rates for electrical and gas service.

Electrical Operation of Pumping Station, Chicago.—The Department of Public Works of the City of Chicago has asked the City Council for authority to install electric pumps at the West Side municipal water works pumping station on Ashland Avenue near Twenty-second Street. Energy for the operation of these pumps is to be obtained from a feeder line which the Sanitary District is about to install in Blue Island Avenue, and the operation of the installation, when completed, will call for about 2000 hp for twenty-four hours daily.

Electric Vehicles for Central-Station Service.—The wagons of the San Joaquin Light & Power Company will be replaced by automobile trucks, five of the new vehicles having been ordered by General Manager A. G. Wishon. Three of these will be used in Fresno and the other two will be used in Bakersfield. In addition to these auto trucks small runabouts have been ordered for use of the local solicitors of the company, looking to a general displacement of horses by electric vehicles.

Tungsten Lighting in Chicago Park.—The new eleven-acre park and playground being completed by the South Park Commissioners, at the corner of Princeton and Forty-fifth Streets, will be lighted entirely by tungsten lamps mounted on concrete pillars. This park will be one of the most completely equipped playgrounds in the city. More than 100 molded concrete posts carrying single lamps or tungsten clusters will be employed in the illumination scheme. The units will be installed at a height of 10 ft. above the ground to conform to the requirements of the dense foliage of the new park tract.

Colorado Electric Club.—At the Thursday lunch of the Colorado Electric Club on Dec. 8 Gen. Chase, of the National Guard, gave a talk on the national defense, the position of the National Guard and our abnormally small fighting force. The absolute necessity for training a large body of men before we get the trouncing which will otherwise come to us sooner or later was his main theme. He was followed by General McAllister, who supplemented certain points and spoke of our unreadiness for mobilizing an army of any size or efficiency at our many vulnerable points or even at one of them.

New Telephone Plant in the Canal Zone.—A new telephone exchange has been established at Miraflores, Canal Zone, Isthmus of Panama, for use on the Pacific division of the Canal Zone. Pedro Miguel, Corozal, Ancon quarry and Balboa are connected with the new exchange, from which about fifty stations are served. Wherever possible the poles carrying the transmission lines from the Miraflores power house have been utilized in stringing the telephone circuits. Service is furnished during working hours only and but one operator is employed. It is expected to extend the service to about 100 stations, using the party-line system.

I. E. S. Nominations.—The Board of Nominators of the Illuminating Engineering Society has selected the following candidates for the offices indicated: Dr. A. E. Kennelly, Boston, president; Mr. Preston S. Millar, New York, secretary; Mr. V. R. Lansingh, New York, treasurer; Messrs. H. E. Ives, Cleveland (to represent Chicago Section); T. H. Piser, Boston, and J. T. Maxwell, Philadelphia, vice-presidents; and Messrs. F. N. Morton, Philadelphia; John C. D. Clark, Chicago, and Arthur Williams, New York, directors. The annual meeting at which the election returns will be reported will be held in New York on Jan. 13, 1911.

Opportunity for American Electric Vehicles in Germany.—A German consul reports that American electric runabouts are occasionally seen in German cities like Berlin, and are conspicuous by reason of apparent lack of domestic rivals. As this type seems to appeal to fashionable city dwellers, and owing to the ease with which it can be operated by women, he advises American manufacturers to advertise and exhibit their electric vehicles in German cities, as by doing so there would be good prospects of an exclusive and profitable trade. The *Consular Report*, Dec. 8, No. 133, goes into details as to methods for introducing automobiles into Germany.

Old Book in A. I. E. E. Library.—Brother Potamian writes to say that attention has been called by the New York *Times* to the Waldseemueller map of the world, 1507, in which the name *America* occurs for the first time, and that it may interest our readers to know that the Wheeler gift of works on electricity and magnetism from the earliest times contains a copy of Mauro's *Sphera Volgare*, the title-page of which has a globe with the name *Ametrica*, written for America. Page 57 has another globe with the name correctly spelt. The *Sphera Volgare*, printed in Venice in 1537, is one of the rarities in the library of the American Institute of Electrical Engineers.

Prize of $25 for Electrical Catch Phrase.—Acting on the suggestion that the Commonwealth Edison Company of Chicago should adopt a standard advertising phrase encouraging the use of central-station service, the advisory committee of the company has offered a prize of $25 to the employee who makes the best suggestion for such a phrase which is adopted by the company. The words "Use Electricity" were first proposed, but it was believed that this phrase does not sufficiently represent the service rendered by the central station, and the prize contest was arranged to encourage the suggestion of other ideas for the slogan. If attractive, the successful motto will be used generally throughout the company's advertisements and signs. The contest closes Dec. 31, after which the suggestions will be opened and passed upon by the judges.

$72,000 for a Gram of Radium.—Sir Ernest Cassel, the British multi-millionaire, has presented to the British Radium Institute a gram of radium which he purchased from the Austrian Joachunstahl Radium Mining Company for $72,000. The institute will use the radium in experiments on the cure of cancer.

Cahill Telharmonium for Chicago.—Plans for supplying electrical music from a Cahill telharmonium to Chicago hotels, restaurants, theaters and public institutions are being completed by a corporation of Chicago electrical men who expect to have the apparatus installed as one of the attractions of the Electrical Show, Jan. 7 to 21.

Meter Service Cost.—In acting on an application of a central station for permission to establish a minimum rate for service, the Wisconsin Rate Commission estimated that the expense to the station of maintaining a meter was 30 cents per month. The details of the case will be found elsewhere under the head of Wisconsin Commission News.

Electrical Service for Farmers.—The chairman of the Canadian Hydroelectric Commission has announced that whenever twenty farmers or more request electrical service the commission will tap a neighboring main transmission line and erect a low-tension line, the farmers to pay for the latter in instalments extending over fifteen or twenty years.

Syracuse A. I. E. E. Branch.—At the regular monthly meeting of the Syracuse University Branch of the American Institute of Electrical Engineers Mr. Saul Lavine, of the General Electric Company and a graduate of the university, presented a paper on "Switchboards for Central Stations," reviewing the history of their development. The lecture was well illustrated with lantern slides and some of the very latest types of control boards with their mimic buses were shown.

Alabama Light and Traction Association.—At the recent annual meeting at Anniston, Ala., of the Alabama Light and Traction Association the following officers were elected: President, Mr. R. L. Rand, manager of the Anniston Electric & Gas Company; vice-president, Mr. R. L. Ellis, Selma; secretary and treasurer, Mr. G. S. Emery, Mobile; executive committee: Messrs. A. F. Kersting, Mobile; J. H. Morgan, Andalusia; M. S. Sloan, Birmingham; A. H. Sparks, Jasper, and R. A. Mitchell, Gadsden.

Officers of the A. S. M. E.—The American Society of Mechanical Engineers has elected the following officers for the ensuing year: President, Col. E. D. Meier; vice-presidents, Messrs. H. H. Vaughan, E. M. Herr and George M. Brill; managers, Messrs. D. F. Crawford, E. B. Katte and Stanley Flagg, Jr.; secretary, Mr. Calvin W. Rice, and treasurer, Mr. William H. Wiley. President-elect Meier is president, chief engineer and director of the Heine Safety Boiler Company, with offices in New York City.

Contract Signed for 10,000 Additional Street Lamps in Chicago.—The contract between the City of Chicago and the Sanitary District by which the latter will take over the existing electric street-lighting plants of Chicago and add 10,000 new lamps during the next three years, making 22,200 in all, was finally signed on Dec. 3. President Robert R. McCormick and Clerk I. J. Bryan attached their signatures for the Sanitary District and City Electrician William Carroll, Comptroller Walter H. Wilson and Mayor Fred. A. Busse for the city. The details of this interesting arrangement have appeared in previous issues of this journal.

Philadelphia Electrical Exposition.—The preliminary design for the decorations of the Philadelphia Electrical Exhibition, to be held Feb. 19-25, shows a unique setting which, if well worked out in detail, should meet with much approval. The scene will be that of a parterre or formal garden under a moonlit and starlit sky. The interior walls of the building will be covered by canvas on which will be represented a boundary garden wall, with trees beyond closing in the horizon, this canvas being continuous with that of the sky. The exhibition spaces will be green-carpeted plots with garden vases containing plants at the corners and vine-clad columns at the middle of the dividing lines running parallel with the aisles, which will have a covering simulating a garden walk.

Electricity in a Tomb.—Pending the construction of a large mausoleum in Mount Auburn Cemetery, Cambridge, Mass., the body of Mary Baker Eddy, founder of the Christian Science cult, will rest in a tomb equipped with electric light and telephone service for the convenience of a guard which has been posted. Two shifts of two men each are to keep watch of the tomb continuously, day and night, until spring, when it is expected that the body of Mrs. Eddy will be placed in a permanent structure. Current for the lighting service is supplied by the Cambridge Electric Light Company and the telephone facilities are furnished by the New England Telephone & Telegraph Company. In this way the tedium of the vigil will be relieved, and immediate assistance summoned in case of necessity.

Meeting of the New York Section of the I. E. S.—At a meeting of the New York Section of the Illuminating Engineering Society held on Dec. 8 a paper by Prof. Edward L. Nichols entitled *Some Notes on the Early History of Standards of Light* was presented in abstract by Mr. A. J. Marshall and briefly discussed by Dr. A. H. Elliott. Mr. Bassett Jones, Jr., presented a profusely illustrated paper dealing with the lighting of the Allegheny County Soldiers' Memorial in Pittsburgh. Abstracts of this paper and the discussion following its presentation are given elsewhere in this issue. At the January meeting of the section papers will be presented by Messrs. P. W. Cobb and Nelson M. Black on the effects of light on the eye, and by Mr. Paul F. Bander on the effects of reflected light in differently treated interiors. Mr. Bassett Jones, Jr., will present a paper entitled *Polar Curves of Finite Line and Surface Light Sources* at the February meeting of the section. At the same meeting Mr. Henry Hornbostel will lead the discussion of the subject "Light and Architecture."

Electrical League of Cleveland.—The first annual meeting of the Electrical League of Cleveland was held on the evening of Dec. 6 at Telling's Restaurant, where a dinner was served prior to the business session. The retiring president, Mr. G. E. Miller, of the Westinghouse company, described the progress which the league has made during the first year of its existence and pointed out various ways in which its usefulness may be increased in the future, particularly along the lines of co-operating with other local organizations in discussing matters pertaining to the electrical field. The league has 105 active members with good prospects for a large increase in the immediate future, and the officers and committees to whose efforts the spirit of hearty co-operation is due are to be congratulated. Mr. H. H. Cudmore, of the Brilliant Electric Company, who was largely instrumental in organizing the league, was elected president for the coming year. The other officers are as follows: First vice-president, Mr. E. E. Noble, Cleveland Electric Illuminating Company; second vice-president, Mr. C. T. McKinstry, the Erner Electric Company; third vice-president, Mr. C. P. Billings, Allis-Chalmers Company; fourth vice-president, Mr. A. L. Oppenheimer, Enterprise Electrical Company. Executive board: Messrs. H. E. Hackenberg, National Carbon Company; G. S. Milner, the Erner Electric Company; J. T. Kermode, Cleveland Electric Illuminating Company; J. Robert Crouse, National Electric Lamp Association. Secretary and treasurer, Mr. T. P. Cagwin, the Cleveland Telephone Company. Nominating committee: Messrs. Billings, McKinstry, Oppenheimer and N. C. Cotabish, National Carbon Company, and D. Aitken, the George Worthington Company.

INTERCONNECTED ELECTRICAL TRANSMISSION SYSTEM.

Hydroelectric Installation of the Central Maine Power Company.

ONE of the chief power sources in Maine is the Kennebec River, extending from the Canada line to the Atlantic Ocean, and passing through a basin about 150 miles ong, with an average width of from 50 to 80 miles. The sources of the streams forming the Kennebec are in general at elevaions of from 1800 ft. to 3000 ft. above sea level, and there is a nean descent of about 9.1 ft. per mile through the portion of he river which is developed for power utilization. The imortance of securing a systematic hydroelectric service in the

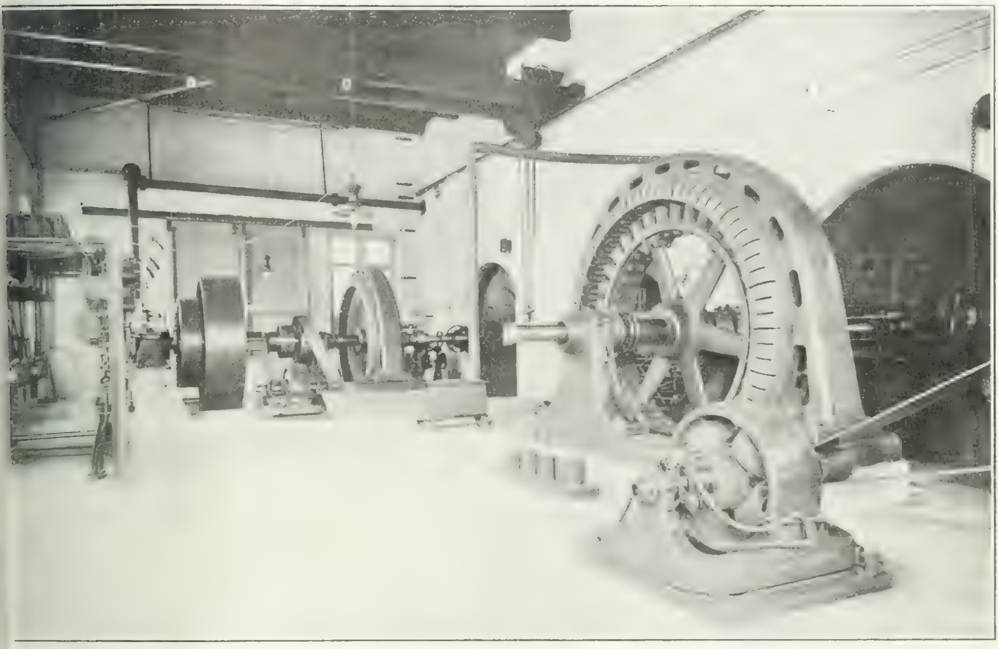


Fig. 1—Interior of Power House of Sebastian Power Company, Pittsfield, Maine.

ritory centering about Augusta and Waterville led to the rmation early in the present year of the Central Maine Power mpany, whose headquarters are in the City of Waterville, d whose scope of operations includes public-utility supply in Pittsfield, Burnham, Winslow, Waterville, Augusta, Oakd, Hallowell, Gardiner, Pittston, Randolph, Farmingdale, hester and Chelsea districts. The accompanying map, . 2, shows in skeleton outline the power house, transmission and substation connections of the system.

The companies forming the Central Maine Power Company re the Fort Halifax Power Company, the Messalonskee Elec- Company, Oakland Electric Company, Kennebec Light & at Company, Sebasticook Power Company, Sebasticook ter Power Company, Dexter Electric Company, Bingham tric Company and Solon Electric Company. The charters r which the Central Maine Power Company is operating perpetual, were granted by special acts of the Maine Legislae and are broad and [illegible] horized to sell electricity for all purposes in all the cities i towns named above, with the addition of Togus, Fairfield l Benton. By the charter of the Sebasticook Power Company, the Central Maine company has the right to sell electricity for any purpose in any town within the four counties of Waldo, Kennebec, Somerset and Penobscot, except where another company is either doing business or is authorized to carry it on.

In consolidating the various properties that make up the company the management sought to secure the benefits of centralized resources, co-operative service from segregated electric generating plants and the advantages of a broader market than a single community can furnish. It was further recognized that the cities and towns in the Kennebec Valley have been built up almost entirely by manufacturing, and that future growth is to a large extent dependent upon cheap and reliable power. The present business of the company is largely under longterm contracts for street lighting, railway and private power service. A residence lighting business is also being developed throughout the territory. The company has a thirty-year contract with the Lewiston, Augusta & Waterville Street Railway Company for furnishing all its power between Waterville and Sabattus, which yields about $35,000 per year, with twentynine years to run. Another contract of about the same size has recently been signed with the Edwards Manufacturing Company, of Augusta. The business in the whole territory served by the company is growing faster than the company can make arrangements to supply it, and during the year 1909 more than 500 new services were added. The earnings for the year 1909 by all the companies which are now combined into the Central Maine organization were about $218,000, and it is expected that as a result of the consolidation and the development of new business in sight the income will rise to about $300,000 per year by the end of 1911.

The company controls five power plants at present and its water and steam plant possibilities are shown in the accompanying table.

The total developed generating capacity is at present 8659 hp. and the ultimate generating capacity when all the water privi- [illegible]

31,650 hp. The undeveloped water-power in Oakland is at Rice Rips and that in Clinton is at Hunter Rips, on the Sebasticook River.

The trunk-line transmission service of the system is performed by 33,000-volt, three-phase circuits connecting the Sebasticook stations with the Fort Halifax plant in the town of Winslow, across the Kennebec River from Waterville, and with the plant formerly owned by the Kennebec Light & Heat

GENERATING CAPACITY, CENTRAL MAINE POWER COMPANY.

	Developed Water-Power in Horse-Power	Developed Steam-Power in Horse-Power	Undeveloped Water-Power in Horse-Power
Oakland .	850	400	1,500
Pittsfield .	1,200	400	
Winslow	2,[illegible]		
Benton ...	1,200		
Clinton			1,500
Augusta ...	400	1,400	
Kennebec River . .			20,000
Total	6,450 hp	2,200 hp	23,000 hp

Company at Augusta. Between the Sebasticook Power Company's plant and Pittsfield a 6600-volt line is installed, between Waterville and the Messalonskee station a 4150-volt line and between Augusta and Gardiner a 10,000-volt line. The company now has about sixty-five miles of transmission lines in

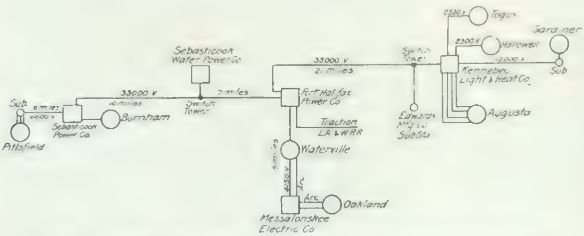


Fig. 2—Distribution System at the Central Maine Power Company.

service between the foregoing points, about thirty-eight miles of which is the 33,000-volt line between Sebasticook and Augusta. All the generating stations are operated co-ordinately, although as little steam power as possible is used when the river stages permit full utilization of the hydroelectric plants. The company has lately been building a 15,000-volt line to connect

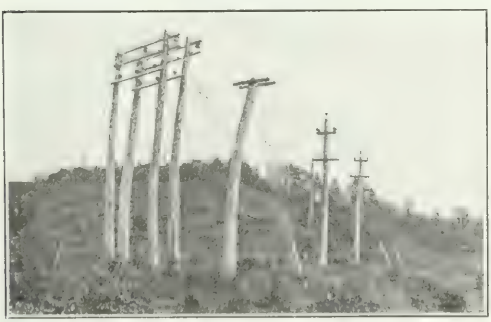


Fig. 3—Fort Halifax-Winslow-Augusta Line.

the towns of Clinton and Dexter, a distance of twenty miles. Substations are located in Pittsfield, Burnham, Waterville, Oakland, Augusta, Hallowell, Togus and Gardiner. In general the high-tension-line spacing is 42 in. between wires, these being placed on a single insulator at the pole top and on two insulators on a short cross-arm below. The trunk line is of No. 1 B. & S. copper between the station of the Sebasticook Water-Power Company and Augusta, and of No. 4 copper between the two Sebasticook stations. Cedar poles from 30 ft. to 50 ft. long are used, and the pole spacing is usually 110 ft. The distance between the two Sebasticook stations is ten miles; between the plant of the Sebasticook Water-Power Company

Fig. 4—Transmission Line.

and Fort Halifax, seven miles, and from Fort Halifax to Augusta, twenty-one miles.

The plant at Pittsfield formerly owned by the Sebasticook Power Company operates under a head of 30 ft. secured by a dam of timber construction with a full apron section, with a wasteway about 250 ft. long. The head and sluice gates are about 90 ft. long and the distance from the foundation to the top of the spillway varies from 20 ft. to 25 ft., not including cut-off piling. One abutment of the dam is of earth construction, with a concrete-core wall about 400 ft in length. The other abutment is of log-crib construction, about 200 ft. in length. Water is conveyed to the plant by a steel penstock 12 ft. in diameter and 500 ft. long. The electric generating capacity of this station is 1200 hp, and it delivers current to Pilttsfield via the 6600-volt line above mentioned and feeds the main transmission line to the southward with 33,000-volt service. The entire system operates on 60-cycle current. The electric generating units are four in number, each being direct-connected to the waterwheel installation.

The Benton power station, or that formerly owned by the

Fig. 5—Fort Halifax Power Station.

Sebasticook Water-Power Company, is provided with a timber dam, the wasteway and sluiceway gate section being founded on solid ledge. The wasteway is 260 ft. long, with a half-apron section. The distance from the foundation of the dam to the top of the spillway varies from 10 ft. to 12 ft. The plant is supplied with water by a canal 2000 ft. long, with headgates of timber construction. The retaining walls at the power house

are of concrete and masonry construction, with an earth em-bankment and concrete-core wall. In this plant the generators are of 300-kw rating and are direct-connected to the water-wheels, the head being 22 ft. The plant rating is 1200 hp.

At the Oakland power station, which is on the Messalonskee stream, the river is never subjected to severe floods, so that the spillway is short, a large part being of natural ledge founda-ion, the rest being of timber and masonry construction. The

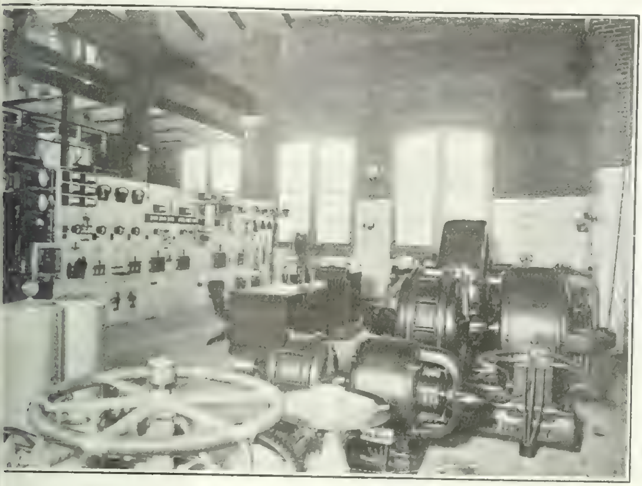


Fig. 6—Operating Room, Fort Halifax Power Station.

-ssalonskee stream has a drainage area of about 200 sq. miles, sq. miles of which is lake surface. This station is equipped th 1250 hp of generating apparatus driven by waterwheels d a steam-engine installation. The head on the turbines is ft. The local service is handled by Stanley generators und for three-phase four-wire supply.

At the station formerly owned by the Kennebec Light & wer Company, of Augusta, the water-power consists of a

Fig. 7—Fort Halifax Power Station.

ial diversion at the local dam of the Edwards Manufac-ng Company. The dam is of timber construction, 20 ft. i, and it crosses the Kennebec River a short distance above city. About 400 hp in hydroelectric machinery is in service , with 1400 hp in steam-driven equipment used at times of water.

he Fort Halifax station is located on the Sebasticook River, its junction with the Kennebec. The power house is a story and basement structure of brick, with concrete cornice and Ferroinclave roof. The floors are of concrete, laid on Ferroinclave. A hollow concrete dam, with a 350-ft. spillway, has been built on a ledge crossing the river at this point, with one end extending to a heavy abutment rising 13 ft. above the level of the spillway and extending well into the clay which forms the bank of the river. The other end of the dam extends into an abutment tied into a flume wall which is carried through as the wall of the generator room of the station. The dam was built by the Ambursen Hydraulic Construction Company, of Boston, Mass. The station contains two horizontal turbine units set in open concrete flumes, the walls of which are carried up to the same height as the abutments of the dam. Each hydraulic unit consists of four 42-in. horizontal turbines, each set being capable of developing 1400 hp under 20-ft. head and about 2000 hp under 24-ft. head. From the flumes the shafts of the waterwheels pass through steel bulkheads set in the wall of the generator room and connect directly to two 750-kw, 25-cycle, 400-volt generators of the three-phase, revolving-field type. One of the generating units is provided with a separate 60-cycle revolving field and armature used in local lighting and power service and acting as a frequency changer when desired to tie the railway and the Central Maine power distribution systems together. The railway company has the use of 1500 kw of the station capacity, and the frequency of its apparatus is 60 cycles. By operating the double-frequency unit the load on the station can be maintained at economical points through the parallel operation of the equipment with the plants on other parts of the Central Maine system.

The main operating room of the Fort Halifax station is located 25 ft. above the generator room to avoid danger in case of the backing up of freshets from the Kennebec River. In the operating room are located waterwheel governors, motor-driven exciters, transformer, switchboard and substation equipment. The transformer installation, which raises the line poten-

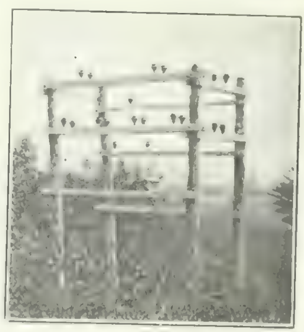


Fig. 8—Transmission Line, Junction on Fort Halifax Branch.

tial to 33,000 volts, is located in a fireproof house outside the main plant, and selector switches and lightning arrester equipment are installed in each circuit. The transformers for the railway service are located in the main station at one side of the operating-room floor, and these deliver current to the line at 19,000 volts for feeding the various substations on the new interurban line between Augusta and Waterville. Power is supplied by this line to substations of the railway company at Day's Corner and Webber Pond, with a lower voltage connec-

tion to a railway substation in the town of Winthrop. The power plant at Fort Halifax contains a 200-kw rotary converter, which supplies energy to the railway feeders and trolley in the Waterville district. The turbines in the Fort Halifax station were built by the Holyoke Machine Company, of Worcester, Mass., and the head-gate installation, divided into eight units, is raised by a 10-hp induction motor operated on a 220-volt circuit. At this station flashboards are used to a height of 4 ft. above the dam level, and the company has used manure most successfully in plugging holes in the boards. A

Fig. 9—Substation, Fort Halifax

Sturtevant blower, direct-driven by an induction motor, is installed in the generator room to facilitate ventilation, the machines being so far below the surface as to require special consideration on this score. Horn-gap lightning arresters are installed in the outgoing lines outside the plant, the equipment being carried on insulators supported on an iron-pipe framing.

Among the larger power customers of the company, in addition to the railway company, are the Wyandotte Worsted Mills, Waterville; the Somerset railway shops at Oakland, the Oakland Woolen Company, the Drum Edge Tool Company and the Maine Central Railroad repair shops at Waterville. In the last-named installation about 250 hp in motors have been placed in service in sizes of from 75 hp to 5 hp, and the tools in most

Fig. 10—Fort Halifax Dam.

cases are back-geared to the motors, with individual driving in the majority of cases. A large number of woodworking concerns, sawmills and grain mills are on the company's lines.

The principal offices of the Central Maine Power Company are located at 141 Main Street, Waterville, and the officers are: President, Harvey D. Eaton; treasurer and general manager, Walter S. Wyman; vice-president, John N. Webber, all of Waterville, Maine. The directors are: Messrs. Eaton, Wyman and Webber, and in addition Messrs. George D. Hegerty, [illegible] Coffin and John R. Macomber, Boston; Samuel C. Manley and Guy P. Gannett, Augusta, Maine; Josiah S. Maxcy, Gardiner, Maine; George F. West and James H. Kelleher, Portland, Maine; C. E. Vickery, Pittsfield, Maine, and W. M. Ayer, Oakland, Maine.

CURRENTS IN DELTA-CONNECTED CIRCUITS.

By B. F. Jacobsen.

It is customary to install three ammeters in a delta-connected circuit in order to enable the operator to ascertain whether or not the load is balanced on the three phases. The purpose of this article is to investigate the relation which exists between line currents as measured by the switchboard instruments and the currents in each phase of the delta-connected generator. Fig. 1 shows the diagram of connections and Fig. 2 the vector diagram; the capital letters in Fig. 2 denote voltages and the small letters denote currents, and the two figures are lettered to correspond. If all currents flowing toward the generator are called positive and all currents away from the generator are called negative, and all currents flowing in clockwise rotation in the generator are called positive and vice versa, it is seen that current a, which is made up of currents ab and ca, is negative when ca is positive and larger than ab; or when ab is negative and larger than ca; or when ab is negative and ca is positive. Current a is zero when ab is equal to ca. The same holds good for currents b and c.

In Fig. 2 the current vectors are positive when their projection on the vertical points upwards, and vice versa. The current vectors a, b and c must be read in the direction of the arrowheads in Fig. 2, so that b is negative, a and c positive. Whether a certain current is to be called positive or negative in a given instance is of course entirely arbitrary, but much confusion will be avoided if one will only make certain assumptions, so that a current vector shown in the vector diagram is always known to represent a current flowing one way or another in Fig. 1; otherwise the vector diagram loses its physical meaning and the vectors themselves become mere mathematical symbols.

From Fig. 2 it is seen that when the load is equally divided between the three phases ab, bc and ca of the delta-connected generator and the phase-angles Θ_{ab}, Θ_{bc} and Θ_{ca} between voltage and current are alike, then the three ammeters A, B and C, Fig. 1, connected in the leads, will each indicate alike, or $\sqrt{3}$ times the currents ab, bc or ca. In Fig. 2 $\Theta_{ab} = \Theta_{bc} = \Theta_{ca} =$ arc cos 0.8; $ab = bc = ca = 7$ amp, and $a = b = c = 12.1$ amp. It is also seen that the angles δ between the currents a, b and c in the leads and the voltages AB, BC and CA are all alike. But this is no criterion as to how the currents a, b and c are divided up between the three phases ab, bc and ca of the generator, for the center O, Fig. 2, may be shifted to any place outside or inside the triangle abc, without changing the angles δ, although ab, bc and ca as well as the phase angles Θ_{ab}, Θ_{bc} and Θ_{ca} would only be equal for the one position shown in Fig. 2. But if $ab = bc = ca$, and $\Theta_{ab} = \Theta_{bc} = \Theta_{ca}$, then the angles δ must be alike.

In Fig. 3 the line currents a, b and c have the same values as above in Fig. 2, and the phase angles $\Theta_{bc} = \Theta_{ca} =$ arc cos 0.8 as before, but $\Theta_{ab} =$ arc cos 0.997, and now $ab = 8$ amp, $bc = 9.3$ amp and $ca = 4.5$ amp. If Fig. 2 represents maximum normal load conditions with $ab = bc = ca = 7$ amp, then the conditions represented in Fig. 3 involve an overload of $9.3 - 7 = 2.3$ amp, or 32.9 per cent in one phase. This would probably not be of much consequence in the generator where the phase windings are distributed over the entire armature and the difference in heating due to I^2R losses would increase only 16.2 per cent $= (8^2 + 9.3^2 + 4.5^2 - 3 \times 7^2) \div 147$. If the copper losses in the generator at full normal load amounted to 2 per cent of the output, then the unbalance would cause an addi-

tional loss of 0.32 per cent. It would also cause some slight additional loss by distorting the field, etc. In case of delta-connected transformers the unbalance would increase the heating of one transformer 76.5 per cent $= (9.3^2 - 7^2) \div 49$. When, therefore, one transformer out of a bank of delta-connected transformers heats considerably more than the others, with line ammeters reading alike, it is known that the phase-angles Θ are not alike. The minimum generator, transformer and line losses for a given load would of course occur when the load

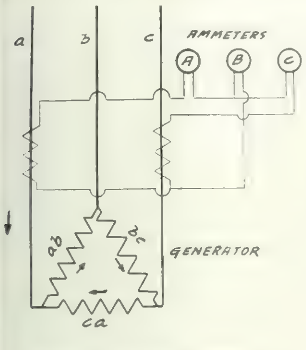
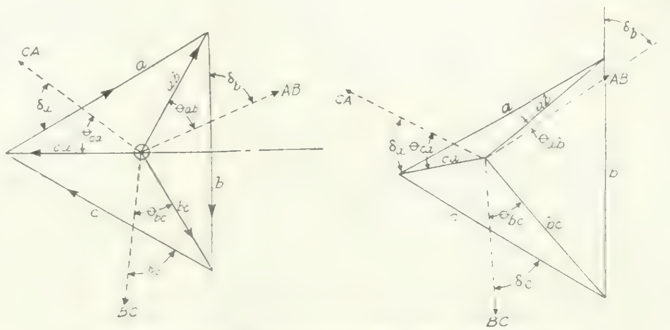


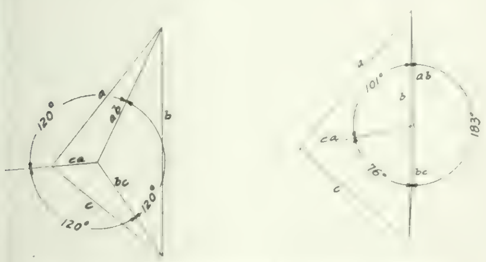
Fig. 1—Connection Diagram.



Figs. 2 and 3—Vector Diagrams of Current and Voltage Relations.

is balanced on the three phases, because the losses are proportional to the square of the currents, and a given load with a given voltage means a given total amperage, or $a + b + c = I$ and $a^2 + b^2 + c^2$ equals a minimum when a, b and c are all equal.

If it can be assumed that the phase-angles Θ are all alike, the distribution of current in the three-phase windings of the generator may be determined from the readings of the line ammeters. This fact is shown in Fig. 4, where a equals 10 amp, b equals 13 amp and c equals 8 amp. A triangle is first drawn with the sides 10, 13 and 8; then on a separate sheet of transparent paper a "Y" is drawn, with an angle of 120 deg. between each of its three branches. By placing this "Y," drawn on the transparent paper, on top of the current triangle, a position of the "Y" may be found where each of the branches



Figs. 4 and 5—Vector Diagrams of Current Components.

intersects one vertex of the current triangle. This is the correct position. The center of the "Y" is marked through on the paper below, and the lines ab, bc and ca can then be drawn in and measured. In Fig. 4 the values found are: $ab = 8.5$ amp, $bc = 6.5$ amp and $ca = 2.5$ amp. Although the maximum ratio between the readings of the line ammeters is only $b : c = 13 : 8 = 1.63$, the maximum ratio between the phase currents is $ab : ca = 8.5 : 2.5 = 3.4$.

In case, however, the phase-angles Θ cannot be assumed to be equal, the readings of the three line ammeters furnish no clue to the distribution of current in the generator. Fig. 3 shows that the line currents a, b and c may be equal and yet the currents ab, bc and ca may not be equal. Fig. 5 shows the same line currents as Fig. 4, but here the phase currents are made equal, $ab = bc = ca = 6.5$ amp.

By adding single-phase motors to a polyphase load a condition of unequal power-factors may very well be brought about, and in such cases the readings of the line ammeters should not be relied upon altogether to furnish the correct information. A diagram may, however, be drawn as Fig. 4, knowing the line currents and assuming equal phase-angles, and then the angles between the phase currents ab, bc and ca may be varied to correspond to the greatest difference in power-factors which would be likely to occur, and in that way the worst possible condition may be approximately determined.

It is evident that as long as there is no appreciable voltage distortion and with power-factors such as are likely to prevail in a commercial circuit the currents ab, bc and ca can never exceed the maximum value obtained by ammeters A, B and C. In case phase ca is disconnected, $ab = a$ and $bc = c$.

SOLUTION OF PROBLEMS IN STAR-CONNECTED UNBALANCED THREE-PHASE CIRCUITS.

By Chesley H. Johnson.

The article by Mr. Harry P. Wood in the issue of the *Electrical World* for June 16, 1910, shows a short solution of some problems involving star-connected three-phase circuits. The following method of attacking similar problems may be interesting to some who are unfamiliar with symbolic equations and yet acquainted with the more usual methods of representing alternating-current vectors. Use will be made of the crank diagram, anti-clockwise vector rotation being positive; the scheme of resolving the vectors into vertical and horizontal components is used. A vertical vector is considered positive when above the horizontal axis and a horizontal vector is considered positive when to the right of the vertical axis.

It may be well to repeat the modified form of Kirchhoff's laws governing unbalanced alternating-current circuits, namely, (1) at any instant the geometric sum of the currents meeting in a point equals zero, and (2) at any instant the geometric sum of the e.m.fs. acting around a closed circuit equals zero.

For a possible direct comparison the problem outlined by Mr. Wood will first be solved. In Fig. 1 is shown a diagram of the circuit. The vector diagram may now be drawn as in Fig. 2. The line voltages, being equal and spaced 120 deg. apart, are first laid off with one vector horizontal. Some value and time position can now be assigned to the phase voltage OA as shown in Fig. 2. This choice determines the other phase voltages. In each case the phase-voltage vector is reversed, thereby completing the parallelogram with the line voltage as

the diagonal, and determining a new phase-voltage vector, which in turn is reversed to determine the third one. This construction is entailed by the fact that the line voltage represented is the vector necessary to close the polygon with the corresponding phase voltages as sides or an illustration of the law (2). The construction will be rendered perfectly clear by referring to Fig. 4. The parallelograms $OB'ZA$ and $OCZA'$ are constructed with equal diagonals OZ and side OA equal to side OA'. In order to prove the construction it is necessary

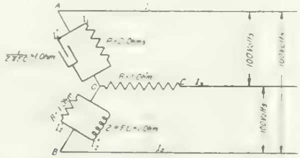


Fig. 1—Three-Phase Unbalanced Load.

merely to show that the diagonal of the parallelogram $OC'ZB$ is equal to OZ. $OC'ZB$ has as sides $OB = OB'$ and $OC' = OC$, the remaining sides of the first two figures.

In the parallelogram $\overline{OCZA'}$, $\overline{OZ}$ cos 30 deg. $= OC$ cos $COM + OA'$ cos $A'OM$.

In the parallelogram $\overline{OC'ZB}$, $\overline{OZ}$ cos 30 deg. $= OC'$ cos $\overline{C'OM'} + OB$ cos $\overline{BOM'}$.

Angle $COM =$ angle $C'OM'$, $OC = OC'$ and $OA' = OA$.

(The projection of a diagonal of a parallelogram is equal to the sum or difference of the projections of its sides.)

Angle $SAZ =$ angle $\overline{BOM'}$, angle $\overline{A'OM} =$ angle $\overline{SAO}$, $AZ = OB' = OB$, cos $SAZ = AS \div AZ$ cos $SAO = AS \div OA$ $AS = OA$ cos $SAO = AZ$ cos $\overline{SAZ}$, substituting OA' cos $A'OM = OB$ cos BOM'. Hence OZ has the same value in each parallelogram. Another fact that may aid in the graphical construction is that the vertical components of two of the phase voltages are always equal when the line voltage vector $O - AB$ is laid off horizontal as in Fig. 2. The figure should always be drawn thus to avoid error. In Fig. 2 the vertical components of OA and OB are equal.

The phase currents, expressed in terms of the unknown

Fig. 2—Assumed Vector Relations for Fig 1.

phase voltages through the constants of the circuit, may now be laid off since their direction is known. I_1' is in time-phase with OA (non-inductive resistance), I_1'' leads OA by 90 deg. (purely condensive reactance), I_2' is in phase with OB (non-inductive resistance), I_2'' lags behind OB by 90 deg. (purely inductive reactance), I_3 is in phase with OC (non-inductive resistance). Note that due to I_1'' being 90 deg. ahead of I_1' the values of the components reverse positions if the impedance of each branch is the same, the sign of the component depending upon the position of the current vector representing it. The same principle applies to I_2''. All the quantities are resolved into vertical and horizontal projections.

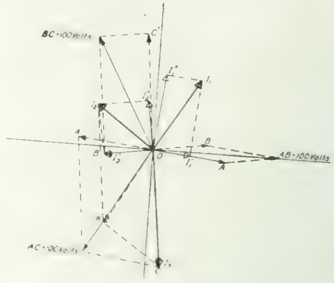


Fig. 3—Correct Vector Relations for Fig. 1.

In order to evaluate xOA and yOA utilize law (1) by putting the sum of the vertical components and then the horizontal components of I_1, I_2 and I_3 equal to zero.

$$\text{Vertical components} = 0$$
$$yOA/2 + xOA + yOA + 100 - xOA + yOA - 86.7 = 0$$
$$yOA = -5.33$$
$$\text{Horizontal components} = 0$$
$$xOA/2 - yOA + xOA - 100 + yOA + xOA - 50 = 0$$
$$xOA = 60$$

The solution shows yOA to be negative. This signifies that OA lags behind instead of leading AB as assumed. The

TABLE I.—LIST OF COMPONENTS.

Let xOA = horizontal component of OA.
Let yOA = vertical component of OA.

	Horizontal Component.	Vertical Component.	Value.
OA	xOA	yOA	60.2
OB	$xOA - 100$	yOA	40.3
OC	$xOA - 50$	$yOA - 86.7$	92.5
I_1'	$xOA/2$	$yOA/2$	
I_1''	$-yOA$	xOA	
I_1	$\frac{xOA}{2} - yOA$	$xOA + \frac{yOA}{2}$	67.5
I_2'	$xOA - 100$	yOA	
I_2''	yOA	$100 - xOA$	
I_2	$xOA + yOA - 100$	$100 + yOA - xOA$	57.2
I_3	$xOA - 50$	$yOA - 86.7$	92.5

numerical value of all quantities may now be found. The correct vector diagram may be constructed to scale as shown in Fig. 3. The e.m.f. and current vectors are plotted to the

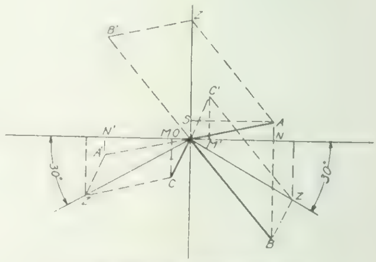


Fig. 4—Proof of Vector Relations.

same numerical scale. The method of deriving the last column in the table is that of finding the hypotenuse of a right triangle having given the two sides.

$$OA = \sqrt{(60)^2 + (-5.33)^2} = 60.2, \text{ in volts.}$$

$$OB = \sqrt{(60 - 100)^2 + (-5.33)^2} = 40.3, \text{ in volts.}$$

$$OC = \sqrt{(60 - 50)^2 + (-86.7 - 5.33)^2} = 92.5, \text{ in volts.}$$

$$I_1 = \sqrt{(60 - 5.33/2)^2 + (60/2 + 5.33)^2} = 67.5, \text{ in amperes.}$$

$I_2 = \sqrt{(100 - 5.33 - 60)^2 + ([illegible] - 5.33 - 100)^2} = 57.2$, in amperes.

$I_3 = \sqrt{(-5.33 - 86.7)^2 + ([illegible])^2} = 92.5$, in amperes.

The correctness of the solution may be checked graphically. There is the condition that $I_1 + I_2 + I_3 = 0$. The diagram must comply with this condition. Referring to Fig. 3 it is seen that OK, the resultant of I_2 and I_3, is equal and opposite to I_1, or in other words I_1 closes the polygon of which I_2 and I_3 are the other sides.

In the foregoing problem it is to be observed that the line e.m.f. is applied directly across the load. A practical variation of this problem is to consider a line drop, the generated line

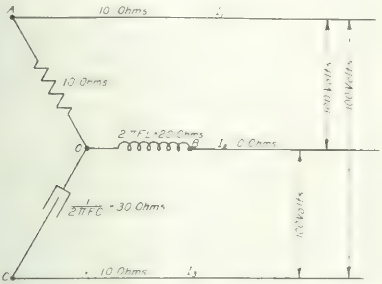


Fig. 5—General Conditions of a Three-Phase Unbalanced Load.

e.m.fs. being as before equal and spaced 120 electrical degrees apart. This problem is equivalent to an e.m.f. impressed across a star-connected load consisting of two or more impedances in series across each phase. The effect of line reactance is neglected to avoid further complication.

Fig. 5 shows a circuit containing resistance and reactance arranged so as to illustrate this problem. The line e.m.f. is again taken at 100 volts for simplicity. The resistance of each wire is 10 ohms.

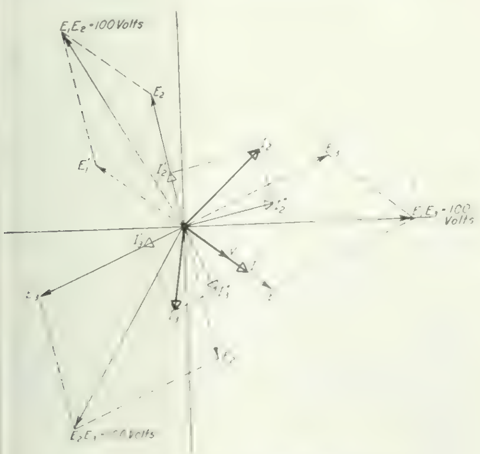


Fig. 6—Assumed Vector Relations for Fig. 5.

Let V_1 = line drop on phase 1 to point A

V_2 = " " " " 2 " B

V_3 = " " " " 3 " C

e_1 = vector sum of phase voltage OA and line drop V_1

e_2 = " " " " " OB " " " V_2

e_3 = " " " " " OC " " " V_3

In order to solve the problem advantage is taken of the resolution of the line current into power and wattless components. In Fig. 7 $I'i$ is the power component of the current, being in phase with E; the phase e.m.f. $I''i$ is the wattless component of the current, being in time-quadrature with the phase e.m.f. Cos Θ is the power-factor of the phase considered. Although $I''i$ and $I'i$ are fictitious currents, their consideration as currents simplifies the solution. The complexity of the problem has been increased by the addition of the line drop V_1 to the phase voltage OA, for instance, the vector sum of the two being e_1. As before, e_1, e_2 and 100 volts must form a closed polygon by law (2).

Fig. 7—Resolution of Current Into Power and Wattless Components.

Assigning some value and phase position to e_1 a diagram may be constructed similar to Fig. 6. On diagram e is shown as OE_1, e_2 as OE_2, etc. After obtaining e_1, e_2 and e_3 the current vectors may be drawn. I_1 is in phase with e_1 (non-inductive resistance); I_2 is resolved into components.

$$I_2' = \text{power component } I_2 = \frac{e_2}{\sqrt{10^2 + 20^2}} \times \frac{10}{\sqrt{10^2 + 20^2}} = \frac{10\,e_2}{500}$$

$$I_2'' = \text{wattless component } I_2 = \frac{e_2}{\sqrt{10^2 + 20^2}} \times \frac{20}{\sqrt{10^2 + 20^2}} = \frac{20\,e_2}{500}$$

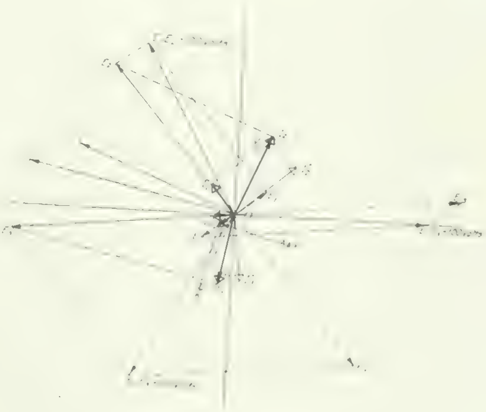


Fig. 8—Correct Vector Relations for Fig. 5.

I_2' is in time-phase with e_2 and the wattless component is in lagging time-quadrature. Note must be taken as before that the quadrature component I_2'' has its horizontal and vertical component values interchanged.

$$I_3' = \text{power component } I_3 = \frac{e_3}{\sqrt{10^2 + 30^2}} \times \frac{10}{\sqrt{10^2 + 30^2}} = \frac{10\,e_3}{1000}$$

$I_3'' =$ wattless component $I_3 = \frac{e_3}{\sqrt{10^2 + 30^2}} \cdot \frac{30}{\sqrt{10^2 + 30^2}} = \frac{30\,e_3}{1000}$

I_3' is time phase with e_3 and I_3'' leads e_3 by 90 deg. The line drop is in time-phase with the line current.

TABLE II.—LIST OF COMPONENTS.

Let x = horizontal component of e_1.
Let y = vertical component of e_1.

	Vertical Component.	Horizontal Component.	Value.
e_1	$-y$	x	[illegible]
e_2	$86.7 - y$	$x - 50$	[illegible]
e_3	$-y$	$x - 100$	[illegible]
$I_1 = \frac{e_1}{20}$	$\frac{-y}{20}$	$\frac{x}{20}$	[illegible]
$I_2' = \frac{e_2}{50}$	[illegible]	[illegible]	
$I_2'' = \frac{e_2}{25}$	[illegible]	$\frac{86.7 - y}{25}$	
$I_2 = \frac{e_2}{22.33}$	[illegible] $+ \frac{[illegible] - x}{25}$	$\frac{86.7 - y}{25} + \frac{x - [illegible]}{50}$	4.52
I_3'	[illegible]	[illegible]	
I_3''	[illegible]	[illegible]	
$I_3 = \frac{e_3}{31.6}$	[illegible]	$\frac{3y}{100} + \frac{x - 100}{100}$	[illegible]

As before, there may be written $I_1 + I_2 + I_3 = 0$. Which gives the values of x and y.

Putting the sum of the vertical components of the three currents $= 0$,

$$\frac{-y}{20} + \frac{86.7 - y}{50} + \frac{50 - x}{25} - \frac{y}{100} + \frac{3x - 100}{100} = 0$$

$$-8y - x + 73.4 = 0. \qquad (1)$$

Horizontal components $= 0$.

$$\frac{x}{20} + \frac{x - 50}{50} + \frac{86.7 - y}{25} - \frac{x - 100}{100} + \frac{3y}{100} = 0$$

$$8x - y + 146.8 = 0 \qquad (2)$$

Solving (1) and (2) $x = -16.94$, $y = 11.3$. Which shows that Fig. 6 as constructed is incorrect, the value of x being negative. Fig. 8 may now be drawn to scale, showing the correct value and direction of all quantities involved. The current scale is taken numerically ten times the voltage scale. The numerical value of all quantities, which appears in the last column of table, may now be calculated.

$e_1 = \sqrt{(-16.94)^2 + (-11.3)^2} = 20.4$, in volts.

$e_2 = \sqrt{(-16.94 - 50)^2 + (86.7 - 11.3)^2} = 100.8$, in volts

$e_3 = \sqrt{(-16.94 - 100)^2 + (-11.3)^2} = 117.5$, in volts.

$I_1 = \frac{20.4}{20} = 1.02$ amp $\quad I_2 = \frac{100.8}{22.33} = 4.52$, in amperes.

$I_3 = \frac{117.5}{31.6} = 3.72$, in amperes

$V_1 = I_1 \times 10 = 1.02 \times 10 = 10.2$, in volts; $OA = E_1 - V_1 = 10.2$, in volts.

$V_2 = I_2 \times 10 = 4.52 \times 10 = 45.2$, in volts; $OB = \sqrt{e_2^2 - V_2^2}$; $OB = \sqrt{(100.8)^2 - (45.2)^2} = 90.2$, in volts.

$V_3 = I_3 \times 10 = 3.72 \times 10 = 37.2$, in volts; $OC = \sqrt{e_3^2 - V_3^2}$. $OC = \sqrt{(117.5)^2 - (37.2)^2} = 111.3$, in volts.

The construction and results may be checked graphically. Any one of the currents should be equal and opposite in direction to the resultant of the other two. On Fig. 8, OK, the resultant of I_1 and I_3, is found to be equal and opposite to I_2, thus checking the construction and calculations.

According to the results obtained voltage resonance exists in the circuit, as might have been expected from the arrangement of the circuit. The chief advantage gained by using the method outlined above is that the time-phase displacements between the various currents and voltages are shown directly.

THE SINGING-SPARK SYSTEM OF WIRELESS TELEGRAPHY.

By William Dubilier.

In the singing-spark system of wireless telegraphy as employed by the Telefunken Company use is made of the Wein principle for producing slightly damped waves. It occupies a position between the noisy transformer type of installation with its poor tuning and the noiseless undamped-oscillation system with its flame requiring constant attention.

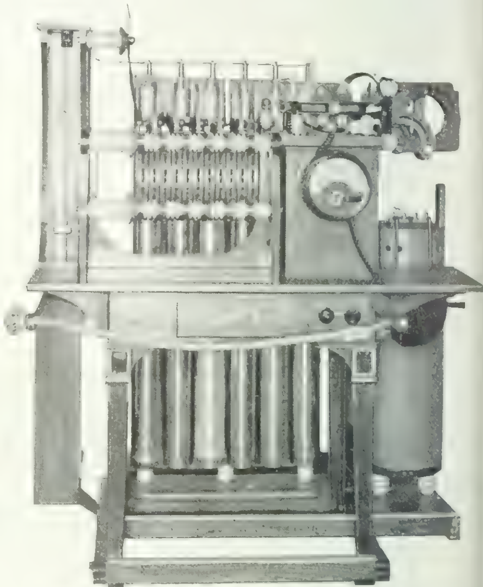


Fig. 1—Musical-Spark Wireless Telegraph Station.

A singing-spark equipment is illustrated in Fig. 1. The open-core transformer at the right increases the e.m.f. to 20,000 volts for charging the exciter condenser, consisting of Leyden jars, shown underneath the table, through an air-cooled spark-gap in series with a coupling variometer. By means of the variomter the wave-length can be adjusted at

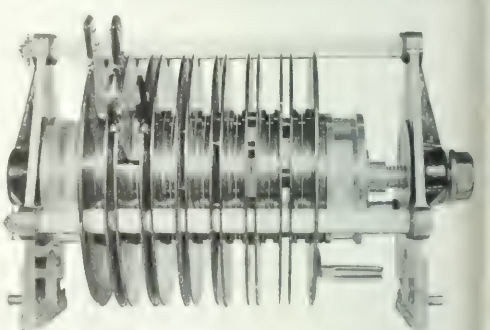


Fig. 2—Musical Spark-Gap.

from 300 m to 2500 m, the degree of "coupling" with the antenna remaining constant for all wave-lengths.

A view of the air-cooled singing-spark apparatus is given in Fig. 2. In connection with this apparatus it is to be noted that in producing quenched sparks or slightly damped oscillations a very short gap is necessary, as first discovered by Wein. When

the spark takes place, the heat evolved is soon absorbed and radiated away so that the arc rapidly extinguishes itself. In the design of the spark-gap illustrated in Fig. 2 this relation has received proper consideration and a regular sequence of the spark is obtained. The electrodes are ring-shaped with plane surfaces on the side where the spark is produced. The best results are obtained by using metal with a high heat conductivity, such as copper or silver. When a spark forms it is driven toward the periphery by means of a magnetic field, being quenched before it reaches the edge. Use is made of mica sheets between the electrodes to maintain a constant separation between them. Porcelain is used wherever possible on account of its excellent insulating qualities.

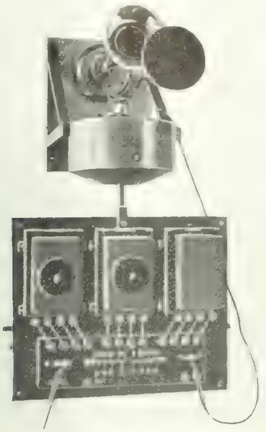


Fig. 3—Resonance Intensifier.

Where the power involved is large use is made of a number of gaps in series, the voltage being so distributed that the stress on each is kept within the permissible limit. A device is employed for short-circuiting such gaps as may not be needed in order that the power used in transmission may be varied according to the distance to be covered. Experimental observations have shown that the power consumed varies directly as the square of the number of gaps in series.

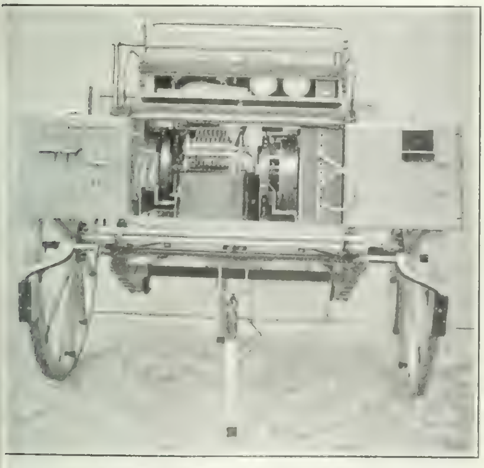


Fig. 4—Military Wireless Telegraph Equipment.

The station equipment illustrated in Fig. 1 is rated at 8 kw. When used with a T-shaped ship aerial having an effective resistance of 4 ohms the current was observed to be 38 amp, thus indicating a power of 5.8 kw at the aerial. With a consumption of 8 kw the indicated efficiency was 72.5 per cent, which is very high in view of the fact that a spark station usually shows an efficiency of about 30 per cent.

Two steamers of the Woermann line between Hamburg and the Cameroon colony fitted with the above type of apparatus communicated with each other at night over a distance of nearly 2000 miles, in spite of the fact that use was made of aerials only 120 ft. in height and 220 ft. long.

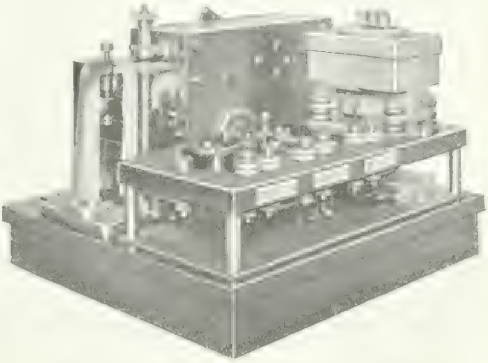


Fig. 5—Morse Recorder for Musical-Spark Apparatus.

At the receiving station use is made of the resonance sound-intensifier shown in Fig. 3. On a board balanced on an electrically damped suspension are mounted three sound resonance relays joined in series and fitted with microphone contacts. During sending the receiver is protected from the inductive action of the nearby sender by means of an automatic electromagnetic relay working in conjunction with the receiving apparatus. The employment of the intensifier makes possible the use of a loud-speaking telephone or a Morse register, such as is usually employed only with a coherer. A Morse register for this purpose is shown in Fig. 5.

The apparatus described above can be used advantageously in army service, a portable set for army use being illustrated in Fig. 4.

FLEXIBLE-TOWER CONSTRUCTION OF TAYLOR'S FALLS TRANSMISSION LINE.

A high-tension transmission line of unique design and construction is being completed from the Taylor's Falls hydroelectric plant of the Minneapolis General Electric Company into its terminal substation at the limits of the city, forty miles distant, to convey the output of two additional 2500-kw waterwheel units recently added to the existing 10,000 kw of equipment. The new transmission line parallels the route of the first line, but the feature of its construction is the use of "flexible," A-frame towers, the chief function of which is to "prop up" the line wires between the square anchor towers which are erected at one-mile intervals on the tangents.

On these straightaway stretches the A-frame prop towers are inserted at nearly 400-ft. distances, conforming to the topography of the country, and are braced erect by clamping to the ⅜-in. steel ground wire which runs throughout the line and is securely attached to the anchor towers. The construction is designed for a single circuit of three No. 0000 copper line-wires and is electrically protected by the steel ground wire at the top of the poles, which has also the structural function above mentioned.

The special A-frame towers are built of two 2.75-in. x 3.5-in. x 2.75-in. channel pieces spaced 9 ft. apart at the base and con-

verging to within 4 ft. 3 in. at the top, 42 ft. above the ground foundation. At this point a peak is formed of two smaller channel sections, carrying the steel ground cable 10 ft. above the top of the main channel legs. Against this peak triangle an 8-ft. angle-section cross-arm is bracketed on two spreaders. The pin-type 50,000-volt insulators for the two top wires of the inverted delta are mounted on this cross-arm, the third or bottom wire being carried through the steel work of the triangular peak structure on an insulator mounted on the A-frame cross-piece. The line wires are of No. 0000 nineteen-strand copper cable and are separated 7 ft. from each other and at a minimum distance of 5 ft. from the 3/8-in. galvanized ground wire.

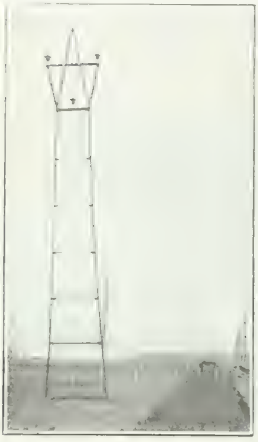


Fig. 1—Standard A-Frame Tower and Special Transportation Tower.

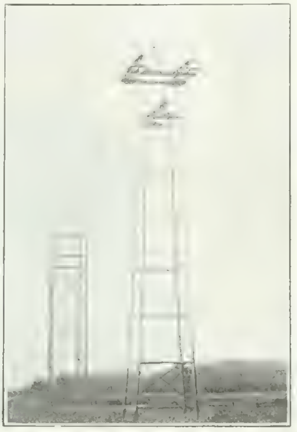


Fig. 2—Disconnecting Switches on Square Tower at Railroad Crossing.

Fig. 3—A-Towers with Suspension-Type Insulators.

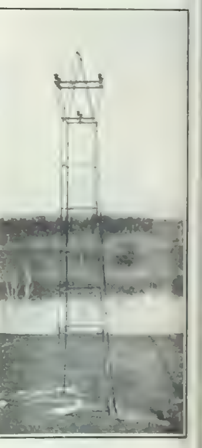


Fig. 4—Four-Legged Anchor Tower.

As an experiment two and one-half miles of the forty-mile line have been equipped with suspension-type insulators, as shown in Fig. 4. For this purpose the top cross-arm has been extended on each side, the insulators depending from its ends. The lower wire is carried on a suspension insulator mounted from a special cross-piece in the structure, the same distance between wires being maintained as before.

The four-legged anchor towers are of special design, arranged to receive and sustain the transmitted stresses of more than a mile of the line wires carried on A-frame towers from each direction on straight stretches. These towers are firmly anchored, but are not guyed except at sharp bends in the line. The A-frame towers were designed for taking curves up to 10 deg., but as actually installed square towers have been used at all points of curvature and wherever the spans exceed 440 ft. Special transposition A-towers are inserted at 220-ft intervals where the transmission wires are rotated for transposing. The standard A-frame towers are not set in concrete, but are simply foundationed on inverted-T bases buried in the earth and tamped. A portion of the transmission line was carried through swamp land and here some of the towers are mounted on sections of 8-in and 10-in. pipe, some 40 ft. in length, driven down to hard strata by a pile driver and cleared of interior material by an inside worm drill.

In building the forty-mile transmission line 413 42-ft. A-frame towers were used, besides twelve 36-ft. similar towers employed at points where shorter poles were needed to conform to the elevation of the country traversed. The 42-ft. A-frame towers each weighed 2150 lb.; the 36-ft. towers, 2000 lb. There are sixty-eight 42-ft. square anchor towers, each weighing 3750 lb., and nineteen 50-ft. anchor towers, each weighing 4225 lb. The telephone circuit, which is carried on the steel cross-pieces of the tower structures, is transposed at every pole, both A-frames and anchor towers, deep-grooved glass insulators with cross-jumpers being used on all towers. The lowest line wire is 36 ft. above the ground at the pole.

The advantages of the A-frame on "flexible-tower" construction, which was designed by the Stone & Webster Engineering Corporation, are the decreased weight and cost per tower and the greater care with which the A-frame prop towers can be erected. The Taylor's Falls-Minneapolis transmission line is the first to embody this unique principle of design in this country and will go into operation before Jan. 1, 1911.

ILLUMINATING CONTRACTOR'S BUCKET FROM HEADLAMP ON DERRICK.

In completing the Evanston Channel of the Chicago Drainage Canal, which was opened by President R. R. McCormick, of the Sanitary District, Nov. 29, twenty-four-hour excavation work in the earth section was made possible by equipping one of the derrick-operated bucket outfits with an electric headlamp mounted on the turntable so as to follow automatically the movement of the bucket in its travel from the pit to the spoil pile.

Contractor's Bucket Illuminated by Headlamp on Derrick Turntable.

The headlamp used was of the locomotive type containing an arc rated at a mean hemispherical candle-power of 3000, without the reflector, and taking 23 amp at 32 volts. This arc was backed by an 18-in. reflector, 3 in. deep, which reflected and concentrated all the light reaching it into a slightly divergent beam cast directly under the boom from which the bucket was hung. The accompanying illustration was made from a photograph taken after nightfall with the bucket 150 ft. distant from the headlamp, and shows the area illuminated by the beam from the lamp. The lamp and case together weighed about 90 lb., and were mounted on the turntable of the crane, being rotated with it so that the light followed the bucket in all positions. When it was necessary to obtain greater diffusion of the light from the lamp the reflector was put out of focus by advancing the arc a fraction of an inch, projecting the reflected light over a large area.

Electric energy for the headlamp was obtained from a Pyle headlight turbine-generator set, capable of developing about 1 kw at 32 volts. This machine ran at 1800 r.p.m., and was fed with steam at approximately 100 lb. pressure from the temporary boilers supplying the derrick hoisting apparatus. The combined turbine and generator weighed 327 lb. Besides the headlamp, which was energized through 50 ft. of cable connecting it with the generator, the turbine set also provided energy for several incandescent lamps in the hoist cab and the boiler shed, where no central-station energy was available.

Central Station

Management, Policies and Commercial Methods

ELECTRIC CHRISTMAS PRESENT.

The Union Electric Light & Power Company, of St. Louis, listributes a brightly colored hanger showing an electric truck piled high with neatly wrapped Christmas presents, with Santa Claus at the steering wheel in charge of the load. Beneath, in a pictured wreath of holly, the company asks, "Is your Christmas gift on the electric truck? Call on Union Electric, Twelfth and Locust Streets, and make your selection." The labels and tags on the articles in the truck reveal that the jolly driver is acting as distributer for electric automobiles, Christmas-tree lighting outfits, flatirons, hair dryers, sewing-machine motors, washing machines, toasters, chafing dishes, shaving mugs, portable lamps, curling irons, coffee percolators and various forms of heaters.

NAPHTHA LAMPS REPLACED BY TUNGSTENS.

Mr. Robert J. McCuen, superintendent of the Department Lamps and Lighting, of Baltimore, has begun the installa-n of tungsten lamps to replace the naphtha lamps now used alleys where there are no gas mains. It is expected to have o of the tungsten lamps in service by the end of next year. here are now 998 naphtha lamps in use. Mr. McCuen finds at the incandescent lamp cost is 50 cents less per year, besides ing superior in quality of service. Mr. McCuen last week epared a report concerning the cost of lighting Baltimore reets, in compliance with a request made to Mayor Mahool the taxpayers' committee on the city finances of Philadelphia.

RATES IN ST. LOUIS.

The Public Service Commission in St. Louis is preparing a w schedule of rates for electricity, and it is reported that e Union Electric Light & Power Company will be required reduce its prices, whereas the company contends that the tes charged should be increased rather than decreased. Negotions have been under way for a long time, and it is said that e matter of rates for electricity will be presented to the unicipal Assembly by Jan. 1. The commission says that rates ould be based on the value of the company's tangible propy, with an additional allowance for depreciation. The comssion and the company find it difficult to agree as to the nner in which this valuation should be made, as to what ngible property" is and as to what is the proper rate of preciation. Further, the company declares that rates should based broadly on the characteristics of the service furnished to each class of consumers, while the commission holds that, for the general good, it is expedient to modify the "cost-to-serve" principle.

COMBINATION INDUSTRIAL POWER PLANT AT WOONSOCKET.

The electric power plant above referred to is that of the Samoset Worsted Spinning Mill and the Nyanza Mill, located about half way between Blackstone and Woonsocket, which formed an independent power corporation called the Manufacturers' Power Company, in order to obtain the benefits of centralization and to avoid the wastes of separate electric generating installations. The power equipment was selected and installed according to the designs and supervision of the engineering firm of Lockwood, Greene & Company, Boston, who were the architects of the Nyanza Mill. The Samoset Mill was designed and its construction supervised by Mr. Charles T. Main, mill architect and engineer, Boston.

The power plant is equipped with six 225-hp vertical Manning boilers discharging into a Heinicke radial brick stack 200 ft. high; a 1200-kw Allis-Chalmers turbo-alternator delivering three-phase, 60-cycle current at 600 volts, and an Allis-Chalmers turbine condenser with a turbo-exciter set and a motor-driven exciter outfit. Feed, make-up and condensing water are supplied from the Blackstone River. The power house is a red-brick structure 45 ft. wide and 95 ft. long.

The motor-driving equipment in the Nyanza Mill was supplied by the Westinghouse Electric & Manufacturing Company, induction motors being used throughout. In the Samoset Mill are about fifty motors, also of the Westinghouse induction type. Each mill is provided with a separate switchboard, so that the power requirements of the different departments can be checked at frequent intervals.

BROOKLYN N. E. L. A. SECTION MEETING.

Public Service Commissioner Edward M. Bassett, of the First District, New York Commission, delivered an address on Monday evening, Dec. 5, before the Brooklyn Company Section of the National Electric Light Association at its regular monthly meeting, in the course of which he made the following broad-gage statement:

"Efficiency in a public-utility corporation redounds not only to the benefit of the public but should redound to the benefit of the corporation itself. That saving that comes from thrift, that greater earning capacity that comes from ingenuity and

faithfulness, are properly divided between the public and the corporation itself, not forgetting the payment of good wages and the making of permanent and promising positions for those who contribute for that result.

"I, for one, am of the opinion that public regulation should incite and increase and encourage private initiative. The result of thrift, economy, better results for a certain amount of work, more electricity for a certain number of pounds of coal, should not entirely, or anything like entirely, be taken advantage of by the public, for the corporation that can produce results is entitled to a large measure of the benefits of its own efficiency and progress.

"Public regulation will in no sense be a success until that principle is largely recognized, because you cannot make all companies the same. If you try to make all the same it will be pressing down the capacity to the level of the poorest rather than the raising up or the endeavor to raise up the capacity of all to that of the highest. Profit for the investor, payment of good wages and the ability to pay good wages to the workmen must be encouraged by the state, representing all the people."

President E. A. Baily, of the company section, presided at this meeting, which was attended by nearly 400 members. After the address by Commissioner Bassett two papers were presented and discussed as follows: "Notes on Power Station Economy," by Mr. H. P. Wood, and "The Follow-up System of a Purchasing Department," by Mr. H. F. Frasse. Selections were rendered throughout the evening by the Ridge Court Orchestra, composed of employees of the Edison company.

ST. LOUIS N. E. L. A. SECTION.

At the meeting of the Union Electric Light & Power Company Section of the National Electric Light Association held in the company's offices, St. Louis, Nov. 25, Mr. E. C. Freeze read a paper on "Underground Conduits and Cables," treating in a historical way the development of underground construction in connection with the distribution of electricity for the past twenty-five years. The paper described the various styles of pipe and conduits, the methods employed in placing them underground and the old two-wire Edison tube system, pointing out the advantages and disadvantages of these constructions. While tile construction has now become generally used it was shown that the use of concrete in various other building industries has been kept pace with also in conduit construction and has demonstrated its utility in securing substantial and lasting construction. The employment of concrete has gone so far as entirely to eliminate the need of any pipe whatever, thus effecting a very material saving in the cost of construction. Concrete construction was also said to give greater strength and protection against electrolytic action on cables.

The second paper of the evening was read by Mr. John F. McGlensey, illuminating engineer for the company, and was entitled "Light versus Illumination, and the Illuminating Engineer." By strong contrasting statements he made clear the difference between light and illumination. "Light," he said, "is a phenomenon; illumination is an effect produced by the phenomenon of light. Light is quantity; illumination is quality. Every central station, every lighting solicitor, every lamp salesman, fixture manufacturer, shade and reflector house are selling illumination. They are not selling so many kw-hours of electricity, so many incandescent lamps, so much light, so many shades. They are selling satisfaction, and light satisfaction is illumination." Lantern slides were employed to show the different methods of illumination, and the nomenclature, the fundamental principles, the photometric standards and the use of photometric curves were explained in detail. One of the points made in the paper, that a higher intensity may be produced at the tip of a bowl-frosted lamp equipped with a shade than with a clear lamp similarly equipped, prompted a very interesting discussion.

The St. Louis Section now has a membership of 250 and holds monthly meetings.

BALTIMORE N. E. L. A. SECTION MEETING.

Mr. T. Commerford Martin, executive secretary of the National Electric Light Association, addressed the Consolidated Gas, Electric Light & Power Company of Baltimore Section at the first of its winter meetings, which was held Dec. 6 in the physical laboratory of the Johns Hopkins University. Mr Martin told of the comprehensive work of the National Electric Light Association, its value to the central-station industry, and gave a brief account of its wonderful growth. He recalled that twenty-four years ago in Baltimore he had addressed the second convention of the association, which was attended by a handful of people and considered a a great success. In St. Louis last summer the convention was attended by more than 2000 members.

Mr. Herbert A. Wagner, director of the electric division of the Consolidated Gas, Electric Light & Power Company and a member of the executive committee of the National Electric Light Association, and Mr. Douglass Burnett, manager of the commercial division of the Baltimore company, spoke of the importance and the value of the work to be accomplished by the company section. An active campaign is in progress to increas the membership and broaden the scope of the work of the sec tion. Upon the initiative of the section the company has ar ranged for a course of ten lectures to be given by Dr. John B Whitehead, professor of applied electricity at the Johns Hop kins University. Dr. Whitehead delivers two lectures eac month, and section meetings are held semi-monthly.

The election of officers for the term of 1910-11 for the com pany section was hotly contested. A primary election was hel at which each member suggested his choice for officers. Fro these votes two tickets were placed in the field. They wer known as the "Progressives" and the "Insurgents." The Insur gents carried the day, although the tickets were pretty we split and both parties are represented on the executive com mittee. The officers elected are as follows: President, Mr. H. H. Tillman; vice-president, Mr. J. S. Cruikshank; secretar and treasurer, Mr. G. S. Colburn. Executive committee: M A. W. Bull, Mr. A. S. Loizeaux, Mr. H. L. Parker, Mr. R. I Bonsall, Mr. William Schmidt, Jr., Mr. Douglass Burnett an Mr. J. E. Hughes.

Mr. William Darbee announced the result of the election an the new president, Mr. Tillman, and the vice-president, M Cruikshank, were called on for addresses. Both told of plar for an energetic, active year.

SUCCESSFUL FORTY-FIVE-DAY HOUSE-WIRIN CAMPAIGN AT MOBILE, ALA.

The forty-five-day campaign for new customers among t owners and occupants of unwired houses recently conducted a number of cities where electric lighting properties are ope ated by H. M. Byllesby & Company closed Nov. 15 with mar new services installed and connected in each city. One of tl most successful of these local campaigns was that at Mobil Ala., where 660 houses were wired and taken on as new cu tomers in addition to the 5000 customers already using the ser ice in this city of 51,000 population, of which nearly 40 per ce are negroes.

In this Mobile campaign very attractive house-wiring prop sitions were offered. The central-station company arrang with a local contractor to make installations complete at t prices quoted below, paying him a bonus of from $2.50 to $ for each house connected to its lines. Of course, many of tl new customers wanted more complete lighting installations th were covered under the introductory propositions, and for the extras the contractor arranged his own price with the hous holder, deriving additional profit from this source. After t success of the campaign was assured the rest of the local co tractors came into the campaign, receiving the same inducemen as the original contractor.

The campaign opened with strong display full-page advertisements in the local papers announcing: "Homes Wired for Electric Light at Actual Cost: We Pay the Contractor's Profit." Three standard propositions were then set forth, it being made clear in the advertisement that the wiring done would be modern, safe and efficient, and that no agreement of any kind to use electric service would be required of the householder. The propositions were as follows:

Proposition A.—Wiring complete with lamps, $8; underwriters' inspection fee, $1; total, $9. Complete wiring for five-room house—five drop cords, five ornamental glass shades, five incandescent lamps. This will supply lighting for parlor or living-room, dining-room, kitchen and two bedrooms.

Proposition B.—Wiring complete with lamps, $10.75; underwriters' inspection fee, $1.50; total, $12.25. Complete wiring for five-room house—two two-light fixtures, three drop cords, six ornamental glass shades, seven incandescent lamps. This installation will give two lights in the living-room and two lights in the dining-room, one in each of the others.

Proposition C.—Wiring complete with lamps, $12.50; underwriters' inspection fee, $1.50; total, $14. Complete wiring for five-room house—square brass tubing fixtures instead of drop cords; wall fixtures where desired; two fixtures have two lights each, the others one. Shades richly ornamented. This gives a really artistic installation of seven lights, the lamps being included in price.

This advertisement was repeated several times and was followed up by several smaller and quarter-page advertisements explaining that the offer, which opened Oct. 1, would be withdrawn after Nov. 15. Four solicitors were employed to follow up inquiries, explain the proposition to prospective consumers and close contracts. When the forty-five-day campaign closed 60 new customers had been secured from among old houses adjacent to the company's lines, where the cost of connecting service was small. As above noted, a large proportion of Mobile's population is colored, and a number of the new installations were placed in the humble homes of the negro section of the city.

NEW-BUSINESS CAMPAIGN AND SALES ORGANIZATION AT MILWAUKEE.

The Milwaukee Electric Railway and Light Company, doing the electric lighting and railway business in the City of Milwaukee and contiguous territory, has recently undertaken a campaign for the development of its lighting and motor business. By the recent United States census the city had 373,857 population, and with the suburbs there must be a total population of 400,000. While Milwaukee has perhaps become humorously known to the majority of people as a center of the brewery industry, statistics show that in annual value of products produced beer stands fourth in the list, being lower in amount than the value of manufactured iron products, leather and cooked meats.

Therefore, in such a large manufacturing center, in addition to the expectation of being able to substitute electricity for other forms of illuminants, it was anticipated that many of the industries forming the basis of Milwaukee's prosperity could be supplied with motor service. Moreover, the knowledge that electric energy could be purchased at reasonable rates would tend to attract new industries to locate in Milwaukee. It was, therefore, decided to develop this business by aggressive methods.

Several months were required in which to prepare for the organization of the new sales department of the Milwaukee Electric Railway and Light Company for this purpose, and on September 1, 1910, the organization had been practically completed and the department was in working order

Coincident with the development of the organization of a sales department a new [illegible] light and motor service was formulated. This new schedule was designed primarily to reach the consumer having a small demand and long-hour use and the consumer using electric service in large amounts for industrial purposes. The elements of this new rate system have been discussed in the Wisconsin Commission News in the columns of this journal, and its main features are given below:

A standard rate to customers signing the standard form of contract, providing for service for a year or more, is based, first, on a demand charge, and second, on an energy charge. The demand charge, which is payable in equal monthly payments, is $42 per year for each kw of demand for the first 10 kw; $30 for the next 50 kw, and $24 for each kw of demand in excess of 60 kw. The energy charge is 5 cents per kw-hour for the first monthly 100 kw-hours consumption; 4 cents for the next 900 kw-hours; 3 cents for the next 3000 kw-hours; 2 cents for the next 6000 kw-hours, and 1½ cents per kw-hour for all energy consumed in any month in excess of 10,000 kw-hours. These rates apply to all customers receiving lighting service and free renewals of lamps.

For power service these rates, less ½ cent per kw-hour, apply to all customers utilizing service for the operation of electric motors for any purpose and who do not receive free lamp renewals.

For a limited or off-peak service a reduction of one-half the demand charge is made, on condition that the service shall not be used during a certain time of the day from October to March. In each month the end of this period is 7.00 p. m., the beginning being for the six months respectively: 5:30, 5:00, 4:30, 4:40, 5:20 and 6:00 p. m.

There is also a "ten-seven" service, which applies to customers utilizing the company's service only during the hours from 10:00 p. m. to the following morning at 7:00 a. m. For this service only one quarter of the demand charge is made

Under the head "Maximum rate for service, and minimum payments," the conditions are that the maximum rate of charge for service during any month shall not be greater than the rates for service that would be obtained under the existing instrument rate schedules, with a prompt payment discount of 5 per cent upon bills paid within ten days after their respective dates. Rates under this schedule for lighting service range from 12 cents per kw-hour for the first 100 kw-hours during any month to 10 cents for the second 100 kw-hours; 8 cents for the third 100-kw hours; 6 cents for the next 300; 4 cents for the next 14,400; 3½ cents for the next 15,000, and 3 cents per kw-hour for all energy in excess of 3000 kw-hours per month. For power service the rates are 8 cents per kw-hour for the first 100 kw-hours per month; 6 cents for the second 100 kw-hours; 5 cents for the third 1000 kw-hours; 4 cents for the next 300 kw-hours, and 3 cents for all energy in excess of 600 kw-hours during any month. Minimum monthly payments are the monthly instalment of the annual "demand charge," provided that this payment in any instance shall not be greater than the minimum charge made under the existing schedule, namely: For lighting a minimum payment of $1, and in addition thereto 25 cents for each Nernst lamp glower installed, and $1.50 for each arc lamp installed; and for power service, a minimum charge of $2 for an installation of 2 hp or less, and $1 in addition thereto for each hp or fraction thereof in addition to the first 2 hp. The provisions for minimum monthly payments are applicable under all rates.

The measurement of demand is determined as follows for different classes of service: For commercial lighting purposes the demand in installations of 1 kw or less is 100 per cent for the first 300 watts connected, plus 66 2/3 per cent of connected load in addition to the first 300 watts, except where tests indicate the demand to be larger than that computed on this basis. In installations of greater than 1 kw connected the actual demand shall be measured. For power service the demand of the consumer is the maximum rate at which energy is used for any continuous period of fifteen consecutive minutes [illegible]

There is a separate schedule for residence lighting service, under which customers contract for service for one year or more with free lamp renewals. There is a primary charge of 12 cents per kw-hour for the first 4 kw-hours consumed per month for each of the first four active rooms, and for the first 2½ kw-hours consumed per month for each of the active rooms in addition to the first four. All rooms are counted active except three bedrooms, bathrooms, basement, garret closets and back porch. The secondary charge for residence lighting is 5 cents per kw-hour for all energy in excess of that paid for at the above primary rate up to a total of 100 kw-hours, and 4 cents per kw-hour for the next 900 kw-hours.

The company will sell flat-rate display lighting on yearly contracts on the basis of use from dusk to 11 p. m. or 12 midnight. The rate varies from $3.35 to $3.80 for 300 watts; $10.65 to $11.90 for 1 kw; $39.65 to $44.55 for 4 kw, and $92.25 to $101.40 for 10 kw. These flat rates include renewal of carbon-filament lamps and no other maintenance.

A discount of 5 per cent is given for prompt payment of bills on the first $25 of all bills, and 1 per cent on amounts in excess of $25. These discounts apply only where the 5 per cent provided for in existing increment rate schedules is not given.

There is also a short-time lighting and power rate to customers obtaining service for periods of less than one year. For free renewals the company supplies carbon-filament lamps of 2, 4, 6, 10 and 16 cp, the first mentioned for sign and decorative lighting only, and graphitized filament lamps of 40 cp.

In formulating the foregoing schedule of rates the company had in mind the following principles:

1. A rate schedule should follow as closely as a relatively simple rate can the law of variation of cost to the company of the production and distribution of electric service.

2. A rate schedule should, if possible, cover the entire field of electric service supply from commercial and residence lighting to night storage-battery charging in garages and the supply of "breakdown" or emergency service.

3. A rate schedule should, if possible, permit the supply of lighting and motor service through the same meter, so as to reduce the expense of supplying service to customers.

4. A rate schedule should be no more difficult to apply than the Wright two-rate schedule used by the large central stations.

5. A rate schedule for residence electric service should permit the use of domestic apparatus, such as cooking and power appliances, at a sufficiently low rate to encourage such use and at the same time yield a reasonable return on the company's investment.

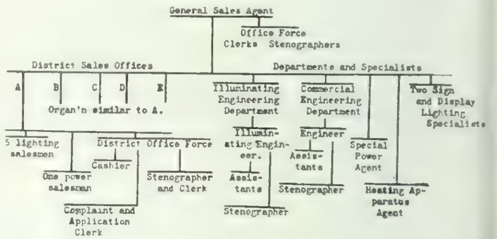
While the "new-residence lighting schedule" appears to differ from the "standard" rate, it is really a combination of the standard rate and the maximum-energy charge under the former increment-rate schedule.

The universal application of the new rate exclusively would increase many consumers' bills, which would not be permitted under the public-utility law of Wisconsin except after a hearing and decision by the Railroad Commission. The former increment-rate schedules were accordingly permitted to remain as the upper limit of charge for service under the new rate.

The City of Milwaukee contains a number of important business centers detached from the central business district. These detached business centers derive their trade from the tributary residence districts which are to a large extent more or less independent of the central business district. The city, in fact, presents the appearance of several small cities grouped around the principal center. To better reach the possible business, for the sales department's purposes, the area of the city has been divided into three districts, central, north and south, the last two to be in turn divided into two districts each when business shall have so increased in these territories as to warrant such subdivision. In quarters as near the geographical and business centers of these north and south districts as the limitations of suitable ground-floor room would permit district offices have been established. The district office for the central district is located with the general sales office itself in the Public Service Building in the heart of the downtown district. The district offices and staffs are each in charge of district sales agents, who report to the general sales agent. Under the latter's direction at the general office are stationed illuminating and commercial engineering staffs, a special motor-service agent, and heating-appliance, sign and display specialists. The arrangement of this organization as originally proposed and as followed as nearly as the personnel would permit is shown in the accompanying diagram. For each of the three district offices already organized the arrangement is in general similar to that shown under A.

The general sales agent, of course, has general jurisdiction over the work of the entire organization, and besides directing the work of the whole department visits the district offices, assisting the district sales agents. The district sales agents are instructed to rise above mere office routine and to make themselves active personal forces in their respective communities. They are advised to cultivate the acquaintance of customers, probable customers, and the men of local prominence, and to take part in local activities and improvements. The offices are rendered attractive with brilliantly lighted display windows containing household electrical devices and other applications of electricity.

Each district agent has his staff of lighting and motor-service salesmen. The duties of these salesmen, as explained to them, are (1) to secure new customers; (2) to increase the consumption of present customers; (3) to establish harmonious rela-



Organization of Sales Department of Milwaukee Electric Railway and Light Company.

tions between the company and the public, and (4) to secure business now rendered by competing services—gas, gasoline, steam engines, etc. A point is made of the third item, as it is especially desired that each customer shall feel that he has a friend within the company's organization who is ready to assist him in his electrical problems. The salesmen are also instructed to familiarize themselves with the ranges of individual customers' bills. Conferences between the soliciting staff and district heads are held daily, benefiting the men through each other's experiences and inspiring in them the enthusiasm which counts so largely in this work.

The illuminating-engineering department's duties are to improve the lighting in existing installations and to draw plans for new installations, embodying in its suggestions the latest methods of scientific illumination. This co-operative service is offered gratis to both customers and architects, and part of the advertising campaign in the daily newspapers which accompanies this new-business campaign is devoted to explaining the broad basis on which the company offers the services of its illuminating experts. Personal letters have also been written to the architects acquainting them with the free assistance they may have in designing the illumination of buildings on which they are at work. The results of the work of this illuminating-engineering department have been especially satisfactory to the customer, architect and electric company. The illuminating-engineering department is also equipped to do testing and is charged with obtaining practical data on lighting installations

The commercial-engineering department occupies to the local field of the motor-service and steam-heating business the same expert consulting position as does the illuminating-engineering department in the electric lighting field. The commercial engineer and his staff make tests, acquire data and make reports on the operation of private plants covering the advantages and economies of purchased energy. They also study special factory operations with a view of equipping these with motor drive, designing and superintending the installations of machinery when desired. The heating-appliance agent makes a special study of the various electric heating and cooking devices on the market and indicates ways for securing the maximum satisfactory use of these by customers. The special motor-service agent's duties are chiefly to assist the district agents when necessary in meeting difficult or important situations, as the superior experience of the special agent will give him the advantage in marshaling arguments in important cases. The sign-lighting and display agents confine themselves to decorative lighting, encouraging the use of electrical displays of all kinds and suggesting special signs and electrical decorations to local merchants.

Coincident with the campaign of personal solicitation taken up by the new sales department of the Milwaukee company newspaper advertising has been used freely and effectively. Quarter-page spaces are used in each of the English, German and Polish papers, presenting strong illustrated "copy."

The present campaign has been in progress only since Sept. 1, but already satisfying results have been accomplished. In all, about fifty people are employed in the new sales department, not including special agents and salesmen associated with the large electrical companies who devote their entire time to increasing the central-station company's lighting business, at the same time aiding in the sale of their employer's products.

Mr. C. N. Duffy, comptroller of the Milwaukee Electric Railway & Light Company, has been appointed general sales agent of the company and has charge of the campaign being undertaken by the new department. Mr. Egbert Douglas, as commercial engineer, has charge of the commercial and illuminating engineering departments. Mr. A. H. Sikes is the district sales agent in charge of the central district; Mr. O. H. Kruse is in charge of the north district, and Mr. P. B. Schuster of the south.

Wiring and Illumination

ORNAMENTAL TUNGSTEN LIGHTING AT ROCHELLE, ILL.

The City of Rochelle, Ill., has just installed a system of ornamental tungsten street lighting, comprising seventy curb standards, each carrying three 60-watt lamps inclosed in frosted-ball globes. The posts are erected at 80-ft. intervals and cost $55 each complete with lamps and wiring. The cost of the installation was shared equally between the merchants whose stores were benefited and the city, the latter devoting a special-lighting fund derived from the saloon tax to this purpose. Energy for the operation of the system of street lighting is furnished by the city electric plant, and the increased demand made it necessary to purchase a new 150-kw Fort Wayne generator driven at 600 r.p.m. by a 200-hp Bates engine. The installation of the posts was made by Mr. E. R. Taylor, of Rochelle.

Ornamental Tungsten Street Lighting in Rochelle, Ill.

BRITISH MUNICIPAL ELECTRIC WIRING BILL.

A measure introduced into the British Parliament is intended to confer upon local authorities owning electric supply powers the statutory right to engage in the wiring of premises for electric light and in the sale of electrical apparatus and fittings. The bill is being promoted by the Incorporated Municipal Electrical Association, a body formed by municipal electrical engineers and members of various municipal electricity committees.

The main opposition to the bill comes from the Electrical Contractors' Association, and is based on the contention that municipal wiring and sales departments will constitute unfair and unnecessary rate-aided competition with an established branch of retail trade. The electrical contractors will be supported in their opposition by associations representing hardware dealers, and also by various taxpayers' associations and trade-defence organizations which have declared themselves in favor of the proposed legislation.

THE LIGHTING OF THE ALLEGHENY COUNTY SOLDIERS' MEMORIAL.

In a paper presented before the New York Section of the Illuminating Engineering Society on Dec. 8 Mr. Bassett Jones, Jr., described in detail the architectural features and illuminating equipment of the Allegheny County Soldiers' Memorial in Pittsburgh, which is said to be the most beautifully illuminated building ever constructed.

The author said that the structure is an imposing pile of majestic proportions in many ways reminding one of the famous tomb of Halicarnasus. The style of the exterior architecture is distinctly classic but is strongly infused with the personality of the designers.

In addition to entrance foyer and three side corridors, which completely surround the building and are illuminated according to methods representing the most advanced of standard modern practice, the building contains a main auditorium and a banquet hall which are lighted by unique combinations of practically all characteristics of electrical illuminants.

The main auditorium, which is illustrated in Fig. 1, is a large room 120 ft. clear span in the square and 65 ft. from the center of the floor to the ceiling. The floor slopes to a stage at the rear. A large gallery extends around three sides of the room. The ceiling of the auditorium is broken into panels by deep plaster soffits covering the bottom chord of the trusses which support the floor of the banquet hall above. These panels are suspended from the steel work in the banquet-hall floor and are thus only indirectly supported by the trusses. Each panel is entirely separated from the soffits by a slot 6 in. wide, and thus hangs free within the frame formed by the projecting trusses. The depth of these trusses, 12 ft., made it possible to obtain a clear space above the panels 6 ft. high which was used in the illumination of the auditorium.

The banquet hall is 35 ft. from floor to ceiling and is 74 ft. square. The ceiling is divided into forty-nine square coffers, about 2 ft. deep, the top of each coffer consisting of a decorative glass sash. The ceiling construction is hung from the steel work supporting the huge pyramidal roof above. Referring to

Fig. 2, it will be seen that a gallery extends entirely around the upper portion of the hall. Under the floor of this gallery on each side of the hall are the corridors giving access to smaller offices, meeting-rooms, kitchens, etc., along the outer wall of the building.

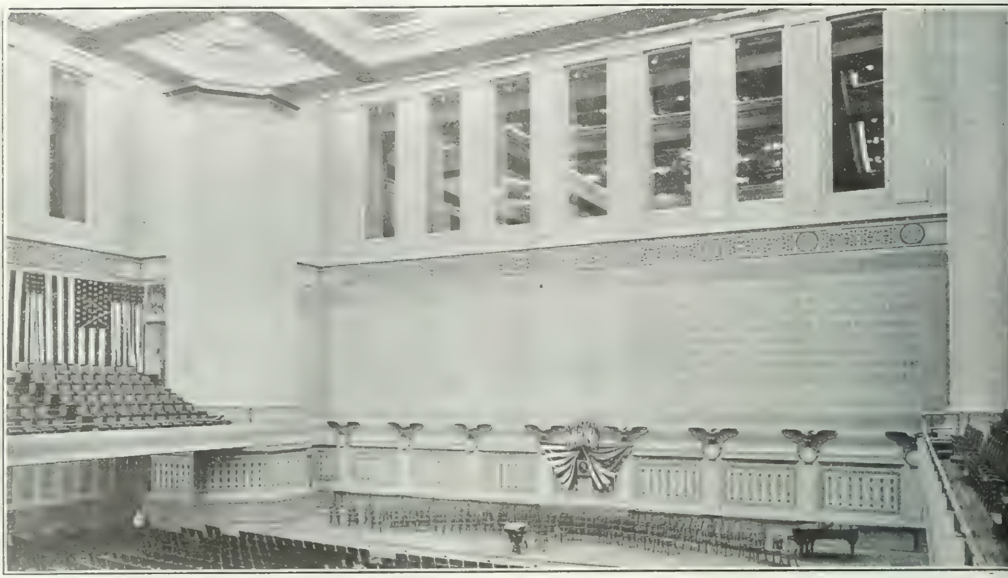


Fig. 1—Night View of Auditorium from Rear Gallery.

LIGHTING OF THE AUDITORIUM.

In Figs. 3 and 4 are given illustrations of the auditorium ceiling. The view of the ceiling, which is the principal architectural feature of this room, could not be obstructed and hence in any case the use of hanging lighting fixtures had to be avoided. The treatment of the ceiling centers around the light centers, which are also architectural centers when the room is lighted by daylight from without. These nine centers consist of circular panels of rich pierced plaster ornament, above each of which are suspended two 18-amp flame-arc lamps, so located and equipped as to cause the plaster lines to stand out in bold relief against a brilliant flickering background. The general effect is that of a scintillating jewel of intricate pattern. One of these circular panels forms the central feature of each of the large panels into which the entire ceiling is divided by the deep beam soffits under the steel trusses supporting the floor above.

Fig. 2—Night View of Banquet Hall.

A group of glass sashes is arranged around each of the flame-

arc panels and forms [illegible] up into small figures by the sash frames. A box reflector is placed over each sash.

Each of the main rectangular panels, consisting of a flame-arc center and its group of sashes, is framed by a concealed nitrogen-vapor tube lamp provided with a reflector that projects the light through a slot entirely surrounding the panel. Each panel is thus bordered by a band of rose-colored light.

The ornamental plaster mullions separating the sashes in each panel are provided with plaster rosettes equipped with exposed incandescent lamps employed to accent architectural features and show off the elaborate decorative treatment of the plaster work

Glass panels are located close to the side walls one over each window and over each is provided a parabolic reflector containing a 400-watt mercury-vapor lamp. The light from these lamps is directed against the walls of the room and through the windows and is so modified by the glass in the panels as to acquire a pale, sky-blue tone.

The lighting of the auditorium is controlled by switching devices in a closet off the stage so that any feature of the lighting may be turned on or off at will. It is intended that either the light from the glass sashes or the light from the exposed lamps under the ceiling will be sufficient for ordinary purposes, while the entire lighting system will be used only on special occasions.

The cost of installing the auditorium lighting was remarkably low, as the cost of fixtures appropriate for lighting this immense room would have almost equaled the cost of the present illuminating equipment of the entire building.

In Fig. 5 is given a view of the building during construction showing the trusses for supporting the banquet hall. These trusses are 12 ft. deep and provide excellent space for containing the equipment for lighting the main auditorium. Fig. 6 indicates the method of installation of the mercury-vapor lamps. The reflectors were arranged so that each lamp trough and its diffusing equipment could be lifted bodily out of the reflector. Unfortunately certain unexpected difficulties were met in the installation which required further changes after the reflectors for this room were delivered. The reflector walls are generally perpendicular instead of sloping, which somewhat cut down the efficiency of the device.

The nitrogen-vapor tube lamps (Fig. 7), mercury-vapor lamps and flame-arc lamps are used solely for effect, efficiency not being considered, since the particular effect desired could not be obtained in any other way. To use incandescent lamps with color screens in place of nitrogen tubes and mercury arcs would require the use of very expensive screens of special burned glass without any certainty that any one melt would have produced the correct tint. Furthermore, the exact character of light required cannot be attained by any such method. Of course, no substitute can be found for the flame-arc lamps that will give a scintillating flux.

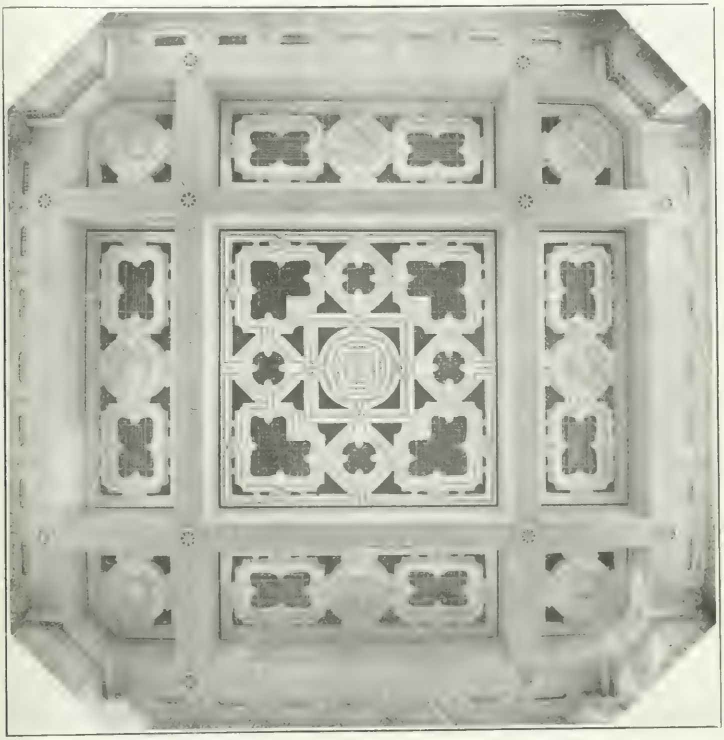


Fig. 3—Auditorium Ceiling by Daylight.

The smaller sashes of irregular pattern (see Fig. 3) were left open to the space above the ceiling and are lighted in an irregular manner by the flame-arc lamps, thus relieving the ceiling from a monotony that it would otherwise have exhibited. The amber glass in these sashes has the appearance of burnished copper when lighted. Some interesting effects have been obtained by covering a few of these sashes by thin developed blue-print paper, the two tints transposing the light transmitted from the flame arcs into an exquisite pale green.

Some difficulty was experienced with the pierced plaster grilles under the flame-arc lamps because the contractor for the plaster work had made the castings too thin. After some experimenting the grilles were covered above with thin cheesecloth which prevents the construction of the ceiling from being

seen. The cheesecloth is entirely disguised and gives a solid appearance to the grilles.

Frosted-tip tungsten lamps were first used in the rosettes under the ceiling, but the great intrinsic brilliancy and excessive whiteness of the light from these lamps when contrasted with the generally soft yellow tone of the rest of the illumination produced unfortunate results, and with the exception of the center lamp in each group they were replaced with 8-cp frosted-bulb carbon-filament lamps.

Fig. 4—Part of Auditorium Ceiling at Night.

Thirty different effects can be obtained in the lighting of this ceiling, all of which are interesting. The most remarkable effect is obtained by using only the nitrogen-vapor lamps and flame-arc lamps. The ceiling then appears like a huge decorative grate above which great fires are burning. The maximum intensity on the floor then reaches 0.7 foot-candle. Adding the mercury-vapor lamps to this combination does not change the illumination on the floor, due to the form of the reflectors used with these lamps, but the effect produced is most weird and profoundly alters the color of the walls to a gray-blue. The light from the nitrogen-vapor lamps so completely detaches the panels from the ceiling that they appear actually to float in their frames and the slight flickering of the light that sometimes occurs seems to set them moving.

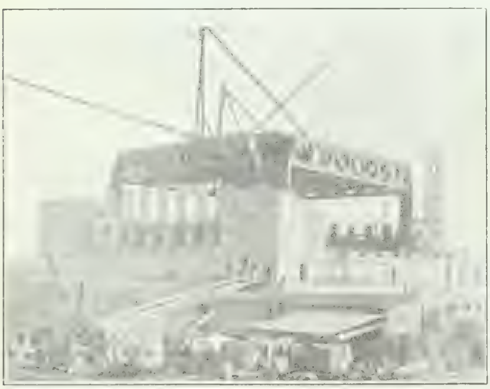


Fig. 5—View During Construction, Showing Trusses for Supporting the Banquet Hall.

The maximum intensities of illumination on the floor for different combinations were as follows: All lamps in use, 3.82 foot-candles; exposed incandescent lamps and sashes, 3.10 foot-candles; sashes only, 1.46 foot-candles; exposed incandescent lamps only, 1.74 foot-candles; nitrogen tubes only, 0.40 foot-candle; flaming-arc lamps only, 0.30 foot-candle.

The above readings were taken directly after the work was completed and with a large amount of accumulated dust and dirt on the sashes. The results are, therefore, the worst that can be obtained, since once the sashes are cleaned the box reflectors will prevent any serious lowering of the intensity due to a similar cause. The loss due to dirt amounted to at least 20 per cent of the lamp flux.

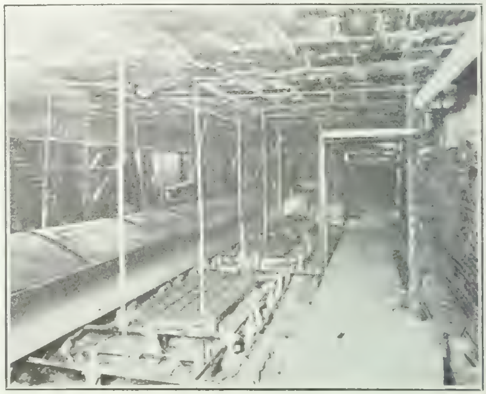


Fig. 6—View Above Auditorium Ceiling, Showing Mercury-Vapor Lamps and Reflectors.

The power consumption per square foot of floor area is: for the sashes, 4.03 watts; for the exposed incandescent lamps, all tungsten, 1.20 watts, and for part 8-cp carbon lamps, 1.14 watts. The total power "let loose" above this ceiling, including the exposed incandescent lamps, amounts to 117.20 kw with all lamps in use.

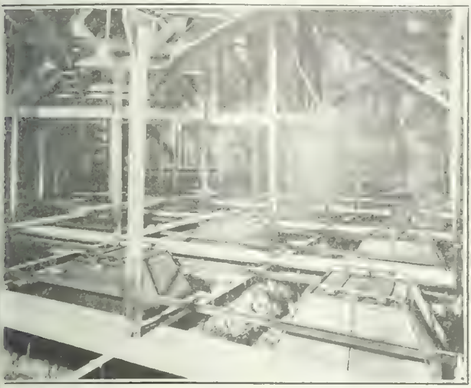
Fig. 7—View Above Auditorium Ceiling, Showing Box Reflector, Flame-Arc Lamps and Nitrogen-Vapor Tube Lamps.

LIGHTING OF THE BANQUET HALL

The lighting of the banquet hall was a comparatively simple matter compared to the lighting of the auditorium. As above explained, there are forty-nine glass sashes in the banquet hall

eiling, each sash forming the top of a ceiling coffer. The area of each sash is 25 sq. ft., from which 10 per cent should be deducted for sash bars and mullions, leaving 22.5 sq. ft. net glass area per sash—a total glass area of 1100 sq. ft. Above each sash is a box reflector similar to those used over the sashes in the auditorium ceiling. Each reflector contained eight 40-watt clear-bulb 112-volt tungsten lamps. In Fig. 8 is shown a view of the space above the ceiling of the banquet hall, where the box-type reflectors are used.

Mr. A. J. Marshall called attention to the great value of the esults recorded in giving an impetus to scientific illuminating



ig. 8—View Above Banquet-Hall Ceiling, Showing Box-Type Reflectors.

ngineering. These results have been rendered possible by reason of the co-operation between the illuminating engineer and e architect. Such co-operation is highly desirable from every oint of view.

Mr. Henry Hornbostel, of the firm of architects responsible r the design of the building described in the paper, remarked at efficiency as measured by the ratio of light utilized to light oduced is of small importance when compared with beauty of sults in a structure such as the Soldiers' Memorial. In arnging the illumination of any room attention must be given e uses to which the room will be put. In the home cheeress should be the keynote; in a dance hall brilliancy is the ne requisite. In many installations a greater attention to lor effects than has been given in the past would result in ter satisfaction. The greatest obstacle to progress at the nt time is tradition inherited from the past. The time has ed for overthrowing certain traditions relating to illumi- requirements and for establishing new ideals, especially rning color combinations.

Mr. G. H. Stickney [illegible] ts in the auditorium of the Soldiers' Memorial produced a ing of reverence rather than one of gayety.

Dr. A. H. Elliott remarked that the installation described the greatest importance in forming a monument to the ning of a new era in lighting.

Mr. J. B. Taylor cited an observation of a certain lighting upment in a home where the tungsten lamps in the living- had been dipped to render the light yellow, and expressed pinion that under such circumstances the tungsten lamp ld prove no more efficient than the carbon lamp, which ld deliver light of the desired cheerful color without pping.

The paper was also discussed from the viewpoint of the chitect by Messrs. Jacobi, Comstock and Effinger, all of whom pressed admiration for the methods employed and results tained.

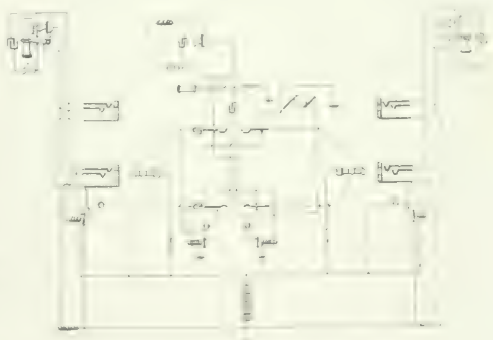
RECENT TELEPHONE PATENTS.

SWITCHBOARD CIRCUIT SYSTEMS.

With party-line ringing, especially with the four-party selective system, it has been customary to furnish each cord-pair with an individual ringing key for each different type of ringing current. As in ringing it is always necessary to use a cut-off type key, such a series of ringing keys would introduce numerous contacts in the talking circuit unless some special arrangements to avoid this were made. In the past it has been customary to use a gang key, wherein the operation of each plunger not only caused the application of its corresponding type of ringing current to the line, but also operated a cut-off key common to all the individual ringing keys. Such an arrangement, of course, requires a mechanical contrivance to connect all ringing keys with the single cut-off key. In order to overcome the necessity for such a mechanical device Mr. A. H. Weiss, of Chicago, has substituted a cut-off relay for the usual cut-off key. The depression of any of the selective ringing keys causes the operation of the cut-off relay incidentally. Mr. Weiss has obtained a patent for this arrangement, which has been assigned to the Kellogg Switchboard & Supply Company.

A patent granted to Mr. A. H. Dyson, of Chicago, and assigned by him to the Stromberg-Carlson Telephone Manufacturing Company, describes a common-battery, multiple-switchboard system. In this system the jacks are of the three-wire type, the circuits of the supervisory lamps being carried over one of the talking strands on both calling and answering cords. It will be seen that such a use of the talking strand might interfere with the busy test and also with ringing. To overcome this difficulty there have been introduced special features in the ringing and listening keys. The listening key is arranged on the calling-cord side and when operated serves not only to connect the operator to the cord strands, but also to sever the lamp connection with its ground connection. Furthermore, the ringing key is arranged so that its cut-off springs sever both the lamp and supervisory relay connections from the talking strands so that the ringing current will not be shunted. This circuit is shown in the accompanying illustration.

A novel arrangement is also used for the control of the line



Dyson Telephone System.

lamp. It will be noticed that the line relay remains energized throughout the connection, but that the shunt associated with the sleeve of the plug serves through disconnection with the jack sleeve to shunt out the line lamp by connecting the battery around it.

Mr. C. S. Winston, of Chicago, has patented a trunking system, the special feature of which lies in a method of through ringing from the outgoing end of the trunk to the called subscriber. The application of the ringing key in the outgoing operator's connecting cords serves to ground one side of the trunk line, and this in turn causes the operation of a ring-

ing relay with contacts included in the talking strands of the distant end of the trunk. The trunk is designed for use with the two-wire system where a cut-on relay must be continuously energized to maintain a connection between the jack terminals and the subscriber's line. The ringing relay is arranged so that during its operation a shunt circuit is closed to provide a non-inductive return for the ringing circuit. The details of the cir[illegible] [illegible] meet the [illegible] requirements of the switchboard system for which the trunk is designed, the usual disconnecting lamp being provided to indicate to the trunk operator when the distant A operator has cleared the outgoing end.

Letters to the Editor

Hydroelectric Head of 585 Feet.

To the Editor of Electrical World:

Sir:—In the report in your issue of Nov. 17 (page 1163) of Mr. James Lyman's lecture before the Chicago Electric Club on "Recent Hydroelectric Developments in the West" the statement is made that the 10,000-kw turbines of the Great Western Power Company are operating under the highest head (430 ft.) under which turbine wheels have ever run. Permit me to call attention to the fact that the Pacific Gas & Electric Company has had in operation for several years a turbine operating at practically 585-ft. head, or 36 per cent greater than the Great Western units. This is a single-discharge turbine of 9000 hp and compares well in efficiency with the Great Western units and has given excellent results.

San Francisco, Cal. F. G. Baum.

Power-Factor and Synchronous Condensers.

To the Editor of Electrical World:

Sir:—In the Nov. 10, 1910, issue of the *Electrical World*, page 1126, in an article by Mr. L. S. Thurston appears a misleading statement concerning the effect of low power-factor on the regulation of an alternator, as follows: "But when the power-factor is lower this ratio does not hold, because the lagging current at low power-factors opposes the mechanical strength of fields, thus reducing the voltage at the generator terminals."

It is evident that the writer is emphasizing the fact that a well-designed alternator will maintain the normal voltage without excessive temperature rise with its normal kva rating at a power-factor as low as 80 per cent, although the design may not include a field strength so strong in comparison with the armature demagnetizing effect that voltage can be maintained at still lower power-factors.

However, the statement quoted above is unfortunate, as it is only necessary to recall that the wattless component of the load, and, therefore, the demagnetizing component, while zero at 100 per cent power-factor, is 14 per cent at 99 per cent power-factor, 20 per cent at 98 per cent power-factor, 43 per cent at 90 per cent power-factor, and 60 per cent at 80 per cent power-factor. Therefore, a curve plotted between field current as ordinates and power-factor as abscissas will be very much steeper at high power-factors than at lower within the range of the ability of the machine to maintain the voltage at a safe temperature rise.

Wilkinsburg, Pa. V. W. Shear.

To the Editor of Electrical World:

Sir:—Although it has the same limitations as have the chart and table given by Mr. L. S. Thurston in his article of your issue of Nov. 10, I believe that engineers will find the following formula useful in calculations involving the rating of synchronous condensers for power-factor correction:

When kva = rated load in kilovolt amperes of the system the power-factor of which is to be improved,

$\cos\Theta_1$ = present power-factor,

and

$\cos\Theta_2$ = desired power-factor,

then

the rating in kilovolt amperes of a synchronous condenser necessary to raise the power factor from $\cos\Theta_1$ to $\cos\Theta_2$

$$= \sqrt{(kva)^2 - (kva\cos\Theta_1)^2} - \sqrt{(kva)^2 - (kva\cos\Theta_2)^2}$$

The following, while not so convenient to handle, is incidental to the derivation of the above:

$$\text{Rating of condenser} = kva\sin\Theta_1 - kva\sin\Theta_2$$

when Θ_1 and Θ_2 are angles whose cosines are as given above.

In the above it is assumed that there is no mechanical load on the condenser. The most economical load which can be imposed on this machine is one whose value in kilowatts is equal numerically to the lagging wattless kilovolt-amperes in the circuit. If this load can be obtained the rating of the condenser should be equal to the value obtained in the above formula divided by 0.707.

While the calculations upon which the above are based are entirely theoretical, the results obtained by their use will be found very satisfactory in practice.

Morrisburg, Ontario A. J. Townsend.

Wattless Power.

To the Editor of Electrical World:

Sir:—I have read with interest the communication of Mr. C. O. Mailloux appearing in the issue of Nov. 24 on the subject of a suitable name for wattless phenomena.

It seems to the writer there is too much mystery shrouded about what is really a very simple matter. It is certainly unfortunate that there are so many different energy names for something which involves no energy. It would be, to say the least, somewhat absurd to point out that the operating voltage of the Niagara Falls Power Company multiplied by the current of the Brooklyn Rapid Transit System represented an amount of power which was fictive, although its factorial components had real values. It would be still more absurd to get into a mighty stew as to what this fictive power should be called, or to argue any power relation because the components happen to be in the same state.

The writer does not question the mathematical convenience of multiplying two non-simultaneous effective values together and bearing in mind the nature of the result, but such a procedure is the bane of the practical student. It would seem that our troubles could be made more truly wattless by ceasing to write a faulty power equation of volts times amperes without qualification, which is by no means universally true even in direct-current work.

A few years ago a device known as the "rheocrat" was constructed for direct-current control. This machine rapidly made and broke a circuit, and supplied direct current to the consuming device in periodic doses, which resulted in reducing and controlling the power in the consuming circuit. An ammeter placed in a circuit so controlled and a voltmeter shunted around the terminals of the rheocrat gave readings which multiplied together produced an amount of "power"! Many were inclined to charge this power to the unfortunate rheocrat, entirely losing sight of the fact that similar readings on the consumer circuit, similarly combined, produced another amount of "power" which added to the first gave a total exceeding the power similarly measured from the mains. This phenomenon produced altogether too great a splash in our

[illegible] theoretical pond in [illegible] properly written power equation.

Let us, therefore, in a spirit [illegible] ate into our power equation the saving qualification "simultaneous." Let us never [illegible] mpere is a watt only under certain conditions. Let us call he excess currents and voltages which appear on our circuits eactions and forever divorce from their names the words power" and "watt." We are then at liberty to point out withut incongruity the power that these reactions consume, whether it be excess I^2R, dielectric or magnetic hysteresis or ddy currents, according to the nature of the circuits in which hey are found.

To the practical user of alternating currents, graduate as he lways is of a primary direct-current school, this will appeal. The mind cannot be readily divorced, and it is not desirable hat it should be, from the actual power output of the system; nd it would seem much easier to conceive of the excess curents and voltages due to reactance as reactions superposed pon the power circuit, capable of being estimated and necessiating a reinforcement of structure to sustain them. Why they hould be referred to as power of any kind in order to fit a ower equation improperly written in the days when the Feranti effect was a mystery is inconceivable. The phenomena are ue to reactance, a most admirably chosen word, and their gical name is current or voltage reactions, according to hether the circuit is parallel or series.

Finally, let us cease to say that Ohm's law is not universally ue and further forbear to discredit the fundamental tenet of ır profession to accommodate a misleading nomenclature. always equals IR, although E may not be the terminal voltge of a circuit, and the writer is not aware of any record that e great pioneer ever so designated it.

New York. [illegible]

Voltage-Wave Distortion and the Life of Incandescent Lamps.

the Editor of Electrical World:

SIR —The editorial in the issue of Nov. 17 relating to the estigation of the effects of alternating-current wave-form the life and efficiency of incandescent lamps, a report of hich was published in a recent issue of the *Bulletin* of the ngineering Experiment Station of the Pennsylvania State ollege, and the later communication to your paper from Dr. yton H. Sharp, seem to make necessary a statement of cern additional information concerning these tests. At the e time, please permit me to take exception to two statets contained in your editorial as well as to a number of Sharp's criticisms.

Referring first to the editorial, I would call attention to your tement in the first paragraph, which reads, " * * * it is ally believed that the candle-power, specific consumption l life of incandescent lamps vary with the 'mean effective' [illegible] of the e.m.f. quite [illegible] of the maximum [illegible]" It is not my purpose to contradict this statement at time, but merely to say that it has thus far been found imible to obtain definite and authoritative information on t point which would either substantiate your conclusion or e it to be incorrect. However, an examination of the large ber of letters from manufacturers of incandescent lamps l from well-known engineers which have been received since publication of the results of the investigation shows a deed difference of opinion [illegible] thi [illegible] rts to secure results of tests which led to the formation of e several opinions have been unavailing, and until such f is forthcoming some reasonable doubt may be assumed to t. At the present time the Experiment Station of the nsylvania State College is preparing to make a series of s which, it is hoped, will aid in the determination of this stion

In Dr. Sharp's communication he reports tests made at the Electrical Testing Laboratories, in New York, which showed the life of incandescent lamps to be shorter on direct current than on alternating current of either 25 cycles or 60 cycles, but he adds that his tests are not considered conclusive. But where may conclusive evidence be obtained?

Further, the editorial states that in the case of an alternating e.m.f. the range of the cyclic fluctuation of temperature depends upon the wave shape and upon the heat-storage capacity of the filament. Here, again, definite information is lacking, but it would seem that the range of the cyclic fluctuation of temperature would also depend upon the frequency of the alternating e.m.f., the *range* being greater with the lower frequency and less with the higher frequency.

If the injurious effect of the peaked wave is due to a higher maximum value that that of a sine wave of equal effective value, then unquestionably a similar result should be obtained by comparing the life of lamps on a unidirectional e.m.f. with the life on a sine wave, but if any part of the injury to the filament is due to the *range* of the cyclic fluctuation of temperature, then a lower frequency might be expected to be more injurious than a higher frequency.

Referring now to Dr. Sharp's letter, the following replies may be made to his questions, taking them in the order in which they are asked:

In making the tests described in the *Bulletin* a total of eighty lamps were used, forty being tested on each wave. It is undeniably true that there is great likelihood of being led to wrong conclusions by basing one's views on the performance of an insufficient number of lamps, but certainly added strength is given to the evidence in the case at hand by the fact that *every lamp in each group* showed results similar to and consistent with the *average results* published in the *Bulletin*. There was not a single exception to this statement.

It was clearly stated in the *Bulletin* that no effort was made to obtain voltage regulation which should be better than that of a well-regulated lighting circuit, and it necessarily follows that close current regulation was not attempted; but it must be borne in mind that the two waves were obtained from the same alternator and the tests were conducted simultaneously, so that any fluctuation in one wave was accompanied by a similar variation in the other.

The lamps were burned on life test at their normal rated voltage of 110 volts, and not at a fixed value of watts per candle.

The photometric measurements were made on alternating current and on the same wave-form as that on which the life test was being run. During these measurements the rated effective volts were applied to the lamps. In fact, the lamps were at no time burned under other than the above-described conditions.

Watts supplied to the lamps were measured on alternating current by an indicating ammeter of the dynamometer type and by a Weston voltmeter.

The frequency of each wave was 60 cycles.

The "smashing point" in all cases refers to the ultimate life of the lamps, the point where the filaments were broken. All lamps were burned to the smasing point thus defined. The *Bulletin* notes the fact that no lamps were broken in handling. Consequently the differentiation of the lamps into classes was unnecessary.

The following is quoted from Dr. Sharp's letter: "Certainly lamps can be burned at the same watts per candle on peaked wave that they can on sine wave. That is only a question of voltage. Certainly lamps can be made to give as much candle-power on peaked wave as on sine wave. That is also a matter of voltage." Undoubtedly lamps can be burned at the same watts per candle on a peaked or on a sine wave and it is a question of voltage, but is there conclusive evidence to show that two lamps which are exactly alike, or even the same lamp, will consume exactly the same amount of energy *when burned at the same effective voltage* on both wave-forms? Undoubtedly lamps may be made to give exactly the same candle-power on peaked or on sine wave and that also is a matter of voltage;

but can Dr. Sharp state positively that two lamps which are exactly alike, or even the same lamp, will give exactly the same candle-power *when burned at the same effective voltage* on the two wave-forms? The writer believes that he can not.

Unless both of the foregoing questions can be answered positively in the affirmative, Dr. Sharp's "natural inference" is without sound premises.

In reply to the question as to the division of lamps into two groups, it may be said that they were selected at random from a lot of about 100 lamps obtained from two manufacturers. The lamps from each company were received in one shipment and presumably were manufactured at about the same time. Each group contained an equal number of the same make of lamps.

Dr. Sharp asks, in case the lamps were selected at random (in which case he admits the results to be comparable), " * * * how is the fact that the candle-power of the lamps in one group was persistently high and their watts per candle persistently low to be explained?" The writer at this time does not care to submit a possible theoretical explanation. It is, however, inconsistent to challenge the correctness of experimental evidence which for the time is unsupported by theoretical proof when there is neither experimental nor theoretical evidence which is beyond question to disprove it.

Dr. Sharp gives as collateral evidence tests performed at the Electrical Testing Laboratories to determine the life of lamps on direct current and alternating currents of 25 cycles and of 60 cycles. These tests showed the longest life to have been obtained on alternating current of 25 cycles, the shortest life to be on direct current and the life on alternating current of 60 cycles to be about midway between the other two. These results are perhaps no less surprising than those contained in the *Bulletin*. Dr. Sharp frankly admits these results to be "inconclusive" for two valid reasons, and naturally the writer is unwilling to accept them as satisfactory evidence to prove the fallacy of his results.

In the second test described by Dr. Sharp the lamps were subjected to pressure waves differing in two respects. One wave was markedly peaked and had a frequency of 133 cycles; the other was but slightly peaked, the third harmonic (which is assumed to have been negative with respect to the fundamental) being but 4.7 per cent of the fundamental, and this wave had a frequency of but 60 cycles. The writer knows of no satisfactory means of separating the effects of the different frequencies from the effects of the different wave-forms, and Dr. Sharp again admits that his tests were inconclusive and yet offers them as "negative evidence" with respect to the tests described in the *Bulletin* because the former "inconclusive" tests made at the Testing Laboratories did not show a marked effect due to frequency.

The inference thus made on the results of two tests, both of which Dr. Sharp admits to be inconclusive to him, under whose direction they were probably performed, can hardly be considered well drawn.

Photographs of magnified filaments reproduced in the *Bulletin* corroborate Dr. Sharp's statement that the filaments of the other lamps do not exhibit the same faulting as do the tantalum filaments when burned on alternating current, but this fact in itself can have but little bearing on the question under discussion.

In the writer's original article mention was made of the fact that plans are under way to perform a series of tests with the third harmonic reversed, as Dr. Sharp suggests near the close of his communication.

Finally, it should be emphasized that the tests published in the *Bulletin* were not and and are not now given as conclusive evidence. The results were obtained from a series of tests performed with extreme care and, it is believed, under proper conditions. It is hoped that later tests will add testimony that will go still further toward establishing facts. The tests so far performed do, however, *indicate* certain conclusions which may eventually be reached; and surely if further evidence be needed firmly to establish these conclusions as facts, it is no less necessary to obtain authentic and contradictory evidence to disprove them.

State College, Pa. CHAS. L. KINSLOE.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generation, Transmission and Distribution.

Three-Phase Inclosed Motors with Forced Ventilation.—An illustrated description of new three-phase inclosed motors of the Oerlikon Company. The starting resistor is placed on the same shaft as the rotor, with which it revolves, and inside the casing. The arrangement for operating the starting resistor

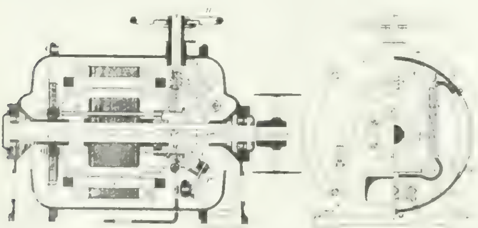


Fig. 1—Inclosed Motor with Forced Ventilation.

also works the main switch, with which it is in keyed connection. A ventilating equipment which is placed inside the motor casing produces a strong current of air, which is drawn into the motor through the foot of one of the end plates and is forced along the whole length of the motor until it is finally expelled through the base of the other end plate. In this way a very efficient ventilation of the motor is obtained in spite of the inclosure and its reduced size. The starting equipment consists of a resistor *R* (Fig. 1), made up of copper ribbon rolled in the form of a thin coil. This resistor is fixed to the motor shaft directly between the armature on a support *S*, which also carries the contacts. The contacts are made of polished copper strips of unequal length, which are placed round the shaft and which are successively short-circuited by the sleeve *M*. The number of contacts is six for motors with ratings not exceeding 25 hp, while the larger sizes have nine. By using this type of starting equipment collecting rings and brushes are not required, thus avoiding the only parts which require constant supervision. Switching in, starting and short-circuiting the winding are all effected by the hand wheel *H*, which is placed on the motor body. By turning this wheel to position *I* the switch *P* is operated, strong springs insuring a good contact Further turning of the wheel in the same direction operates the sleeve *M*, thus gradually short-circuiting the starting resistor. To switch out the motor the wheel is turned in the opposite direction.—Lond. *Electrician*, Nov. 25.

Variable-Speed Motor.—P. BARY.—A translation of his recent French paper on the B. V. D. variable-speed motor and its application to traction work. As noticed before in the Digest, the feature of the motor is the fact that the fluxes of the main field poles and of the commutation poles are partly overlapping.—Lond. *Electrician*, Nov. 25.

Polyphase Series Motor.—R. RÜDENBERG.—The first part of

a mathematical paper in which the author develops diagrammatically the principal properties of the three-phase series motor. To simplify matters several approximations are made. A simple circular diagram is given to explain the phase compensation and the variation of speed. The paper is to be concluded.—*Elek. Zeit.*, Nov. 24.

Induction Motor.—J. Rezelman.—A continuation of his long mathematical investigation of "synchronous and non-synchronous reactance." In the present instalment the author considers the case of a 50-hp, three-phase induction motor with squirrel-cage secondary.—*La Lumière Elec.*, Nov. 12.

Lamps and Lighting.

Street Lighting.—H. T. Harrison.—The author first gives details of the street lighting of the borough of St. Marylebone, where incandescent gas lamps have recently been replaced by metallic-filament lamps. The cost of the conversion and of maintaining the electric lamps is set out. He also points out that, with the exception of very important streets, the tungsten lamp will give a better result at lower cost than the open-type arc lamp. But it would be unwise to incur fresh capital charges by replacing existing arc lamps with a large number of small posts and fittings. In Croydon the experiment has been made to use groups of tungsten lamps contained in one lantern fixed as high as possible from the ground. It was found that a group of three 110-watt osram lamps, contained in a suitably designed and constructed lantern, erected from 20 ft. to 30 ft. above the ground, gave a much better minimum illumination

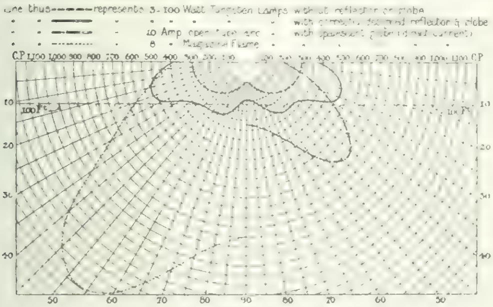


Fig. 2—Light Distribution Diagram.

and much more even illumination than the arc lamps. These lanterns are designed to have a larger area of white reflecting surface in very close proximity to the incandescent metal of the lamp, with the object of making the source of light appear large so as not to strain the eye in any way. And owing to the height at which these lamps are erected this white surface can be and is designed to act as an efficient reflector and does considerably improve the distribution of light by nearly doubling the candle-power at 30 deg. from the horizontal, as will be seen from Fig. 2. The horizontal dotted line shows the position of the pavement to light angles for the lamp 20 ft. high. This compares the distribution from tungsten lamps fitted in these lanterns with that of an open-type arc lamp. The illuminating results are as follows, these lamps being 73 yd. apart and from 20 ft. to 23 ft. high: The minimum direct illumination is 0.041 ft.-candle when using the tungsten group lantern, against 0.024 ft.-candle with the 10-amp open-type arc lamp. The cost per mile is approximately $1,000 per year; thus a minimum illumination double that of arc lamps is obtained and at slightly over half the cost. When these roads were lighted by gas mantles the minimum direct illumination was 0.0036 ft.-candle, so that the illumination is now about ten times as high, the cost being about three times as great. The paper is to be concluded.—Lond. *Electrician*, Nov. 25.

Street-Lighting Costs.—C. Toone.—The first part of a paper illustrated by diagrams in which the author gives details of the annual cost of running and upkeep of various electric street lamps in 150 British cities, including carbon, metallic and Nernst-filament "incandescent" lamps, and open, inclosed and flame-arc lamps for direct and alternating current. In the present instalment the author deals with actual annual costs, voltage and current of various arc lamps; grouping of various pressures; burning hours per year. Tables and diagrams are given. The paper is to be continued.—Lond. *Elec. Review*, Nov. 25.

[illegible]—M. B. Daguerre.—A note stating that at first sight it would seem that the ultra-violet rays would be absorbed to so great an extent by liquids that bacilli could not be reached at any depth. A millimeter thickness of water absorbs completely waves below 1800. The author, however, has discovered that the ultra-violet rays exert remarkable sterilizing effect on water. It seems possible that it may be a surface effect which is transmitted from bacilli to bacilli, for the light certainly has little penetrating power. The sterilizing action appears to be confined to clear water; impurities, suspended particles and colloids arrest it. Daguerre places a mercury-vapor lamp in a tube through which the water circulates.—*Amer. Journal of Science*, December.

Effects of Ultra-Violet Rays.—E. Schneckenberg.—The author first discusses the sterilization of water by means of ultra-violet rays obtained from quartz tubes filled with hydrogen gas through which electric discharges are passed as in the case of Geissler tubes. He then discusses the penetration of ultra-violet rays through various liquids and the decomposition of carbonic acid gas and steam and the formation of hydrocarbons by ultra-violet rays. He finally deals with the decomposition of chemical compounds of carbon by ultra-violet rays.—*Elek. u. Masch.* (Vienna), Nov. 20.

Generators, Motors and Transformers.

Low-Pressure Steam Turbines.—F. E. McKee.—A paper on the possibilities of the exhaust steam turbine. The author gives results of various installations and points out that the application of low-pressure turbines is flexible and can be used in connection with almost any existing engine plant with remarkable results. The size and design of engines, nature of engine load, as well as general operating conditions, all influence the selection of the turbine and every case must be thoroughly considered in all its details. There was an extended discussion.—*Proc. Eng. Soc. of Western Penna.*, November.

Charging Zinc Furnaces.—C. Hoebener.—An illustrated description of a machine of Saeger for charging mechanically the retorts of zinc furnaces. This may best be done by the use of electric motors. Special appliances had to be devised, due to the high temperature to which the apparatus is subjected.—*Elek. Zeit.*, Nov. 24.

Installations, Systems and Appliances.

[illegible]—An article on methods of protecting an induction motor against overloads and at the same time permitting the motor to take a heavy current, when starting, without blowing the fuse or opening the circuit-breaker. A change-over switch which permits of the use of a heavy fuse during starting and a lighter fuse when the motor has run up to speed is probably the most commonly adopted, but unless the switch is automatic and flies over to the running position on being released there is always the risk that the switch will be left in the starting position when only the heavy fuse is in the circuit. When rheostatic starting switches are used there is a simple method of getting over the difficulty. From the point of view of the machinery insurance company it is the motor which needs protection rather than the cables leading to it. Any leakage or defect in the cable work rapidly develops into a short-circuit, and, therefore, the cables may be more heavily fused than the motor, which needs to be protected against, say, a 50 per cent or 100 per cent overload. The simple method referred to is to place the circuit-breaker or fuse between the last two contacts of the rheostatic starter, taking the motor connection from the contact next to

the last, this being the last resistance contact (Fig. 3). This fuse, or circuit-breaker, is not in circuit at all during starting, but comes into action only when the starter handle is pushed over to the last stop, the starting resistor having in the meantime been all cut out and the motor run up to full speed.—Lond. *Elec. Eng'ing*, Nov. 24.

Fig. 3—Diagram of Motor-Starting Device.

British Central Station.—An abstract of last year's financial account of the West Ham municipal central station. The total number of kw-hours sold was 19,156.399, of which 11,694,432 kw-hours, or 43 per cent, make up the motor load, 4,815,592 kw-hours the tramway load, and the balance the lighting load, which is of minor importance. For private lighting 1,948,797 kw-hours were sold. In the whole 23,827,281 kw-hours were generated. The generating cost per kw-hour sold was 0.70 cent; the distribution cost, 0.10 cent; the cost attending lamps, 0.08 cent; the management cost, 0.20 cent; the total cost, including rents, taxes, etc., 1.22 cents, and including capital charges, 2.06 cents.—Lond. *Electrician*, Nov. 25.

Controlling Voltage at Feeder Points.—C. Laue.—An illustrated article describing a new and simple method of controlling the e.m.f. at the feeding points of direct-current networks. Milliammeters inserted in the testing wires permit one to find directly the voltage differences between the different feeding points.—*Elek. Zeit.*, Nov. 24.

Wires, Wiring and Conduits.

Aluminum versus Copper Cables.—F. C. Raphael and J. B. Sparks.—The conductivity of aluminum is three-fifths that of copper, so that an aluminum conductor of 0.5 sq. in. cross-section will take the place of 0.3 sq. in. copper conductor. The corresponding aluminum conductor is, however, much lighter, and, as the cost of aluminum per pound is not very much greater than that of copper, the aluminum cable in its uninsulated state is far cheaper. The larger amount of insulation and lead necessary to cover the larger diameter to the same radial thickness diminishes the advantage, but the fact remains that for cable above a certain size aluminum is cheaper, at least for single-core, low-tension cables. With respect to paper-insulated, lead-covered cables, the authors recommend cable users to obtain alternative prices when buying cable of 0.1 sq. in. upward. For ordinary vulcanized bitumen cables for laying on the solid system aluminum is considerably cheaper in all sizes; in fact, the difference is so great that aluminum will also be cheaper for armored cables. For shaft cables in mines aluminum will be cheaper also, but it must be pointed out that, in case of armored cables, it will not be lighter, as the extra weight of armoring on the larger-diameter cable more than compensated for the lighter conductor. The authors then discuss joints and describe experiments in which they found that for ordinary service connections mechanical aluminum clamps similar to the brass clamps used in standard joint boxes can be employed for aluminum cables without any risk of connection not being made with the inner strands. It is important that the clamps should be screwed up rather more firmly than usual so as to break down mechanically the insulating film on the outer strands and to squeeze out the oil or other foreign matter which may have run between the individual strands and layers. Methods of joints used in different British cities are then described.—Lond. *Elec. Eng'ing*, Nov. 24.

Temperature-Resistance Coefficient of Copper.—J. H. Dillinger.—A preliminary report to the American Physical Society on the temperature coefficient of the resistivity of copper. The values in use for this constant vary widely and are based upon but little experimental work. None of these values, therefore, can be relied upon to give accurate results when applied to any particular sample. The present investigation indicates a simple linear relation between the conductivity and the temperature coefficient, so that a measurement of the former gives also the latter for any particular sample. The relation is found to hold for samples of both lake and electrolytic copper, and for both annealed and hard-drawn samples throughout the range of conductivity of copper now on the market. The relation is in corroboration of a conclusion of Matthiessen's for the pure metals. It may be expressed as follows: The 20 deg. C. temperature-resistance coefficient of a sample of copper is given by multiplying 0.00393 by the percentage conductivity. (Percentage conductivity is reckoned on the basis of 100 per cent conductivity corresponding to 0.1530_{22} ohm per meter-gram, or 1.721_{28} micro-ohms per centimeter cube at 20 deg. C.). There may be herein an explanation of the disagreements of previous determinations of the temperature-resistance coefficient. The temperature coefficient assumed by the American Institute of Electrical Engineers, 0.0042 at 0 deg. C., or 0.00387 at 20 deg. C., corresponds to a conductivity of 98.6 per cent; if it were used for a sample whose conductivity is 100.3 per cent (an average value for the annealed copper of commerce) the error of the computed value at 100 deg. C. would be over one-half of 1 per cent.—*Phys. Review*, November.

Excessive Voltages.—A. Leaute.—Large feeders are generally provided with two circuit-breakers, one in the plant and the other in the distributing network. In putting the line under current by closing the circuit-breaker in the station excessive voltages can be produced. This fact had been investigated by Wagner. The present author takes up the other problem of determining the excessive voltages produced when the circuit-breaker in the network is closed. The fundamental formulas of the problems are given. The paper is to be continued.—*La Lumière Elec.*, Nov. 19.

Fuses.—E. Jasse.—The first part of an article on the theory of fuses. In the present instalment the author derives the fundamental equations of the heating of a fuse and then discusses applications of his equation with the aid of diagrams.—*Elek. u. Masch.* (Vienna), Nov. 20.

Electrophysics and Magnetism.

Congress of Radiology.—R. B. Boltwood.—An account of the proceedings of the International Congress of Radiology and Electricity held in Brussels in September. The proceedings were begun by Professor Rutherford, who stated that he had recently compared by the gamma-ray method the radium standards employed in the leading laboratories of several different countries and had observed very considerable differences, amounting in some cases to 20 per cent, between them. He pointed out the importance of a uniform international standard by which the results and experiments of workers in all parts of the world might be brought into accord. It was, therefore, suggested that a specimen of the purest obtainable salt of radium should be prepared and accepted as an international standard and that facilities be afforded by which all scientific workers might be able to express their results in terms of that standard. An address was given by Mme. Curie on the subject of her recent experiments on the preparation of metallic radium. In the discussion of the subject of nomenclature it was suggested that the term "half-value period" should be used to express the time required for any given radioactive product to become half transformed into other substances, and that the expression "active deposit" should be used in place of the terms "induced" and "excited" activity. These proposals were received with general approval. A large number of papers

re presented in the full [illegible] the congress. At one of the last meetings the International ommittee of Standards reported, and among its recommen-tions which were formally adopted are the following: Mme. rie has agreed for the purposes of the standard to prepare quantity of the purest obtainable anhydrous radium chloride ntaining about 20 milligrams of radium (element). This ll be used only for the measurement and comparisons of condary standards by means of the gamma rays. The orig-al standard is to be suitably preserved and deposited in ris. Through the committee national scientific laboratories d bureaus of standards willing to pay the costs are to be ovided with certified secondary standards. As radium emana-n is now so generally used in scientific investigations, the nmittee considers the adoption of a unit for the measure-nt of the amounts of radium emanation desirable. The nmittee recommends that the name "Curie" be given to the antity of mass of emanation in equilibrium with 1 gram of lium (element). The millicurie would thus be the amount emanation in equilibrium with 1 milligram of radium. The t of the primary standard will be about $2,500.—*Science*, c. 2.

Carriers of Positive Electricity.—F. Horton.—A note on a per read before the Royal Society in London. The emission positive ions from substances heated in a vacuum has been estigated by several experimenters and it has been found t the ratio of the charge to the mass of the ions is the ne for all substances so far experimented on. Assuming t the charge is equal to that carried by the hydrogen ion in trolysis, the mass of the carriers of positive electricity from ted substances must be about twenty-six times that of the rogen atom. The object of the present research was to ain the spectrum of these ions. Aluminum phosphate was sen for investigation because of the very large positive ioni-on produced on heating this substance. A calculation wed that, with the apparatus used, one might expect to col-a sufficient quantity of the carriers to obtain their spectrum small vacuum tube. The vessel used to collect the car-s was cooled in liquid air during the passage of the mionic current from a strip of platinum covered with ninum phosphate to a surrounding platinum cylinder. The erial collected was then allowed to vaporize and its spec-1 was obtained by rendering it luminous with an electrode-ring discharge. The spectrum of carbon monoxide was ys obtained, although precautions had been taken to ex-e this gas or materials which might give rise to it from the ratus. It was concluded, therefore, that the positive ions isted of carbon monoxide, the molecular weight of which ed fairly well with that required by the results of the e/m rminations. It was considered improbable that this gas evolved on heating every substance which had been ex-ted on in the determinations of the specific charge, but the nature of the apparatus used it must always have present during these determinations. In the paper rea-were given for believing that molecules of carbon mon-readily acted as carriers of positive electricity and this ably diffused into the hot metal or other substance and lved in an ionized state.—Lond. *Electrician*, Nov. 25.

um.—L. S. McDowell.—A third paper on the author's mental researches on electric properties of selenium. chief results are summed up as follows: The actions of and of heat in producing change in the conductivity of um are apparently identical. The increase in resistance decrease in temperature continues down to the tempera-f liquid air, where the cell becomes almost entirely non-ting. Changing in [illegible] f the same intensity takes place more slowly at low ratures than at ordinary temperatures, but the final produced by saturation is enormously greater. Recov-t low temperatures is markedly slower than at ordinary ratures.—*Phys. Review* [illegible]

Crest Factor and Form Factor.—W. C. Clinton.—The crest r is the ratio of the maximum amplitude to the square root of the mean square and the form factor is the ratio of the square root of the mean square to the true algebraic mean over half a period. The author gives general expressions for the crest factor and form factor of periodic functions in terms of the harmonics. Expressions for maximum crest factor and minimum form factor are given, and curves for certain special cases are reproduced.—Lond. *Electrician*, Nov. 25.

Electrochemistry and Batteries.

Calcium Cyanamide.—M. [illegible] Thompson and R. H. Lombard.—An experimental investigation of the equilibrium of the system consisting of calcium carbide, calcium cyanamide, carbon and nitrogen. The equilibrium pressure of nitrogen in the reaction $CaC_2 + N_2 = CaCN_2 + C$ was determined from both sides for a number of temperatures between 1050 deg. C. and 1450 deg. C. The free energy increase of the reaction taken from left to right is -1714 gram-calories at 1450 deg. C. and -6700 calories at 1100 deg. C. Calcium cyanamide distils to the cold parts of the furnace at temperatures as low as 1050 deg. C. Pure lime distils appreciably in the neighborhood of 1500 deg. C.—*Met. and Chem. Eng'ing*, November and December.

Units, Measurements and Instruments.

Alloys for Permanent Magnets.—C. F. Burgess and J. Aston.—An account of an extended investigation of various alloys made from carbon-free electrolytic iron, with respect to their suitability for permanent magnets. The desired feature is as high a residual magnetism as possible, or, better, a high retentivity after some disturbing factor has tended to destroy the residual magnetism, together with a high coercive force to resist the tendency toward this loss of the magnetic flux. The method of measurement was essentially the taking of various readings in a hysteresis loop test. All alloys which showed a fair retentivity and a fairly high coercive force were then subjected to a test for their stability or their ability to hold residual magnetism after shock. The results are given in various tables. In a general way it appears that chromium, manganese, molybdenum and tungsten are the important additions in the manufacture of steels for permanent magnets, but the presence of some third element is necessary. While carbon is beneficial, it is possible to obtain highly satisfactory materials either by various combinations of the above four elements or by suitable additions of silicon or vanadium, the latter, in particular, being very desirable. Moreover, suitable materials may be made which will require quenching, although in this case carbon is beneficial; if desired, equally satisfactory results may be obtained without carbon.—*Met. and Chem. Eng'ing*, December.

Frequency Meters.—O. Martinenssen.—An article in which the author first described Ferrie's frequency meter, which is based on the formula

$$2\pi f = [illegible]$$

which is valid for a circuit containing resistance and inductance, where f is the number of alternations per second, L is the coefficient of self-induction, R the resistance, E the voltage and I the current. If L and R are constant f is a function of E and I. The frequency meter of Ferrie is, therefore,

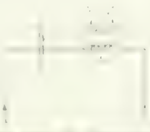


Fig. 1—Diagram of Frequency Meter

a combination of a voltmeter and an ammeter placed side by side so that the needles of the two instruments intersect each other. The point of intersection determines the frequency. This instrument has already been described in the Digest. The wave-form has, however, an effect on the measurement since

the fundamental equation holds good only for a sine wave. The author has devised a measurement which is intended to remedy this defect. A condenser C is joined in series with a choking coil L, which has a closed laminated iron core, a voltmeter V being connected up as shown in Fig. 4. The values of C and L are so chosen that as the frequency increases over the desired range of the instrument the value of $2\pi fL$ approximates to that of $1/2\pi fC$; the current in the circuit, therefore, increases and consequently also the voltage across the terminals of the choking coil. If the voltage of the circuit changes it can be shown experimentally that, provided the magnetization of the iron in the choking coil is suitably chosen, the voltage at its terminals can be kept constant. The voltmeter V can therefore be calibrated to show the frequency of the current, the results depending in no way on variations of the applied voltage of the circuit. Experimentally it has been found that variations of 10 per cent on either side of the normal produce no effect on the exactness of the readings; neither is it possible to trace anything to variations in the shape of the wave. All the upper harmonics, which have at least three times the frequency of the fundamental vibration, lie far outside the sphere of resonance, and, therefore, produce a correspondingly small effect on the voltage at the terminals of the choking coil. The instrument naturally reads over only a limited range and the voltage must, if necessary, be adjusted by a suitable transforming device. The little choking coil and the transformer can be mounted in the voltmeter case. The condenser consists of a roll of paper which separates two strips of tinfoil, the paper being impregnated under a vacuum with a viscous oil.—Lond. *Electrician*, Nov. 25.

Pyrometry.—C. R. Darling.—A note on a lecture before the Royal Society of Arts in London. After summarizing the work of early investigators, the lecturer dealt briefly with particular methods. The gas thermometer is the foundation of all the accurate work in this direction, and by using platinum-rhodium bulb temperatures up to 1550 deg. C. can be measured by this means. The water pyrometer has the advantage of cheapness, and when made in such a form as that of Siemens it is simple to use, but does not give a continuous record. Seger's cones are made with intervals of 30 deg. C.; the "Sentinel" pyrometers, consisting of a series of salts, give a similar means for determining lower temperatures within certain limits. Expansion pyrometers are apt to give trouble owing to a shifting zero. Graphite in an iron tube has been used with some success in this class of pyrometer and gives the temperature on a dial. Another dial instrument depends upon mercury in a steel tube, this being connected to a pressure gage. The mercury, being under pressure, does not boil, and thus there is obtained a form of mercury thermometer for comparatively high temperatures.—Lond. *Electrician*, Nov. 25.

Resistance Standards.—In the report of the work of the Reichsanstalt during 1909 it is stated that the comparison of the manganin standards continues to give satisfaction; the year was very damp, but the manganin boxes did not show any notable fluctuations. The forty-five standard resistances of the technical laboratory and five standards of the "strong-current" laboratory were re-tested in April and in October in two complete series of measurements (S. Lindeck), some being kept all the time in the hygrostat (air containing 50 per cent of moisture), others exposed to the fluctuations of atmospheric moisture. These tests have now been continued for three years, and in future all the standard resistances will be kept in the hygrostat. Lindeck has also resumed his inquiry into the influence of stress on the resistance of wire. A fine manganin wire covered with two layers of silk was wound on a steel cylinder, 25 mm external diameter, 4 mm wall thickness, 25 cm length, a resistance of 500 ohms covering 6 cm of the middle portion of the cylinder. Hydrostatic pressure was applied internally so as to act radially on the cylinder. The observed increase in resistance amounted to about 0.039 ohm for each pressure increase of 200 kg per square centimeter. These values were concordant, and a permanent increase in the resistance resulted when the pressure was pushed above 800 kg. In another experiment performed with a hardened-steel t no permanent increase was observed, however, when the pr sure exceeded 1000 kg per square centimeter, although the st was certainly not less sensitive than the other.—Lond. *Eng'i* Nov. 25.

Silver Voltmeter and Standard Cells.—In the report of work of the Reichsanstalt in 1909 it is stated that the work the silver voltameter and on the mercuro-sulphate Weston c is proceeding, and that the Weston standard cell should, in cordance with the recommendations of the International C ference on Electric Units in 1908, contain an excess of cadmi sulphate crystals and not merely be saturated with cadmi sulphate at 4 deg. C. New cells of the latter type were s mitted in 1909 to the Reichsanstalt, which points out t two kinds of Weston standard cells of almost, but not qu the same e.m.f. should not be put in the market.—Lo *Engineer*, Nov. 25.

Alternating-Current Measurements.—In the report of Reichsanstalt for 1909 it is stated that it has been proved t the constants of the quadrant electrometer determined direct-current measurements remain valid for alternating-c rent measurements when a phase difference exists in the tentials of the needle and the quadrants. In the course of t research the determination of the constants has been re vestigated and several new connection systems have been scribed. In transformer tests difficulties were experienced splitting a resistance on the high-tension side. Although resistors on the two branch circuits were of the same ty phase differences arose in the potential owing to differences the capacities of the resistors as regards the earth and one other; to cure this trouble the resistors are provided w metallic sheaths charged to definite potentials. The self duction of bifilar standard resistors (tapes) has been det mined by the aid of the electrometer with high-frequency c rents.—Lond. *Eng'ing*, Nov. 25.

Meter.—An official article of the Reichsanstalt concerning induction meter for single-phase and three-phase currents s mitted by the Allg. Elek. Ges. The construction is descri and illustrated, and the method of calibrating is describe *Elek. Zeit.*, Nov. 24.

Measuring Strength of Magnetic Fields.—W. Peukert translation of his recent German article on a new method measuring the strength of magnetic fields.—Lond. *Electri* Nov. 25.

Reichsanstalt.—A report of the work of the Reichsanst during the year 1909. Those parts which deal with electri engineering are dealt with separately in the Digest.—Lo *Eng'ing*, Nov. 11 and 25.

Telegraphy, Telephony and Signals.

Bookkeeping.—J. F. Schaer.—A paper in which the aut explains the commercial and mathematical principles of t double-entry bookkeeping system and its application to en neering problems.—*Elek. Zeit.*, Nov. 24.

Book Reviews.

Einführung in die Elektrotechnik. By Dr. C. Heinl Leipzig: S. Hirzel. 501 pages, 512 illus. Price, 14 mar

An elementary textbook in electrical engineering for the u of students in the Technische Hochschule of Munich. The ma subjects treated are: (1) Introduction. (2) Electromoti sources. (3) Direct-current dynamos. (4) Alternators. (Electric power and energy. (6) Electric motors. (7) Electr heating. (8) Electric lighting. (9) Storage batteries. (1 Measuring instruments. (11) Conductors. The book is sy tematically prepared and the method of treatment is very cle and practical. The illustrations are excellent and ample. T treatise appears to be one of the best elementary textboo on direct-current and alternating-current engineering in t German language.

THE SHOT FIRER'S GUIDE. [illegible] Manual on Blasting and the Prevention of Blasting Accidents. By Wm. Maurice. London: The Electrician Printing & Publishing Company. New York: D. Van [illegible] [illegible] pages, illus. Price $1.50.

The elementary theory of explosion, the properties of explosives and different types of fuses, rules for blasting and precautions to be taken in order to avoid accidents are all brought out in answers to a selected list of questions arranged to develop the subject [illegible].

ÜBER ELEKTRONEN. By Dr. W. Wien. Leipzig: B. G. Teubner. 39 pages, 2 illus. Price, 1.40 marks.

This little pamphlet is an essay on electrons and the electronic theory of Prof. Dr. W. Wien, of Würzburg University. It sets forth the principal facts thus far experimentally deduced in researches on electrons and in simple language readily followed by any scientist who has not given special attention to this new and rapidly developing field of physics. The author is to be congratulated on presenting so relatively full and clear a statement [illegible] the subject in such [illegible] small number of pages.

New Apparatus and Appliances

SANITARY WATERPROOF TRANSMITTER.

The accompanying illustration shows a new form of telephone transmitter, the invention of Mr. Felix Gottschalk, who has been closely identified with the electrical industry for the past twenty-five years, particularly with the branches of telegraphy and telephony. Eight patents relating to the transmitter were issued Dec. 6 and there are two patents of earlier date relating to the same device.

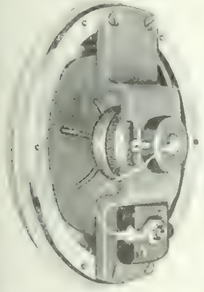


Fig. 1—Transmitter with Rear Casing Removed.

Fig. 2—Transmitter with Perforated Guard Removed.

Fig. 3—Transmitter with Perforated Guard in Place.

The transmitter consists of the usual shaped casing in two parts, and a granular carbon resistance cup with front and rear electrode of the standard type. The usual diaphragm is replaced by a metallic disk, which is put under adjustable tension by means of a screw ring. The front electrode or resistance cup is connected with the diaphragm by spired legs soldered to it and attached centrally to a hub, a threaded aperture of which engages the front electrode stud. The rear electrode has a solid back with the usual bridge connection, and is insulated from the bridge by means of a fiber bushing, while the front electrode is in circuit with the casing.

The flaring mouthpiece of the ordinary type of transmitter is replaced by a perforated guard covering the entire face of the diaphragm, the sides of which have a bayonet slot engagement with the casing, to which it is finally secured by a screw at the periphery. The damping is accomplished by means of a flexible ring at the circumference of the inner side of the diaphragm, which is held in place by a flat metal ring secured by a projecting rib. The sections of the casing are made watertight by means of screws through the front casing engaging in lugs soldered within the wall of the back casing, a washer being interposed between the two sections. Should any water pass through the extremely small perforations in the guard it cannot pass beyond the diaphragm into the chamber containing the working parts. For cord connection the insulating block attached to the bridge is provided with a socket opening to the rear, the walls of which are split and constricted; the aperture in the rear casing is fitted with a tubular boss externally threaded and projecting beyond the surface, over which fits a cup-shaped rubber cap provided with an aperture for the terminal cord. This cap is fitted with a soft-rubber gasket, and when tightened forces the tip of the connecting cord into the constricted socket, thus making a good contact and effectually sealing the working parts of the transmitter against water and atmospheric influences. By this method the wire tip is connected without taking the transmitter apart. By means of a thumb-screw attachment the transmitter can be clamped to any suitable support.

Tests on the transmitter were made by Professor George C. Shaad, professor of electrical engineering of the University of Kansas, in comparison with a standard commercial transmitter carefully selected with regard to its transmission properties. An artificial line in section was used, the arrangement being such that the two instruments compared could be quickly interchanged. The result was that for all practical purposes the transmission of the two instruments was the same over various sections of the line, the total length of which was 750 miles, thus showing that the perforated guard did not affect the operation of the transmitter.

Tests at low and high temperature were made without affecting the qualities of the instrument. One test consisted in placing the transmitter in water and gradually bringing it to a temperature of 150 deg., at which it was then tested and no change in the transmission qualities could be detected. In all the above tests the line was varied so as to give a comparison with the standard instrument on short, intermediate and long lines. After the above test under water at 150 deg. the instrument was opened and the working interior found to be entirely dry and free from moisture, although it had been entirely immersed for a period aggregating thirty minutes.

Some of the conclusions of Professor Shaad as to the advantages of the Gottschalk transmitter in comparison with the ordinary type are as follows: Elimination of the open, flaring

mouthpiece, thus making the instrument sanitary; with the mouth 3 in. away from the guard transmission was not impaired. The transmitter is effectually sealed against atmospheric influences, so that moisture cannot affect any of the interior parts, including the carbon chamber. The instrument does not have to be dissembled in any way in order to connect or disconnect it from a wall or desk set, and it contains no springs and all connections are rigid. Owing to the waterproof property, together with the fact that all exterior parts are metallic, Professor Shaad points out that it makes an ideal transmitter for use where the instrument is much exposed, as in public stations, on railways and in mines.

A CABLE-FORMING BOARD.

In order to make it easier for the electrical contractor who has had no experience whatever in installing intercommunicating telephones to install its inter-phones in an up-to-date manner the Western Electric Company is furnishing full-sized diagrams of cable-forming boards. These diagrams enable the contractor to make cable-forming boards for every variety of inter-phone sets.

The advantage of forming the cable is apparent to all those experienced in telephone work, but until recently its importance was not realized by many electrical contractors. Experience has shown that the very best plan to follow in cabling an interior telephone system is to form the cable at each telephone set so that each conductor or pair of conductors will be separated from the rest and sewed permanently into their respective

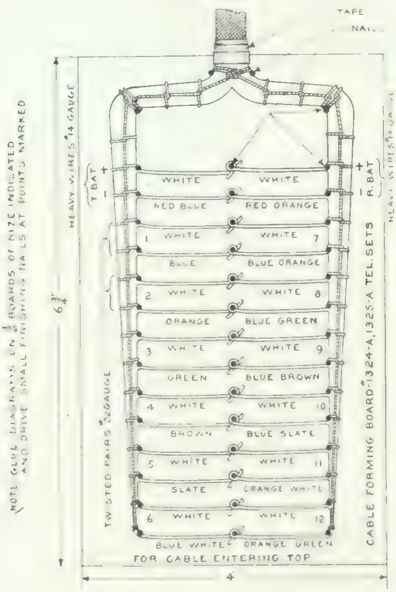


Fig. 1—Diagram of Board.

places by the means of extra stout twine made especially for the purpose. In this way every conductor is brought out of the cable at its proper place and there can be no disarrangement of the conductors due to later handling. This reduces the likelihood of the conductors being crossed to a minimum.

Fig. 1 shows a cut of a diagram which, as furnished, is first glued upon a board about ½ in. thick and then the board sawed along the edges of the diagram. This makes the board of the proper size for the different types of telephones noted on the diagram. At the points marked small nails are driven into the board and the wires are formed around the nails and sewed into place as indicated on the diagram.

A completely formed cable, sewed as it should be, is illustrated in Fig. 2. The proper twine used for the purpose is twelve-strand linen, as this provides sufficient strength for allowing the stitches to be drawn up extremely tight without the chance of breaking the twine. When the cable is completed it is lifted off the forming board and is then of the

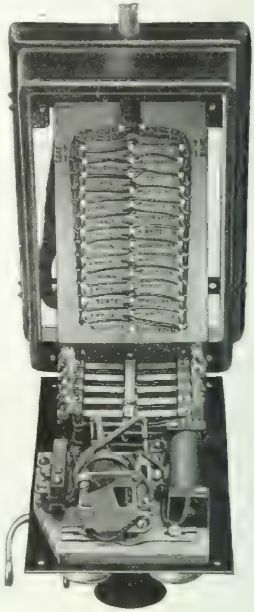


Fig. 2—Finished Board.

proper size, so that the conductors come out of the proper places to attach directly to the correct terminals in the telephone sets.

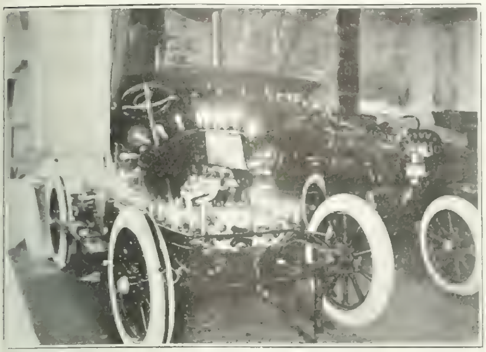
The use of these forming boards insures the continued satisfactory operation of an inter-phone system, as there is little chance of the apparatus itself getting out of order when properly installed.

SIGN LAMPS THAT WITHSTOOD PUNISHMENT.

Specialized types of incandescent lamps are sometimes perverted to strange uses. For example, lamps having flat-coiled filaments designed to give a downward distribution of light are sometimes seen suspended in long corridors; torpedo lamps are used for the illumination of display cases, miniature lamps are used to illuminate rooms, and so on. While in many instances lamps will not give satisfaction under conditions different from those for which they are primarily intended, it does not by any means follow that this is always the case, as the following account of sign lamps in automobile service will show.

The automobile here illustrated was exhibited at the Interstate Auto Show, Sioux City, Ia., in March, 1910. Outlining the body and dashboard of the machine were seventy-two 10-volt, 5-watt sign lamps, wired ten and eleven in series. Part of the time a pressure of 104 volts alternating was impressed on the circuit, and at other times a pressure of 110 volts alternating; this was due to the fact that electricity was supplied by two competing central stations. On one occasion, due to an accident, the potential at the lamps rose to double its normal value and was not lowered for three minutes.

In connection with the [illegible] during which the machine decorated with sign lamps was run over the streets for about three hours and a half. One might not expect that metal-filament lamps, such as are used normally in stationary sign service [illegible]

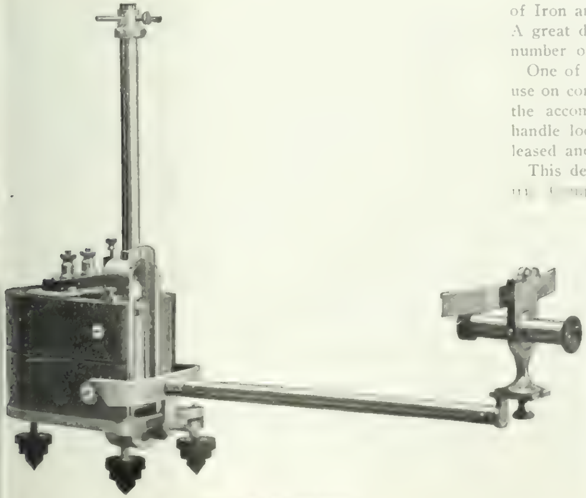


Automobile Outlined with Incandescent Lamps.

tion incident to such a test, which was rendered especially severe by the fact that the lamps were not lighted during the parade. However, it is claimed that not one of the filaments was broken during any of the rough mechanical and electrical treatment above described. The "Mazda" sign lamps used for the decoration of the automobile were furnished by the Brilliant Electric Company, of Cleveland.

HIGH-SENSIBILITY GALVANOMETER.

The galvanometer shown herewith, made by the Thompson-Levering Company, Philadelphia, is of the high-sensibility type, having any sensibility up to 1600 megohms. It is composed of



High-Sensibility Galvanometer.

two units, the magnet and the tube with the coil system. The construction is such that the tube is easily removed. The magnet is carefully aged and hardened and insulated from earth by three leveling screws. [illegible] admits of rapid and easy adjustment. The system is ballistic and is provided with a removable damper which can be easily placed on the coil in order to make the system dead-beat. It is visible in its entirety through a glass window, which may be removed, and is readily accessible at all times for any adjustment desired or for the putting in of new upper and lower suspensions. The design throughout is such as to admit of ease and rapidity in cleaning the entire galvanometer, and parts where dust and dirt can collect can be quickly removed.

The galvanometer coil is clamped by a special arrangement by a lever on the back of the tube, which insures the coil being held rigidly during transit and also renders it capable of quick and careful release when it is to be used. The contacts, which are made on platinum-iridium points, this material being superior to pure platinum, are automatically established when the tube is slipped into the pole-pieces in place in the magnet. The pole-pieces are so designed that the instrument shall give a deflection proportional to the current throughout the entire scale. Zero galvanometer adjustment is obtained by means of a level bar at the top of the tube, which gives a very sensitive adjustment; there is also a rack pinion adjustment on the scale. The telescope arms are insulated from the magnet and are supplied with a leveling screw to give the exact adjustment easily and readily.

The galvanometer lens system consists of an acromatic objective lens and acromatic Ramsden eye-piece, both non-hygroscopic. The objective is especially corrected for flatness of field, which is an important feature of the instrument. The eye-piece consists of two lenses, acromatic eye and single field. This combination of lenses, it is claimed, gives the highest results obtainable. The scale, which is a copper-plate reproduction of a standard millimeter scale, is one-half red and one-half black, thus facilitating the deflection readings.

SAFETY DEVICE FOR STEEL MILL CONTROLLING APPARATUS.

The importance of increasing the safety factor of electrical apparatus used in steel mills was one of the subjects which received much attention at the recent meeting of the Association of Iron and Steel Mill Electrical Engineers held at Pittsburgh. A great deal of discussion on safety devices took place and a number of new appliances were exhibited.

One of the simplest of these was a Kittredge safety lock for use on controllers and an application of this device is shown in the accompanying illustrations. Fig. 1 shows the controller handle locked in position, Fig. 2 showing the safety lock released and the controller handle free.

This device, which is manufactured by the Delta-Star Electric Company, of Chicago, Ill., consists of [illegible]

Fig. 1.—Controller Handle in Position.

[illegible] as to engage or disengage the controller handle. When in the engaging position two projections on the safety lock inclose the controller handle, as shown in Fig. 1, and it is impossible to

operate the controller until the lock is released by the use of a special key. An attendant can, therefore, securely lock the controller handle against operation by unauthorized persons, thus preventing possibility of starting up and causing injury to men or apparatus.

As an example of the necessity of using such devices one incident is recalled where an electrical accident caused a damage suit of $20,000. The case in point occurred at a mill where

Fig. 2—Safety Lock Released.

an employee carelessly threw the controller handle to the first-notch position, where it remained. Later on another employee thoughlessly closed the main-circuit switch, and the result was a very bad accident, involving a suit in which the jury made the above-mentioned award.

INDUCTION MOTOR DRIVE IN AN ELASTIC-WEBB MILL.

[illegible] Elastic Webb Company, Mansfield, Ohio, illustrates excellently the great advantages of the electric drive. The plant was origi- [illegible] electric drive there are thirty-five looms averaging forty shuttles each, while in the old plant, which is still run by steam, there are twenty-four looms averaging twenty-nine shuttles each. While the new plant has thus practically twice as many shuttles as the old one the cost of running is less than one-half the present cost of running the steam plant. The average bill for electrical energy in the new building for the past three months has been about $46 per month, while the bill for fuel gas, at 10 cents per 1000, to run the old plant was $43 per month, to which must be added the engineer's salary of $60 per month. In addition there are other charges against the old plant of $8.50 for water and oil; thus the cost of power in the old plant is $65 per month more than in the new plant, which has double the capacity. These figures are more remarkable from the fact that the boilers in the steam plant are fired with natural gas, which costs only 10 cents per 1000 cu. ft.

Owing to the higher speed possible on account of the uniform angular velocity of the motors an electrically driven loom has a considerably higher output than a similar steam-driven loom. Moreover, the electric looms are under more direct control; one operator who attends to two looms can instantly start or stop either loom from either end. Besides the reduced cost of producing power, as noted above, the other advantageous features are that the rooms are much lighter, due to the elimination of shafting and belting. This can be readily seen by comparing the accompanying illustrations giving a view down similar aisles of two practically identical rooms, except that one is equipped with belts and the other with motors.

Besides the main shaft it is also necessary to have a jack shaft across the building between each pair of looms. These shafts consume an enormous amount of power and are continually spoiling material through dropping oil and grease upon the finished product. It is also much easier to keep the new mill clean, and the fuzz given off by the looms is not continually being churned up and down by the swiftly moving belts and pulleys. Moreover, if a given machine is to be threaded up for special work and run day and night to fill an order, if a steam loom is thus used it is necessary to have the engineer present and to run a line of shafting throughout the entire mill. The motors in the mill were installed by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. At present there are forty-seven Ideal motors in use, and the looms in the old mill are being electrically equipped one by one at intervals when the looms can be laid off a sufficient length of time. Most of the motors are 2 hp, although several are ¾ hp, and 3 hp are used on special looms.

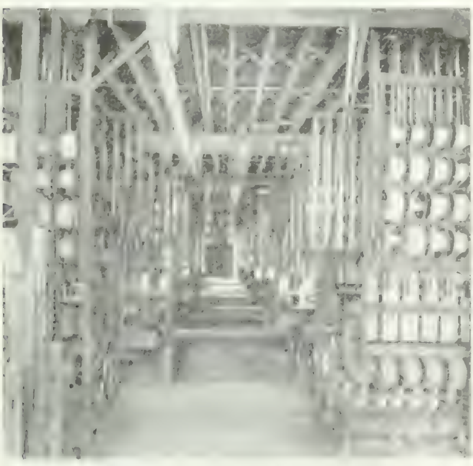


Fig. 1—Webb Mill Equipped with Belt Drive.

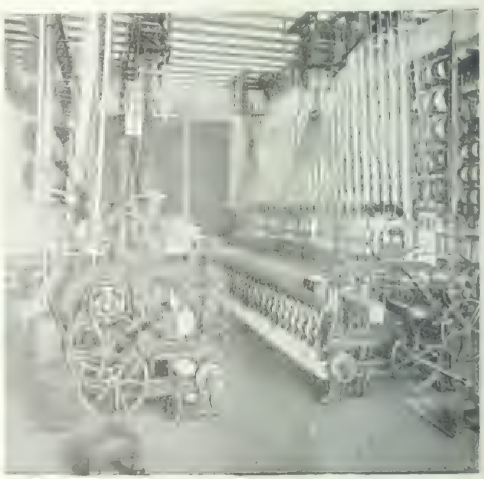


Fig. 2—Webb Mill Equipped with Motor Drive.

Industrial and Commercial News

THE WEEK IN TRADE.

WHILE it is undeniably true that the colder weather and the holiday demand have done something toward stimulating trade, business as a whole is not satisfactory. obbers and wholesalers report only a fair number of orders, nd these are hardly up to expectations. There has been very ttle buying for spring delivery, and this is taken as an indiation that retailers over almost all the country are extremely onservative. In industrial lines any changes that are worthy f notice are in the direction of reductions. Many mills, espeally in the iron and steel industry, are laying off hands. It as stated last week that 15,000 steel mill employees had been id off in the Pittsburgh district, and this is but an indication f the general condition. When hands are laid off in Pittsurgh every other industrial center is comparatively quiet. here have been few orders for rails and orders for car equipent have been very much lighter than is customary at this riod of the year. Building material is quieter all around, ructural iron is not in demand and the lumber markets of the orthwest are extremely dull. Collections are only fair, but are ally as good as the state of business should warrant. Busiss failures for the week which ended Dec. 8, as reported by *adstreet's*, were 267, as against 217 the previous week, 259 the same week of 1909, 298 in 1908, 284 in 1907, and 220 1906.

THE COPPER MARKET.

ELECTROLYTIC copper did not advance in price during the past week and, in fact, the demand was so small that it was only by artificial methods that old quotations re maintained. The monthly report of the Copper Procers' Association for November, which was published Dec. 8, owed that during the month there was a reduction in the umulated supplies of copper in the United States of 8,872,- lb. The surplus at the present time is 139,261,914 lb., ich is the lowest that has been recorded since March. The st interesting feature of the Copper Producers' figures, howr, is the fact that the production for the month of November off 7,116,000 lb., while deliveries fell off almost as much. is was not unexpected. The main interest in the figures that

[illegible]	[illegible]	[illegible]	Settling [illegible]
[illegible]	[illegible]	12.45	..
[illegible]	[illegible]	[illegible]	12.35
[illegible]	[illegible]	12.45	12.40
[illegible]	[illegible]	12.50	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	Noon.	Closing.
[illegible]	[illegible]	[illegible]

e offered by the Copper Producers' Association was in those production. If the curtailment which had been promised in summer went into effect there was some hope in the copper ket that production would eventually drop below consump- This curtailment was looked for in the reports of Sepber and November, but it did not show up. While the curnent went into effect in the actual operations of the mines August, and to some extent in July, the method of arriving he figures which has been adopted by the Copper Producers' ociation does not allow such shortening of production to w up for two months. The figures given out by the assoion were: Stocks on hand Dec. 1, 130,389,069 lb., as comd with 139,261,194 lb. on Nov. 1; the production the month of November was 119,353,463 lb., as comd with 126,469,284 lb. in the month of October; the dotic deliveries were somewhat shorter than those in the pres month, being figured at 60,801,092 lb., as against 67,-172 lb. in the previous month. Exports, from which the rnment figures are taken, were almost the same as in the previous month. They were 67,424,316 lb., as against 68,186,912 lb. in October.. The result of these figures is that, while the total deliveries of foreign and domestic trade were some 7,000,-000 lb. less than in the previous month, the surplus stock showed a decrease of 8,872,845 lb. This is much the best statement that the Copper Producers' Association has made within the past six months, but it has not had the effect of advancing the price of copper. Electrolytic is still quoted at 12.87½c@13c, and copper has not been much cheaper than this during the present year. The condition of the market, however, is distinctly improved by the reduction in surplus stocks and by the continuance of a fair export trade. There was some little increase in the jobbing demand during the past week, but for the most part concessions below the quotations of the Metal Exchange were demanded. No large consumers were in the market and the majority of the sales were made for February and March delivery. In Europe standard copper has been offered at £56 16s 3d. Temporarily there seems to be a lack of European interest and there is little margin of profit in arbitrage transactions. Exports for the month of December, including Dec. 12, were 8818 tons. Imports so far this month have been at about the same average that they were during November. The daily call on the Metal Exchange Dec. 12 quoted standard copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Keokuk Power Company.—It is understood that the Keokuk Power Company has sold to a New York syndicate an issue of $10,000,000 of 5 per cent long-term bonds. British and Canadian capitalists are also interested in the underwriting of this issue. The proceeds of the sale of these securities will go to the construction of a dam across the Mississippi River at Keokuk and the building of a large power plant. This project has been under contemplation for a number of years, and it is expected that work will be completed within three years. The company has made a long term contract with the North American Company, by which it will furnish electrical energy to the North American properties in St. Louis. It will be remembered, as published in these columns, that the North American Company after having made this contract endeavored to have it canceled, but the Keokuk Power Company refused to permit this to be done. It is estimated that the total cost of the construction of the dam and power plant at Keokuk will be in the neighborhood of $16,000,000. The project was promoted by White & Company, 25 Pine Street.

Machado & Roller Company.—The sale of meters and circuit-breakers has been fairly large during the fall, although nothing extraordinary, according to reports made by Machado & Roller. The Roller-Smith Company, which is connected with the above-mentioned firm, has its plant at Bethlehem, Pa. The output of this plant is handled by Machado & Roller. It is said that this plant has been operating at about 80 per cent of capacity and that while the demand has been good it has at no time been insistent. The Machado & Roller firm has a number of selling agencies and branch offices all over the country. Within the present month a new branch office has been established in Chicago, which will be in charge of H. I. Shire. Another general office will soon be opened in Pittsburgh.

More Western Electric Property in Chicago Sold.—The Sanitary District of Chicago has agreed to purchase from the Western Electric Company property on the west bank of the South Branch of the Chicago River and extending from Polk Street south, needed for the purpose of widening and deepening the river, for the sum of $98,710, being at the rate of $6.35 per square foot for the 15,545 sq. ft. involved.

Illinois Traction Men Organize.—A call has been issued for a meeting of representatives of all of the traction lines in Illinois, to be held in Joliet. The purpose of this meeting is the organization of the Illinois Interurban Railroad Association. It is the plan of those who are back of the organization to secure co-operative action in legislative matters.

Officers of Public Service Corporations Without Implied Authority to Borrow Money.—The Kansas City Court of [illegible]

liable on a note signed by him in the corporate name. The man who held the office of vice-president and general manager of such a company, operating in Missouri, signed the name of the company to a note for $4,200, and discounted it with a bank. When the bank sued the company the latter defended on the ground that the vice-president had no authority to make the note. It was held that this defense was good. In the opinion of the court it was said: "Defendant was a public service corporation, and as such belonged to the class denominated non-trading corporations. The implied powers of the general manager of such corporations do not include authority to borrow money and to emit the notes of the corporation. In banking and mercantile pursuits the necessities of business frequently demand quick action in the borrowing of money, and, to meet such emergencies, it is customary for the chief executive officer to be clothed with the power to borrow money on behalf of the corporation. That usage and custom have invested him with the implied power thus to bind the corporation. But with non-trading corporations, such as defendant, there are no such necessities and there is no reason for bestowing upon the executive implied authority to plunge the company into debt. The income and outlay may be forecast with reasonable certainty, and the pecuniary wants of the corporation supplied without recourse to emergent action. We conclude that the vice-president and general manager possessed neither express nor apparent authority to borrow money on behalf of the defendant, and that strangers dealing with him were bound to take notice of his lack of authority."

Westinghouse Electric & Manufacturing Company.—There was a meeting last week of the directors of the Westinghouse Electric & Manufacturing Company, in which Pittsburgh bankers took part. There appears to be a better feeling toward the company than there has been for a considerable time, and it is promised that an early dividend will be paid upon the common stock. While it cannot be said that November was a record-breaking month in the way of business at any of the Westinghouse plants, the volume of orders at all of them was greater than for the corresponding month of the last two years and the shipments were very satisfactory. At the Westinghouse Electric & Manufacturing Company it was reported that the November shipments represented an amount somewhat in excess of $3,000,000, whereas the shipments of the machine company were almost equal to those of October, which was one of the largest months in several years. The electric company is doing a very heavy business in small motors. As an indication of this, it might be well to mention that within the last two or three weeks the company has received orders for 1000 graphophone motors for the American Graphophone Company; 500 1/4-hp special alternating-current motors for the Electric Renovator Manufacturing Company; 500 1/8-hp motors for the 1900 Washer Company; 450 1/15-hp motors for the Wayne Manufacturing Company, and 624 ½-hp alternating-current motors for the Hobart Electric Company, of Troy, N. Y.

Manufacturers' Library.—The Commercial Bureau Company has established a manufacturers' library in the Hudson Terminals at 50 Church Street, New York City, which will accept catalogs of American manufacturers, classifying and filing the same and digesting them in card-index form for reference and consultation by buyers, manufacturers, engineers, contractors, purchasing agents and other consumers, both resident in and visitors to the metropolitan district. A committee of prominent manufacturers has consented to act in an advisory capacity in furtherance of the project, and has extended an invitation to manufacturers to take immediate steps to become identified with the work by placing their catalogs on file in the library. The total cost to the manufacturer will be $10 per year, for which sum he is entitled to have placed on file any or all of his catalogs, photographs, drawings, etc. This fee also includes the insertion in card-index files for buyers of a card giving a printed index of the original catalogs placed on file by the manufacturer. These card-index files are distributed to buyers and others interested in same for use in their own offices. Over 600 manufacturers have already accepted the invitation.

The Lathbury-D'Olier Company, Morris Building, Philadelphia, [illegible] terests, both established in 1894. B. B. Lathbury, member American Society of Civil Engineers, formerly located in the Land Title Building, Philadelphia, has specialized in the design and construction of Portland cement plants, and has installed many plants throughout the United States and foreign countries. The D'Olier Engineering Company, formerly 119-2 South Eleventh Street, Philadelphia, mechanical and electrical engineer and manufacturer, has done extensive work in steam electrical and hydraulic plants and industrial equipments in this country and abroad. The new company has established executive offices in Philadelphia and an office in New York. With enlarged shop facilities in Philadelphia the new firm will be enabled to carry on more extensive work than formerly.

Stavanger Electric Steel Works.—The Stavanger Shipwrecking Company, Norway, has recently offered subscription of stock to the amount of 450,000 kroner for the Stavanger Electric Steel Works. The purpose of the company is to buy steel scrap from several shipwrecking companies and manufacture high-grade steel by means of electricity. The works will be located at Jörpeland in Ryfylke. The Ryfylke Power Company has already been contracted with for delivery of 2500 hp electrical energy. The yearly production will be about 3000 tons. The plant is planned to be ready for operation in latter part of [illegible]

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at The Dalles, Ore.; Silver Springs, N. Y.; Wetumpka, Ala.; Uintah, Utah; Salina, Kan.; Chicago, Ill.; Solvay, N. Y.; Kingston, Ont., Can.; Stoughton, Wis.; Greenville, Cal.; Chehalis, Wash.; Lodi, Cal.; Georgetown, Tex.; Roberta, Ga.; Kiowa, Okla.; Bluffton, Ind.; Hartford City, Ind.; Dahlonega, Ga.; Columbus, Ohio; Hoisington, Kan.; Painted Post, N. Y.; Dublin, Ga.; Vancouver, B. C., Can., and Fresno, Cal.

Queens Borough Gas & Electric Company.—At an adjourned hearing before Commissioner Maltbie of the Public Service Commission of the First District last week Carleton Macy, president of the Queens Borough Gas & Electric Company, furnished information as to the number of meters in service in 1909 with the various amounts each meter totaled during the year. The hearing was adjourned.

Rateau-Smoot Turbine for Mill Work.—The Ball & Wood Company, Elizabethport, N. J., has taken a contract for furnishing and erecting for the French Worsted Company, Woonsocket, R. I., a 750-kw mixed flow Rateau-Smoot turbine and Smoot three-phase, 60-cycle generator, with direct-connected exciter, under a general contract with the Rateau Steam Regenerator Company.

Trump Turbines.—The Trump Manufacturing Company of Springfield, Ohio, maker of water-power machinery, has recently shipped to the City of Idaho Falls, Idaho, for its municipal water and lighting plant seven large turbine units. The turbines for the lighting plant will drive vertical umbrella-type generators.

Edison Storage Battery Car.—The double-truck car equipped with Edison storage batteries which was described in our issue of Oct. 27 has been put into regular service upon the Erie Railroad. It is being operated on the Orange branch and makes three trips daily between West Orange and Forest Hill.

Financial.

THE WEEK IN WALL STREET.

LAST week was one of declines and of liquidation in the stock market. The fact that prices went off from two to five points was hardly so important as the fact that the entire tone of the market was lower and that the buying interest was distinctly less in evidence. As a matter of fact Wall Street seems to have struck a position where liquidation is the program of every conservative trader. There is very little buying except that of speculators, and this is so weakly substantiated by cash resources that it makes very little impression upon the general condition of the market. During the past week there were few news happenings that should have had or did have any effect upon the market. The truth of the matter was that the market was weak, and that there were more sellers of stock than there were buyers. The result of this was that the average decline in prices was from two to f

points. For this decline there was no real reason, further than that it is generally understood that prices have been at too high a basis for the present condition of trade. Everybody knew that for many weeks during the fall the prices of stock were artificially upheld by manipulators. This condition, of course, could exist only so long as the manipulators were strong enough to hold up the market. It was generally believed that a decline was necessary, in order that prices of securities should reach a fair basis with the general commercial situation. Whether this basis has been reached as yet or not is the difference of

NEW YORK.

	Dec. 5.	Dec. 10.	Shares Sold.		Dec. 5.	Dec. 10.	Shares Sold.
All. Ch.	8[illegible]*	8½*	100	Int. Met., pf.	53⅞	53¼	28,0[illegible]
All. Ch., pfd.	30⅛*	27[illegible]*	100	Mackay Cos..	90*	88*	300
Amal. Cop...	64⅜	63⅝	138,400	Mackay C..pf	74⅞	74	225
Am. D. T...	29½*	2[illegible]*	———	Man. Elev...140		138	1,011
Am. Loco....	36½	37*	3,900	Met. St. Ry..	15*	1[illegible]*	———
Am. Loco..pf.	105⅛	105*	300	N.Y.&N.J.Tel.	139¼*	139¼	———
Am. Tel. & C.	80*	80*	———	Steel, com...	73¾	72¾	985,647
Am. T. & T..	139½*	141¾	10,625	Steel, pfd....	115¾	116⅜	6,300
B. R. T.....	74⅞	73¾	13,180	W. U. T....	70¼	71½	2,[illegible]47
Gen. Elec....	151	153½	4,400	West'h, com..	67	66	3,840
Int.-Met.	19¾	19¼	29,850	West'h, pfd	122½*	120*	300

PHILADELPHIA.

	Dec. 5.	Dec. 10.		Dec. 5.	Dec. 10.
Am. Rys...........	42¾	42¾*	Phila. Elec..........	15⅝	15¾
Elec. Co. of A......	11¾	11⅝*	Phila. R. T..........	18¼	18⅛
Elec. St. B'ty......	47	48*	Phila. Trac	83*	83¼
E. S. B'ty, pfd......	30*	30*	Union Trac.........	43¼*	42½

CHICAGO.

	Dec. 5.	Dec. 10.		Dec. 5.	Dec. 10.
Chi. City Ry........	170*	170*	Chi. Tel Co.........	123	122½
Chi. Rs., Ser 1. ...	92*	90*	Met. El. Co.........	20	20¾
Chi. Rs., Ser. 2.. ..	23¼	23½	Met El., pfd........	65	65*
Com. Edison.........	115	115*	Nat'l Car............	123*	120*
Chi. Subways... ...	4¼*	4¼	Nat'l Car, pfd. . .	110*	110*

BOSTON.

	Dec. 5.	Dec. 10.		Dec. 5.	Dec. 10.
Am. T. & T.......	140	141¾	Mex. Tel...........	5	5*
Cum. Tel...........	145*	150*	Mex. Tel., pfd.....	6¼*	6¼*
Edison E., Ill.......	280*	284	N. E. Tel..	138	138
Gen. Elec	152	153⅝	W. T. & T.........	16½	16
Mass. E. Ry........	18*	18¼*	W. T. & T., pfd.....	90	90*
Mass. E. Ry., pfd...	85*	84			

*Last price quoted.
Shares sold for week Dec. 5 to Dec 10.

opinion that now makes the market somewhat speculative. The bears declare that prices will go much lower, while the bulls are of the opinion that prices have already gone as far down as is necessary, and that we may look for a reaction either before the end of the year or early in January. In the meantime the money market continues to be entirely easy, and there are more offers of loans from the banks than there are borrowers. Quotations Dec. 12 were: Call, 3@3½ per cent; 90 days, 4 per cent. The quotations in the table are those of the close Dec 12.

Financial Notes.

Philadelphia Traction Reorganization.—A plan for refinancing the Philadelphia Rapid Transit Company and the Union Traction Company has finally been agreed upon, and follows out the lines originally suggested by E. T. Stotesbury, a member of the firm of Drexel & Company. About two months ago Mr. Stotesbury was invited to take charge of the finances of the Philadelphia Rapid Transit lines. He agreed to enter the board and become the financial head of the companies if certain conditions were carried out. The directors of the company were inclined to oppose Mr. Stotesbury's conditions, and for six weeks negotiations have been carried on which have now finally resulted in an acceptable plan. The two boards of directors of the Union Traction Company and the Philadelphia Rapid Transit Company have agreed to recommend to the stockholders the guaranteeing of a $10,000,000 bond issue, provided that the Rapid Transit stockholders will make over to the Union Traction system the ownership of the Market Street elevated road. This will then be used as a collateral for the new bond issue. The stockholders' meeting of the two companies can only be held after sixty days' advertised notice, and therefore the new financing cannot be made effective until after this time. It is also necessary that the City Council of Philadelphia assents to the new plan. These meetings have not yet been called but will be within a few days. If the plan goes through, it is expected that the banking firm of Drexel & Company will place the $10,000,000 bond issue which is proposed. It is not expected that there will be any opposition from the stockholders of either company. With the approval of this financial plan, Mr. Stotesbury will enter the directorate of the Philadelphia Rapid Transit Company, and it is probable that he will insist upon some changes in that board.

Cities Service Company.—A meeting of the stockholders of the Cities Service Company, the new holding organization recently formed by Henry L. Doherty & Company, will be held next week, at which a permanent board of directors will be elected to take the place of the temporary board which has had charge of the company's affairs since the organization. Henry L. Doherty will be retained as president of the company. At this meeting it is expected that quarterly dividends of 1½ per cent on the preferred stock and ¾ of 1 per cent on the common stock will be declared. These dividends will be payable Jan. 1. It is announced that in the future dividends on the preferred stock will be paid monthly at the rate of ½ of 1 per cent, if the stockholders so desire. This plan of monthly dividends was adopted by Mr. Doherty in the Denver Gas & Electric Company, and has proved very popular. The earnings of the properties now held by the Cities Service Company during October and November were sufficient to show a surplus in excess of the amount required to pay all dividends.

Third Avenue Reorganization.—The Public Service Commission of the First District of New York last week declined to approve the reorganization plan submitted by the bondholders' committee of the Third Avenue Railroad Company. This is the second time that this plan has been overruled. The committee after the first decision asked for a rehearing as a matter of form, in order that the merits of the case could be carried into court. The decision of the commission last week puts the question in a position where it can be appealed to the courts without further hearings. In its second opinion disapproving of this reorganization the commission states: "It would be obviously unwise and useless to approve a plan which might mean another foreclosure and reorganization in a few years. This is the second time within ten years that the Third Avenue company has been in the hands of a receiver. It is time that a conservative plan were adopted, and upon sound principles, that another cataclysm will not be necessary."

Butte Electric & Power Company.—The earnings of the Butte Electric & Power Company for the twelve months ended Aug. 31 showed a surplus over and above all charges and preferred stock dividends equal to about 15 per cent on the $4,000,000 outstanding common stock. During the calendar year 1909 the company earned a surplus available for dividends of 17 per cent on the outstanding stock at that time, which was $3,500,000. The company at the present time is reporting monthly gains in earnings, and the outlook for the future is said to be very bright. By the completion of the 36,000-hp hydroelectric plant at Great Falls the company will be placed in an excellent position to take care of all demands. The Butte Electric & Power Company owns one-half of the capital stock of the Great Falls Water Power & Townsite Company. This latter company has a double transmission line from Great Falls to Butte and Anaconda, and its energy is taken by the Amalgamated and Anaconda Copper Companies.

Electric Consolidation in Boston.—Special legislation will be asked of the Massachusetts Legislature at the coming session for permission to bring about the consolidation of the Boston & Northern and the Old Colony Street Railway systems. These systems operate in the north and south sides of Boston, respectively. This consolidation is being engineered by P. F. Sullivan, president of the Boston & Northern company. The two companies have for many years been working under the same managers through a voluntary holding company—the Massachusetts Electric Companies. The consolidation will mean the union of more than 900 miles of street railway tracks in New Hampshire, Massachusetts and Rhode Island. The Boston & Northern system is capitalized at $11,000,000, and its latest report showed a property value of $24,709,205.

Detroit Edison Bond Issue.—The Detroit Edison Company has sent a circular to its shareholders announcing that the company has decided to issue $1,500,000 of its ten-year 6 per cent convertible bonds. This is the balance of an issue of $3,000,000 authorized by the shareholders last February. The proceeds of the new issue will be used for construction requirements, and to pay for as many of the convertible debentures due September, 1911, as shall not have been converted into stock by the present holders. The new bonds will be convertible between Feb. 1, 1913, and Feb. 1, 1919, at the option of the holders, into the stock of the company at par. The stockholders of record of Jan. 10, 1911, will have the right to subscribe to the new issue to the extent of about 25 per cent of their stock holdings.

Western Electric Company.—The Western Electric Company last week sold to Lee, Higginson & Company and other [illegible] puts into the market the entire authorized issue of $15,000,000 of bonds. Last January the company sold $5,000,000 of two year 4½ per cent notes, and pledged as collateral $6,250,000 of 5 per cent bonds. These bonds are now marketed in order that the notes may be retired in the coming January. So far as the financing of the Western Electric Company is concerned, the disposition of these bonds furnishes all the cash that is necessary for the operation of the company for years to come. The earnings of the company during the past fiscal year have been very large, but it was thought necessary to accumulate some additional working capital. The American Telephone & Telegraph Company owns 80 per cent of the Western Electric Company stock. At a meeting of the directors of the Western Electric Company last week an extra dividend of 2 per cent, payable Dec. 31, was declared upon the $15,000,000 outstanding stock. This was in addition to the regular dividend of 1 1/3 per cent. The company has changed its fiscal year, which heretofore has ended Nov. 30, to correspond with the calendar year, and its future reports will be made according to the calendar year.

Carolina Power & Light Company.—The earnings of the Carolina Power & Light [illegible] ended Oct. 31 were not only sufficient to meet all operating costs, taxes and charges, but left a balance equal to more than twice the amount required to pay interest charges on the company's $865 500 first-mortgage 5 per cent bonds. It is generally asserted by the managers of the company that the future of this property is very bright. The franchises which it owns extend for many years, a favorable contract has been made with the City of Raleigh for eight years, and the company has good contracts with Sanford and Jonesboro. In addition, the company has a number of contracts with cotton mills, some of which are of long duration. The present physical valuation of the property is estimated at $1,476,521.

Pacific Power & Light Company.—White, Weld & Company, 5 Nassau Street, New York, are offering $1,200,000 of the 7 per cent cumulative preferred stock of the Pacific Power & Light Company. This is the principal part of an authorized issue of $1,500,000. The Pacific Power & Light Company is a consolidation of properties serving eighteen communities in western Washington and Oregon and in Idaho. It operates both hydroelectric and steam plants, and furnishes energy for light and power. It also operates gas, water and railway properties. The Pacific Power & Light Company is controlled through stock ownership by the American Power & Light Company, which in turn is controlled by the Electric Bond & Share Company, an organization owned and controlled by the General Electric Company.

Northern Ohio Power Company.—The directors of the Northern Ohio Traction & Light Company, of Akron, Ohio, have prepared plans for the organization of the Northern Ohio Power Company, which will control the new power plant which will soon be erected in the neighborhood of Cuyahoga Falls. The new company will be capitalized at $3,000,000 stock and $3,000,000 bonds. The cost of the new power station will be approximately $1,500,000. The new company will be owned by interests identified with the Northern Ohio Traction & Light Company.

Southern & Atlantic Telegraph Company.—The Southern & Atlantic Telegraph Company, which has lines extending from Washington through the Southern and Gulf States, and which is under a 999-year lease to the Western Union Company, held its annual meeting last week and elected Theodore N. Vail, U. N. Bethel, Newcomb Carlton and H. B. Thayer directors to succeed R. C. Clowry, J. C. Barclay, George J. Gould and J. T. Terry. This is simply carrying out the recent change in management in the Western Union Company.

Long Acre Electric Light & Power Company.—The Supreme Court of New York last week decided that the $350,000,000 mortgage which was claimed to exist against the Long Acre Electric Light & Power Company was invalid. This clears the way for the Long Acre company to proceed with its business. Another court last week decided that the Public Service Commission must consider the Long Acre company's application for the issuance of stocks and bonds.

Burlington (N. J.) Electric Light & Power Company.—The Public Service Corporation of New Jersey last week purchased the entire capital stock of the Burlington Electric Light & Power Company. This company was capitalized at $25,000. The company secured just before its purchase a fifty-year franchise from the City of Burlington, N. J.

DIVIDENDS.

American Power & Light Company, preferred, quarterly, 1½ per cent, payable Jan. 3.

Brooklyn Rapid Transit Company, quarterly, 1¼ per cent, payable Jan. 1.

Chattanooga Railway & Light Company, preferred, quarterly, 1½ per cent, payable Jan. 1.

Cincinnati Gas & Electric Company, quarterly, 1¼ per cent, payable Jan. 2.

Niagara Falls Power Company, quarterly, 2 per cent, payable Jan. 2.

Phelps-Dodge & Company, quarterly, 2½ per cent, extra, 2 per cent, both payable Dec. 30.

Portland (Ore.) Railway, Light & Power Company, preferred, quarterly, 1¼ per cent, payable Jan. 1.

Providence Telephone Company, quarterly, 1 per cent, payable Jan. 2.

Sao Paulo Tramway, Light & Power Company, Ltd., quarterly, 2½ per cent, payable Jan. 2.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, preferred, quarterly, 1¼ per cent, payable Jan. 1.

Union Traction Company, Philadelphia, semi-annual, 3 per cent, payable Jan. 2.

United Traction & Electric Company, Providence, R. I., quarterly, 1¼ per cent, payable Jan. 2.

Western Electric Company, extra, 1⅓ per cent, payable Dec. 31.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Commonwealth Power, [illegible]					
October, 1910	[illegible]	....	[illegible]	.....	[illegible]
October, 1909	[illegible]	.....	[illegible]	......	[illegible]
Lowell (Mass.) [illegible]					
October, 1910	[illegible]	$21,533	[illegible]	....	[illegible]
October, 1909	[illegible]	[illegible]	[illegible]	...	[illegible]
Keystone Telephone Company, Philadelphia:					
November, 1910	[illegible]	48,105	[illegible]	$24,392	[illegible]
November, 1909	91,851	[illegible]	[illegible]	24,634	[illegible]
Kings County Electric Light Company:					
November, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	107,376
November, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Massachusetts Electric Companies:					
Year ended [illegible]	[illegible]	5,360,295	[illegible]	[illegible]	[illegible]
Year ended [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
New York State [illegible]					
Quarter ended [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Quarter ended [illegible]	[illegible]	521,924	[illegible]	[illegible]	[illegible]
North Shore Electric Company:					
October, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pacific Coast Railway Company, San Luis Obispo, Cal.:					
October, [illegible]	[illegible]	[illegible]	[illegible]		
October, [illegible]	[illegible]	601,393	[illegible]	....	......
United Railroads of San Francisco:					
October, 1910	670,295	[illegible]	[illegible]		
October, 1909	[illegible]	402,537	331,220		
United Railways [illegible]					
October, [illegible]	[illegible]	[illegible]	[illegible]	232,654	[illegible]
October, 1909	1,035,624	[illegible]	[illegible]	232,267	[illegible]

General News

Construction News.

BIRMINGHAM, ALA.—The City Council has granted the Coosa River Development Company a thirty-year franchise to supply electricity in Birmingham. Under the terms of the franchise the company is to have its plant in operation within three and one-half years and the maximum rate for electrical service is not to exceed 8 cents per kw-hour, with a discount of 12½ cents for payment within 10 days. The company also agrees to furnish arc lamps to the city at a price not exceeding $50 each per year.

GADSDEN, ALA.—Louis Hart, owner of the Bellevue Hotel, a summer resort located on Lookout Mountain, is reported to have completed arrangements for organizing a company to construct an electric railway up the mountain. It is stated that capital stock to the amount of $50,000 has been subscribed.

WETUMPKA, ALA.—The town of Wetumpka has engaged the Solomon-Norcross Company, engineers, of Atlanta, Ga., to make investigations and submit a report for improvements and extensions to the municipal electric light plant and water-works system and to prepare plans and estimates for a sewer system.

DOUGLAS, ARIZ.—The Western Construction Company, of Wichita. Kan., is reported to have submitted a proposition to the Chamber of Commerce, in connection with the irrigation of about 10,000 acres in this section. The company proposes to install pumping plants and furnish water to the landowners.

PHŒNIX, ARIZ.—Plans are being considered by S. H. Mitchell and associates for the construction of an electric railway between Phœnix and Glendale, a suburb, for which surveys have been made and most of the right-of-way secured.

NASHVILLE, ARK.—The Nashville Ice, Coal & Light Company has been granted a franchise by the City Council for a franchise to construct and operate an electric light plant in Nashville. It is understood that equipment for the proposed plant has already been purchased.

BODIE, CAL.—The Hydro-Electric Company is reported to have contracted for a 2500-hp Pelton impulse wheel and Pelton governor to operate under a 680-ft. head, and for an Allis-Chalmers generator to be installed at its plant in Bodie, Cal.

BRIDGEPORT, CAL.—The Board of Supervisors has granted the Hydro-Electric Company a franchise to erect transmission lines over the roads and highways of Mono County for the transmission of electricity for lamps and motors; also for the erection of telephone and telegraph lines.

FRESNO, CAL.—S. N. Griffith, promoter of the Fresno-Clovis electric railway, is reported to have made arrangements to secure energy for operating the proposed railway from the San Joaquin Light & Power Company, of Fresno. It is understood that contracts have been placed with the General Electric Company, of San Francisco, Cal., for transformers, etc., at a cost of about $30,000. Work will begin on construction of the railway as soon as franchise to enter the city is secured.

FRESNO, CAL.—Preparations are being made by F. S. Granger, promoter of the Fresno-Hanford Interurban Railroad, for the construction of the proposed railway, work on which will begin in the near future. The company is planning to erect a power plant near Fowler to furnish electricity for the railway. It is expected to develop about 1500 hp. The cost of the proposed railway is estimated at about $4,000,000. J. B. McDonald, superintendent of construction of the Hudson Counties Company, will have charge of the work.

GREENVILLE, CAL.—The Indian Valley Light & Power Company is reported to be contemplating increasing the output of its power plant and extending its transmission lines in the near future. It is understood that the lines will be extended to Taylorsville, Crescent and Seneca.

LODI, CAL.—Bids opened by the Trustees for the installation of a municipal electric light plant on Nov. 29 were rejected as none came within the amount of the appropriation. The specifications will be amended so as to provide for less expensive equipment. Most of the bids exceeded $8,000 and the trustees have but $4,000 to expend.

LOYALTON, CAL.—The City Trustees are reported to be considering the question of installing a new lighting system.

MONROVIA, CAL.—J. H. Holman, managing director of the new U. S. Grant Hotel, at San Diego, and W. R. Staats, of Pasadena, are contemplating the construction of an electric railroad to the summit of Mount Wilson in the near future.

MONTEREY, CAL.—The Pacific Gas & Electric Company, of San Francisco, Cal, has recently absorbed the plant and holdings of the Monterey County Gas & Electric Company, of Monterey. In connection with the deal comes the news of an extension by San Francisco capitalists of the Monterey electric railway to Salinas, twenty miles in length. Work will begin at once on construction of the proposed railway. W. H. P. Hill, manager of the present Monterey County Gas & Electric Company, will have charge of the Pacific Gas & Electric Company's new holdings.

OAKLAND, CAL.—It is reported that negotiations are under way for the absorption by the Pacific Gas & Electric Company of the Suburban Light & Power Company, of Oakland, Cal. The holdings of the Suburban company are estimated at about $1,000,000. The company supplies electricity for lamps and motors in Haywards, San Leandro, Niles, Irvington, Newark, Elmhurst, San Lorenzo, Pleasanton, and other Almeda County towns.

PIEDMONT, CAL.—Steps have been taken by Hugh Craig, president of the Board of Trustees, for establishing a municipal electric light plant in Piedmont. It is proposed to erect a distributing system and purchase energy from a private corporation to operate same.

RIVERSIDE, CAL.—Plans have been prepared by the Riverside Portland Cement Company for additions to its plant at Crestmore, which will include the installation of two new kilns, three ball mills and two tube mills. The company is also considering the erection of several new buildings for handling and storing cement. It is understood that the company expects to install considerable new equipment.

SANTA ROSA, CAL.—The contract for grading the proposed Santa Rosa & Clear Lake Scenic Electric Railroad, extending from Santa Rosa to Clear Lake, fifty-six miles in length, has been awarded to the Santa Rosa & Clear Lake Construction Company.

SUSANVILLE, CAL.—The Lassen Water, Light & Power Company is reported to have placed contracts for an additional unit for its plant, including a Pelton water wheel and a General Electric generator.

VALLEJO, CAL.—Sealed bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, until Jan. 10, 1911, for furnishing an electric traveling crane at the Navy Yard, Mare Island, Cal., under schedule No. 3170.

DENVER, COL.—The Denver & Intermountain Railway, operating between Denver and Golden, has been purchased recently by the Denver Realty Company. The road has been in receiver's hands for some time. The company supplies an electric railway passenger service and a steam freight service. W. G. Evans, J. A. Beeler and W. H. Moffat are interested in the Denver Realty Company.

MANZANOLA, COL.—The Pueblo & Suburban Traction & Light Company, of Pueblo, Col., is reported to be contemplating extending its transmission lines to Manzanola to supply electricity for lamps. The company, it is understood, is considering extending its electric railway down through the valley in the near future.

SELBYVILLE, DEL.—The Town Council is reported to have granted a franchise to an electric light company to install an electric lighting system in Selbyville.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Commissioners for the District of Columbia, Washington, D. C., until Dec. 27 for wiring and apparatus for a time and signal bell system for the Western High School and for the McKinley Manual Training School, of Washington, D. C. Proposal forms, specifications and necessary information may be obtained upon application to the property clerk of the District of Columbia, Room 320, District Building, Washington, D. C. Cuno H. Rudolph, John A. Johnston and William V. Judson are commissioners.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Dec. 28, for furnishing electrical supplies under proposal No. 495. Captain A. S. Cowan is disbursing officer.

AUGUSTA, GA.—The Augusta Railway & Electric Company has applied for a charter to extend its railway to the city wharf on the Savannah River. It is reported that the company is contemplating other extensions to its railway. James U. Jackson is vice-president.

COLUMBUS, GA.—The contract for the machinery and electrical equipment for the new manufacturing plant of the Meritas Mills has been awarded to Deronda Levy, of Columbus, Ga.

DAHLONEGA, GA.—Plans are being considered by the Cedar Mountain Land Company for establishing an electric light plant to provide electricity for lighting the hotels, cottages, etc. H. R. Robertson, 727 Candler Building, Atlanta, Ga., is secretary and general manager.

DUBLIN, GA.—At an election held Dec. 6 the citizens voted to authorize an issue of $30,000 in bonds, the proceeds to be used for improvements to the water and light plant and for paving streets.

LAFAYETTE, GA.—Bids will be received by D. W. Herndon, Mayor, until Dec. 20 for $12,000 electric light bonds and $28,000 water-works bonds.

MACON, GA.—A movement is on foot to secure a reduction in the cost of street lighting or to install a municipal plant for lighting the streets only.

[illegible]NOUGH, GA.—[illegible] M[illegible] is reported [illegible]

ROBERTA, GA.—Arrangements are being made for the installation of an electric light plant and water-works system in Roberta, including the building of a concrete dam at a cost of $10,000. The cost of the equipment is estimated at $7,000. It is understood that bids for the work will be called for in about sixty days. W. J. Marshall, R.F.D., Lizella, Ga., is engineer in charge.

[illegible]—It [illegible] the Rome & Northern Railroad Company, the Chattanooga Southern Railroad Company and the Chattanooga Railroad Company, recently incorporated, whereby the last named company proposes to use the tracks of the Chattanooga Southern Railroad to Trion and the Rome Northern Railroad to Rome, and also proposes to build an extension between Rome and the Seaboard Air Line Railway, and to use the latter road to Atlanta. The company is planning to provide an interurban service with motor-driven trains.

[illegible], IDAHO.—[illegible] Mining Company for the installation of a motor-driven air compressor, contract for which has already been placed. It is understood that other improvements will be made later.

SALMON CITY, IDAHO.—The Lemhi Telephone Company has been granted a franchise to install a telephone system in Salmon City.

WARDNER, IDAHO.—The Washington Water Power Company, of Spokane, Wash., has completed its new substation at Wardner. The new station will have an output of 1500 kw and will supply electricity to operate the machinery in the mills and ore-handling plants of the Bunker Hill and Sullivan Mining Company.

CHICAGO, ILL.—The installation of two 25,000,000-gal. electrically driven turbine pumps as an auxiliary to the present steam reinforced pumping engines at the Twenty-second Street pumping station is reported to be under consideration by the city. John Ericson is city engineer.

CHILLICOTHE, ILL.—It is reported that the Economy Light & Power Company, of Joliet, Ill., is negotiating with local parties to supply electricity to operate the pumping station in the Partridge and Hennepin Levee and Drainage Districts.

DECATUR, ILL.—The Decatur & Southern Traction Company has filed a notice with the Secretary of State showing an increase in capital stock from $25,000 to $1,500,000. Announcement has been made that the division from Decatur to Witt, sixty-eight miles in length, will be built first, after which the railway will be extended through Coffeen and Greenville to St. Louis. A belt line, one mile in length, around the southwest part of Decatur, connecting with the belt line of the Illinois Traction system, is part of the project. Peter Chase is president of the Decatur & Southern Traction Company.

EASTON, ILL.—It is reported that F. H. Conroy and Roy Holly will apply to the Village Board for a franchise to establish an electric light plant in Easton.

NAPERVILLE, ILL.—The Inter-State Telephone Company has been granted a twenty-five year franchise by the City Council, under the terms of which the company is to pay the city 5 per cent of its gross rental earnings after ten years from Jan. 1, 1911.

PEORIA, ILL.—It is reported that the citizens are contemplating the purchase of the cereal sugar plant to be used in connection with the combination electric light plant and pumping station for the water-works system to be installed.

ST. CHARLES, ILL.—The Business Men's Association is reported to have awarded the contract to install fifty-four ornamental lamp-posts on Main Street to the McFell Electric Company, of Chicago, Ill. Each post is to carry three 60-watt tungsten lamps.

ANDERSON, IND.—Suit has been filed against the Citizens' Heat & Light Company, of Elwood, asking for a receiver and for forfeiture of its charter. The suit was brought against the company owing to its failure to pay back $10,000 deposited by its customers for meters demanded by its predecessors.

BLUFFTON, IND.—The City Council has voted to make improvements to the municipal electric light plant, including the installation of a new engine and other apparatus.

BRAZIL, IND.—The City Council is reported to have taken steps toward the establishment of a municipal electric light plant in Brazil.

BROOKVILLE, IND.—Separate bids will be received by the Board of Commissioners of Franklin County, Brookville, Ind., until Jan. 19, for electrical work in connection with repairing and remodeling the county court house in Brookville, plans and specifications for which are on file at the office of the county auditor and at the office of Elmer E. Dunlap and Marshall E. Van Arman, architects, 909 State Life Building, Indianapolis, Ind.

FORT WAYNE, IND.—The Bass Foundry & Machine Company is [illegible]

HARTFORD CITY, IND.—Arrangements are being made by the Hart[illegible] company has recently made extensive improvements and extensions to [illegible]

JEFFERSONVILLE, IND.—The Jeffersonville Water, Light & Power Company is contemplating making improvements to its electric plant.

LAPORTE, IND.—The Chicago-New York Air Line Traction Company is reported to have contracted with the Northern Indiana Gas & Electric Company for energy to operate its Laporte-Gary division for a term of ten years. A large substation will be erected at Goodman.

LINTON, IND.—Suit has been brought against the City Council by Arthur Simms, a taxpayer, asking that the Council be restrained from selling the municipal electric light plant. The city purchased the plant about ten years ago, and at present it is leased to S. V. Parrott, of Indianapolis, Ind. The lease expires March 1, and the city authorities are considering the advisability of selling the plant, as it will require extensive repairs to place it in order to supply satisfactory service.

PARKER CITY, IND.—Preparations are being made by the Eastern Indiana Telephone Company for rebuilding its local telephone system, which will include the erection of a new exchange building, replacing wires with cables and other improvements. Earl Rucker is general manager.

PORTER, IND.—The Town Council has granted the South Shore Electric Railway permission to construct an electric railway from Porter to the south shore main line of the Porter, Chesterton & South Shore Railway Company.

ATLANTIC, IA.—At an election held Dec. 5 the proposition to issue $50,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant, was carreid.

BELLE PLAINE, IA.—It is reported that work has commenced on the construction of a municipal electric light plant in Belle Plaine. The cost of the proposed plant is estimated at about $20,000.

COLFAX, IA.—The Iowa Telephone Company has awarded the contract for the installation of an underground conduit system in Colfax to the Ryan Construction Company, of Davenport, Ia.

COLUMBUS JUNCTION, IA.—The city authorities are considering the question of granting a franchise for the installation of an electric light plant in Columbus Junction.

ELDORA, IA.—The Park Dam Power Company, which is constructing a large dam across the Iowa River and a power plant and electric system in Eldora, is reported to have purchased the dam at Steamboat Rock, which will supplement the dam now being erected here. E. H. Lundy, George W. Wood and A. H. Latimer, of Mason City, Ia., are interested in the Park Dam Power Company.

KEOKUK, IA.—The Keokuk Power Company is reported to have sold bonds to the amount of $10,000,000, the proceeds of which will be used for the construction of a large dam across the Mississippi River and a large power plant at Keokuk, Ia. It is expected to have the work completed within three years.

LOGAN, IA.—The citizens are reported to be considering the question of installing a municipal pumping plant, work on which will begin in the spring.

HAMBURG, IA.—The proposition to grant a franchise to install an electric light plant in Hamburg will soon be submitted to a vote.

SIOUX CITY, IA.—Plans have been prepared for the construction of a building, 100 ft. x 150 ft., five stories high, for the Johnson Biscuit Company, of Sioux City, Ia. The building will be equipped with an air purifier laundry, electric lighting plant, telephone system, fire sprinkler system, icing trolleys, etc. Orders have been placed for some of the machinery, but engines, boilers, etc., have not yet been decided upon.

VALLEY JUNCTION, IA.—Preparations are being made by the Iowa Telephone Company for the erection of a new telephone exchange building in Valley Junction, bids for construction of which will soon be called for. At present the Hawkeye Telephone Company operates the Valley Junction system under lease secured from the Mutual Telephone Company before the Iowa company purchased the independent system in Iowa.

WEBSTER CITY, IA.—The Fort Dodge, Des Moines & Southern Railroad Company is contemplating the construction of an electric railway in Webster City, for which a franchise will soon be applied for.

HOISINGTON, KAN.—The Hoisington Electric & Ice Company is reported to be preparing plans for enlarging its power plant, the cost of which is estimated at $15,000. J. R. Murphy is superintendent.

NEODESHA, KAN.—The contract for the construction of the proposed municipal electric light plant is reported to have been awarded to the Squire Electric & Construction Company. The equipment will include a 150-hp Monarch engine and a 100-kw generator, switchboard, etc. The street lighting system will consist of forty-four arc lamps.

SALINA, KAN.—It is reported that the People's Light, Heat & Power Company is contemplating using water-power to operate its plant. Surveys are now being made with a view of utilizing an old dam on the Smoky Hill River, a few miles out of Salina.

BARBOURVILLE, KY.—Local capitalists have leased the plant of the Barbourville Electric Light & Power Company. A new contract has been made with the city. Allory Smith will have charge of the plant.

DAISY, KY.—The Daisy Telephone Company, recently organized with a capital stock of $1,000, is reported to be planning to erect a telephone system in this county, work on which will begin immediately. Charles Franck, R. H. Madden and others are interested in the company.

LEXINGTON, KY.—Plans are being prepared for the construction of [illegible] in Lexington. A company will be organized under

the name of the Fayette Light Company to construct and operate the plant. The company will be capitalized at $500,000 and will supply electricity for lamps and motors in this city. A. H. Peck is general manager.

FREDERICK, MD.—The Frederick Railway Company has recently installed a 750-hp engine and a 400-kw alternating-current generator in its power house and has also equipped three rotary substations complete. Oscar B. Coblentz is chief engineer.

BOSTON, MASS.—The Boston Elevated Railway Company, of Boston, Mass., is reported to have purchased the property of the George Lawley & Sons Corporation, at South Boston. The elevated company is planning to build a large power plant at South Boston to supply electricity to operate its railway system, including subways, elevated and surface lines.

GARDNER, MASS.—Steps have been taken by the Business Men's Association of Gardner for improving the lighting system in the business district. It is proposed to replace the present lamps with tungsten lamps to be erected on iron standards.

LEOMINSTER, MASS.—The Light, Heat & Power Corporation, of Boston, Mass., is erecting a new boiler plant with all piping and auxiliary apparatus for the Leominster Electric Light & Power Company, Leominster. The boilers have been installed and the smokestack is now being erected. It is expected to have the building completed before the end of the year.

NEWBURYPORT, MASS.—In a decision handed down by the Board of Gas and Electric Commissioners a reduction is ordered in the price of electricity for lamps in Newburyport from 20 cents per kw-hour to 14 cents per kw-hour, and the rate for gas is to be reduced from $1.40 to $1.35 per 1000 cu. ft., to go into effect on Jan. 1, 1911.

NORTH ADAMS, MASS.—The Light, Heat & Power Corporation, of Boston, Mass., has completed the installation of a 1000-kw Allis-Chalmers steam turbine with all auxiliaries for the electrical department of the North Adams Gas Light Company.

PLYMOUTH, MASS.—The Massachusetts Gas & Electric Light Commission has authorized the Plymouth Electric Light Company to issue capital stock to the amount of $30,000, the proceeds to be used to pay for power plant improvements made since its generating equipment was destroyed by fire about a year and one-half ago.

SANDWICH, MASS.—It is reported that the surveys have been completed for the extension of the Plymouth Electric railway from Fresh Pond to Sandwich. It is expected that work will begin early in the spring.

IRON MOUNTAIN, MICH.—O. C. Davidson and L. T. Sterling, of Iron Mountain, Mich., are reported to be interested in a project for the construction of a hydroelectric power plant at the Twin Falls of the Menominee River.

OLIVET, MICH.—It is reported that bids will be received until Dec. 20 by the company recently organized to install an electric light plant for equipment for same. The company is remodeling the local flour mill for a power plant. E. M. Arnos, treasurer of the college, is interested in the project.

PONTIAC, MICH.—The Common Council has passed an ordinance incorporating the proposition of the Michigan Telephone Company as to service, rates and conditions, and annulling the franchise of the Oakland Telephone Company, provided the Michigan State Telephone Company takes over the physical property of the Oakland Telephone Company on terms that have already been arranged.

SANDUSKY, MICH.—The City Council is reported to be considering the question of constructing an electric light plant and water works system. F. T. Benedict is city clerk.

BRAHAM, MINN.—The Eastern Minnesota Power Company, of Pine City, Minn., it is reported, is contemplating extending its system to Braham to furnish electricity for lighting the streets and residences. Twenty-five electric street lamps will be installed.

CLINTON, MINN.—The [illegible] Central Telephone Company is contemplating rebuilding its local exchange, work on which will begin at once.

DEERWOOD, MINN.—M. D. Storer, of Bemidji, Minn., has secured a site for the erection of a warehouse and power house in Bemidji. Contracts have been awarded for equipment for power plant, including a 300-hp Corliss engine and a 200-kw generator.

MINNEAPOLIS, MINN.—The Crown Iron Works Company, of Minneapolis, Minn., is reported to be preparing to build a new fireproof building, 74 ft. x 152 ft., to replace the shop recently destroyed by fire. The new plant will be equipped with a 10-ton electric crane, punches and other machinery and tools.

GULFPORT, MISS.—The Gulfport & Mississippi Coast Traction Company is contemplating the extension of its North Gulfport and Twenty-fifth Avenue line to Bayou Banard, and probably into Handsboro.

PORT GIBSON, MISS.—It is reported that plans are being considered for the installation of an electric light plant in the Chamberlain [illegible] lamps. Rev. M. [illegible] is president.

MARIONVILLE, MO.—[illegible] ing plant in Marionville is reported to be under consideration.

ST. LOUIS, MO.—The electric light franchise owned by the Light & Development Company has been declared invalid by Judge Shields, of the United States Circuit Court, because of non-use. The franchise was [illegible]

AVON, MONT.—A charter has been granted to a telephone company recently organized by W. H. Whitehall, W. A. Kimmerly, A. R. Grosfield and Henry H. Parker, of Avon. The company is capitalized at $5,000.

CORBIN, MONT.—Plans are being considered by the Corbin Metal Mining Company for the erection of a concentrating plant and installation of additional machinery in its mine.

PHILIPSBURG, MONT.—The farmers of this vicinity are considering the question of co-operating with the government in regard to erecting a telephone line from Philipsburg to the west fork of Rock Creek.

RADERSBURG, MONT.—The Black Friday Mining Company has contracted with the Western Supply Company, of Butte, Mont., for the installation of a new air-compressor and drilling outfit for its mine at Radersburg. Arrangements are being made to discard steam power and install electric motors.

OMAHA, NEB.—The Omaha & Western Iowa Traction Company is reported to be in the market for equipment for its proposed electric railway, which is to connect Sioux City, Ia., and Omaha, Neb., ninety miles in length. Headquarters of the company are at 3901 Eighteenth Street, Omaha, Neb.

WYMORE, NEB.—It is reported that the citizens have voted to issue bonds to the amount of $75,000 for the installation of an electric light plant and water works system.

PORTSMOUTH, N. H.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 7, 1911, for furnishing and installing one electric motor-driven capstan at the Navy Yard, Portsmouth, N. H. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. The cost of the work is estimated at about $3,000. R. C. Hollyday is chief of bureau.

BRANCHVILLE, N. J.—It is reported that Thomas Becker & Sons have secured the contract for the construction of the new power house of the Andover Electric Light Company, work on which will begin within a short time. A new engine and dynamo will be installed.

FLORHAM PARK, N. J.—The City Council has passed the ordinance calling for lighting of the borough. At first the main thoroughfares will be lighted, which will be extended to other streets as soon as the borough is able to provide funds for same.

HARRISON, N. J.—The Mayors of Harrison, East Newark and Kearny have decided to employ an electrical engineer to prepare plans for a municipal electric lighting plant to be owned and operated jointly by the three municipalities. After plans have been prepared steps will be taken to secure legislation to allow the three towns to carry out the project.

NEWARK, N. J.—Plans are being considered for extending the service of the electric lighting plant in the city hall to the other municipal buildings. It is proposed to utilize the New York Telephone Company's conduits, as the franchise of the company provides that the city may use the conduits.

NEWARK, N. J.—Investigations are being made by Morris R. Sherrerd, chief engineer of the Water Department, in regard to the feasibility of utilizing the water power obtained from the Pequonnock watershed in connection with a municipal electric light plant. It is estimated that a fall of approximately 100 ft. could be obtained by diverting the water at the Macopin intake and constructing the plant at Charlottesburg, which would provide sufficient power to operate a plant to supply electricity for lighting all the city buildings and for street lamps.

OCEAN CITY, N. J.—The Millville, Tuckahoe & Ocean City Railroad Company, recently organized, is contemplating the construction of an electric railway from Ocean City to Millville. It is understood the company has acquired the property of the Ocean City Electric Railroad and right-of-way has been secured. It is said that the Edison electric storage battery system will be used. W. Scott Hand is president of the company and C. M. Van Tassell vice-president and treasurer.

ALAMOGORDO, N. M.—The Alamogordo Improvement Company, which is constructing a hydroelectric power plant in Box Canyon, near Alamogordo, is reported to be contemplating the installation of several such plants to provide electricity for industrial purposes.

ENGLE, N. M.—Definite steps have been taken by the Water Users' Association, which is composed of landowners of the Rio Grande Valley who will irrigate from the large water storage and canal system which the United States government is constructing, for the installation of a large hydroelectric power plant to be operated in connection with the Elephant Butte dam and land reclamation project now being constructed by the government. In a report submitted by W. E. Anderson, one of the engineers, the cost of installing the plant and transmission lines down the valley on both sides of the river is estimated at about $326,000. It is proposed that the water users shall bear the expense of installing the proposed plant, the amount to be paid by each shall be prorated by the amount of acreage irrigated, the payments to be made on instalment, and at the end the power plant and transmission system to revert to the Water Users' Association. In addition to providing power for operating pumping plants, there will be a large surplus of energy available for private industries and for municipal purposes, [illegible]

[illegible] & [illegible], [illegible] power plant on the Upper Gila River, work on which will begin in the [illegible]. [illegible] hp will be developed.

[illegible], N. Y.—[illegible] will be received by the [illegible] Supply until Dec. 19 for furnishing electricity for lighting the streets of [illegible] five years from June [illegible]. [illegible] is secretary of board.

BROOKLYN, N. Y.—Bids will be received by Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity, Room 1904, 13 to 21 Park Row Building, New York, N. Y., until Dec. 21, for furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and public places in the Borough of Brooklyn, N. Y. Blank forms may be obtained at the office of the department, Room 2339, Park Row [illegible], New York, N. Y.

BROOKLYN, N. Y.—Sealed proposals will be received by Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity, Room [illegible] New York, N. Y. [illegible] maintaining and reserving for use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 1850-kw of three-phase, 6600-volt, 25-cycle of electric power and furnishing and delivering this power under terms of contract from Jan. 1 to Dec. 31, 1911, at each of the high-pressure fire service pumping stations located in the Borough of Brooklyn, at Furman and Joralemon Streets and at Willoughby and St. Edwards Streets, respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York, N. Y.

BROOKLYN, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Dec. 20, for removing four hydraulic elevators in the Kings County Hospital and replacing same with electric elevators. Blank forms and further information may be obtained at the office of the supervising engineer of the department, foot of East Twenty-sixth Street, New York, N. Y., where plans and specifications may be seen. Michael J. Drummond is commissioner.

ELMIRA, N. Y.—The Public Service Commission, Second District, has granted the Elmira Water, Light & Railway Company permission to extend its railway on Pennsylvania Avenue to the city line, thence along Pennsylvania to Southport Corners in Southport.

HOWE CAVE, N. Y.—The Howe Cave Improvement Association is considering the question of establishing an electric street lighting system in Howe Cave. Charles W. Wieland is chairman.

NEW YORK, N. Y.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Jan. 5 for two electric elevators for the United States Assay Office, New York, N. Y., in accordance with plans and specifications, copies of which may be obtained at the above office. James Knox Taylor is Supervising Architect.

NEW YORK, N. Y.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Jan. 3, 1911, for the installation of a conduit and electric wiring system in the United States Assay Office, New York, N. Y., in accordance with plans and specifications, copies of which may be obtained at the above office, or at the office of the superintendent of construction, New York, N. Y. James Knox Taylor is Supervising Architect.

NEW YORK, N. Y.—Bids will be received by Calvin Tomkins, Commissioner of Docks and Ferries, Pier A, foot of Battery Place, North River, New York, N. Y., until Dec. 23 for furnishing electrical supplies, under class 29; for steam steering engines, under class 31, and for watchman's clocks and dials, under class 30. Blank forms and other information may be obtained at the office of the department.

NEW YORK, N. Y.—Bids will be received by the President of the Borough of Manhattan, Room 14, City Hall, New York, N. Y., until Dec. 20, for the erection and installation of an elevator shaft and elevator in the rear of the building located at 264 Madison Street, Borough of Manhattan. Blank forms and specifications may be obtained at the office of the auditor, offices of the Commissioner of Public Works, 13 to 21 Park Row, New York, N. Y. George McAneny is Borough President.

NEW YORK, N. Y.—Proposals will be received by Henry S. Thompson, Commissioner of Water Supply, Gas & Electricity, Room 1904, 13 to 21 Park Row, New York, N. Y., until Dec. 21, for furnishing and maintaining for the use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 3250 kw of three-phase, 6600-volt, 25-cycle of electric power and furnishing and delivering this power under terms of contract from Jan. 1, 1911, to Dec. 31, 1911, at each of the high-pressure fire service pumping stations, located in the Borough of Manhattan, at Oliver and South Streets and at Gansevoort and West Streets, respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York, N. Y.

NEW YORK, N. Y.—Bids will be received by Henry Thompson, Commissioner [illegible] Park Row, New York, N. Y., until Dec. [illegible] furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and public places, [illegible] Borough of Manhattan [illegible] Borough of the Bronx; No. 3, Boroughs of Manhattan and Bronx; No. 4, Borough of Queens; No. 5, Borough of Richmond. Blank forms may be obtained at the office of the Department of Water Supply, Gas and Electricity, Room [illegible], Park Row Building, New York, N. Y.

NIAGARA FALLS, N. Y.—Announcement has been made that the Niagara Falls, Dunnville & Welland Electric Company has decided to begin work immediately on its proposed railway between Niagara Falls, Welland and Dunnville. It is understood that the storage battery system will be used. The company will furnish both freight and passenger service. The cost of the proposed railway is estimated at about $1,000,000.

PAINTED POST, N. Y.—The Village Board has granted a franchise to the Corning Gas & Electric Company, of Corning, N. Y., for a period of thirty years. The company has submitted a proposition to the Village Board offering to furnish arc lamps of 2000 cp at the rate of $80 each per year and 60-cp incandescent lamps for street lighting at $28 per lamp per year, on condition that the village agrees to use fifty of the incandescent lamps or their equivalent. The contract is to be for a term of five years. Work will begin on extension of the transmission from Corning to Painted Post as soon as permission is obtained from the Public Service Commission.

ROCHESTER, N. Y.—The State Water Supply Commission is reported to have adopted final plans for the construction of the storage dam to impound the waters of the upper Genesee River for the purpose of preventing the disastrous floods that have devastated the valley for many years and to develop the water-power of the river in Rochester and at other points along the river.

SILVER SPRINGS, N. Y.—Preparations are being made by the village of Silver Springs for the installation of a combined pumping and electric light plant, work on which will begin in the spring, as soon as the weather will permit. The water supply will be secured from artesian wells yet to be drilled. Bids for the work will not be called for. J. C. Nash is village president.

SOLVAY, N. Y.—It is reported that the Village Trustees are contemplating reopening the local lighting plant, which has been abandoned for some time. It is understood that bids have been asked for installation of a generator and overhauling the plant. Edwin Hall is village clerk.

SYRACUSE, N. Y.—The Syracuse Lighting Company is reported to have secured franchises in the villages of Camillus and Solvay to supply electricity for lamps and motors.

VOORHEESVILLE, N. Y.—The residents of Voorheesville have petitioned the Albany Illuminating Company to extend its transmission line to this village. It is understood that the company is willing to grant the request, provided the village authorities will grant a franchise. Many of the residents will install electric lamps, and it is expected that the streets of the village will be lighted by electricity later.

WHITESBORO, N. Y.—The Board of Trustees has awarded a contract for lighting the streets of the village to the Utica Gas & Electric Company, of Utica, N. Y., for a period of five years, under the terms of which the company is to supply 2000-cp arc lamps at $75 each per year, with an all-night service, to take effect from Jan. 1, 1911. About forty lamps will be required.

HETTINGER, N. D.—The Lodgepole Telephone Company, recently organized, is planning to erect a telephone line between Hettinger and Lodge Pole.

CINCINNATI, OHIO.—It is reported that Smith & Mills, manufacturers of machine tools, are erecting an addition to their plant on Spring Grove Avenue, Cincinnati, which will be equipped with a 100-hp Miller gas engine and generator to provide electricity for lamps and motors for the machine shop.

CLEVELAND, OHIO.—The City Council has adopted a resolution asking the State Legislature to enact a law which will give the Council or some city official power to supervise the operation of telephone systems within the limits of the municipality. This action has been taken owing to frequent complaints that are being made regarding the service.

CLEVELAND, OHIO.—Preparations have been made by the Perry-Payne Company, of Cleveland, Ohio, for the construction of a large power plant on Oregon Avenue, Cleveland. The building will be 125 ft. x 87 ft., five stories high and will cost about $80,000.

CLEVELAND, OHIO.—The Shaker Heights Land Company is considering plans for the construction of an electric railway across the Shaker Lakes Park connecting with the Cleveland Railway at Coventry Road.

COLUMBUS, OHIO.—A company is being organized for the purpose of supplying electricity to that portion of the city north of Broadway and all suburbs north of Columbus, including the village of Worthington, with electricity for lamps and motors. Energy for the service will be supplied by the Columbus, Delaware & Marion Railway Company and a transformer station will be installed at Chaseland, from which transmission lines will be erected on the poles of the railroad company. George W. Meeker is at the head of the project.

NELSONVILLE, OHIO.—Preparations are being made by the Hocking-Sunday Creek Traction Company for extending its railway in the [illegible]. It is [illegible] that a bond issue of $200,000 has been provided for.

ROSSFORD, OHIO.—Preparations are being made by the Ford Plate Glass Company for extensive additions to its plant, which will include the erection of fourteen new reinforced concrete buildings, at a cost of more than $1,000,000. Among the buildings will be a power house 70 ft. x [illegible] ft., and a [illegible] house [illegible] ft. x 102 ft.

TOLEDO, OHIO.—The Bunting Brass & Bronze Company, of Alliance,

Ohio, is reported to be in the market for foundry equipment for its new plant to be erected in Toledo, Ohio, including motors and generators, air compressors, 5-ton crane, and milling machines.

TOLEDO, OHIO.—It is reported that the Maumee Valley Electric Company, which some time ago was refused admission into Toledo, has secured entrance to the heart of the city through an unexpected source. The State has granted the company permission to erect transmission lines on the banks of the Miami and Erie Canal. The poles have already been erected and it is expected that the plant will be in operation in a short time.

KIOWA, OKLA.—Preparations are being made to enlarge the electric light plant and water-works system, for which bonds to the amount of $18,000 have been voted. Bids will be received until Jan. 1 for the work. W. N. Vernon is president of board of trustees.

OKLAHOMA CITY, OKLA.—The Oklahoma City & Fort Smith Traction Company is reported to be making preparations for the construction of its proposed electric railway to connect Oklahoma City, Okla., and Fort Smith, Ark., 200 miles in length, for which, it is said, bids will be received Jan. 1, 1911. Joseph Kreis, of Oklahoma City, Okla., is general manager and chief engineer.

STILWELL, OKLA.—At an election held Nov. 29 the citizens voted to issue $5,000 in bonds, the proceeds to be used for the installation of an electric light plant.

DALLAS, ORE.—The contract for the construction of the proposed street railway in Dallas has been awarded to Frank P. Phillips. The railway will provide for both passenger and freight traffic and will eventually be extended into the country. E. W. Thomas is interested in the project.

SPRINGFIELD, ORE.—The Northwestern Corporation, of Eugene, Ore., is reported to be planning to erect a substation in Springfield to supply the upper Willamette Valley with electricity for lamps and motors.

THE DALLES, ORE.—Preparations are being made by the Pacific Power & Light Company for the installation of a 1500-hp water wheel in January, increasing the output to 3700 hp.

VALE, ORE.—The Malheur Home Telephone Company, recently organized with a capital stock of $75,000, has taken over the plant and holdings of the Malheur Telephone Company. It is understood that the new company will make considerable improvements to the system, including the erection of a new exchange building. J. E. Jennings, of Salt Lake City, Utah; M. G. Heope and T. W. Halleway are interested in the new company.

BELLWOOD, PA.—The plant and holdings of the Bellwood Electric Light Company are reported to have been purchased by the Blair Electric Company, which is owned and operated by the American Railways Company, of Philadelphia, Pa.

HAZLETON, PA.—Plans have been prepared by A. W. Leh, 203 West Fourth Street, South Bethlehem, Pa., for the construction of a hotel to be erected on Broad Street, in Lancaster, for James Loughran. The proposed building will be 30 ft. x 160 ft. A power plant and two passenger elevators will be installed. It is understood that bids will be called for construction of same during the latter part of January or early in February.

NORTHUMBERLAND, PA.—The capital stock of the Commonwealth Telephone Company has been increased from $120,000 to $200,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 27, for furnishing and erecting a 15-ton traveling crane at the Navy Yard, Philadelphia, Pa., under schedule No. 3151.

PHILADELPHIA, PA.—Plans are being prepared by Bergdoll & Pawling for the construction of a large factory building for Alexander Brothers, manufacturers of leather belting, to be erected at 414 and 416 Third Street, adjointing its present plant. It is understood that additional power plant equipment will be required.

PITTSBURGH, PA.—Bids will be received at the office of the City Controller until Dec. 19 for furnishing and maintaining arc or incandescent electric lamps and incandescent mantle lamps for lighting the streets, boulevards, alleys and parks of the City of Pittsburgh for a term of one year. Specifications and blanks can be secured at the general office of the Department of Public Works. Joseph G. Armstrong is director of public works.

WILKES-BARRE, PA.—The Wyoming Valley Traction Company is making improvements to its power plant on South Main Street for the purpose of supplying more power for its Duryea and Hughestown lines.

ROCK HILL, S. C.—The Board of Public Works has awarded contracts for equipment for the proposed municipal electric light plant as follows: For generators and other electrical equipment to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.; for poles to the Charlotte Supply Company, and to the Southern Electric Company for wire and cross-arms.

DEADWOOD, S. D.—Plans are being considered by the Gilt Edge Maid Mining Company for the erection of a smelter at its property, located near Deadwood.

EGAN, S. D.—The installation of a municipal electric light plant in Egan is reported to be under consideration.

ST. LAWRENCE, S. D.—The installation of an electric light plant in St. Lawrence is under consideration. It is reported that the equipment of the old plant in Miller, S. D., will be installed here.

BRISTOL, TENN.—Plans are being considered by the Board of Trade of the two Bristols for the construction of an electric railway from Bristol to Kingsport, a distance of twenty-five miles. George L. Carter, president of the C. C. & O. Railway, is reported to be interested in the project.

SIOUX FALLS, S. D.—The Sioux Falls Light & Power Company is reported to be making extensive additions to its auxiliary steam power plant. It is understood that other improvements are to follow.

SOUTH PITTSBURG, TENN.—Harry Patton is reported to have purchased an interest in the local electric light plant and will remodel the same. Charles Houston is manager.

EL PASO, TEX.—The El Paso Electric Railway Company is considering the erection of transmission lines from its power plant down the valley of the Rio Grande River for the purpose of supplying electricity for operating irrigation pumping plants and other industries.

GEORGETOWN, TEX.—The City Council is making preparations to take over the plant and holdings of the Georgetown Water, Light & Power Company on or before Jan. 1, 1911. The price paid for the plant is said to be $13,500. Extensive improvements and extensions will be made to both the water and electric service, which will involve an expenditure of about $31,500.

LAMPASAS, TEX.—It is reported that the plant and holdings of the Lampasas Light & Power Company have been purchased by E. Haby. The new owner, it is said, will erect a new power station and install additional equipment, at a cost of about $15,000.

LA PORTE, TEX.—The Bay Shore Rapid Transit Company, it is reported, will soon purchase steel and equipment for its proposed electric railway to connect La Porte and Houston. O. L. Allen is interested in the project.

MARFA, TEX.—It is reported that the St. Stephen Land Company is contemplating the construction of a storage reservoir and the installation of a large amount of irrigating pumping machinery on its property near Marfa.

SAN ANGELO, TEX.—The San Angelo National Bank has filed foreclosure proceedings against the San Angelo Street Railway Company, and a date for the sale of the property will be fixed by the court. It is understood that two syndicates contemplate bidding on the property, and it is stated that whichever syndicate purchases the railway important extensions and improvements will be made.

TAYLOR, TEX.—The International & Great Northern Railroad Company is erecting reinforced concrete buildings in connection with its car repairing shops at Taylor, Tex., including a power house and round house. Air compressor machinery will be installed.

VICTORIA, TEX.—Application has been made to the City Council by D. D. Fairchild, Jr., of San Antonio, Tex., for a franchise to construct and operate an electric street railway in Victoria.

WACO, TEX.—The City Council is reported to be considering the question of issuing bonds for the construction of a municipal electric light plant.

BRIGHAM CITY, UTAH.—It is reported that contracts have been placed for an 850-hp Pelton Francis turbine and a Westinghouse generator for the municipal electric light plant at Brigham City. The turbine is to operate under a 1280-ft. head.

SALT LAKE CITY, UTAH.—It is reported that the Utah, Nevada & Idaho Telephone Company will increase its capital stock from $200,000 to $600,000, to provide funds for extensions, principally throughout the State of Nevada. Extensions have been authorized to the through line west from Salt Lake City to Ely, Nev., and north through Montello to a connection with the new copper camp at Contact. Several lines will be erected to supply Reno, Carson and San Francisco connections, among which will be a line from Reno through Lovelock to a connection with Winnemucca and the famous camp of National. Another line will be erected from Fallon to Austin and also a line to connect the town of Mason with Salt Lake City.

UINTAH, UTAH.—Work has commenced on the construction of a hydroelectric power plant in Weber Canyon, near Uintah, for the Davis and Weber Counties Canal Company. The proposed plant will have an ultimate output of 15,000 hp and will supply electricity for an irrigation system now operating in Weber and Davis Counties. The initial installation will be limited to about 6000 hp. The water will be carried to the power house in steel penstocks. H. A. Strauss, vice-president and chief engineer of the Falkenau Electrical Construction Company, of Chicago, Ill., has charge of the work. E. P. Ellison, of Layton, Utah, is president of the canal company.

COVINGTON, VA.—The Town Council has ordered an election to be held Feb. 11, 1911, to vote on the proposition to issue $50,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant. R. W. Crowder is Acting Mayor.

CHEHALIS, WASH.—The Valley Development Company is reported to be preparing plans for the construction of a new power plant in the Big Bottom country, work on which will begin about Feb. 1, 1911.

HANFORD, WASH.—It is reported that the Pacific Light & Power Company is contemplating extending its transmission line south to Richmond and possibly to Kennewick.

NORTH YAKIMA, WASH.—The Pacific Light & Power Company has entered into a contract with the White Bluffs Land & Irrigation Company to supply electricity for operating pumping plants for irrigating purposes. The Pacific Light & Power Company is planning to extend its transmis-

[illegible]

[illegible] equipment between now and spring.

[illegible] pany, now under construction near Seattle, Wash., will be placed in [illegible] operation throughout.

SPOKANE, WASH.—The Washington Consolidated Telegraph & Telephone Company, recently incorporated with a capital stock of $1,000,000, proposes to take over a number of smaller and independent telephone systems in this vicinity. C. M. Cooley, of Spokane, and others are interested in the company.

TACOMA, WASH.—The Seattle-Tacoma Power Company has been granted a franchise by the Commissioners of Pierce County to erect a high-tension transmission line from the south boundary of the Puyallup Indian reservation to North Puyallup.

TACOMA, WASH.—The Equality Telephone Company has applied to the Commissioners of Pierce County for a franchise to erect telephone lines on certain of the county roads. George W. Edwards, W. H. Pierce and others are interested in the enterprise.

TACOMA, WASH.—The Municipal Commission has voted to double the size of the Nisqually power plant. The present plans prepared by Frank C. Kelsey, former chief engineer, provide for a plant of 16,000 hp, to cost $1,700,000. At an additional cost of $150,738 Commissioner Nicholas Lawson, of the Department of Light and Water, states that he can build a plant with an output of 32,000 hp.

WALLA WALLA, WASH.—It is understood that the transmission line of the Pacific Power & Light Company, to be extended to the Freewater country to supply electricity to pump water to irrigate 11,000 acres, will probably be extended to include from 40,000 to 50,000 acres.

CHARLESTON, W. VA.—The Kanawha Water & Light Company is reported to be preparing plans for rewiring the entire business district of the city and buildings supplied with electrical service.

BENTON, WIS.—Plans are being considered by the Wisconsin Zinc Company for the installation of a power plant and concentrating plant at its Winskill Mine, near Benton.

NORTH MILWAUKEE, WIS.—The Home Brewing Company is re [illegible] waukee. A power plant will be installed.

STOUGHTON, WIS.—Negotiations have been closed whereby the City of Stoughton will purchase the water rights and property of the Stoughton Milling Company. The consideration is said to be $18,700. The property has been purchased to be used in connection with the proposed plan for increasing the output of the municipal electric light and power plant for operating the pumping station of the water works system by electricity. The cost of the improvements is estimated at about $8,000.

TOMAHAWK, WIS.—[illegible] by W. T. Bradley, of Tomahawk, Wis., to erect a soap factory here. The plant will be equipped for electrical operation.

VIOLA, WIS.—The construction of a concrete dam across the Kickapoo River to provide power for an electric light plant to be installed next spring is reported to be under consideration.

WEST ALLIS, WIS.—The Standard Separator Company, of Milwaukee, Wis., has purchased a site in West Allis, Wis., on which it proposes to erect a manufacturing plant, 250 ft. x 550 ft., one story high. An electric power plant will be installed and the machinery equipped for electric motor drive.

LARAMIE, WYO.—Extensive improvements are being made to the plant of the Laramie Electric Company, of Laramie, including the reinforcement of feeder lines, the installation of a new switchboard, new boilers and a general overhauling of the station apparatus.

RAWLINS, WYO.—The passing of an ordinance requiring uniform electrical installations is being strongly advocated in Rawlins.

NANAIMO, B. C., CAN.—It is reported that negotiations are under way between the citizens of Nanaimo and the Dominion Stock & Bond Corporation, of Vancouver, B. C., Can., for the construction of an elec- [illegible] vote.

VANCOUVER, B. C., CAN.—It is reported that surveys have been completed for the proposed electric railway to extend from Bakerville to Fort George, a distance of about 150 miles. A hydroelectric power plant will be erected to furnish power to operate the proposed road. It is understood that work will begin in the spring. Mr. Murphy, of Vancouver, is reported to have charge of the construction work.

KINGSTON, ONT., CAN.—The managers of the light, heat and power plant have recommended improvements to the street lighting system, which will involve an expenditure of $13,000.

[illegible] tric Power Commission's service the manufacturers who have been using electricity supplied by the local plant will have to change their [illegible]

[illegible] Marmora Electric Light Company by the municipality was carried by a

NORTH TORONTO, ONT., CAN.—The City Council is considering the [illegible] light plant at a cost of about $[illegible] to supply electricity for lighting the streets and residences in North Toronto.

OTTAWA, ONT., CAN.—Announcement has been made by Adam Beck, of the Hydro-Electric Power Commission, that the entire transmission line carrying electricity at 11,000 volts to all the chief centers of Ontario, west of and including Toronto, will be completed and in operation before Jan. 1, 1911. The entire pole line will be 290 miles in length.

STRATFORD, ONT., CAN.—A by-law asking for an appropriation for electric lighting purposes will be submitted to the ratepayers.

VILLA ALTA, OAXACA, MEX.—Plans are being prepared by the Cajones Mining Company for the erection of a stamp mill having a daily capacity of 200 tons at Villa Alta. A 300-hp hydroelectric power plant will also be installed.

New Industrial Companies.

THE BATTEN-DAYTON MOTOR COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $125,000 by William O. Dayton, M. A. Dayton and Edmund S. Carr. The company proposes to manufacture motors and accessories.

THE BUTTE ELECTRICAL SUPPLY COMPANY, of Butte, Mont., has been incorporated with a capital stock of $250,000. The company has opened a wholesale house in Butte with five branch retail stores, two of which will be located in Helena, Mont., one each at Great Falls, Billings and Missoula, Mont. R. W. Nichol is president and general manager, L. H. Allen is vice-president and assistant manager and E. E. Brazier is manager.

THE COOPER HEWITT ELECTRIC COMPANY, of Hoboken, N. J., has been incorporated by George Whitefield Betts, Jr., of Englewood, N. J.; William Hazen Peck, of Glen Ridge, and Reese D. Alsop, 96 Remsen Street, Brooklyn, N. Y. The company is capitalized at $2,500,000 and proposes to acquire, own and work patents relating to lamps in which vapor forms a portion of the conducting circuit. The office of the company is located at 703 Grand Street, Hoboken, N. J.

THE DICKERSON MANUFACTURING & SUPPLY COMPANY, of Clinton, Ill., has been incorporated with a capital stock of $200,000 to manufacture a water gage for steam boilers of all kinds, locomotives, marine and stationary, invented by Charles L. Dickerson, president of the company.

THE DYNETO ELECTRIC COMPANY, of Elbridge, N. Y., has been chartered by A. E. Doman, C. L. Amos and A. A. Costello, of Syracuse, N. Y. The company is capitalized at $60,000 and proposes to manufacture electric and mechanical devices, etc.

THE ELECTRICAL LAUNDRYING COMPANY, of Waterville, Maine, has been organized with a capital stock of $10,000 for the purpose of manufacturing and dealing in apparatus for electrical laundrying and conducting a laundry business. Fred C. Dunlap, of Skowhegan, Maine, is president, and W. R. Pattangall, of Waterville, is treasurer.

THE ELECTRODE COMPANY OF AMERICA, of Niagara Falls, N. Y., has been granted a charter with a capital stock of $200,000 for the purpose of manufacturing electrodes and carbon articles of all kinds. The incorporators are: Paul L. T. Heroult, the Ansonia, Broadway and Seventy-third Street, New York, N. Y.; William P. Marseilles, of Niagara Falls, N. Y.; Albert Stetson, 38 Park Row, and Fred White, 718 West 178th Street, both of New York, N. Y.

THE GALE INSTALLATION COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $10,000 for the purpose of manufacturing and dealing in electrical appliances, etc. The incorporators are: N. [illegible], [illegible] Thal and Frank S. Swett.

THE HOLBECK RIVERSIDE GAS POWER COMPANY, of Oil City, Pa., has been chartered by John D. Smithman, H. H. Smithman and Joseph M. Jenckes. The company is capitalized at $1,000,000 and proposes to establish a plant for the manufacture of engines, compressors, boilers and tanks.

THE MOTOR SAFETY CRANK COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 by M. G. Worth, F. A. Linn and G. Reif, of New York, N. Y. The company proposes to manufacture motors, engines and accessories.

THE NORTHWESTERN ELECTRIC EQUIPMENT COMPANY, of St. Paul, Minn., has filed articles of incorporation under the laws of the State of New Jersey with a capital stock of $600,000. All the capital stock of the company is said to be held by Minnesota people. F. B. Thompson, of St. Paul, Minn., is the Minnesota representative.

THE OSCAR MILLER COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $120,000 for the purpose of dealing in calculating machines. The incorporators are: O. Miller, P. B. Thompson and H. C. Beadleston, of New York, N. Y.

THE OZONE GENERATOR & ENGINEERING COMPANY, of New York, N. Y., has been incorporated by Dr. J. G. Atkinson, 1134 Pacific [illegible] both of Brooklyn

N. Y., and Joseph B. Unlacke, 256 West 168th Street, New York, N. Y. The company is capitalized at $20,000, and proposes to manufacture electrical water purifying devices, etc.

THE PETERSON RERUM BATTERY COMPANY, of Charles City, Ia., has filed articles of incorporation with a capital stock of $50,000 for the purpose of manufacturing electric batteries. It is understood that the company expects to erect a large factory in the spring.

THE SHAW PROPELLER COMPANY, of Boston, Mass., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing engines, etc. E. W. Richardson, of Brighton, Mass., is president, and J. B. Leake, of Boston, Mass., treasurer.

THE WESTERN MOTOR SUPPLY COMPANY, of El Paso, Tex., has been chartered with a capital stock of $6,000 by P. J. Savage, George W. Kennedy and John T. Fletcher.

THE W. T. WOOD COMPANY, of Waterloo, Ia., has been incorporated for the purpose of manufacturing wagons, farm trucks, gasoline engines, etc. W. T. Wood is president of the company.

New Incorporations.

STOCKTON, CAL.—The Western States Gas & Electric Company has been incorporated with a capital stock of $15,000,000 for the purpose of taking over the properties of the Stockton Gas & Electric Company and the Richmond Electric Company in Contra Costa County. H. M. Byllesby & Company, of Chicago, Ill., are interested in the new company.

BRUNSWICK, GA.—The St. Simonds Island Railway Company has been incorporated with a capital stock of $20,000 by Frank D. Aikin, A. Fendig, F. D. M. Strachan, J. B. Wright and others, of Brunswick, Ga., and M. Kiser, of New York, N. Y. The company proposes to construct a street railway system on St. Simonds Island, near Brunswick.

PAYETTE, IDAHO.—Articles of incorporation have been filed for the Salmon Falls Light & Power Company with a capital stock of $100,000 by A. E. Wright, J. M. Swanson, W. C. Sturdevent, James Spofford and J. H. Wright. The company proposes to operate an electric light and power plant, flour mills, saw and planing mills.

WARDNER, IDAHO.—The Washington Water Power Company, of Spokane, Wash., has completed its new substation at Wardner. The new station will have an output of 1500 kw and will supply electricity to operate the machinery in the mines and ore-handling plants of the Bunker Hill and Sullivan Mining Company.

CHAMPAIGN, ILL.—The Bloomington, Decatur & Champaign Railroad Company has been incorporated with a capital stock of $3,525,000 by B. E. Bramble, W. H. Carnahan and G. R. McComb, of Champaign, Ill. The company proposes to construct and operate a railway from Bloomington to Decatur, thence to Champaign, Ill.

CHICAGO, ILL.—The Ardmore Electric & Gas Company has been incorporated by C. C. Hessen, E. M. Hammond, G. A. Jewett and Charles C. Hamilton. The company is capitalized at $10,000 and proposes to manufacture and distribute electricity for lamps and motors and also gas.

CHICAGO HEIGHTS, ILL.—Articles of incorporation have been filed for the Chicago, Terre Haute & Southeastern Railway Company with a capital stock of $2,500,000 for the purpose of constructing and operating a railway from Chicago Heights to Edgar County, Ill. The incorporators are: M. D. Lawlor, O. A. Bestal and E. A. Stake, of Chicago, Ill.

ELGIN, ILL.—The Elgin Belt Railway Company has been granted a charter to construct and operate an electric railway to connect Elgin and Desplaines. The company is capitalized at $25,000 and the incorporators are: P. Freller, J. Newman and J. M. Blackburn.

ELKADER, IA.—The Boardman & Wagner Telephone Company has been incorporated with a capital stock of $1,000.

BOWLING GREEN, KY.—The Bowling Green & Northern Railroad Company has filed articles of incorporation with a capital stock of $30,000 to construct an electric railway from Bowling Green to Leitchfield. The incorporators are: B. F. Gardner, M. H. Crump and C. H. Felton.

HAGERSTOWN, MD.—The Hagerstown & Clear Spring Railway Company has been incorporated to construct an electric railway to connect Hagerstown, Clear Spring, Md., and Mercersburg, Pa., a distance of twenty-five miles. L. F. Downs, of New York, N. Y., and James B. Kreps, of Hagerstown, Md., are interested in the project.

BUFFALO, N. Y.—Articles of incorporation have been filed for the International Traction Railways, of Buffalo. The company is capitalized at $100,000 and proposes to operate an electric railway in the Abbott Road, Buffalo, between Cazenovia Street and the southerly line of Buffalo. The directors are: Morris Cohn, Jr., of Niagara Falls, N. Y.; Robert L. Fryer, O. P. Letchworth, of Buffalo, N. Y.; Thomas E. Mitten, of Chicago, Ill.; Edmund B. Osler, of Toronto, Ont., Can., and Nelson Robinson, of New York, N. Y.

STACKHOUSE, N. C.—The Madison County Railway Company has been chartered with a capital stock of $50,000 by E. B. McMillan and others. The company proposes to build an electric railway to connect Stackhouse and Allenstand, ten miles in length.

[illegible], OHIO.—The McKee Light & Power Company has been incorporated by S. E. McKee, L. E. McKee, F. W. McKee and William J. Hanna.

NEWVILLE, PA.—The Green Spring Rural Telephone Company has been organized to construct and operate a telephone line between Newville, Green Spring and vicinity.

NORRISTOWN, PA.—Charters have been granted by the Secretary of State to the Plymouth Electric Company, Lewes Providence Company and the West Norristown Electric Company, all of Norristown, Pa. Each company is capitalized at $3,000. H. H. Ganser is treasurer.

SASSAMANSVILLE, PA.—Articles of incorporation have been filed for the Douglas Telephone Company with a capital stock of $5,000.

CLARK, S. D.—A charter has been granted to the Day-Merton Telephone Company with a capital stock of $2,000. The incorporators are: C. D. McClelland, Julius Kropp and C. P. Enwright.

FATE, TEX.—The Hackberry Telephone Company has been incorporated with a capital stock of $500 by William Zollner, C. Zollner and Matthew Zollner, Jr.

ASHLAND, WIS.—Articles of incorporation have been filed for the Gogebic & Iron County Railway & Light Company with a capital stock of $100,000. The company proposes to develop a water power in northern Wisconsin and build an interurban railway system.

GRAFTON, WIS.—The Grafton Light, Heat & Power Company has been incorporated with a capital stock of $20,000 by Herman N. Croehuke, August Croehuke and John G. Busch.

Personal.

MR. E. D. ADAMS has made a gift of $3,000 to Columbia University for the purpose of establishing and maintaining a "Deutsches Haus."

MR. GEORGE J. LIVER, who has been connected with the Metropolitan Electric Supply Company, of Chicago, for eight years, has been promoted to the position of sales manager of that company.

MR. H. C. WORTHEN, formerly chief inspector of the Western Union Telegraph Company in New York, has been appointed superintendent of the Southern division of that company with headquarters in Atlanta, to succeed B. F. Dillon, who died a very short time ago.

MR. FREDERICK SARGENT, of Sargent & Lundy, engineers, has sailed for Europe. Mr. Sargent is accompanied by Mrs. Sargent, and the two will spend the holidays with their daughter, who is being educated abroad. He will return to his office in Chicago about the middle of January.

MR. W. H. SMAW, formerly assistant to the purchasing agent for the Georgia Railway & Electric Company, has been promoted to the position of purchasing agent of that company to succeed Mr. George B. Graves, who recently resigned. Mr. W. G. Thomas, formerly storekeeper for the company, has been appointed assistant to the purchasing agent. Mr. Smaw has been with the Georgia Railway & Electric Company for the past eight years in the capacity of clerk and assistant to purchasing agent.

MR. A. L. POND, who is now the manager of the Chicago office of the Fort Wayne Electric Works, was acting manager for some time prior to his recent appointment, succeeding Mr. Walter Goll, now located at the company's branch in Madison, Wis. Mr. Pond has been connected with the Fort Wayne company for about five years, and prior to that was superintendent of the water works and electric light plant in the City of Coldwater, Mich. Before that again Mr. Pond had a wide experience both in the central-station and manufacturing and selling end of the electrical business.

MR. FRANK L. PERRY, widely known among electrical men in Chicago, has returned to that city from a summer and autumn sojourn in Baltimore, where he demonstrated his versatility by organizing a classified advertising department for the Baltimore *Sun* after an exhaustive investigation of the advertising methods of the Chicago daily papers. During a four-month campaign Mr. Perry organized a new classified advertising department, as the result of which the *Sun* is making large gains in this class of business compared with any previous period in its history. So pleased was Mr. C. H. Grasty, president of the *Sun*, with the work of Mr. Perry that he presented to him as a trophy a handsome silver cup, standing 11 in. high, suitably inscribed to the winner of the "Classified Sweepstakes."

MR. CHARLES G. ARMSTRONG, consulting engineer, of New York City, has taken into partnership his son, Mr. Francis J. Armstrong, under the firm name of Charles G. Armstrong & Son. Mr. Charles G. Armstrong is well known, particularly in connection with the planning and construction of the Auditorium Hotel, Stock Exchange Building, Lake Shore Passenger Station and the Coliseum in Chicago, and the Singer Building and United States Express buildings in New York City. Mr. Armstrong is also the inventor of many modern office building devices, particularly the elevator signaling system which is now in practically universal use. Mr. Francis J. Armstrong is a graduate of the Manual Training School of the Chicago University and of the Stevens Institute of Technology. He has been engaged with his father in consulting engineering work for the past year.

Obituary.

MR. FRANK S. GORTON, who was prominent a number of years ago in the affairs of the Chicago Edison Company, predecessor of the Commonwealth Edison Company, died in his apartments at the Congress Hotel, Chicago, on Monday evening, Dec. 12, from an attack of asthma. For a number of years Mr. Gorton was secretary and treasurer and a director of the Chicago Edison Company, and for a time, prior to the coming of Mr. Samuel Insull as president in 1892, he was conspicuous in the administration of the company. Later he acquired a considerable interest in the Chicago Pneumatic Tool Company, but he retired from active business in 1903.

MR. CARL BAJOHR, a lightning-rod manufacturer of St. Louis, died on Nov. 30 after an illness of several months. He was one of the leading makers and erectors of lightning rods in the country and maintained branch offices in New York and Chicago. He made a specialty of lightning protection for churches, smokestacks and high buildings, and is said to have obtained orders to place lightning rods on the White House, as well as other government contracts. He received awards for lightning conductors at the St. Louis World's Fair and other exhibitions. Mr. Bajohr was born in Königsberg, Germany, fifty-three years ago, and began his studies of lightning protection in Germany.

WILLIAM HENRY BRYAN.—The last issue of the *Electrical World*, containing a personal item to the effect that William Henry Bryan, formerly a consulting engineer of St. Louis, had removed to Chicago in consequence of his appointment as chief engineer of the Board of Education of the latter city, was hardly off the press when the sad news came of his being found dead from heart failure in a Chicago hotel, only a few days after he reached the city to take up his new position. Mr. Bryan was born in Washington County, Mo., Aug. 14, 1860. After preparatory schooling at Smith Academy, St. Louis, he was graduated from Washington University in mechanical and electrical engineering in 1881. His first position was with the Pond Engineering Company, after which he was appointed manager of the Chicago office of the Yale & Towne Company. In 1890 he formed a partnership with Mr. H. H. Humphrey, of St. Louis, as a firm of consulting mechanical and electrical engineers. Since this partnership was dissolved in 1899 Mr. Bryan had maintained his own office as a consulting engineer in St. Louis until his appointment to the position of chief engineer of the Chicago Board of Education, following his success in taking the civil service examination, where he received the highest mark. Besides his widow and three daughters, Lucile, Agnes and Minnie, Mr. Bryan is survived by two sons—Walter, who is electrical foreman for the United States Incandescent Lamp Company, St Louis, and Ralph, a student in the architectural school of Washington University. Mr. Bryan was a member of the American Institute of Electrical Engineers and several times president of the Engineers' Club of St. Louis. He was also an active member and several times president of the Washington University Alumini and the Washington University Association. Besides his well-known work as consulting engineer in mechanical and clerical fields, he was called into consultation in several important water-works cases at Kansas City, Buffalo and Omaha, and at the time of his death had in preparation an engineers' handbook on the subject of heating and ventilation, the manuscript of which is unfinished. On the day of Mr. Bryan's demise (Dec. 5) he was apparently in good health, and he had retired to his room at the Plaza Hotel, Chicago, where his body was discovered a number of hours later, after it had been found impossible to obtain response to telephone calls or knocks on the door.

MR. W. H. BRYAN.

MR. WILLIAM J. WHETZELL, owner of the electric service system of Eureka, Ill., was killed on Nov. 26, as the result of a distressing accident in the plant. Mr. Whetzell's stations furnish electrical energy to Eureka, and also to the near-by villages of Roanoke and Metamora. On the day of his death Mr. Whetzell was busily engaged about his Eureka plant, and in some way he was caught in the flywheel of the engine and the main driving belt and so badly injured that he died a few minutes afterward without being able to speak. His two young sons were the only persons who witnessed the accident, but these boys—one ten and the other five years of age—were unable to render any assistance. They cried for help, however, and the day engineer was attracted to the spot and shut down the plant. Mr. Whetzell was removed to the office of the station, but he was in a dying condition and soon ceased to breathe. The dead man was highly esteemed by all who knew him, both in his home town and elsewhere. He was born in Virginia in 1865, but went to Illinois with his parents at the age of five years. After finishing school he took up the work of teaching and he was elected county superintendent of schools of Woodford County in 1898. In that year he removed to Eureka [illegible] Retiring [illegible] work, Mr. Whetzell erected the electric light plant in Eureka, and for [illegible] years he had been successfully engaged in building up the [illegible] He extended the system to Roanoke and Metamora, towns lying seven and nine miles distant respectively, and recently instituted a day service in all three villages. He was a man of character, determination and industry, and his unexpected death was a painful shock to his friends. A widow and five children, the oldest twelve years of age, survive him.

Trade Publications.

FLOOR OUTLETS.—Numerous types of floor outlets for use with conduit wiring are illustrated, listed and described in a catalogue issued by the Steel City Electric Company, 507 Washington Avenue, Pittsburgh, Pa.

INDUCTION MOTORS.—The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has issued circular No. 1188, describing a line of polyphase slip-ring motors designed especially for cranes, hoists and elevators.

ADJUSTABLE-SPEED MOTORS.—Adjustable-speed motors of the variable-reluctance type are described in bulletin No. 54 of the Stow Manufacturing Company, Binghamton, N. Y. These motors are rated at from one-quarter to 20 hp.

COAL MINE STORAGE BATTERY.—Bulletin No. 129 of the Electric Storage Battery Company has for its subject the storage battery installation forming part of the mining plant of the New River & Pocahontas Consolidated Coal Company, at Gentry, W. Va. Lighting, power and haulage are provided from three 300-kw generators regulation being afforded by a "chloride" battery of 114 cells, having a capacity of 320 amp for twenty minutes and 640 amp in regulating rapid fluctuation of load.

BUSINESS NOTES.

THE TRIUMPH ICE MACHINE COMPANY, which is occupying its new plant at Oakley, Ohio, has arranged to open an office in the Fourth National Bank Building, Cincinnati.

THE GYRO MOTOR COMPANY has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $100,000. The incorporators are: E. Berliner, R. S. Moore and J. L. Simmons, of Washington, D. C.

THE SCIPLE-GOUCHENOUR COMPANY, of Philadelphia, Pa., has been chartered with a capital stock of $18,000 by H. M. Sciple, W. E. Gouchenour and C. B. Sands, all of Philadelphia, Pa. The company proposes to manufacture boilers and other machinery.

MR. DUGALD CRAWFORD HILL has been elected secretary of the Metropolitan Electrical Supply Company, of Chicago. Mr. Hill is not an electrical man, but he has had a good business training under the tutelage of Marshall Field & Co., and is well equipped for his new field of endeavor.

THE MACKEY MOTOR COMPANY, of Newark, N. J., has been incorporated with a capital stock of $300,000 for the purpose of manufacturing motor boats, automobiles, engines, etc. The incorporators are: J. C. Mackey, W. G. Jerolemon, of Newark, N. J., and R. M. Bateman, of East Orange, N. J.

AUTOMOBILE COMPANY ADOPTS CONNECTICUT SHOCK ABSORBERS.—As a result of comparative tests, the Knox Automobile Company, of Springfield, Mass., has adopted Connecticut shock absorbers as regular equipment on all 1911 cars. These shock absorbers, which have been on the market but a short time, are manufactured by the Connecticut Shock Absorber Company, Meriden, Conn.

THE LATHBURY-D'OLIER COMPANY, Philadelphia, announces a merger of the interests of B. B. Lathbury, consulting engineer (formerly president of Lathbury & Spackman, Inc.), and of the D'Olier Engineering Company. The company, with enlarged scope and facilities, will continue the general and special engineering, manufacturing and contracting business heretofore carried on by the respective interests. The offices of the company are in the Morris Building, Philadelphia.

ROYSE ELECTRIC COMPANY, INDIANAPOLIS, SOLD.—The Royse Electric Company, of Indianapolis, has changed hands. The new owners have taken over the entire holdings of the old company, the name of which is changed to the Indianapolis Electric Supply Company, with the following officers: R. P. Oblinger, president; H. E. Rasmussen, vice-president; C. E. Kennedy, secretary; R. A. Macgregor, treasurer. A general electrical jobbing business will be carried on.

H. B. LOGAN, president of Dossert & Company, has been elected president of the American Oil Storage Company, a New Jersey corporation capitalized at $500,000, which has the patent rights for the manufacture, sale and rentals of Keefe's Patent Sectional Steel Flange Storage Tanks. Mr. Logan is well known in electrical trade circles through his connection with the successful development of Dossert solderless connectors. He will continue at the head of Dossert & Company. The New York office of the American Oil Storage Company [illegible] Broadway.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED, DEC. 5, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

977,336. MEANS FOR FILTERING AIR AND PRODUCING OZONE; S. C. Shaffner and S. T. Hutton, Chicago, Ill. App. filed June 26, 1909. A plurality of electrodes produce the field, alternate electrodes being inclosed and the intermediate ones exposed. A step-up transformer charges them.

977,354. ELECTRIC RAILWAY; R. P. Williams, San Francisco, Cal. App. filed Oct. 29, 1908. For third-rail system, the trolleys being connected with a source of electrical supply and the car trucks having dependent arms to contact with the trolleys.

977,361. RADIANT ELECTRIC HEATER; R. W. Baker, New York, N. Y., and V. L. King, Woodridge, N. J., and H. C. Parker, New York, N. Y. App. filed Dec. 29, 1909. A radiant electric heater including a stiff non-metallic resistor in filament form which when cold conducts and glows when the current flows through it, together with electrical connections for the resistor and a containing globe open to the air for a filament.

977,398. TROLLEY RETRIEVER; N. Peterson, Omaha, Neb. App. filed July 29, 1909. A support with trunnions which carries a resilient member and trolley yoke with angular slots, the trunnions engaging the slots.

977,400. BRUSH-HOLDER; F. W. Reeves, Pittsburgh, Pa. App. filed March 7, 1910. A pair of brushes slide in a holder with yielding springs on opposite sides to give longitudinal pressure.

977,401. ELECTRIC CONTACT SHOE; C. C. Rich, Mount Vernon, N. Y. App. filed July 6, 1909. A contact shoe with a main member having a longitudinal opening, an auxiliary member, mounted therein with end tongues and side tongues and springs on opposite sides of the slot bearing upon the side tongues.

977,416. TROLLEY HEAD; E. N. McCall, Goldfield, Nev. App. filed Dec. 21, 1908. Details in the construction of a trolley head which includes two trolley wheels in tandem upon a yoke pivotally mounted upon the trolley arm.

13,178. CONTROLLER; E. Schattner, London, Eng. App. filed Sept. 12, 1910. A motor starting rheostat with a self-reducing carbon resistance and a movable switch arm, which short-circuits the resistance, and which is retarded.

977,443. STORAGE BATTERY PLATE; B. Ford, Philadelphia, Pa. App. filed April 14, 1910. Has a lug and consists of groups of leaves and ribs with a web adjacent to the lug and terminating on an angle to the top of the plate.

977,446. PENDANT; C. D. Gervin, New York, N. Y. App. filed March 26, 1908. An electrical switch with a rotable spindle and a plunger telescoping over the spindle and a spring acting when the plunger is released for rapidly rotating the spindle.

977,447. CUT-OUT TELEPHONE SYSTEM; E. Gould, Spring Valley, Minn. App. filed Oct. 14, 1908. A magneto circuit for a telephone system with selecting switches at different stations, bell circuits and a lever which connects the magnetos with the bells on either side of the line, and may also connect the speaking and listening circuits.

977,452. TELEGRAPH SENDING MACHINE; J. R. Jones, Port Arthur, Ontario, Canada. App. filed Feb. 9, 1910. Portable sending of the automatic type mounted on a pivoted frame which can be inserted in place of the ordinary key and a pendulum within the casing or frame for sending dots and dashes by a movement of the casing.

977,456. RESISTANCE DEVICE; H. W. Leonard, Bronxville, N. Y. App. filed March 29, 1909. Field rheostat for a large generator or for use as a heater in which resistance units are used, each unit comprising a metal conductor exposed to the air supported on insulators, the distance between which can be adjusted.

977,460. CONTACT FINGER FOR ELECTRICAL CONTROLLERS AND SWITCHES; R. C. Lyness, Sunderland, Eng. App. filed June 27, 1910. Comprises a metal strip with one end bent to form a loop and a contact tip with a recess embracing the loop.

977,476. TROLLEY CATCHER; F. J. Roache, Somerville, Mass. App. filed Nov. 12, 1909. A spring actuated drum to receive the trolley rope and a fixed plate with a groove containing a locking member, moves the locking member more or less as the drum turns.

977,521. ELECTRICALLY IGNITED BURNER; E. J. Goldblatt, Chicago, Ill. App. filed Feb. 21, 1910. A housing of non-conducting material with a passage for the gas and a pair of electrodes in the material of the housing terminating in proximity to the burner tip with connecting plugs at opposite ends.

977,536. AUTOMATIC SWITCH FOR TELEPHONE SYSTEMS; G. H. North, Cleveland, Ohio. App. filed Dec. 8, 1908. Fixed contacts passed over by a selecting arm operated by a plurality of electro-magnets, which electro-magnets are interchangeable.

977,554. ELECTRICAL EQUALIZER SYSTEM; O. S. Schairer, Pittsburg, Pa. App. filed Sept. 3, 1907. Means for equalizing the load upon the generator station when the load upon its system is variable. using a fly wheel connected to a dynamo operating as a motor or generator and directly connected to the distributing circuit without the intervention of a rotary converter.

977,571. SYSTEM OF ELECTRIC MOTOR CONTROL; W. H. Thompson, Wilkinsburg, Pa. App. filed Jan. 5, 1907. Electric motor for gate valves, etc., in which the circuit is opened to stop the motor and then closed to reverse it, and then again opened, this bringing the motor to rest a short space.

977,577. ELECTROMAGNET; R. Wikander, Edgewood Park, Pa. App. filed Aug. 2, 1905. A magnetizing coil with a movable core which operates a pair of toggles and a pair of links between the core and the toggles and a spring between the toggle and the contacts.

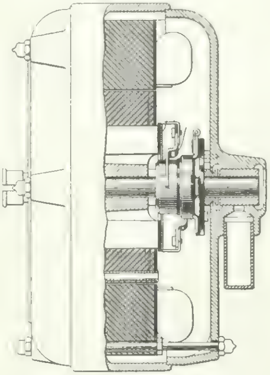
977,580. ELECTRIC HEATING AND COOKING APPARATUS; T. Abtmeyer, Wilkinsburg, Pa. App. filed May 13, 1909. Toasting apparatus, each resistance unit having a stamped metal envelope, the units being secured to a frame, edge to edge.

977,591. CENTRIFUGAL SWITCH; W. J. Brandon, Wilkinsburg, Pa. App. filed Sept. 8, 1908. For single-phase motor. The switch includes stationary concentric terminal cylinders at different [illegible] and electrically connected rotatable brushes to engage it with the cylinders, except when rotated at a greater speed than the predetermined speed.

977,595. ELECTRICALLY OPERATED SWITCH; F. Chamness and J. P. Kriegbaum, Huntington, Ind. App. filed Oct. 12, 1909. Tongue point switch operated by a solenoid magnet the circuit through which is controlled through a battery on the car and a contact arm.

977,597. SYSTEM OF OPERATION FOR ALTERNATING-CURRENT MOTORS AND GENERATORS; W. Cooper, Pittsburg, Pa. App. filed Sept. 3, 1907. Alternating current distributing circuit with a generator, an exciter for the field with the field connected to the distributing circuit with means for adjusting the phase supplied to the circuit with relation to the E. M. F.

977,598. ELECTRICAL EQUALIZER SYSTEM; W. Cooper, Pittsburg, Pa. App. filed Sept. 3, 1907. A dynamo operating either as a motor or generator mechanically connected to a flywheel and directly connected to a distributing circuit without the intervention of the rotary converter with means for adjusting the field of the machine to cause it to operate as a motor on failure of current and as a generator on excess current with means for adjusting the phases of the electromotive force of the field.



977,591.—Centrifugal Switch.

977,607. ARC LAMP ELECTRODE; G. Egly, Berlin, Germany. App. filed Sept. 9, 1909. Inclosed arc lamp in which the electrode consists of a plurality of cores containing an illuminating mixture, each of the cores embedded in a thin carbon shell with a wall of substantially uniform thickness, the shells symmetrically disposed in cross-section.

977,616. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed Jan. 29, 1910. Has a flat mouthpiece. A diaphragm is stretched over the aperture and carries a deep cone at the center which is secured to one of the electrodes.

977,617. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed Feb. 24, 1910. A flat mouthpiece with a screen secured to the front and a cup-shaped member secured to a diaphragm which rests against the front electrode.

977,618. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed Oct. 1, 1910. Has a flat mouthpiece and is sanitary. Makes use of a guard which is perforated and can be detachably secured over the front of the transmitter.

977,619. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed Feb. 12, 1910. A guard of a screen-like form forward of the aperture and a plurality of arms near the margin of the aperture for preventing tampering with the diaphragm.

977,620. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed Jan. 28, 1910. A casing with an apertured front and a resistance cup, comprising the electrodes with the casing, a diaphragm closing the front of the casing and a shell between the diaphragm and the front electrode for transmitting the sound therethrough.

977,621. SOUND REPRODUCING DEVICE; F. Gottschalk, New York, N. Y. App filed Oct. 25, 1909. A telephone transmitter with a resistance cup in the front of the casing and a cup-shaped diaphragm next to the cup supported upon a stud connected to the front electrode.

977,622. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed Feb. 25, 1910. Sanitary transmitter in which a cup-shaped shell projects into the mouthpiece and is connected to a diaphragm in contact with the resistance element.

977,623. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed March 24, 1910. A diaphragm between the variable resistance and the front wall of the casing with a cup extending into the mouthpiece aperture to concentrate the sounds.

977,625. ELECTRICALLY HEATED DEVICE; W. S. Hadaway, Jr., East Orange, N. J. App. filed May 1, 1909. An electrically heated laundry roll, including an outer shell, an inner cylinder with a higher coefficient of expansion and an insulated electric resistance between the shell and the cylinder.

977,626. ELECTRIC TOASTER; W. S. Hadaway, Jr., East Orange, N. J. App. filed May 1, 1909. Includes a supporting frame with a plurality of cross bars and sections of resistance ribbon supported at the edges by the bars and insulated therefrom.

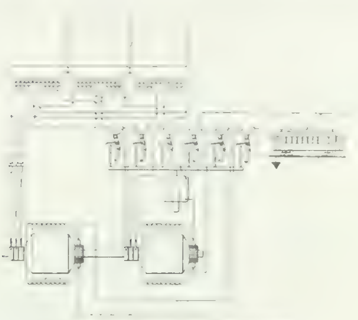
977,640. SYSTEM OF OPERATION FOR DYNAMO ELECTRIC MACHINES; B. G. Lamme, Pittsburg, Pa. App. filed March 15, 1906. For preventing alternating motors of the commutator type from being converted into direct-current generators by combining with the field and armature an impedance device in shunt to the field, the field of which is magnetically saturated when a predetermined amount of current traverses the field.

977,641. SYSTEM FOR OPERATION OF DYNAMO-ELECTRIC MACHINES; B. G. Lamme, Pittsburg, Pa. App. filed March 15, 1906

[illegible] field and armature to prevent unstable action, the field when the motor is operating as a generator has substantially constant excitation by supplying it from a phase changing device between the field and the circuit to which the armature is connected so that the e.m.f of the armature agrees with that of the circuit to which the armature is [illegible].

[illegible] TION WITHOUT CONNECTING WIRES; H. G. Matthews, Gloucester, Eng. App. filed June 18, 1910. Acts by induction and a loop [illegible] transmitting telephone and rotary disk of aluminum upon which a steel shoe presses, opposing resistance which breaks down under the rotation of the disk.

977,643. OUTLET BOX; E. R. La Manquais, Economy, Pa. App. filed [illegible] surrounded by a rim with threaded orifices in the body.



977,645.—System of Distribution

977,645. SYSTEM OF DISTRIBUTION; P. M. Lincoln, Pittsburgh, Pa. App. filed Feb. 3, 1910. Rotary converter railway system for high voltage work in which a direct current circuit is used, as well as an alternating current circuit and two mechanically coupled rotary converters are connected to both circuits which may be simultaneously disconnected from the direct circuit and one from the alternating circuit on short circuit.

977,648. MEANS FOR PROTECTING ELECTRICAL CIRCUITS; P. MacGahan, Wilkinsburg, Pa. App. filed Jan. 10, 1908. Parallel transmission lines are protected from overloads by means of circuit breakers controlled by two switches, one closed when the circuit reverses and the other kept open when the circuit is traversed in the normal direction and closed when the circuit is reversed.

977,649. PROTECTIVE DEVICE FOR ELECTRICAL CIRCUITS; P. MacGahan, Wilkinsburg, Pa. App. filed Jan. 10, 1908. For protecting parallel transmission lines from overloads by means of a circuit-breaker and switch, the latter having a magnet winding and means for establishing a low resistance circuit for the said winding when the circuit reverses and a high resistance circuit when the circuit becomes overloaded.

977,657. TELEPHONE TRANSMISSION SYSTEM; O. T. Lademan, Milwaukee, Wis. App. filed Sept. 2, 1909. Substation telephone devices in connection with a long-distance transmission line, making use of a receiver of particular form and a separate bridge between the line conductors and the secondary of the induction coil, and an independent bridge across the conductors, especially for railway telephone work.

977,658. TELEPHONE DESK STAND; W. Leaver, Chicago, Ill. App. filed March 3, 1908. The parts are concealed and the transmitter back casing and lug are integral. A cylindrical transmitter is supported within the conical cap provided with a slot and a spring within the cap holds the cap and support in frictional relation.

977,664. CONTROLLING MEANS FOR ELECTRIC CIRCUITS; J. K. Lux, St. Louis, Mo. App. filed April 26, 1906. Snap switch for switchboards in which the knives are operated by a yielding starter and strike up against a yielding buffer.

977,711. METHOD OF ELECTRIC WELDING; J. F. Craven, Pittsburg, Pa. App. filed March 5, 1909. For welding sheets in thin plates by means of a stiffening ring inside of the overlapping portions and an electric rotary welding tool supplied with current rolling down the welded joint.

[illegible] ELECTRIC CABLE; [illegible], Hoboken, N. J. App. filed March [illegible] work by increasing its inductance so as to counteract the distributed capacity of the line, the conductor being continuously wound helically about a non-current carrying core, the core being of stranded material.

977,721. ELECTRIC BATTERY; C. J. Everett, New York, N. Y. App. filed March 6, 1905. Water-tight box for inclosing a battery and switch.

977,768. DYNAMO ELECTRIC MACHINE; J. B. Wiard, Lynn, Mass. App. filed April 27, 1910. Has a stationary core with holes for re[illegible] tering with the holes.

977,774. ARC LAMP SAFETY DEVICE; O. F. Asbury, Charlotte, N. C. App. filed Feb. 8, 1909. For preventing the feeding carbon from short-circuiting through the frame when the other carbon burns out by means of a swinging member which intercepts the feeding carbon when it burns away.

[illegible]

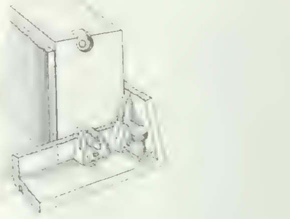
[illegible] OPERATING MEANS FOR ROTARY ELECTRIC SWITCHES, J. K. Lux, Washington, D. C. App. filed Dec. 4, 1906. Rotary snap switch in which the handle contains a plunger which engages the [illegible] disk [illegible]

977,821. ALTERNATING-CURRENT DYNAMO ELECTRIC MACHINE; [illegible] 1904. [illegible] brushes bearing thereon with means for inducing an equal and opposite e.m.f. in the coil, short-circuited by the brushes by means of the fluctuating field so as reduce sparking.

977,836. FIXED POLARITY ATTACHMENT PLUG; C. D. Platt, Bridgeport, Conn. App. filed April 25, 1910. For charging batteries and the like which can only be inserted one way into the sockets. Details.

977,870. INDUCTION COIL; J. O. Heinze, Jr., Lowell, Mass. App. filed May 22, 1909. Spark coil in which the box contains two coils with two secondary terminals of the spark gap connected to each secondary, each pair of terminals forming a spark gap of suitable length when the coils are in normal position.

977,879. ELECTRIC TELEGRAPHY; J. Kajiura, Tokyo, Japan. App. filed April 4, 1910. Semi-bridge duplex system for cable and telegraphic circuits with overhead line wires with means for reducing [illegible] artificial line



977,870.—Induction Coil

corresponding to the line cable and a balancing rheostat with self-inductances, resistance and capacities branching from the center of the rheostat.

977,912. MOTOR CONTROL SYSTEM; H. E. White, Schenectady, N. Y. App. filed July 19, 1910. Motor controller with movable contacts and contact fingers with magnets energized from the motor circuit on overload for holding the fingers out of engagement with the contacts.

977,981. TELEPHONE RECEIVER; H. R. Stuart, Wheeling, W. Va. App. filed March 21, 1908. Improvement in telegraphones to produce a sensitive receiver. A pair of magnets in ring form with opposed pole pieces are arranged on opposite sides of a diaphragm and the system inclosed in a casing from each end of which the sound [illegible]

977,984. GRAPHITE ARTICLE AND METHOD OF MAKING THE SAME; Frank T. Tone, Niagara Falls, N. Y. App. filed Nov. 11, 1905. Artificial graphite in the state of molecular separation of a certain density.

978,004. ELECTRICAL CUT-OUT; J. L. Burton, Plainville, Conn. App. filed Feb. 11, 1910. A fuse member with a tubular body containing the fuse and a clip with a shank hitting the body and a disk closing an end of the tube to which the fuse is connected.

978,022. ELECTRICAL RESISTANCE CONTACT, AND THE LIKE; H. S. Hatfield, Hove, Eng. App. filed Dec. 28, 1906. Consists of a body of silicon with a surface coating of an alloy of silicon and another metal.

978,038. SYSTEM OF REGENERATIVE CONTROL FOR ELECTRIC MOTORS; B. J. Lamme, Pittsburgh, Pa. App. filed March 15, 1906. For electric railways employing motors of the commutator type with series connected fields and armatures which may be operated as generators under stable conditions. Makes use of a source of current to be connected in shunt to the field when the machine is operated as a generator.

978,053. SWITCH-OPERATED MECHANISM; E. S. Olmsted, Louisville, Ky. App. filed July 1, 1910. The track switch is thrown automatically and electrically by the approaching car. Controlled through a solenoid magnet, the wires being run in tubes to protect them.

978,070. TELEPHONE TRANSMITTER; J. Sparks, Kimberly, Cal. App. filed March 30, 1910. Pneumatic microphone transmitter in which a valve chest receives fluid under pressure, the valve being operated by the diaphragm of the mouthpiece and the fluid pressure operating circuits for reproducing the sound electrically.

978,075. TELEPHONE MOUTHPIECE; G. R. Taylor, San Francisco, Cal. App. filed Sept. 27, 1909. A mouthpiece supported a short distance away from the transmitter button with an open space between.

978,079. KEYBOARD TELEGRAPH TRANSMITTER; D. S. Troth, Oakland, Cal. App. filed May 8, 1909. A plurality of rotating disks with recesses and contacts adjacent thereto engaging the recesses, a contact bar for transmitting the code.

978,083. TELEPHONE REPEATER SYSTEM; N. G. Warth, Columbus, Ohio. App. filed July 15, 1907. A main line secondary and a primary repeater with two local or tertiary circuits each connected with the repeater, one inductively connected with the main line secondary and the primary repeater and the other with the primary repeater circuit only.

978,094. INCANDESCENT ELECTRIC LAMP; A. L. Wilkins, Middleton, Mass. App. filed Sept. 13, 1909. The filament is composed of alternate sections of carbon and tungsten in series.

978,112. TRANSPORTATION SYSTEM; W. C. Carr, Buffalo, N. Y. App. filed Dec. 11, 1908. Overhead rail system in which the car is supported and depends from the side rails, which rails are supported on posts. Details in the construction of the rush and other parts of the system.

978,119. LIFTING MAGNET; A. C. Eastwood, Cleveland, Ohio. App. filed May 13, 1910. A lifting magnet in which the winding consists of superposed sections, each a flat spiral with spacing between the [illegible] admit [illegible]

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NEW YORK, THURSDAY, DECEMBER 22, 1910.

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RATES FOR ELECTRIC SERVICE.

In a letter printed elsewhere, Mr. Percy H. Thomas points out one of the complications that beset the application of dogmatic rational rate systems. It should not be lost sight of that the one thing that separates the electrical supply company from shoe or dry-goods stores in the matter of prices charged is that the former is a public-service corporation doing business in virtue of a franchise granted to it by the public and usually freeing it wholly or partly from competition. Hence the public is generally regarded as having a certain equity in the electrical supply business which justifies it in insisting on reasonable prices; and as every member of the community is virtually a contributor to the franchise it is generally held that every member of the community should have fair and equitable treatment. Were it not for this close relation to the public, which is fully recognized by the most progressive station managers, there would be no more reason for a uniform schedule of prices than there is in the case of a dry-goods store. The various rate systems are praiseworthy efforts at fair dealing, or at least at such a logical treatment of the public as shall not expose the supply company to the charge of discrimination.

A rate based on standby and service costs may give a fair approximation to an equitable distribution of charges or it may not, according to the particular things which are considered in making the rate by general average rather than on the basis of facts. For example, it is common to assume a distribution charge as proportional to the consumer's maximum demand, whereas in point of fact, as every engineer who has ever laid out service knows perfectly well, by far the largest factor in determining the cost of delivering a certain amount of energy to a consumer is the distance of that consumer from the station. If one assumes two consumers with absolute equal loads in every respect, one of them 200 ft. from the station and the other 200 miles, the distribution cost in the first case becomes almost negligible compared to that in the second; yet it is perfectly obvious that no manager would dare broadly to propose and no public-service commission would dare to attempt to enforce a zone system based on the somewhat fortuitous distance of the consumer from the station. Systems of rates are merely more or less convenient approximations, based always on taking by general average certain factors which are admittedly extremely variable. There is, therefore, no reason why a rigid basis of rates, to which our correspondent very properly objects, should be enforced. The effort of the public and the public-service corporations ought to be directed toward the square deal to all parties concerned, and nothing is more unfair to the community and the company in the long run than a hard and fast insistence on certain specific arbitrary methods of charging which are in their essence only loose approximations at best.

As Mr. Thomas points out, the existence of motor-service as distinct from lighting rates is practically a frank admission that the scheme of charging is not a logical one, but is based

on making prices that will get business. It is undoubtedly to the advantage of the community that electric energy for all purposes should be generated on a large scale, so that it can be furnished the more cheaply; and it can only be generated on a large scale when prices can be made for electric service which will get a large volume of business. The time is coming when central stations will furnish enormous quantities of energy for all sorts of purposes—for railways, for electrochemical works, even for heating—but this end cannot be reached by adherence to somebody's hard and fast system guaranteed to be strictly scientific and logical until it is investigated. The special rate for special service, if fairly and openly applied, is likely to work benefit to all the consumers instead of harm to any. The one important thing is that it shall be administered with even-handed justice, and not in the form of secret rebates, but by open discounts. Only by means of special rates for service which has special requirements is it possible to win that expansion of electric service which ultimately means a lowering of all the rates. The evil of special rates comes to the surface only when these rates are secret rates.

THE BUREAU OF STANDARDS.

There is now before the Congressional Appropriations Committee a proposal for increasing the efficacy of the Bureau of Standards by providing it with an adequate special building for its work in electricity, magnetism and photometry. It is certainly for the interest of the whole electrical industry that so useful a proposition should be acted upon favorably. Since its establishment, only a few years ago, the Bureau of Standards has become an institution of which the government has a right to be justly proud. Its *Bulletin* shows scientific work in quality and amount which would be highly creditable to an institution with much larger resources. The history of the scientific work undertaken by the United States government is, upon the whole, a peculiarly creditable one. In spite of occasional setbacks from a small and pitiful economy, it has been the policy of our government to undertake scientific investigations of a character tending to benefit the industrial development of the country and to push them steadily forward as the demand for their work increased.

It would have been a good thing if the Bureau of Standards had been founded many years before it actually came into being, and now that we have it in a state of high efficiency, considering its resources, it would certainly seem to be the duty of the government to stand by it and make up for its years of delay in starting so important a foundation by pushing its development as rapidly as its needs require. The work of the bureau in providing a scientific basis for the electrical industries in the preparation of standards and in tests of precision has already shown its great importance, and the industries which it has benefited are, it is needless to remark, of a commercial magnitude that calls for high consideration. The investments in electrical enterprises have risen comfortably into nine figures and the yearly value of the product into hundreds of millions. For the proper co-ordination of the work involving these vast amounts a suitable authoritative source of exact data is an absolute necessity, and the Bureau of Standards is providing this admirably up to the limit of its resources. A government which has avowedly undertaken to foster industry and to promote science, as has ours, is in duty bound to see to it that the electrical investigations made necessary by the rapid growth of electrical interests shall not suffer through neglect. Nor do we believe that there is the slighest intention to neglect this valuable department of the government service. We trust that the present appropriation for providing adequate facilities for the electrical work of the bureau will be pushed promptly through and the work prosecuted with the utmost vigor, so that the Bureau of Standards will be at the earliest possible moment provided with suitable facilities for this very valuable department of its public service.

ELECTRICAL PROPERTIES OF COMPOUND WIRES.

In the early days of applied electricity, when the electric telegraph constituted almost its only industrial application, the aerial conducting wires were made of galvanized iron. Indeed, at the present day iron wires continue to be used in telegraphy. Such wires, although heavy to suspend, had a very satisfactory tensile strength. When telephonic aerial conductors began to spread and multiply the iron wires of telegraphy were at first adopted for telephony also. Here, however, an additional objection soon manifested itself. At the relatively high frequencies of telephonic currents, the skin effect and the inductive impedance increased the apparent resistance of the iron wires in marked degree, so that although iron in the form of a metallic cylinder provides a given direct-current conductance at about half the cost of copper, yet it costs more than copper for a given telephonic alternating-current conductance. Besides this it weighs five times as much as copper for a given direct-current conductance and over ten times as much as copper for a given telephonic alternating-current conductance. For these reasons aerial copper wires were introduced into telephone lines. At first their tensile strength was found to be dangerously low, but after a time hard-drawn copper wires were found which possessed a tensile strength that was reasonable in amount, although far inferior to that of steel. As the result practically all telephone aerial wires are now composed of hard-drawn copper, and this practice has reacted upon telegraphic practice, so that most modern aerial telegraph wires are also of hard-drawn copper. The aerial conductors for transmission and distribution are likewise always of copper, except when aluminum is used. Iron and steel are never used for such conductors except at river crossings or for especially long spans.

Although hard-drawn copper has thus secured an almost complete monopoly for overhead wires, yet it has not been without objections. In point of volume conductivity no objections have been raised, for copper leads all metals in this particular, but in point of tensile strength there is still much objection. An overhead hard-drawn copper wire has ample strength for sustaining its own weight over ordinary lengths of span, but there is but little margin of extra strength for sustaining the occasional burdens of a winter climate in snow, ice and sleet. To meet the demand for increased tensile strength trials have been made of various types of compound wire formed of coaxial cylinders of two metals, one, usually of steel, for tensile strength, and the other, usually of copper, for conductivity. In an article commencing on page 1471 Mr. Frank F. Fowle discusses the electrical properties of a comparatively new and improved type of compound wire with a steel core and a copper shell. In such a case the tensile strength of the compound wire is mainly that of the steel core alone, while the conductance

of the wire is, to a first approximation, that of the copper shell alone.

For direct-current purposes the behavior of such a compound wire is shown to be comparatively simple. The linear conductance of the wire is, for all practical purposes, the simple sum of the conductance of the steel core and of the copper shell. The inductance of the wire can be ignored complacently. But when alternating-current service is considered the matter is not so easy. The inductance inside the steel core cannot be ignored and its amount cannot be predicted with any certainty. The inductance within an iron wire depends upon the magnetic permeability of the wire at different radial distances from its axis, and this permeability depends upon the strength of the current. The ratio of the self-induced flux inside the wire to current strength is not a constant as in the ordinary copper wire, but increases when the current increases in a somewhat complicated manner. Taking into account the effect of hysteresis and the skin effect, the inductance within a wire carrying alternating currents is a very complicated question. It is certain, in any case, that the IZ drop in an iron wire carrying an alternating current is not proportional to the current I, so that if the current I is sinusoidal the IZ drop will not be exactly sinusoidal owing to the cyclic variations of the internal inductance. A number of electrical measurements on these compound wires are contained in Mr. Fowle's article. It is indicated that the permeability in the steel reached the value of 389 in one case. This is an unusually high value under such circumstances and adds materially to the inductance within the wire. It might be worth experimenting with the steel used in the cores of such wires to ascertain whether its permeability might not be kept much lower without material prejudice to the strength and softness of the wire. The conductivity of the steel is of secondary importance and can be sacrificed in favor of either increased tensile strength or of diminished permeability.

WHAT IS DAYLIGHT?

There has been much talk of "normal color values," of pure white light and similar fictitious objects within the past few years, and it is high time for some sort of convention regarding the use of such terms, in the interest of veracity if not of science. Everybody agrees that it is sometimes a desirable thing to be able to reproduce the color values of daylight in artificial illumination, and there are adequate methods of performing the feat if there could only be a reasonably approximate agreement as to what should be the final result sought. Up to now no two investigators who have sought to define a normal daylight or a normal white have done so in the same terms or to the same effect. Abney's white is one thing, Nichol's another, Ives' still another, and so on, each investigator drawing his own conclusions and working from them consistently enough, but not agreeing even approximately with his fellows. Each investigator, moreover, has been firmly convinced that his particular daylight or his particular white is the only proper one to assume. A still further difficulty lies in the fact that part of the researches on this matter have been carried out with spectral colors and part with absorbing screens, so that proper intercomparison of results is no easy job. Consequently, when one attempts to define the color of a particular artificial illuminant there is no standard of reference in the least degree satisfactory. The intensified arc, certain luminous arcs, the Moore CO_2 tube, the Nernst lamp, the Cooper Hewitt lamp, with the recently described fluorescent screen, certain high-pressure incandescent mantles, the acetylene flame behind a suitable screen, and tungsten lamps similarly treated, all give illumination that passes for white or as a match for daylight, which is a somewhat different thing. Now, any of these illuminants properly screened or combined with other sources can unquestionably be made to give a pretty close approximation to the varying effects of daylight. The fundamental trouble lies not so much with the illuminants as with our conception of what "white light" or "daylight" is or ought to be.

Daylight in fact ranges from a strong blue to a strong orange according to conditions of time and atmosphere. If one could see side by side the daylight of high noon under a blue sky and the daylight of sunrise and sunset hours the contrast would be something astonishing and almost unbelievable. Fortunately one's memory for absolute color is singularly bad. Possibly some favored or skilled individuals may acquire facility in this particular, as now and then some person has an exceptionally keen memory for absolute pitch in music; but, fortunately upon the whole, the world at large is psychologically incapable of noting the extraordinary changes in color that take place regularly in the progression of the hours. Moreover, different people want somewhat different standards of daylight as a matter of convenience in their occupations. One prefers full sunlight and another the illumination received from a bright north sky, admirably adapted for showing up shades of blue. Even "average daylight" is exceedingly difficult to find even after one is acquainted with its range of variation in color. It would be a very desirable thing if some general agreement on a definition for normal white could be had by such another international convention as has already secured us a definite understanding as to the unit of intensity. If the various national laboratories would take up the matter it would probably not be difficult to settle upon a practical method of forming a reliable reference standard, although there would certainly be vigorous discussion as to what particular combination should be called a normal white. One thing is clear, that whatever standard the convention may assume for color, it should be defined in terms of a definite mixture of spectral colors and not in terms of absorbing screens, which, however convenient, present colors always impure as compared with spectral colors and liable to change. Screens, however, might be utilized in comparing secondary standards, which would practically serve a very useful purpose.

The subject is one which the Illuminating Engineering Society could take up to advantage as it took up the question of an international unit earlier in its career. The problem is an important one and should be worked out without delay. It is, after all, a conventional matter which has to be settled by mutual agreement in the very nature of things. Psychologically speaking, one is apt to call, in the absence of comparison colors, any very bright illumination white, but this judgment is upset at the slightest entrance of simultaneous contrast into the conditions. Apparent color depends so much upon simultaneous contrast that its definition save in terms of a conventional standard is extremely difficult. Even successive contrast, introducing the element of retinal fatigue, is a constant disturbing factor in one's judgment of color. The program here suggested of a general convention established by the several national physical laboratories is about the only practical means of settling the outstanding difficulties, which are certainly great enough to demand prompt action.

Graduates from Electrical Courses in the United States.

Below are given the results of our fourth annual census of schools in the United States conducting systematic courses in electrical engineering. The results of the previous censuses appeared in the issues dated July 27, 1907; Dec. 26, 1908, and Feb. 10, 1910. In Table I are given the total number of students enrolled in 104 regular electrical engineering courses and the number of graduates in June, 1910, from the schools, which are grouped in three separate classes. Class I includes the

ALL [illegible] ELECTRICAL ENGINEERING STUDENTS AND GRADUATES.

	Number of Schools	Students 1909-10	Graduates 1910	Total Graduates to June, 1910
Class I	25	3,679	629	8,147
Class II	[illegible]	3,977	649	5,344
Class III	14	[illegible]	267	[illegible]
Total	[illegible]	9,041	[illegible]	[illegible]

schools of highest standing, the degrees from which confer more or less prestige on the graduate. Class III includes those schools in which the instruction is quite elementary, but which have regularly organized courses in electrical engineering. All other recognized schools giving complete courses of instruction in electrical engineering are included in Class II. During the past year there have been no changes in the number of schools listed and none in the classification.

TABLE II.—COMPARISON OF STATISTICS FOR FOUR YEARS.

Year	1907	1908	[illegible]	[illegible]
Number of students	8,929	9,651	8,670	9,041
Number of graduates	[illegible]	1,501	1,473	1,545

As will be noted from Table II, both the number of students enrolled and the number of graduates were greater in 1910 than in 1909, but the total number of students was less than in 1908.

It will be seen from Table II that during each year there were from 15 per cent to 17 per cent as many graduates as enrolled students. An analysis of the classes shows that of a freshman class of 100, 82 became sophomores, 65 juniors, 50 seniors and 47 graduates. The probable number of students receiving instructions during one, two and three years is shown in Table III.

On the basis of percentages found to exist among the classes it is permissible to assume that if 15,689 students have graduated after completing four years of study about 33,400 entered upon the course leading to the electrical engineering degree. Of these, 27,400 completed the freshman studies, 21,650 covered both the freshman and the sophomore and 16,700 received instructions for three years. Few of the men who have had the benefit of two or three years' training, numbering no less than 38,350, can be considered as having dropped out through being unequal to the intellectual task of acquiring an engineering education; in the main they form a valuable part of the product of the engineering college and in many cases have assumed positions of prominence in the industry. Thus the electrical field has received from the colleges more than 50,000 men who have had two, three or four years of systematic training in electrical science and its applied arts, of which great body few have yet reached the forty-year milestone of life. While some of these have passed into other fields of work the percentage is undoubtedly small, and death has not greatly reduced the ranks. The electrical industry indeed owes a huge debt to the educational system which has supplied to it this great army of intelligent workers.

TABLE III.—ESTIMATED NUMBER OF STUDENTS FOLLOWING LESS THAN A FULL COURSE.

	1907	1908	1909	[illegible]
Less than one year	520	580	560	[illegible]
One year	[illegible]	540	530	561
Two years	435	480	475	503
Three years	87	[illegible]	92	97
Less than four years	1,532	[illegible]	1,657	1,746

Keokuk Water-Power Development.

Work is about to be begun on the 4700-ft. dam across the Mississippi River, between Keokuk, Ia., and Hamilton, Ill. By means of this dam 200,000 electrical horse-power may be developed in the manner described and illustrated in the article in these columns in the issue of May 19, 1910, page 1287. The initial installation will be of 100,000 hp, it is expected. Heretofore construction work has been on shore, but a few days ago a large contract was awarded to the T. L. Smith Company, of Milwaukee, for all the concrete mixers required in the building of the great dam itself, which will be of massive concrete, 37 ft. high and 43 ft. wide, with a straightaway spillway section 4400 ft. long. The power house, built as a part of the dam, near the Iowa side, but at an angle with the spillway portion, will be 1400 ft. long and 123 ft. wide. The operating head will vary from 21 ft. to 35 ft. Turbine waterwheels will drive electric generators by means of vertical shafts.

Expiration of the Tesla Split-Phase Patents.

Two patents, generally known as the "Tesla split-phase patents," which have excited a great deal of attention and caused much litigation in the electrical industry will expire on Dec. 26, 1910. Both of these patents were issued to Nikola Tesla on Dec. 26, 1893. They were numbered 511,559 and 511,560 and related to the same invention, the former being a "process" patent and the latter a "system" patent. Patent No. 511,559 was entitled "Electrical Transmission of Power" and patent No. 511,560 bore the title "System of Electrical Power Transmission." Applications for both were filed on Dec. 8, 1888, and both were issued to Nikola Tesla, of New York, assignor to the Tesla Electric Company.

The first patent embraced two claims relating to the split-phase rotating field in the operation of alternating-current motors. In the second patent seven claims were allowed and the principal one of these covered a generator of alternating currents, a circuit therefrom, a motor having a field with two energizing circuits, means for rendering the magnetic effects of these two energizing circuits of different phase, and an armature in inductive relation thereto.

The Tesla Electric Company was composed of Mr. A. S. Brown and some other gentlemen who were interested in the inventions of Mr. Tesla. Tesla had previously invented the rotating-field principle for alternating-current generators and the patents covering this invention were issued in 1888 and expired in 1905. The two split-phase rotating-field patents were assigned to the Westinghouse Electric & Manufacturing Company before they were issued and about the year 1898 were included in the patent arrangement between the Westinghouse Electric & Manufacturing Company and the General Electric Company by which each of these companies agreed to extend to the other the use of its patents.

The split-phase patents were of great importance in the manufacture of alternating-current watt-hour meters and of small alternating-current motors. The Westinghouse Company began the manufacture of meters and small motors, utilizing the principle of the Tesla split-phase rotating-field patents. Suits for infringement under the patents were begun about 1896 or 1897 and for ten years or more thereafter the litigation was a familiar one in the patent law courts and in the electrical industry generally. Ultimately the United States courts of appeals upheld the patents in the First, Second, Sixth and Seventh Circuits. In all perhaps twenty suits were brought under these patents.

The defendants sued for infringement made a vigorous defense, asserting that Ferraris and others anticipated Tesla's invention of the split-phase rotating field, but the courts held that the patents were valid. The patents had their greatest effect on the meter industry and under the decisions of the

courts of last resort it was necessary that the maker of every alternating-current watt-hour meter should be licensed under these patents, as it was assumed to be necessary to employ the principle of Tesla's invention to make a practicable alternating-current watt-hour meter. Patents Nos. 511,559 and 511,560 will become public property on Dec. 26, 1910, and the invention therein described can be used freely by anyone after that date. Whether, however, supporting and "protective" patents will be brought forward to prevent such use remains to be seen.

Line-Pole Statistics for 1909.

The total number of poles reported to the Bureau of the Census as purchased during the calendar year 1909 by the telegraph and telephone companies, steam and electric railroads and electric light and power companies of the United States was 3,739,000, as against 3,249,000 in 1908 and 3,283,000 in 1907. There were purchased in 1909 by the same class of users 3,509,000 cross-arms, 6,168,000 brackets and 18,463,000 insulator pins. Cross-arms, brackets and insulator pins were not included in the annual census of lumber and timber products prior to 1909.

Telephone and telegraph companies reported purchases during 1909 of 2,916,000 poles, or 78 per cent of the total. This was an increase over 1908 in the number reported as bought by this class of users of 354,000 poles, or 14 per cent, and over 1907 of 604,000 poles, or 26 per cent. Steam railroads reported the purchase of 26 per cent more poles in 1909 than in 1908, though 34 per cent less than in 1907, while the reported purchases by electric railroads and electric light and power companies were 18 per cent greater than in 1908 and 7 per cent less than in 1907.

There was little change in the average cost per pole of all lengths and from all species of wood in 1909, as compared with 1908, it being $1.89 in the later and $1.82 in the earlier year. The average cost per pole, $2.46, in 1907 was substantially larger than in either of the later years, mainly for the reason that a class of pole consumers in the United States which uses chiefly short poles was not included in the census for 1907.

As will be seen from the accompanying summary, cedar continues to be the principal pole timber, contributing 65 per cent of the total purchases in 1909, 68 per cent in 1908 and 64 per cent in 1907. Chestnut, after cedar, was used in greatest quantity in all three years, forming 16 per cent of the total in 1909, 16 per cent in 1908 and 19 per cent in 1907. Among the remaining species the increase in the number of oak poles reported as purchased during the last three years is noteworthy, more than three times as many poles from this species having been reported as purchased during 1909 as was the case in 1907.

Substantial progress in the practice of treating poles with chemicals to preserve them from decay is disclosed by the returns for 1909, nearly one-sixth of the total purchases during that year having been given some preservative treatment, as against about one-tenth in 1908 and one-eighth in 1907.

Of the total outlay during 1909, $1,621,000, for cross-arms, brackets and insulator pins, the telegraph and telephone companies contributed 63 per cent, electric railroads and electric light and power companies 32 per cent, and steam railroads 4 per cent.

SUMMARY OF POLES PURCHASED.

Kinds of Wood.	1909		1908		1907	
	Number.	Cost.	Number.	Cost.	Number.	Cost.
Cedar	2,440,000	$4,680,000	2,200,000	$3,781,000	2,109,000	$5,203,000
Chestnut	608,000	[illegible]	516,000	1,227,000	630,000	1,620,000
Oak	237,000	137,000	161,000	95,000	76,000	60,000
Pine	180,000	520,000	117,000	383,000	156,000	460,000
Cypress	78,000	[illegible]	91,000	148,000	100,000	308,000
Juniper	44,000	79 000	42,000	83,000	39,000	109,000
Tamarack	30,000	18,000	24,000	32,000	14,000	10,000
Douglas fir	25,000	35,000	20,000	80,000	16,000	41 000
Redwood	23,000	[illegible]	13,000	39,000	31,000	109,000
Bois d'Arc	21,000	9,000	18,000	11,000	6,000	3,000
Spruce	11,000	18,000	8,000	23,000	11,000	29,000
Locust	10,000	9,000	10,000	8,000	5,000	4,000
All other	32,000	19,000	29,000	18,000	89,000	12,6000
Total	[illegible]	$7,074,000	3,249,000	$5,929,000	3,283,000	$8,082,000

Chicago Electrical Show.

About ninety exhibitors have agreed to take space at the Chicago Electrical Show of Jan. 7-21 at the Coliseum, and little space remains to be sold. The most distinguished exhibitor will be the United States government, which will have the so-called "Annex" at the southern end of the building. The Treasury, Interior, Post Office, War and Navy Departments will make exhibits of educational and popular interest. Special decorations are planned for the Annex and there will be a large number of illuminated translucent pictures. In the navy exhibit the modern electrical equipment of a warship will be shown, including "wireless" demonstrations and the methods of electric cooking lately adopted for the navy. Adjoining the government display will be a working exhibit of the Chicago Wireless Club and working exhibits of the pupils of the Lane and Crane technical high schools of the Chicago public-school system, consisting largely of "wireless" apparatus made and operated by the students. Three central-station companies, the Commonwealth Edison Company, the North Shore Electric Company and the Cosmopolitan Electric Company, will display methods of using electricity. The general scheme of illumination will be new. Looking upward the spectator will see, apparently, the drapery of a great pavilion drawn aside to reveal in the center a wide expanse of cloud-flecked noonday sky. Indirect lighting will be relied upon to provide the illumination for the bright-sky effect, which will be in marked contrast to the night-sky effect at the 1909 show.

Loaded Submarine and Underground Telephone Cables.

A patent was issued Dec. 6 to Dr. J. H. Kuntz, of Hoboken, N. J., on application filed March 29, 1901, covering a method of construction of cables whereby the effect of capacity is counteracted in whole or in part. The effect of the distributed capacity is counteracted by means of an inductance, and it is stated that by the construction described a cable can be produced with an inductance as large as may be required for the given conditions, and, what is more important, the amount can be predetermined and the dimensions of the elements of the cable so fixed as to secure the proper adjustment in a way mechanically simple and commercially practicable. The conductor is disposed helically about a core, which may or may not be of iron, depending upon the amount of inductance desirable. In the case of a submarine cable with capacity and resistance

such as are encountered in actual practice the amount of inductance necessary to neutralize the capacity is calculated and then the dimensions and arrangement of the core and conductor are determined from these data. The specifications give an example of such a calculation. In the case of an iron core the strands are of fine soft-iron wire, which may be insulated from each other by a coating of oxide, or they may have a thin coating of insulating compound. There are eighteen claims in the patent, one of which is as follows: "A cable consisting of a continuous conductor disposed helically about a supporting non-current carrying core, said core consisting of stranded paramagnetic material so as to secure a suitable amount of inductance to counteract the electrostatic capacity."

Boston Elevated to Build Large Power Plant.

The Boston Elevated Railway Company has awarded the Stone & Webster Engineering Corporation, of Boston, a contract for the erection of a power plant of 30,000 kw initial capacity on the company's property in South Boston. Two 15,000-kw General Electric turbo-alternators will first be installed, with the necessary boilers, coal-handling equipment and auxiliaries. About a year ago the company purchased a tract of twenty-five acres on the harbor front between the plants of the Boston Edison Company and the Walworth Manufacturing Company. Under the plans of Stone & Webster the company will be relieved from the necessity of purchasing outside power for a year or two, with ample opportunity for future extensions. A modern coal plant will form a part of the station service and a storage capacity of 100,000 tons will be provided on the property, which has a water front 800 ft. long.

As announced in these columns, the construction of the new plant at South Boston will mark a radical change in the methods of power supply on the Boston Elevated system, which now consists of about 500 miles of track, serving a population of over 1,000,000 people in the Boston metropolitan district. The present power supply is in the main from direct-current stations located at various points on the water front and rivers in the Boston district. The completion of the new plant will require the installation of extensive transmission line and substation facilities, with many probable rearrangements of the feeder system. For about eighteen months the beginning of this work has been apparent in the transmission of power by alternating current from a 2000-kw steam turbine set at the Dorchester power plant to the Egleston Square substation, from which direct current is supplied to the Forest Hills elevated extension and other lines in the vicinity. In case the company is permitted by the next Legislature to assume control of the great systems of suburban trolleys outside Boston proper the South Boston plant can be extended to handle a wider power distribution service than the present limits of the system require.

Charter Amendments Adopted in San Francisco.

On Nov. 15 San Francisco voted on thirty-eight amendments to the city's charter that had been proposed by the Board of Supervisors. Of these eighteen were carried, those lost being principally amendments which would have made heavy demands on the municipal expenditures. Of principal importance to the city and the State of California was amendment No. 1, which authorized a bond issue of $5,000,000 in aid of the Panama-Pacific Exposition which San Francisco proposes to hold in 1915. This amendment was carried by a vote of 42,040 to 2122 against, which is probably as nearly unanimous a vote as ever could be obtained at a municipal election. This sum added to the $5,000,000 voted by the State a week previous and the $7,500,000 raised by individual subscribers gives San Francisco a total of $17,500,000 with which to bid to Congress for the exposition.

Amendment 7, which was the next in importance and the most far-reaching from a civic standpoint, provides for a majority rule in municipal elections and the pure Australian ballot at the primaries. It was carried by a vote of nearly five to one. This amendment was recommended by the Merchants' Association and the improvement associations, and was opposed by the Union Labor and Socialist parties.

Some idea of the general trend of the returns may be had from a study of the way the recommendations of the different civic bodies fared at the polls. The vote favored all but six of the recommendations of the Merchants' Association, and was adverse on thirteen of the recommendations of the organ of the Labor party.

Several of the amendments related to public-service corporations: Of these Amendment No. 4, which was defeated by a majority of over 15,000, proposed to revise the procedure connected with public-utility franchises, giving the city officials greatly increased powers. Although it contained several excellent features, it was disapproved by the civic associations.

Amendment No. 19, which was carried, requires as a condition upon which street-railway franchises may be granted that the city shall have the right at any time to purchase the tangible property owned by the grantee of the franchise used in the exercise thereof and to take over the franchise. The value is to be ascertained by arbitrators appointed for that purpose. The value of the tangible property shall include a bonus of not less than 10 per cent or over 20 per cent of the actual value if the franchise has run less than ten years, and the bonus shall be only 10 per cent if the franchise has run for more than ten years. Such franchises must provide that in the operation of the railway thereunder eight hours shall constitute a day's work and the minimum wage shall be $3 a day with overtime at the rate of one and one-half times this. Violation of any of the provisions of the franchise shall work a forfeiture thereof. This amendment was opposed by the Merchants' Association on the ground that no capital could reasonably be expected to invest in the construction and development of street railways under any such restrictive provisions.

Amendment No. 20, which gave the detailed method for granting street-railway franchises and gave additional powers to the Supervisors, was considered more radical than No. 19 and was defeated. It contained features which would have absolutely prohibited the securing of any investment of private capital in building street railroads in San Francisco.

Amendments Nos. 11 and 12, which were adopted by large majorities, permit the construction of tunnels, subways and viaducts on, under or over accepted or unaccepted streets, and permit the cost of said construction to be raised by assessment upon the property immediately benefited, and also permit the city to pay one-half the cost thereof out of its treasury. This will greatly facilitate and aid in the construction of tunnels, subways and viaducts, all of which are matters of prime necessity and immediate urgency in the city. They were proposed by the Merchants' Association.

Other amendments carried included the following: No. 6, establishing the initiative, referendum and recall on a more elaborate basis than heretofore and reducing the number of signers on petitions to place ordinances upon the ballot; No. 8, providing for the elimination from ballots of party circles and all party designations; No. 9, changing the terms of Mayor, Supervisor and other officials from two to four years; No. 38, providing for a minimum wage for all persons in the city's employ of $3 per day and requiring contractors on city work to pay the same rate.

Energy Supply and Traffic of Chicago's Elevated "Loop."

The much congested Union Loop in Chicago, by means of which the four elevated electric railways discharge and take on nearly all of their downtown passengers, is now carrying about 450,000 passengers daily on 2300 trains averaging four cars to

the train. During the "rush" periods, when the trains are operated under the closest possible headway, the peak of demand of the Loop reaches 22,000 amp at 550 volts, and the total monthly consumption during the winter season of heavy traffic aggregates about 1,600,000 kw-hours.

Under normal operating conditions this energy is supplied from the Loop's own 6100-kw generating station at Market Street and St. Charles Place, where four direct-connected, engine-driven, 600-volt, direct-current railway generators are installed. On Nov. 4 a combination of unfortunate accidents resulted in putting this station out of commission, and during part of the following week energy for operating the trains was obtained from the systems of the South Side Elevated Railroad Company and the Chicago Railways Company, the latter operating surface railways on the North Side and West Side.

The Loop power plant shutdown occurred at a time when one of the four sets was receiving its overhauling, in accordance with the regular practice of going over one of the units each year. One of the remaining three engines developed crank-pin trouble, and when it was relieved of service the heavy overloads imposed on the other two units caused them successively to short-circuit and break down, burning out several coils of each. This put the Loop generating station out of commission entirely, and the South Side Elevated and Chicago Railways companies then stepped into the breach and supplied energy for operating the Loop from their own systems. As the latter company purchases a portion of its energy from the Commonwealth Edison Company, the Loop has been operating during the emergency in part with central-station power. All during the trouble President Insull, of the Commonwealth Edison Company, has held his system in readiness, if need developed, to furnish energy directly to the Loop, through such converting apparatus as could be impressed into service from the 550-volt systems of the other electric railways, which use a large amount of central-station energy. Meanwhile a large force of men was put to work on the Loop generating station, and the machines were repaired in time to resume service within a week of the original shutdown. The delay to passenger travel which resulted from the breakdown was slight, only a few trains during one of the rush periods being interfered with.

The Union Elevated Loop is in fact owned by the Northwestern Elevated Railway Company, but is used jointly by the four Chicago elevated railways, including the South Side Elevated Railroad, the Metropolitan West Side Elevated Railway and the Chicago & Oak Park Elevated Railroad Company. For each passenger carried by any of the elevated roads around the Loop the Union Elevated Loop collects a toll of 0.5 cent. During the six months January to June, 1910, 81,276,412 passengers were carried from elevated stations communicating with the Loop, while another million used the Congress Street stub terminal of the South Side Elevated Railroad. During the same period of 1909 the elevated roads carried only 74,166,506, showing an increase of 10 per cent for the present year. The Loop's income from the four elevated railroads was $406,832 for the first half of 1910, and after charging off $125,000 as interest, 15 per cent of the remainder was paid to the city as compensation for the use of the streets, amounting to $42,207. After 1917 the Loop must pay 20 per cent to the city, and from 1932 to 1946 the cost of the occupancy privilege will be raised to 25 per cent. Mr. F. J. Guernsey is superintendent of the Union Consolidated Elevated Railway Company.

Eastern New York N. E. L. A. Section.

The first meeting of the season of the recently formed Eastern New York Section of the National Electric Light Association was held at Schenectady on Dec. 13. A large gathering of men from the cities and towns of eastern New York was present to welcome President W. W. Freeman and Secretary T. C. Martin, of the national body, the principal speakers of the evening.

Mr. Bryce E. Morrow, of the Hudson Valley Power Company, presided at the meeting, the address of welcome being given by Mayor Duryee, of Schenectady. Mr. Freeman was then introduced as the first speaker, and his account of the growth of the national association and its field of usefulness was very enlightening to the electrical men present. The benefits of the association were very conclusively stated by the speaker, and he accounted for the rapid advancement of the association to its position of to-day on the score of its great utility to the electrical industry. Mr. T. C. Martin elaborated some of the points brought out in President Freeman's speech, and especially interested the many young men present by picturing the splendid opportunities offered both in central-station work and in the electrical manufacturing industry.

Mr. M. Webb Offutt, manager of the Schenectady Illuminating Company, showed clearly the value of a local organization of men interested in the commercial phase of the electrical industry in bringing together the central station, the contractor and the general public.

Mr. C. D. Haskins, manager of the lighting department, General Electric Company, was very optimistic about the future of the local organization. He predicted for Schenectady, with its large body of men interested in things electrical, a large engineering building with headquarters for a number of scientific organizations. The officers of the Eastern New York Section brought before the members some of the plans for the coming year's work which promise to bring to Schenectady many of the foremost men in the electrical industry.

Fuel Supply of a Large Central-Station System.

A well-attended meeting of the Commonwealth Edison Branch (Chicago) of the National Electric Light Association was held on Dec. 6, being the first since the annual election. Mr. E. F. Smith, the new chairman, presided, and in an introductory speech made brief reference to the work of the coming year. Mr. Smith and his colleagues give evidence already that they propose to take up this task in earnest. The committees for the year 1910-1911 were announced by Mr. Smith, the chairmen being as follows: Membership, Mr. P. Junkersfeld; finance, Mr. William A. Fox; publications, Mr. E. A. Edkins; papers, Mr. R. F. Schuchardt; entertainment, Mr. H. L. Gannett; program, Mr. E. F. Smith. Mr. Smith also announced that 130 new members had been elected since the annual meeting of last month, making the present number of members of the branch 615.

Two short and interesting papers were presented. They both related to "The Purchase, Transportation, Storage and Use of Fuel." Mr. Smith announced that the speakers would be Mr Charles A. Lind, fuel agent, and Mr. Alex. D. Bailey, assistant cheif engineer at the Fisk and Quarry Street stations. He dubbed these gentlemen the "coal-dust twins," and as he spoke an amusing colored cartoon was flashed on the screen representing Messrs. Lind and Bailey as the "twins" aforesaid.

Mr. Lind was the first speaker and he gave an account of the manner in which the fuel department of the Commonwealth Edison Company buys its coal and stores it. The company is unloading about eighty-five carloads of coal a day at the present time, and each car contains on an average 40 tons of coal. Coal salesmen are made welcome at the office of the fuel department and pleasant relations with the mine operators and their representatives are cultivated.

The plan ordinarily is to have seven days' supply of coal for the stations of the company on hand or in transit in cars. This is in addition to the reserve supply in storage. Mr. Lind displayed pictures showing the processes of mining soft coal and the journey from the mines to, say, the Fisk Street station of the company in Chicago. Ordinarily the coal used is nearly all screenings and is obtained from mines in Illinois and Indiana

The reserve coal held in storage, however, is of the lump or nut sizes, because screenings are more liable to spontaneous combustion. Careful tests are made of the coal as received and these results are tabulated and form a valuable guide in the purchasing of future supplies.

For precaution against interruption of supply from any cause about 180,000 tons of coal is carried in outside coal storage. This amounts to about two months' supply. The daily consumption of the company during the heavy-demand winter months is about 3400 tons of coal daily. It is interesting to note that in 1900 the annual consumption of coal by the Commonwealth Edison Company was 132,000 tons, whereas in 1910 it will amount to about 900,000 tons.

Mr. Bailey described the manner in which the coal and ashes are handled at the Fisk and Quarry Street stations. His paper also was illustrated. Ordinarily, he said, about 100,000 tons of coal is kept in storage at the two stations. The company has its own railroad tracks and locomotives to shift coal cars and handle the coal outside the station. Pictures were given to show how the coal cars are taken into the train sheds of the generating stations and the manner in which the coal is conveyed from the cars into bins beneath the tracks by means of coal-unloading cranes equipped with grab buckets. Under normal conditions the operation of taking the coal into the train sheds through the coal crushers and transporting it by means of conveyors to overhead bunkers proceeds uninterruptedly, the only need of manual labor being in cleaning out the cars bringing the coal into the train sheds. In severe winter weather, however, the coal as received is sometimes frozen clear through the car and it has to be picked out by laborers.

The coal crushers, conveyors and ash-handling machinery were briefly described. The coal is stored in bunkers over the boilers and is let down into the boiler hoppers as required. The ash which is to be taken away is equivalent to about 20 per cent by weight of the incoming coal. It is interesting to note that the boilers and stokers in the Fisk Street and Quarry Street stations, which are near neighbors, weigh about 8300 tons and that the boilers hold about 2600 tons of water.

There are three ways of controlling the fires in the furnaces: by governing the thickness of the bed of coal on the grate bars, by regulating the speed of the automatic stoker and by manipulating the damper in the uptake. By combining these three methods intelligently the fireman aims to secure the greatest boiler efficiency without producing smoke. About one-half of the station force is employed in handling and utilizing the fuel. Under the most favorable circumstances only about 12 per cent of the energy of the coal is actually utilized in the manufacture of electricity.

An intermission of about ten minutes followed the reading of the two papers before the discussion. During this period the members rose from their seats and strolled about in groups, some gathering around the piano and singing to the music of that instrument and a violin. Later in the evening there was a cornet solo, all the vocal and instrumental selections being by company talent. The intermission afforded a pleasant relief and was much enjoyed.

In the discussion Mr. C. E. McBride remarked that the demurrage on coal cars amounts only to ½ cent per ton on the cost of coal burned. Mr. C. J. Zanke told of the manner of fuel testing and said that about the only loss in the consumption of fuel which cannot be measured exactly is that of boiler radiation. Mr. Bailey remarked that two smoke recorders are used at the Fisk Street station and that they are working out very well in practice. Mr. A. Bement pointed out that the introduction of automatic stokers in power plants has had the effect of increasing the cost of coal screenings, which were very cheap a number of years ago, but are now much higher in price owing to the demand for them caused by the use of mechanical stokers. The Commonwealth Edison Company, he said, has probably done more to solve the fuel problem and the scientific utilization of fuel by practical methods than any other concern in the entire world. This record is due largely to one man, Mr. W. L. Abbott, the chief operating engineer of the company The company was also the first, perhaps, to make an exhaustive study of practical methods of smokeless combustion.

Mr. Abbott was, of course, called upon next, and his first remark was to inform his hearers that Mr. Bement's flattering reference to him was all the result of a prearranged plan. In the course of his remarks Mr. Abbott recalled the time when crude oil was burned in the Harrison Street station of the company, and related how it was discovered that money could be saved by burning coal. He agreed with one of the preceding speakers in the statement that the inaccessibility of coal adds very greatly to its cost to consumers. Bituminous coal can be bought in the ground, he said, for ¼ cent a ton. It is the getting out of the coal, the hauling of it and the handling of it which make the cost. The profit to the mine operators is probably less than 5 cents a ton. He noted the interesting fact that the Commonwealth Edison Company burns nearly one-tenth of all the coal consumed in Chicago. There is but one larger consumer, the Illinois Steel Company.

Messrs. E. F. Bracken, A. G. DeClerq, H. G. Kobick, B. E. Strohm, Milton Rich, W. H. Childs, C. H. McClure and others spoke briefly.

New York Commission News.

The Public Service Commission, Second District, has received a petition from the Syracuse Rapid Transit Railway Company asking for approval of an increase of capital stock from $4,000,000 to $5,750,000. The increase is to be preferred stock of the same class and with the same rights and privileges and subject to the same restrictions as the present preferred stock. The company asks for an issue at this time of $1,660,000 to cover outstanding notes, $1,585,000 of which are owned by the New York State Railways. The commission has also received a petition from the New York State Railways for authority to acquire $1,750,000 increased capital stock applied for by the Syracuse Rapid Transit Railway.

The commission has dismissed the complaint of the Islip Electric Light Company as to alleged unlawful stringing of wires of the Sayville Electric Company in East Islip, Suffolk County, it appearing that the Sayville Company is entirely within its legal rights in supplying electricity to any part of that town under the terms of the franchise which it has received.

The commission will give hearings this week on the application of the Utica Gas & Electric Company for authority to issue $500,000 par value of its $5,000,000 refunding and extension mortgage 5 per cent fifty-year gold bonds; on the petition of the Owego Light & Power Company for consent to mortgage its property and issue bonds; on the application of the Bolton Light & Power Company for an order authorizing the issuance of stock and bonds and the right to exercise rights and privileges granted in its franchises; on the application of the Geneva-Seneca Electric Company and the Wayne County Gas & Electric Company for permission to consolidate under a new company to be known as the Western New York Gas & Electric Company, and as to the issuance of mortgage bonds and capital stock and as to the exchange of the new stock and bonds for old stock and bonds.

Permission has been granted to the Dunkirk Power & Heating Company and the Dunkirk Distribution Company to consolidate into one corporation to be known under the name of the Dunkirk Power & Heating Company. The outstanding stock of the Dunkirk Distribution Company is to be convertible into the capital stock of the new corporation share for share, and the existing capital stock of the Dunkirk Power & Heating Company is to be exchanged at the rate of one share of the new corporation for five and three-quarter shares of the Dunkirk Power & Heating Company. The new corporation may issue capital stock to the amount of $3,000 to pay for actual improve-

ments and extensions of its distributing system. The Dunkirk Distribution Company has been authorized to issue its capital stock of the par value of $9,200 for the purpose of acquiring certain works and property from the Dunkirk Power & Heating Company and authorized to exercise a certain lease of part of a franchise granted by that city to A. W. Cummings for the service of electricity in that city. The Dunkirk Power & Heating Company has been granted permission to transfer to the Dunkirk Electrical Manufacturing Company certain property for the sum of $45,789 and the Dunkirk Power & Heating Company has been authorized to transfer to the Dunkirk Distribution Company certain property upon the payment of the sum of $9,159.

Members of a committee of Webster Grange, No. 436, of Webster, N. Y., have appealed to the commission as to alleged violation of contracts which the New York Telephone Company had entered into with residents of that place. One of the matters agreed upon was the limiting of party lines to seven subscribers; complainants now state most of the lines have far in excess of that number of telephones on them. They also state that the company has broken its contract by charging $1.25 per party, when the understanding was that the service would cost but $1 for each telephone. Objection is also raised to a 10-cent toll to Rochester, while nearby towns enjoy a 5-cent rate into that city. The complaint has been served upon the company and an answer will be filed within the following ten days.

The commission has received the petition of the New York Telephone Company asking for approval of the transfer to it of the franchises of the Empire State Telephone & Telegraph Company. The latter company is now operating a public telephone system in the counties of Wayne, Ontario, Oswego, Yates, Cayuga, Seneca and Cortland, and on April 1, 1909, it conveyed all of its property, rights, privileges and franchises to the Central New York Telephone & Telegraph Company, which latter company has been merged into the New York Telephone Company. The capital stock of the Empire Company is $200,000, which the New York Telephone Company now owns.

A complaint has been received from Mayor Duryee, of Schenectady, asking for an investigation as to the rates of fare charged by the Schenectady Railway Company in that city. It is claimed that the company's rates are unjust and unreasonable. Prior to March 1, 1909, the company sold six tickets for 25 cents, good for transportation to any point within the 5-cent fare limit. This was withdrawn and 5 cents for each ride charged after that date. Mayor Duryee states that he believes the Schenectady Railway Company can afford to sell six tickets for a quarter, as it did prior to March 1, 1909.

A petition has been received from the Bolton Light & Power Company, of Bolton, Warren County, asking for approval of the issuance of $12,500 common capital stock and ten-year 6 per cent mortgage bonds to the amount of $10,000 secured by a mortgage upon all of its property in the village of Bolton Landing, Warren County. The company has received the franchise for the lighting of streets in that village and asks the commission's consent to exercise that franchise. It intends to furnish electricity for commercial purposes to manufactories in Caldwell and in the adjacent village of Hill View. It will also furnish energy to residents of this locality. The territory in question is not at present supplied with either gas or electric light.

The Owego Light & Power Company, of Owego, Tioga County, N. Y., has requested permission to issue its bonds secured by a mortgage on its property to the amount of $40,000. The proceeds of the bonds are to be used to retire existing bonded indebtedness of the company which has been incurred in the extension of its plant and distributing system and to cover cost of future improvements. The company asks for a present authorization of $32,000, and the remaining issue of $8,000 is to be held in the treasury subject to the further order of the commission.

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission has approved the issue by the Worcester Electric Light Company of additional capital stock of the par value of $200,000, the proceeds to be devoted to the construction of a new power plant and modifications of the distributing system. The board approves the issuance of the stock at the price of $200 per share, as determined by the directors.

Mayor Logan, of Worcester, has addressed a petition to the commission asking for a public hearing on the price of street lights furnished by the Worcester Electric Light Company. The petition states that the company refuses to sell electricity for this purpose at less than $86.25 per arc lamp per year and contends that the price is excessive.

The Railroad Commission has transmitted to the Bank Commissioner of Massachusetts the names of the following street railway companies whose bonds are legal investment for savings banks, as a result of their having paid at least 5 per cent dividends for the past five years: Boston Elevated Railway Company, Boston & Northern Street Railway Company, Boston & Revere Electric Street Railway Company, Citizens' Electric Street Railway Company (of Newburyport), Dartmouth & Westport Street Railway Company, East Middlesex Street Railway Company, Fitchburg & Leominster Street Railway Company, Holyoke Street Railway Company, Springfield Street Railway Company, Union Street Railway Company (New Bedford), West End Street Railway Company and Worcester Consolidated Street Railway Company.

The various public utility commissions in Massachusetts are now putting the last touches on a number of special reports which are required to be submitted to the Legislature of 1911 during January in connection with railroad, electric railway and power questions likely to be acted upon during the next session. The Gas and Electric Light Commission will submit a report dealing with the laws and conditions affecting the transmission of electricity in bulk and in particular with the question of granting the right of eminent domain to electric transmission companies. The joint board, consisting of the Railroad, Boston Transit, Harbor & Land, and Metropolitan Park Commissions, will submit a report on the electrification of railroads within the Boston district and will include a draft of a bill providing for electrification within a specified time. The same board will also report upon the advisability of constructing a tunnel between the North and South stations in Boston with electrical operation and will include a discussion of the desirable terms of construction and ownership. The Railroad and Boston Transit Commissions will submit a report upon the desirability and cost of a subway from Park Street to the South Station in Boston and will also file a report on the proposed plans for subway construction in the West End. A further report is required on proposed subway construction in the Dorchester and South Boston districts. Still another report will deal with the important question of permitting the Boston Elevated Railway Company to acquire control of other street railways, to form a unified operating system throughout eastern Massachusetts. Finally, the railroad board will report upon the advisability of requiring street railways to receive the cars of other companies. It is expected that the 1911 legislative session will be one of the most active in many years from the electric transportation point of view.

The Boston Elevated Railway Company has filed a brief with the Massachusetts Railroad Commission protesting against the establishment of any stations in the so-called Riverbank subway, which is shortly to be built between the Park Street district of Boston and the Charlesgate district via Beacon Hill and the Charles River embankment. The Boston Transit Commission, which is to build the subway, recently located stations on its plans at Massachusetts Avenue, Dartmouth Street and Charles Street. The company points out that in addition to the delay to rapid transit caused by these stations the additional yearly cost to the company would be $6,297 for lighting

and heating, $16,302 for extra motive power and $17,387 for additional labor on the cars. The company contends that the principle of giving rapid transit to outlying districts of the city should not be sacrificed by the establishment of these stations.

Wisconsin Commission News.

As a result of an investigation on its own initiative into the reasonableness of the rates, rules, regulations and service of the La Crosse & Onalaska Street Railway Company, the commission has found the service unreasonably inadequate. Thirty days' time has been given the company in which to discontinue the operation of the car that it now has in service and substitute therefor a car of sufficient carrying capacity and provided with such appliances as will render it comfortable to passengers. This order is supplementary to the larger decision, involving the question of fares, now pending before the commission.

The hearing was held in La Crosse on November 1. It appears from the testimony that the Onalaska line is a part of, and is tributary to, the general system of the La Crosse Street Railway Company. The line is about two miles in length and connects the La Crosse city railway system with the village of Onalaska. One car is operated on this line under a thirty-minute headway, and a considerable number of people find it necessary to use the service daily. The testimony showed that the car now in service is of an obsolete type with open vestibules and seats running lengthwise. It is not weather-tight and is very poorly heated. The section of the country through which the line extends is open and unprotected from storms and wind, which, under the present conditions, makes the comfort of the passengers during inclement weather entirely out of the question. The commission considered that the car in present use had reached the end of its serviceable life; that the public is entitled to better accommodation than the car in question affords, and that consequently the company is not furnishing "the reasonably adequate service" required by the public utilities law.

There was also some complaint at the hearing of the absence of shelter in Onalaska for passengers waiting to take the car for La Crosse. It appears that the terminus of the line at Onalaska is near the station of the C. & N. W. Railway, which is available to the street railway's patrons, and while stations or stopping points along the line would be a convenience to the traveling public, the commission did not consider that the traffic was sufficient to justify the investment.

In the matter of the application of the Bloomer electric light plant for authority to increase its rates the commission has withheld its decision pending action on the part of the applicant toward permanently bettering the service conditions in Bloomer. The generating station for power supplied consumers in Bloomer is located about seven miles distant and about half way between Bloomer and Chippewa Falls. The plant is now operated by water-power and the energy transmitted at 6600 volts pressure. It appears from the commission's inspection that the power at present available for the plant is not sufficient to give consistent service, and that the plant is unable to take on any new load or even to carry the present load successfully. It appears also that certain residences and business houses are wired for electric service, but have been denied such service, and that the installation of additional street lamps has been refused because of inadequate power facilities. The service actually given does not meet the requirements as to voltage regulation.

The commission considered it impossible to furnish adequate service under present conditions, and that it is absolutely necessary to secure additional power. To correct the inadequate service conditions and to provide for future growth two plans were recommended by the commission. One was to repair and change the present water-power equipment and to install a gasoline engine auxiliary, the other to purchase power from the Chippewa Valley Railway, Light & Power Company at its switchboard in Chippewa Falls. The second proposition would necessitate the complete abandonment of the existing generating station and the construction of an eight-mile transmission line from the present plant to the City of Chippewa Falls. The commission discussed both plans quite fully and pointed out the fact that the annual fixed charge would be about the same under either plan; also that the rate given by the Chippewa Falls company is dependent upon the load factor, and that with good service and sufficient power, a day service could be given and a motor load taken on which would improve the load factor and decrease the rate demanded by the Chippewa Falls company.

In conclusion the statement is made that "steps must be taken by the plant in the immediate future to bring the service conditions up to the standards required in the State, and that, further, the plant is urged to arrive at some decision in the matter and take active measures as soon as possible."

Upon request of the Municipal Electric Light Plant of Cashton, the commission has made an investigation of its present rate schedule and has reported its recommendations. As this plant was but recently purchased by the municipality from the Cashton Light & Power Company, under the option granted by the public utilities law, and has, since its acquisition, been radically changed and extended, no complete yearly data on output or cost of operation were available. As the number of consumers in each class was known, the probable output for the year was estimated from the following table, which represents the average conditions existing in the smaller electric plants of the State, as shown by their annual reports to the commission:

Class	Average Daily Hours Use of Installation. Hrs.	Min.	Annual Kw-Hrs per Consumer.
Residences		[illegible]	185
Offices	1		230
[illegible]	1	50	682
[illegible]	1	[illegible]	682
[illegible]	3	45	945
Hotels	2		1,970
[illegible]		42	394
[illegible]		28	423
Churches		28	423

The value of the plant and its operating expenses were estimated from the data at hand and from comparisons made with similar plants under similar circumstances.

When the expenses were distributed over the different classes of service on the basis of current consumption and demand, the unit cost of the commercial lighting service was found to vary about as follows: 15.2 cents for one hour's operation daily of active connected load; 10.7 cents for two hours' operation; 8 cents for five hours' operation, etc.

A schedule of flat rates is now in force, with a minimum charge of $1 per month and a meter rental of 25 cents per month. It was estimated that with this schedule of rates the yearly revenue would not be enough to cover the operating expenses when the items of depreciation and interest are included.

The commission suggested that the charge for meter rental be abolished, as it is included in the minimum charge, and that a rate for commercial lighting be offered as follows: 12 cents per kw-hour for all current used in the first thirty hours' daily use per month of the active connected load, and 9 cents for all current used in excess of thirty hours' daily use of the active connected load per month.

The active connected load is to be considered as 50 per cent of the full connected load for residences and 100 per cent for all others.

Maryland Commission News.

The Chesapeake & Potomac Telephone Company has been requested by the Public Service Commission to send to that body two detailed statements—one of the property owned by the corporation in Baltimore, the other of the property owned by it in the State of Maryland. The request is the beginning of an investigation that the commission will make with a view of determining whether the company shall or shall not be permitted to put into force its new schedule of rates, which abolishes unlimited service. The commission asks that in each case the book values of the several items, together with the actual values of the said items as estimated by the company, be set down in parallel columns. The segregation report called for applies, of course, only to the property within Baltimore and within Maryland and is as follows: 1. All land and buildings owned by the company. 2. The exchanges and equipment. 3. Subscribers' equipment (including service wires). 4. Underground conduits. 5. Lines and distributing poles. 6. Underground cables (including terminals). 7. Block distribution system. 8. Aerial cables (including terminals). 9. Aerial wires: (a) copper, (b) iron. 10. Stores on hand. 11. Teams. 12. Tools. 13. Miscellaneous. 14. Furniture and fixtures. 15. Supplies on hand.

The commission has been asked for advice by the promoters of the Hagerstown & Clearspring Railway Company, which has been incorporated with a capitalization of $15,000, divided into 300 fifty-dollar shares, in order to build an electric railway to carry passengers, freight, express and baggage from Hagerstown to Clearspring, a distance of twelve miles. It is proposed to build the road ultimately to Mercersburg. The incorporators are: Major L. N. Downs, of New York; Hugh L. Kirby, of Harper's Ferry; Alexander R. Hagner, Robert H. McCauley and James B. Kreps, of Hagerstown, who, with the exception of Mr. McCauley, will be the first year's directors, with the addition of Oscar D. Bower, of Hagerstown. The Public Utilities Commission, it is reported, recommended that the company's present charter be canceled and a new charter, with a capitalization of $250,000, be procured. The promoters expect to apply for the new charter, which will provide for the issuing of 5000 shares at $50 each. The promoters were also before the Good Roads Commissioners with a view of obtaining the right to use the Hagerstown and Conococheague turnpike on which to lay their tracks. It is understood the commission will grant the use of one side of the turnpike for the trolley. The Mayor and Council have under advisement the draft of a franchise which the company wishes granted and which will give it permission to lay its tracks into Hagerstown over West Franklin Street.

Canadian Hydroelectric Commission News.

Arrangements have been completed whereby the Hydroelectric Commission will supply the towns of Midland and Penetanguishene with 1500 hp through the medium of the Simcoe Power Company, whose plant is located at the Big Chute near the Georgian Bay. The Simcoe Company now has a line running into Midland, and is willing to extend to Penetanguishene on terms and conditions similar to those under which energy is supplied to the commission at the present time by the Ontario Power Company.

The price has not yet been settled, but under the existing system of granting leases to power companies the Hydroelectric Commission has the right to fix the prices at which energy shall be sold and it is understood that the rates in the present case will not be very reasonable.

The Village Council of Weston (Ont.) is endeavoring to prevent the Toronto Suburban Railway Company from selling energy for lighting and other purposes in the village. The Council has contracted with the Hydroelectric Commission for a supply of energy and expects to supply energy to consumers in a short time. It is claimed by the Council that the company has no right whatever as a distributor of energy in the village, while, on the other hand, the company affirms that it has an exclusive franchise and proposes to exercise it. The village solicitors have been instructed to take out an injunction against the company.

Thirty-five representatives of municipalities from Napanee to Morrisburg interested in securing energy from the Hydroelectric Commission met at Brockville, Ont., on Dec. 14. The meeting was called at the suggestion of the commission to get the municipalities united so that cheaper quotations may be made than have been heretofore furnished the towns east of Belleville.

A resolution was passed that the representatives of the different municipalities present should agree to form a union for the purpose of asking the Hydroelectric Commission to give figures for a supply of electrical energy to the municipalities and others who may come in. A resolution was also passed asking the commission for prices for the following places, two rates to be given in case 50 per cent more is required than asked: Napanee, 200 hp; Kingston, 1200 hp; Lansdowne, 100 hp; Lynn, 150 hp; Brockville, 1000 hp; Prescott, 500 hp; Cardinal, 100 hp; Morrisburg, 2000 hp; Athens, 75 hp; a total of 5325 hp.

AMERICAN ELECTRICAL ENGINEERS—XXIV.

Dr. E. P. Hyde.

Edward Pechin Hyde was born in Baltimore County, Md., Jan. 3, 1879. On his father's side he is of English and French Huguenot descent; his maternal grandfather, William Clemm,

Dr. E. P. Hyde.

was cousin to Edgar Allan Poe and half-brother to Virginia Clemm, the poet's wife. After passing through the Baltimore public primary and grammar schools and high school he entered Johns Hopkins University, from which he was graduated in 1900 with first honors. The same year he entered upon graduate work in physics at Johns Hopkins and in 1901 became Fellow in Physics. In 1902 he was appointed laboratory assistant in the Bureau of Standards, Washington, continuing as

Fellow by Courtesy in Johns Hopkins University until February, 1906, when the degree of Ph.D. was conferred.

In the Bureau of Standards Dr. Hyde became assistant physicist in 1905 and associate physicist in 1907. He organized and had charge of a section of photometry from 1903 to 1908, and while at the bureau was chairman of the committee on standard specifications for the purchases of carbon-filament incandescent lamps, which drew up specifications primarily for use by the government, but which later were adopted extensively throughout the country. In 1906 he visited the national laboratories of England, Germany and France for the purpose of intercomparison of the photometric units of the various countries. Principally as a result of this visit a movement was started looking to the establishment of a common national unit for use in the photometry of both gas and electric lamps and for a common international unit between England, France and the United States. This campaign was carried forward principally by the Bureau of Standards and by the sub-committee on nomenclature and standards of the Illuminating Engineering Society, of which sub-committee Dr. Hyde was secretary. In September, 1908, Dr. Hyde accepted an invitation to organize and become director of a new scientific laboratory for the National Electric Lamp Association, which position he now holds. The object of this laboratory is to promote the development of those branches of science on which lighting depends.

The results of many of Dr. Hyde's scientific and technical investigations are contained in the *Bulletin* of the Bureau of Standards, *Transactions* of the Illuminating Engineering Society, *Proceedings* of the American Physical Society (*Physical Review*), *Journal* of Franklin Institute and in the technical press of this country and England. Among the subjects of his various contributions are the following:

On the Theory of the Matthews and the Russell-Leonard Photometers for the Measurement of Mean Spherical and Mean Hemispherical Intensities.—The Use of White Walls in a Photometric Laboratory.—Talbot's Law as Applied to the Rotating Sectored Disk.—An Efficiency Meter for Electric Incandescent Lamps (in collaboration with H. B. Brooks).—On the Determination of the Mean Horizontal Intensity of Incandescent Lamps by the Rotating Lamp Method (in collaboration with F. E. Cady).—A Comparison of the Unit of Luminous Intensity of the United States with Those of Germany, England and France.—Geometrical Theory of Radiating Surfaces with Discussion of Light Tubes.—An Explanation of the Short Life of Frosted Lamps.—A Comparative Study of Plain and Frosted Lamps (in collaboration with F. E. Cady).—Primary, Secondary and Working Standards of Light.—Photometry at the Bureau of Standards.—Selective Emission of Incandescent Lamps as Determined by New Photometric Methods (in collaboration with F. E. Cady and G. W. Middlekauff).—The Physical Laboratory of the National Electric Lamp Association.—The Relation between Natural Science and the Development of Lighting.—Moore Tube Tests (in collaboration with J. E. Woodwell).—New Photometric Methods of Studying the Radiating Properties of Various Substances.—The Physical Production of Light.—Radiation from Metals.

Dr. Hyde is a member of the American Physical Society and of the American Electrochemical Society; Fellow of the American Association for the Advancement of Science; member of the National Electric Light Association; associate member of the American Institute of Electrical Engineers and member of its educational committee; corresponding member of the London Illuminating Engineering Society; associate member of the American Gas Institute; member and president of the Illuminating Engineering Society and member of its international committee on nomenclature and standards. During his present term of office as president of the Illuminating Engineering Society Dr. Hyde inaugurated the movement for the course of lectures on illuminating engineering given at the Johns Hopkins University in October of this year; he served as chairman of the lecture committee of the society, and delivered two lectures on "The Physical Characteristics of Luminous Sources."

CURRENT NEWS AND NOTES.

Electric Locomotives for Panama Canal.—According to reports from Washington electric locomotives will be used for towing ships through the Panama Canal locks. The locomotives will be gear-connected to the track by a middle rail cut into the form of a rack in order to obtain the requisite tractive effort. The work of installation will be done by the Canal Commission. The equipment will require 831,744 lb. of copper and 721,250 lb. of steel conductor rails.

Indiana Municipal Plant Criticised.—The Indiana State Board of Accounts has, after an examination, severely criticised the municipal plant at Knightstown. The examiners reported that many persons were getting light and water service free of charge; that others were not paying at the established rate, and that the superintendents had failed to collect the total amount due annually for the service by approximately $5,000, thereby causing a deficit in the repair and maintenance fund and leaving the city without a sinking fund upon which to draw for rebuilding a worn-out plant.

Proposed German Law Affecting Foreign Patents.—The German government has introduced a law into the Reichstag which gives power to rescind a patent after three years in the event that the article is manufactured chiefly outside Germany or the colonies. The government memorandum declares that the measure is necessary in order to protect German industry, which is threatened by the patent laws of other countries. A provision of the proposed law makes it possible for the authorities to compel a patentee to license another person to develop his patent should the holder not make use of it himself.

Electric Railway Profit-Sharing Plan Abandoned.—The Columbia Electric Railway Company, of Vancouver, B. C., has just made the last annual payment on its employees' profit-sharing plan put into effect in 1903. At a meeting this year with the company the employees requested a raise in wages in consideration of which the annual bonuses would no longer be paid. The bonus this year was $57.31 to each of more than 1000 employees who have been in the service of the company for six months or more. The first bonus was paid in 1903, the amount being $25; in the following years to date the bonus has been, respectively, $35, $40, $45, $63, $66.78, $58.10 and $57.31 (1910).

Southern Anti-Trust Telephone Cases.—So-called anti-trust cases against the Cumberland Telephone & Telegraph Company are now before the Mississippi Supreme Court at Jackson. The charge is that the telephone company is seeking to cancel its contracts with Independent telephone companies relating to physical connections and long-distance service. It is alleged in the complaint that the form of contract providing long-distance connections to outside companies over the Cumberland lines and prohibiting similar contracts with other companies amounts to a combination in restraint of trade and hence is in violation of the Mississippi anti-trust law. Penalties of several million dollars are involved.

Annual Fire Loss.—In a paper presented before the National Association of Cement Users in New York on Dec. 13, Mr. W. H. Merrill, president of the National Fire Protection Association, stated that the average annual loss by fire in the United States in the past ten years has been more than $200,000,000, and during the past five years it has averaged more than $250,000,000. An average loss for the last five years of $250,000,000 means a loss of about $30,000 for each hour. The annual number of fires in American cities averages forty for each 10,000 of population, as compared to eight to each 10,000 population in European cities. The annual per capita loss in Austria, Denmark, France, Germany, Italy and Switzerland varies from 12 cents in Italy to 49 cents in Germany, with an [illegible] 33 cents. In the United States the average is $2.47

Bavarian Central Stations.—The preliminary results of the government inquiry relative to the number and condition of electrical generating stations in Bavaria show that 1620 are owned by private individuals, 374 belong to limited liability companies, while about 500 are controlled by the government, by municipalities and by co-operative societies. The output of all these stations, including also the installations used only for private purposes, amounts to 275,472 kw. About 47 per cent of the plants are driven by steam, 30 per cent are worked by water-power and steam and 8 per cent are operated by water-power only.

Russian Storage-Battery Car.—According to United States Consul-General John H. Snodgrass the Moscow-Windau-Rybinsk Railway has recently acquired a storage-battery car of Russian make for experimental and demonstrative purposes. The car cost 75,000 rubles ($38,625) and is to develop a speed of from thirty-five to sixty-seven miles per hour. It is divided into first and second class compartments of twenty-three berths and thirty-eight berths respectively. This car is to run on the line between St. Petersburg and Tsarskoye-Selo, and should it give satisfactory service more cars will be installed by the railway company.

Meeting of Boston Edison N. E. L. A. Section.—A special meeting of the Boston Edison Section of the National Electric Light Association was held at the Edison Building, Boston, on Dec. 15 with President R. E. Curtis in the chair. The evening was devoted to a discussion of the paper of Mr. E. G. Reed on "Some Interesting Points About Modern Transformers" and that of the committee on a "Uniform System of Accounting," read before the St. Louis convention of 1910. The first paper was abstracted by Mr. H. W. Stevens and discussed by Messrs. T. E. Penard, S. R. Keyes, L. L. Elden and James Vahey. The accounting report was abstracted by Mr. C. H. Crockett and discussed by Messrs. F. E. Stevens, J. C. Redmond and W. F. Stevens. About forty members were in attendance.

German Railless Trolley System.—During the past two months two railless overhead trolley systems of street cars have been built in Bremen, Germany, for connecting the outlying districts with the street-car lines of the city. The two overhead wires are 20 cm (50 in.) apart, one above the other. The current collector consists of two contact rollers, which slide on the upper wire, and two bent sliding hoops, which are pressed from underneath against the lower wire. In order to protect the wires against any jerking which might be caused by the swaying of the car the cable loop is a knee pipe the sides of which are pressed together by means of a spring. The loop gives a leeway of 2 m (6.5 ft.), while for a larger leeway the wires uncoil from a drum inside the car and the drum automatically winds them up again at the least slackening.

Independent Telephone Connections for Chicago.—Mr. Adam S. Clow has issued a circular in which he says that the lines of the Interstate Independent Telephone & Telegraph Company reach the limits of the City of Chicago at Forty-sixth Avenue and West Twenty-second Street. He says that a connection at that point with the automatic telephone system of the Illinois Tunnel Company could be arranged easily and that this connection would be of great importance to the commercial interests of Chicago, enabling them to reach the Independent telephone users in the Central West. Both the Illinois Tunnel Company and the Interstate company are in the hands of receivers. Mr. Clow says that he was a director of the latter company for many years, and that shortly before the appointment of the receivers he was elected secretary. He says that the Interstate company has over 10,000 bona-fide subscribers in Kane, DuPage and Will Counties in northern Illinois. He appeals to commercial organizations and telephone users generally to exert their influence with the receivers of these two companies to the end that the desired connection may be made.

Production of Artificial Graphite.—According to a recent announcement of the United States Geological Survey the production of graphite artificially by electricity at Niagara Falls in 1908 was 7,385,511 lb., valued at $502,667, the average price being 6.8 cents per pound, as compared with 6,590,000 lb., valued at $481,239, the average price being 7.3 cents per pound, in 1907; with 5,074,757 lb., valued at $337,204, the average price being 6.6 cents per pound, in 1906; with 4,591,550 lb., valued at $313,-980, the average price being 6.8 cents per pound, in 1905; and with 3,248,000 lb., valued at $217,790, the average price being 6.7 cents per pound, in 1904. In 1905 the total production for the world was 118,938 tons, valued at $3,165,439; in 1906 the production was 128,793 tons, valued at $4,315,965, while in 1907 the production was 143,930 tons, valued at $3,797,142. Ceylon produced 36,406 tons in 1907, valued at $2,889,596.

Lewis Institute Registration.—Lewis Institute, of Chicago, has for the present quarter the largest registration in the history of the institute, the total being 2700, counting both day and evening students. In the evening classes there are 1100 men registered, of whom 285 are taking the course in engineering principles and 160 in electrical engineering. There are 550 men and boys in attendance in the day school, most of whom are taking engineering or studying in preparation for engineering. There are twenty-one candidates for the degree in mechanical engineering. On Dec. 16 the first class to complete the two-year co-operative course for machine-shop apprentices will leave the institute. There are twenty of these boys who plan to enter the evening classes in January in order to continue their studies. The boys passed their time alternately between the institute and the machine shops, changing about every week.

Publication of Edison Life Resumed.—The Edison Electric Illuminating Company of Boston has resumed the publication of *Edison Life*, a small magazine devoted to the business and social interests of the organization. It is planned to publish the paper quarterly hereafter instead of monthly, as previously. The first issue contains a large amount of company news, including a readable article on the new portable house of Edison light recently opened by the company in Winchester, which was constructed in sections and opened on Dec. 12, completely equipped electrically from the doorbell to a domestic motor-driven refrigerating plant in the basement beneath the pantry. The paper will be printed under the direction of Messrs. R. S. Hale, C. H. Crockett and C. H. Hodskinson, committee on publication, and will probably be restricted to the Edison organization. Mr. L. D. Gibbs, superintendent of advertising, is editor.

Municipal Lighting Troubles at Wakefield, Mass.—On account of the limited capacity of the local municipal electric lighting plant at Wakefield, Mass., many complaints of the service have been aired by the public during the past month. Interruptions have occurred at annoying intervals and the progress of Christmas shopping has been seriously impeded. A recent interruption left the center of the town in darkness for forty-five minutes at the height of the shopping period, and several large factories were obliged to shut down. The lighting commissioners state that it will shortly be necessary for the town to expend anywhere from $25,000 to $75,000 for new machinery. Efforts are being made to tide over the Christmas demand, but there is a feeling in the town that a serious mistake was made two years ago when the citizens voted to retain the municipal electric plant instead of purchasing electricity from a long-established and well-managed central-station company in an adjacent municipality.

A Correction.—In the *Electrical World* of Dec. 15, page 1421, the statement was made that the electric motor equipment of the Nyanba Mills, Woonsocket, R. I., was supplied by the Westinghouse Electric & Manufacturing Company. This was incorrect, the manufacturer of the motors being the General Electric Company.

The Electric Furnaces in Norway.—At Tinnfoss, Norway, a small electric furnace for melting iron ore was installed about eight months ago. The results obtained have been so satisfactory that the company has recently decided to increase the plant to a capacity of 10,000 hp, or possibly 15,000 hp, which is now available at the Tinnfoss waterfalls.

Marine Producer Gas Installation.—In a paper presented at the recent annual meeting of the Society of Naval Architects and Marine Engineers Mr. Charles B. Page described two successful gas-producer gas-engine plants for marine propulsion, one of 50 hp and the other of 75 hp. Owing to shipboard conditions no water-vaporizer was used with either plant and the entire arrangement had to be such that there was absolutely no escape of gas into the machinery compartment. Notwithstanding the special nature of the equipment, an economy trial showed a consumption of only 1.13 lb. of coal per indicated horse-power. The producer will begin to furnish gas thirty minutes after starting a new fire, and the fire can be kept for months at a time and the engine started on ten or fifteen minutes' notice.

Steam Turbine vs. Reciprocating Engines.—In a paper presented at the annual meeting of the Society of Naval Architects and Marine Engineers Mr. Clinton H. Crane gave the comparative results in steam and coal consumption with turbines, reciprocating engines and a combination of the two. A triple-screw, 1300-ton steam yacht had been fitted with steam turbines which, on trial, failed to fill the guarantee of the makers as to economy, and it was decided to substitute a triple-expansion engine for the middle-screw turbine, the engine to exhaust into the remaining turbines. With the three turbines 34 tons of coal were required to produce thirteen knots over the trial course. With the triple-expansion engine alone this consumption was reduced to 25 tons and to 22.7 tons with the combination of engine and two exhaust turbines.

Meeting of New England Section I. E. S.—The regular monthly meeting of the New England section of the Illuminating Engineering Society was held at the Edison Building, Boston, on Dec. 12, with Mr. C. O. Baker in the chair. An illustrated talk on the "Evolution of the Arc Lamp" was given by Mr. C. A. B. Halvorsen, of the General Electric Company, West Lynn, Mass. The talk was accompanied by the exhibition of a large number of lantern slides, showing in photographic and diagram form the progress of arc lighting from the experiments of Sir Humphry Davy in 1810 to the latest developments in magnetite, flaming and intensified lamps. By means of a number of shielding tanks, reflectors and mirrors the speaker threw the images of various types of arcs in actual operation on the screen and the features of the luminous stream between electrodes, the shape of craters, luminosity and other characteristics of various electrodes were shown in magnified form with full details of coloring.

Wisconsin Electrical Association.—The annual convention of the Wisconsin Electrical Association will be held in the Hotel Pfister, in Milwaukee, on Jan. 18 and 19. President Clement C. Smith announces the following subjects for discussion: "Publicity Campaigns," with paper by Mr. Ernest Gonzenbach, of Sheboygan; "Some Principles Established by the Wisconsin Railroad Commission," with address by Mr. Edwin S. Mack, counsel for some of the member companies of the association; "Electric Meter Testing," with a paper by Mr. A. J. Goedjen, of the Milwaukee Electric Railway & Light Company; "Ornamental Street Lighting" (author of paper or leader of discussion not yet assigned); "Insurance," with discussion on rates and risks; "Electric Railway Repair Shop Practice," with paper by Mr. W. J. Kelsh, of the Eastern Wisconsin Railway & Light Company; "Transformers and Their Proper Arrangement," and "Storeroom and Store Records." The last two subjects have not been assigned, and Mr. Smith asks the opinion of members in relation to them, and, indeed, in relation to the entire program.

Chicago Commonwealth Edison N. E. L. A. Branch.—The large and active Commonwealth Edison Branch of the National Electric Light Association in Chicago has a committee on papers which has prepared a general plan for the season's meetings that is worthy of attention. The committee emphasizes the importance of papers bearing directly on some phase of the work of the Commonwealth Edison Company rather than papers dealing with the general development of the art. A comprehensive plan is in contemplation with papers to be presented at different meetings and devoted to illustrated descriptions of the company's different departments followed through, if practicable, in a regular sequence. Thus, the first meeting in December was a fuel meeting. There was an interesting description of the mining, transportation and handling of the coal used by the company. This is to be followed, if the plan is carried out, by similar descriptions of generating stations, the transmission of energy, substations, conversion and distribution, and the selling, billing and statistical branches, etc. There may also be extra meetings, such as that of Dec. 20, when Mr. D. W. Roper read a paper on "Testing and Repairing the Underground Transmission Lines." At the completion of the series everyone who has attended the meetings should have a good understanding of the operation of the company's business as a whole. Mr. R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company, is the chairman of the committee on papers

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Special Technical Libraries.—At the recent convention of the Illinois Library Association Miss Louise B. Krause, librarian for H. M. Byllesby & Company, Chicago, read a paper on special libraries—that is, special private libraries established by large commercial, industrial or financial concerns for the benefit of their employees and in charge of a professional librarian. Such libraries are those of Stone & Webster, the Arthur D. Little Company and Fiske & Robinson in the East, and those of the Commonwealth Edison Company and H. M. Byllesby & Company in Chicago and the Studebaker Brothers Manufacturing Company, of South Bend, Ind. These special libraries are divided by Miss Krause into two classes—first, what may be termed welfare libraries, maintained by firms for the betterment of their employees, supplying literature for general culture and recreation, and, second, strictly technical libraries. The library of H. M. Byllesby & Company belongs to the latter class, while that of the Commonwealth company, of which Miss A. B. Fraser is librarian, may be classified under both headings. In the technical special library the librarian has numerous other duties besides being in charge of the books. Photographs of plants during construction and when completed are carefully preserved and filed; also maps and manuscript data in the form of letters, reports and special examinations on engineering and operating subjects vital to the company's business. The librarian is often asked for information on a specific subject and it is his duty to get it quickly and accurately. The information need not necessarily be obtained from the special private library, but the librarian is expected to keep in touch with all the other library facilities of the city so that any information desired may be obtained from some source.

LOW-HEAD HYDROELECTRIC DEVELOPMENT.

The New 10,000-kw Power Station of Chippewa Railway, Light and Power Company at Cedar Falls.

THE Chippewa Railway, Light & Power Company, which furnishes electric service in Eau Claire, Chippewa Falls and Menomonie, Wis., and in Red Wing, Minn., has just completed the construction of a 10,000-kw development of a 50-ft. head in the Red Cedar River, six miles north of Menomonie, the first 2500-kw unit of which was recently put into operation. The New Cedar Falls plant will operate in parallel with the 1200-kw water-power plant of the company at Menomonie, with its 710-kw water-power plant and 300-kw steam-relay station at Eau Claire, twenty-five miles east, and with its 1000-hp water-power station at Chippewa Falls, ten miles north of Eau Claire. All of these plants are connected by a 33,000-volt transmission system, which is extended forty miles southwest of Menomonie and across the Mississippi River to furnish electric lighting for the town of Red Wing, Minn. Besides its lighting business in the cities mentioned the lines of the company supply energy to a large connected motor load at Eau Claire and also operate the electric railway systems at Eau Claire and Chippewa Falls.

The Red Cedar River, on which the Chippewa Valley Electric Company owns two other water-power sites of 22-ft. and 40-ft. heads respectively, besides the developed powers at Cedar Falls and Menomonie, provides the drainage of a large watershed area of interior Wisconsin, the flow from which is conserved and controlled by a system of thirteen lakes, whose gates and dams are all owned and operated by the Chippewa Valley company. This system of lakes providing season storage extends about eighty miles above Cedar Falls and has an available containing capacity of about 6,000,000 cu. ft. of water. The Red Cedar River itself exhibits an unusually uniform flow throughout the year, ranging from its minimum flow of 1500 cu. ft. per second up to floods of 7500 cu. ft., which is the highest discharge figure recorded during recent years. The 50-ft. reinforced-concrete dam erected at Cedar Falls backs up the water for a number of miles above, creating a pond having an area of 7 sq. miles. The upper level elevation is 871.3 ft. at the crest of the dam, without flashboards, and the tail-water elevation is 823.3 ft. above sea level.

The Cedar Falls dam is a reinforced-concrete structure of the Ambursen type, in which the structural design of the hollow cell walls provides greater strength than a solid dam of the same dimensions and is held against overturning by the weight of the water itself. The dam is 502 ft. long, locking into the solid sandstone ledge on each side of the deep channel which the river has worn for itself at this point. It is built up of twenty-eight bays, each approximately 18 ft. wide.

The power-house bulkhead wall with its five machine bays is carried on the easternmost six buttresses, and at the interval of a single protecting bay begins the 252-ft. spillway, with three end-pier bays closing into the western ledge. The spillway section is carried on nineteen reinforced-concrete buttresses, each 3 ft. in thickness at the base and tapering to 14 in. thick at the crest slab. The base of the dam formed by the footings of these buttresses averages 80 ft. wide. The upstream deck of the dam, which is supported at a 45-deg. angle to resist overturning of the structure, is made up of reinforced-concrete slabs 30 in. thick at the bottom and 12 in. thick at the top, so supported as to allow for expansion and contraction of the decks due to temperature changes. The spillway surface is constructed with a reverse curve to discharge the overflow water without impact onto the tail-race below. The four spillway bays nearest the power house are constructed with sluice gates discharging from the bottom of the forebay through 7-ft. x 14-ft. openings controlled by hand-operated gates manipulated from within the dam chambers. Fig. 3 shows a section of the spillway at one of the sluice gate bays illustrating the characteristic sections of the concrete decks and the position of the openings and passageways through the buttresses, which are connected by bridges, so that one can walk from end to end through the dam. In the sluice-gate sections stairways are provided for access to the hand-screw gate-operating mechanisms. The crest of the spillway is arranged for the erection of flashboards for raising the level in the pond 2 ft These flashboards will be of the self-leveling type, lowering automatically when the flow of water over their crests exceeds 1 ft. in height.

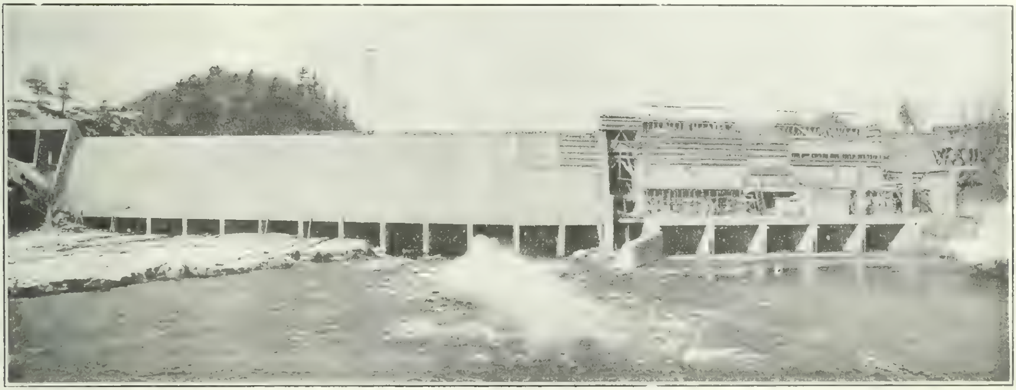


Fig. 1—Cedar Falls Dam and Power House (Unfinished).

The power-house is a molded concrete structure 138 ft. x 55 ft. in floor plan and approximately 35 ft. from the buttresses to the generator-room roof. The four 2500-kw water-wheel-driven alternators will be installed in the 21-ft. bays on the right and left (the first of these units being already in operation), while the two turbine-driven exciter units are mounted in the middle bay. Opening into the power house on the east is the transformer and high-tension structure containing the oil switches, lightning arresters, etc. The arrangement of the power-house apparatus is best shown by the plan view, Fig. 4, in connection with the sectional elevation at the main turbine penstocks, Fig. 6.

The incoming water from the forebay passes through the trash racks and into the rectangular penstocks down to the double-runner Allis-Chalmers water turbines at the main floor level and thence out through the molded draft tubes discharging below the normal water level of the tail-race. These main water-wheels have 52.5-in runners and are capable of deliver-

ing 3600 brake-hp at 48 ft. of hydraulic head. The outer ends of the turbine shaft are carried in oil bearings, both front and rear bearings being accessible for inspection. As is shown by the elevation section, the down-stream bulkhead of the dam structure forms one wall of the turbine chambers, the rear bearings of the runner shafts being reached by a passage beneath the dam deck. The middle [illegible]

Fig. 2—Penstock Rocks and Upstream Face of Cedar Falls Dam.

lignum vitæ. The inclined trash racks protecting the penstocks are also slightly unusual in design to enable either half panel to be pulled up and cleaned without disturbing the other. The racks are formed in two panels, each 11 ft. long and separately arranged to slide in the channels of two pairs of I-beams, like sash in a window frame. The molded curved draft tube is of rectangular cross-section and discharges below the tail-water level without forming eddies. The tail-race has been excavated to a depth and cross-section designed to create only 2-in. rise when discharging the entire exhaust of all four units.

The main generating units are 2300-volt, 60-cycle, three-phase General Electric alternators driven directly from the water-wheel shafts. The first of these machines is now in service and the others will be installed as the demand for the total station rating grows. Three exciter units are provided, two water-wheel-driven and one motor-generator set. The turbine units are 100-kw, 125-volt direct-current generators, running at 600 r.p.m. All of the water turbines are controlled by Allis-Chalmers oil governors.

Adjoining the main generator floor in the high-tension addition to the power house are the closed concrete cells for the main step-up transformers and the oil-switch and generator-bus cells for the 2300-volt circuits. The controlling switchboard is mounted on a gallery between the two inner main penstocks

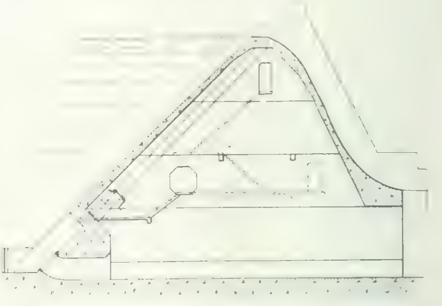


Fig. 3—Cross-Section of Hollow Concrete Dam at Sluice-Gate Bay.

and overlooking both the exciter bay and the generator floor with communicating galleries connecting with the second story of the high-tension structure, on which are installed the high-tension line and tie switches. Over these are the lightning arresters and spark-gaps and the high-tension entries leading to the transmission line.

From the generators 1,500,000-circ. mil cables insulated for 6600 volts are led from junction boxes in the floor, through the basement and up to the 2300-volt buses in the concrete compartments along the west wall of the transformer room. Here they traverse General Electric 2300-volt oil switches and the series transformers and are led between ebony-board barriers to the middle posts of double-throw hook switches, the upper and lower clips of which are connected respectively to the upper and lower separate 2300-volt buses, each of which ex-

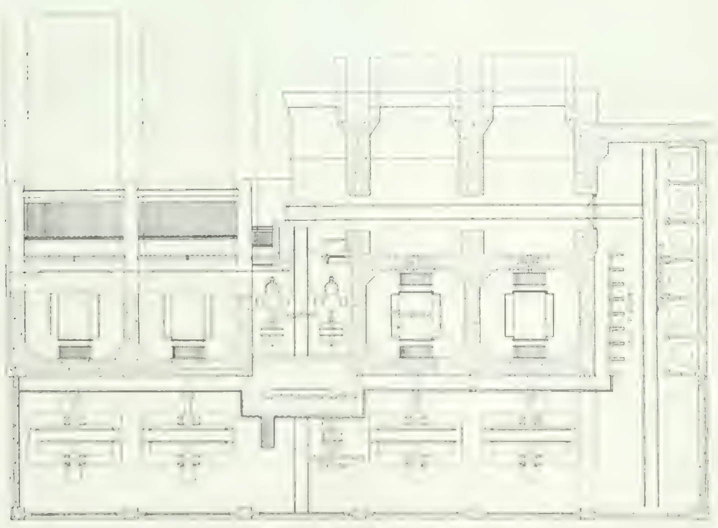


Fig. 1—Plan of Power House

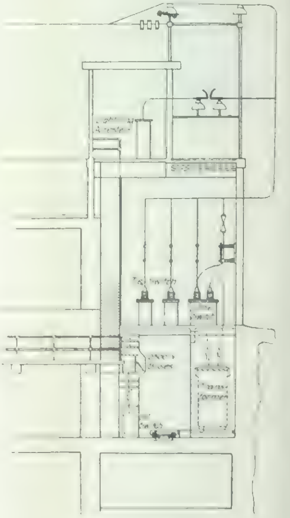


Fig. 5—Cross-Section Through High-Tension Gallery.

tends throughout the station. These duplicate generator buses are built up of two 3-in. x 0.25-in. copper busbars, the lines being separated by ebony-board barriers. For making the curved bends from the middle switch clips to the series-transformer terminals 0.75-in. copper tubing has been employed.

From the 2300-volt buses similar oil switches and double-throw disconnecting switches connect to the primaries of the 2300/33,000-volt, oil-insulated, water-cooled step-up transformers, of which two banks of three 1666-kva units will be installed. These are inclosed in separate concrete compartments with steel doors, and with the cooling-water connections accessible from the passageway outside. The secondary lines from these transformers are led up through the ceiling to the General Electric high-tension line switches, designed, like the transformers, for 60,000-volt operation, the pressure to which the transmission potential will later be raised. A similar solenoid-operated oil switch with high-tension trip is employed for tying the secondary sides of the transformer banks together. From the line switches the outgoing lines are led through high-tension entries in the side wall and up past the spark-gap connections to the electrolytic lightning arresters, to the transmission wires, the first circuit of which is completed on a wooden-pole line into Memomonie. This line is protected by an overhead ground wire.

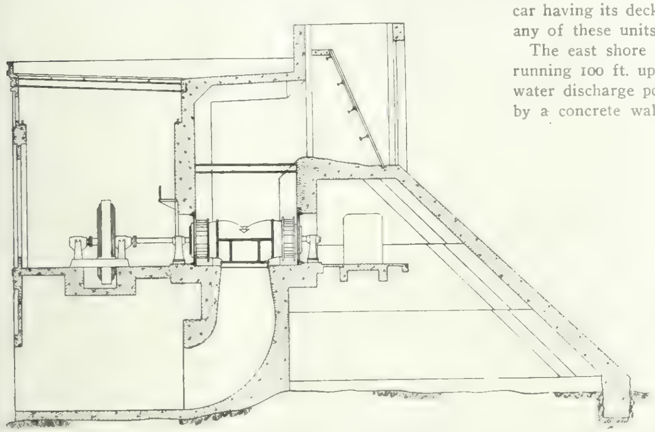


Fig. 6—Sectional Elevation of Power House.

Duplicate exciter buses are provided in the station, only the positive side of the circuits being brought to the switchboard. Special throw-over switches are installed for transferring the generator-field circuits from one exciter bus to the other without interruption. The negative side of the exciter circuits is carried directly to the several machines, switches being mounted on the frames of each for access from the floor.

Besides the four generator and two transformer oil-switch barrier cells in the transformer addition an extra cell is provided at the south end of the row for the station and the town lighting of Cedar Falls, a village of 100 houses near the dam. At the north end is another extra cell designed to contain the remote-operated automatic starting compensator for the motor-generator exciter set. The switchboard on the overhead gallery contains, beside the usual complement of ammeters, voltmeters, etc., on the machine panels, a power-factor meter, synchroscope and Reed-type frequency meter, together with the remote-control contacts for operating the switching apparatus. High-tension ammeters will be inserted directly in the outgoing lines for reading the transmitted currents, the dials of these instruments being legible from the switch gallery.

In the basement of the power house beneath the transformer cells an oil-treating system capable of purifying 850 gal. of oil an hour will be installed. A hydraulic ejector operating on the 50-ft. head available between the head-race and tail-water has also been utilized for the purpose of producing a vacuum line used for cleaning machines in the power house. The generator-room is served by a hand-moved crane with electric hoist; while running oposite the transformer bays and to the turntables connecting with a spur track across the engine-room floor is a 30-in. narrow-gage track on which moves a flat hand-car having its deck at the level of the transformer cells so that any of these units can be transported about the station.

The east shore of the forebay is connected by a river wall running 100 ft. upstream from the power house, and the spill-water discharge pool is protected from the draft-tube tail-race by a concrete wall projecting downstream. Fifteen thousand cubic yards of reinforced concrete was used in the construction of the dam and power house.

The system of the Chippewa Valley Railway, Light & Power Company is unusual among neighboring Wisconsin water-power plants in being able to use hydroelectric energy with a minimum of steam-relay service, the small steam plant being now kept for standby service only, with the large water-power facilities now available in the company's four generating stations besides its two undeveloped sites.

Mr. O. H. Ingram is president of the Chippewa Valley Railway, Light & Power Company; Mr. George B. Wheeler is secretary and general manager, and Mr. A. E. Peirce is chief engineer, having designed the operating features of the new Cedar Falls development.

ELECTRICAL PROPERTIES OF COMPOUND WIRES.—I.

By Frank F. Fowle.

It is many years since it became recognized that a compound wire would have a variety of uses in the electrical industry. The necessary requirements of conductivity and tensile strength are not fulfilled, for all conditions of service, by a homogeneous wire of any known material. Copper is the standard metal, commercially, for high conductivity; but in small sizes it lacks tensile strength to withstand the stresses encountered in overhead spans. Iron and steel, on the other hand, are superior from the standpoint of strength, but deficient in conductivity.

In 1870 a compound wire of copper and steel was erected between New York and Washington,* a distance of 275 miles, for telegraph service. This wire had a steel core with a coating of copper. This form of conductor, when properly designed and manufactured, obviously possessed advantages over solid iron or steel and was expected to be a superior substitute for small wires of solid copper. At this time, and for many years afterward, there was no known method of uniting the copper with the steel at the junction of the metals, so as to exclude air and moisture. The copper was placed around the steel by a mechanical process and, as might be expected, the junction between the metals was not always tight. Iron is electropositive to copper, the potential difference in dilute sulphuric acid being about 0.8 volt.

It was found that this type of compound wire was subject to electrolytic corrosion, which impaired its strength, and also its conductivity, with time. No way was found until recently to overcome this difficulty, and consequently such a compound wire found little or no favor after the early trials. It was on the market for many years, under various trade names, and is

*"American Telegraph [illegible]," by Messrs. Maver and McNicol, *Proceedings of the* [illegible], Vol. XXIX, [illegible]

still obtainable to-day. In bare-wire construction the joints, with their exposed ends of wire, offered the weakest point, because the process of making a joint usually produced some open separation between the metals, no matter how tight they might have been initially. Air, moisture, smoke and dirt then found an entrance, with the well-known result.

The obstacle to a successful wire of this type was the seeming impossibility of welding copper to steel. The problem received for a long time the earnest attention of metallurgists, prominent among whom was a Frenchman, J. Ferreol Monnot, who devised a process for some time known under his name. The net result of these long and painstaking researches is that there is now on the market a compound wire of steel and copper which appears, from all the tests applied to it, to be firmly and durably welded.

This copper-clad steel wire, so called, has been in satisfactory service for as long as about three years and over 25,000 miles are now in service or in the process of erection. The bulk of this mileage is in telephone and signal service, while some of it is in railway and high-tension service. This wire consists of a steel core with a concentric coating of copper, the two metals being welded together through a series of copper-iron alloys at the junction. Up to this time the only form of successfully welded compound wire which has appeared on the market is copper-clad steel, but it may reasonably be expected that other types of such wire will appear later. There are several reasons for believing that aluminum-clad steel, for instance, would find a considerable field of use.

These compound wires have electrical properties unlike those of solid wires and a study of these properties therefore becomes of interest generally. The purpose of this article is to present the results of a study of the properties of compound wires of copper and steel, and to compare the properties as calculated from theoretical considerations with the properties as determined by actual measurement. The general problem of determining the comparative economy of such compound wires in comparison with copper, aluminum, iron and steel depends fundamentally upon their elementary electrical properties.

All electrical circuits possess, in varying degree, the four properties of resistance, inductance, capacity and leakage. Passing over the first two, temporarily, to a consideration of capacity and leakage, it may be observed that leakage is not a property of the conductor and hence it falls outside of the present subject; capacity depends upon the external dimensions of the conductor and its spacing from other conductors, but is independent of the substance and internal structure of the conductor. The properties of resistance and inductance, therefore, form the subject under consideration. The true or ohmic resistance depends upon the form, substance and temperature of the conductor; the true inductance of any circuit, however, can be regarded as the sum of two factors, one representing the inductance of the circuit external to the conductor, the magnitude of which depends upon the spacing of the conductor from its mate or return conductor, and the other factor representing the inductance of the conductor itself, the magnitude of which depends upon the form and substance of the conductor.

The distinctive features of compound wires are, therefore, resistance (or conductance) and internal inductance, when continuous currents or low-frequency alternating currents are considered. For such currents the apparent resistance and the apparent inductance are identical with the true or ohmic resistance and the true inductance, respectively. For alternating currents of high frequency the apparent resistance exceeds the ohmic resistance in increasing degree for greater frequencies; at the same time the apparent internal inductance is less than the true inductance. This phenomenon is commonly termed the "skin effect," which arises from the fact that all elements of current in the wire do not encounter equal inductance. The current element at the axis of the wire meets the maximum inductance, while a surface element meets the minimum, and intermediate values of inductance range between these limits according to the radial distance of the current element from the axis, for homogeneous wires. At high frequencies this difference in inductance causes a corresponding difference in impedance to different current elements, with a resultant unequal distribution of current over the cross-section. A continuous current distributes itself uniformly over the cross-section, but for alternating currents the density is a minimum at the axis and a maximum at the surface, except at very low frequencies. Other things being the same, the skin effect is very much greater for conductors made of magnetic substances than for those of non-magnetic substances; the skin effect is more prominent, also, in large than in small conductors.

Except for very large conductors the skin effect is not a material factor with alternating currents at the commercial frequencies employed in energy distribution for lighting and motor service. On the other hand, it becomes very prominent at telephonic frequencies. No attempt has been made in what follows to investigate the skin effect for compound wires, but some ratios of apparent resistance to true resistance will appear from the measurements to be presented later. As regards the apparent inductance of circuits composed of wires made of non-magnetic substances, it may be observed that the true inductance is but slightly greater even at considerable frequencies, because the external inductance is ordinarily many times the internal inductance. When the wires are of iron or steel, however, the apparent inductance may be much less than the true inductance.

A discussion of the conductance of a compound wire is so simple that it would require no consideration were it not for the fact that it forms a natural introduction to the consideration of inductance. Copper is naturally the standard of reference in a commercial sense. The particular type of compound wire which is to be considered in detail is copper-clad steel, but the general case will be taken up first. The general type of bimetallic compound wire is shown in Fig. 1.

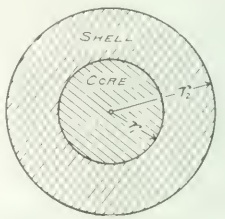


Fig. 1—Cross-Section of Bi-metallic Compound Wire.

The following nomenclature will be employed: L = inductance; G = conductance; ρ = specific resistance; I = current; μ = magnetic permeability; s = specific gravity; r = radius; A = cross-sectional area; W = weight; n = conductance ratio of a compound wire to a solid copper wire of equal size; n_1 = proportion of core weight to total weight in a compound wire; n_2 = proportion of shell weight, ditto.

The properties of different kinds of wire will be distinguished by subscripts. The subscript $_1$ will denote the properties of the core of a compound wire and the subscript $_2$ those of the shell. The subscript $_{12}$ will denote the properties of a compound wire and c those of solid-copper wires.

The weight of a compound wire per unit of length is

$$W_{12} = W_1 + W_2 = \pi r_1^2 s_1 + \pi (r_2^2 - r_1^2) s_2. \quad (1)$$

The proportions of core and shell weight, respectively, are

$$n_1 = \frac{r_1^2 s_1}{r_1^2 s_1 + (r_2^2 - r_1^2) s_2} \quad (2)$$

$$n_2 = \frac{(r_2^2 - r_1^2) s_2}{r_1^2 s_1 + (r_2^2 - r_1^2) s_2} \quad (3)$$

The ratios of the cross-sectional areas of the core and the shell to the whole area, respectively, are

$$A_1 = \frac{r_1^2}{r_2^2} \quad (4)$$

$$A_2 = 1 - \frac{r_1^2}{r_2^2} \quad (5)$$

Whence (2) and (3) are also expressible in the form

$$n_1 = \frac{A_1 s_1}{A_1 s_1 + A_2 s_2} \tag{6}$$

$$n_2 = \frac{A_2 s_2}{A_1 s_1 + A_2 s_2} \tag{7}$$

By further transformation of (2) and (3) it appears that

$$A_1 = \frac{n_1 s_2}{n_1 s_2 + n_2 s_1} \tag{8}$$

$$A_2 = \frac{n_2 s_1}{n_1 s_2 + n_2 s_1} \tag{9}$$

The ratio of the weight of a compound wire to a solid copper wire of the same size is

$$\frac{W_{12}}{W_c} = \frac{r_1^2 s_1 + (r_2^2 - r_1^2) s_2}{r_2^2 s_c} \tag{10}$$

$$= A_1\left(\frac{s_1}{s_c}\right) + A_2\left(\frac{s_2}{s_c}\right) \tag{11}$$

$$= A_1\left(\frac{s_1 - s_2}{s_c}\right) + \frac{s_2}{s_c} \tag{12}$$

$$= A_2\left(\frac{s_2 - s_1}{s_c}\right) + \frac{s_1}{s_c} \tag{13}$$

This ratio can also be expressed in the form

$$\frac{W_{12}}{W_c} = \frac{\left(\frac{s_1 s_2}{s_c}\right)}{n_1 s_2 + n_2 s_1} \tag{14}$$

The conductance of a compound wire in general terms is

$$G_{12} = G_1 + G_2 = \frac{\pi r_1^2}{\rho_1} + \frac{\pi(r_2^2 - r_1^2)}{\rho_2} \tag{15}$$

However, the ratio of this conductance to that of a solid copper wire of equal size is

$$n = \frac{G_{12}}{G_c} = \frac{r_1^2 \rho_c}{r_2^2 \rho_1} + \frac{(r_2^2 - r_1^2)\rho_c}{r_2^2 \rho_2} \tag{16}$$

$$= A_1 \frac{\rho_c}{\rho_1} + A_2 \frac{\rho_c}{\rho_2} \tag{17}$$

$$= A_1\left(\frac{\rho_c}{\rho_1} - \frac{\rho_c}{\rho_2}\right) + \frac{\rho_c}{\rho_2} \tag{18}$$

$$= A_2\left(\frac{\rho_c}{\rho_2} - \frac{\rho_c}{\rho_1}\right) + \frac{\rho_c}{\rho_1} \tag{19}$$

$$= \frac{n_1 s_2 \left(\frac{\rho_c}{\rho_1}\right) + n_2 s_1 \left(\frac{\rho_c}{\rho_2}\right)}{n_1 s_2 + n_2 s_1} \tag{20}$$

The general purpose of a compound wire is to combine tensile strength and conductivity in proportions not obtainable with a solid homogeneous conductor of the ordinary kind. The core of a compound wire, considered by itself, will possess greater inductance than the shell unless the latter is composed of some material the magnetic permeability of which is considerably greater than that of the core material. The whole internal inductance of a compound wire is divisible into two parts, one corresponding to the core and one to the shell, but the relative proportions of these parts are affected not only by the relative dimensions of the core and the shell and by their magnetic permeabilities, but also by their relative conductivities. If either the core or the shell must have a high magnetic permeability it should obviously be the core because the resultant inductance of the whole wire will thus be made a minimum. If, in addition, the core has relatively less conductivity than the shell, the total inductance will be further minimized.

The choice of metals for a bi-metallic compound wire obviously will be one for tensile strength and one for conductivity. Those metals and alloys which possess greater tensile strength than copper have, in general, less conductivity and some of them (iron and steel) have high magnetic permeability. The correct design is obviously a core for tensile strength and a shell for conductivity, primarily. There is also a further consideration that the shell should be composed of a non-oxidizable metal in order to prolong the useful life in outdoor service.

The combinations which naturally suggest themselves are steel core with copper shell or steel core with aluminum shell. Since the shell material will be the most expensive, per pound, of the two, it will be convenient to rate a compound wire by its proportion of shell material by area or weight. For any combination of two metals at constant temperature the expression in (19) is of the general form

$$y = ax + b, \tag{21}$$

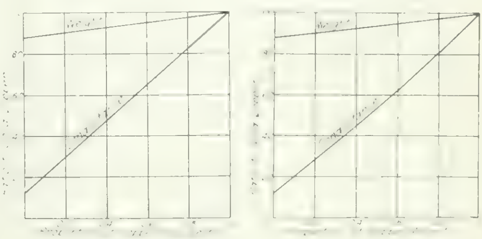
which is a straight-line relation; this relation is true also of (13). A simple straight-line plot is readily prepared for any combination of two metals, showing the relative weight or the relative conductance to copper in terms of proportional cross-section of shell or of core.

The proportion of shell by area may not be so convenient as the proportion by weight. Expression (14) gives the ratio of weights and (20) gives the ratio of conductances. They can be transformed slightly to the following:

$$\frac{W_{12}}{W_c} = \frac{\left(\frac{s_1 s_2}{s_c}\right)}{n_2(s_1 - s_2) + s_2} \tag{22}$$

$$n = \frac{n_2\left[s_1\left(\frac{\rho_c}{\rho_2}\right) - s_2\left(\frac{\rho_c}{\rho_1}\right)\right] + s_2\left(\frac{\rho_c}{\rho_1}\right)}{n_2(s_1 - s_2) + s_2} \tag{23}$$

These expressions give the desired quantities in terms of the proportion of shell weight to total weight. It will be observed that the specific resistances do not appear in the result except as ratios, and then in such form as to express the ratio of the conductivity of the core or shell metal to the conductivity of copper. The specific gravities of steel, copper and aluminum



Figs. 2 and 3—Comparison of Copper-Clad Steel Wire with Solid Copper of Same Size, in Terms of Proportional Cross-Section of Copper (Fig. 2) and Proportional Weight of Copper (Fig. 3).

and their relative conductivities in the form of hard-drawn wire are next given.

	Copper	Steel	Aluminum
Specific gravity	8.9	7.80	2.68
Relative conductivity	1.00	0.12	0.62

The conductivity of steel varies to such an extent with its composition and treatment that precise values cannot be stated without careful qualification. The value above given is a safe average for the quality of steel used in copper-clad wires ranging between the sizes of No. 6 and No. 10 B. & S. gage, provided the tensile strength does not exceeed 100,000 lb. per square inch, approximately. For larger sizes the relative conductivity is probably as high as 0.14 and for smaller sizes it may not exceed 0.10; in the latter case the amount of annealing which the wire receives during manufacture has an important bearing.

The grade of steel used in BB iron wire has an average relative conductivity of about 0.16 and so-called steel wire has about 0.14 in terms of hard-drawn copper wire, the conductivity of which is 98 per cent of Matthiessen's standard for pure annealed copper.

Substituting these values of specific gravity and relative con-

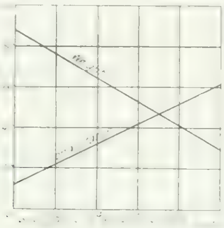


Fig. 4—Comparison of Aluminum-Clad Steel Wire with Solid Copper of Equal Size, in Terms of Proportional Cross-Section of Aluminum.

ductivity in some of the preceding formulas gives for copper-clad steel,

$$\frac{W_{11}}{W_c} = 0.121\,A_2 + 0.879 \qquad (24)$$

$$= \frac{7.85}{8.93 - 1.08\,n_2} \qquad (25)$$

$$n = 0.880\,A_2 + 0.120 \qquad (26)$$

$$= \frac{0.78\,n_2 + 1.07}{8.93 - 1.08\,n_2} \qquad (27)$$

The last four expressions have been used in computing the values which appear in Tables I and II.

TABLE I.—COMPARISON OF COPPER-CLAD STEEL WIRE WITH SOLID COPPER OF EQUAL SIZE, IN TERMS OF PROPORTIONAL CROSS-SECTION OF COPPER.

Ratio of Copper Cross-Section to Total Cross-Section.	Ratio of Weight of Copper-Clad Wire to Weight of Solid Copper Wire of Equal Size. (24)	Ratio of Conductivity of Copper-Clad Wire to Conductivity of Solid Copper Wire of Equal Size. (26)
0.00	0.879	0.120
[illegible]	0.891	0.208
0.20	0.903	0.296
0.30	0.915	0.384
0.40	0.927	0.472
0.50	[illegible]	0.560
0.60	0.952	0.648
0.70	0.964	0.736
0.80	0.976	0.824
[illegible]	[illegible]	[illegible]
1.00	[illegible]	1.000

The ratios given in Table I have been plotted in Fig. 2, which shows a straight-line relation in each case.

TABLE II.—COMPARISON OF COPPER-CLAD STEEL WIRE WITH SOLID COPPER OF EQUAL SIZE, IN TERMS OF PROPORTIONAL WEIGHT OF COPPER.

Ratio of Copper Weight to Total Weight.	Ratio of Weight of Copper-Clad Wire to Weight of Solid Copper Wire of Equal Size. (25)	Ratio of Conductivity of Copper-Clad Wire to Conductivity of Solid Copper Wire of Equal Size. (27)
0.00	[illegible]	0.120
0.10	0.890	[illegible]
0.20	0.901	[illegible]
0.30	0.912	0.361
0.40	0.924	0.445
0.50	0.936	0.532
0.60	[illegible]	0.620
[illegible]	[illegible]	0.712
[illegible]	[illegible]	0.805
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1.000

The values given in Table II have been plotted in Fig. [illegible]; the ratios in this case are not exactly in linear relation, but nearly so, because the specific gravity of steel and copper are not greatly different.

The corresponding formulas for aluminum-clad steel wires are as follows:

$$\frac{W_{12}}{W_c} = 0.879 - 0.579\,A_2 \qquad (28)$$

$$= \frac{2.36}{5.17\,n_2 + 2.68} \qquad (29)$$

$$n = 0.500\,A_2 + 0.120 \qquad (30)$$

$$= \frac{4.55\,n_2 + 0.322}{5.17\,n_2 + 2.68} \qquad (31)$$

The relative weight and conductivity of aluminum-clad steel

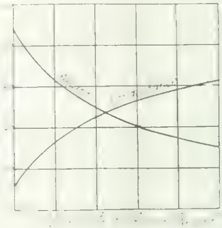


Fig. 5—Comparison of Aluminum-Clad Steel Wire with Solid Copper of Equal Size, in Terms of Proportional Weight of Aluminum.

computed from expressions (28) to (31) appear in Tables III and IV. Fig. 4 is plotted from Table III and Fig. 5 from Table IV. The most interesting difference between copper-clad and aluminum-clad which these tables show is the weight characteristic.

TABLE III.—COMPARISON OF ALUMINUM-CLAD STEEL WIRE WITH SOLID COPPER OF EQUAL SIZE, IN TERMS OF PROPORTIONAL CROSS-SECTION OF ALUMINUM.

Ratio of Aluminum Cross-Section to Total Cross-Section.	Ratio of Weight of Aluminum-Clad Wire to Weight of Solid Copper Wire of Equal Size. (28)	Ratio of Conductivity of Aluminum-Clad Wire to Conductivity of Solid Copper Wire of Equal Size. (30)
0.00	0.879	0.120
0.10	0.821	0.170
0.20	0.763	0.220
0.30	0.705	0.270
0.40	0.647	0.320
0.50	0.590	0.370
0.60	0.532	0.420
0.70	0.474	0.470
0.80	0.416	0.520
0.90	0.358	0.570
1.00	0.300	0.620

TABLE IV.—COMPARISON OF ALUMINUM-CLAD STEEL WIRE WITH SOLID COPPER OF EQUAL SIZE, IN TERMS OF PROPORTIONAL WEIGHT OF ALUMINUM.

Ratio of Aluminum Weight to Total Weight.	Ratio of Weight of Aluminum-Clad Wire to Weight of Solid Copper Wire of Equal Size. (29)	Ratio of Conductivity of Aluminum-Clad Wire to Conductivity of Solid Copper Wire of Equal Size. (31)
0.00	0.879	0.120
0.10	0.737	0.243
0.20	0.635	0.332
0.30	0.557	0.399
0.40	0.496	0.451
0.50	0.448	0.493
0.60	0.408	0.528
0.70	0.374	0.557
0.80	0.346	0.581
0.90	0.321	0.602
1.00	0.300	0.620

For direct-current work the basis of comparing different conductor materials is the cost for equal conductances. The most convenient unit to use is the mile-ohm, which is the weight

in pounds of a conductor one mile long which has a resistance of 1 ohm. The mile ohm of any uniform linear conductor is equal to the product of its weight per mile into its resistance per mile, or the quotient of its weight per mile divided by its conductance per mile.

Table V shows the ratios of the mile-ohm of copper-clad steel and aluminum-clad steel to solid copper in terms of the ratio of shell weight to total weight. The values for copper-clad were obtained from Table II by dividing the weight factors in the second column by the conductance factors in the third column; the values for aluminum-clad wire were similarly obtained from Table IV.

TABLE V.—THE MILE-OHM OF COMPOUND WIRES COMPARED WITH THE MILE-OHM OF SOLID COPPER WIRE.

Ratio of Shell Weight to Total Weight.	Ratio of the Mile-Ohm of a Compound Wire to the Mile-Ohm of Solid Copper.	
	Copper-Clad Steel.	Aluminum-Clad Steel.
0.00	7.33	7.33
0.10	4.50	3.03
0.20	3.24	1.913
0.30	2.53	1.396
0.40	2.076	1.100
0.50	1.760	0.909
0.60	1.529	0.773
0.70	1.348	0.671
0.80	1.209	0.596
0.90	1.094	0.533
1.00	1.000	0.484

Fig. 6 shows the mile-ohm ratios for copper-clad and aluminum-clad wires plotted from Table V. Given the weight of the mile-ohm and the price per pound for each of two or more conductors, it becomes possible to compare them at once on the basis of cost for equal conductance. This is the proper basis of comparison when none of the conductors has a tensile strength so low as to impair its reliability in service under extreme weather conditions; when this is not the case, tensile strength becomes an important and perhaps governing consideration.

The tensile strength or breaking weight varies in direct pro-

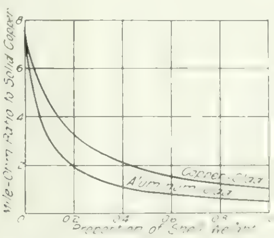


Fig. 6—The Mile-Ohm of Compound Wires Compared with the Mile-Ohm of Solid Copper Wire.

portion as the cross-section, approximately, and the resistance varies inversely as the cross-section. Therefore, the product of these two quantities is practically constant. When tensile strength becomes a governing consideration this strength-resistance factor becomes quite useful; it shows, for example, the maximum permissible resistance when the strength is fixed at a certain minimum or the maximum attainable strength with a certain minimum of resistance. If it is desired that the elastic limit of stress shall not be exceeded, the strength-resistance factor should be the product of the resistance and the elastic limit of strength. In this connection it may be well to point out that the tensile strength and the elastic limit are slightly greater in the small wire sizes than in the large, because of the greater amount of drawing.

In a subsequent issue the inductance effects in copper-clad and aluminum-clad steel wires will be treated in great detail, and the distribution of current in compound wires of different proportions will be fully discussed.

ENTROPY ANALOGY.

An interested audience which attended the discussion on "Entropy" at the meeting of the Western Society of Engineers in its Monadnock Block rooms Dec. 7 departed from the session with more firmly fixed physical conceptions of this thermal quantity, which has been wrongfully endowed with an enigmatical significance by those who have not taken trouble to learn or to teach its comparatively simple nature. The formal paper of the evening was presented by Prof. G. A. Goodenough, of the University of Illinois, a non-member of the society, who favored its members with this discussion in response to many requests received by the program committee for a paper on the subject of "Entropy." Professor Goodenough was not present, and his paper, which contained a number of mathematical passages, was read in abstract by Secretary Warder.

In the discussion which followed, Mr. A. Bement remarked that the physical conceptions involved in a consideration of entropy are no more abstract or involved than the ideas of electric current, potential and resistance used so familiarly by electrical men, and he charged that the failure of engineering students to gain even a conception of entropy in the study of thermodynamics was due to the undeveloped condition of the latter subject as academically handled. He deplored the tendency to make the subject complex by introducing mathematical symbols where simple explanation would serve, and declared that there must be a return to clearer thinking, less mathematics and more common sense before the idea of entropy would be thoroughly grasped and used. Mr. Bement quoted a number of definitions for entropy which he has collected, some of which seem complex and involved. One writer defined entropy as a numerical ratio, while others assigned to it units of measurement like any other property of matter or energy, the unit of entropy proposed being the "rank." A simple definition, though conveying little idea beyond a numerical relation, refers to entropy as the quotient of the heat exchanged divided by the average absolute temperature.

Mr. W. L. Abbott, operating engineer of the Commonwealth Edison Company, Chicago, brought out a more concrete significance of the last definition by drawing on the blackboard a curve recording the heating of ice from absolute zero up through the successive states of water and steam, plotting temperature as the vertical co-ordinate. Between points where the state of the material is unchanged, the temperature as heat is added, the curve making an angle with both ordinates. But the heat energy added to the body must be represented by an area on the graph, and is, in fact, the area under the curve. One dimension of this area is in the direction of the vertical ordinate, temperature; the other is in the direction of the hitherto unnamed ordinate, entropy. Considering temperature as the intensity factor of heat, entropy may be considered as its extensity, or "mass," factor.

Mr. W. M. Wilson added a striking illustration of the physical meaning of entropy by drawing up a list of analogies showing that all forms of energy are composed of a potential or "intensity" factor and a quantity component to which the rather peculiar name "extensity" factor is given. This list follows:

	Intensity.	Extensity.
Potential energy due to gravity. .	Height	Mass
Kinetic energy of moving body. .	Velocity squared	Mass
Energy of static electrical charge. .	Potential	Quantity
Energy of current flow...........	E.m.f.	Quantity
Chemical energy	Chemical affinity	Mass
Heat energy	Temperature	Entropy

A glance at this table shows that entropy bears to heat the same necessary factorial relation that coulombs or amp-hours of electrical quantity bear to the energy of an electrical circuit. This comparison may give the electrical reader the clearest conception of the entropy factor of thermal energy.

According to one author, wrote Professor Goodenough in his

paper before the society, entropy may be considered as "heat-weight"; another terms it the "extensity factor," while a third calls it "the quantity which remains constant throughout an adiabatic expansion." When natural or "self-acting" thermal changes take place, such as the transfer of heat from a body of high temperature to one of lower temperature, although the total heat energy of the system remains constant from the law of the conservation of energy, yet, owing to the "degradation law," the energy remaining "available" for use has been decreased by the change, while the "unavailable" energy which cannot be transformed into work is increased. Entropy goes hand in hand with unavailable energy, an increase of one involving an increase of the other, proportionally to the reciprocal of the absolute temperature. Professor Goodenough also showed that while a reversible change in an isolated system leaves the total entropy unchanged, a natural irreversible change is accompanied by an increase of entropy. We must look upon entropy, wrote Professor Goodenough, as merely a function of the state of the system which, applied to an isolated system, gives us information regarding the possibility of change and the direction of change. It further gives a measure of the degradation of energy due to the change.

In the discussion Mr. B. E. Chamberlain called attention to the useful service of the entropy diagram in determining what takes place in an engine cylinder during a stroke of the piston.

COST OF ELECTRICAL EQUIPMENT FOR BOSTON RAILROAD.

As noted in our issue of Nov. 17, the railroad companies operating in the Boston neighborhood have prepared estimates of the cost of equipping their lines electrically within the metropolitan district. The companies lay particular emphasis upon the large investment necessary to make the change from steam to electricity, the total estimated cost for all railroads being about $40,000,000.

The New York, New Haven & Hartford Railroad Company finds it advisable to install the overhead-trolley system with high-voltage distribution after the plans now in use on the New York division of its system. Energy would be supplied to the electric locomotives or multiple-unit trains at 11,000 volts, and the third-rail system is deemed impracticable, with special reference to the yard and terminal conditions found at Boston. For the electrification of radial suburban and trunk lines within fifteen miles of Boston on the north and south of the city the estimated cost is $32,751,942, including both the Boston & Maine and New Haven lines. The major items of the estimate are:

Generating station (normal rating, 60,000 kw)	$6,000,000
Transmission lines and overhead contact system	3,850,240
Suburban terminal shops and inspection facilities	1,417,000
Heavy repair shops	400,000
[illegible]	[illegible]
[illegible]	[illegible]
Multiple-unit motor cars	6,960,000
Multiple-unit trail cars	5,014,100
Spare parts for multiple unit cars	299,352
[illegible]	[illegible]
Total	[illegible]

The proposed New Haven and Boston & Maine electrification would cover 461 miles of track and provide for the operation of 14,630 daily train-miles. These estimates are based upon a plan for electrification within the Boston Metropolitan District, which is an artificial area. This would doubtless force the extension of electrification much farther outward from the city at an augmented expense for installation. Emphasis is laid upon the difference between the Boston and New York conditions, the former being characterized by radial service upon about twenty through routes and branches, compared with a trunk-line traffic concentration in the latter case. It is noteworthy that the total passenger traffic handled yearly at the North and South stations in Boston is in each case about 25 per cent greater than at the Grand Central Terminal in New York. The New Haven company considers that the present terminals should not be electrified if there is any reasonable probability of the construction of a tunnel between the North and South stations in Boston in the near future. It contends that it would seem more practicable at first to restrict the substituion of electricity for steam to a few of the more important routes, subsequently extending the system as rapidly as consistent with the financial conditions and the public needs. In the detailed estimates the cost of four-track electrification is taken at $40,000 per mile for transmission lines and overhead-contact system, two-track construction costing $20,000 per mile, single-track construction $7,000 per mile, and yard trackage, overhead service, $4,000 per mile. Electric locomotives of the light passenger type are figured at $40,000 each and of the heavy passenger type at $45,000 each. Multiple-unit cars are estimated at $30,000 each and the trail cars at $13,300 each. The total estimated cost of the New Haven electrification in the Metropolitan District is $13,862,750 and of the Boston & Maine $18,889,192. The New Haven figures cover lines as far out as Campello, Readville, Cohassset, South Braintree, Dedham, Mattapan and Needham Junction, and those for the Boston & Maine extend as far as Swampscott, Wakefield Junction, Wilmington, Lexington Wayland and Waltham.

The Boston & Albany electrification studies follow the lines recently reviewed in a forecast of the probable development on this system, the striking points being the use of a 1200-volt third-rail service, with direct-current distribution. The probable cost is $6,413,300. The railroad company estimates that there would be an annual deficit of about $500,000 in addition to the present deficit on suburban service, with electrification, and concludes that a raise in fares will be imperative if electricity is adopted.

SMALL TUBULAR RESISTANCE FURNACES.

By Albert A. Somerville.

The things most considered in the construction and use of heating appliances or furnaces of various kinds are the items of initial cost, running cost, efficiency, both commercial and mechanical, or rather thermal, and finally the wear on the apparatus.

As this article applies only to small furnaces and not to those in use in foundries, only two kinds need be considered, namely, gas heaters and electrical resistance furnaces. Resistance furnaces are specified rather than arc furnaces because with the former temperatures as high as 1200 deg. C., or 2100 deg. Fahr., may easily be attained under conditions much more easily controlled than in the arc furnace and also with much less disastrous effect on the equipment.

A gas burner or heater is inexpensive. A small electrical furnace that will supply the same energy need not cost much more unless it is nickel-plated, which adornment is entirely unnecessary.

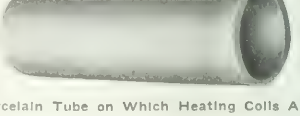


Fig. 1—Porcelain Tube on Which Heating Coils Are Wound.

The running cost depends entirely on the locality. Natural and artificial gas is known to vary in price in various cities of the United States from 15 cents to $1.65 per 1000 cu. ft. Also the cost of electrical energy varies considerably, depending entirely on natural resources, as water-power or accessibility to coal fields, and considerably on political and corporate interests. Considering everything, the cost of electrical energy is much less than that of gas used to accomplish the same work. This, of course, implies commercial efficiency.

The thermal efficiency is equal to the useful energy divided by the total energy supplied, and, of course, is always less than 100 per cent. It has been said that the efficiency of an electrical circuit used for heating purposes may be 100 per cent, as all of the energy may go into the form of heat, but generally the generated heat is not all applied in the most desirable place. However, there is the advantage in electrical heating that the heat generated can be more closely located at the desired place

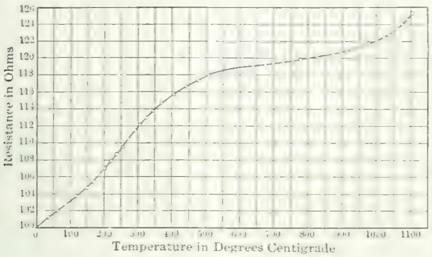


Fig. 2—Temperature-Resistance Curve for Nichrome.

than in any other heating system. Certainly the thermal efficiency of a resistance furnace is far ahead of that of a gas burner, and hence also the commercial efficiency is in the same proportion, which tends to make electrical fuel the cheaper. Finally, a gas burner will last a long time with ordinary usage and the same may be said of a modern resistance furnace. An electric furnace fulfilling the above conditions will be described below.

Suppose it is desired to build a furnace to heat a soldering

Fig. 3—End View, Showing Coil and Asbestos Covering.

iron. Fig. 1 shows a picture of a form on which to build the heating coil. It is a porous porcelain tube, closed at one end, walls about 3/16 in. thick, inside diameter 2½ in., length 8 in. Formerly the heating units were of platinum wire or foil. Nickel may also be used, as it does not oxidize readily, but is liable to burn out by arcing across when near the recalescence point. Nichrome is a very serviceable alloy, having a high melting point, small temperature coefficient and high specific resistance and oxidizing scarcely at all. The temperature-

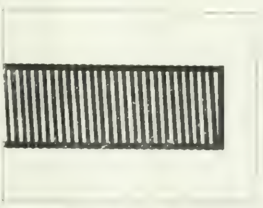


Fig. 4—Cross-Section, Showing Coils and Asbestos Covering.

resistance curve for the same is shown in Fig. 2. This wire may be obtained in ribbon form ⅛ in. wide by 0.007 in. thick with a resistance of 450 ohms per 1000 ft. The porcelain cylinder, being a non-conductor, is wrapped with about 24 ft. of this ribbon wire, making about twenty-eight turns on the cylinder about ⅛ in. apart, or one-half of the whole cylinder is covered with the heating surface. The current from a 55-volt direct-current circuit will be about right for obtaining the desired temperature. Figs. 3 and 4 show an end and a longitudinal view respectively.

The heating coils are inclosed in about 1½ in. thickness of asbestos or mineral wool used for insulating the heat. Some of this material is also placed over the closed end of the porcelain

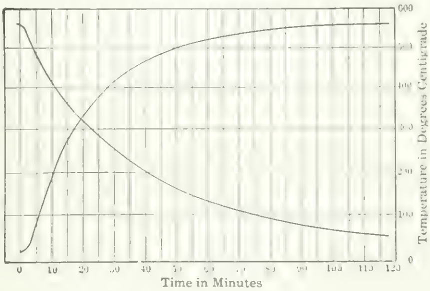


Fig. 5—Heating and Cooling Curves.

tube. The whole apparatus is then incased in sheet iron to protect the asbestos wrapping from injury. Since the porcelain is liable to crack, due to rapid heating and consequent cooling, a cylinder of sheet iron fits snugly inside to prevent the porcelain from breaking down and falling into the center. It is mounted in an iron frame to prevent it coming in contact

DATA FOR AN ELECTRIC RESISTANCE FURNACE.

Length, inches	9
Diameter, outer, inches	6
" inner, inches	2¼
Number of coils (approximate)	28
Dimensions of wire (approximate)	[illegible] in. x [illegible] in. x 24 ft.
Resistance, cold, ohms	11.25
" 560 deg. C., ohms	13.27
Voltage, direct current	55
Current, amperes (approximate)	4
Maximum temperature attained, degrees C.	560
Point of maximum temperature, inches from open end	6
Time to reach maximum temperature	1 hr. 40 min.
Time to reach 400 deg. C.	28 min.
Power used, watts	220
Cost in cents per hour at 10 cents per kw-hour (approximate)	2

with wood and possibly causing a conflagration due to overheating, if that be possible, and mounted on a suitable base so that it may easily be taken from one place to another, and convenient lead wires are attached for connecting onto a switch-

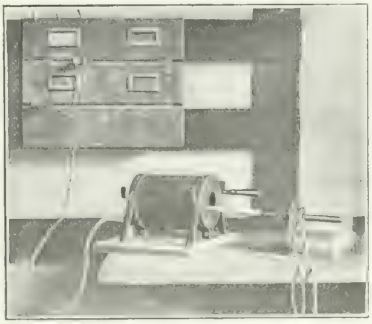


Fig. 6—Small Electric Furnace.

board or screwing into a lamp socket. Fig. 6 illustrates the outfit, while a resistance thermometer, incased in a porcelain tube, was in the furnace for the purpose of measuring temperatures during an experimental run.

This thermometer was connected to a Callendar automatic temperature recorder and the curves shown are drawn auto-

matically. The heating curve starts from room temperature and reaches a maximum at 560 deg. C., or a little short of red heat as visible in ordinary daylight. The cooling curve falls from this maximum in two hours' time.

The point of maximum temperature along the axis of the furnace was also determined after it had reached a steady state by moving the thermometer along this axis until the point was reached where the highest temperature was recorded. This place was found to be about two-thirds the whole distance from the open end.

Central Station

Management, Policies and Commercial Methods

ELECTRIC IRONS FOR LAUNDRIES.

In introducing electric flatirons in laundries, which it has done with considerable success, the Commonwealth Edison Company of Chicago points out that in some classes of work, as in shirt-bosom polishing, it is necessary to keep two gas irons going, whereas only one iron is needed where electricity is employed. This results in a marked saving in time. Further, the time taken to plunge a gas iron into water to reduce the surface temperature every time it is taken off the stove and the damage done to the face of the iron by this practice are avoided by the use of the electric units. It is said that operatives can make better pay on piece work where electric irons are employed instead of gas irons. Further, the employer benefits by saving in space, for it is recognized that five operators with electric irons can do the work of six using the older methods. The establishment is also a more attractive and comfortable place in which to work, particularly in summer, and the use of electricity has an advertising value and marks the laundry as modern and progressive.

LIABILITY FROM JOINT USE OF LINE POLES.

The Kansas City Court of Appeals has held that where a telephone company and an electric light company having lines near together at a corner mutually agree, in view of the fact that the lines of either may get out of order, that either company may use the poles of the other in restoring its lines to their proper condition an employee who is on one of the poles for the purpose of lifting a wire of the other company from the wires of his employer is more than a mere licensee, and that the other company is under an obligation not to endanger his safety by shock.

This was held in a case where an action was brought to recover damages for the death of a telephone company employee against another telephone company and an electric light company, the three companies having jointly used the same pole. The man killed was the troubleman for the Queen City Telephone Company. He was sent out to locate trouble on the line which had been reported by a patron. He found that the defendant telephone company's wire had dropped or sagged down until it was in contact with the Queen City wire. He climbed the pole of the electric light company at the corner for the purpose of lifting the telephone wire from that of his own company. The telephone wire was in contact with the wire of the electric light company at a point some distance from the pole, and when he took hold of the telephone wire to lift it he was immediately killed. It was held, as stated above, that the defendant companies were under an obligation not to endanger the safety of the employees of the Queen City company and that they were liable in damages.

NEW YORK CITY ELECTRICAL GARAGE RULES.

The Bureau of Electrical Inspection of New York City has formulated new rules, as follows, relating to electrical vehicle garages: In wiring garages approved metal conduit or approved armored cable must be employed, and cut-outs, switches, receptacles and sockets which are permanently located must be placed at least 4 ft. above the floor. Switchboards and charging panels, if not placed 4 ft. above the floor, must be located in a room or inclosure provided for the purpose.

For portable lights flexible cable designed for rough usage must be employed, this cable carrying the male end of a pin plug connector or equivalent of at least 3 amp capacity, the female end being of such design or so hung that the connector will break apart readily at any position of the strained cable. The connector must be kept at least 4 ft. above the floor. For all portable lights keyless molded-mica or metal-sheathed porcelain sockets equipped with handle, hook and guard must be employed.

For charging theater stage cable must be employed, this cable carrying the female end of a pin plug connector or equivalent of a capacity of at least 50 amp, the male end being of such design or so hung that the connector will break apart readily at any position of the strained cable. The connector must be kept at least 4 ft. above the floor and the male end, if not located on a switchboard or charging panel, must be shielded against accidental contact.

Motors, if not located at least 4 ft. above the floor, must be of the fully inclosed type or must be inclosed in an approved fireproof room shut off from the main building.

ELECTRIC FOUNTAIN AT SAN DIEGO, CAL.

The accompanying engraving is from a day photograph of a $10,000 electric fountain recently presented to the City of San Diego by Mr. Lewis J. Wilde. The fountain, which was designed by Architect Gill and is located on the city plaza, is chiefly of marble, but the dome is of corrugated glass covered with perforated bronze. The six Corinthian supporting columns are of white Vermont marble. A similar dome is located at the bottom of these columns, but in the engraving is hidden by the spray. Water runs continuously over the upper dome

Electric Fountain at San Diego, Cal.

and the smaller lower dome is covered by the spray from nozzles around the side of the basin. Tungsten lamps colored red, white and blue are located inside the dome and can be blended into many combinations of colors by a flasher driven by a 1/8-hp motor. Pumping is done by a 20-hp motor in the base of the fountain. The flasher and electrical apparatus also are located in the base, the domes being thoroughly watertight. There are in all for the lighting of the fountain sixty 500-watt and 184 40-watt tungsten lamps. The total connected load of the fountain, including the motors, is 52.3 kw. The energy is supplied by the San Diego Consolidated Gas & Electric Company, one of the properties controlled by H. M. Byllesby & Company.

DECORATIVE ADVERTISING STREET LIGHTING.

A fine example of decorative advertising street lighting, due to individual enterprise, has just been installed in Brooklyn. Mr. Hugo Tollner, who is building a block of stores and apartments on Bedford Avenue between Putnam Avenue and Madison Street, decided at the solicitation of a salesman of the Edison Electric Illuminating Company that it would be good policy to install a distinctive and attractive system of street illumination as an advertisement for his property. The details of the installation were worked out between the owner

Decorative Advertising Street Lighting.

and the sales force of the company. The result is shown in the accompanying illustration. The block is 200 ft. long, and, as will be noted, six standards are used. Each standard is equipped with five 100-watt tungsten lamps, with 16-in. opal globes. The standards, which were made by the J. L. Mott Iron Works, are installed on the sidewalk abutting the curb. They are switched on and off by the company in accordance with a definite schedule.

The resulting illumination is excellent, and the effect can possibly be best put in its inverse form, namely, that the other side of the street is thrown so completely in the shade that the merchants there have taken into immediate consideration the installation of additional lighting, which will prevent the business all being done on the opposite side.

Since this lighting has been installed, although the buildings are not yet completed, there has been already a 300 per cent increase in the number of inquiries concerning them, and Mr. Tollner is so well pleased and satisfied with the effectiveness of this advertising that he has contracted to have two additional standards, one on each of the side streets.

The Brooklyn Edison Company has advertised this installation extensively in the local newspapers, and already a number of merchants in other parts of the city have become interested.

THE RATE QUESTION.

BY H. C. ABELL.

I have read with interest the various articles on rates, diversity factor, etc., which have appeared in the *Electrical World* from time to time and should like to make some comments on the editorial on "Diversity Factors," Nov. 24, page 1212; on the discussion at the recent meeting of the Illinois Electrical Association of the basis used for figuring a rate, Nov. 3, page 1048; and on the example of a consumer's bill on a readiness-to-serve rate given in the report of the meeting of the Empire State Gas & Electric Association and appearing in the issue of Nov. 3, page 1050. The consumer's bill above referred to shows three distinct charges, namely, consumer, capacity and output, each of which is undoubtedly based on cost. Many operators and managers of public-service corporations, as well as rate-regulating bodies, are apparently in favor of a rate which charges a maximum price for the first number of hours' use on a demand or assumed demand, the rate decreasing with the increased hours of use. The basis for estimating the step is usually the same as the example shown on page 1048. The demand or percentage of connected load on which the consumer is to pay for his use of energy is usually based on the relative demand of the class of consumer to which he belongs with respect to the maximum station demand. If nothing else entered into the problem, and the fixed charges were lumped together as shown, and not separated, as they should be, into the consumer's and capacity expense, then the claim that the residential consumers showing a demand of 20 per cent to 25 per cent of the connected load are profitable is substantiated. A further analysis would be necessary to obtain rates as shown by the sample of a consumer's bill. Such an analysis, I think, will clearly demonstrate that generally residential consumers as a class are unprofitable with a maximum rate of only 10 cents to 12 cents per kw-hour.

The records which I have obtained of the demands of certain classes of consumers with respect to the maximum station demand show a simultaneous demand of residences of from 18 per cent to 70 per cent of the connected load. These demands were obtained individually, collectively grouped on one lighting transformer, and on individual feeder circuits running direct from the distributing switchboard, furnishing energy to practically only one class of consumers. In the example which follows the demand for residences, as nearly as could be obtained, was 25 per cent of the connected load at the time of the maximum station demand.

Many rate-makers advocate that the total fixed charges, the interest (total allowable net earnings), the depreciation, etc., should be put into the fixed portion of the rate. If bills were rendered on a readiness-to-serve rate, as shown by the example on page 1050, then each consumer would pay his portion of the fixed expense whether he used energy or not and there would be no incentive for the company to develop long-hour use, as the energy would be paid for only according to the actual output costs, with no profits to the seller, except the profit obtained from the consumer on account of being

connected and being able to demand service whenever he desired.

The operating expenses should be carefully analyzed and segregated into consumer, capacity and output expenses, and then the interest, depreciation, etc., should be divided in such a manner that the output cost of energy will return a profit and bear a portion of the depreciation charge.

The following example will show how it is possible to be misled into believing residential consumers more profitable than they actually are. The sales of energy for residential and commercial lighting amounted to 3,300,000 kw-hours for the year considered. The segregated expenses, which include interest on the property of the company and allowance for depreciation, are as follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

The demands were estimated from the relative class group demand to the maximum station demand and were taken as a percentage of the connected load. Residences were found to have a demand of relatively 25 per cent of the connected load at the maximum station demand; but by analysis (not to a conclusion) it was found, owing to the increased investment necessary in distribution, etc., that this should be increased.

Tentative figures of 60 per cent of connected load for the first ten lamps and 33⅓ per cent for all other residential lamps were considered to represent the active or residential demand, the average of all working out to about 50 per cent of the connected load for the residential demand instead of 25 per cent.

On the basis of demand to connected load which was taken the consumption was as follows:

En[illegible] first hour	[illegible]
" second "	[illegible]
" third "	[illegible]
" fourth "	[illegible]
" excess over four hours	2[illegible]

The energy used by the residential consumers was as follows:

First hour	50.8 per cent of residential consumption
Second	[illegible]
Third	11[illegible]
Fourth	[illegible]
Excess	[illegible]

Assuming that a rate is desired which has one price for the first two hours of use, a reduced price for the next two hours and a third price for all excess over the first four hours' use, then

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total	3,300,000

Consumers' expense	$80,715 05
Capacity expense	87,586 89
1,669,800 kw-hours at output cost figured	78,580 78
Total	$246,882 72

Assuming that an initial rate of 14 cents per kw-hour was desired, then:

[illegible]	[illegible]
[illegible]	[illegible]
603,300 kw-hours at output cost	31,214.[illegible]
[illegible]	[illegible]

which makes the third step approximately 4 cents per kw-hour.

Assuming a rate of 8 cents per kw-hour for the second step, we have:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

The total expense, including interest and depreciation, was $323,627.85, as shown in the next table.

There was consumed by the residential patrons 824,012 kw-hours, of which 641,577 kw-hours was during the first two hours, 133,544 kw-hours during the next two hours, and 48,891 kw-hours in excess of the first four hours.

SUMMARY OF REVENUE

Revenue from first rate	$233,772.00
" second "	53,064.00
[illegible]	[illegible] 85
Total revenue	$323,627.85

Based on approximately 50 per cent of the connected load as active, instead of 25 per cent, as shown by the instantaneous demand with respect to the station maximum demand, the revenue would be as follows:

641,577 kw-hours at $0.14	$89,820.78
133,544 " at 0.08	10,683.52
[illegible]	1,955 64
Total	$102,45[illegible] 94
[illegible]	123,601 80
Reduction	$21,141.86

On the basis frequently used the residential consumers would have a reduction of $21,141.86. Therefore, in order that the company may meet the same obligations, some other consumers would have to be raised an equal amount.

The following shows more nearly the actual conditions: 75 per cent of the consumers were occupants of residences and 78 per cent of the bills were for residences.

[illegible] of the consumers' charge	$60,536 28
25 per cent of the capacity charge	21,896.72
824,012 kw-hours at output cost	38,683.88
Actual cost, including interest and depreciation	$121,116 88

or about 14.7 cents per kw-hour.

Therefore, on a cost basis as nearly as can be arrived at, the deficit on the residential consumption by the use of the apparent equitable step system would be $18,756.94, or 18.3 per cent, which would have to be made up by the more profitable consumers. Loading the expense on to the profitable consumers makes it more difficult to compete with other services of light (private plants, etc.), without discrimination between consumers.

As to installing a flat-rate system based on a demand which is limited by some interrupting device, my experience has been that it is essential to estimate a large load factor, as otherwise the consumption and cost is out of proportion with the actual money received. This rate appears to me to encroach too much upon the fuel-supply man's business and without receiving a just compensation, unless the flat rate is put at almost a prohibitive price.

I do not write this as a rate expert, but merely as one interested in the question of rates and with the hope that it will lead to other contributions.

ELECTRIC COMPANY PRECLUDED FROM GIVING EVIDENCE AS TO CONDITION OF WIRES.

The Court of Appeals of Maryland has decided that if in defending an action for damages an electric company wishes to introduce evidence as to the condition of its wires at the time of the accident for which the action is brought it should conduct the examination as soon as possible after the accident. In the case an electric light company was not permitted to introduce testimony as to the condition of its wires where it appeared that the witness had not examined the wires until nearly two years after the accident for which the company was being sued.

The following is quoted from the opinion: "An examination of the wires at the place of accident in September, 1909, could reflect no light upon the position or condition of the wires in August, 1907, the date of the accident. According to the proof

the wires had been repaired along the line from time to time after the accident, and after a storm, on March 4, 1909, they were all taken down and a new wire put up. The position of the wire in 1909, nearly two years after the date of the accident in this case, would afford no fair or reasonable presumption as to the position of the wire at the date of the accident, because the whole line had been taken down and a new one put up. The condition or place of a thing at the time of an injury, says Mr. Wigmore in his work on evidence, page 367, may always be evidence by showing its condition before or after that time, provided no substantial change has occurred. This wire, as we have seen, had been repaired from time to time after the accident and had been so damaged by the storm of March, 1909, that it had to be removed and new wire substituted therefor. It would be exceedingly dangerous and obnoxious to the well-established rules of evidence to permit the introduction of this character of testimony after such a length of time and after the wires had been repaired and had been subject to such use for the purpose of showing that they remained in the same condition as at the date of the accident. It would not be relevant to the issue nor capable of explaining it, but, on the contrary, would be entirely too remote and misleading."

Wiring and Illumination

SPECIAL LIGHTING AT GREEN BAY, WIS.

Coincident with the bringing of hydroelectric energy into Green Bay, Wis., from the High Falls of the Peshtigo River, sixty miles north of the city, the Green Bay Gas & Electric Company has begun an aggressive new-business campaign for lighting and motor customers. Within two months the electric lighting consumers have increased to 1200, a gain of 20 per cent in a city of 25,000 population. A number of gasoline lighting systems have already been removed and tungsten installations have been substituted. The company has set an example in the use of electricity by arranging a brilliant display on the front of the building in which its offices are located, besides

Fig. 1—Series Tungsten Arc Lighting.

installing attractive exhibits in its show windows. Each of the large question-mark figures in the right-hand window contains ten lamps, one group being 40-watt, 32-cp tungstens and the other 56-watt, 16-cp, carbon-filament lamps. These are supplied with energy through two meters, which can be easily read by the public, educating users of electricity in the comparative economy of the new metal-filament lamp.

The downtown streets have also been lighted by special tungsten-lamp arches paid for by the adjoining merchants. Within three months thirty-five of these arches, each carrying sixteen 75-watt series tungsten lamps, have been erected throughout five of the principal blocks. The arches are operated until 11 p. m. and the company derives an income of 62 cents per month for each lamp.

In the construction of the arches the Grand Rapids method of suspending lamp hangers of varying lengths from catenary spans stretched between buildings has been employed. Two 110-volt series circuits are used, alternate lamps in each span being connected to separate circuits, so that the breaking of one lamp will extinguish only part of the lamps on the arch. The

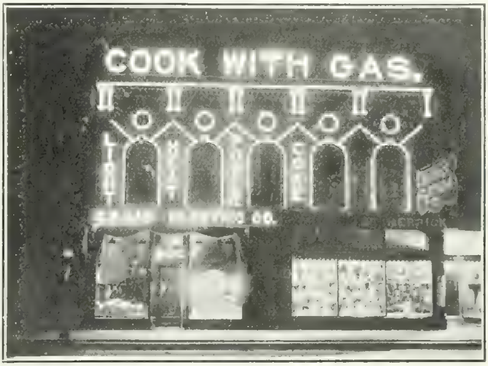


Fig. 2—Office of Green Bay Gas & Electric Company.

merchants pay their assessments on a front-foot basis, distinction being made, however, on the number of hours during which the merchant's store is open in the evening. Those establishments closing at 6 p. m. pay $2.12 a month for each 33-ft. front. Business houses remaining open after 6 p. m. pay $4 a month for each store front. The expense of installing the arches has been met by charging the property owners a larger monthly amount during the first six months. The short-hour stores thus pay $4.40 during this period, and the long-hour stores $5 per front. Mr. F. E. Koehler is manager of the new-business department of the Green Bay Gas & Electric Company and has charge of the campaign which is now in progress.

INTERIOR WIRING IN IRON CONDUIT.

Trinidad, Col., is taking up the passage of an electrical ordinance requiring all new wiring and rewiring within fire limits to be in iron-conduit construction. The work of the Rocky Mountain Fire Underwriters' Association and of Mr. R. Daugherty, the municipal inspector, has been so effective that out of nine large buildings now under construction in the city eight are being wired in conduit. It is probable that an Eastern city of 12,000 installing such a proportion of conduit wiring would be hard to find. Trinidad is the sixth city in Colorado to pass a conduit ordinance.

Mr. E. R. Townsend, electrical engineer with the Western Union Underwriters, is investigating the advisability of urging Denver to adopt an ordinance calling for underground wiring in the congested district of that city.

Pueblo, Col., which in the past has been notorious for its hazardous methods of inside wiring construction, has developed greatly in this respect under the ordinance recently submitted by Mr. W. J. Canada, electrical engineer for the Rocky Mountain Fire Underwriters' Association. Mr. J. F. Campbell, the city electrician, is devoting much time to reinspection and calling the attention of property owners to dangerous existing wiring conditions. In the last three months some fourteen complete rewirings have been secured in rigid conduit construction, and the owners and tenants have received sub-

stantial credits in insurance ratings. In several instances the rewiring has amounted in insurance saving to 20 per cent on the investment.

TUNGSTEN-CLUSTER LIGHTING FOR MICHIGAN BOULEVARD, CHICAGO.

After practical tests lasting more than a year of the various modern illuminants available for outdoor lighting, including open and inclosed carbon-arc lamps, metallic-flame lamps, white and orange flaming-arc lamps, tungsten clusters and mantle gas lamps the Chicago South Park Commission has awarded its choice for the ornamental lighting of Michigan Boulevard between Randolph and Twelfth Streets in favor of tungsten-cluster standards. An account of the interesting preliminary experiments, in the course of which complete installations of the various illuminants were made along different sections of Michigan Boulevard, was given in the *Electrical World* of July 29, 1909. The final choice and arrangement of illuminants was determined with a view to the ornamental appearance of the street, both by daylight and after dark, as well as with reference to the illumination secured on the street surface. Throughout this section, along the Grant Park lake front, Michigan Boulevard is 130 ft. wide and is the principal automobile thoroughfare of the city. The west side of the boulevard is flanked by massive hotels and office buildings which overlook the roadway, park, Art Institute, Field Museum site and yacht clubs to the lake on the east. Michigan Boulevard is therefore one of the promenade and show places of Chicago and extreme care was taken in arranging its lighting to have this represent the most advanced practice.

The curb posts selected for this boulevard lighting are shown in the accompanying illustration, which is taken from a picture of the wooden model recently erected on the sidewalk for the inspection of the judges who passed upon the design. With slight modifications the type of post shown here was accepted. It is of dignified ornamental design, 19.5 ft. high, surmounted by a Renaissance cap with six richly decorated arms from

Fig. 1—Proposed "Safety Island" Pillars for Chicago Boulevard.

which are suspended six 100-watt tungsten lamps in 12-in. Alba globes, at a height of 15 ft. above the street level. These posts will be spaced opposite each other at approximately 80-ft. intervals along the curb lines, 135 posts being used in the downtown section from Randolph to Twelfth Street.

At the principal crossings of this automobile thoroughfare it has been found necessary to place islands of safety for the convenience of pedestrians and to insure that drivers heed the rules of the road about keeping well to the right in rounding corners. These "islands of safety" in the middle of the roadway are marked by lamp-posts, which carry a single 100-watt tungsten lamp inclosed in a red, frosted globe to warn drivers after nightfall of their presence. The accompanying picture shows several of the island standards which were submitted in the competition. The one selected by the commissioners will be a composite of two of those illustrated. Its

Fig. 2—Tungsten-Cluster Posts for Michigan Boulevard, Chicago.

upper shaft, conforming closely to the design of the curb posts, will be carried on a tripod base. The 100-watt tungsten lamp inclosed in its red ball globe will be mounted 11 ft. above the street level. Besides its use at the Michigan Boulevard crossings the same type of island pillar will be employed at other boulevard and park crossings in the South Side park system. One hundred of these island pillars have been contracted for by the commissioners.

The successful curb-lighting posts were designed by D. H. Burnham & Company, architects, Chicago, and are being cast by the Dearborn Foundry Company, Chicago.

RECENT TELEPHONE PATENTS.

AUTOMATIC SYSTEMS.

In all automatic systems, just as in the multiple manual systems, the finding or selection of desired lines is dependent upon the terminals of these latter being arranged according to co-ordinates related to the serial numbers. With the manual systems the usual arrangement is by hundreds upon a plane surface, the individual numbers being arranged within the hundred groups by secondary co-ordinates. Similarly, automatic systems may be arranged with terminals upon a plane surface in groups of 100. Such an arrangement has been largely superseded, as two translations of the contact wipers in a single plane are not so readily obtained as a rotation and a translation. The usual automatic system has a cylindrical contact surface with inwardly projecting terminals. The wipers are carried by a shaft coincident with the axis of the cylinder. Longitudinal motion of the shaft selects one co-ordinate and rotation the other.

In a selector patented by Mr. A. H. Dyson, of Chicago, the cylindrical surface has been abandoned in favor of the spherical. The usual rotation shaft carries a contact-carrying cam upon a horizontal axis, this latter coincident with the center of the sphere. The contacts are arranged in vertical and horizontal planes. The rotation of the vertical shaft selects the vertical row and the rotation of the arm about its horizontal axis

selects the proper unit of the row. Fig. 1 shows the parts of the apparatus. Mr. Dyson has assigned his patent to the Kellogg Switchboard & Supply Company.

Mr. H. G. Webster, of Chicago, has also obtained a patent for an automatic system, this being assigned to the same company. This system is one where the contacts are arranged in considerable groups, say, 100, in a complete circle. With a

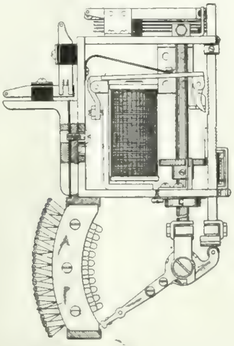


Fig. 1—Dyson's Switch for Automatic Telephone System.

single wiper it will be appreciated that for high numbers of a group considerable time will be required to drive the arm from normal position almost around the circle. To avoid this the contacts are divided into several parts. Thus five parts would give twenty contacts each. A space is left between each two groups and a spider of five arms is used as the contact maker. The arms are electrically isolated normally and at the time of use only one is in service, as the connection of the arms is under control of a relay associated with the desired group of lines. After a connection has been made and cleared, the shaft travels forward until the arms again clear all contacts.

SWITCHBOARD CIRCUIT SYSTEMS.

With the usual two-wire common-battery system the cord supervisory lamps are under control of two relays. One relay closes the circuit of the lamp as soon as a cord is put in use and it maintains its contacts closed so long as connected to a line. To overcome the necessity for this control relay Mr. C. C. Bradbury has made his answering and multiple jacks differently, the latter retaining the small spacing and simplicity of the two-wire jack and the former being made a three-wire jack. Similarly, answering plugs have a ring contact to register with the extra jack springs. The circuits of both supervisory lamps of a cord pair are then carried through this ring contact, so that the circuits of both lamps are completed when and only when the answering plug is up. The patent for this circuit is also assigned to the Kellogg company.

A through ringing-trunk circuit forms the subject of a patent granted to Mr. E. E. Clement, of Washington, D. C. With such trunk circuits used with selective party lines it has been heretofore necessary for the trunk operator not only to connect the trunk with the desired line, but also to set a selector ringing key so that when the distant operator desires to ring a station on the line the proper type of ringing current for the desired station would be applied. According to the present invention the distant operator may choose and connect the proper type of selective current. This is done through auxiliary relays responsive in sequence to current impulses sent over the trunk by the distant operator. This patent has been assigned to the North Electric Company.

In a similar trunk system patented by Mr. C. S. Winston the trunk operator sets the selective key and connects the trunk, and the ringing current is then intermittently applied through the agency of a rotating commutator until the called station answers or the distant operator disconnects.

COMBINED TELEPHONE AND TELEGRAPH SYSTEM.

Along electric railways the telephone and telegraph may be operated over the same wires, using the 500-volt trolley current as a current supply for the telegraph. Mr. E. R. Cunningham, of Des Moines, has invented and patented such a system. Fig. 2 shows a station of his system. The telegraph intruments are worked in multiple instead of the usual series relation. The arrangement for stepping down the effective voltage of the trolley circuit will be self-evident. It will also be noted that the telegraph circuit is applied at the inductive middle of the line through a split coil and that the home instru-

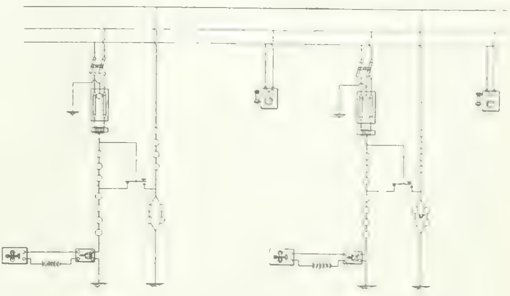


Fig. 2—Cunningham's Combined Telegraph and Telephone System.

ment is protected against an excess of current by introducing resistance at each depression of the home key.

STEP-BY-STEP SYSTEM.

A patent has just been granted Mr. H. J. Roberts, of Evanston, Ill., which relates to his well-known system of step-by-step party-line working. In his system one side of the line is divided into sections and is built up as far as desired by relay apparatus at the various stations. These relays are responsive to current impulses sent out by the operator. At the same time intermediate stations are locked out.

Letters to the Editor.

Electrical Charge on Dead Wire.

To the Editor of Electrical World:

Sir:—In a letter in your issue of Nov. 10 relating to a charge collecting on a line parallel to a railroad track Mr. R. St. Clair Seese says he does not think it likely that the charge referred to was collected from the steam of the locomotives. As, however, no distance from the track is mentioned, it is not clear whether it was possible for the vapor to hit the wires without wind.

I have had considerable experience in connection with a telephone line that crossed a railroad track at a height of 40 ft. to 50 ft., and which would get a charge every time a locomotive passed under it going up hill. When the locomotive passed on the way down hill it generally coasted, and in that case no charge would collect. The discharge was always over the telephone lightning arresters. The altitude was about 5500 ft. above sea level and our climate here is generally very dry. Of course, during damp weather the wire did not collect any charges, probably owing to leakage over the insulators and at other places.

The charge, of course, was given the wire by the vapor from the locomotive, and at times so little vapor was required to make it discharge that I am inclined to think in the case mention by Mr. Seese there must have been enough steam, or rather vapor, carried over to the wire to create the charge. It is very hard to say that there was no wind to carry the moisture, as it sometimes takes very little vapor. Unless very careful attention was given to this point ordinary observation would lead one to think that the vapor did not touch the wire, as the observer would be guided by the smoke, which would be the only visible portion on a hot day, and the locomotive might

have been burning a fuel that was well handled and naturally gave but little smoke, thus misleading the observer.

Virginia City, Nev. F. O. Broili.

To the Editor of Electrical World:

Sir:—In your issue of Nov. 10, 1910, Mr. R. St. Clair Seese cited a case of electrical charge on dead wire. The locality in which the incident related occurred, which is assumed to have been Urbana, Ill., or vicinity, suggests the possibility of such a charge being given to the wire by radiation from some nearby wireless sending station. The distance in this case between the location of the charged wire and the location of one or several wireless stations of reasonably high capacity is not so great but that the wire might fall well enough within sending range of the wireless antenna to absorb a charge from it. The wire, not being ground-connected, would retain any charge it had received until a way for discharge was provided.

U. S. S. Des Moines. H. C. Coombs.

Special Rates for Special Service.

To the Editor of Electrical World:

Sir:—The editorial in your issue of Dec. 1 on certain aspects of rate-making for public-utility companies points out certain conditions, possibly inequitable, which exist in the present practice with regard to energy rates made by hydroelectric transmission companies which do not retail their product, and discusses the bearing thereon of regulation of rates by the community. This suggests a related phase of the question which should receive full discussion, namely, the effect on future development of the establishment by public authority of rigid so-called "non-discriminatory" rates for electric service furnished by public-utility companies. A short explanation will bring out the bearing of this matter.

The existing rate-making commissions seem to get at the regulation of rate schedules for public-utility companies from two points of view. According to one, well typified by the Wisconsin Railroad Commission, an attempt is made to arrive at an exact cost for energy and to prescribe rates in such a form as to distribute this cost, including the return on the investment, proportionately, among the several consumers or classes of consumers actually taking energy. According to the other point of view, the commission is supposed merely to see that the maximum rate or some particular rate is not so high as to return an unreasonably large dividend on the fair value of the property used in the service. The former method works out to a fairly *logical* result, at least in the type of cases considered up to the present time, but has in it an element of potential danger for the future development of the utility companies and consequently for the public served.

For example, we may suppose that in a certain system the actual cost per kw-hour, the demand cost and the consumer cost have been determined by a commission according to some suitable system of analysis and rigid rates established thereupon. If, now, a prospective new consumer, perhaps an ice plant, offers to take considerable energy at a rate, we may say, 10 per cent less than the prescribed rate for energy in this quantity, but still larger than the output cost of the energy plus the direct cost of serving this consumer, the utility company must refuse the offer, to the actual detriment of the company and ultimately of the consumers. For, although the ice plant would not pay its full share of all fixed charges (including the fair return on the investment), it would still pay something over and above the entire increase of expenses to the utility plant resulting from the new service. Of course, if the ice plant should pay the full prescribed rate it would pay a still higher amount toward the total fixed expenses, and this rate should be insisted upon when the service company will actually get the business at the higher price. But we may assume that a different source of energy is available to the ice plant which will be more economical than electricity at the higher rate, and that the lower rate is the only one that will get the business. In this case it is clearly to the advantage of the consumers as a whole that the ice plant be taken on at the lower rate, since the net amount of fixed charges remaining to be met by the former consumers will in the aggregate be less.

While such a line of argument may be open to abuse and may frequently be offered in particular cases where the facts do not warrant, nevertheless, the very important principle is involved that it may be of advantage to a public utility and to the public served to supply consumers at less than their proportionate contribution to the total fixed charges, *provided* such consumers cannot be got at a higher rate, and *provided* that the rate contemplated is sufficient to cover all increase in the prior expense of the system, due to the new load, and to contribute in addition some substantial amount toward the fixed charges. Such an acceptance of a consumer would not be at all inequitable, since it would be for the benefit of all the consumers.

This matter is not one to be passed over lightly, for the future of electric lighting and motor service depends to a superlative degree upon the ultimate cost of electric energy to consumers. The lowering of the cost of electricity below the cost of some competing source of energy will ordinarily transfer a large part of that load to electric service, other things being equal. This will render the cost of production less, in turn permitting a lowering of price. The force of this action will be seen in considering what would have been the effect of rigidly holding the price of electric energy in the past at the rate it was found necessary to charge for lighting service. Such consumers as railways, electrochemical producers, pumping and large manufacturing establishments of various sorts must have low-priced energy, and while ultimately, on account of the enormous outputs involved, they will be very likely to carry their full share of all fixed expenses, yet the start must be made by offering low rates to the initial customers of this class. The question of whether extra low rates can be properly offered in the class of service where isolated building plants are most common, especially in large cities, involves this principle.

New uses for electric energy will spring up on all sides with the lowering of its cost, in heating, cooking, sterilization, etc., but for the lower cost actually to be realized it is necessary to get these new and enlarged demands actually established, which can be done only by offering the low rates in advance. The cost of electric energy drops not only with the increase of output, but with the improvement in daily and yearly load-factor which will result from the variety of uses that have been suggested.

Another danger in the specification of rigid rates is the possibility that the utility company, owing to the necessary grouping of consumers into classes, will not be allowed to take full advantage of energy users who for some rather exceptional reason are especially economical to serve, but who must have low-priced energy—for example, a large consumer located very close to the power house or one that takes energy only off the peak. The latter will probably be found with increasing frequency in the future and is an extremely desirable consumer.

It can undoubtedly be said that any regulating commission which makes a practice of establishing rates and forms of schedules will be willing to make a special rate in any special case on being shown that such would be for the benefit of the other consumers, but this procedure will not serve the purpose effectively. The question as to how far a company can afford to lower its rate below the strictly proportionate basis will depend upon many conditions very difficult of determination by a commission. The extent of overlapping peaks in considering a new consumer, the yearly load curves of the consumer and of the station, the probable effect of a low rate on other similarly situated possible consumers and much experience and familiarity with the local conditions are important elements. But more important still are the delay and cumbersomeness of

the procedure in the determination in a contested case of any particular rate matter by a commission. It is clear that the utility company in negotiating for new consumers of the character here under discussion must be able to offer definite rates and have some discretion in making contracts, even though they may be made within the full knowledge of and subject to later review by a commission. Again, the expense of many rate contests in cases of single consumers would be an extremely serious feature.

These special rates cannot well be formulated in advance of the appearance of consumers, since they will depend fully as much on the limitations surrounding the consumer and the competing sources of energy open to him as will the actual costs of energy to the service company.

As a conclusion from these various considerations it would appear that: First, it should always remain possible for a public-utility company, in spite of the prior fixing of rates by a commission and the publishing of schedules, to offer special rates to individual consumers whereby additional desirable energy may be obtained, *provided* the rate is sufficient to return something toward the fixed charges over and above all additional expense caused by the new load, and *provided* the new business cannot be obtained at the usual rate; second, that the initiative should rest with the utility company in proposing new rates.

This does not mean that the rates should not all sooner or later be approved by a commission having jurisdiction, nor that they should be made without knowledge of the commission, but merely that the term "no discrimination" should not be held to require an absolutely proportional distribution of fixed expenses, but should mean merely that the interests of the whole number of consumers shall not be subordinated to that of one or more special consumers. To hold otherwise in substance may mean that the natural interest of all parties will be sacrificed to uphold some particular theory of analysis.

It will, of course, be always true that no two consumers taking energy under *like conditions* shall receive different treatment, but this is in no way inconsistent with the special rates provided for above. The matter of publishing schedules is not directly involved one way or the other in the principles here discussed.

Common sense must be used in dealing with matters of this sort and no principle should be forced to an absurd degree. The fundamental point to be borne in mind is that any special rates made as described are for the ultimate benefit of all the consumers and not for the utility company or any particular consumer. While it may be feasible to prescribe rigid rates for distributing the costs of any particular plant proportionally among the several customers *then existing*, such a proceeding, if without provision for flexibility and for the initiative of the utility company, may, in the long run, work very great harm to the community in limiting the development of an all-important low-priced supply of energy.

New York. PERCY H. THOMAS.

The Electric Light for Policing.

To the Editor of Electrical World:

SIR:—It is a pretty well established fact that very few of the "hold-ups" and other night crimes common to cities occur directly under an arc lamp on a well-lighted street, the dark street or alley being much preferred by criminals as a stalking ground. Hence we are safe in assuming that if there were no inviting dark streets or alleys in a city there would be less opportunity for crime, which, of course, would mean less crime. In other words, it would seem that we can count on a certain amount of policing power for each street lamp installed; and within limits we might say that when a certain number of street lamps are put on a certain number of policemen could be put out, thus effecting an actual and direct saving in the payroll of the police department. However, we are not suggesting the cutting down of the police force, but that the cities lessen the opportunity for crime, which the police seem powerless to prevent, by better lighting of the streets, and especially the alleyways and heavily shaded sections.

Very few of the crimes that take place are committed before 9 or 10 p. m., up to which time the streets are more or less crowded with people. Therefore, we are fairly correct in saying that the greatest need of street lighting is from 9 or 10 p. m. until daylight the next morning. This is also true because of the fact that the general illumination from stores and residences on the larger thoroughfares does a large part toward street lighting during the early part of the evening.

Now, the commercial peak load of nearly all lighting plants is off by or before 9 o'clock, and the management would be glad to sell lighting to the city from the commercial circuit from this time until daylight at a low price compared to regular peak-load service in order to help out the cost of operation during this "valley load" time; and with the perfection of the high-efficiency series tungsten lamp and its much lower cost of installation per unit the city should get this extra street lighting at a total cost very much below the regular charges for all-night street-lighting service.

The "new-business" departments of the lighting companies and the police and street-lighting departments of the cities might well get together and try this scheme out. It will be to the advantage of both city and company to have the city well lighted during the "hold-up" and "burgling" hours, particularly during the season of "hold-ups" which comes in every city with the cold weather.

Memphis, Tenn. JAMES Z. GEORGE.

Digest of Current Electrical Literature

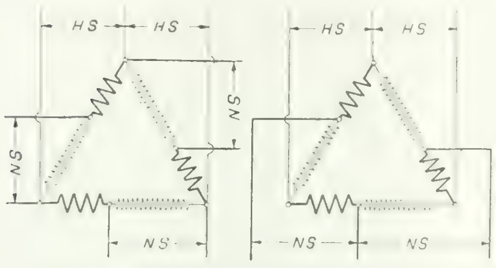
ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Autotransformers.—G. RASCH.—The chief advantage of the autotransformer over ordinary transformers with separate primary and secondary windings is the better utilization of the iron and of the copper. If n is the ratio of transformation of voltages and if iron and copper weights are the same and the induction in the iron and the current density are also the same the kilowatt rating of the autotransformer equals approximately $n/(n-1)$ times the rating of the double-coil transformer. The smaller the ratio of transformation the greater is the advantage of the autotransformer. This explains its usefulness in connection with arc lamps and metallic-filament lamps. The author discusses especially the advantages of two connections for three-phase autotransformers. There is nothing especially peculiar about the arrangement shown in Fig. 1. Its advantage is that it can be used for any ratio of transformation, but it requires six conductors on the low-tension side. The high-tension conductors are marked H. S., the low-tension conductors are marked N. S. On the other hand, in the arrangement shown in Fig. 2 only three conductors are required for the low-tension side, but this method can be used only when the ratio of transformation is between two and unity. Both systems have the advantage of a certain load equalization over the double-coil transformer. For instance, if an ordinary double-coil, three-phase transformer is loaded on the secondary side with three non-inductive circuits the resistances of which have the ratio of 1 to 3 to 5 and if star connection is used, the ratio of the currents in the secondary circuits is 1.94 to 1.54 to 1. The ratio of the currents in the primary circuits is the same. If, however, the autotransformer is arranged accord-

ing to Fig. 2, with a transformer ratio of $n = 1.3$, then the ratio of the primary currents is 1.7 to 1.1 to 1, while in the arrangement of Fig. 1 the ratio of the primary currents is 1.36 to 1.17 to 1. The author gives in some detail the mathematical theory of the arrangement of Fig. 2.—*Elek Zeit.*, Dec. 1.

Heating of Magnet Coils of Direct-Current Machines.—T. ROSSKOPF.—To check the calculation of magnet coils with respect to temperature rise the usual method is to calculate the



Figs. 1 and 2—Showing Autotransformer Connections.

cooling surface per watt of Joulean heat flow and then determine from this by means of empirical constants (which depend on the design of the machine) the rise of temperature. Contrary to usual practice the author thinks that in such calculations the total coil surface (including the cylindrical surface in contact with the iron core) should be taken as the cooling surface. The formula used by him is:

$$a_s = \frac{4[illegible]\,U}{s \cdot AW}$$

where a_s is the permissible specific cooling surface in square centimeters per watt, U the circumference of the coil cross-section in centimeters, s the current density in the wire of the coil in amperes per square millimeter and AW_s is the number of ampere turns of the coil. Some further formulas are added showing how to calculate the dimensions of the magnet coil.—*Elek. u. Masch.* (Vienna), Nov. 27.

Windings.—In a continuation of the long illustrated serial on the windings of dynamo-electric machines the discussion of large alternating-current machines is taken up. The subject is discussed under the following headings: Core, coils, insulation, inserting the coils, diamond coils, testing, connecting and bracing.—*Elec. Journal,* December.

Lamps and Lighting.

Electric Street Lighting.—H. T. HARRISON.—The conclusion of his paper read before the (British) Institution of Electrical Engineers. He compares different types of lamps with respect to cost of energy, cost of maintenance and capital charges. With respect to the cost of energy he thinks that, treating the street lamps as an ordinary consumer, a remunerative price per kw-hour may be taken as 2 cents for large undertakings and 3 cents for small undertakings, which includes, as in the case of consumers, the cost of service to the ordinary distributors, but not of fittings, etc., which would come under the same heading as the consumers' wiring and fittings, which are part of the installation. Figures are then given on the cost of maintenance on tungsten lamps and different arc lamps and also a table of the total candle-power required to produce a minimum horizontal illumination of 0.1 ft.-candle with lamps at different distances and suspended at different heights. From this table two important features are noticeable, namely, the large reduction in total candle-power necessary to produce the same minimum degree of illumination with small units of light placed close together, and the effect of the height of the lamps on horizontal illumination. In general the author recommends a multiplicity of small tungsten lamps as productive of greater efficiency and greater uniformity of light than could be obtained with arc lamps. In the discussion C. P. Sparks thought that 2 cents per kw-hour for larger towns is too high a charge. H. L. P. Boot said from actual tests he had made that for large towns energy for street lighting could be supplied at 1 cent per kw-hour. Some of the speakers thought arc lamps are more effective and doubted whether a very uniform illumination is really wanted by the public. C. N. Russell spoke of the excellent results which had been obtained at Shoreditch by the replacement of incandescent gas lamps by 50-cp and 100-cp tungsten lamps, the latter not only giving a better light but costing less.—Lond. *Electrician,* Dec. 2.

Street Lighting.—C. TOONE.—The conclusion of his article on street-lighting costs in British practice. In the present instalment the author gives an analysis of the costs of various lamps, including capital costs, renewal charges, electrode costs, energy costs and attendance costs. Numerous diagrams and tables are given.—Lond. *Elec. Review,* Dec. 2.

Selective Emission of Incandescent Lamps.—In the report of the Reichsanstalt for 1909 mention is made of F. Henning's work with a spectropyrometer of the Holborn-Kurlbaum (1901) type for the determination of the selective emission of incandescent lamps. The rays of the lamp pass through a slit onto a prism of flint glass, which is turned to bring the required wave-length into the field; an image of the filament is also seen by the observer. So far twelve lamps, fitted with filaments of carbon, graphitized carbon, osmium, tantalum and tungsten, have been tested, and the reflecting powers of tantalum, ruthenium and iridium have also been determined, mirrors of these metals being used. For photometric measurements metallic filaments are recommended. It had previously been established that for the metals gold, silver and platinum the absorptive power (within the visible spectrum) is independent of the (black) temperature, so that $(1 \div S) - (1 \div S_0) = k$, where S and S_0 are the absolute temperatures of the metal for wave-lengths λ and λ_0 and k is a constant which depends upon the wave-lengths, but not upon the temperature. This is now confirmed for metallic filaments. In standardizing a lamp it would hence suffice to determine the relation between the (black body) temperature and the current intensity for a certain wave-length and further to find the k for the desired number of colors (or wave lengths) at any particular temperature. Different lamps of the same type yield the same k.—Lond. *Eng'ing,* N[illegible]

Evacuating Metallic-Filament Lamps.—A note on a recent British patent of H. Kuzel (25,889, Nov. 24, 1910). To improve the vacuum obtained during exhaustion of lamp bulbs, the mercury vapor from the air pump is prevented from entering the bulbs by placing between the pump and the bulb a large area of metal such as gold or silver leaf, zinc or copper fillings, which absorbs the vapor. In addition, the mercury in the pump is cooled to a temperature of about 1 deg. C.—Lond. *Elec. Eng'ing,* Dec. 1.

Drafting-Room Lighting.—C. E. CLEWELL.—An account of experiments on the lighting of a typical drafting-room with bays 16 ft. x 20 ft. and a ceiling height of 11.5 ft. The best solution was found to be the use of sixteen 40-watt tungsten lamps per bay arranged in clusters of four each, by mounting the units on fixtures so constructed as to make use of the lamps in an inverted position. Completely indirect illumination was not employed, however, since use was made of reflectors of a softly diffusing quality of glass which furnished a considerable amount of transmitted light to the work.—*Elec. Journal,* December.

Generation, Transmission and Distribution.

Long-Distance Transmission in Italy.—The development of hydroelectric works in Italy was at first almost exclusively carried out in connection with low-pressure installations in the low-level tracts of country in the neighborhood of the centers of consumption and was subsequently extended to high-pressure installations in the mountainous districts where the quantity of

water is small and the fall very considerable. Among the first important works of the latter kind are the Brusio works in the Puschlav, belonging to the Societa Lombarda. The high-pressure line from Campocologno to Lomazzo (between Milan and Como) traversed a distance of 112 miles and involved an outlay of $1,600,000, or $100 per kilowatt available at the place of consumption, so that the line cost one-half of the average cost of $200 per kilowatt reckoned for hydroelectric works (concession, water works, turbines, electrical machinery, conductors, etc.) in Italy. Other long transmission lines have been installed since the Brusio works were started in 1906. The Societa di Elettrochimica has a line 112 miles long from Bolognano in the Abruzzi to Naples, and the Adamello Company has a line from the High Alps to the foot of the Apennines in the district of Parma, the length being 136 miles. The pressures used on these two lines are 88,000 volts and 72,000 volts, which were until recently the highest in Europe. The transmission-line spans have gradually increased from 200 ft. in 1899 to 600 ft. in the case of the Adamello line. These installations have been in operation for only a short time. The development of the high-head hydroelectric installations is being accompanied in general by the establishment of storage reservoirs, owing to the great fluctuations in the supply of water and to the natural reservoirs formed by the mountain lakes. The reservoirs assure a sufficiency of water-power throughout the winter. A large number of noteworthy reservoirs are reported to be in course of construction in various parts of Italy.—Lond. *Elec. Review*, Dec. 2.

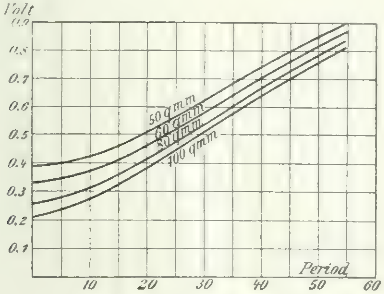


Fig. 3—Voltage Drop for Single-Phase Trolley Wires.

Excessive Rise of Voltage.—A. Leaute.—The conclusion of his mathematical paper in which he discusses the problem on excessive rises of voltage which may be produced when in a long feeder containing a circuit-breaker at the power plant and another one on the line and connected to the primary of a transformer the latter circuit-breaker is closed. In the present instalment the analysis is extended to a transformer with appreciable capacity and to the effect of the self-induction of the armature of the generators. Finally a comparison is made between the results of analysis and of oscillographic records.—*La Lumière Elec.*, Nov. 26.

Electricity in Steel Works.—G. Sauveau.—The first part of a profusely illustrated description of the steel works in Dommellaugen, in Luxemburg, where electric steel refining is being used. In the present instalment the blast-furnace plant and the use of blast-furnace gases for generation of electrical energy by means of gas engines are dealt with.—*La Rev. Elec.*, Nov. 30.

Electrically Operated Turntables.—E. C. Wayne.—An illustrated article on the use of electric motors for operating turntables The advantages are stated to be great saving of time with consequent promptness of service; low cost of installation, operation and maintenance; ease of energy transmission; absence of all energy loss while motors are idle; simplicity and accuracy of control, and reliability and high efficiency of operation.—*Elec. Journal*, December.

Lignites.—H. K. Benson.—An article on a method for increasing the calorific power of Washington lignites by means of partial distillation. The results of partial distillation are that the moisture content is greatly reduced and the relative amount of fixed carbon is increased. In a test the heating value of lignites was increased from 0 per cent to 21 per cent. Coal gas, ammonia and coal tar are recovered as by-products. The extended range of utility for these lignites and the commercial value of the by-product suggest this method as an improvement over the means heretofore used for utilizing low-grade lignites.—*Met. and Chem. Eng'ing*, December.

Traction.

Voltage Drop with Alternating-Current Railways.—G. Huldschiner.—A mathematical paper on the calculation of the voltage drop in the trolley wires and in the rails used as return conductors in single-phase and three-phase railways. Fig. 3 gives the results for single-phase railways. It gives the voltage drop per ampere-kilometer for single-phase trolley wires of different cross-sections when the rails are used as return conductors. The abscissas represent the frequency in cycles per second, the ordinates the voltage drop. The different curves relate to different cross-sections in sq. mm. The diagram shows the increase of reactance with increasing frequency. It further shows that an increase of the cross-section reduces the voltage drop to a much smaller degree for single-phase current than for direct current, and this is especially true for higher frequencies. Fig. 4 gives the voltage drop per ampere-kilometer for three-phase railways with different cross-sections of the trolley wire. The cross-sections marked on the curves refer to a single trolley wire.—*Elek. Zeit.*, Dec. 1.

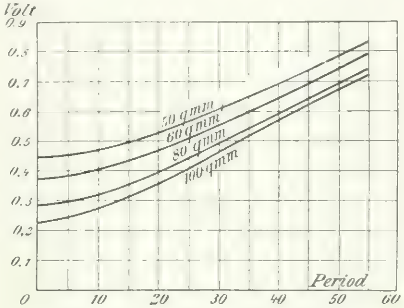


Fig. 4—Voltage Drop for Three-Phase Railways.

Storage-Battery Car.—A note on recent tests of a six-axle storage-battery car designed and built by the Halle railways. These tests have been made on the line between Kottbus and Schönwalde, which is forty miles long. The car weighs 60.5 tons and was loaded with six tons to represent passengers The route was first traversed at a speed of thirty miles an hour, stopping at all stations, then at 37.5 miles per hour without stopping and finally at 37.5 miles per hour including stops. The results are shown in the following table:

State of Rails.	Speed in Miles per Hour.	Number of Stops.		[illegible]		[illegible] per Ton-Mile.	
		Going	Return.	Going	Return.	Going.	Return.
Damp....	[illegible]	[illegible]	10	61	63	22.9	23.7
Damp....	37.5	1	[illegible]	52.5	[illegible]	19.8	20.0
Dry	[illegible]	[illegible]	10	67.5	66.5	25.3	24.9

The battery consists of 168 cells and has a rating of 368 amp-hours.—Lond. *Electrician*, Dec. 2.

Alternating-Current Locomotives.—A. Soulier.—An illustrated article giving descriptions of the various types of electric locomotives installed on the railways in Italy, Switzerland, Baden and Prussia in Germany.—*L'Industrie Elec.*, Nov. 25.

Water Storage versus Electric Storage.—A. W. Barham.—The author suggests that the water-storage scheme proposed by Prof. R. A. Fessenden for utilizing wind-power would afford an appropriate method of dealing with peak loads on generating stations. Motors are used for pumping water during times of light load, and these motors are run as generators coupled to Pelton wheels when the load is heavy. A comparison is drawn between the cost of steam plant, storage batteries and water storage for supplying energy during the peak load. For this purpose a central station is assumed having a maximum load of 10,000 kw, which is maintained for three hours, and having also a load factor of 25 per cent, which is considerably above the average. Since spare plant is a necessity in a station guaranteeing continuity of supply, he assumes a plant equipment rated at 12,500 kw. The 2500 kw of spare plant may be either steam generators, lead storage batteries, or, as suggested, a system of water storage. With regard to the problem of providing a system of water storage to obtain an available output of 2500 kw for three hours, the plant could consist of three sets, each of 800-kw rating, consisting of a Pelton wheel, a motor (suitable for running as a generator) and a one-stage pump (high lift); the three machines being mechanically connected together by means of clutches, so that when discharging the Pelton wheel is driving the motor as a generator, with the high-lift pump disconnected. In charging the motor would drive the pump, with the Pelton wheel disconnected. The clutches would be electrically operated, together with the rest of the plant, from a continuation of the main switchboard in the generating station. The machines would be placed at the base of a deep shaft, at the bottom of which a large chamber would be excavated, the storage consisting of water descending from a reservoir on the ground level to the Pelton wheel and filling the lower reservoir, whence it would be pumped back to the ground level. The amount of water required for storage for three hours' maximum load running at an over-all efficiency of 80 per cent would be 380,000 cu. ft., contained in a reservoir of 14,160 cu. yd. at the bottom of a shaft 1000 ft. deep. In the comparison of the cost of the three systems the author reaches the following results:

	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	75.00	64.00	52.00
[illegible]	8 60	8.39	[illegible]

Regarding the case of an extension after a trial plant dealing only with the present peak load has been installed and found satisfactory, the scheme could be enlarged so as not only to deal with the present and future peaks, but to flatten out the day and night loads on the generators, thereby approaching nearer to the 100 per cent load-factor so much desired by the central-station engineer. The advantages of water storage over battery storage in connection with alternating-current stations are emphasized.—Lond. *Electrician*, Dec. 2.

Rates for Electrical Energy.—K. Gajczak.—The author discusses in some detail a new rate system which he formerly proposed. His fundamental idea is that the problem of a fair charge should be considered rather from the viewpoint of the consumer than from that of the central station. He proposes to charge a fixed rate per kilowatt connection and this fixed rate should equal the cost which the consumer would have to pay if he erected his own plant for his purposes. Besides this a very low price for energy is to be paid per kw-hour consumed, and this price should correspond to the fuel consumption in a plant which the consumer would have to erect for his own purpose. At the same time the author proposes to introduce a maximum rate to protect those consumers who use their connections only for comparatively few hours in the year. The author compares a rate of this kind with the usual rates and shows that the prices of energy generally charged at present do not correspond at all to the cost of the energy in isolated plants. In most cases the charge is too low for short hours and far too high for long hours and for large installations. Tables and a diagram are given.—*Elek. u. Masch.* (Vienna), Nov. 20.

Electrical Industry in Great Britain.—H. A. Carney.—A paper read before the Students' Section of the (British) Institution of Electrical Engineers on the unsatisfactory condition of the electrical industry in Great Britain. The author discusses the following as the principal causes of the present unsatisfactory condition of the electrical industry: Apathy, want of pushful development of electricity supply, want of specialization in manufacturing, want of commercial ability in the industry. Restrictive legislation, free imports and labor questions are shown to be of purely minor consequence. The removal of the four main troubles mentioned above would, he believes, bring about the desired change for the better in the industry.—Lond. *Electrician*, Dec. 2.

Electric Heating and Cooking.—An article illustrated by diagrams giving statements of various British central-station engineers as to the extent to which electric heating and cooking are employed, etc. The matter is summed up in a long editorial. It is pointed out that British central stations have too long neglected electric heating and cooking as a satisfactory load. If any satisfactory progress is to be made the rate for heating and cooking should not exceed 2 cents per kw-hour and should be lower if possible. As regards the construction of heating and cooking apparatus, little fault can be found with the heating apparatus, although the mistake is frequently made of installing too small a radiator. The design of electric cooking apparatus is not yet satisfactory in Great Britain. But progress is being made. Electric toasters have been adopted on a very large scale in many London clubs, and Mr. Seabrook, the engineer of the Marylebone station, reports that he is able to furnish tenement rooms with electric cooking apparatus and to supply energy at 2.2 cents per kw-hour per 900 watt-hours, which price covers the charge for hire.—Lond. *Electrician*, Dec. 2.

Fire-Damp Safety Cut-Out.—An illustrated description of a fire-damp safety cut-out of English make which works with 2 per cent of fire-damp, but could be adjusted to operate at any larger percentage. The detector itself consists of two compound metal strips, E and F, in Fig. 5, normally out of contact. Below these are coils of thin wire, of silver and platinum respectively.

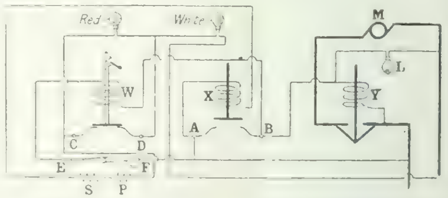


Fig. 5—Diagram of Connections of Fire-Damp Safety Cut-Out.

These coils are in series and normally heat up both strips equally, so that they do not touch. Variations of temperature or voltage affect both strips equally. Should fire-damp be present, however, the platinum coil will increase in temperature, due to catalytic action, and the strip F will bend up and close the circuit. This results in the solenoid switch W lifting and putting the red lamp in circuit by opening the short-circuit at C D and at the same time cutting down the current. Although the coils cool and the contact separates, the plunger of the solenoid W is held up by a catch. The air enters the detector box through openings covered with fine wire gauze as in a safety lamp. In order that the device shall cut off the supply a second solenoid switch X is provided. In its off position this closes two contacts, A and B, which are connected to the motor switch gear in such manner that when closed they will cause the current to be cut off. This result can be obtained by connecting the two contacts A and B to the "no voltage" release

coil of the starting switch, but as it is possible for the attendant to switch current on again it is recommended that a solenoid-controlled main switch be employed, as shown in the diagram. If this solenoid switch be inclosed in a case the attendant cannot switch on again until the solenoid W has been reset by the person having the key of the case. The solenoid X is in series with the heating coils and the two lamps. The core of this solenoid will remain so long as there is any supply and thus leave the two contacts A B disconnected. Should gas be present and the strips come into contact the reduction in the current due to the red lamp coming into circuit will cause the core X to fall and make contact across A B and short-circuit the solenoid Y of the main switch. Although the strips separate, the main solenoid switch cannot be closed again until the red lamp has been short-circuited again by releasing the catch of the solenoid switch W. A switch is provided in the détector to short-circuit the heating coil under E, so that the apparatus may be tested periodically. The closing of this switch will cause strip E to cool and come into contact with F and thus operate the cut-out gear.—Supplement to Lond. *Elec. Eng'ing*, Dec. 1.

Wires, Wiring and Conduits.

Fuses.—E. Jasse.—The conclusion of his illustrated paper on the theory of fuses. The author gives formulas for determining the time in which a fuse will melt with a certain current and then discusses the different constants which are characteristic of different metals for use as fuses. These data are given in a table. While these constants are defined for fuses of infinite length the effect of a finite length is discussed. Finally rules are given on the applications of the formulas.—*Elek. u. Masch.* (Vienna), Nov. 27.

Earthing of Electrical Apparatus.—G. A. Webb.—A paper read before the South African Institute of Electrical Engineers. The author discusses means for efficiently earthing underground electrical plant in mines, so as to minimize risk of accidents. He also makes several suggestions as to earth-contact indicators.—Lond. *Electrician*, Dec. 2.

High-Tension Cables.—Hoechstaedter.—A French translation, illustrated by diagrams, of his recent German paper on modern high-tension cables.—*La Rev. Elec.*, Nov. 30.

Regulations.—A summary of the modifications recently adopted in the wiring regulations of the German Association of Electrical Engineers.—*L'Industrie Elec.*, Nov. 25.

Electrophysics and Magnetism.

Power-Factor of Three-Phase System.—F. Niethammer.—A brief mathematical article on the proper definition of the power-factor of a three-phase system with unequally loaded phases.—*Elek. u. Masch.* (Vienna), Nov. 27.

Electrochemistry and Batteries.

Electric Zinc Smelting.—A description and discussion of two recent electric furnace processes of W. McA. Johnson and

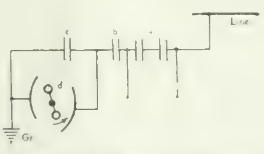


Fig. 6—Connections of a 200,000-Volt Electrostatic Voltmeter.

H. W. Hixon. The chief feature of Johnson's process is that continuous operation may be combined with a high degree of working efficiency by electrically smelting a charge adapted to yield a fusible slag and passing the vapors therefrom through a body of carbon at a reducing temperature of maximum reductivity, that is to say, at a temperature at which carbon vapors are present. The process of Hixon refers to details of charging an electric zinc furnace and condensing the zinc vapor.—*Met. and Chem. Eng'ing*, December.

Units, Measurements and Instruments.

Units of Thermal Resistivity and Resistance.—C. Hering.—The author first points out that for many thermal calculations it is better to use thermal resistivities and resistances instead of thermal conductivities and conductances. As to the units to be used in such calculations he shows that thermal conductivities are expressed in watts for 1 in. (or centimeter) cube and 1 deg. drop; that conductances are expressed in watts for 1 deg. drop; that thermal resistivities are expressed in degrees drop for 1-in. cube and 1-watt flow; that resistances are expressed in degrees drop for a flow of 1 watt, and that the numerical values of the resistivities and corresponding conductivities are then the reciprocals of each other, as are also the values of the resistances and conductances.—*Met. and Chem. Eng'ing*, December.

High-Voltage Electrostatic Voltmeter.—A. W. Copley.—An illustrated article on a 200,000-volt electrostatic voltmeter. The meter element consists of two stationary curved aluminum plates, between which is suspended a movable vane, with a light coiled spring so adjusted that the pointer remains at zero with no voltage on the meter and gives the full-scale deflection at the proper voltage. When a difference of potential exists between the stationary vanes the moving vane, which is in the position shown in Fig. 6, rotates in the direction of the arrow, in its attempt to shorten the distance between itself and the stationary plates. The meter is placed in a sheet-iron tank filled with transformer oil. This is necessary from the insulation standpoint as the distance between live parts is less than the break-down distance in air. At the same time it makes the meter practictically dead-beat, the coil acting as a damper. The electrostatic voltmeter element is shunted across one or more metallic layers of the condenser terminal of the instrument. Thus the voltage impressed is only a fraction of the total voltage from line to ground. Metallic rings or collars are connected to two of the metallic layers, dividing the series of condensers from line to ground in three sections. The first section, marked a and shown for simplicity as two condensers in series, has a potential of one-half the line voltage impressed across it, while sections b and c have each a potential equal to one-quarter of the line voltage impressed upon them. The voltmeter element d, which is shunted across section c, is thus seen to operate on a voltage of one-quarter the impressed e.m.f., or 50,000 volts when 200,000 volts is impressed across the terminals. For the measurement of e.m.fs. not exceeding 100,000 volts section a is short-circuited. Sections b and c then have one-half the line voltage impressed upon them, so that the meter element still has 50,000 volts across it when the full rated

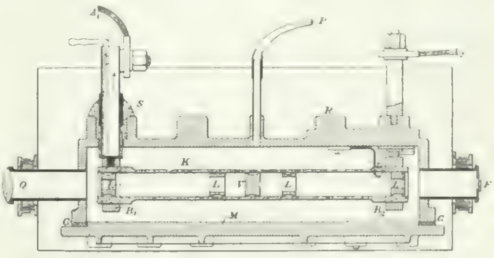


Fig. 7—Black Body of Lummer-Kurlbaum Type.

e.m.f. is impressed on the terminals. In a similar manner, for measurements of e.m.fs. not exceeding 50,000 volts, sections a and b are both short-circuited—that is, the meter element is connected directly across the line.—*Elec. Journal*, December.

Radiation from a Black Body; Optical Pyrometers.—In the report of the Reichsanstalt on the work done in 1909 the researches by S. Vanentiner on the radiation laws are reported. According to the law of Stefan and Boltzmann the total energy radiated by a black body at the temperature T (absolute scale)

[illegible]. The value of the constant c has been determined up to 1600 deg. C. (absolute) and the figure used by Kurlbaum some years ago for 100 deg. C. has been confirmed, namely, 1.28×10^{-12} gramme-calorie per second per square centimeter. The constant c of the Wein-Planck law is also being redetermined by E. Warburg and G. Leithäuser. As the temperature of a hot body rises the maximum of radiation in its diffraction spectrum is displaced more and more toward the violet, though it is still outside (in the infra-red) of the visible spectrum, even at 2000 deg. C. Wien's displacement law is utilized in measuring temperatures above 1300 deg. C. absolute by means of optical pyrometers (Holborn-Kurlbaum, Wanner and others), and the constant c must be known for these measurements. Several determinations of c have been made at the Reichsanstalt, but there are still doubts as to the reliability of the experimental basis of the thermodynamical scale used in these measurements. The black body (Fig. 7) constructed for the redetermination is of the Lummer-Kurlbaum type, but the heating is now effected in a vacuum in which the carbon tube can be heated up to 2500 deg. C. absolute without being burnt. The carbon tube K has a length of 35 cm and an internal width of 26 mm; it is mounted within a bronze box R and held by the jaws B_1 and B_2, in which the carbon wall is thicker than outside. The bronze casting is fixed to the base M, rubber washers G being interposed. The box has four openings—two, F and Q, for the windows, which are made of fluorspar or quartz, the third for evacuating and the fourth A_1 for introducing the one insulated lead, the other A_2 being joined to the frame. The connection with the tube is sliding, to allow for the expansion of the tube. S is sealing-wax serving as cement for the pipe A_1, which is water-cooled, like the whole box R. The space between K and R is packed with kryptol (fine-grained graphite) or, for very high temperatures, with calcined charcoal, which is a poorer conductor for electricity at high temperatures than graphite; asbestos paper keeps this carbon off the bearings. $L L$ are stops of carbon placed within the tube, V is a block of carbon. As soon as a uniform black radiation is attained L is no longer visible on the background of V. A temperature of 2500 deg. C. is realized for an expenditure of 4.5 kw. A vacuum bolometer is used in connection with the black body.—Lond. *Eng'ing*, Nov. 11.

Measuring Insulation and Capacity Without Interruption of Operation.—H. Hausrath.—A mathematical paper discussing the theory of the different methods for determining the insulation and capacity of a system without interrupting operation.—*Elek. u. Masch.* (Vienna), Nov. 13 and 20.

Telegraphy, Telephony and Signals.

Electric Recording Target.—An illustrated description of an automatic electric device which records the location of a shothole on a target at rest or in motion on a facsimile of the target at a distance.—Lond. *Elec. Review*, Dec. 2.

Book Reviews.

The Tesla High-Frequency Coil, Its Construction and Uses. By George F. Haller and Elmer T. Cunningham. New York: D. Van Nostrand Company. 119 pages, 56 illus. Price, $1.25.

This is a thoroughly practical work on a piece of electrical apparatus which, in the form it has acquired since described by Tesla, has become of commercial importance of late years by reason of the essential and prominent part which it plays in wireless telegraphy. The authors have made a careful study of a 12-in. spark-coil with a view to output and efficiency and have embodied their results in numerous clear and well-drawn diagrams from which nothing of importance is omitted.

The would-be constructors of induction coils giving a 7-in. as well as a 12-in. spark will find in these pages information which will save time and experimentation. Not only are numerical data and technical details given, but also the general elementary theory of the typical transformer, the magnetic circuit and the condenser. A chapter of fourteen pages is devoted to the uses of the coil for lighting vacuum tubes, for Roentgen-ray work and wireless telegraphy.

Dynamo-Electric Machinery, Its Construction, Design and Operation. By Samuel Sheldon and Erich Hausmann. New York: D. Van Nostrand Company. 339 pages, 210 illus. Price, $2.50.

That this work has reached its eighth edition shows that both the matter treated and the mode of presentation are eminently adapted to meet the requirements of junior students in electrical engineering colleges. If the subject is primarily a practical one, theory is well enforced throughout the chapters by general explanations, by differential equations and by problems for solution. It would have been a decided help if answers had been given to the numerical questions appended to the chapters. Exercises of this kind contribute to a clear apprehension and firm grasp of fundamental principles; they can, however, be fruitful only when the youthful toiler has an answer before him with which to compare the result of his own calculations. Such an addition in a following edition would tend to increase the usefulness of the work as a text-book.

Solenoids, Electromagnets and Electromagnetic Windings. By Charles R. Underhill. New York: D. Van Nostrand Company. 342 pages, 223 illus. Price, $2.

The author of this treatise is well known for the investigations which he has carried out on matters connected with electromagnetism and for the thoroughly practical way in which he has dealt with the various problems connected with the subject, as well as for the value and reliability of the data obtained. If the profession is indebted to Prof. S. P. Thompson, of London, for his splendid treatise on the electromagnet, it is also greatly indebted to Mr. Underhill for the details of the expensive researches of his own as given in this volume. The general reader will here find a consecutive account of the evolution of the electromagnet, while the designer as well as the builder of electromagnetic mechanisms and machinery will find ready to hand in the text, in the plotted curves and in numerous tables just the kind of information wanted.

If, as is stated on page 12, retentiveness is "that property which tends to retain magnetization," we find it difficult to see how it can be said that soft iron has "great" and hardened steel "little" of that quality. The definition of "pole" given on page 13 as "the surface where the density of the lines entering or leaving the magnet is greatest" is not a happy one. The name of Professor Silvanus P. Thompson is misspelt in the preface and again on page 188. If these are blemishes, they are entirely wiped out by the great electromagnetic wealth contained in the work.

Wireless Telegraph Construction for Amateurs. By Alfred P. Morgan. New York: D. Van Nostrand. 187 pages, 147 illus. Price, $1.50.

This manual contains practical information for the ever-growing number of young amateurs who have to build up a wireless set either for experimentation or for mere amusement. The construction of simple, efficient instruments is given by clear diagrams drawn to scale, together with a sufficient amount of elementary theory to enable the experimenter to carry on his work intelligently.

Electrotechnics Electrical Engineering Laboratory Manual. By John Henderson. New York: Longmans, Green & Company, 179 pages, 38 illus. Price, $1.20.

This book is Vol. III of a series of physical and electrical laboratory manuals, intended for the City and Guilds of London Technological Institute's syllabus, and gives a comprehensive list of experiments which can be carried out with such apparatus as all laboratories are sure to have.

The ground covered includes electrical properties of circuits; characteristics of direct-current machines, alternators, transformers, batteries, etc.; calibration of instruments. There are eighty-seven experiments, and at the end of the book is a list of reference tables. Every college prepares its laboratory course to fit its equipment in order to get maximum benefit from such equipment; therefore, no laboratory manual however good it may be, can ever meet the requirements of very many different schools. The solution of the laboratory manual question for schools which are not large enough to publish one of their own would appear to be a loose-leaf manual wherein each school can choose the make-up of its own book.

L'Année Électrique, Électrothérapeutique et Radiographique. By Dr. Foveau de Courmelles. Liege: Ch. Beranger. 348 pages. Price, 3.50 francs

The first third of this annual review of progress in electrotherapeutics and radiography as applied to medicine and surgery is devoted to general progress in electricity, such as theoretical advances in electrophysics and electrochemistry, practical advances in heating, lighting and power transmission, etc. The remaining two-thirds treat of electrical progress in relation to therapeutics. The treatment is particularly good and detailed in relation to radiography. It is less notable in regard to electrotherapeutics, and it is not so precise in dealing with electrophysics in general. The book will be of special interest to students and practitioners of radiotherapeutics and of electrotherapeutics.

Welding and Cutting Metals by Aid of Gases or Electricity. By L. A. Groth. New York: D. Van Nostrand. 207 pages, 124 illus. Price, $3.

New processes of welding have revolutionized certain lines of manufacture and resulted in the substitution in many cases of welded utensils for clumsy cast iron with its uncertain strength. The present book is given up largely to gas welding, the treatment of electric welding being practically confined to the Thomson process. The subject is treated according to the following outline: Gases and their generation; welding processes; blowpipes; welding of sheet iron; welding applied to boilers; cutting of metals by burning; reports on acetylene welding; statistics on accidents; tables and useful information. The character of the treatment is largely descriptive, the theory of welding and the welding properties of various metals not being treated. The book brings together a large amount of information on the subject and gives the reader a good idea of the importance of modern welding processes in manufacture as well as an idea of the nature and limitations of these various processes.

Jahrbuch der Elektrochemie und Angewandten Physikalischen Chemie. By Dr. W. Nernst and Dr. W. Borchers. Halle a. S.: Wilhelm Knapp. 1049 pages, 114 illus. Price, 30 marks.

This excellent and carefully elaborated treatise of the progress and development of electrochemistry and applied physical chemistry throughout the world of publications during the year 1905 is the twelfth annual volume of the series to which it belongs. The work is divided into two sections—the scientific or technical, and the applied or practical. In the former the various publications on researches in electrochemistry, discoveries, measurements, constants or principles are discussed at length and in their respective categories. In the latter the various new apparatus, methods of analysis, products and processes are described and enumerated, with bibliographical references to further details. No working electrochemist can dispense with the use of, or reference to, this series of volumes if he seeks to keep informed concerning the history and progress of the science and art of his profession.

New Apparatus and Appliances

SQUIRREL-CAGE MOTORS IN FERTILIZER WORKS.

That electric motors can be operated successfully under very severe conditions is forcibly demonstrated by the accompanying pictures, which were taken in the fertilizer works of G. Ober & Sons, Baltimore, Md. The motors were installed about five years ago, and have been working under a triple combination of difficulties—sulphuric acid fumes, dust and grit, and lack of skilled supervision. Under these conditions the motors have given very satisfactory service since they were installed and have justified their adoption.

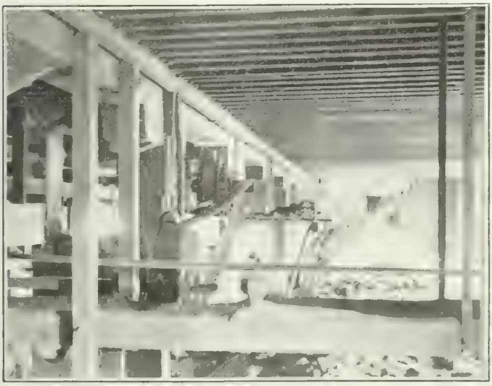


Fig. 1—Squirrel-Cage Motor in Fertilizer Work.

Fig. 2—Autotransformer Motor Starter.

The operations of grinding the bone and phosphate rock that are used in the manufacture of fertilizers produce great quantities of dust which settle everywhere in the plant and cover the machinery with a dirty, gritty mantle. The photographs reproduced herewith are typical of the appearance. Besides the

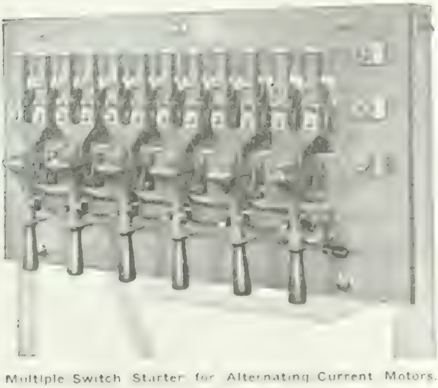
and the air is permeated with the fumes of sulphuric acid which is used in the manufacture of phosphoric acid from phosphate rock. The operators are recruited from negroes and the less intelligent class of whites. Their appreciation or knowledge of machinery is very slight and their usage of it is likely to be rough.

In spite of all the abuses the motors are operating as smoothly as when they were installed over five years ago. The motors are of the polyphase induction type, with squirrel-cage rotors made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Polyphase induction motors of the squirrel-cage type offer advantages for an installation of this kind superior to those of any other type of motor. The absence of sliding contacts makes possible an extremely simple construction, with no wearing parts except the bearings. Absolute freedom from sparking is assured and hence the motors can be used with perfect safety even when surrounded by inflammable or explosive material. The line connections are made to the stationary element when the motor is installed and no further connections are necessary. The rotating element is practically indestructible. Simplicity of construction and operation and low cost for attendance and maintenance are among the prominent features of this type of motor.

MULTIPLE-SWITCH STARTERS FOR ALTERNATING-CURRENT MOTORS.

It is well known that beyond certain current values sliding-contact starters cannot be used successfully because of the arcing and rapid wearing of the contacts. For starting large motors starters having sliding contacts are not so satisfactory as devices of the multiple-switch type. The increased use of alternating current has caused a demand for many new alternating-current controlling devices. The Cutler-Hammer Manufacturing Company, of Milwaukee, has put on the market a multiple-switch starter for polyphase slip-ring motors in standard sizes ranging from 60 hp to 600 hp.

Many features of the direct-current multiple-switch starter have been embodied in this alternating-current device. No sparking at the switch can occur in starting, whether under load or not. The switches are not like ordinary knife switches, but are of circuit-breaker construction, making full contact instantly. Besides doing away with sliding contacts the multiple-switch starter prevents the hasty cutting out of resistance, as each switch must be closed separately, beginning at the left. The time taken insures a smooth acceleration of the motor and prevents injury due to large current inrush.



Multiple Switch Starter for Alternating Current Motors.

The contacts of the switches are so connected that the resistance is cut out of the separate phases of the secondary simultaneously. The currents in the legs are therefore approximately equal and an electrical balance is maintained. The motor is started under the best conditions, each phase producing its share of the total torque. This type of starter is asserted to be the most serviceable for use with large motors.

THEATER DIMMER.

In the accompanying illustrations is shown a dimmer provided with 120 control steps which was built for use in an English theater where fifty steps of control were considered inadequate. Each dimmer plate consists of a standard field rheostat plate 15 in. in diameter provided with an additional inside row of contact buttons. The rheostat is designed for carrying 25 amp.

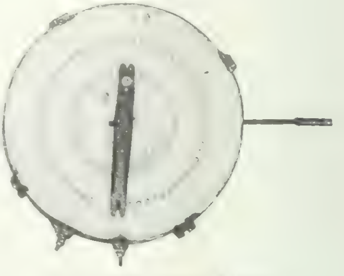


Fig. 1—Back View of a Plate.

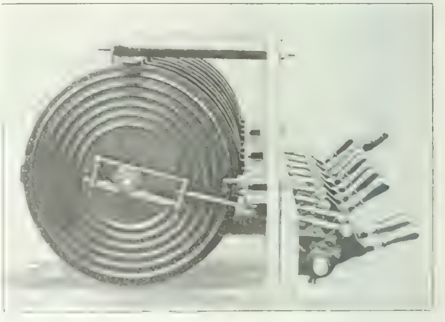


Fig. 2—Theater Dimmer.

The above-described dimmer has been built by the Ward Leonard Electric Company, Bronxville, N. Y.

SMALL EXHAUST-STEAM TURBINES.

Of the several methods for increasing the output of a non-condensing reciprocating steam-engine installation the most satisfactory consists in installing a condenser together with an exhaust-steam turbine. The turbine illustrated in Fig. 1 is designed to operate at any steam pressure above 2-lb. gage at its inlet and exhaust into a vacuum of from 24 in. to 28 in. When used with a reciprocating steam engine that has previously been running non-condensing this engine continues to exhaust at about the same pressure and carries the same load after the turbine is put into the exhaust line. A condensing engine can be adjusted to exhaust at atmospheric pressure or thereabouts and will be relieved of that part of the load as-

sumed between atmospheric pressure and the vacuum while the turbine is being operated. The increase in output obtained over the non-condensing engine is from 40 per cent to 100 per cent, and is about 25 per cent greater than could be obtained from a reciprocating engine operating condensing.

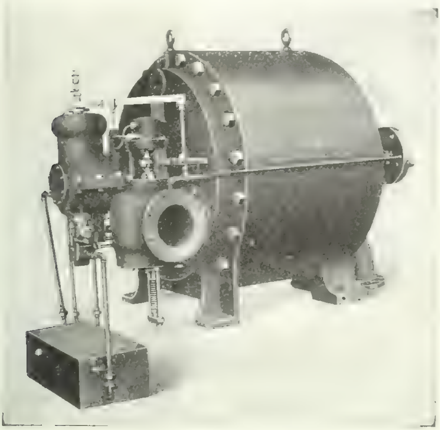


Fig. 1—200-Hp, 5-Stage Exhaust-Steam Turbine.

The power developed by an exhaust-steam turbine is available for driving a generator or any other machine, and under much the same conditions as are obtainable from high-pressure turbines. Rigged up for belt or chain drive the exhaust turbine delivers into the same line or jack shaft as the engine, in which case the turbine assumes an almost fixed proportion of the load. Fig. 2 is a typical installation of this kind. The output of the turbine may be delivered entirely independently of the engine to drive belted auxiliaries or machinery of any kind, the speed requirements of the driven machine being perfectly met by a conforming pulley ratio. An exhaust-steam turbine may be arranged to carry a uniform or fluctuating load regardless of whether the load upon the engine, and consequently the source of steam supply to the turbine, is constant, fluctuating or even entirely cut off for short intervals.

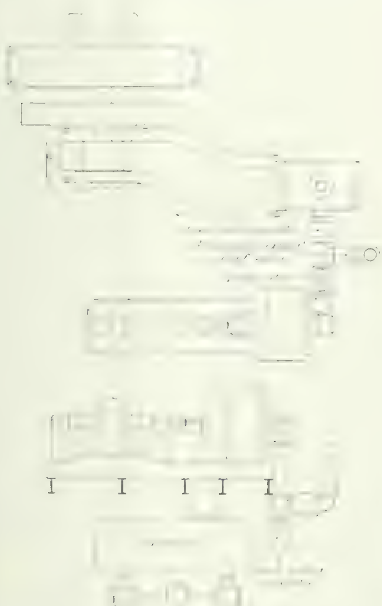


Fig. 2—Combination Engine and Exhaust-Steam Turbine Unit.

The above-described turbine has been placed on the market by the Kerr Turbine Company, Wellsville, N. Y.

ELECTRIC MOTORS IN THE CLOTHING INDUSTRY.

The application of electric motors has become so general that it is not now surprising to find them anywhere. Unfortunately their application to the manufacture of clothing was held back and up to a few years ago electric motors were little used in that industry.

There have been many reasons advanced for this, some contending that the manufacturers of electric motors were too busy supplying the demand of the large mechanical manufacturing plants, others that the clothing manufacturers had thought them expensive. In any case the fact remains that only in recent years have electric motors been used to any extent.

All of the well-known advantages of the electric motor for industrial establishments apply to the clothing industry, particularly that affecting the employees, for it is a well-known fact that clothing shops are of necessity crowded and everything which will aid in giving workmen more air, light and comfort will soon pay for itself in increased production alone.

The photographs shown herewith illustrate the two principal forms of electric motor drives, one a group drive, the other an individual motor drive. Each has its advantages and both are extensively used.

For driving sewing machines perhaps the most economical method of operation is to run a dozen or more machines from a shaft under the working table. Each individual machine, however, is under the control of the operator, who, being relieved of the fatiguing duty of treading the machine, can give his whole attention to his work. When the operators are at work the motor, and consequently the line shaft which furnishes power for all machines, run continuously.

In Fig. 1 a 2-hp Western Electric motor is shown driving twelve machines. This motor also drives a blower for six gas irons and could, if necessary, easily drive a half-dozen or more machines. To start the machine the operator presses his foot on the treadle; to stop it he releases the pressure and the machine stops instantly.

Fig. 1—2-Hp Motor Driving Twelve Sewing Machines.

In some shops each sewing machine is individually driven, but while this has the advantage of the motor running only

when the machine is in operation, the increase in the investment in most cases more than makes up for the saving in power, and this form of installation is not, therefore, economical.

In the cloth-shrinking department of Marks Arnheim, custom tailors of New York City, one finds an excellent example of individual electric motor drives.' The motor equipment of this establishment, which is one of the few custom tailoring houses in New York that shrink their own cloth, consists of two small motors. In Fig. 2 is shown an illustration of a 1-hp Western Electric "Hawthorn" motor connected to a cloth-folding machine. The other motor is a 3-hp machine of the same manufacture and is used to run a hydraulic press, one edge of which can be seen in the cut. The cloth is first shrunk, then placed in the hydraulic press, when all the water is squeezed from it; afterward it is thoroughly dried. When dry it is run through the folding machine and it is then ready for cutting. The motors are connected to both the folding machine and the hydraulic press by belts, and each motor and machine makes a complete unit in itself. In this way each machine can be started and stopped at will, and power is used only when the machine is actually doing work. These two photographs do not show the extent to which electric motors are used in the clothing industry, but merely illustrate the convenience, flexibility, cleanliness and adaptability of electric motor drives in this particular industry.

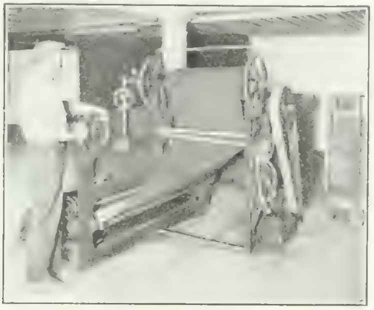


Fig. 2—1-Hp Motor Driving Cloth-Folding Machine.

LARGE HYDRAULIC TURBINE.

The Stone & Webster Engineering Corporation, acting as consulting engineer for the Pacific Coast Power Company, has placed an order with Allis-Chalmers Company for two 20,400-hp reaction turbines to be installed in connection with a new development on the White River, which are said to be the largest ever built.

This development is one of the most comprehensive undertaken on the Pacific Coast, and the problems which have confronted the engineers have been extremely interesting as well as complex. The White River is fed by the glaciers of Mount Ranier and receives its name from the milky silt which the river carries and which gives it a whitish color.

The development is about twenty miles east of Tacoma. The diversion dam is to be built at a point near the big viaduct of the Northern Pacific Railroad north of Buckley. This will not be of unusual size or strength and will simply serve to divert the water into a ditch discharging into a settling pond in which the silt will have a chance to be dropped. The headworks and gates will present some new features of design and will be made extremely strong. From the diversion dam the water will be carried through an earthen ditch about five miles long to the main storage reservoir. This storage reservoir is one of the most important elements in the entire development, as it will hold enough water to operate the plant for a period of three or four months should no additional water be received. It is to be made up of several existing lakes which will be interconnected and which will have their holding capacities largely supplemented by the building of heavy embankments and masonry dams. The flow line of the reservoir will be about four miles long.

From the storage reservoir the water will be carried through a tunnel about 3000 ft. long to the head basin. At present only one tunnel will be built, but eventually another will be added. From the head basin a separate steel pipe line will be built for each turbine. These lines will be approximately 2200 ft. long and will be 8 ft. in diameter at the upper end and 6 ft. in diameter at the power-house end.

The power house is designed for a total length of approximately 373 ft. The generating units will be placed along 45.5 ft. of the width with their shafts in line. Room is to be provided for six units, although only two will be installed at the present time. The other side of the building, 26 ft. wide, will be given over to exciter units, pumps, toilet-rooms and transformer bays. Concrete foundations will be employed with brick superstructure.

The hydraulic installations will be supplied by the Allis-Chalmers Company and will consist at present of two units, each of which will have a maximum rating of 20,400 hp under a head of 480 ft. They will run at 360 r.p.m. Each turbine will be directly connected to a 60-cycle, three-phase, 6600-volt generator.

The turbine runner is of the high-pressure Francis type with horizontal shaft. Water will be admitted to the runner through a cast-steel spiral casing. The runner, which will also be of cast steel, divides the water into two lines of flow, and it is discharged from the wheel by two quarter-turns to separate draft tubes. The flow of water to the turbine will be controlled by a cast-steel butterfly valve.

It is said that the spiral casing of this turbine will be the largest steel casting of this kind ever made. The butterfly valve is to be over 7 ft. in diameter and will be the largest valve of this type ever used. The shaft carrying the turbine runner will be nearly 2 ft. in diameter and the bearings for it will be about 16 in. in diameter. All parts of the turbine which will have to withstand the operating pressure of the water will be tested in the shops under a pressure corresponding to about 900 ft. head. To give an idea of the size and strength of the parts it is only necessary to state that the total testing load on the butterfly valve will be about 1,500,000 lb.

The governors for these turbines will be of Allis-Chalmers standard oil-pressure type and the specifications call for extremely close speed regulation. Separate governors will be supplied for each unit, but a rather elaborate central oil-pressure system will be employed.

As this plant will have to regulate the supply of energy to the whole system of the Pacific Coast Power Company, the problem of proper regulation is an important one. It becomes of still greater importance on account of the necessity of conserving the storage supply of water. To meet this condition and handle the water in a way which will protect the plant from injury and at the same time save water pressure regulators will be installed. These are similar in design to those the Allis-Chalmers Company is now installing on the 18,000-hp turbines in the Great Western power plant, a design which has done excellent service on other installations.

The size of the exciter units has not yet been definitely determined, but there will be two of at least 500 hp. One exciter is to be provided for each three units of the ultimate equipment. As the proportionate amount of water which these wheels will use is not large, they will be of the impulse type and will be governed by means of a deflecting hood similar to that used with the exciter units of the Kern River No. 1 station of the Edison Electric Company.

Construction is progressing rapidly under the direction of the Stone & Webster Engineering Corporation. Mr. S. L. Shuffleton, the Western representative of this organization, is in direct charge.

Industrial and Commercial News

THE WEEK IN TRADE.

INCREASED activity in retail trade, fewer orders for the wholesalers and jobbers and a further slight curtailment in industrial lines are the leading features brought out in the reports of commercial conditions for the past week. The influences which have affected the retail trade are entirely seasonable. The holiday buying is always a feature in the retail business of the year, and during the past week there has been extreme cold weather over a great part of the country, which has added materially to the distribution of winter supplies. In the jobbing trade some reorders are being received, but orders for spring delivery are extremely light. Wholesale salesmen are now returning from the road for the January inventories, and, as a rule, the reports received from these salesmen are to the effect that retail merchants in every section are inclined to be extremely conservative. The entire tone of business seems to be one of uncertainty as to the future and unwillingness to incur heavy commitments. In manufacturing lines there is a manifest disposition to go slowly. Iron and steel operations are being curtailed, and in many sections over-holiday shut-downs are announced. No new rail orders of any importance have been received, and the order placed by the Pennsylvania Railroad two weeks ago for 130,000 tons has not yet been accepted by the mills, because the matter of specifications, which, it is claimed, were unsatisfactory to the manufacturers, has not been settled. A few inquiries for railway cars are being received, but no orders of any importance have been placed. Structural material is still in demand to some extent, though at this season of the year it is always quiet. There continues to be considerable activity in the wire mills, and this is really the only bright spot in the iron and steel situation. Collections are quoted as from slow to fair. They are better in the South and Southwest than in other parts of the country. Business failures for the week which ended Dec. 15, as reported by *Bradstreet's*, were 290, as against 267 the previous week, 273 in the same week of 1909, 311 in 1908, 300 in 1907 and 277 in 1906.

THE COPPER MARKET.

LITTLE interest was manifested in the copper market during the past week, and prices were somewhat easier. Sales were light, and reports were current that domestic melting and European consumption had both fallen off sharply. It was evident that the deliveries of American copper in both countries were greater than the actual consumption. The whole statistical position was more or less unsatisfactory. It is pointed out that electrolytic copper is to-day 1 cent a pound cheaper than at the same time a year ago and that the consumption is no greater. The output continues to be excessive throughout the world. In the United States it is figured that the production is close to the rate of 125,000,000 lb. per month, while the actual consumption is estimated at less than 100,000,000 lb. per month. In spite of the elaborate plans for decrease in production, they do not seem as yet to have been very effective. The more sanguine dealers in copper are still hopeful that the curtailment which was promised will eventually appear. Various reasons are advanced to explain why the promised curtailment, which should have begun more than ninety days ago, has not yet appeared to any extent in the statistics. Exports continue to be fairly heavy, but this is largely on account of the necessity of shifting stocks rather than on account of foreign demand. It is stated that there is carried in the warehouses of Great Britain and France 190,000,000 lb., to which must be added 30,000,000 lb. carried in Hamburg and covered by certificates dealt in on the German exchange. Exports for the week which ended Dec. 19 were 17,417 tons. Imports are running at about former figures. The daily call on the Metal Exchange Dec. 19 quoted standard copper as per the accompanying table.

Standard Copper	Bid.	Asked.	Settling Price.
Spot	[illegible]	[illegible]	.....
December	[illegible]	[illegible]	[illegible]
January	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]

[illegible]

	Noon.	Closing.
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
Best selected	[illegible]	[illegible]

INDUSTRIAL AND COMMERCIAL NOTES.

Electrical Appliances for the Holidays.—An official of the General Electric Company is responsible for the statement that the holiday trade in electrical appliances during the present season has more than doubled that of last year. This does not refer to decorations and Christmas tree lamps, but to useful household appliances. This authority says that reorders have been sent in from all parts of the country for percolators, chafing dishes and other such utensils, and that the increase in this demand has been directly attributed to Christmas purchasing. An extensive campaign of advertising has been carried on for the past six months in connection with this class of goods, and the results of it are just now being appreciated. Such appliances are particularly appropriate as Christmas presents among the well-to-do and middle classes of people. They are made in such a variety of grades and decorations as to afford a wide range in prices. It is believed that this Christmas demand will continue to develop and will hereafter be a very important factor in the sales of the year.

Storage Battery Cars in Service.—An arrangement was made by Joseph B. Mayer, receiver of the Twenty-eighth Street and Twenty-ninth Street Railway Company, with Frederick W. Whitridge, receiver of the Third Avenue Railroad Company, for the operation of the former line with the storage battery cars which the Third Avenue Company has recently constructed. This service was commenced Dec. 18, and about fifteen cars are now being operated. In addition to this, the Third Avenue company is operating ten cars on its 110th Street line. These cars are equipped with the Gould Storage Battery Company cells, and it is claimed that they have shown in tests more than 100 miles on a single charge. The cars themselves are for the most part rebuilt horse cars, but there are some new cars also in the service. For a number of months past an Edison storage battery car has been operating on the Twenty-eighth Street line, but the receiver of that company concluded that it was better to make a running arrangement than to purchase new cars.

Western Union Gets Anglo-American Cable.—It was announced last week that arrangements had been concluded between the Western Union Telegraph Company and the Anglo-American Cable Company whereby in future the business of the two concerns would be under one management. This is taken to mean in financial circles that the Western Union has succeeded in obtaining not only a working but a financial control of the cable company. The negotiations for this combination were carried on by Edward J. Hall, chairman of the executive committee of the Western Union, who has been in London for six weeks. Mr. Hall says that the arrangement will include the signing of an agreement by the British Postmaster General accepting the one-half rate proposal for deferred cable messages written in plain language, which was made some time ago. Mr. Hall also secured, while in England, license from the government for landing rights for the Western Union's new cable. This gives the telegraph company control of seven out of the sixteen transatlantic cables, three of its own and four owned by the Anglo-American company.

Municipal Plant in Pittsburgh.—City Controller Morrow of Pittsburgh has proposed a plan for furnishing the city with a municipal electric lighting plant. He has prepared an ordinance, which will be presented to the Council at once, authorizing the chief engineer of the Department of Public Works to report on the estimated cost of erecting and equipping such a plant in that city.

Western Electric Company.—It is semi-officially given out that the gross sales of the Western Electric Company for the year which ended Nov. 30 will amount to about $61,000,000. The monthly sales of the company have varied so little during the year that the total sales will hardly differ 1 per cent from the estimate made last February. The company will make its official report at the end of the calendar year, showing gross sales for thirteen months, and these will be approximately $66,000,000. Hereafter the fiscal year of the company will correspond with the calendar year. The sales for the twelve months ended Nov. 30 compare with $46,000,000 for the same period in 1909 and $32,000,000 in 1908. They have been exceeded only once in the company's history, the sales for 1906 amounting to $69,000,000. As the company in 1909 showed a margin of profit of 5.2 per cent on its gross sales, and as it is operating as favorably at present as it did in that year, the profits for the year which has ended should amount to $3,172,000, which is equivalent to about 10.7 per cent on the $15,000,000 capital stock, after deducting estimated fixed charges. The regular dividend paid on the stock is 8 per cent, and this, with the 2 per cent extra dividend recently declared, will about take care of the net earnings. The company now has a working capital of about $36,000,000, which will be increased somewhat more than $1,000,000 with the issuance of $6,250,000 of bonds now held as collateral on the company's $5,000,000 of notes. The increase in telephone sales for the past year was fairly evenly distributed among the Bell customers and independent systems. The business was also very nearly proportionately divided among the three main branches of the company's activities—telephone apparatus, lead-covered cable and miscellaneous electrical apparatus. The recent issue of bonds above referred to was largely taken in Chicago, the investors of that city showing considerable eagerness to secure them.

Queens Borough Gas & Electric Hearings.—At a hearing before Public Service Commissioner Maltbie last week in connection with the rates for electricity charged by the Queens Borough Gas & Electric Company in the Far Rockaway district, L. S. Hubbard, a certified accountant, testified to the present value of the electrical property and as to its earning capacity. This report, which was quite voluminous and went into the earning value of the plant year by year, was put in evidence. The figures taken by the accountant adopted 8 per cent as a proper earning for the electrical plant. The report was filed with the commission. The figures of the accountant showed that the company, even at the present rates, was not earning reasonable depreciation charges. There was also filed with the commission a report made by Carleton Macy, president of this company, estimating that the requirements of the company for betterments and improvements for 1911 would amount to $174,600. This report of the president had been approved by the board of directors and authority was given Mr. Macy to go ahead with the program mapped out in the report. The hearing was not concluded.

Prices of Rubber Goods Unchanged.—Samuel P. Colt, president of the United States Rubber Company, in discussing the probable effect of the decline in crude rubber on the prices of rubber goods in 1911, makes the statement that, while no definite action has been taken upon the matter by his board of directors, he does not anticipate any reduction in the price of rubber goods next year. He stated that the prices at which the company's merchandise is now being sold are practically the same as those in force since September, 1907. While Col. Colt's statement particularly referred to rubber footwear and rubber mechanical goods, it is understood that the same circumstances will control prices for rubber-covered wire, a considerable amount of which is manufactured by subsidiary companies of the United States Rubber Company. At the present time crude rubber, up-river fine Para, is quoted at $1.43 per pound. This is a slight advance over the quotations of two months ago, but not a sufficient advance to cause any change in the prices of manufactured goods. Other rubbers are quoted proportionately according to the price fixed for Para, which is the standard.

Train-Dispatching Telephones Prove Useful.—The reliability of the telephone method of dispatching trains, which has superseded the telegraph on many of the large railroads, has been demonstrated by the behavior of this system on the Pere Marquette Railroad during recent sleet storms. The telegraph was put out of commission, but the telephone circuit worked continuously. Telephones and selectors furnished by the Western Electric Company have been placed in service along 136 miles of this road, between Saginaw, Mich., and Toledo, Ohio. The telephones have been installed at thirty way-stations and four sidings. The traffic on the Toledo Division is unusually heavy. Several times in the past the railway has found it necessary to cut the telegraph train wire into two sections in order to handle the traffic, but it is believed that the telephone equipment will enable the work to be handled entirely with one circuit. The Michigan Central has recently installed train dispatching telephone circuits between Jackson, Mich., and Niles, Ohio, 105 miles, with thirty-four telephone stations; between Jackson and Bay City, Mich., 115 miles, with twenty-three stations, and Jackson and Grand Rapids, Mich., ninety-four miles, with twenty-one stations. Equipment has been ordered for a telephone line between Windsor and St. Thomas, Ontario, Canada, 111 miles, with twenty stations. Plans have been made for the installations of a number of other circuits during the coming year.

Long Acre Electric Lighting & Power Company.—The Public Service Commission of the First District held a hearing last week on the application of the Long Acre Electric Lighting & Power Company for authority to issue capital stock and bonds to the amount, respectively, of $10,000,000 and $50,000,000. This is the application that was formerly denied and the denial subsequently reversed by the Appellate Division of the Supreme Court. The court held that the reasons given by the commission for the denial were insufficient. At the hearing a letter was submitted by Henry R. Towne, president of the Merchants' Association, declaring that it would be inadvisable to authorize competition in electric lighting when there is already a company in the field the rates and service of which are satisfactory. Counsel for the Long Acre company objected to the submission of this letter, and it was not admitted in evidence. Owing to the absence of the attorney of the New York Edison Company, the hearing was adjourned.

United States Engineering & Manufacturing Company.—The construction of a large plant for the manufacture of machinery will be commenced in Tarentum, Pa., in a few days by the United States Engineering & Manufacturing Company, which was recently incorporated under the laws of Delaware with a capitalization of $1,000,000. J. J. Jones is consulting engineer and president of the company. He has secured eighty-seven acres of land south of Tarentum and will at once erect a machine shop, foundry and power house, having a total floor space of 87,200 sq. ft. A railroad 4000 ft. long will be built to connect the plant with the Pennsylvania Railroad.

New Haven Railroad Electrification.—At a meeting of the board of directors of the New York, New Haven & Hartford Railroad last week the plans for a new station in New Haven, to cost $2,000,000, were finally approved. It was stated after the meeting, however, that the directors had decided not to undertake the electrification of the road from Stamford to New Haven in the coming spring. Subsequently an interview with President Mellen was published stating that work on a big power house at New Haven would begin at once, and electrification work within a few months.

Electrical Construction.—Among the items printed under Constructions News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Sioux City, Ia.; St. Catharines, Ont., Can.; Horton, Kan.; Jacksonville, Fla.; East St. Louis, Ill.; Long Prairie, Minn; Saginaw, Mich.; Cartersville, Ga.; Norwich, Conn.; Los Angeles, Cal.; Giltner, Neb.; Washington, D. C.; Libby, Mont.; Wausau, Wis.; Toledo, Wash.; Norwalk, Ohio; St. Joseph, Mo.; Atlantic, Ia.; Stayton, Ore.; Willows, Cal.; Stafford, Kan.; Fort Dodge, Ia., and Manitowoc, Wis.

Chicago Automatic Telephone System.—The Automatic Electric Company, a subsidiary of the Chicago Subway Company, will open its telephone system to the public Jan. 1. The company will start operations with about 33,000 subscribers on its books, which is 13,000 more than the ordinance requires it to have on June 1, 1911, in order to save its franchise. There is every promise at present that the telephone branch of the subway company will prove extremely successful if it is not complicated with the financial troubles of the parent company.

General Vehicle Company.—The Western office of the General Vehicle Company has recently received an order from Marshall Field & Company, Chicago, for two 2000-lb., two 2-ton and two 3½-ton chassis

Financial.

THE WEEK IN WALL STREET.

ANOTHER period of light trading and fractional price changes is the report of the stock market for last week. The total number of shares sold was less even than during the previous week, and there seemed less general interest in the market. The Stock Exchange is approaching the Christmas and New Year holidays without any enthusiasm and with very little disposition to transact business. It is apparent that the present position of the market is fairly secure, from the fact that it is pretty well "sold out." The forced liquidation of the last few weeks has disposed of almost all of the long holdings that were in any way hazardous. While investment buying has been extremely light, there is always a little of it to be found in the Street, and this is especially true when prices are low. At the present moment there does not seem to be any disposition on the part of professional traders to put up prices, and if there is any bear clique ready to operate it is holding off until after the first of the year. While the most unexpected things frequently happen in Wall Street, it is the general opinion that until after the first of January trading will be very light and that price changes will be unimportant. A decision of the Interstate Commerce Commission is expected in the matter of rates early in January, and there is not likely to be much movement in railroad stocks until this is handed down. There was some evidence during the past week that bonds were in better demand. While but little actual activity appeared in the market, there were more inquiries made. One of the features of the week was the selling to prominent bond houses of $10,000,000 of 5 per cent bonds of the Southern Bell Telephone Company. The American Telephone & Telegraph Company owns the property. These bonds were sold for a very good price, considering the present market, and this indicates that Wall Street is satisfied with securities on properties belonging to the big telephone company. They are being offered to the public at 96 and interest. Money remained easy throughout the week, and the decline in foreign exchange rates indicates that gold imports will be forthcoming in the near future. Rates for money Dec. 19 were: Call, 2½@3½ per cent; 90 days, 4 per cent. The quotations in the table are those of the close, Dec. 19.

NEW YORK.

	Dec. 12.	Dec. 19.	Shares Sold.		Dec. 12.	Dec. 19.	Shares Sold.
All. Ch.	8½*	8¼*	110	Int. Met., pf.	53	[illegible]	10,810
All. Ch., pfd.	27½*	30	10	Mackay Cos.	88*	88*	—
Amal. Cop.	63⅛	64¾	[illegible]	Mackay, C., pf	74	74½	150
Am. D. T.	29½*	29½*	—	Man. Elev.	138	138*	825
Am. Loco.	37*	37	[illegible]	Met. St. Ry.	15*	[illegible]	—
Am. Loco. pf.	105*	[illegible]	[illegible]	N.Y.&N.J.Tel.	130½	[illegible]	—
Am. Tel. & C.	[illegible]	[illegible]	—	Steel, Com.	72¾	73	472,984
Am. T. & T.	141¾	141¾	7,000	Steel, pfd.	116⅜	[illegible]	4,935
B. R. T.	73¾	75½	[illegible]	W. U. T.	71½	74	2,375
Gen. Elec.	153½	155⅞	4,511	West'h, com.	66	67	1,000
Int.-Met.	19¼	20¾	13,565	West'h, pfd.	120*	122*	400

PHILADELPHIA.

	Dec. 12.	Dec. 17.		Dec. 12.	Dec. 17.
Am. Rys.	42¾*	42½	Phila. Elec.	15¾	15⅞
Elec. Co. of A.	11⅝*	11⅝*	Phila. R. T.	18	18⅝
Elec. St. B'ty	48*	49	Phila. Trac.	83¼	83½
E. S. B'ty, pfd.	30*	32*	Union Trac.	42½	43¼

CHICAGO.

	Dec. 12.	Dec. 17.		Dec. 12.	Dec. 17.
Chi. City Ry.	170*	170*	Chi. Tel Co.	122½	123
Chi. Rs., Ser. 1	90*	91*	Met. El. Co.	20¾	21
Chi. Rs., Ser. 2	23½	25¾	Met. El., pfd.	65*	65*
Com. Edison	112*	112½	Nat'l Car.	120*	120*
Chi. Subways	4½	4¼	Nat'l Car., pfd.	110*	117½

BOSTON.

	Dec. 12.	Dec. 17.		Dec. 12.	Dec. 17.
Am. T. & T.	141¾	142⅛	Mex. Tel.	5*	4
Cum. Tel.	150*	151	Mex. Tel., pfd.	6¼*	6¼*
Edison E., Ill.	284	282*	N. E. Tel.	128	138*
Gen. Elec.	153⅝	156¼	W. T. & T.	16	16*
Mass. E. Ry.	18¼*	17⅝*	W. T. & T., pfd.	90*	90
Mass. E. Ry., pfd.	84	[illegible]			

*Last price quoted.
Shares sold for week Dec. [illegible] to Dec. [illegible]

FINANCIAL NOTES.

Whitney Power Company Reorganization.—Details of the reorganization plan of the Whitney Power Company, of North Carolina, have just been made public. The company was incorporated to construct an extensive hydroelectric plant near Salisbury, N. C., on the Yadkin River. It issued $10,000,000 of stock and $4,860,000 of 6 per cent bonds. The project was promoted by George I. Whitney & Company, of Pittsburgh, and A. O. Brown & Company, of New York, and its failure caused both of these firms to assign a couple of years ago. Under the terms of reorganization, to which it is said 50 per cent of the bondholders have assented, the total capitalization will be cut down to $720,000. This figure, in the opinion of the reorganizers, represents a fair value of the assets. It means the wiping out of the original stockholders completely, and that the bondholders will get only one share of new common stock of a par value of $10 for each $1,000. Bonds are being deposited with the New York Trust Company, the time for deposition expiring Dec. 27. Under the reorganization the new capital will consist of $600,000 of 6 per cent notes, maturing in six months, with the privilege of extending for another six months; $70,000 of 6 per cent cumulative preferred stock in shares of $10 each, and $50,000 of common stock. After the common stock shall earn 6 per cent both issues of stock participate equally in further earnings. The property was bid in Dec. 15 by the reorganization committee for $490,000.

Union Switch and Signal Company.—The stockholders of the Union Switch & Signal Company on Dec. 14 voted to increase the capital stock of the company from $2,500,000 to $5,000,000. This plan was referred to in our issue of Nov. 24 Succeeding the stockholders' meeting the board of directors met and declared the regular quarterly cash dividend of 3 per cent on the common and preferred stocks, payable Jan. 10, and a 60 per cent stock dividend, payable in equal amounts of common and preferred on the same date. It was later announced that it had been decided to offer the stockholders of record Dec. 31 the right to purchase, pro rata, 10,000 shares of the new stock issue at $75 a share; the remaining 10,000 shares will be placed in the treasury. The par value of this stock, which is offered at $75, is $50; but it has sold within the week on the Pittsburgh Stock Exchange at $130 per share. George Westinghouse, president of the company, stated that the year now closing would show the greatest volume of business ever done by the Union Switch & Signal Company since its inception, thirty years ago.

Cataract Power & Electric Company.—A report has just been issued by the Cataract Power & Electric Company showing earnings for the nine months which ended Sept. 30. The gross revenues of the company were $1,018,368, as compared with $871,345 in the same period of 1909. The operating expenses were $711,690, and the total income from operations amounted to $264,361. After allowing for the fixed charges upon the bonded debt there was a surplus available for dividends of $222,568. The Cataract Power & Electric Company furnished energy to the Buffalo General Electric Company in 1898, and has a contract which does not expire until 1932. The company does the entire lighting business of Buffalo, Niagara Falls, West Seneca and Roland, including the municipal lighting in Buffalo and Niagara Falls. The International Railway Company is a large consumer of the Cataract company's energy, and the pumping station of the City of Buffalo is another large customer.

Moody's Daily Financial Service.—A daily financial service has been inaugurated by the Moody Manual Company, which furnishes to its subscribers every morning a boiled-down digest of all the important financial happenings of the day. These are presented in condensed form, alphabetically arranged with reference notes showing where fuller information may be obtained when the news has been published in some other financial publication. This service should be very valuable to the busy man, who in a few minutes can discover whether anything has occurred in which he is interested. The daily sheet taken in connection with the monthly digest—in pamphlet form—forms a complete corollary to the annual edition of "Moody's Manual" and keeps the subscriber up to date.

Power Company Bonds at Auction.—Among the sales at the auction of securities in New York last week were the following hydroelectric power company bonds: $26,000 Sierra & San Francisco Power Company second mortgage 5 per cent bonds, with $875 same company's scrip, at 20; $24,000 Sierra & San Francisco second mortgage 5 per cent bonds, with $500 scrip, $1,000 same company second mortgage 6 per cent bond, with $666.67 scrip, $4,800 for lot; $55,000 Stanislaus Electric Power Company first mortgage 5 per cent bonds, with 275 shares same company preferred stock, at $11,000 for the lot.

McKinley Buys Barbados Traction.—A dispatch from Champaign, Ill., states that William B. McKinley, president of the Illinois Traction System, and some of his financial associates have purchased the street railway system at Bridgetown, Barbados.

Cities Service Company.—Announcement was made last week by Henry L. Doherty & Company that the Empire District Electric Company, a subsidiary of the Cities Service Company, had purchased the entire capital stock of the Webb City (Mo.) & Carterville Gas Company and the Carthage (Mo.) Gas Company. These companies control the entire gas business of Webb City, Carterville and Carthage. They are natural gas companies and serve a combined population of about 12,000. These are the first properties that have been acquired by the Cities Service Company since its reorganization a few months ago by H. L. Doherty & Company. It is stated, however, that other electrical properties may be taken over before very long by the holding company. The Empire District Electric Company now practically controls the electric and gas business of the Joplin district of Missouri.

Consolidated Gas, Electric Light & Power Company.—At a meeting of the board of directors of the Consolidated Gas, Electric Light & Power Company, of Baltimore, last week the resignation of General Ferdinand C. Latrobe was accepted as president, and that of William Darbee was accepted as general manager. The vacancies thus created will be filled by the promotion of J. E. Arnold from vice-president to president and the reinstatement of Charles M. Cohn as vice-president in charge of the gas division. Herbert A. Wagner was named vice-president in charge of the electrical division, and William Schmidt, Jr., secretary. After his resignation had been accepted General Latrobe was appointed special counsel for the company, and he will continue to serve as a director. Frank A. Furst resigned as a member of the board of directors.

Minnesota & Ontario Power Company.—It is given out that the earnings of the Minnesota & Ontario Power Company, which has a hydroelectric plant at International Falls, Minn., and which is developing another plant at Fort Frances, Ont., are more than three times the requirements for the interest on bonds, and it is expected that the business of the company will grow very rapidly as its transmission lines are extended. This property is controlled by the Backus-Brooks Company, of Minneapolis. It has a total authorized issue of $5,000,000 of stock, of which amount $1,370,000 is reserved for extensions and additions. The estimated value of the property is $7,880,000, and the water-power is said to be one of the largest in the Northwest. It is estimated that at ordinary or mean stage of water the plants of this company will furnish 30,000 hp.

Canadian Power Merger.—Much speculation was created in Montreal last week owing to the fact that a corporation was formed in London called the Montreal Tramway & Power Company, with an authorized capital of $20,000,000. The declared objects of this corporation are to acquire electric generating and street railway concerns in Canada. Officials of the Montreal Street Railway, Canadian Light, Heat & Power Company and the Shawinigan & Montreal Light, Heat & Power companies all deny that the London corporation is in any way connected with their enterprises. It has been suggested by some of the Canadian financiers that the word "Montreal" refers to the Montreal River in the Cobalt district, and that the new enterprise is probably interested in power developments in the Canadian mining section.

Western Union Telegraph Company.—The preliminary estimated statement of the Western Union Telegraph Company for the last quarter of 1910 was issued last week. The estimated net revenue for the quarter is $1,660,000, which is a decrease of $87,200 as compared with the same quarter in 1909. The interest on the bonds is $433,063, and the balance available for dividends is $1,226,937. After paying the regular quarterly dividend of ¾ of 1 per cent which the board of directors declared, there will be a surplus left of $479,141, a decrease from the surplus of the same period last year of $87,357. The total surplus at the present time is $8,073,068.

Philadelphia Rapid Transit Company.—E. T. Stotesbury has sent a letter to President Kruger, of the Philadelphia Rapid Transit Company, accepting his election to a directorship in that company and indorsing the recent action of the directors of both the Rapid Transit and Union Traction companies relative to the proposed new financing. Mr. Stotesbury, it is understood, will be practically in charge of the financial matters of the Philadelphia traction companies.

New York Central to Acquire Trolleys.—It is reported that the New York Central Railroad Company will soon acquire the Buffalo, Lockport & Rochester and the Rochester, Syracuse & Eastern electric lines. This action will be taken in preference to permitting competing interests to acquire these properties. If merged the two roads would parallel the New York Central for a distance of 100 miles.

Shawinigan Water & Power Company.—It was announced last week that the Shawinigan Water & Power Company, of Montreal, will issue 5000 shares of new stock. Of this additional issue, 3000 shares will be taken by the Montreal Light, Heat & Power Company and the remaining 2000 shares will be taken by the directors of that company.

DIVIDENDS.

American Cities Railways & Light Company, semi-annual, common, 2 per cent, extra ¼ per cent; preferred, quarterly, 1¾ per cent, all payable Jan. 2.

American Gas & Electric Company, quarterly, preferred, 1½ per cent, payable Feb. 1; common, 1½ per cent, payable Jan. 1.

Bell Telephone Company of Canada, quarterly, 2 per cent, payable Jan. 14.

Canadian Westinghouse Company, quarterly, 1½ per cent, extra 1 per cent, payable Jan. 10.

Chicago City Railway Company, quarterly, 2½ per cent, extra, 2 per cent, payable Dec. 2.

Cincinnati & Hamilton Traction Company, quarterly, preferred, 1¼ per cent, common, ¾ per cent, both payable Jan. 1.

Cities Service Company, initial, preferred, ½ per cent, common, ¾ per cent, both payable Jan. 1.

Columbus (Ga.) Electric Company, preferred, semi-annual, 3 per cent, payable Jan. 2.

Duluth-Edison Electric Company, quarterly, preferred, 1½ per cent, payable Jan. 3.

Manila Electric Railroad & Lighting Company, quarterly, 1 per cent, payable Dec. 31.

National Gas, Electric Light & Power Company, script, 21 per cent, in payment of accumulated preferred dividends, payable Jan. 1.

Norfolk & Portsmouth Traction Company, quarterly, 1¼ per cent, payable Jan. 10.

Northwestern Elevated Railroad Company, Chicago, quarterly, preferred, 1 per cent, payable Jan. 18.

Otis Elevator Company, preferred, quarterly, 1½ per cent, payable Jan. 16.

Providence (R. I.) Telephone Company, quarterly, 1 per cent, payable Jan. 2.

Public Securities Company, Chicago, preferred, semi-annual, 3½ per cent, payable Jan. 1.

Reading Traction Company, semi-annual, 1½ per cent., payable Jan. 1.

United Gas Improvement Company, Philadelphia, quarterly, 2 per cent, payable Jan. 14.

United Traction & Electric Company, Boston, 1¾ per cent, payable Jan. 2.

Virginia Railway & Power Company, preferred, semi-annual, 2½ per cent, payable Jan. 5.

Washington Water Power Company, quarterly, 1¾ per cent, payable Jan. 3.

Western Union Telegraph Company, quarterly, ¾ per cent, payable Jan. 16.

REPORT OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings	Changes.	Surplus.
[illegible]	[illegible]	[illegible]	$230,539	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Year ended Nov. 30, 1910					
[illegible]	[illegible]	562,344	480,625	[illegible]	203,604
[illegible]	956,888	[illegible]	408,717	416,646	100,069
[illegible]	[illegible]	222,581	276,372	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	111,712
[illegible]	[illegible]	95,006	[illegible]	37,920	37,920
[illegible]	[illegible]	87,230	[illegible]	33,452	33,452
Quarter ended Dec. 31, 1910 (Est.).			1,660,000	[illegible]	1,226,937
[illegible]			1,747,200	433,063	1,314,137

General News

Construction News.

HELENA, ARK.—The Scofield Engineering Company, of Philadelphia, Pa., is reported to have taken an option on the plant of the Helena Gas & Electric Light Company, of Helena, Ark. The price placed on the property is said to be $135,000.

AUBURN, CAL.—Notice of appropriation of 250,000 in. of water in Miner's Ravine, in the western part of Placer County, has been filed by B. T. Marshall. He proposes to construct a dam, flumes, ditches and pipe lines sufficient to carry 2000 in. of water, which will be used for irrigating, domestic and power purposes.

BANNING, CAL.—The Consolidated Reservoir Power Company is constructing a ditch to divert water from the Whitewater River to Banning. It is understood that two electric power plants will be installed next spring. H. E. Moore, of Los Angeles, Cal., is president of the company, and K. B. Scarborough, of Monrovia, Cal., is secretary.

JACKSON, CAL.—John L. Henry has applied to the Board of Supervisors for a franchise to erect electric transmission lines over the roads and highways in Amador County.

LODI, CAL.—Plans have been prepared for the construction of the power house of the new municipal electric light plant, bids for which will be called for in the near future.

LOS ANGELES, CAL.—Plans are being prepared by the Los Angeles Gas & Electric Corporation for extensive improvements to both its electric and gas systems to meet the increasing demands for service.

LOS ANGELES, CAL.—It is reported that the Pacific Electric Railway is planning to equip the tracks of the Southern Pacific Railroad from the Southern Pacific station to Oneonta tower for electrical operation. From that point it is proposed to have a double track connect with the inside tracks of the four-track system.

ONTARIO, CAL.—Work has commenced on increasing the output of substation No. 1 of the San Antonio Water Company, which will involve an expenditure of about $20,000.

PLACERVILLE, CAL.—Notice of appropriation of 460,000 miner's inches of water flowing in various streams in El Dorado County has been filed by Otis Gibson, agent of the Loon Lake Water & Power Company. The water is to be used for generating electricity and for mining, irrigation, domestic and other purposes.

PLACERVILLE, CAL.—H. M. Byllesby & Company, of Chicago, are reported to have acquired the plant and holdings of the American River Electric Company, located on the American River, near Placerville. It is understood that the new owners will increase the output of the plant from 10,000 to 16,000 hp. The American River Company has about 200 miles of transmission lines supplying electricity in Stockton, Placerville and a number of smaller towns. It is understood that the consideration for the plant was about $1,375,000.

SACRAMENTO, CAL.—The proposition of the Merchants' Association for the lighting of the business section of the city is to be considered in connection with the lighting contract for the coming year. The plan submitted by the Merchants' Association provides for the installation of five-lamp clustered electroliers, eight to each block, in the section bounded by J and L, Front and Tenth Streets, the association to pay for the electroliers and the city to maintain the same.

SAN RAFAEL, CAL.—Preparations are being made by the Pacific Gas & Electric Company for the construction of a new reinforced concrete building at its plant on Third Street, which will be the first of three buildings to be erected by the company, replacing practically all of the old buildings in use at present. Other improvements are also contemplated on Fourth Street and on Bay View, which will improve the service in these districts.

VALLEJO, CAL.—It is stated that work will begin on the construction of a central power plant on Mare Island immediately after the first of the year. The proposed plant will cost about $100,000, contract for construction of which has been awarded to E. D. Crowley, of San Francisco, Cal.

WHITTIER, CAL.—Announcement has been made by the Santa Fe Springs Company that it has purchased the Santa Fe Springs property, consisting of fifteen acres, near Whittier. The company proposes to erect a number of cottages and houses, a dining hall, bottling plant and electric plant. G. D. Peck is manager of the company.

WILLOWS, CAL.—Plans are being made by the Northern California Power Company for the erection of a new transmission line, 100 miles in length, work on which will begin soon after the first of the year. The line will be supported on 50-ft. reinforced concrete poles and will cost about $200,000. It will extend from the new power house of the company at Coleman, on Battle Creek, Shasta County, through Red Bluff and Corning and to the head works of the Sacramento Valley Irrigation Company's canal system, two miles north of Hamilton City, where 8000 hp will be delivered to the pumping plant that will lift the water from the Sacramento into the canal, thence to Willows. Later the line will be extended to San Francisco Bay. The new plant at Coleman's is nearly completed. The entire cost of the plant is estimated at $1,000,000. H. A. Telford is construction superintendent.

CANON CITY, COL.—The Colorado Telephone Company has appropriated $25,000 for improvements and extensions to its system in Canon City. Cables will be installed throughout the residence section of the city to supersede the open wire system now in use.

NEW HAVEN, CONN.—The contract for the installation of a passenger elevator in the United States Building at New Haven, Conn., has been awarded to the Otis Elevator Company, 17 Battery Place, New York, N. Y., for $2,874.

NEW HAVEN, CONN.—It is reported that the New York, New Haven & Hartford Railroad Company is planning to erect a central power house in New Haven, instead of at Naugatuck Junction, on the Housatonic River, in connection with equipping its railroad from Stamford to New Haven for electrical operation. It is understood that work will begin on the power house in the near future. The cost of the power plant is estimated at about $2,000,000.

NORWICH, CONN.—The City Council has granted the petition of the Gas and Electric Commissioners for an appropriation of $35,000 for extensions and improvements to the municipal electric light plant. Additional generating equipment will be installed.

STRATFORD, CONN.—The question of installing an electric street lighting system is under consideration. It is said that a special town meeting will be called in the near future to vote on the matter.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 27, for furnishing at the navy yards supplies as follows: Brooklyn, N. Y., Schedule 3185, two 1500-kw generator sets, twenty-nine ¼-kw transformers. Bids will also be received at the same place until Jan. 10 for one generator and one transformer for the navy yard, Puget Sound, Wash., as per Schedule 3188.

JACKSONVILLE, FLA.—The Jacksonville Electric Company is planning to construct a new power house on Riverside Avenue, to replace the old plant now in operation near the viaduct.

PALATKA, FLA.—The Florida Woodenware Company is reported to be preparing plans for the construction of a new factory, which will probably be equipped for electrical operation.

CARTERSVILLE, GA.—The City Council has authorized the Water, Light and Bond Commission to install additional machinery in the municipal electric light plant to supply the city with a day service for motors. The cost of the work is estimated at $6,000.

CŒUR D'ALENE, IDAHO.—It is reported that plans are being considered to organize a company to establish an electric light and power plant in Cœur d'Alene. It is proposed to utilize the refuse from the mill of the Stack-Gibbs Company as fuel for the plant. William Dollar, president of the Exchange National Bank, of Cœur d'Alene, is interested in the project.

ATCHISON, ILL.—The Illinois Traction System, with headquarters at Champaign, Ill., is reported to be contemplating the erection of a power house in Atchison, in the spring, at a cost of about $300,000.

DECATUR, ILL.—The Union Iron Works is reported to have purchased a site adjoining its plant and proposes to erect two new buildings early in the spring, one of which will be used as a machine shop, which will be equipped for electric motor drive.

DEKALB, ILL.—The City Council has granted the Exchange Telephone Company a twenty-five-year franchise to install and operate a telephone system in DeKalb.

JOLIET, ILL.—The Illinois Valley Gas & Electric Company, of Joliet, Ill., is reported to have purchased the plant and holdings of the Henry Electric Light & Power Company, of Henry, Ill., and the plants at Chillicothe and Lacon, Ill. It is understood that extensive improvements will be made to the plant in Lacon and new machinery installed.

BEDFORD, IND.—It is reported that a deal has been consummated whereby the two telephone systems in Bedford will be consolidated. It is understood that the property of the Bedford Home Telephone Company has been taken over by parties supposed to represent the Morgan interests.

COLUMBUS, IND.—Plans are being considered by the City Council for remodeling the municipal electric light plant. It is proposed to install additional machinery to establish a day service. The cost of the improvement is estimated at about [illegible]

CROSS PLAINS, IND.—The capital stock of the Farmers' Mutual Telephone Company has been increased to $10,000, to provide funds for necessary extensions.

INDIANAPOLIS, IND.—The question of extending the railway system of the Indianapolis & Cincinnati Traction Company from Connersville to Hamilton, Ohio, is under consideration.

INDIANAPOLIS, IND.—It [illegible] to get the matter in court for

settlement, the Board of Public Works has decided to withhold the payment of the bills of the Indianapolis Light & Heat Company until the company files a schedule of classified rates for electricity for lamps and motors. The company has refused to do this on the ground that its franchise does not require it to do so. The other public service companies have likewise refused to file such a schedule. C. A. Schrader, president of the board, states that not only the city, but consumers can withhold payment until a schedule of classified rates is filed. It is expected that extensive litigation will follow.

LEBANON, IND.—The property of the Citizens' Electric Light & Power Company has recently changed hands. The officers of the new company are: T. C. McReynolds, of Kokomo, Ind., president, and C. E. Layton, secretary and treasurer.

MARION, IND.—Frank R. Heck, city clerk, is asking for bids for the purchase of electric light bonds to the amount of $50,000.

MISHAWAKA, IND.—Preparations are being made by the Town Board for the installation of a police and fire alarm system, bids for which will soon be called.

PORTLAND, IND.—The City Council has decided to engage an engineer to examine the municipal electric light plant and make recommendations for improvements to same.

PRINCETON, IND.—Arrangements are being made by the Evansville & Terre Haute Railroad Company for the erection of a telephone system, to be operated in connection with its new block system.

SULLIVAN, IND.—The street lighting system has been out of commission for several nights, owing to the burning out of a new dynamo at the plant of the Sullivan County Electric Company.

YORKTOWN, IND.—The installation of a lighting system in Yorktown is reported to be under consideration.

ATLANTIC, IA.—Preparations are being made for the construction of a municipal electric light plant in Atlantic, bids for which will be called for about March 1, 1911. The cost of the proposed plant is estimated at about $40,000. T. E. Nichols is city clerk.

COGGON, IA.—The installation of a municipal electric light plant in Coggon is reported to be under consideration.

FORT DODGE, IA.—The Fort Dodge, Des Moines & Southern Railway Company, of Fort Dodge, Ia., will, it is said, enlarge its electric power plant in the near future to provide electricity for extensions to its system. The company is planning to equip the steam railroad, extending from Lehigh to Webster, recently purchased, for electrical operation. An extension will also be built from Lehigh to Gypsum.

IOWA FALLS, IA.—The construction of a municipal water power plant in Iowa Falls, Ia., is under consideration. Messrs. Harp & Roberts, who propose to build a new cement dam next year, are interested in the project.

MARSHALLTOWN, IA.—All bids received Nov. 28 for the installation of machinery and water wheels for the development of water power were rejected. O. L. Ingledue is Mayor.

SIOUX CITY, IA.—The Sioux City & Bijou Hills Railway Company, of Sioux City, Ia., is reported to be preparing plans for the construction of its proposed electric railway, work on which will begin in the spring. It is understood that extensive power equipment will be required.

SIOUX CITY, IA.—Plans have been prepared for the construction of the new power plant of the C. Shenkberg Company to be located just north of its new warehouse on Third and Douglas Streets. The building [illegible] ft., with smokestack 125 ft. high. The proposed plant will supply light, heat and power for the entire plant of the company.

WATERLOO, IA.—The Central Heating Company, of Waterloo, Ia., has filed amendments to its charter with the Secretary of State providing for expansion of its field to include the generating and sale of electricity and increasing its capital stock from $15,000 to $40,000. C. F. Fowler is president of the company.

ATCHISON, KAN.—Work has commenced on the construction of a machine and forge shop by the Atchison Railway, Light & Power Company, at Falls City, which will be equipped for electric motor drive.

FORT SCOTT, KAN.—The City Council has awarded a contract to the Fort Scott Gas & Electric Company for the installation of a complete new lighting system for the business section of the city.

HORTON, KAN.—B. B. Morris, city clerk, writes that the City of Horton is contemplating the installation of an electric light plant and would like to receive estimates on the cost of a plant with sufficient output to supply a town with a population of about 4000.

STAFFORD, KAN.—Bids will be received by the City Clerk, Stafford, Kan., until Jan. 3, for the construction of water works and electric light systems, to cost about $3,500. The J. S. Worley Company, Reliance Building, Kansas City, Mo., has charge of the engineering work.

WICHITA, KAN.—Plans have been prepared by the city engineer [illegible] plant, and a large motor-driven suction pump for work on the Little Arkansas River.

[illegible] Council and the Mandeville Electric Lighting Company, of Mandeville, La., whereby the latter is to extend its transmission line to Abita Springs, a distance of nine miles, to supply electrical service in this town.

BATH, MAINE.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Jan. 16 for the extension, remodeling, including electric conduits, wiring system, gas piping, heating apparatus, etc., for the United States post office building, at Bath, Maine, plans and specifications for which may be obtained from the custodian, at Bath, Maine.

CORINNA, MAINE.—A new engine is being installed in the local electric light plant, owned by Ireland Brothers, to operate the plant during the low-water periods. Owing to the lack of water the street lamps have not been lighted for nearly two months.

BELAIR, MD.—It is reported that the Kenmore Farm Company is contemplating the construction of a hydroelectric plant. The company proposes to develop about 600 acres at a cost of about $100,000. Harry D. Hanway, A. Munger, William G. Chittick and others are interested in the project.

CAMBRIDGE, MD.—The Cambridge Gas, Electric Light & Power Company has asked that its present contract with the Town Commissioners of Cambridge, under which both gas and electric lamps are furnished the town, be annulled for the remainder of the time it has to run, and that the company be allowed to supply electric lamps exclusively. Under the present contract the town pays $75 each per year for arc lamps with an all-night service, $24 for gas lamps burning all night, and $16 for gas lamps burning until 12 o'clock, the total cost being slightly in excess of $3,000 per year. The company wishes to discard the gas lamps and install electric lamps, increasing the number of lamps by sixteen, making the total number 120, and the total cost a little over $3,200 per year.

BOSTON, MASS.—The Boynton Bicycle Railway Company has petitioned the Legislature to revive this company and to authorize construction work to the extent of $5,000,000.

BOSTON, MASS.—Superintendent Rourke, of the Street Department, has recommended to the Council the purchase by the city of a lamp equipment, which will cost about $310,000. He advises the owning of the equipment by the city, but favors having the lighting done by private corporations. The superintendent will also ask the City Council for an appropriation of $75,000 for the establishment of an incinerating plant in the Brighton district.

BOSTON, MASS.—The Boston Elevated Railway Company has awarded the contract for the construction of its new power house in South Boston to the Stone & Webster Engineering Corporation. A plant for unloading coal will be installed and accommodations for 100,000 tons of coal provided for. Contracts have been placed with the General Electric Company for two 15,000-kw steam turbines for the new power plant. The cost of the plant, complete, is estimated at about $3,000,000.

CHICOPEE, MASS.—Announcement has been made by the Electric Light Commissioners of a change in the rates of electricity for lamps to take effect on Jan. 1, 1911. Under the new schedule the rates will be as follows: From 5 kw to 15 kw, 18 cents per kw-hour; 16 kw to 150 kw, 10 cents per kw-hour; 151 kw to 500 kw, 9 cents per kw-hour; 2001 kw to 5000 kw, 8 cents per kw-hour; 5001 kw to 7000 kw, 7 cents per kw-hour; 7001 kw to 9000 kw, 6 cents per kw-hour; 9001 kw to 11,500 kw, 5 cents per kw-hour; 11,501 kw to 15,000 kw or over, 4 cents per kw-hour. The commissioners have also decided to adopt a minimum charge of 50 cents per month, instead of the former system of a flat rate with a meter rental of 6 cents.

CLINTON, MASS.—The contract for furnishing and installing the power plant at the gatehouse at the Wachusett dam has been awarded by the Metropolitan Water and Sewerage Board to the S. Morgan Smith Company, of York, Pa., for both hydraulic and electrical machinery, for $71,500. Electrical apparatus manufactured by the Westinghouse Electric & Manufacturing Company will be used. From 2500 hp to 3000 hp will [illegible]

FAIRHAVEN, MASS.—The New Bedford Gas & Electric Company has been granted a franchise to extend its transmission lines to this town.

GREENDALE, MASS.—Negotiations are reported to be under way between the Connecticut River Transmission Company, of Vernon, Vt., and the Morgan Spring Company, Greendale, Mass., whereby the former company will supply electricity to operate the plant of the last named company in Greendale. The Morgan Spring Company has its own electric plant, which it will continue to maintain for the present. It is understood that the contract calls for 600 hp. E. J. Richards is general manager of the power company.

NORTH ATTLEBORO, MASS.—The Electric Light and Water Department is contemplating increasing the output of the municipal electric light and water plants to provide for the increasing demands for both electricity and water.

WORCESTER, MASS.—The Massachusetts Gas and Electric Light Commission has approved the issue of additional capital stock by the Worcester Electric Light Company to the amount of $200,000, the proceeds to be used for the construction of a new power plant and modifications of the distributing system. The stock is to be issued at $200 per share.

ANN ARBOR, MICH.—The City Council has decided to discard all gas lamps and install electric arc lamps throughout the city.

CENTERVILLE, MICH.—Contracts have been awarded by Vance & Gray, engineers, 226 Huron Street, Toledo, Ohio, for construction of electric light plant and water works for the Centerville Water & Light

Company, in Centerville, as follows: For mechanical and pumping equipment, to Young-Gray Company, of Toledo, Ohio, and for electrical equipment, to F. Bissel Company, 226 Huron Street, Toledo, Ohio. The Centerville company will build t[illegible] structure. F. W. Thomas, 1919 Monroe Street, Toledo, Ohio, is secretary.

DETROIT, MICH.—The Detroit Edison Company is offering to its stockholders $1,500,000 in bonds, the proceeds to be used to take up the debenture bonds due next year, and also to provide funds for construction.

IRON MOUNTAIN, MICH.—Plans are being considered for the construction of a hydroelectric power plant at the Twin Falls of the Menominee River. O. W. Mead, of Madison, Wis., is engineer in charge.

OWOSSO, MICH.—The Owosso & Corunna Electric Company, of Owosso, Mich., and the Shiawassee Light & Power Company, of Corunna, Mich., have been consolidated under the name of the Consumers Power Company. The Shiawassee Light & Power Company's property consists of a dam and power house on the river, three miles south of Corunna, from which the villages of Vernon, Byron, Bancroft, Morris and Perry are supplied with electrical service. James De Young, formerly of Holland, Mich., will be manager of the company.

SAGINAW, MICH.—Plans are being prepared by the Eastern Michigan Power Company for the construction of a dam and power plant on the Au Sable River, north of Saginaw. The proposed plant will supply electricity for lamps and motors in Saginaw and Bay City.

DULUTH, MINN.—The installation of additional pumping units in the several pumping stations in Duluth is reported to be under consideration by the Board of Water and Light Commissioners, which will involve an expenditure of about [illegible].

LONG PRAIRIE, MINN.—The City Council has decided to install a new boiler at the municipal electric light plant, to replace the one destroyed by an explosion recently. The installation of a new engine and generator is also under consideration.

MINNEAPOLIS, MINN.—Sealed bids will be received by the State Board of Control, State Capitol Building, St. Paul, Minn., until Jan. 3, 1911, for the erection and completion of the mechanical equipment of Millard Hall and the Institute of Anatomy Buildings, College of Medicine, University of Minnesota, Minneapolis, Minn., including plumbing work, heating and ventilating and electrical work, in accordance with plans and specifications furnished by Clarence H. Johnson, architect, Capital Bank Building, St. Paul, Minn., and the Charles L. Pillsbury Company, engineer, 805 Metropolitan Life Building, Minneapolis, Minn. Bids must be submitted on forms supplied by the architect. Copies of plans and specifications may be seen at the Builders' Exchange, St. Paul, Minn.; Builders' Exchange, Minneapolis, Minn.; at the dean's office in the Institute of Public Health and Pathology Building, University of Minnesota, and also at the office of the State Board of Control. Extra copies of plans and specifications may be obtained on application to the engineer on payment of cost of duplication.

NORTHFIELD, MINN.—The City Council is reported to have decided to substitute tungsten lamps for the incandescent lamps now in use in the residence section.

PINE CITY, MINN.—The Power Engineering Company has been awarded the contract for the equipment for the hydroelectric power plant being erected by Webber & Hill at Pine River, Minn.

ST. JOSEPH, MO.—Plans are being considered for extensions to the municipal electric light plant. It is proposed to make extensions to the street lighting system and to enlarge the commercial lighting department. The proposed extensions will involve an expenditure of about $250,000.

CHINOOK, MONT.—It is reported that contracts have been awarded for the construction of an electric light plant in Chinook to the Laird Engineering Works and to the Fort Wayne Electric Works.

LIBBY, MONT.—It is reported that plans are being prepared by the Villars-Barnum Engineering Company, of Great Falls, Mont., for the proposed electric light and power plant and water works system for the Libby Water Works, Electric Light & Power Company. It is understood that specifications will be ready about the first of the year. E. K. Barnum is interested in the Libby Water Works, Electric Light & Power Company.

CORTLAND, NEB.—The installation of an electric light plant and water works system in Cortland is reported to be under consideration.

GILTNER, NEB.—At an election held recently bonds were voted for the installation of an electric light plant and water works system.

PORTSMOUTH, N. H.—The City Council has awarded the contract for lighting the city for a period of five years to the Rockingham County Light & Power Company. The minimum cost will be $11,000 per year. The new contract will net an annual saving of $2,500 per year.

SOUTH RIVER, N. J.—It is reported that no bids were received for the construction of electric light plant. It is understood that new bids will be called for.

TRENTON, N. J.—The City Council has adopted a resolution providing for the appointment [illegible] to make investigations and secure estimates of the cost of installing an electric generating plant at the city water-works pumping station for the purpose of supplying electricity for lighting the public buildings.

ALBANY, N. Y.—Sealed proposals will be received by the secretary of the Trustees of Public Buildings, Albany, N. Y., until Jan. 24, 1911, as follows: 1, for electric light fixtures; 2, for metal book stacks and metal cases; 3, for wood book cases; 4, for electric wiring for book stacks and book cases and extension to existing plant; 5, elevators and book lifts, etc., for the New York State Education Building, Albany, N. Y. Plans and specifications, form of contract and blank proposal forms may be obtained at the office of Palmer & Hornbostel, 63 William Street, New York, N. Y. Franklin B. Ware is State Architect.

BOLTON, N. Y.—The Bolton Light & Power Company has applied to the Public Service Commission, Second District, for permission to issue $12,000 in capital stock and $10,000 in bonds. The company has secured a franchise in the village of Bolton for street lighting and asks the consent of the commission to exercise the franchise. It also proposes to supply electricity for lamps and motors in Caldwell and in the adjacent village of Hill View.

BROOKLYN, N. Y.—The Coney Island & Brooklyn Railroad Company has applied to the Public Service Commission, First District, for permission to issue $500,000, the proceeds to be used for the proposed change of tracks on Coney Island Avenue.

BROOKLYN, N. Y.—Sealed proposals will be received by Henry S. Thompson, Commissioner of Department of Water Supply, Gas and Electricity, room 1904, 13-21 Park Row, New York, N. Y., until Dec. 30, for furnishing 360 lamp posts and brackets in the Borough of Brooklyn, N. Y. Blank form of proposal and specifications can be obtained on application at the office of the department, room 2330, 13-21 Park Row, New York, N. Y.

BUFFALO, N. Y.—The Atlas Works of the Standard Oil Company, located at Babcock Street and Buffalo Creek, Buffalo, N. Y., are contemplating the erection of an addition to its power house.

BUFFALO, N. Y.—Plans have been filed by the Frontier Electric Railway Company for a high-speed electric railway, which will extend from Buffalo to Niagara Falls along a private right-of-way. T. S. Ramsdell is president of the company.

MARCELLUS, N. Y.—Plans are being prepared by the Marcellus & Otisco Lake Railroad Company for the construction of a factory and power buildings, 50 ft. x 150 ft., three stories high, to be erected at Marcellus, N. Y. John Stewart is manager.

NATURAL BRIDGE, N. Y.—Contracts have been awarded by the St. Lawrence Talc & Asbestos Company, 5 East Forty-second Street, New York, N. Y., for the construction of a log crib and concrete dam about 200 ft. long and small power house with water wheel, at Natural Bridge, N. Y., to Leonard Gates, Carthage, N. Y. Plans are being prepared for a mill to be erected later.

NEW YORK, N. Y.—The contract for changing the present arc lamp system to tungsten lamps on the recreation piers was awarded to Peet & Powers, 45 West Thirty-fourth Street, New York, N. Y., for $5,484.

NEW YORK, N. Y.—Bids will be received at the office of the Depot Quartermaster, Army Building, New York, N. Y., until Dec. 29, under Schedule No. 156, for furnishing miscellaneous supplies, including tools, electrical supplies, belting, cargo cable, fans, wire, tube expanders, etc. Colonel M. Gray Zalinski is depot quartermaster.

NEW YORK, N. Y.—Bids will be received by Henry S. Thompson, Commissioner of Department of Water Supply, Gas and Electricity, room 1914, 13-21 Park Row, New York, N. Y., until Dec. 30 for furnishing 255 lamp posts, brackets and parts thereof in the Borough of Manhattan. Specifications and blank form of proposal can be obtained on application at the office of the department, room 2339, 13-21 Park Row.

SYRACUSE, N. Y.—The Public Service Commission, Second District, has received a petition from the Syracuse Rapid Transit Company for permission to increase its capital stock from $4,000,000 to $5,750,000, the proceeds to be used to take up outstanding notes to the amount of $1,660,000, of which $1,585,000 is owned by the New York State Railways Company.

SYRACUSE, N. Y.—In order to bring about the reorganization of the Municipal Heating Company, of Syracuse, foreclosure proceedings on a $300,000 mortgage have been started by the New York Trust Company, as trustee for the bondholders. Ernest I. White, an officer of the company, states that the main purpose of the action was to place its business operation on a business basis. It is proposed to build a new plant and install electric generating machinery, the exhaust steam to be used [illegible].

ASHEVILLE, N. C.—The Isothermal Traction Company has applied to the City Council for a sixty-year franchise to operate a railway over the streets in Asheville. The company proposes to build a railway through the Hickory Nut Gap section of the Appalachians on the route from Gastonia to Asheville, a distance of about seventy-five miles.

LENOIR, N. C.—The Lenoir Chair Company is reported to be contemplating the construction of a new plant, which will be equipped for electric motor drive.

RALEIGH, N. C.—Extensions have been completed to the power house of the Carolina Power & Light Company, increasing the output of the plant to 10,000 hp.

ROCKINGHAM, N. C.—It is reported that initial steps have been taken for transferring the property of the Rockingham Power Company, which includes the Blewitt Falls hydroelectric power plant on the Pee Dee River, to Edward Clifford Potter, of Newton, Mass., who, it is [illegible], represents [illegible]

[illegible] 60 per cent completed. It is understood that work will be resumed on the plant as soon as possible.

[illegible] hydroelectric power plant on the Yadkin River at Whitney, near Salisbury, at auction Dec. 15 for $490,250. The property has been in the hands of receivers for about two years. The company had issued $10,000,000 in capital stock and had a bonded indebtedness of $4,860,000. Plans are now under consideration for reorganization.

SMITHVILLE, N. C.—At an election to be held Feb. 21 the proposition to issue $55,000 in bonds, the proceeds to be used for the construction of an electric light plant, water works and sewerage systems, will be submitted to a vote. Plans have been prepared by White & Piatt, Durham, N. C., engineers.

CARRINGTON, N. D.—The Board of County Commissioners has awarded the contract for the electric light fixtures for court house and jail to the Loyd Garrett Company, of Chicago, Ill. C. W. Burnham is county auditor.

COLUMBUS, OHIO.—Three new motor generator sets are being installed at the Columbus Edison plant on East Gay Street by the Columbus Railway & Light Company to transform the current from the new 4000-kw generator in the Spring Street station for lighting purposes. Transformers have also been installed in the Mound Street station of the Columbus Light, Heat & Power Company and in the Milo station of the Columbus Railway & Light Company, and arrangements have been made to tie all these stations together, so that any load may be carried and all kinds of weather conditions met.

COSHOCTON, OHIO.—The City Council has passed an ordinance authorizing the Director of Public Works to advertise for bids for furnishing and installing an additional steam or electrically driven pump for the water works station.

LIMA, OHIO.—The Western Ohio Railway Company, which operates an electric railway connecting Piqua, Findlay, Lima and Celina, has decided to enter the commercial lighting and power field and is equipping and repairing its high-tension transmission lines along the route for that purpose at a cost of about $25,000. The company has already secured franchises for street and domestic lighting in the villages of Rawson, Lockington and Beaverdam, and a bid has been submitted to the Council at Sidney for street lighting at the rate of $62.50 per arc lamp per year for an all-night service. Application will be made for franchises in Lima, Sidney, Anna, Botkins, Wapakoneta, Cridersville, Bluffton, Celina and other small villages along the line. It is said that the company is in a position to furnish electrical service at a lower rate than private companies and is now only using about 50 per cent of energy generated at its power houses.

NORWALK, OHIO.—The Wheeling & Lake Erie Railroad Company is reported to have entered into an agreement to supply electricity for lighting the village of Norwalk. It is understood that work will begin immediately on the erection of a distributing system.

TOLEDO, OHIO.—Contracts have been placed by the Toledo Railways & Light Company with the General Electric Company of Schenectady, N. Y., for one 1000-kw, 575-volt motor-generator set and one 1000-kw, 3-unit, 135-volt motor generator set, with transformers and station equipment.

TOLEDO, OHIO.—The Maumee Valley Electric Company has closed a lease with the State of Ohio for water from the Miami Canal for all purposes for its new plant at Miami. This lease is supplementary to the one now held by the company and provides for a much greater supply of water. The channel of the canal between Miami and Waterville is to be deepened by the company, the banks raised and the stream patroled at the expense of the company by men employed by the State. Most of the work has already been done, which was necessary to secure the water already under the lease. It is expected to have the plant ready for operation early in January. The plant will have an output of about 1,500 hp. The officers of the company are: J. M. Ashley, president; R. R. Livingston, vice-president; Fitzhugh Speer, secretary, and H. L. Crawford, treasurer.

WARREN, OHIO.—The City Council has awarded the contract for street lighting to the Warren Water & Light Company, Warren, Ohio, for a period of ten years. Under the terms of the contract 835 Mazda lamps will be furnished, 676 of which call for an all-night service and 150 to burn until midnight. Ornamental lamp standards are to be erected in the business section, of which there are to be 85, carrying one, three and five lamps. The wires are to be placed underground in the business district. Contracts have already been placed for material for the street lighting system. C. F. Inman is superintendent of the Warren Water & Light Company.

ENID, OKLA.—Plans are being considered by the Enid Electric & Gas Company for improvements to its plant which will increase the output of the plant by 200 kw. The installation of a separate circuit for the business district is also contemplated.

MUSKOGEE, OKLA.—Plans are being prepared by the city engineer for the installation of an ornamental street lighting system throughout the entire business district.

OKLAHOMA CITY, OKLA.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 28 for the installation of a conduit and electric wiring system and gas piping system in the United States Post Office building, Oklahoma City, Okla., in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of the superintendent of construction, Oklahoma City, Okla. James Knox Taylor is Supervising Architect.

PORTLAND, ORE.—At a meeting of the stockholders of the Portland Railway, Light & Power Company, held Nov. 28, a reorganization of the company was effected for the purpose of increasing the capital stock from $15,000,000 to $25,000,000, in order to provide additional funds to carry on the extensive development now under way. The company is now constructing two hydroelectric plants, which have a total output of 70,000 hp, one of which will be completed in eighteen months and the other in three or four years. B. S. Josselyn is president of the company.

STAYTON, ORE.—Announcement has been made by A. L. Shreve, manager of the Stayton Electric Light Company, that a deal has been consummated whereby he has purchased a power site on the Santiam River, three miles from Stayton, where it is estimated that about 5000 hp can be developed. A power plant will be erected on the site.

PANAMA.—The War Department has granted Henry T. Cook, of New York, N. Y., a franchise to construct and operate an electric railway system between Panama City, in the Republic of Panama, and La Boca, in the Canal Zone. The railway will also touch Secanus, the Hotel Tivoli and the Ancon Hospital in the Canal Zone.

ALTOONA, PA.—Plans are being considered by the Penn Central Light & Power Company for the construction of a large electric power plant in Altoona, work on which will begin next spring.

BUTLER, PA.—It is reported that contracts have been awarded for the construction of the proposed electric railway, which will extend from Evans City to Harmarville, Pa. The company will be organized under the name of the Allegheny & Northwestern Railway Company, with headquarters in Butler, Pa.

CHESTER, PA.—Application will soon be made to the Governor of the State for a charter for a new street railway, which will be known as the Darby, Media & Chester Cut-off Railway Company. The company will provide for passenger and freight service. The incorporators are: Charles O. Kruger, G. W. Mantz, Thomas K. Bell, Alexander Rennick and Frank W. Janney.

ELLWOOD CITY, PA.—Contracts have been placed by the Pennsylvania Power Company for additional equipment for its power plant in Ellwood City as follows: For the installation of two 750-hp water turbines, to the S. Morgan Smith Company, of York, Pa., and for two 600-kw generators to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa. The cost of the improvements to the plant is estimated at from $25,000 to $35,000. The company now supplies electricity in Ellwood City, Zelienople, Wampum, West Pittsburgh, Rock Point and Wurtemburg.

JENKINTOWN, PA.—The residents of Breadyville and Ivyland have petitioned the Jenkintown Electric Light Company to extend its transmission lines into their villages.

PHILADELPHIA, PA.—An agreement has been entered into between the city and the railroad companies whereby the railroad companies have pledged themselves to light and maintain all overhead bridges on their lines in all parts of the city free of charge to the municipality for all time.

PITTSBURGH, PA.—The question of establishing a municipal electric light plant in Pittsburgh is under consideration by the City Council. The city is operating a municipal plant on the north side, which was taken over when the City of Allegheny was annexed.

PITTSBURGH, PA.—Bids will be received by K. Hansen, chief engineer of the Orenstein-Arthur Koppel Company, Machesney Building, Pittsburgh, Pa., until Dec. 28, for constructing buildings and material for addition to the works of the Orenstein-Arthur Koppel Company at Koppel, Pa., including power house, outside crane runway, heavy car shop, machine shop, wood shop and erection shop. F. G. Ross is consulting engineer.

WOONSOCKET, R. I.—Work is progressing rapidly in the new mill of the Lafayette Worsted Company. The building will be four stories high and will be equipped for electrical operation. An 800-hp turbine will be installed.

CHARLESTON, S. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Jan. 13, for the installation of conduit and wiring and extension of present gas piping system of the present United States custom house at Charleston, S. C., in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of the custodian, Charleston, S. C. James Knox Taylor is Supervising Architect.

ROCK HILL, S. C.—It is reported that contracts have been awarded for equipment for the proposed municipal electric light plant. Contracts have not yet been awarded for construction of power house or engine. C. Parks Rucker, of Charlotte, N. C., is engineer.

ABERDEEN, S. D.—Bids will be received by George F. Sims, clerk of Board of Education, Aberdeen, S. D., until Jan. 4 for the construction of high school building, including electric wiring and telephones, program clocks, lighting fixtures, vacuum cleaning system and heating and ventilating, plumbing, etc. Patten & Miller, of Chicago, Ill., are architects.

BRYANT, S. D.—It is reported that local business men have contributed $3,000 toward the construction of a municipal electric lighting system in Bryant.

HIGHMORE, S. D.—The installation of an electric light plant in Highmore, S. D., is reported to be under consideration. T. J. Wixon, of Highmore, is interested in the project.

ERWIN, TENN.—George E. Ladshaw, of Spartanburg, S. C., is engineer in charge of the construction of the proposed power plant of the Nolochucky Power Company on the Nolochucky River, at Erwin. The cost of the plant is estimated at about $434,000.

KNOXVILLE, TENN.—Chisholm & Osborne, hydraulic engineers, of Charlotte, N. C., have been engaged by the Tellico Power Company, 619 Gay Street, Knoxville, Tenn., to take charge of its water power development project, on the Tellico River, Tenn., for which preliminary surveys are now being made.

TRENTON, TENN.—It is reported that the Trenton Electric Light Company, recently incorporated, will purchase the electric plant owned by Keenan, Wade & Wade. It is understood that improvements will be made to the system.

DEL RIO, TEX.—Arrangements are being made by the Del Rio & Western Telephone Company for improvements and extensions to its system, which will involve an expenditure of about $5,000.

TEMPLE, TEX.—The City Council is reported to be contemplating the construction of a municipal incinerating plant in Temple.

WEBSTER, TEX.—The Tri-City Telephone Company, recently incorporated, is reported to be preparing to erect a telephone line, thirty miles in length, connecting Freindswood, Webster and League City.

BURLINGTON, VT.—The Board of Aldermen has voted to issue $53,000 in bonds, the proceeds to be used for improvements and extensions to the municipal electric light plant.

ABINGDON, VA.—Plans have been prepared by Baumann Brothers, of Knoxville, Tenn., for the erection of new buildings, including a power house, for the Martha Washington College.

NORFOLK, VA.—All bids opened Nov. 19 for three electrically driven centrifugal pumps at the Colley Avenue sewer pumping station were rejected. New specifications will be prepared and bids called for later. W. T. Booth is city engineer.

PASCO, WASH.—Work has commenced on the erection of a power station for the Pacific Power & Light Company, in Paco, which will be used as a generating and distributing station.

TACOMA, WASH.—Hamilton F. Groner, chief engineer, writes that bids will be received until Feb. 1, 1911, for the completion of the Nisqually power plant, as follows: Section 1—Bridge, to cost $44,890. Section 2—Conduit and reservoir, to cost $292,675. Section 3—Pressure pipes and anchor piers, to cost $116,696. Section 4—Power house, cranes and cableway, to cost $149,875. Section 5—Water wheels and generators, to cost $168,733. Section 6—Electrical equipment for power house, to cost $88,573. Section 7—Electrical equipment for substation, to cost $102,690. Section 8—Transmission line, to cost $100,000.

TOLEDO, WASH.—The City Council has passed an ordinance granting a franchise to E. P. Badger and A. R. Badger to install and operate an electric light system in Toledo.

BUCKHANNON, W. VA.—A movement is on foot to organize a company to install a new electric light and power plant in Buckhannon. The plant of the Buckhannon Light & Water Company was damaged by fire more than a month ago, and as yet no effort has been made by the company to make repairs to its plant. The town is at present without a street lighting service.

PARKERSBURG, W. VA.—The Parkersburg Mill Company is planning to enlarge its timber and woodworking plant, which will be equipped for electrical operation throughout.

CHIPPEWA FALLS, WIS.—Messrs. Johnson & Lee are reported to be contemplating the construction of a new timber cutting plant at Chippewa Falls, which will be equipped for electric motor drive.

MANITOWOC, WIS.—Plans are being prepared by the C. Reiss Coal Company, of Sheboygan, Wis., for the construction of a new power plant and coal dock at Manitowoc, Wis. The equipment required will include engine, dynamo, boilers, electric motors and coal handling machinery.

MENDOTA, WIS.—The State Board of Control has awarded the contract for the construction of the foundation for the new power house at the Mendota Insane Asylum to George Nelson, of Madison, Wis., for $2,885.

VIOLA, WIS.—The Village Council has engaged C. R. Thomson, of Richland Center, Wis., engineer, to take charge of the construction of a dam across the Kickapoo River for power purposes. C. H. Meyer, Jr., is village clerk.

WAUSAU, WIS.—The City Council has authorized the Board of Public Works to secure estimates and plans for a municipal electric light plant. It is proposed to install an electric plant in connection with the water works pumping station. The city now owns and operates the street lighting system, electricity for which is supplied by the Wausau Street Railway Company.

CHEYENNE, WYO.—The City Council has passed an ordinance requiring the National [illegible] material, providing for fees and penalties. Amendments to the ordinance require the grounding of secondaries throughout the city, use of cabinets for all cutouts in all classes of buildings, and a minimum spacing of 18 in. instead of 6 ft.

VICTORIA, B. C., CAN.—Among the by-laws to be submitted to the ratepayers at the forthcoming election will be one authorizing an appropriation of $25,000 for the purchase of electrical equipment for extensions and improvements to the street lighting system.

WINNIPEG, MAN., CAN.—Proposals will be received at the office of M. Peterson, secretary of Board of Control, until Dec. 23, for a new or second-hand 50-kw generator, with steam engine, for direct connection or for belt driving.

BOWMANVILLE, ONT., CAN.—The by-law granting the Seymour Power & Electric Company, Ltd., a franchise to erect and operate an electric light plant in Bowmanville will be submitted to the ratepayers on Dec. 27.

DESERONTO, ONT., CAN.—A by-law will be submitted to the ratepayers at the municipal elections to authorize and confirm certain agreements between the Trenton Electric & Water Company, Ltd., and the town of Deseronto, Ont.

FORT WILLIAM, ONT., CAN.—It is reported that by-laws will be submitted to the ratepayers appropriating $67,000 for extensions and improvements to the street railway system and for $25,000 for improvements and extensions to the telephone system.

GALT, ONT., CAN.—The by-law to provide for an issue of $4,000 debentures, to secure funds for the local distribution of electricity and for the extension of the electric light system in the town of Hespeler, will be submitted to the ratepayers at the municipal elections.

KINGSTON, ONT., CAN.—At an election to be held Jan. 2 a by-law asking for an appropriation of $13,000 for improvements to the street lighting system will be submitted to the ratepayers. The present plans call for the installation of 200 new lamps, of which 150 will be substituted for those now in use. Bids will be received for the work about the first of the year. C. C. Folger is engineer in charge.

LISTOWEL, ONT., CAN.—At an election to be held Jan. 2 the by-law to issue $5,000 electric light debentures will be submitted to the ratepayers.

OTTAWA, ONT., CAN.—The Board of Control is reported to have recommended to the City Council that the city install ornamental street lamps on Sparks Street. If acceptable to the Council, bids will be called for at once for ornamental lamp posts.

ST. CATHARINES, ONT., CAN.—The Niagara Falls, Welland & Dunnville Electric Railway Company is planning to erect substations next spring at Niagara Falls, Welland and Dunnville. J. C. Gardner, of Niagara Falls, Ont., is interested in the company.

New Industrial Companies.

THE AMERICAN SURFACE CONTACT COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $250,000. The incorporators are: L. Lehman, B. Rosenfeld, of New York, N. Y., and E. A. Phippen, of Salem, Mass. The company proposes to manufacture tools, machinery, etc.

THE AMERICAN TELOCLEAN COMPANY, of New York, N. Y., has been incorporated by H. Kanoffsky, S. Menschel and M. Menschel, of New York, N. Y. The company is capitalized at $25,000 and proposes to clean and disinfect telephones, etc.

THE ARMSTRONG ENGINEERING COMPANY, of Philadelphia, Pa., has been granted a charter with a capital stock of $25,000. The directors are: Robert P. Field, Thirty-sixth and Chestnut Streets, West Philadelphia, Pa., treasurer; N. Bruce Armstrong and Samuel Field, Jr., both of Overbrook, Pa.

THE AUTO ELECTRIC & BATTERY COMPANY, of San Francisco, Cal., has been incorporated, with a capital stock of $4,500, by R. H. Robinson, John Varney and O. W. Lillard.

THE CANADIAN ELECTRIC FIXTURE AND CONTRACTING COMPANY, of Toronto, Ont., Can., has been incorporated with a capital stock of $40,000 by Samuel Wood, Harry M. Van Gordor and William Burton, all of Toronto, Ont., Can.

THE ELECTRIC INSTALLATION COMPANY, LTD., of Toronto, Ont., has been chartered with a capital stock of $40,000 by John Berry Ferris, James Pavitt Archer and Arthur Boucher Colville, all of Campbellford, Ont., Can.

THE F. & M. SPECIALTY COMPANY, of New York, N. Y., has been chartered with a capital stock of $50,000 by R. V. Fitzgerald, of Newark, N. J.; O. S. McFarland and G. Colvin, of New York, N. Y. The company proposes to manufacture and sell self-propelling vehicles, engines, etc.

THE GAINER ENGINEERING & CONSTRUCTION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 for the purpose of doing a general contracting and construction business. The incorporators are: E. E. Gainer, P. Henry and Z. U. Dodge, of New York, N. Y.

THE GENERAL PAPER GOODS COMPANY, of Newark, N. J., has [illegible] manufacturing manufacturers' and mill supplies, also to do a general mechanical and electrical engineering business. The incorporators are: C. H. Stewart, of Irvington, N. J.; F. B. Stewart and E. W. Ponce, both of Newark, N. J.

THE INTERNATIONAL ROTARY MOTOR COMPANY, of Cumberland County, Maine, has filed articles of incorporation with a capital stock of $250,000 for the purpose of manufacturing and dealing in motors, Merrill engines and other engines. W. L. Merrill is president, and R. L. Merrill, treasurer, both of Portland, Maine.

THE LIGHT, HEATING AND VENTILATING COMPANY, of Auburn, Ind., has been organized for the purpose of doing a general contracting business, making a specialty of constructing new lighting, heating and ventilating plants. Joseph Lige is president of the company, and Roy Lige is secretary.

THE NESTOR ELECTRIC VEHICLE COMPANY, of San Francisco, Cal., has filed articles of incorporation, with a capital stock of $200,000. The incorporators are: S. Hendricks, R. M. Searls, W. E. Colby, G. H. Smith and G. S. Arnold.

THE NICHOLS & WRIGHT MOTOR COMPANY, of Buffalo, N. Y., has been chartered with a capital stock of $300,000 by W. R. D. McQuarrie, C. G. Hornung and B. Knox, all of Buffalo, N. Y. The company proposes to manufacture motors, engines, etc.

THE RECORDING SPEEDOMETERS SALES COMPANY, of East Orange, N. J., has been incorporated by H. H. Picking, C. O. Geyer and F. E. Ruggles, of East Orange, N. J. The company is capitalized at $125,000 and proposes to manufacture recording instruments.

THE STERLING ENGINEERING & CONSTRUCTION COMPANY, of Atlantic City, N. J., has been chartered with a capital stock of $100,000 by E. R. Bolloty, W. H. Rentscheller and R. J. Bolloty, of Atlantic City, N. J. The company proposes to do a general engineering and construction business.

New Incorporations.

BAKERSFIELD, CAL.—The Midway Light & Power Company has been chartered, with a capital stock of $250,000, by H. L. Dearing, H. Williams, of Los Angeles, Cal.; E. F. Hughes, of Sierra Madre, Cal.; H. J. Coudge, of Alhambra, Cal., and C. L. Chandler, of South Pasadena, Cal.

JACKSON, CAL.—The Amador Mines, Power & Water Company has been incorporated, with a capital stock of $300,000, for the purpose of entering the local electrical field and to deal in coal and oil lands. The company proposes to construct a storage reservoir covering 150 acres, near Pine Grove, ten miles east of Jackson. An option has already been secured on the site. It is planned to erect a power plant near New York ranch, about five miles from this city, to generate 2000 hp, half of which will be utilized by the mines owned by the company, and the other half will supply electricity for lamps and motors in the three mining towns. The company also proposes to furnish water to the City of Jackson. The directors are: W. P. Greenhalgh, R. S. Rainsford, George W. Brown, Richard Webb and Dr. E. E. Endicott.

LOS ANGELES, CAL.—The City Railway Company has been incorporated to construct certain railways in Los Angeles. The company is capitalized at $5,000,000 and the incorporators are: Howard E. Huntington, George C. Ward, C. A. Henderson, J. E. Brown, W. E. Dunn, S. M. Haskins and Albert Crutcher.

CARROLLTON, GA.—Articles of incorporation have been filed for the Gainesboro Telephone Company with a capital stock of $250,000 by J. C. Bass, L. Mandeville, L. K. Smith and others.

CHICAGO, ILL.—The Interstate Power Company has been chartered under the laws of the State of Virginia, with a capital stock of $1,000,000. The principal offices of the company are located in Chicago, Ill., and it proposes to construct and operate electric, natural and artificial gas plants, railways, manufacture artificial ice, and to own and control water-power sites and furnish power. The incorporators are: Ralph M. Burtis, of Oshkosh, Wis.; William H. Burtis, of Decorah, Ia.; Jacob E. Dittus, Harold T. Sibley and John A. Clark, of Chicago, Ill.

SULLIVAN, ILL.—The Sullivan Home Telephone Company has been incorporated with a capital stock of $70,000 by C. B. Cheadle, A. G. Hawley and E. S. Sterrett, of Joliet, Ill.

MACEO, KY.—The Maceo Home Telephone Company has been incorporated with a capital stock of $15,000 by B. W. Hawes, Louis Geritson, Z. T. Perkins, George M. Taylor and D. G. Bright.

CUMBERLAND VALLEY, PA.—The Valley Stock Telephone Company has filed articles of incorporation with a capital stock of $5,000. Charles F. Doyle, of Cumberland Valley, is treasurer.

OTTAWA, ONT., CAN.—The Western Central Railway Company has been incorporated for the purpose of building electric railway between Toronto and London, with branches to Stratford, Woodstock and Windsor, connecting with ferries to be operated across the Detroit River

Personal.

MR. J. P. MITCHELL has been appointed superintendent of the Bucyrus (Ohio) Light & Power Company.

MR. J. S. MALTMAN has resigned as manager of the Kankakee Electric Light Company to accept the position of electrical engineer for the Robertson Engineering Company, of Baltimore, Md.

MR. SAMUEL INSULL, accompanied by his wife and son, sailed for England on the *Mauretania* on Dec. 17. The Insulls will spend their Christmas holidays near London, returning to Chicago about the middle of January.

EDWARD WESTON was the guest of honor at a dinner at the Lotos Club on Dec. 16, at which Dr. R. B. Owens, secretary of the Franklin Institute, presented the Elliott Cresson medal, recently awarded to Dr. Weston for eminent work in science.

MR. HERBERT A. WAGNER has been elected vice-president of the Baltimore Consolidated Gas, Electric Light & Power Company, and will have charge of the electrical division. Mr. E. D. Edmondston has been promoted to the office of general superintendent of the electrical division

MR. A. L. TUCKER, for a number of years prominently connected with the Western Electric Company in Chicago and who still takes a lively interest in electrical affairs, has lately returned from a pleasure trip to Jamaica, Cuba and the Isthmus of Panama. Mr. Tucker was impressed with the excellence and magnitude of the work on the Panama Canal.

MR. C. D. WARNER has been appointed sales manager of the Moore Light Company, at 500 Fifth Avenue, New York City. Mr. Warner is a graduate of the University of Nebraska in electrical engineering. He joined the Moore company in 1896 as assistant chief engineer, his service therefore having extended through the experimental stage and commercial development of the Moore tube light up to the present time.

MR. J. K. MAHAFFEY, who was assistant secretary of the Jandus Electric Company prior to the purchase of this company by the Adams-Bagnall Electric Company, has accepted the position of sales-manager of the Union Metal Manufacturing Company, Canton, Ohio, and will assume the duties of this position Jan. 1. Mr. Mahaffey was formerly connected with the General Electric Company, and his many friends in the electrical field will be glad to learn of his advancement.

FRANK L. SESSIONS has opened an office at 16 East Broad Street, Columbus, Ohio, as consulting mechanical and electrical engineer and expert in patent cases. Mr. Sessions is an associate member of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers. He is a graduate of the Worcester Polytechnic Institute. For the past ten years he has been chief engineer of the mining department of the Jeffrey Manufacturing Company, of Columbus, and previous to that he was connected with the engineering departments of the Siemens & Halske Electric Company, Chicago, and the Fort Wayne Electric Company.

Obituary.

MR. FRED RECKENZAUN, who left New York for Graz, Austria, on Aug. 17, died at that place on Sunday, Dec. 11. A cablegram on Monday notifying Mrs. Reckenzaun of the death came as a great shock, as it had been assumed from Mr. Reckenzaun's letters that he was on the rapid road to recovery, his health and eyesight being reported as improving, with gain of weight.

MR. WALTER L. PIERCE, who for thirty-two years had been connected with the Lidgerwood Manufacturing Company and for twenty-nine years was its secretary and general manager, died suddenly of heart failure at his winter home in the Hotel St. Andrews, New York City, in the early hours of Saturday, Dec. 10. He was a son of John F. Pierce and was born at Dorchester, Mass., on June 8, 1855. His parents survive him, and he leaves a widow, an only son, Walter L. S. Pierce; a brother, Charles C. Pierce, and a sister, Mrs. E. W. Jones. Mr. Pierce's death was entirely unexpected and was a great shock to his family and associates. He had suffered for several years with nervous troubles, but by devoting much of his time to out-of-door pursuits he had apparently recovered. He was feeling particularly well when he left his office on the evening preceding his death. Mr. Pierce was remarkable as an organizer, and so efficient was his work that no detail of the great business which grew up under his hand was neglected during his long absences from his desk while seeking health. Besides his connection with the Lidgerwood Manufacturing Company, he was treasurer of the Hayward Company and of the Gorton-Lidgerwood Company. His summer home was at Englewood, N. J., where he was a member of the Englewood Country Club. He was also a member of the Apawamis Golf Club, the Wright Fish and Game Club of Canada, the Lawyers' Club, the Engineers' Club, the Machinery Club, in which he was also a director; an associate member of the Naval Architects and Marine Engineers and of the American Society of Mechanical Engineers and a past president of the National Metals Trades Association. Funeral services were held at St. Paul's Church, at Eighty-sixth Street

and West End Avenue, New York City, on Tuesday, Dec. 13, and the burial was at Woodlawn, N. Y.

MR. FRANK S. GORTON, of Chicago, whose death on Dec. 12 was briefly announced in these columns last week, was a man who deserves an honored place among the American business men whose discernment made possible the upbuilding of the electrical industry. He was a pioneer in the electric lighting business in Chicago. He believed in the industry and backed it with his influence and his money in the early days, when some perspicacity was required to foresee the remarkable development that was to follow. His death recalls an interesting chapter in the establishment of electric lighting in Chicago.

Mr. Gorton was a native of Rochester, N. Y., and was born in 1847. Before coming to Chicago he was engaged in manufacturing business in New York City. In 1882 Gen. Anson Stager, then vice-president of the Western Union Telegraph Company in Chicago and a man of excellent business judgment, organized the Western Edison Light Company, of Chicago, with $500,000 capital stock, securing exclusive rights from the old Edison Electric Light Company for the States of Illinois, Iowa and Wisconsin. At first the business consisted mainly in installing isolated plants. In 1883 Frank S. Gorton, Gen. Stager's son-in-law, became connected with the company, of which he was made treasurer.

Business was slow in those days, and the company experienced the difficulties of all pioneers. But it was not idle, establishing a number of private plants in Chicago and a few central-station plants—notably that at Appleton, Wis., the first central station in the United States—in other cities. Gen. Stager died in 1885, and in the following year the parent Edison company bought back the territorial rights of the Western Edison Light Company, of Chicago, and the firm of Humbird & Gorton, composed of James S. Humbird and Frank S. Gorton, was placed in charge of the Western business of the parent company. Subsequently Mr. Humbird sold his interest in this business to Mr. Gorton and associated himself with George Westinghouse.

Early in 1887 the Chicago Edison Company (since succeeded by the Commonwealth Edison Company) was established, with capital stock of $500,000. The principal stockholders were the old stockholders of the defunct Western Edison Light Company. Mr. Gorton was made a director and also secretary and treasurer, which positions he retained until he retired from the company, May 1, 1902, fifteen years later. The company built its first central station on the site of the present headquarters building at 139 Adams Street. At first most of the stockholders had little faith in the earning qualities of a central station, and before the Adams Street Station was finished the company ran short of funds and made a bond issue to complete the plant, because it could sell no more stock. At that time Mr. Gorton was almost alone in the management of the company, and he brought its affairs to a successful issue.

In 1889 the Chicago Edison Company began to pay 2 per cent quarterly dividends, and it continued to divide profits at the same rate until succeeded by the Commonwealth Edison Company on Sept. 17, 1907, as the result of the consolidation of the Chicago Edison Company and the Commonwealth Electric Company. Mr. Samuel Insull became president of the Chicago Edison Company in 1892, and Mr. Gorton was associated with Mr. Insull in the management of the business for ten years. The business was successful in a marked degree. When Mr. Gorton retired in 1902 the capitalization had been increased from the original $500,000 to $7,500,000, and at the last report the amount of capital stock issued by the Commonwealth Edison Company had reached the sum of $32,272,100.

For a time after leaving the Chicago Edison Company Mr. Gorton was interested in the Standard Pneumatic Tool Company, afterward absorbed by the Chicago Pneumatic Tool Company, but in 1903 he retired from all business. He made his home for much of the year at his country house in Wheaton, Ill., but this winter he and Mrs. Gorton had apartments at the Congress Hotel, where he died, his death being due to heart failure following an attack of asthma. Mrs. Gorton and Mr. Gorton's nephew, Edward F. Gorton, were with him at the time of his death. The funeral was held in Lake Forest, Ill., on Dec. 14 and was attended by a large number of men prominent in the business and social life of Chicago. Mr. Gorton was a member of a number of clubs and social organizations. He was at one time considerably interested in fine horses as a gentleman driver, and he and Mrs. Gorton traveled extensively, and, although both were rather retiring in their tastes, they had a wide circle of friends, not only in Chicago but in other cities also.

Trade Publications.

"HIGH EFFICIENCY CARBON LAMPS" is a folder which is being distributed by the General Incandescent Lamp Company, Cleveland, Ohio, in which treated carbon and graphitized carbon lamps are catalogued and illustrated, and reasons for using high-efficiency rather than low-efficiency carbon lamps are tersely summarized.

RATEAU-SMOOT TURBINES.—In addition to building Rateau-Smoot turbines of the high and low pressure types, the Ball & Wood Company, Elizabethport, N. J., announces by means of a new catalog just issued that it is also building these turbines, which are of the impulse type, for mixed flow pressure. The new type consists of a straight low-pressure turbine with supplementary wheels to use economically high-pressure steam by means of an automatically controlled governor. The catalog is attractively illustrated, and contains much information of interest relative to the steam turbine.

HYDRAULIC TURBINES.—Bulletin No. 101 of S. Morgan Smith Company, York, Pa., is a handsome pamphlet of fifty-two pages giving illustrations and data of Smith hydraulic turbines. Among the engravings are excellent views of a number of large hydroelectric equipments, some of which have not yet been described in the technical press. Of particular interest to electrical engineers are views and data of hydroelectric equipments for the Connecticut River Power Company, Chattanooga & Tennessee River Power Company, Roosevelt Salt River plant, Great Falls (Mont.) Water Power Company, Winnipeg Electric Railway Company and La Crosse Water Power Company. Another bulletin recently issued by the same company illustrates and describes head-gate hoists.

WATER TURBINES.—The Trump Manufacturing Company, Springfield, Ohio, has issued in sheet form a set of illustrated bulletins devoted to its various types of water turbines, as follows: Bulletin A, vertical turbines arranged for direct connection to generators; bulletin B, horizontal turbines for direct connection to generators; bulletin C, horizontal turbines for driving centrifugal pumps; bulletins E and K, turbines of the open-penstock type; bulletin F, runners of standard 66-in. turbines; bulletins G and I, turbines designed especially for high heads; bulletin J, vertical turbines for direct connection to centrifugal pumps; bulletin L, quarter-turn turbines of the open-flume type; bulletin M, runners for Francis type turbines.

BUSINESS NOTES.

THE OTIS ELEVATOR COMPANY at a meeting of its directors last week elected W. E. McCune as treasurer of the company, to succeed L. Belknap, deceased.

MACHADO & ROLLER, 203 Broadway, New York, have opened a Western sales office at 740 Monadnock Block, Chicago, in charge of Mr. Harry I. Shire, secretary of the company. The new sales office will be the Western distributing point for the Roller-Smith line of instruments and circuit-breakers, H. & B. resonance-type frequency meters, and Columbia watt-hour meters, including single and polyphase induction types of alternating-current meters and the new shunted type of direct-current switchboard meters, for which Machado & Roller are selling agents.

AMERICAN ELECTRIC FUSE COMPANY'S CHICAGO OFFICE.—Mr. Fred B. Bonde, Chicago district sales manager of the American Electric Fuse Company, is now located in the Vogue Building, at 290 Fifth Avenue, where he carries a complete sample line of "Blue Ribbon" telephone protectors, "Allen-Bradley" motor-starters, controllers and battery-charging rheostats, "American" enameled magnet wire and "Americoil" ignition apparatus. This is new territory for Mr. Bonde, who has been recently transferred from the St. Paul district.

THE NATIONAL X-RAY REFLECTOR COMPANY, of Chicago, owing to greatly increased business, has found it necessary to secure larger quarters for its general offices and display salesroom. The ground-floor store in the new Brooks Building, corner of Jackson Boulevard and Franklin Street, has been secured, in which display salesrooms have been fitted up, which enable the demonstration to the best advantage of the "Eye Comfort" system of indirect illumination and direct reflectors. Mr. E. L. Hanes, vice-president of the company, will [illegible] make his annual pilgrimage to the Northeastern States and Canada.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. [illegible]

[Conducted by W. H. [illegible], Patent Lawyer, [illegible] St., N. Y. City.]

978,128. TELAUTOGRAPH; R. W. Armstrong, New York, N. Y. App. filed Nov. [illegible] controls the connection of the transmitting and receiving instruments of [illegible] that is used in writing.

978,130. ADVERTISING DEVICE; T. H. Barron, New York, N. Y. App. filed April [illegible] path by placing them on a belt.

[illegible] APPARATUS FOR ELECTRIC SMELTING; [illegible], New York, N. Y. App. filed Jan. 7, 1904. Electric furnace for cal[illegible] and a plurality of receptacles moving across the openings to retain a molten body within the chamber.

[illegible] ELECTRIC FURNACE; [illegible], Paris, France. App. filed January 30, 1907. To avoid opening the joints in the furnace, lined with carbon by providing a jacket around the con[illegible]

978,160. ELECTRIC CHAIN-WELDING MACHINE; C. L. Hoff, York, Pa. App. filed Nov. 20, 1908. Fixed terminals and reciprocating dies in front, with a link carrying carriage, a cam for imparting an intermittent movement to the carriage, for transferring a line from one position to the other and means for returning the carriage to its initial position.

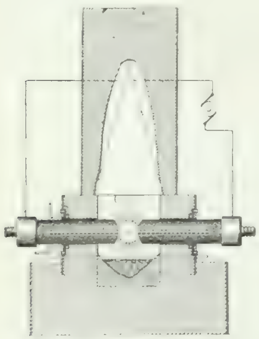
978,171. ELECTRIC FURNACE; F. Von Kugelgen, Holcombs Rock, Va., and G. O. Seward, East Orange, N. J. App. filed Dec. 18, 1907. Instead of a flat cover, uses a hood in which the arc burns removed from the arc so as not to be melted thereby. The deep hollow in the hood confines a protecting layer of gas.

978,1[illegible]. ELECTRIC MOTOR CONTROLLING APPARATUS; [illegible] App. filed Jan. 23, 1905. A shunt wound motor with a variable field, the shunt and the starting armature resistance being permanently connected to the local circuit and a magnet in the local circuit, so as to insure the proper field strength when the motor is started.

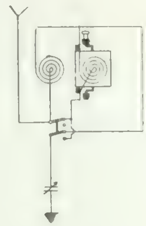
[illegible]

978,180. RAILWAY SIGNALING SYSTEM; A. C. Mather, Chicago, Ill. App. filed July 3, 1907. Operates signals near the tracks by electric current carried by the vehicle running upon the tracks.

978,199. PLUG FOR ELECTRICAL CONDUCTORS; J. W. Phelps, Detroit, Mich. App. filed Dec. 5, 1908. Contact plug for electric lights with means for revolving the threaded contact while screwing it into or out of the socket without rotating the cord connection.



978,171.—Electric Furnace



978,606.—Electrical Tuning Device.

978,211. ART OF EXTRACTING METALS ELECTROLYTICALLY; J. H. Robertson, New York, N. Y. App. filed June 20, 1908. Subjects the powdered ore while in suspension in the electrolyte to the combined action of the heated vapor or gas while in motion and to an electrical current.

978,269. AUTOMATIC BURGLAR ALARM; H. B. Collier, Prairie Grove, Arkansas. App. filed Sept. 14, 1908. For windows in which the circuit closer includes an insulating base with contacts upon one face, a wire connected to two contacts and passed back and forth across the other face of the base and a pair of contacts normally in engagement with the first contact.

978,322. COMBINED SWITCH SOCKET AND PLUG; W. P. McNeel, San Antonio, Texas. App. filed Aug. 9, 1910. A body with a plug at one end and a socket at the other with internal extensions of the like members of the plug and socket and an external switch coupled to said terminals.

978,370. TELEPHONE RECEIVER SUPPORT; J. G. Harris and A. Mancuso, Philadelphia, Pa. App. filed Sept. 5, 1908. A bracket attached to the telephone stand in which the receiver is clamped, so as [illegible]

978,388. ELECTRIC LIGHTING APPARATUS; J. F. McElroy, Albany, N. Y. App. filed May 3, 1905. Car lighting system, including lamps and a storage battery and a generator driven at variable speed by the motion of the car, the potential of the generator connecting the [illegible] switch and manual rheostat for varying the point at which the connection takes place.

[illegible] ELECTRICAL [illegible] WELDING [illegible] Warren, O. App. filed Oct. 8, 1909. A set of welding contacts and [illegible] ing lever therefor having a support mounted upon the head and rotating about the reciprocating member.

978,435. TELEGRAPH TRANSMITTER APPARATUS; H. G. Davis, [illegible] an actuating contact operated by the latch device and an interrupter connected with the pin drum and actuating contact to generate impulses.

[illegible] APPARATUS FOR TREATING [illegible]

[illegible]

vided into reduction and refining chambers through which the current passes when the communicating passages are open, with slides for [illegible]

978,465. ELECTROMETALLURGICAL FURNACE; F. Louvrier, Mexico, Mexico. App. filed Dec. 18, 1909. Loading columns for feeding ore to the reduction chambers and gates for cutting off the feed of the ore, spouts for withdrawing the slags in the reduction chambers and a preliminary crucible between the reducing chambers connecting them electrically.

978,483. CASING FOR INCANDESCENT LAMP SOCKETS; C. D. [illegible] App. filed Jan. [illegible] An interlocking [illegible] the shell of the socket.

[illegible] SYSTEM OF ELECTRICAL DISTRIBUTION; J. H. Tracy Philadelphia, Pa. App. filed Jan. 10, 1908. Storage battery and three-wire system, together with a booster with means for supplying any unbalance of load on two sides of the system and charging one side of the battery more than the other, should the battery become unequally discharged.

978,514. SYSTEM OF ELECTRICAL DISTRIBUTION; J. H. Tracy, Philadelphia, Pa. App. filed April 22, 1909. Storage battery for emergency purposes on a circuit which is subject to violent fluctuations in voltage, with means for throwing the entire load onto the battery and throwing out the fluctuating voltage when the fluctuations exceed predetermined values.

978,518. ELECTRICAL MEASURING INSTRUMENT; T. W. Varley, [illegible] N. Y. App. filed [illegible] Permanent magnets for [illegible] the wires and also a pointer. De-[illegible]

978,603. TESTING SYSTEM FOR PARTY LINES; D. A. Lawyer & C. C. Bradbury, Chicago, Ill. App. filed Dec. 17, 1908. For testing the idle or busy condition by means of a cord circuit with tips and sleeve voice current conductors, a calling line, a distinctive current source connected to the sleeve for special test and a relay common to a plurality of cords for connecting the current source with the sleeve during testing.

978,604. ELECTRICAL TUNING DEVICE; R. H. Marriott, Brooklyn, N. Y. App. filed Nov. 13, 1908. A receiving circuit with a variable inductance therein, a local circuit, a variable inductance in the local circuit, consisting of a plurality of inductance coils and a regulating switch for cutting any one or more coils and to cut out the others so as to avoid dead ends.

978,605. ELECTRICAL TUNING DEVICE; R. H. Marriott, Brooklyn, N. Y. App. filed July 7, 1909. A fixed coil on the frame, a coil on the movable frame, a condenser plate on the movable frame co-operating with a fixed condenser plate, so as to simultaneously vary the in-[illegible] and capacity.

978,606. ELECTRICAL TUNING DEVICE; R. H. Marriott, Brooklyn, N. Y. App. filed Aug. 24, 1909. For wireless telegraphy, a bodily movable coil for varying the inductance which presents one side and then the other to the fixed coil.

978,607. PROTECTION APPARATUS FOR DYNAMO-ELECTRIC MACHINES; R. H. Marriott, Brooklyn, N. Y. App. filed Nov. 27, 1909. For protecting dynamos from high-frequency discharges by means of condensers and inductance included between the frame of the machine, which is insulated and the leading in wires.

978,626. AUTOMATIC ELECTRIC SIGNALING SYSTEM; J. G. Nolen, Chicago, Ill. App. filed Feb. 26, 1904. Fire alarm system which distinguishes between the trouble signal and the alarm signal by means of a normally charged supervisory circuit and a plural impulse signal transmitter.

978,630. CONDUCTOR SPLICER; F. W. Oettgen, New York, N. Y. App. filed May 3, 1910. A helical spring receives the conductor and screw threaded sleeves surround the spring and bind the latter upon the wire.

978,636. METAL CONNECTING BLOCK; G. E. Palmer, Winchester, Mass. App. filed June 6, 1910. An insulating block with sectional walls secured thereto and separated by inlet and outlet members with a cover supported by the wall.

978,638. REGULATION OF DYNAMO ELECTRIC MACHINERY; C. A. Parsons and A. H. Law, Newcastle-Upon-Tyne, England. App. filed May 15, 1908. For rotary converters and the like with field magnets having poles, magnetic material connecting them on which a primary winding is wound and also a secondary winding with means for supplying alternate current of different phase to the primary winding and for varying the constants of the circuit.

978,676. PROTECTIVE SAFETY DEVICE FOR ELECTRICAL CIRCUITS; W. F. Swoveland, Altoona, Pa. App. filed Oct. 16, 1908. A line cut out and grounding instrument operated by an electro-magnet. Details.

978,695. SIGNALING APPARATUS; G. H. Caughrean, Ketchikan, District of Alaska. App. filed Jan. 3, 1910. Does away with bells by arranging the receiver and transmitter to produce a whistling sound for the signal.

978,709. COMBINED TELEPHONE AND ALARM OR KINDRED SERVICE SYSTEM; W. W. Dean, Chicago, Ill. App. filed April 30, 1903. Provides for the auxiliary use of telephones to give an alarm service by including a magnet in each side of the metal telephone lines and an alarm receiving apparatus with means controlled by the magnets to prevent the operation of the alarm when normal telephone currents are present on the line.

978,733. ANSWER-BACK SIGNAL; E. R. Gill, Yonkers, N. Y. App. filed July 27, 1907. For operating selectively, including an answer-back signal, a local signal, a second answer-back signal inductively related to the local signal and selecting means controlling both the answer-back signals and the local signals.

[illegible] OZONIZER; R. F. [illegible], Chicago, Ill. App. filed Sept. 23, 1910. A stationary dielectric with a fixed electrode on one side, a rotating electrode on the other side and a cleaning brush thrown by [illegible] with the dielectric for cleaning the [illegible]

978,805. SWITCH MECHANISM; C. D. Wiemer, Los Angeles, Cal. App. filed May 9, 1910. Pull socket for controlling a plurality of series of lamps.

978,808. ELECTRIC CIRCULATION WATER HEATER; J. I. Ayer, Cambridge, Mass. App. filed July 7, 1908. For heating water in the kitchen boiler by circulating the water through an auxiliary bypass in which the electric heater is arranged.

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INTERNATIONAL ELECTRICAL CONGRESS OF TURIN.

We are informed that it is proposed to hold next year at Turin, Italy, during the week commencing Sept. 11, in conjunction with the International Exhibition of Industry and Labor at that city, an International Electrical Congress of the Applications of Electricity. A committee of organization has been formed under the auspices of the Associazione Elettrotecnica Italiana and circulars of information are commencing to be issued concerning the organization. A number of important practical questions are proposed for discussion during the convention. The importance of the convention will be enhanced by the fact that it is proposed to hold the next meeting of the International Electrotechnical Commission at Turin during the same week. It is expected that the commission will not only increase the attendance at the congress, but that there will also be some co-ordination between the two bodies.

The last International Electrical Congress was held at Marseilles in 1908, but, unfortunately, the number of electrical men other than Frenchmen attending that congress was limited, so that it was very nearly reduced to a national electrical congress. The last preceding International Electrical Congress was held at St. Louis and was attended by over 700 persons, 200 of whom were from abroad. The total number of adhesions was about 2050, of whom about 400 were from abroad. It was the more difficult to secure foreign members for the St. Louis congress because St. Louis lies at a distance of about 4000 miles from the shores of Europe. On the other hand, with a fine city like Turin for a meeting place, in the heart of beautiful Piedmont, at a pleasant season of the year, and within easy access of all parts of Europe, it should readily be possible to attract from other countries a large gathering of men interested in applied electricity, thus making the congress truly international.

We hope that the American Institute of Electrical Engineers will appoint a number of delegates to the congress at large, and that the United States may be fairly represented. Of course, our distance from Turin is great and the time of year selected is late, from an American standpoint, but, on the other hand, the date selected is early from a European point of view and Americans usually regard the distance from New York to central Europe as shorter than our confrères in Europe ordinarily regard the distance from central Europe to New York. Apart from the technical and social advantages of such a congress to the members who gather there for joint discussion and meeting, there should be many incidental advantages in such a gathering. Efforts might be made to co-ordinate the work of the congress, which is a temporary and evanescent organization, with that of the commission, which is a semi-permanent organization, so that by the discussions in the congress on some of the questions under consideration by the commission the latter body might find its work helped, its decisions hastened [illegible]

MAGNETIC PROPERTIES OF IRON AND ITS ALLOYS IN INTENSE MAGNETIC FIELDS.

The systematic study of magnetism in iron and its alloys through all the range of available magnetic forces is important not only to the development of magnetic science, but also to that of applied magnetism. The magnetic properties of iron and steel are now almost as important to civilization as the structural and mechanical properties of these most useful substances. If there can exist a practically procurable substance with more powerful magnetic properties than iron it is very important to the electrical industry that such a substance should be procured and tried. Moreover, even if we are necessarily limited to the use of iron and steel in magnetic machinery, the influence of the admixture of other substances by alloying with iron is worthy of being thoroughly investigated from the practical standpoint alone. A paper on the above topic has recently been read, by Messrs. R. A. Hadfield and B. Hopkinson, before the Institution of Electrical Engineers of Great Britain, covering mainly a research into the behavior of iron in intense magnetic fields, i. e., fields producing in the iron a flux density of from 5 kilogausses to 25 kilogausses, or more. The results, which are abstracted in the Digest, are of great interest from various points of view.

The broadest result obtained is that which sustains the existing theory of magnetization in iron—namely, that iron and its alloys may be regarded as saturating magnetically in a field of 5000 gilberts per centimeter, although a few alloys show incomplete saturation even in this field. Pure iron, of specific gravity 7.8, generates a saturation flux density of 21 kilogausses in such a field, and it may be considered as incapable of generating any more than this. But a total flux density of, say, 50 kilogausses can, of course, be produced in iron by subjecting it to a field of 29,000 gilberts per centimeter, which would be able to generate a flux density of 29 kilogausses in the absence of the iron. Consequently, so far as we know, there is no upper limit to the flux density that can be produced in a small sample of iron under laboratory conditions. It is, however, assumed in this thory that the high flux density produced will be 21 kilogausses over and above what can be produced in air in the absence of the small sample. The results also show that no alloy was found with a higher specific magnetism or a higher saturation flux density than pure iron, although certain alloys with a small proportion of silicon, or of aluminum, magnetically outrank pure iron in relatively feeble magnetic fields. Another very important result is that in an annealed iron-carbon steel a linear relation was found between the percentage of carbon and the saturation flux density for small proportions of carbon admixture. Similar straight-line law results were obtained with certain silicon and aluminum alloys of iron, but no such result with nickel-iron or manganese-iron alloys.

The general deduction from this interesting paper seems to be that the magnetic properties of alloys are more readily detected and collated when working with intense magnetic fields than when working with feeble or with moderate magnetic fields. The complexities that present themselves are sufficiently great when powerful fields are used, but additional complexities and differences arise when feeble fields are used. Indeed, the authors suggest that such tests of alloys may be capable of throwing light, not merely on their magnetic properties, but also on their constitution and structure. The more familiar we become by laboratory investigation and by industrial experience with the magnetic properties of iron the more wonderful and salient the latter become. We are still in ignorance as to whether the magnetism of iron is a subatomic or a molecular property. That is, we are not yet certain whether a single atom of iron is a magnet in and of itself, or whether it takes a certain grouping or assemblage of a plurality of iron atoms to develop magnetic properties. Whatever may be the fact in this ultramicroscopic field of matter, it seems clear that in iron there is a certain m.m.f. per molecule which is always capable of being evoked and oriented by the action of a superposed aligning magnetic field. When the magnetic field is absent the total m.m.f. in the mass may fall to zero; but in a powerful field the structural m.m.f. in the iron reaches a certain saturation limit and each individual molecule develops, pro rata, a certain fraction of an ampere-turn.

REPRESENTATION OF HYSTERESIS LOSSES IN IRON.

It is well known that when we subject laminated steel to alternating magnetization, as in the armature core of a dynamo machine, the iron becomes heated and power is wasted therein. A certain share of this total loss, or total waste power, takes the form of eddy-current loss, and this share can be reduced by using thinner laminations. The remainder of the loss does not admit of being reduced by further lamination and is called the hysteresis loss. If we increase the amplitude of the alternating flux density, keeping the temperature and the frequency constant, the two components of loss—the eddy and hysteresis components—increase, but not to the same extent. Ordinarily, the eddy-current loss increases as the square of the maximum cyclic flux density, while the hysteresis loss does not increase so rapidly. If the hysteresis loss increased directly with the density, doubling the density would multiply the hysteresis watts by two. If the hysteresis loss increased as the square of the density, doubling the density would multiply the hysteresis watts by four. It is found by experiment that doubling the density within the ordinary range of densities employed multiplies the hysteresis watts by three, very nearly, or midway between the effects of the first and second powers.

It was first pointed out by Dr. Steinmetz that the hysteresis loss varied as the 1.6th power of the flux density to within a satisfactory degree of precision for engineering purposes, and this rule has become generally adopted. The 1.6th power of 2 is, in fact, approximately 3.03. This rule is generally known as Steinmetz's hysteresis law. It is, however, known and admitted to be an empirical formula rather than a physical law. Discrepancies present themselves when the rule is applied rigorously. An article by Herr Rudolf Richter has recently appeared in the *Elektrotechnische Zeitschrift*, as alluded to in this week's Digest, suggesting that the curve connecting hysteresis loss and maximum cyclic flux density to rectangular co-ordinates is really a parabola instead of a curve of the 1.6th power. A parabolic relation may be defined as a relation which includes, in general, a term involving the first power, added to a term involving the second power, of the independent variable, so that the known approximate relation of trebled

hysteresis loss to doubled density is explainable as due to the summation of two terms, one involving the first power and the other the square of the density. Curves and tables derived from measurements are produced in the article to show that the parabolic relation satisfies the observations somewhat more closely than the Steinmetz rule

The two-term parabolic equation is longer than the Steinmetz equation, and, at first sight, appears the more formidable of the two. It is pointed out, however, that the total loss in the iron requires two terms to be used in any event, so that it is merely a choice, in practice, between an equation containing the 1.6th and second powers, or one containing the first and second powers. The latter is the easier to deal with of the two, because tables of squares are nearly always available, whereas tables of 1.6th powers are uncommon and are tedious to compute. From a practical standpoint it is not a very important matter whether the law of hysteresis is parabolic or of the 1.6th power. There is abundant experience to show that the 1.6th power deals with the matter satisfactorily, so far as engineering is concerned. It is important, however, to investigate the matter more thoroughly from a physical standpoint in order to check the proposition that the parabolic rule is the more precise of the two.

ELECTRICITY IN FARMING.

An article abstracted in the Digest this week makes clear that interest has been aroused in Germany with respect to the application of electric power to farming. From the historical standpoint one would expect a greater progress in the agricultural application of electricity than has heretofore been recorded, for the very first commercial application of the electric motor was to tilling the land in the famous plowing experiments at Sermaise, now more than thirty years ago, and the next application near the same place was a motor lift for unloading beets at a sugar factory; so one may fairly say that the farmer had the first chance at electric power. If one looks for the cause of the slow development from this beginning it is easily found in the matter of cost. Until very recently electric power has been somewhat too costly to encourage its use by those who have little ready money, and farmers, save on the huge estates of some of the grain-raising belts, are only too apt to belong to this class. The small farmer in particular manages to pick up a very good living if he is industrious and thrifty, but he is not in a position usually to get electric power for the minor mechanical operations around the farm as cheaply as he can get power from gasoline engines or even by the use of horse motors.

The German paper which serves as the text of this comment bears especially on the use of electricity on farms of the larger size replacing horse-power in the various operations for which power is required, from plowing to reaping, as well as in the minor mechanical operations for which motive power is convenient. In the former case the motor can replace horses as draft animals, and in the latter case it can free them from the treadmill. Of the applicability of motors to these agricultural tasks there is no doubt. Electrical operation of farm machinery, whether fixed or movable, has already been demonstrated too many times to leave any question as to the effectiveness of the work. However, when it comes to the question of economy the situation changes, not with respect to the usefulness of electricity, but as regards the economy of mechanical power generally as contrasted with animal power. Granted the use of draft horses, which is a practical necessity in any region where the transportation facilities are not first class, full utilization of their working capacity would seem to call for their employment in all the work about the farm which they are capable of doing. A horse, considered merely as a machine, is probably considerably less efficient than an electric motor, but the farmer can feed the horse off the products of the soil directly and largely off products which might otherwise go to waste, while he must feed the motor from the receipts derived from his selected farm products passed through several intermediaries over expensive lines of transportation. At this point the horse, although a somewhat wasteful means for the transformation of energy, makes a good showing of economy, since he is his own middleman and transportation system. On the other hand, in the case of very large farms where the work can be pretty thoroughly differentiated, there is much to be said for the suggestions of our German contemporary. Working on a scale big enough to enable one, so to speak, to divide the output of energy upon the farm into transportation and stationary motor departments, the latter can, if elecric supply is available, be accomplished through electric power with both convenience and efficiency, and in the former department the automobile has already made inroads upon the laborious prerogatives of the horse. In our own country the National Electric Light Association has appointed a committee to look into this question of the applications of electricity to farming, and from the investigation there should appear at least a modest number of cases in which electric power would be extremely well worth trying.

We have, however, in our own country very large areas of agricultural country in which electric power is not readily obtained. To be sure, the electric transmission systems are of immense extent, but of late there has been so strong a tendency toward the wholesaling of power rather than its distribution to the ordinary consumer as to decrease somewhat the usefulness of electrical transmission from the standpoint of the casual user along the lines. It requires a fairly complete network of distribution to furnish convenient and adequate supply of energy over a large and scattered farming territory. Intensive farming, such as is carried on in parts of the Continent, is scarcely known on this side of the Atlantic, and it is only in intensive farming or in farming on a large scale that the motive power department, so to speak, can conveniently be separated from the rest of the work. Granted intensive farming on a considerable scale, the farm would naturally become a user of power large enough to justify a general distribution for power purposes over a territory almost strictly agricultural; but that, we fear, is a matter for the future and perhaps a rather distant future. At our present rate of increase of population the United States, which has already lost the characteristic economic features of frontier life, must ere long come to the point where, in order to supply its own wants without inordinate expense for transportation, it must undertake intensive agriculture under scientific conditions. When this time comes electricity on the farm will become a practical issue rather than an attractive theory.

Railroad Terminal Electrification Agitation in Chicago.

Sometimes quiescent but never totally extinct, the agitation for the electrification of the terminals of the steam railroads in Chicago has been conducted for a number of years. The latest chapter in the story is revealed by a letter from Mr. H. A. Stillwell, the president of the Association of Commerce, to the Mayor and Common Council, made public at the meeting of the City Council on Dec. 19. As announced in the *Electrical World* of Feb. 3, 1910, the Association of Commerce, which is a powerful and influential organization of business men, has been conducting an investigation into the subject, and this study has already covered a period of eighteen months. The work is in charge of a special committee of the association, and Mr. Stillwell writes to the city authorities to say that a point has been reached where it seems necessary to go into the practical or business side of the question, involving, among other things, the element of cost. It appears that the committee of the association has finished its [illegible] the feasibility of electrification from an engineering point of view and it now desires to co-operate with the city in relation to the economic problems involved. Mr. Stillwell asked the Mayor to name four persons to represent the city in making the remaining investigations, and, with the concurrence of the City Council, Mayor Busse named Alderman Milton J. Foreman, chairman of the local transportation committee; Dr. W. A. Evans, commissioner of health; Paul P. Bird, chief smoke inspector, and T. E. Donnelley, president of the Chicago Smoke-Abatement Commission, as the city's representatives to assist in making the inquiry requested by the Association of Commerce.

The Association of Commerce is making an impartial study of the subject and its strong committee consists of Mr. John M. Ewen, engineer and contractor, chairman; Bion J. Arnold, consulting engineer; Mr. A. Bement, consulting engineer; Mr. Paul P. Bird, city smoke inspector; Mr. W. F. M. Goss, dean of the College of Engineering, University of Illinois; Mr. William B. Jackson, consulting engineer; Alderman Charles E. Merriam, professor of political science in the University of Chicago. These gentlemen serve without compensation.

At the same meeting of the City Council at which this request was received Alderman Britten introduced an ordinance, which was referred to the local transportation committee, and which, if enacted into law, will require all the railroad companies operating cars or trains of cars within seven miles of the city hall in the City of Chicago to propel them "by other power than that of steam, or in a manner that will not produce smoke or any noxious gases." The date fixed for the enforcement of the proposed ordinance is Jan. 1, 1913. A penalty in the shape of a fine of $200 a day for every movement of any car or train by steam power after the date mentioned is provided in the proposed ordinance.

Electric Vehicles at Chicago Automobile Show.

At the Chicago Automobile Show [illegible] from Jan. 28 to Feb. 11, 1911, there will be a representative showing of electric pleasure vehicles, delivery wagons and trucks. For the first time in the history of the Chicago Automobile Show the exhibition will extend over a period of two weeks. The first week will be devoted to the pleasure vehicles, which will be shown on the main floor of the Coliseum and Coliseum Annex and on the main floor of the First Regiment Armory. The electrical exhibitors include the Woods Motor Vehicle Company, Chicago; Columbia Motor Car Company, Hartford, Conn.; Baker Motor Vehicle Company, Cleveland; Studebaker Brothers Manufacturing Company, South Bend, Ind.; Babcock Electric Carriage Company, Buffalo; Waverley Company, Indianapolis; Anderson Carriage Company, Detroit; [illegible] Electric Car Company, Detroit; Ohio Electric Car Company, Toledo, and Broc Electric Vehicle Company, Cleveland.

All of the pleasure cars will be removed on the night of Feb. 4, and on the following Monday the doors of the Coliseum will open for the first time upon a purely commercial wagon show. During this week electric vehicles built for industrial purposes will be shown by the Studebaker company, Waverley Company, General Vehicle Company, of Long Island City; Lansden Company, of Newark, N. J.; Automobile Maintenance & Manufacturing Company, of Chicago, and the Anderson Carriage Company.

Meeting of Electric Vehicle Association of America.

At a meeting of the Electric Vehicle Association of America held in New York on Dec. 20 two papers were presented, one by Mr. W. E. Holland entitled "The Alkaline Battery," and the other by Mr. R. E. Russell entitled "The Mercury-Arc Rectifier for Charging Vehicle Batteries."

The paper by Mr. Holland was devoted to the Edison nickel-iron, alkaline electrolyte battery, the development of which was described in detail. The chief operating characteristics of the Edison battery were outlined in our issue for Jan. 20, 1910; its application to street-railway service was discussed in our issue for Jan. 27, 1910, while its constructive details were described in our issue for April 28, 1910. Mr. Holland exhibited test curves showing that the ampere-hour output of the battery is practically independent of the rate of discharge. However, the voltage decreases with increase of discharge rate on account of the resistance of the battery circuit. Instead of being injured by severe treatment the battery is actually improved by being directly short-circuited. That is to say, the performance after being recharged following a direct short-circuiting is slightly better than before the short-circuiting took place.

In reply to a question by Mr. Arthur Williams, Mr. Holland stated that when completely discharged by short-circuiting the temperature reaches 220 deg. Fahr., which is sufficient to cause the electrolyte to boil. The conditions return to normal rapidly as the battery is recharged. The output obtainable from the battery is from 14 watt-hours to 18 watt-hours per pound.

The paper by Mr. Russell covered the operating characteristics and practical application of the single-phase mercury-vapor rectifier for charging vehicle batteries in public and private garages and homes. The type of equipment for each service indicated was described and illustrated. The "runabout" charging installation is designed for use at either 110 volts or 220 volts alternating current and delivering 30 amp direct current. The standard type for garage service operates at about 78 per cent efficiency when charging the usual type of vehicle battery. The efficiency varies with the charging voltage, but is almost independent of the load. In comparison with a motor-generator set, which has an efficiency of possibly 60 per cent, the rectifier is more efficient, more convenient and less expensive for a tube life of 300 hours or more. The actual life of a tube is 600 hours or more.

Mr. Russell stated that as a result of experience with both motor-generator sets and rectifiers in Cleveland ninety-three rectifiers had been placed in service to seven motor-generator sets. In reply to a question by Mr. T. I. Jones Mr. Russell stated that a rectifier set for charging a thirty-cell, 66-volt battery would have an efficiency of from 70 per cent to 75 per cent and would cost perhaps $185. In charging such a battery from a 110-volt direct-current circuit the loss would be 44 volts and the efficiency 60 per cent.

Mr. R. M. Searle said that in Rochester it has been found advantageous to install mercury-vapor rectifiers even where direct current is available. The prime requisite for rectifiers to be used in charging vehicle batteries is simplicity. All complications should be removed from the switchboard

Mr. Alex Churchward entered a plea for standardization of electric vehicle equipments, especially with reference to the battery e.m.f. There is no adequate reason for the existence of one e.m.f. for a commercial vehicle battery and a different e.m.f. for pleasure-vehicle battery. The e.m.f. should be of such a value that the batteries can be charged properly from 110-volt lighting mains.

Mr. T. I. Jones outlined the difficulties encountered by central stations in formulating a method for charging for the energy used by vehicle batteries. Neither a kw-hour rate nor a maximum demand plus a kw-hour rate seems to fit all cases.

Mr. Russell outlined the reasons for failures of mercury-vapor rectifiers to open the circuit automatically when the battery is fully charged, including defects in the battery as a cause for low counter voltage and poor line regulation as a possible cause for high impressed voltage. He said that it is best not to depend upon the automatic features of the rectifier for disconnection, but to install some positive circuit-opening device, such as a time switch.

The secretary of the association reported that the membership had reached the total of 106, thirty-four new applications having been received during the past month.

Transformer Discussion by St. Louis N. E. L. A. Section.

The Union Electric Light & Power Company Section (St. Louis) of the National Electric Light Association was addressed at its Dec. 16 meeting by Mr. E. G. Reed, of the transformer engineering department of the Westinghouse company, Pittsburgh. Mr. Reed recounted some interesting transformer history, discussing the work of the early inventors, and pointed out the theoretical differences between the core and shell types. He also made clear the distinction between the copper and iron losses in present transformers, and discussed the phase relations of the load currents and the exciting current. In the discussion which followed his talk Mr. John Fay, foreman of the overhead department of the Union Electric Company, brought out the point that grounding a three-phase transformer may make it possible to continue operation as an open-delta arrangement when one of the phases has been burned out.

Locating and Repairing Burnouts in Underground Transmission Lines.

An excellent paper on "Recent Improvements in Procedure for Locating and Repairing Burnouts in Underground Transmission Lines" was read by Dr. D. W. Roper, assistant to chief operating engineer and superintendent of the street department of the Commonwealth Edison Company, Chicago, at an extra meeting of the Commonwealth Edison branch of the National Electric Light Association on Dec. 20. The paper was illustrated by lantern slides and in addition the speaker displayed samples of burned-out cables, as well as an emergency kit for light repair work, an emergency telephone set and the Schweitzer potential detector for testing for "live" high-potential circuits in oil-switch compartments at the generating station.

Mr. Roper began by saying that the Commonwealth Edison Company has in service at the present time 525 miles of transmission lines and about 95 per cent of these lines consist of underground cables, representing, with the conduits in which they are installed, an investment of more than $4,000,000. These underground lines may be called the arteries of the system. Burnouts of transmission lines are far more numerous than those of generators or substation apparatus, and the quick repair of these lines after a burnout is of prime importance.

The first indication of the breaking down of a line is the automatic opening of its oil switch in the generating station, which is reported promptly to the load dispatcher and by him to the street department. The latter department takes steps immediately to make the necessary repairs. Arrangements are made with the company's transportation department for three vehicles. A gasoline automobile is obtained first, to be used by the men in locating the trouble; an electric truck, or possibly the emergency wagon, is used in sending tools and material, together with pumps for removing water from manholes, to the place where the trouble in indicated by test. The third vehicle required is a wagon or an electric truck which can be used for hauling the cable, and is equipped preferably with an electric windlass or winch which may be used for pulling the cable into the conduit.

A preliminary low-tension test is usually made to determine whether the cable is grounded sufficiently to enable a Murray loop test to be made. If practicable the loop test is made immediately afterward. Frequently the cable is not sufficiently grounded for the purpose, and the resistance of the fault must be reduced by burning it with energy from a testing set. The Murray loop test is considered the quickest and cheapest way to locate the trouble wherever it can be used. Under favorable conditions the accuracy of this test is within 0.1 per cent, and it enables the men to proceed readily to the manhole nearest to the seat of trouble. Ordinarily this test can be made within fifteen minutes after the preliminary tests have been completed.

If the Murray loop test cannot be used the trouble can be located frequently by the use of an exploring coil and a telephone receiver. As this method requires going over the conduit line, opening a number of manholes and locating the particular cable in question, an hour or more may be required to make it. About 20 per cent of underground cable troubles occur in manholes, and if there is an explosion the company is usually notified within a few minutes by the police or by some citizen.

Where all other methods fail resort must be made to the cut-and-try method. This consists in cutting the cable at the middle of the line and then making a test to determine in which section the trouble is located. Another cut is made in the middle of the section containing the fault, and so on, until the trouble is located between adjacent manholes. For a line two miles long five or six cuts may be required and three additional cuts would be necessary for the company's longest underground line, which is about sixteen miles long. This method may easily take two hours, and four hours would be considered good time for a long line. After the trouble is located there may be from two to seven extra joints to make, in addition to the two which are necessary to disconnect the injured section of cable.

Mr. Roper gave the following table to show the proportion of methods actually adopted to locate burnouts in cables in a given number of cases extending over a period of several years:

Loop test	[illegible]
Cut-and-try method	[illegible]
Reports of manhole explosions	[illegible]
[illegible]	[illegible]
Exploring coil	[illegible]
Total	[illegible]

The exploring coil method is more effective than indicated by the table, as its use extends over only one-third of the time covered by the above list of burnouts, and it is utilized only after the failure of the Murray loop test.

Frequently water has to be pumped out of a manhole in which it is necessary to cut the cable. Before cutting the cable it is important that the men should be sure that they have the right one, and in crowded manholes this is not always a simple task. It would be a serious matter to cut into a cable which was alive. An electroscope will indicate the presence of high-tension energy, but it requires the removal of the lead sheath before it can be used. Ordinarily the repair men depend upon the company's records, and in case of doubt it is always possible to follow the cable for some distance and determine its destination in this manner.

When the burnout is located between two adjacent manholes this section of the cable is removed and a new piece of cable installed in its place. After the new piece of cable is pulled in, and before making the last joint, it is necessary to identify the phases in order to retain the correct phasing of the connections in the substation. Finally, a high-tension test is necessary to determine if the cable is in proper condition, with the phases properly identified and connected.

The speaker gave a table showing that the actual time consumed for locating, repairing and testing an underground cable burnout under actual conditions was fourteen hours and thirty-nine minutes as the average of five cases. Under ideal conditions this time might be reduced to five hours, perhaps, and as it is often of great importance to repair the damage as quickly as possible every effort is made to make the actual time approach more closely to the time required under ideal conditions, although in practice it will never be possible to meet the ideal conditions exactly.

Mr. Roper then took up recent improvements in methods and equipment for this class of work. He first spoke of the Schweitzer potential detector, consisting of one or two small lamps in series with a high resistance, which is used in the switch house of the generating stations to make test on 9000-volt lines and buses to determine whether they are live in the same manner that a wireman would use a test lamp on low-tension switches and connections.

Extension of the use of the Murray loop test in one of the most profitable fields for investigation. The use of this test has heretofore been limited to cases where the resistance of the fault was less than 1000 ohms, and the burning of the cable for several hours, in the endeavor to reduce the resistance of the fault, has not been a rare occurrence. The resistance is liable to be high when the original burnout was rather severe, so as to burn off a large amount of lead in proportion to the area of copper exposed, or where the fault occurs under water. Recent experiments with artificial grounds of known resistance indicate that the loop test will be reliable with the fault resistance as high as 50,000 ohms, and a further extension of this limit appears possible by obtaining a galvanometer of higher resistance than the present one and using a slide wire of a resistance corresponding to maximum accuracy.

If the fault is submerged the leakage of energy from the auxiliary conductor may be sufficient to render the test worthless, and this has been the apparent cause of misleading results obtained in several tests under these conditions. There are two methods of determining whether leakage of this kind is affecting results—first, by measuring the insulation resistance of the conductor used to complete the loop, and, second, making the loop test from both ends of the line.

To communicate with the load dispatcher after the line has been cut to locate trouble a signaling scheme has been devised. Energy is applied to each end of a grounded conductor through an incandescent lamp. If the resistance of the fault is low both of these lamps will burn. When the cable splicer cuts the cable he will always have a defective piece of cable on one side of the cut and a length of good cable on the other side, leading to a generating station or a substation. When a cut is made the lamp in the station will go out and the other lamp will continue to burn. The cable splicer can then, with a test lamp, use the energy from the live conductor for the purpose of signaling by flashes of the lamp to the station. A simple code of signals has been devised for this purpose.

The identification of cables in a manhole is of much importance, and a careful system of records has been worked out to enable this identification to be made in any manhole on the company's system. As a precaution, however, the lead is always removed from the sleeve covering the joint and test made with an electroscope in all cases where the identification is not positive. The exploring coil can frequently be used to advantage for this purpose, and the street department of the Commonwealth company is endeavoring to extend the field of application of [illegible] instrument [illegible].

An emergency telephone outfit is provided for the use of the foreman on the ground after the trouble has been definitely located. If a telephone line to which this outfit can be attached is available the equipment may be in use within from one to two hours after the order is placed. An "emergency kit" contains a complete set of tools used by a cable splicer, together with the material for making up one joint on any of the several varieties of high-tension cable. These kits are useful where the burnout is not serious, and it is customary to put one of them and an emergency telephone in the first automobile that goes out on the trouble call.

All cable for future transmission lines is to be furnished with one conductor marked by a thread wrapped around the insulation. This scheme, which has been used for many years on telephone and telegraph cables, will eliminate the necessity of testing for phases when making up the last joint.

In concluding his instructive paper Mr. Roper said that the entire procedure in testing and repairing underground transmission lines of the Commonwealth Edison Company has recently been revised by a committee consisting of Messrs. Guy W. Lunn, J. T. Mountain, F. J. P. Seuel, B. E. Strohm, E. O. Schweitzer and D. W. Roper. Many of the recent improvements in the company's methods are due to the suggestions of this committee

Following the reading of the paper there was an intermission of ten minutes, during which an opportunity to examine Mr. Roper's "exhibits" was given. Mr. E. F. Smith presided at the meeting, at which the attendance was about 230. Mr. A. P. Thoms, chief load dispatcher, opened the discussion. He spoke of the work of the load dispatcher in connection with cable repairing and said that he is the man who takes charge of the entire procedure in case of a break-down. He gave some instances where the use of the exploring coil had proved of practical value.

Mr. P. Junkersfeld, of the vice-president's office, emphasized the necessity of maintaining the underground transmission lines which are the arteries of the Edison system in Chicago. He said that the public judges the company not by its successes, but by its failures. The underground cables not only represent an investment of $4,000,000 in themselves, but any breakdown in them reflects on the whole system. The speaker remarked that more has been learned in the last year in relation to the work of testing and repairing underground cables than in the preceding fifteen years. There is still something to learn, however, and the importance of the subject can hardly be overestimated.

Mr. B. E. Strohm, general foreman of the underground department, told of some interesting cases of troubles on underground lines. In one case the keel of a boat in the North Branch of the Chicago River caused a break-down by injuring a cable laid in the bed of the river at a crossing.

Mr. J. C. Johnson, assistant chief electrician of the Fisk Street generating station, discussed briefly the "trouble" work from the station operator's point of view.

Mr. Guy W. Lunn, chief electrician of the Fisk and Quarry Street stations, in a lively speech, described the scene at the station when there is trouble on a line.

Mr. D. E. Rivers said that, in addition to mechanical accidents or defects, electrostatic capacity of cables had something to do with the breaking down of the dielectric strength of the cable.

In answer to Mr. E. W. Grover, Mr. Roper said that he could recall only one case of trouble which could be traced definitely to potential surge.

Mr. P. B. Juhnke touched on the question of co-operation between men in all departments of the company. There are few accidents, considering the number of line changes due to the growth of the high-tension system in Chicago. He suggested a possible new use of the Schweitzer testing device in manholes, as well as in the generating station, and Mr. Roper thought that the idea was worthy of investigation. Messrs. [illegible] and [illegible] Gannett also spoke briefly.

Canadian Hydroelectric Commission News.

On Saturday, Dec. 17, F. H. McGuigan, contractor for the Hydroelectric Commission's transmission lines, announced to Hon. Adam Beck, chairman of the Commission, that the lines were now all completed. With the completion of the loop from St. Mary's and the line to St. Thomas, reaching off south from London, there is but the stretch from the Humber River to Toronto station to bring the whole undertaking to final completion. Two hundred and ninety-three miles of lines have been constructed from Niagara Falls westward, and the construction force, which was laid off on Dec. 17, has been working steadily for two years. It is expected that the Commission will now consider the question of extending the line further west from London to Windsor.

On Dec. 20 the city streets of London were officially lighted with Niagara energy, the current being turned on at the Armory by Hon. Adam Beck, in the presence of thousands of citizens. Chairman Ald. Pocock of the Water Commission stated that London now has a rate of 4½ cents per kw-hour, cutting the former price in half and making it the cheapest rated city in Canada. There were 2800 customers, who last year paid $70,000 for their power. The civic water board had about 12,000 customers, and if as many could be secured in London for the hydroelectric power he felt it was possible to reduce the rate to 4 cents or even 3 cents. Hon. Adam Beck said that at 4½ cents per kw-hour London was receiving the cheapest electric lighting in America. He expected that by the first of the year the Commission would be able to take up the question of individual lighting and wiring of houses in London. The Commission had a surplus of $25,000 over the first estimate of the cost of installing hydroelectric power in London.

The formal lighting of the city's streets with Niagara energy was made the occasion of an electrical exhibition at the Armory, where a number of interesting exhibits were made by various electrical firms in Canada.

On Dec. 21 Hon. J. S. Hendrie, member of the Commission, pressed the button at Hamilton, which was the occasion of the turning on of Niagara electric power when the electric pumps were operated at the waterworks station at the beach. The test was satisfactory, and the waterworks system will be operated with electric power continuously in a few days. The ceremony of turning on the Commission's power at Hamilton was made the occasion for a large gathering of prominent citizens and manufacturers, concluding with a banquet at the Hotel Royal in the evening.

Hon. Adam Beck made the principal speech. He said the Commission's transmission line was 376 miles long, with tributary lines 100 miles, making it the longest transmission line in the world. Opponents of the project had predicted that the cost would be $10,000,000, but it was built for $3,500,000. He predicted that not only would the DeCew Falls generating station of the Cataract Power Company be incapable of supplying the power needed for Hamilton, but the supply at Niagara Falls would also be exhausted by the demand throughout Ontario, and it would be necessary to develop other water-powers. Hamilton had large interests and cheap electric power before the Hydroelectric Commission was organized, but it did not enjoy as cheap rates for street and house lighting and small power users as it should have, so it had benefited by the Commission already, the Commission affording legitimate competition. London, by hydroelectric power, although three times as far removed from the source of supply as Hamilton, had a rate of 4½ cents per kw-hour for house lighting, while Hamilton paid 8½ cents. With the Commission's power there the rate would be about 3½ cents.

The sale of power at Windsor would reduce the price by 10 per cent. Hamilton would be asked in the course of two or three months if it wished to share the responsibility and advantages of that sale by taking a co-operative contract. All the speakers paid a tribute to Mr. John Patterson (the founder and promoter of the Cataract Power Company) for being the first to introduce long-distance transmission of hydroelectric power in Canada.

The proposed turning on of electric lights at Toronto with Niagara power, which was intended to take place on New Year's night, has been held up by an action instituted by Mr. G. P. Magann, who has complained to the Dominion Minister of Public Works that the commission's transmission line running through South Parkdale (a portion of West Toronto) has been weakly constructed and is a constant source of danger. Mr. Magann has asked that the plans for the transmission line constructed be not approved until the stability of the wires has been investigated. The fact that the line runs along the shore of the lake or navigable territory is said to place the matter within the jurisdiction of the Dominion government.

When the contractors, F. H. McGuigan & Company, commenced the construction of the line, about five weeks ago, it was planned to locate one of the towers on Mr. Magann's property with the understanding that he should be reasonably compensated. Mr. Magann's property, which fronts on Dowling Street, near Lake Ontario, is said to be worth $70,000, but the sum asked for giving the tower a resting base was considered exorbitant. The commission, however, it is understood, was prepared to pay a substantial sum to compensate Mr. Magann until it was found that the city was willing to have the tower placed in the street allowance, and there it was erected.

Mr. W. K. McNaught, a member of the Hydroelectric Commission, stated that the towers were constructed on the same lines as are all similar works in America, that the Dominion government's resident engineer, Mr. J. G. Sing, was perfectly familiar with the work, as well as the commission's engineer, and that he expected when Mr. Magann's application was heard by Hon. Mr. Pugsley, Minister of Public Works, on Dec. 30, the plans would be duly approved, which would mean the delay of only one week in the time promised for delivery of power at Toronto.

The light and heat commission of the City of Stratford (Ont.) have announced the following tariff for Niagara electric power to be supplied to the town by the Hydroelectric Commission and distributed by the town:

House customers, 3 cents per month per 100 sq. ft., less 10 per cent reduction for walls and partitions, cellars and attics not to be counted unless occupied for actual residential purposes; also 6 cents per kw-hour, with no meter charge, less 10 per cent discount for payment by the fifteenth of the month. In addition free carbon-lamp renewals of 8 cp or 16 cp with proviso that the householder purchase first equipment from the commission. The rate works out to be 8 cents net per kw-hour.

An alternative rate is 9 cents per kw-hour, with no meter charge, and 10 per cent discount and carbon-lamp renewal as above. Shops, theaters, hotels and factories, 9 cents per kw-hour; churches the same, with 20 per cent instead of 10 per cent discount. Sign, window and display lighting, $6 per month per kilowatt connected, with 10 per cent reduction, but no lamp renewals. The old rates for houses were 15 cents per kw-hour, less 20 per cent reduction, plus 25 cents a month meter rate. The power standard recommended by the conference of engineers of Niagara power municipalities was adopted

New York Commission News.

The Public Service Commission of the First District held two hearings last week upon the application of the Long Acre Electric Light & Power Company for permission to issue $10,000,000 of capital stock and $50,000,000 of 5 per cent bonds. This application was once refused by the commission, but the Appellate Division of the Supreme Court decided that the grounds of refusal were insufficient and ordered that a rehearing be granted. At the hearings last week Henry J. Hemmens, counsel for the New York Edison Company, opposed the Long Acre application and argued that the new company had no right to operate under its present franchise. The attor-

[illegible] the Long Acre company contended that the [illegible] company had no standing in the proceedings and claimed that it was a monopoly endeavoring to choke off competition. Last week's hearings were entirely occupied with the arguments of the attorneys. The case was adjourned until Jan. 4.

There were two hearings last week by the Public Service Commission of the First District upon the complaint made by consumers in Far Rockaway against the Queens Borough Gas & Electric Company that rates were too high. The hearings were devoted to the testimony of expert accountants as to the cost and value of the plant. The hearings were adjourned subject to the call of Commissioner Maltbie.

The Public Service Commission, Second District, has consented to the issuance by the Niagara & Erie Power Company of a mortgage upon its property, rights and franchises to the Guaranty Trust Company of the City of New York to secure the payment of $1,250,000 in 5 per cent thirty-year bonds. The company is authorized to issue at present $510,000 of its bonds for cash at not less than 85 and $100,000 of its capital stock at par. The bonds are to be used to acquire certain property of the Niagara, Lockport & Ontario Power Company, consisting of its Gardenville substation and distributing system, and from the Buffalo & Lake Erie Traction Company the electric light, gas and heating plant and the capital stock of the Fredonia Natural Gas Company, the transmission lines in the towns of Cheektowaga and Amherst, Erie County, and for miscellaneous expenses in connection therewith. The proceeds of the capital stock are to be used in payment to the Niagara, Lockport & Ontario Power Company for part payment in acquiring the Gardenville substation and distributing system and high-tension transmission line extending from the property of the Lackawanna Steel Company in the City of Lackawanna to the switching and transformer station of the Buffalo & Lake Erie Traction Company at Athol Springs. Ten thousand dollars of the capital stock is to be paid to the Buffalo & Lake Erie Traction Company for part payment for the electric light, gas and heating plant and for the capital stock of the Fredonia Natural Gas Company in the village of Fredonia, Chautauqua County. The commission has consented that the Buffalo & Lake Erie Traction Company may transfer to the Niagara & Erie Power Company the plant and franchises referred to above, in the village of Fredonia, and has also consented that the Niagara, Lockport & Ontario Power Company may sell to the Niagara & Erie Power Company the property mentioned above.

The commission has received a complaint from twenty-five residents of the village of Sea Cliff, Nassau County, directed against the Nassau Light & Power Company, alleging exorbitant rates for the use of electricity for lighting purposes. The charge for commercial service was at one time fixed at 10 cents per kw-hour, and when the original company was taken up by the Nassau company the price was raised to 15 cents per kw-hour. The commission is asked to reduce the rate to 9 cents, which the complaint alleges is a just and reasonable rate and affords ample and just returns on the company's investment.

The Hartwick Power Company has been authorized to execute and deliver a mortgage to the Trust Company of America to secure an issue of $750,000 of thirty-year 5 per cent bonds. The company is authorized to issue presently $400,000 of these bonds to be sold at not less than eighty, also to issue its capital stock to the amount of $300,000 par value. The proceeds are to be used in payment to the Susquehanna River Power Company for the purchase of a hydroelectric development system on the Susquehanna River at Colliers, Otsego County, consisting of dams, storage reservoir, all flow lands, power house and transmission line from the hydroelectric plant to the steam-power electric plant at Hartwick, Otsego County, and in payment to the Trust Company of America of certain expenses paid by it for the construction of the hydroelectric development system at Colliers of the transmission line; also for the purchase from the Otsego & Herkimer Railroad Company of the steam-power electric plant formerly owned by the railroad company situated at Hartwick, and for improvements and betterments made by the Trust Company of America to the steam-power plant.

The Niagara Falls Power Company has been authorized to issue its common capital stock to the amount of $1,534,000 par value, the proceeds to be used in the discharge of its ten-year 6 per cent debentures, Series A, to the amount of $614,000; 6 per cent debentures, Series B, to the amount of $815,000, and 6 per cent debentures, Series C, to the amount of $105,000.

The Deer River Power Company has been authorized to exercise franchises granted in the towns of Denmark and Champion and in the village of West Carthage, Jefferson County, for furnishing and distributing electricity in these [illegible]

The Patchogue Electric Light Company has been authorized to issue $30,000 additional common capital stock to be sold at par and for cash, the proceeds to be used in payment of obligations incurred by this company in improving and adding to its equipment; also for the completion of lines between the power station at Patchogue and the substation at Center Moriches.

The Utica Gas & Electric Company has been authorized to issue $500,000 par value of its remaining unissued $3,000,000 5 per cent fifty-year gold bonds. The proceeds derived from the sale of the bonds are to be used for the discharge of an indebtedness incurred on account of construction and extensions of its plant. The bonds are to be sold at not less than 95.

The Owego Light & Power Company has been authorized to issue $32,000 of its twenty-year 5 per cent gold bonds. The proceeds are to be used to pay in full and discharge the present outstanding indebtedness of the company, and also notes and bills payable incurred for proper capital purposes.

The Bolton Light & Power Company has been authorized to exercise franchises granted it for the furnishing of electricity in the town of Bolton, Warren County, and also to issue 250 shares of its common capital stock, total par value of $12,500, and to issue its ten-year 6 per cent first mortgage bonds to the amount of $10,000, to be sold at not less than par, the proceeds of the stock and bonds to be used for the construction and equipment of its plant.

Wisconsin Commission News.

By a decision recently announced by the Railway Commission the Southern Wisconsin Railway Company, of Madison, has been ordered to publish a proper train schedule and make the same reasonably accessible to the patrons of its lines and to operate its cars accordingly. Ten days is deemed a sufficient time within which to comply with the order.

At a hearing held on Sept. 16, 1910, the respondent admitted that the number and type of cars used on this line were not satisfactory, but said it was compelled to use them because of its inability to acquire new cars at a more rapid rate. In regard to the use of old cars the commission comments as follows: "It appears to us that the public cannot reasonably object to such cars, provided they are maintained in serviceable condition and are capable of doing the work required of them. Both the public and the company will be the gainers if equipment which is still in serviceable condition is used as long as practicable and not scrapped in advance of necessity. It is obvious that any waste in the use of cars must be made up out of the revenues of the company contributed by the public."

In reference to the company's plea of poverty as an excuse for poor service the commission has this to say: "We are unable to recognize as valid the financial reasons advanced by the company for its alleged inability to acquire new cars, because in our judgment the present business of the respondent company is in excellent condition. The company is earning an extremely satisfactory rate of return upon the property devoted to public use. To be sure, it is doubtless heavily handicapped by its present financial history, for which the present management may not be responsible except in so far as it has voluntarily inherited this abnormal financial situation through purchase at a price. Whatever the weight of this

handicap may be and whatever consideration it may deserve, it cannot be recognized as a valid basis in an attempt to plead the financial inability of the company as a reason for not adequately serving the public. The company must be considered financially able to do whatever may reasonably be required in the interests of good service."

Following the hearing the engineers of the commission conducted an exhaustive investigation of the company's service, and the decision was based largely upon the results of this investigation. Observations made regarding the schedule showed that there was practically no schedule, but that the cars were supposed to maintain a certain headway. The investigation showed that out of every hundred attempts to board a car at a certain street the passenger would fail to find a car at that point at the normal time from forty to eighty-seven times, depending upon the particular street corner at which the attempt was made. This unreliability of the cars was considered sufficient proof that if a normal schedule had as a matter of fact existed, as respondent testified at the hearing, there was nothing in the operation of the cars to show an appreciable tendency toward its observance. The investigation showed further that the trainmen themselves apparently knew little about a running schedule, and also that they lacked definite information with respect to the various matters connected with the operation of the cars. "This suggests," says the commission, "a probable lack of systematic instruction and the proper disciplinary superintendence to enforce the reasonable observance of rules and regulations." It was pointed out that this condition of affairs was clearly the fault of the management for not properly performing the duties which unquestionably are its. ....

The commission in discussing the difficulties arising in maintaining a schedule under certain abnormal conditions on a single-track line recommended that the company adopt a simple block-signal system such as has been used with success on other single-track lines in the country. It called attention to the fact that some such system is necessary before satisfactory service can be given, even after a good schedule has been adopted.

Under the terms of the decision the company will be obliged to adopt a rigid schedule instead of running its cars on a headway, and after the schedule has been published the cars must be run accordingly.

In a decision dated Dec. 16 the commission has ordered the Whitewater Electric Light Company to make such readjustments in its lamps and other equipment as will enable it to supply 432 watts of electrical energy at each of its arc lamps, and that its service in other respects be brought up to the standards that are reasonable and adequate. The decision arose out of a petition filed by the City of Whitewater in which it was alleged that, among other things, the electric company has not and is not now furnishing arc lights of the standard illuminating power of 2000 candles each with 432 watts at the arc as agreed and required by the terms of a certain contract previously entered into by company and municipality. The hearing was held in Madison on May 23, 1910. The chief points in controversy related to the valuation of the property as made by the engineers of the commission and the character of the service rendered by the respondent company. The value of the plant as determined by the commission was $43,446, apportioned 70 per cent to the incandescent and 30 per cent to the arc service. The company claimed a total valuation of $59,347, but investigation showed that this value could not be allowed because of the failure of the respondent to distinguish properly between cost of renewals, extensions to the plant and depreciation. Several items in the valuation were objected to, but the commission could see no reason for deviating from the figures determined upon by the engineers.

In arriving at the cost of service it was necessary to estimate the probable maximum demand inasmuch as the company was unable to furnish the necessary information. The average connected load per consumer and the ratio of maximum demand to connected load for fifty companies in the State, having from 200 to 500 consumers, gave a value of 1.04 for the former and 0.45 for the latter. Also the statistics compiled from thirty plants, serving from 2000 to 4000 population, showed a median of 288 consumers, a plant capacity of 200 kw and connected load of 242 kw, a maximum demand of 115 kw and a total operating expense of $5,904. Checked by these values the maximum demand appeared to be considerably higher than the estimate furnished by the company, and was accordingly used in the calculation. The operating expenses as reported by the company were in excess of the average quoted above, but there was no testimony to show that expenses of the plant in question were excessive.

The arc lamp now in use is an alternating-current series arc requiring 7 amp and 432 watts at the arc. The city pays $80 per lamp per year. It appeared from all the data available that $90 per lamp is the lowest amount at which the respondent can fulfil the terms of its contract and secure a proper return upon the property used.

In regard to the 2000 cp which the city alleged was not being received, and the penalties provided for the failure to furnish such candle-power, the commission says: "The term '2000 cp' in the contract between the parties to this case is merely a nominal rating and does not represent the actual amount of light given, and the provision of the contract providing for the city deducting a certain amount in case the lamps do not reach the stated illuminating power is impossible of enforcement." The commission points out that the only test which would indicate whether lamps in Whitewater came up to the specifications in the contract would be the watt test. A series of inspections made under the direction of the commission showed that most of the globes were dirty, that the lamps were hung without reference to any standard height, and that there is a considerable obstruction to the light. The tests that were made at the same time showed that all lamps tested were operating below the standard watts by amounts varying from 17 watts to 100 watts. A difference of 0.4 amp in the current of the two circuits was observed. The report states that the company is equipped with adequate facilities for remedying the defects observed, and consequently there is no valid excuse for their existence.

The commission called attention to the fact that merely keeping the energy at the prescribed watts did not necessarily mean satisfactory service, but that there were influencing factors to which attention was called, and these must be carefully looked after.

The commission further did not consider that the fact of the city getting its light at less than cost was any reason why the service should not be ordered kept up to standard. The earnings of the plant as a whole, while not unreasonably high, were high enough to warrant a reasonable standard of efficiency.

Maryland Commission News.

The Maryland Public Service Commission will consider a request made by the City of Baltimore for a revision of rates for both gas and electric service. The Mayor will advocate the adoption of the London sliding scale of rates. The case has been under advisement for some time and the Mayor has employed experts to look into the local conditions and submit reports. The expert who was assigned to the investigation of the electric rates has already placed his detailed report in the hands of the Mayor. Mr. Charles E. Phelps, chief engineer to the Public Service Commission, is of the opinion that the Boston or London sliding scale of rates would be the most equitable plan to adopt as a means of adjusting both gas and electric rates in Baltimore. The London sliding scale is a profit-sharing arrangement between the supply company and its consumers. It is automatic and for that reason if it is once adopted will be a permanent method of regulating rates. It

provides that the company is entitled to earn fair dividends on its actual investment, but that dividends may only be increased according as the price of the commodity is decreased; or, as provided in Boston, the company for every stated reduction in its rate may earn an additional dividend. If this plan of rate regulation is adopted by the commission it does not necessarily follow that the present rates need be lowered. A complete consideration of the subject requires that a full and comprehensive valuation of all of the company's properties be made and a capitalization determined commensurate with this valuation, and also an investigation made of all of the costs of operation, administration and distribution in placing the gas or electricity on sale. Mr. Robert J. McCuen, superintendent of the Department of Lamps and Lighting, has expressed the opinion that the Consolidated Gas, Electric Light & Power Company may voluntarily consider this suggestion; that there is a good possibility of its adoption in view of the fact that Mr. Aldred is now at the head of the compnay.

An argument against the abolition of the unlimited service contract as proposed by the Chesapeake & Potomac Telephone Company was submitted to the Public Service Commission last week by Owen Daly & Company. It consisted of a statement showing the financial condition of the American Telephone & Telegraph Company, the holding company of the Chesapeake & Potomac Company. According to the statement the gross earnings of the former company are increased at an annual uniform rate of nearly 11 per cent, and the net earnings at a ratio of about 5 per cent each year. Owen Daly & Company complained that the rate for unlimited service was sufficiently high and that the company should not be allowed to install a system by which its revenue from the citizens of the State would be so materially increased. The complaint intimated that there was practically no opposition in the telephone field in the State and that the people's rights rested entirely with the commission, which was urged to take some definite action in this matter of telephone rates.

Massachusetts Commission News.

The Massachusetts Gas and Electric Light Commission will give a hearing on Jan. 6 upon the petition of the Weymouth Light & Power Company for authority to issue additional capital stock to the amount of $210,000. The board has nearly completed its report on high-tension-transmission conditions and laws to be presented to the incoming Legislature.

The Railroad Commission has received a petition from the Selectmen of Attleboro asking that the board require the Interstate Consolidated Street Railway Company to provide reduced fares for workingmen during certain hours in the morning and evening.

AMERICAN ELECTRICAL ENGINEERS.—XXV.

H. C. Specht.

Hans Christian Specht was born in Farmsen, Hamburg, Germany, Aug. 24, 1876, where he received his primary education. When eighteen years old he entered the machine shops of the Grotkast & Kespohl Machine Company at Wandsbeck, Germany, as an appentice, and a year later entered on a two-year apprenticeship course with the Klamberg Electric Company at Hamburg, Germany. During his apprenticeship period he gained practical experience in the manufacture of electric generators, motors, detail apparatus and in the installation of electric power plants. Next came a service of one year in the engineering corps of the German army at Berlin, following which for two years he studied mechanical and electrical engineering at the Ducal Technical High School at Braunschweig, Germany. Being attracted by the reputation of Prof. E. Arnold, he then went to the Grand Ducal Technical High School of Karlsruhe, Germany, from which he was graduated with the degree of Electrical "Diploma Engineer" in 1901. During the long summer vacations he worked in the engineering office of the steamship department of the state of Hamburg and also served again in the army engineering corps.

In May, 1902, Mr. Specht accepted a position as electrical engineer with the Submarine Cable Company at Nordenham, Germany. During this period he took part in several expeditions for the repair of cables in the English Channel and Atlantic Ocean, and was also engaged in the laying of the second German Atlantic cable from the island of Borkum via the Azores Islands to New York.

As it was not his intention to become a specialist in submarine cables, Mr. Specht resigned in September, 1903, and came to this country in fulfilment of a desire of many years' standing. In October, 1903, he obtained a temporary position as winder of alternating-current generators and motor armatures in the shops of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., and after two months was transferred to the dynamo test department for duty in working up test curves of all kinds of generators and motors. Four months later he was put in charge of the engineering work in the latter department. During this period he worked up a new practical diagram for induction motors, an account of which was published in these columns in the issue of Feb. 25, 1905. In October, 1905, he was transferred to the engineering department for work in the designing of induction motors. Besides designing motors for ordinary industrial work he made a special study for some years of the electric drive in cement and steel mills. Of special designs may be mentioned the large rolling mill motors for the Indiana Steel Company, at Gary, Ind.; the Illinois Steel Company, at South Chicago; the National Tube Company, at Lorain, Ohio; the American Steel & Wire Company, at Birmingham, Ala., and the Cambria Steel Company, Johnstown, Pa., all built at the Westinghouse works.

H. C. Specht.

In 1908 Mr. Specht presented at the Atlantic City convention of the American Institute of Electrical Engineers a paper on "Induction Motors for Multi-Speed Service, with Particular Reference to Cascade Operation," and in 1909 at the Frontenac convention of that body presented a paper on the "Function of Flywheels in Connection with Electrically Operated Rolling Mills." A series of articles on different methods of obtaining

multi-speeds with induction motors and their practicability was contributed in 1909 to the *Electric Journal,* appearing in the issues of July, August, October and December. In June, 1906, Mr. Specht delivered a lecture on "Submarine Cables: Their Construction, Laying and Repair," before the Engineers' Society of Western Pennsylvania, which was printed in the *Proceedings* of that society for July, 1906.

Mr. Specht is a member of the American Institute of Electrical Engineers, the Elektrotechnischer Verein and Verband, of Germany, the National Geographic Society, and the German-American Technical Society of Pittsburgh, of which latter body he has been vice-president since October, 1909.

CURRENT NEWS AND NOTES.

Damages for Omitting Name from Telephone Directory.—A court at Sterling, Ill., has awarded $10 damages to a telephone subscriber whose name was omitted from the directory of the Central Union Telephone Company.

Automobile Engineers at New York.—The annual convention of the Society of Automobile Engineers will be held in New York City Wednesday and Thursday, Jan. 11 and 12. Mr. Howard E. Coffin, of Detroit, Mich., is president of the society.

Church Lighting by Wind Energy.—English newspapers report that Rev. W. Spencer, vicar of Coseley parish church, in Staffordshire, has caused to be erected a windmill 18 ft. in diameter near the churchyard, and by this means generates electrical energy to light the church and vicarage and operate the organ motor. No doubt a storage battery is also used in connection with this intermittent source of energy.

American Investments in Russia.—A St. Petersburg press dispatch announces that Mr. John Hays Hammond arrived in that city on Dec. 12, representing a group of American capitalists who may, it is said, make investments in Russian commercial and industrial enterprises, including electric lighting and street railway plants. Mr. George M. Wilenkin, Russian financial agent at Washington, is said to be co-operating with Mr Hammond.

Examination for Assistant Physicist.—The United States Civil Service Commission will hold an examination Feb. 8 to fill as they may occur positions as assistant physicist and laboratory assistant in physics in the Bureau of Standards, Washington. The salaries are respectively $1,400 to $1,800 and $900 to $1,200 per annum. A circular (No. 50) on the subject may be obtained upon application to the Bureau of Standards.

Illuminating Engineering at Massachusetts Institute of Technology.—The subject of illumination and photometry has been added to the subjects taught in the electrical engineering department of the Massachusetts Institute of Technology. This is treated from the standpoint of illuminating engineering and is made an optional study. The instruction is by lectures, recitations and laboratory work under the direction of Professor Wickenden, who is the author of a work on "Illumination and Photometry."

Electricity on the Farm.—The American Society of Agricultural Engineers held its annual meeting at Purdue University, Lafayette, Ind., Dec. 27 and 28. Among the subjects discussed was that of the use of electricity in farm work and about the farmhouse from both isolated-plant and central-station sources of supply. Mr. P. S. Rose, of Madison, Wis., is president of the society and Prof. E. W. Hamilton, of Ames, Ia., is secretary. The arrangements for the Lafayette meeting were in charge of Prof. William Nye, of the farm mechanics department of Purdue University.

New York Section of I. E. S.—A meeting of the New York Section of the Illuminating Engineering Society will be held on Jan. 12, at which the following four papers will be presented: *Artificial Illumination as a Factor in the Production of Ocular Discomfort,* by Dr. Nelson M. Black, Milwaukee, Wis.; *Physiological Points Bearing on Glare,* by Dr. P. W. Cobb, physiologist of the National Electric Lamp Association, Cleveland, Ohio; *Reflection Coefficients,* by Mr. Paul Bauder, of the National Electric Lamp Association, and *Photometry of Mercury-Vapor Lamps,* by Dr. J. C. Pole, of the Cooper Hewitt Electric Company.

Government Control of Telegraph and Telephone Companies.—By the act of June 18, 1910, telegraph and telephone companies doing an interstate business in the United States were placed under the jurisdiction of the Interstate Commerce Commission. In its annual report, submitted to Congress on Dec. 21, the commission says that steps have been taken for the formation of a system of operating tariffs for these companies, and it is expected that this system will become effective July 1, 1911. Concerning the application of the law to telegraph and telephone companies the report says: "There are from 25,000 to 30,000 telephone companies which make provision for interstate communication, and the commission is in doubt whether it was the intent of Congress to place all these companies under its supervision and control. No opinion is expressed at this time as to the administrative interpretation which should be placed upon the law in this regard."

N. E. L. A. Membership Over 6000.—The National Electric Light Association continues to enjoy the growth which it has experienced so remarkably during the past eighteen months. On Dec. 12 the membership reached the high mark of 6007, inclusive of 904 operating companies and 222 manufacturing concerns. The operating companies and their sections have 4133 employees and members of their staff in Class B membership. The membership in July, 1909, was 3137, and at the meeting of the executive committee last January was reported as 4500, so that the net growth during the present year, after dropping 250 individual members for various reasons, is around 1500. Mr. H. H. Scott, the energetic chairman of the membership committee, has, with the aid of a large and enthusiastic committee, just set on foot another membership campaign, and there seems every reason to believe that 1911 will witness a growth in every way equal to that just noted.

"Motor Drive" on a Kansas Farm.—A large electrical manufacturing company recently received an order from a farmer in Kansas for a 30-hp motor to drive some of his farm machinery. The farmer wrote that he had read of the advantages and economies of electric drive, and from one of the company's catalogs had selected the rating, speed and voltage of the motor he thought fitted for his needs. As the amount of the full list price of the motor accompanied the order, the machine requested was shipped immediately without further inquiry. Full wiring diagrams accompanied the motor, but two weeks later the farmer wrote back that his new motor would not run. He was sent a letter of instruction and more wiring diagrams, but again the answer came back that, although everything was connected up just as shown in the drawing, the motor still refused to budge. Finally the electrical manufactory sent one of its men from a Western office to inspect the Kansas farm installation and determine the trouble. He found the motor wired up exactly as the plans called for, but he also found that there was not an electric line wire within twenty miles of the truly "isolated" motor installation. The disappointed farm owner, to whom the necessity for a source of energy supply had never occurred, then sadly accepted the generous offer of the manufacturer to take the machine off his hands at cost price and treat the whole transaction as a joke.

League of Electrical Interests, St. Louis.—The annual election of officers of the League of Electrical Interests of St. Louis will be held at the Missouri Athletic Club on the evening of Jan. 10. The entertainment committee is planning some novel and interesting features.

Proposed Colliery Transmission in Indiana.—It is reported from Indianapolis that Mr. T. N. Stilwell and associates propose to establish electric generating stations at one or more coal mines in Indiana to transmit energy within a radius of seventy miles for general light and power purposes. It is said that the first plant will be erected at Bedford. According to the newspapers coal lands in several locations have been secured and construction work will be begun soon.

Agricultural Engineers Discuss Farm Electricity.—At the convention of the American Society of Agricultural Engineers, held at Lafayette, Ind., Dec. 27 and 28, Prof. L. J. Smith, of Manitoba Agricultural College, read a paper on "Means of Prevention and Control of Lightning," and Mr. E. P. Edwards, of the General Electric Company, Schenectady, N. Y., discussed "The Promise of an Electrified Agriculture." Mr. P. S. Rose, of Madison, Wis., is president of the society.

Rejuvenation of Sons of Jove in Chicago.—Careful preparations are being made for a rejuvenation of the Sons of Jove, which will be held at the Coliseum, Chicago, during the Electrical Show, on the evening of Jan. 20. Committees on membership, dinner and publicity have been organized, and they are actively at work. Following the initiation there will be a Jovian dinner. It is proposed to initiate a large class of candidates into the order in an impressive manner, and the management of the Electrical Trades Exposition is co-operating cordially in the effort to make the occasion a notable one.

Work on the Roosevelt Dam and Power House.—The Reclamation Service of the United States government reports that at the Roosevelt dam and power house on the Salt River project in Arizona satisfactory progress was made last month. The weir of the south spillway has been completed, and at the power house the gate hoist for the shutter and screen at the upper end of the 10-ft. penstock is completed. Satisfactory progress is also reported on the work at the Phœnix substation and in the installation of the Phœnix 2300-volt transmission line.

Baltimore Section, N. E. L. A.—At the annual election of the Baltimore Consolidated section of the National Electric Light Association, held last week in the physical laboratory of the Johns Hopkins University, the following officers for the ensuing year were elected: President, Mr. R. H. Tillman; vice-president, Mr. J. S. Cruikshank; secretary, Mr. A. W. Hawks; treasurer, Mr. D. C. Bruce. As previously noted, a course of lectures will be given during the quarter under the auspices of the section by Dr. J. B. Whitehead, Ph.D., of Johns Hopkins University.

Electric Club of Chicago.—Capt. O. D. Steele, of the Illinois National Guard (retired), was the speaker at the weekly luncheon of the Electric Club of Chicago on Dec. 21. His subject was "The Illinois National Guard," and in the course of an interesting talk he said that the law of 1902 placed the National Guard on the same footing as the regular army establishment. Enlistment in the militia teaches young men how to obey, respect for authority and how to command. The speaker urged his hearers to give their moral support to this important element in the national defense. Lieut. J. S. Button, of Schenectady, an officer in the National Guard of New York State, was called upon and among other things pointed out the advantage of the militia training in teaching a man how to handle a rifle. He made the interesting statement that there are two separate companies of the National Guard in Schenectady, and of the 170 men on the rolls of these companies probably 130 are employees of the General Electric Company. This company feels that the men in its employment are better men for belonging to the National Guard, and full pay is cheerfully given to the militiamen in its employment when absent on actual military duty as required by drill and camp life. Following Lieutenant Button, President F. P. Vose, of the Electric Club, gave an illuminating talk on the history of the United States Supreme Court and its chief justices, apropos of the recent appointments to that tribunal.

Locomotive Supplies Steam for Town Lighting.—During the reconstruction of the municipal street-lighting plant at Galesburg, Ill., which is being equipped with vertical boilers and a Lenz engine, a locomotive has been utilized to furnish steam for the existing engine-driven units. The locomotive was run onto the coal-bunker track just outside of the former boiler-room, and a pair of 2-in. pipe lines are taken from its steam dome to the power house header. A steam jet in the stack of the marooned locomotive takes the place of the usual exhaust nozzle for inducing forced draft in the firebox.

Growth of Commercial Edison Branch of N. E. L. A.—At the meeting of the Commonwealth Edison Branch (Chicago) of the National Electric Light Association held on Dec. 20 Mr. E. F. Smith, the chairman, announced that 231 new members had been received since the annual meeting on Nov. 1. As the membership at that time stood at 485, there are now over 700 members in the branch. It was announced that the branch will give an entertainment some time in February or March consisting of a first-class musical comedy, forming a background for a number of vaudeville sketches. The entire evening will be devoted to this performance, for which elaborate preparations are under way.

Electrical Echoes of Chicago Stockyard's Fire.—Fire Marshal James Horan, who, with twenty-two of his men, was killed in the disastrous fire in Morris' packing house at the Union Stockyards, Chicago, on Dec. 22, was a telegraph and telephone lineman as a young man before he entered the Fire Department. He had many friends among electrical men, and Mr. B. E. Sunny, president of the Chicago Telephone Company, called the first meeting to raise funds for the families of the firemen who were killed. The fire shocked the people of Chicago profoundly. It threw a great volume of emergency business on the telephone company during the busiest week of the year, and at about 10 or 11 o'clock in the morning calls were answered at the probable rate of 200,000 an hour. Every available operator and traffic operator was called into service.

Research Work at Massachusetts Institute of Technology.—Among work being conducted in the graduate department of the Massachusetts Institute of Technology, mostly under the direction of Professor Pender and Professor Wickenden, are researches relating to the effects of heat treatment on the magnetic qualities of silicon iron, to certain transient phenomena that may occur in long electric circuits, to the effect of high frequencies on the permeability of iron, to the effective resistance and reactance of steel rails when conveying alternating currents, to the selective action of spark-gap lightning arresters with respect to frequency, to the reflection of light from walls or ceilings, to the disruptive strength of rubber-insulated coatings on wires, etc. Certain of these researches are continuations of work started last year, and in each case will be carried on as may be convenient and needful to get knowledge of the phenomena under investigation.

ELECTRIC DEVELOPMENT ON THE SCHUYLKILL NAVIGATION CANAL.

Generating Station of the Philadelphia Hydro-Electric Company on the Canal Bank at Manayunk, Pa.

THE Philadelphia Hydro-Electric Company of Philadelphia, Pa., has just completed a small generating station on the canal of the Schuylkill Navigation Company just below the stations of the Pennsylvania and Philadelphia & Reading railroads at Manayunk, Pa. The station is on the south bank of the canal on land leased from the navigation company and is shown in Fig. 1. Coincident with the erection of the generating station it was necessary for the Schuylkill Navigation Company to enlarge the intake, feeder and canal section and to improve the dam and headworks at Flat Rock, one and one-half miles above the plant, so as to render the necessary water available at the station for its operation. The extra work, including that at the gate house and the upper locks and on the reconstructed timber dam at Flat Rock, necessitated an expenditure on the part of the navigation company of approximately $200,000. The improvements give enough water from the Schuylkill River to develop power at the station site without in any way interfering with the navigation of the river, one of the conditions under which the company is bound.

The station, near Green Lane, rests on solid rock, the foundation being 23 ft deep. The structure is 140 ft x 30 ft and

Fig. 2—Generator Room of the Philadelphia Hydro-Electric Company, Showing Water-Wheel Driven Units

44 ft high and is built of steel, brick and reinforced concrete. The forebay as well as the spillway is a good example of concrete work and the foundations of the waterwheels, generators and gas engine are of the same material. Adjacent to the forebay and adjoining the producer room of the station is a large coal-storage yard with a siding of the Philadelphia & Reading Railroad running into it. Anthracite coal may also be brought to the station in canalboats. There is a small industrial track communicating with the producer room and the storage yard, the cars being elevated to the charging floor on a 2-ton plunger elevator.

The hydraulic equipment comprises four pairs of 36-in. water turbines built by the S. Morgan Smith Company, of York, Pa., each of which is housed in a separate concrete compartment and direct connected to a 300-kw, three phase,

Fig. 1—Station of the Philadelphia Hydro-Electric Company at Manayunk, Pa.

60-cycle, 6600-volt Westinghouse generator running at 200 r.p.m. The speed is controlled by Lombard governors. Two belt-driven, vertical, direct-current generators, rated at 70 kw each, furnish the energy for excitation. In the basement below the generator room floor are the oil pumps, rheostats and belt drives from the main shaft of the water turbines to the exciter shafts. The water turbines are rated at 550 hp when operating under a 20-ft. head and develop 654 hp when operated under a 24-ft. head with full gate opening. A general view of the interior of the station, showing the arrangement of the main generators along the north wall, is given in Fig. 2, and Fig. 5 is a cross-sectional elevation of the plant.

The water is taken from the canal under the railroad bridge into the forebay, one side of which serves as a spillway. The

usual arrangement of racks prevails. The wheels are set 20 ft. below mean water and approximately 4 ft. above tail water, so that with the draft tubes covered under normal river conditions a head of 24 ft. is available. In addition to the waterwheels there is a producer gas auxiliary equipment installed at the eastern end of the station, consisting of a three-cylinder Westinghouse engine rated at 270 hp and capable of a 10 per cent overload, and two R. D. Wood producers, each rated at 300 hp, and a scrubber. The gas producers burn buckwheat coal and with the scrubber are located in a separate compartment of the generating station, which also houses electrically and hydraulically driven blowers for the producers. The gas engine is direct-connected to a 150-kw, three-phase, 60-cycle, 6600-volt generator and has a $12\frac{1}{2}$-kw exciter set belted to its shaft. The producer plant is said to be capable of generating a brake hp-hour on $1\frac{1}{2}$ lb. of coal and may be operated independently or in multiple with the hydroelectric equipment.

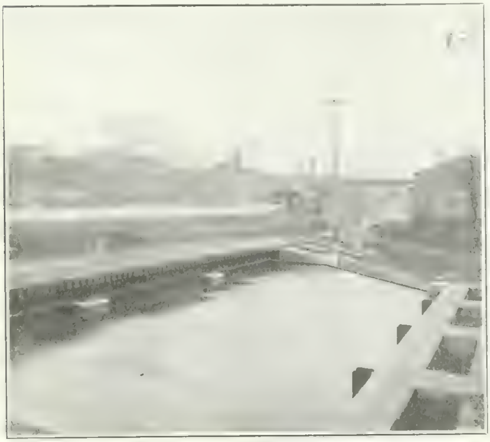


Fig. 3—Canal, Forebay, Spillway and Transmission Line.

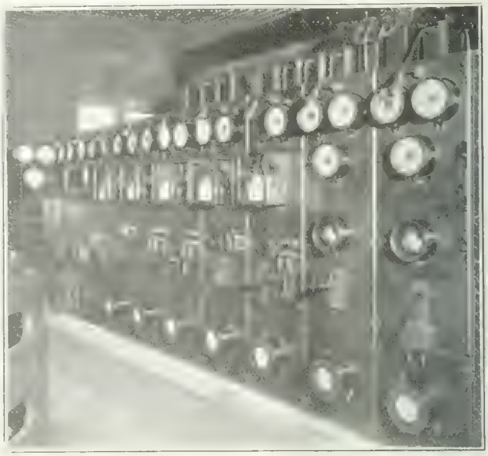


Fig. 4—Switchboard.

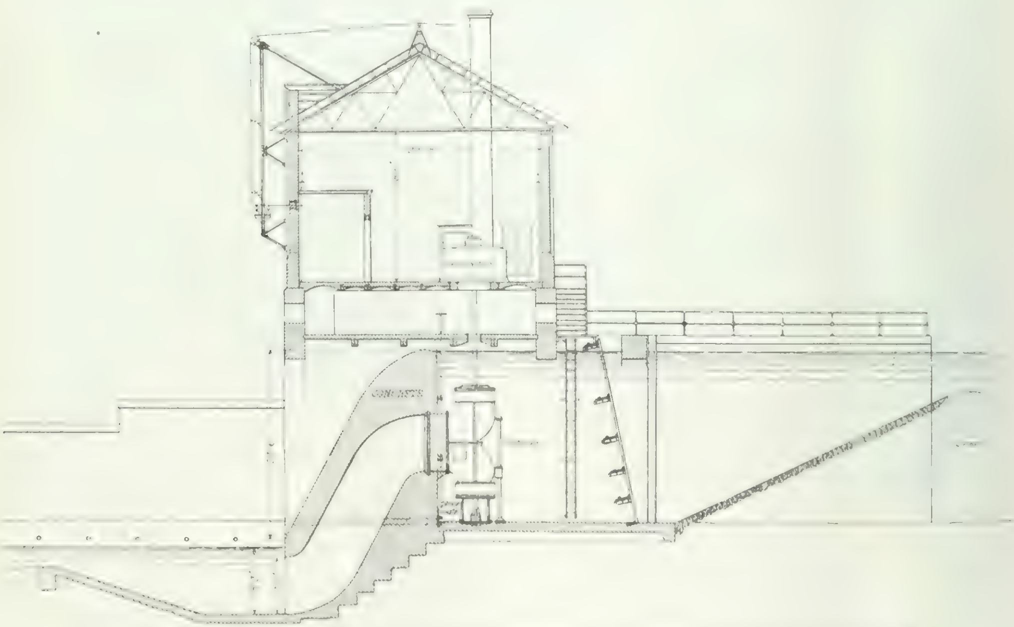


Fig. [illegible]—Cross-Section Through Power House of the Philadelphia Hydro-Electric Company at Manayunk, Pa.

The generators, exciters and feeder circuits are controlled from a nine panel, black slate switchboard fitted with the necessary measuring, indicating and recording instruments

A single, three-phase, 6600-volt transmission line connects the generating station with a rotary-converter station of the Philadelphia Rapid Transit Company at Broad and Erie Streets, five miles away. The line is owned by the railway company and the substation contains nine 185-kw air-cooled transformers and three 500-kw rotary-converters. The entire output of the station is at present sold to the Philadelphia Rapid Transit Company.

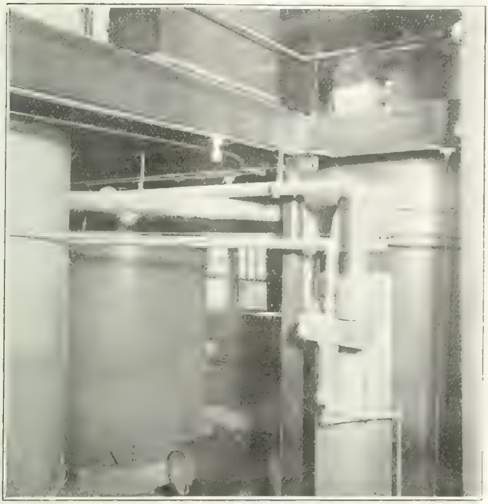


Fig. 6—Suction Gas Producers.

The station was constructed by the American Pipe & Construction Company, of Philadelphia, under the supervision of Mr. J. W. Ledoux, who designed it. The officers of the Philadelphia Hydro-Electric Company are: Mr. [illegible], of Lansdowne, Pa., president; Mr. Walter L. Rogers, of Riverton, N. J., secretary and treasurer, and Mr. A. B. Smedley, superintendent.

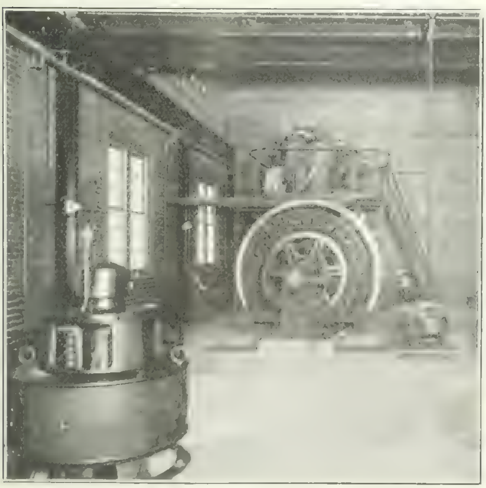


Fig. 7—Producer Gas Engine Equipment.

The office of the company is in the Witherspoon Building, Philadelphia, Pa.

ELECTRICAL PROPERTIES OF COMPOUND WIRES—II.

By FRANK F. FOWLE.

THE investigation of the inductance of a compound wire requires a knowledge of the distribution of the total current between the core and the shell. If I_1 and I_2 represent the proportionate core and shell currents, respectively, they can be expressed in the following terms:

$$I_1 = \frac{i_1}{i} = \frac{\frac{\pi r_1^2}{\rho_1}}{\frac{\pi r_1^2}{\rho_1} + \frac{\pi (r_2^2 - r_1^2)}{\rho_2}} \quad (32)$$

$$= \frac{\frac{r_1^2}{r_2^2}}{\frac{r_1^2}{r_2^2} + \left(1 - \frac{r_1^2}{r_2^2}\right)\left(\frac{\rho_1}{\rho_2}\right)} \quad (33)$$

$$= \frac{A_1}{A_1 + A_2\left(\frac{\rho_1}{\rho_2}\right)} \quad (34)$$

$$= \frac{n_1 s_1}{n_1 s_1 + n_2 s_2\left(\frac{\rho_1}{\rho_2}\right)} \quad (35)$$

and similarly,

$$I_2 = \frac{\left(1 - \frac{r_1^2}{r_2^2}\right)}{\left(\frac{r_1^2}{r_2^2}\right)\left(\frac{\rho_2}{\rho_1}\right) + \left(1 - \frac{r_1^2}{r_2^2}\right)} \quad (36)$$

$$= \frac{A_2}{A_1\left(\frac{\rho_2}{\rho_1}\right) + A_2} \quad (37)$$

$$= \frac{n_2 s_2}{n_1 s_1\left(\frac{\rho_2}{\rho_1}\right) + n_2 s_2} \quad (38)$$

The sum of I_1 and I_2 is always unity. Expressions (34) and (37) have been employed in computing the values of I_1 and I_2 for copper-clad and aluminum-clad wires, which appear in Table VI.

TABLE VI.—DISTRIBUTION OF CURRENT BETWEEN CORE AND SHELL, IN TERMS OF PROPORTIONAL SHELL AREA.

Ratio of Shell Cross-Section to Total Cross-Section.	Proportional Distribution of Current Between Core and Shell.			
	Copper-Clad Steel.		Aluminum-Clad Steel.	
	Core.	Shell.	Core.	Shell.
0.00	1.000	0.000	1.000	0.000
0.10	0.519	0.481	0.636	0.364
0.20	[illegible]	0.676	0.437	0.563
0.30	0.219	0.781	0.312	0.688
0.40	0.153	0.847	0.225	0.775
0.50	0.107	0.893	0.162	0.838
0.60	0.074	[illegible]	0.115	0.885
0.70	[illegible]	0.951	0.077	0.923
0.80	0.029	0.971	0.046	0.954
0.90	0.013	0.987	0.021	0.979
1.00	0.000	1.000	0.000	1.000

Expressions (35) and (38) have been used to compute the proportions of I_1 and I_2 in terms of the proportion of shell by weight, given in Table VII.

Fig. 7 is plotted from Table VI and Fig. 8 from Table VII. It is notable that the proportion of current in the shell always exceeds the proportion of shell by either cross-section or weight, and the excess is considerable for small proportions of shell. The result of this distribution of current is to mini-

[illegible] the effect of the high magnetic permeability of the core upon the total inductance.

[illegible] DISTRIBUTION OF CURRENT BETWEEN CORE AND SHELL IN TERMS OF PROPORTIONAL SHELL WEIGHT.

Weight to [illegible]	Copper-Clad Steel. Core.	Copper-Clad Steel. Shell.	Aluminum-Clad Steel. Core.	Aluminum-Clad Steel. Shell.
0.00	1.000	0.000	1.000	0.000
0.10	0.551	[illegible]	0.373	0.627
0.20	0.353	0.647	0.209	0.791
0.30	0.241	0.759	0.134	0.866
0.40	0.170	0.830	0.090	0.910
0.50	0.120	0.880	0.062	0.938
0.60	0.083	0.917	0.042	0.958
0.70	0.055	0.945	0.028	0.972
0.80	0.033	0.967	0.016	0.984
[illegible]	0.015	0.985	0.007	0.993
1.00	0.000	1.000	0.000	1.000

The considerations up to this point have been based on wires of equal size. It may be useful to have expressions for the

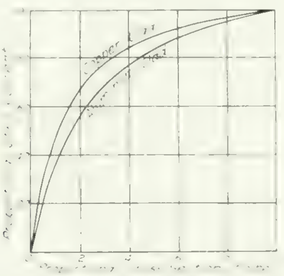


Fig. 7—Distribution of Current Between Core and Shell, in Terms of Proportional Shell Area.

comparative size and conductance in terms of equal weights. Proceeding upon this assumption:

$$W = \pi r_1^2 s_1 + \pi (r_2^2 - r_1^2) s_2 \quad (39)$$

$$W_c = \pi r_c^2 s_c \quad (40)$$

and

$$[illegible] \quad (41)$$

$$\frac{r_c^2}{r_2^2} = \frac{r_1^2}{r_2^2}\left(\frac{s_1}{s_c}\right) + \left(1 - \frac{r_1^2}{r_2^2}\right)\left(\frac{s_2}{s_c}\right) \quad (42)$$

$$= A_1\left(\frac{s_1}{s_c}\right) + A_2\left(\frac{s_2}{s_c}\right) \quad (43)$$

$$A_2\left(\frac{s_2}{[illegible]}\right) + \frac{s}{[illegible]} \quad (44)$$

$$= \frac{[illegible]\left(\frac{[illegible]}{s_c}\right) [illegible]\left(\frac{s_2}{s_c}\right)}{[illegible]} \quad (45)$$

$$\left(\frac{s_1 s_2}{s_c}\right) \quad (46)$$

Or finally the ratio of diameters is

$$[illegible] \quad (47)$$

$$[illegible] \quad (48)$$

When the weights are equal the ratio of conductances is

$$[illegible] \quad (49)$$

$$\frac{r_c^2}{r_2^2}\left(\frac{\rho_c}{\rho_1}\right) + \frac{r_2^2 - r_1^2}{r_2^2}\left(\frac{\rho_c}{\rho_2}\right) \quad (50)$$

$$= \frac{r_c^2}{r_2^2}\left[\frac{r_1^2}{r_2^2}\left(\frac{\rho_c}{\rho_1}\right) + \left(1 - \frac{r_1^2}{r_2^2}\right)\left(\frac{\rho_c}{\rho_2}\right)\right] \quad (51)$$

$$= \frac{r_c^2}{r_2^2}\left[A_1\left(\frac{\rho_c}{\rho_1}\right) + A_2\left(\frac{\rho_c}{\rho_2}\right)\right] \quad (52)$$

$$= \frac{A_1\left(\frac{\rho_c}{\rho_1}\right) + A_2\left(\frac{\rho_c}{\rho_2}\right)}{A_1\left(\frac{s_1}{s_c}\right) + A_2\left(\frac{s_2}{s_c}\right)} \quad (53)$$

$$= \frac{n_1 s_2\left(\frac{\rho_c}{\rho_1}\right) + n_2 s_1\left(\frac{\rho_c}{\rho_2}\right)}{\left(\frac{s_1 s_2}{s_c}\right)} \quad (54)$$

The relations last given when the weights are equal are sometimes useful, but are rarely of controlling importance. The

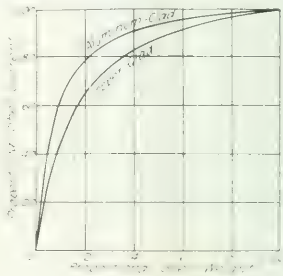


Fig. 8—Distribution of Current Between Core and Shell, in Terms of Proportional Shell Weight.

relations when the conductances are equal, however, are ordinarily very useful, and the following expressions develop the relative sizes and weights under this assumption. Primarily,

$$G_c = G \quad (55)$$

and hence

$$[illegible] \quad (56)$$

$$\frac{r_c^2}{r_2^2} = \frac{r_1^2}{r_2^2}\left(\frac{\rho_c}{\rho_1}\right) + \left(1 - \frac{r_1^2}{r_2^2}\right)\left(\frac{\rho_c}{\rho_2}\right) \quad (57)$$

$$= A_1\left(\frac{\rho_c}{\rho_1}\right) + A_2\left(\frac{\rho_c}{\rho_2}\right) \quad (58)$$

or

$$[illegible] \sqrt{\left[\frac{1}{A_1\left(\frac{\rho}{\rho}\right) + A_2\left(\frac{\rho_c}{\rho_2}\right)}\right]} \quad (59)$$

Instead of the relative areas A_1 and A_2 the corresponding expressions in terms of relative weights and specific gravities can be taken from (8) and (9). The ratio of weights is,

$$\frac{W}{W_c} = \frac{r_1^2}{[illegible]}\left(\frac{s_1}{s_c}\right) + \frac{[illegible]}{r_c^2}\left(\frac{s_2}{s_c}\right) \quad (60)$$

$$= \frac{A_1\left(\frac{s_1}{s_c}\right) + A_2\left(\frac{s_2}{s_c}\right)}{A_1\left(\frac{\rho_c}{\rho_1}\right) + A_2\left(\frac{\rho_c}{\rho_2}\right)} \quad (61)$$

$$= \frac{\left(\frac{s_1 s_2}{s_c}\right)}{n_1 s_2\left(\frac{\rho_c}{\rho_1}\right) + n_2 s_1\left(\frac{\rho_c}{\rho_2}\right)} \quad (62)$$

The foregoing relations as a whole are capable of numerous inversions of independent variable, of course, to suit the needs

of any particular consideration. These changes are too obvious to dwell upon. In leaving this part of the subject it may be noted that expressions (61) and (62) give the ratio of the mile-ohm of a compound wire to the mile-ohm of solid copper.

The method of deriving the inductance formula for solid homogeneous wires is well known; only that portion of it which gives the inductance internal to the wire will be considered here. The common formula is subject to certain limitations, but these will be taken up later.

Fundamentally the derivation rests upon the following statement by Maxwell*: "It appears, therefore, that the magnetic force at a given point due to a current arranged in cylindrical strata, the common axis of which is the axis of z, depends only on the total strength of the current in the strata which lie between the given point and the axis, and not on the distribution of the current among the different cylindrical strata."

Referring to the core shown in Fig. 9 the general expression for the inductance is

$$L_1 = \int_0^{r_1} \left(\frac{2\mu_1 r}{r_1^2}\right)\left(\frac{r^2}{r_1^2}\right)\delta r \qquad (63)$$

in which $\left(\frac{2\mu_1 r}{r_1^2}\right)$ is the field density at the end of a radius r and $\left(\frac{r^2}{r_1^2}\right)$ is the proportion of the total current inclosed within a circumference of radius r, the whole current being unity. The integration gives

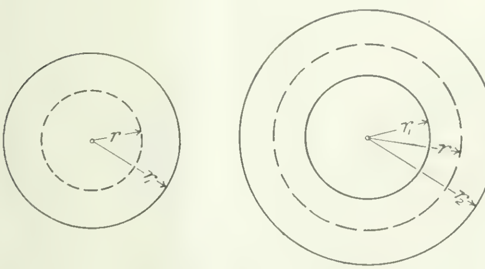
$$L_1 = \frac{1}{2}\mu_1 \qquad (64)$$

which is the total number of linkages between the unit current and the flux. But the core of a compound wire conducts only a fraction of a unit current which flows over the wire as a whole, and the final expression is, therefore,

$$L_1 = \frac{1}{2}\mu_1 I_1^2, \qquad (65)$$

where I_1 is given by expressions (32) to (35) or the complement of (36) to (38).

The flux density is not constant, but varies as a function of



Figs. 9 and 10—Core and Shell of Compound Wire.

the radius. At the axis of the core the density is zero and at the circumference it is $\left(\frac{2\mu I}{r_1}\right)$: other values lie between these limits, increasing with the distance from the axis toward the circumference. The total flux is given by the integral

$$\phi = I\int_0^{r_1} \left(\frac{2\mu r}{r_1^2}\right)\delta r \qquad (66)$$

$$= \mu I \qquad (67)$$

and the average density is

$$B = \frac{\mu I}{r_1} \qquad (68)$$

This shows that the density increases uniformly from the axis to the circumference, and the average density is one-half the maximum. This deduction neglects the skin effect and assumes μ_1 to be independent of B, which is not true unless the $B-H$ curve within the limits of B is a straight line or sensibly so. The error is not likely to be large if the maximum value of B is very small: the actual value of B will be considered later.

The shell of a compound wire is shown in Fig. 10.

The total current inclosed within the radius r when the whole current in the wire is unity, referring to Fig. 10, is given by the expression

$$I_r = I_1 + \left(\frac{r^2 - r_1^2}{r_2^2 - r_1^2}\right) I_2 \qquad (69)$$

The field density at the extremity of the radius r is given by

$$B_r = \frac{2\mu_2 I_1}{r} + \frac{2\mu_2 (r^2 - r_1^2) I_2}{r(r_2^2 - r_1^2)} \qquad (70)$$

$$= \left(\frac{2\mu_2}{r}\right) I_r \qquad (71)$$

The inductance internal to the shell is the integrated product of expressions (69) and (70), or,

$$L_2 = \int_{r_1}^{r_2} \frac{2\mu_2 I_r^2}{r}\,\delta r \qquad (72)$$

$$= 2\mu_2 \int_{r_1}^{r_2} \left[I_1 + \left(\frac{r^2 - r_1^2}{r_2^2 - r_1^2}\right) I_2\right]^2 \frac{\delta r}{r} \qquad (73)$$

$$= 2\mu_2 \int_{r_1}^{r_2} \left[\frac{I_1^2}{r} + \frac{2 I_1 I_2 (r^2 - r_1^2)}{r(r_2^2 - r_1^2)} + \frac{(r^2 - r_1^2)^2 I_2^2}{r(r_2^2 - r_1^2)^2}\right]\delta r \qquad (74)$$

$$= \left[2\mu_2 I_1^2 \log\frac{r_2}{r_1} + 2\mu_2 I_1 I_2 - \frac{4\mu_2 r_1^2 I_1 I_2}{r_2^2 - r_1^2}\log\frac{r_2}{r_1} + \frac{\mu_2 (r_2^4 - r_1^4) I_2^2}{2(r_2^2 - r_1^2)^2} - \frac{2\mu_2 r_1^2 I_2^2}{r_2^2 - r_1^2} + \frac{2\mu_2 r_1^4 I_2^2}{(r_2^2 - r_1^2)^2}\log\frac{r_2}{r_1}\right] \qquad (75)$$

$$= \left[2\mu_2 I_1 I_2 + \mu_2 I_2^2 \left[\frac{r_2^2 + r_1^2}{2(r_2^2 - r_1^2)} - \frac{2 r_1^2}{r_2^2 - r_1^2}\right] + 2\mu_2 \left[I_1 - \left(\frac{r_1^2}{r_2^2 - r_1^2}\right) I_2\right]^2 \log\frac{r_2}{r_1}\right] \qquad (76)$$

Therefore the total inductance internal to a compound wire is expressed as

$$L_{12} = L_1 + L_2$$

$$= \left[\frac{1}{2}\mu_1 I_1^2 + 2\mu_2 I_1 I_2 + \frac{1}{2}\mu_2 I_2^2\left(1 - \frac{2 r_1^2}{r_2^2 - r_1^2}\right) + 2\mu_2\left(I_1 - \frac{r_1^2 I_2}{r_2^2 - r_1^2}\right)^2 \log\frac{r_2}{r_1}\right] \qquad (77)$$

While this expression is unfortunately complicated and unwieldy, it can be reduced to the sum of two terms, of the form

$$L_{12} = a\mu_1 + b\mu_2 \qquad (78)$$

where a and b are constants for any particular wire. The following simplification will probably be helpful:

[illegible] (79)

The values of the constants are then,

$$a = \frac{1}{2} I_1^2 \qquad (80)$$

*"Electricity and Magnetism," Vol. II, 3d ed., p. [illegible].

[illegible]

It appears to be convenient and practical to rate a compound wire by its conductance ratio to solid copper of equal size. In this case the following relations will be useful in computing inductance. The proportion of shell by weight will be

$$n_2 = \frac{s_2\left(\frac{\rho_c}{\rho_1} - n\right)}{[\text{illegible}]} \qquad (82)$$

and

$$A_1 = [\text{illegible}] \qquad (83)$$

$$\frac{r_2}{r_1} = \sqrt{\frac{1}{A_1}} = [\text{illegible}] \qquad (84)$$

where n is the conductance ratio of the compound wire to a solid copper wire of equal size.

Compound wires of copper-clad steel are obtainable with conductance ratios of 20 per cent, 30 per cent, 40 per cent and 50 per cent, but ratios of 30 per cent and 40 per cent are now the standards commercially. The greatest difficulty in predetermining the properties of such wire arises in connection with the probable conductivity of the steel in the core. In general the conductivity of a steel of given composition becomes less as the tensile strength increases, resulting from rolling and drawing; but the process of annealing introduces modifications to this rule. In general, also, the conductivity of hard, tough steel is less than that of soft, mild steel. The grades of steel used in telegraph wires range in tensile strength from 58,000 lb. to 65,000 lb. per square inch, with conductance ratios ranging from 16 per cent to 14 per cent respectively. The grade of steel used in the core of copper-clad steel, in annealed rods, shows from actual test in one case a tensile strength of 61,500 lb.; the value runs up very considerably with the amount of drawing. It is not possible to draw steel wires through many reductions without annealing, because they become hard and brittle very rapidly and the conductivity diminishes. Copper-clad steel wires must be annealed during the drawing process, but not necessarily after each reduction. Hence, it might be possible, for example, to find the steel in a No. 10 wire softer and of higher conductivity than that in a No. 9 wire, if annealing took place between the reduction from No. 6 to No. 7 and again from No. 9 to No. 10. No fixed and invariable rule applies to the repetition of the annealing process, because of unavoidable variations of small magnitude in the composition and treatment of the steel. It should be observed, also, that the process of annealing steel hardens copper, as a result of which the conductivity of the latter will decrease progressively with the drawing. As a general proposition the conductivity of the steel core may be expected to diminish with the wire sizes, but not uniformly or without some exceptions.

Before considering the values of the constants in detail, it may be pointed out that the formula for the whole internal

TABLE VIII.—PROPORTIONAL SHELL WEIGHT AND RATIO OF SHELL TO CORE RADIUS, FOR COPPER-CLAD STEEL WIRES, IN TERMS [illegible]

ρ_c	$n=20\%$	[illegible]	[illegible]	[illegible]	$n=20\%$	[illegible]	[illegible]	[illegible]
0.15	0.0664	[illegible]	0.322	0.443	1.031	[illegible]	1.190	1.304
0.14	0.0786	0.2064	0.330	0.450	1.037	1.108	1.197	1.312
[illegible]	[illegible]	[illegible]	[illegible]	0.457	1.043	[illegible]	1.204	1.319
0.12	[illegible]	[illegible]	[illegible]	0.464	1.049	1.121	1.211	1.327
[illegible]	[illegible]	[illegible]	[illegible]	0.470	1.055	1.128	1.218	1.334
0.10	[illegible]	[illegible]	[illegible]	0.476	1.061	[illegible]	1.225	1.342

TABLE IX.—[illegible] CORE RADIUS, FOR ALUMINUM-CLAD STEEL WIRES, IN TERMS OF [illegible]

ρ_1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.1380	0.2795	1.058	[illegible]	1.462
0.14	0.0465	0.1458	0.2875	1.069	1.225	1.477
0.13	0.0538	0.1535	0.2952	1.080	1.237	1.492
0.12	0.0611	0.1611	0.3029	[illegible]	1.250	1.508
0.11	0.0682	0.1686	0.3104	[illegible]	1.263	1.523
0.10	0.0752	0.1759	0.3177	1.113	1.275	1.537

TABLE [illegible]—[illegible] OF CURRENT BETWEEN CORE AND SHELL, IN COPPER-CLAD STEEL WIRES.

[illegible]	[illegible]		$n=30\%$		$n=40\%$		$n=50\%$	
	I_1	I_2	I_1	I_2	I_1	I_2	I_1	I_2
[illegible]	0.706	0.294	0.412	0.588	0.264	0.736	0.177	0.823
[illegible]	0.651	[illegible]	0.380	0.620	0.244	0.756	0.163	0.837
[illegible]	0.598	0.402	0.349	0.651	0.224	0.776	0.149	0.851
[illegible] 12	0.546	[illegible]	0.318	0.682	0.204	0.796	0.136	0.864
[illegible]	0.494	0.506	0.288	0.712	0.185	0.815	0.124	[illegible]
0.10	0.444	0.556	0.259	0.741	0.167	0.833	[illegible]	0.889

TABLE X[illegible]—[illegible] OF CURRENT BETWEEN CORE AND SHELL, IN ALUMINUM-CLAD STEEL WIRES.

[illegible]	$n=20\%$		$n=30\%$		$n=40\%$	
	[illegible]	[illegible]	I_1	I_2	I_1	I_2
0.15	0.670	0.330	0.340	0.660	0.175	0.825
0.14	0.612	0.388	0.311	0.689	0.160	0.840
0.13	0.557	0.443	0.283	0.717	0.146	0.854
0.12	0.504	0.496	0.256	[illegible]	0.132	0.868
0.11	0.453	0.547	0.230	0.770	0.119	0.881
0.10	0.404	0.596	0.205	0.795	0.106	0.894

TABLE [illegible]—INTERNAL [illegible] OF COPPER-CLAD STEEL WIRES WHEN [illegible] OF STEEL TO COPPER IS 12 PER CENT.

[illegible]	Formula for Internal Inductance. In c.g.s. Units.
20%	[illegible]
[illegible]	$L_{12}=0.0506\mu_1+0.102\mu_2$
[illegible]	[illegible] 147 [illegible]
50%	$L_{12}=0.00925\mu_1+0.193\mu_2$

TABLE XIII.—INTERNAL [illegible] OF ALUMINUM-CLAD STEEL WIRES, WHEN THE CONDUCTANCE RATIO OF STEEL TO ALUMINUM IS 10.35 PER CENT.

[illegible]	[illegible] Internal Inductance. In c.g.s. Units.
[illegible]	[illegible]
[illegible]	$L_{12}=0.0328\mu_1+0.1816\mu_2$
[illegible]	[illegible] 2624 [illegible]

inductance as given in (77) is entirely consistent when either I_2 or I_1 becomes zero. In the first case,

$$\left.\begin{array}{l}\text{when } I_2 = 0 \\ L_{11} = L_1 = \frac{1}{2}\mu_1\end{array}\right\} \qquad (85)$$

which is the result obtained for a solid homogeneous wire. In the second case,

$$\left.\begin{array}{l}\text{when } I_1 = 0 \\ L_{12} = L_2 = \frac{1}{2}\mu_2\left[\dfrac{r_2^2-3r_1^2}{r_2^2-r_1^2}+\dfrac{4r_1^4}{(r_2^2-r_1^2)^2}\log\dfrac{r_2}{r_1}\right]\end{array}\right\} \qquad (86)$$

which is Maxwell's expression for the inductance of a hollow tubular conductor. The inductance of a compound wire is not directly the sum of two such terms as (85) and (86), but is more complicated in form and contains an additional term.

In order to furnish a ready basis for calculating the inductance, expressions (82) and (84) have been employed in calculating a table of values of the proportional shell weight and the ratios of the radii, for copper-clad and aluminum-clad steel, in terms of the conductance ratios. Table VIII gives the results for copper-clad and Table IX for aluminum-clad.

The proportional distribution of current between core and shell, which is also needed in the inductance calculation, is given in Tables X and XI.

These values recorded in Tables VIII to XI make it possible to carry out a calculation for the total internal inductance of copper-clad or aluminum-clad wires, the conductance ratios of which to solid hard-drawn copper range from 20 per cent to 50 per cent, when the conductance ratio of steel to copper ranges from 10 per cent to 15 per cent. Such calculations, carried through for all the cases when the conductance ratio of steel to copper is 12 per cent, are shown in Table XII. The results so obtained will give the inductance when the values of μ are known.

The value of μ_2 is unity for copper-clad and aluminum-clad wires. The value of μ_1 will be the subject of further consideration. The values of the constants given in Table XII show clearly the diminishing effect of the steel core as the proportion of copper to steel increases. Similar constants are given for aluminum-clad wire in Table XIII.

The constants given in Table XIII correspond to conductance ratios of 12 per cent for steel to copper and 62 per cent for aluminum to copper.

The inductance expressed by these formulas is given in c.g.s. electromagnetic units. In order to express the inductance in henries per 1000 ft. or per mile, the constants a and b should be multiplied by the quantities: 0.00003048 for henries per 1000 ft., 0.0001609 for henries per mile.

The considerations up to this point have been wholly theoretical, so as to develop the theoretical side of the subject. A comparison of the results thus obtained with the results of actual measurements for copper-clad steel will be taken up in a subsequent issue.

TURBINES OF INCREASED CAPACITY AT NIAGARA FALLS, ONT.

The Canadian Niagara Power Company has just placed in commercial operation a water turbine of special interest in that it was designed by the company itself and actually does what turbine builders both here and in Europe said could not be done under the conditions obtaining at Niagara Falls, Ontario. Fig. 1 herewith shows elevations of units Nos. 5 and 6, and gives a general idea of the appearance of both the old and new types of turbines.

The plant of the Canadian Niagara Power Company was originally designed for an ultimate installation of eleven 10,000-hp units and the wheelpit was completed with inlets, draft tubes and machinery supports suitable for turbines of that size. Five 10,000-hp units were installed and have been in successful operation since 1906. The first three turbines were designed and built by Messrs. Escher, Wyss & Company, in Zurich, Switzerland, and the fourth and fifth turbines were manufactured from the same designs by the I. P. Morris Company, in

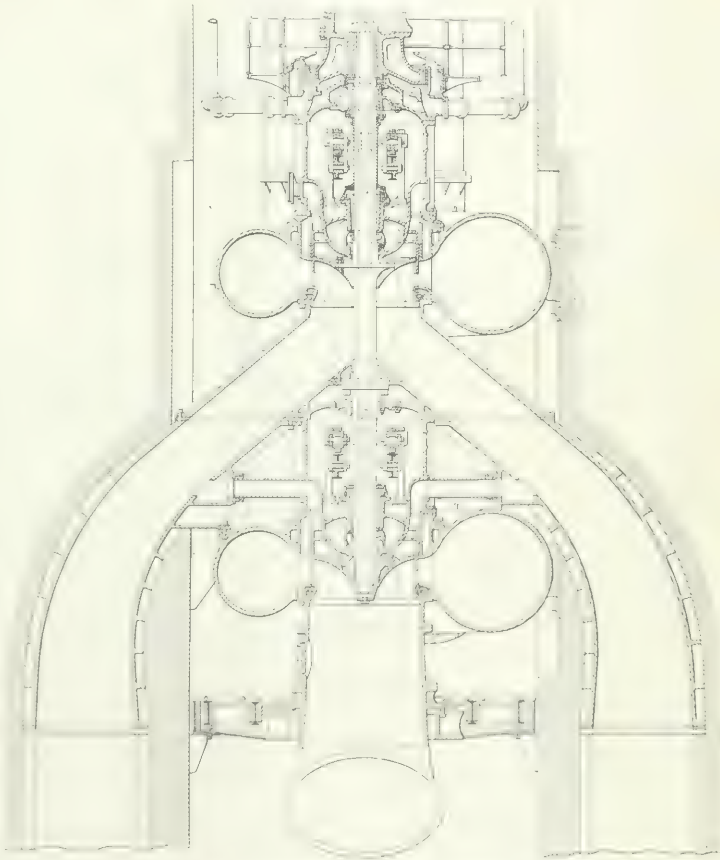


Fig. 1—Cross-Section of New Turbine

Philadelphia, Pa. The general hydraulic construction of the plant is very similar to that of the Niagara Falls Power Company on the American side, which is so well known to all engineers as to require no detailed description. The station differs principally from that of the American company in that three-phase currents instead of two-phase currents are generated and

[t]he units are rated at 10,000-hp, whereas those in the American [s]tations are rated at 5000 hp.

The turbines are of the Francis type, inward discharge, with [d]raft tubes led to the bottom of the wheelpit. To maintain the [l]evel of the water in the wheelpit at a sufficient height at all [l]oads to cover the mouths of the draft tubes a regulation gate [i]s installed at the end of the wheelpit. The latter is operated [b]y a direct-current motor rated at 85-hp. The weight of the [r]otating machinery is carried by an oil-thrust bearing under the generator and also by a hydraulic piston at the bottom of the wheel. The available head is approximately 135 ft.

A study of the hydraulic conditions in the tunnel and wheelpit after the completion of the first five turbines indicated that each of the remaining units could profitably be made to give 25 per cent greater capacity than those first installed. Proposals were, therefore, sought in this country and in Europe for the design and construction of a turbine that would deliver 12,500 hp at the switchboard. Some of the manufacturing companies refused to undertake the work, while others submitted plans of turbines which could not, under the existing conditions, deliver the power called for except at very low efficiency. Mr. C. C. Egbert, mechanical engineer of the Niagara Falls Power Company, then undertook to design a turbine [illegible] would deliver [illegible] at reasonably good efficiency, and working drawings in complete detail were made in the office of the company at Niagara Falls, N. Y.

The contract for the construction and delivery of the new turbine and lower penstock was given to the Bethlehem Steel Company, of South Bethlehem, Pa., which built the machine in all its parts. The complete turbine and shaft were erected during the past summer by employees of the power company, and the three-phase, 25-cycle, 12,000-volt generator was built and installed by the Canadian Westinghouse Company, Ltd. The governor is of the modified Escher, Wyss & Company design, part of which was built by the power company and the remainder by the des'gners in Zurich, Switzerland. The riveted steel penstock was built by the John Inglis Company, Ltd., of Toronto, Canada, and erected by the power company. The high-pressure oil pumps for supplying the oil to the governor and to the thrust bearing were also designed by Mr. Egbert and built in the machine shop of the power company, so that taken all in all the water turbine and its auxiliary apparatus are strictly a product of the Niagara Falls Power Company.

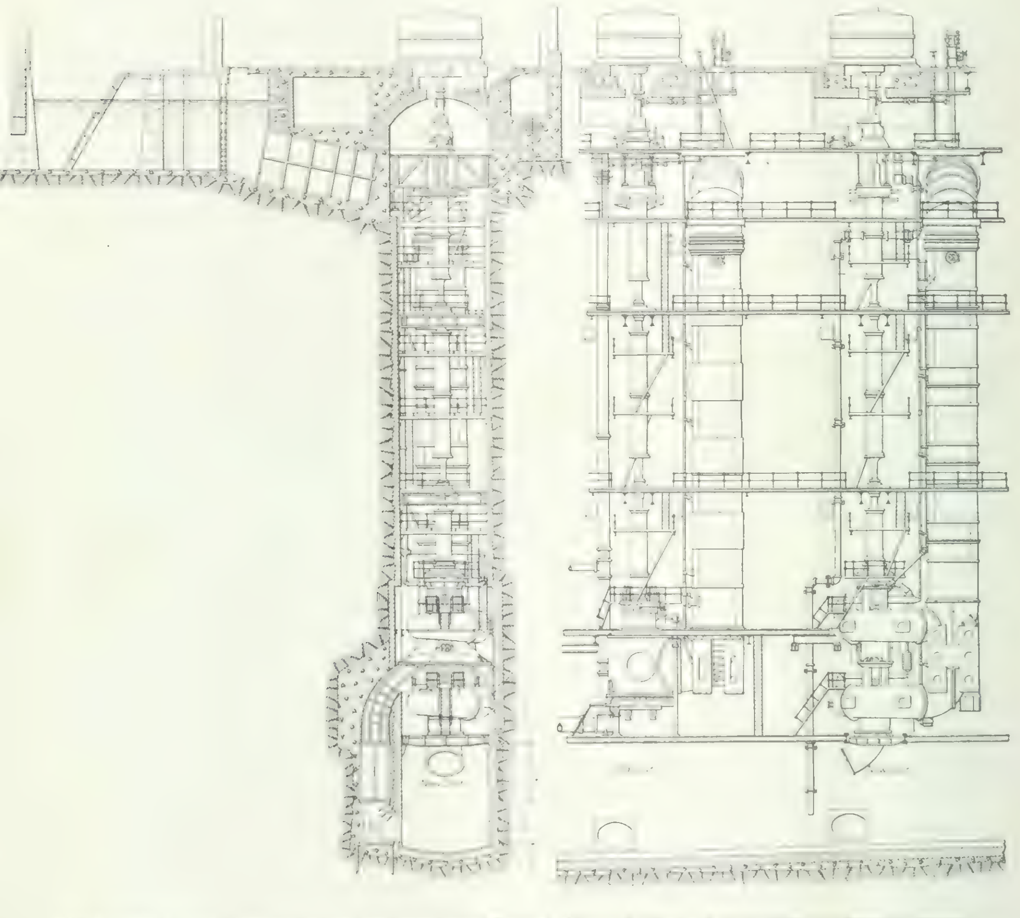


Fig. 2—Cross Section Elevation of Old and New Water Turbine Units in Station of Canadian Niagara Power Company.

The new turbine, which, as stated before, has just been placed in commercial operation, has shown a most gratifying performance. When operating under a head of 133 ft. it delivers [illegible] and under normal running conditions the head and consequently the output of the turbine will

be somewhat greater. The head was purposely reduced to 133 ft. by means of the tail-water regulating gate at the lower end of the wheelpit so that the head during the test would approximate that which will exist when the ultimate development is reached. The indications are that the efficiency of the unit is equal to or better than that of the turbines of the older type. The cost of construction as compared with that of the older

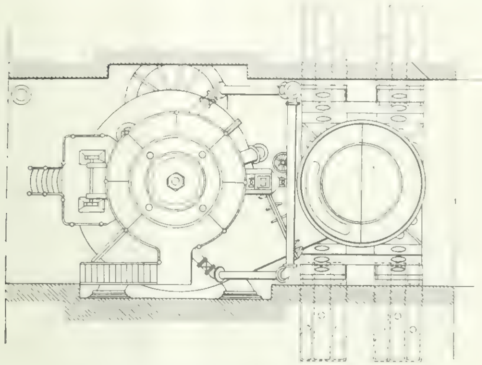


Fig. 3—Plan View of New Unit.

turbines is greatly in favor of the new design. Moreover, by making its own designs it has been possible for the power company to purchase in a broader market and thereby obtain better prices and quicker deliveries. The unit will shortly be given a very thorough test, when its efficiencies at various loads will be determined and its operating characteristics compared with those of the older units.

HYDROELECTRIC DEVELOPMENT OF THE CALGARY POWER COMPANY.

The generating station of the Calgary Power Company, now under construction at the Horseshoe Falls on the Bow River, near Kananaskis Siding, on the main line of the Canadian Pacific Railroad and about forty-five miles west of Calgary, Alberta, Canada, is rapidly nearing completion. A concrete dam is being built across the river and four steel penstocks will run from the forebay to the generating station, where a head of 72 ft. is available. Three of the penstocks are now under construction and the dam and the generating station are almost complete. The immediate equipment for the generating station has been ordered and a large amount of it is now on the site. It consists of two 2500-kva, 60-cycle, 12,000-volt, three-phase, horizontal, waterwheel-type generators having a speed of 300 r.p.m. and one 4000-kva generator running at 225 r.p.m. with characteristics similar to the other two machines.

Two 175-kw, 125-volt, turbine-driven exciters have also been provided. The three main generators and the two exciters are being built by the Canadian General Electric Company, Ltd., and the water turbines for the two smaller units and the two exciters are being built by Messrs. Jens Orten Boving, of London, England. The water turbine to drive the 4000-kva unit will be built by the Wellman-Seaver-Morgan Company, of Cleveland, Ohio. Space has been left in the station for the installation of a second 4000-kva unit and a motor-driven exciter.

The transformer equipment at the generating station will eventually consist of four 3000-kva, 60-cycle, three-phase, water-cooled units, stepping up the potential from 12,000 volts to 55,000 volts. Three of these transformers are now being built in the works of the Canadian Westinghouse Company, Ltd., which will also furnish the three-phase transformers for the Calgary terminal station from which energy will be distributed at 600 volts, 2400 volts and 12,000 volts. A single circuit, 55-000-volt transmission line about fifty miles long, on wooden poles, connects the Calgary terminal station to the generating station, and a duplicate line will be constructed in the near future. The line conductor is a No. 0 stranded aluminum wire and the line is protected from lightning by a ¼-in., seven-strand, galvanized-iron cable running along the top of the poles and grounded at every second pole. A telephone circuit is also carried below the main transmission wires.

The entire switching equipment for the generating station and terminal station will be furnished by the Canadian Westinghouse Company, Ltd. The generator voltage was fixed at 12,000 volts to permit of the transmission of 3000 hp at the generator voltage to the Western Canada Cement & Coal Company's cement mill at Exshaw, Alberta, which lies about eight miles from the generating station. The substation at the Exshaw mill and the transmission line thereto had been completed, so that the cement mill will be operated entirely from energy transmitted from the generating station as soon as the latter is ready for operation, which will be in the early spring. Contracts have been closed with the City of Calgary and with the Alberta Portland Cement Company at Calgary, which will add from 3000 hp to 4000 hp additional to the load on the plant.

The office of the Calgary Power Company is in Montreal, Quebec. The president is Mr. H. S. Holt and the managing director Mr. Cecil B. Smith. Messrs. Smith, Kerry & Chace, of Toronto, are the engineers in charge of the design and construction of the system

Central Station

Management, Policies and Commercial Methods

CHRISTMAS OFFER TO BROOKLYN CHURCHES.

Appreciating the danger incurred by the use of lighted candles on Christmas trees in church festivals during the Yuletide season and with the object of illustrating the safety and beauty of the modern method of electrical Christmas-tree decoration, the Edison Electric Illuminating Company of Brooklyn made an offer to loan to any church in Brooklyn using its service a complete Christmas-tree lighting outfit consisting of vari-colored miniature lamps. Outfits for any tree, however large, were provided. The only stipulation applying to the loan of the outfits was that they were to be used between Dec. 20 and Dec. 30, and that requests must be addressed to the sales department and signed by an officer of the church or Sunday school desiring to be served. Owing to the demands for the sets by sale to the company's customers for home use the number loaned was limited to the first fifty requests received. Needless to state, the invitation met with a hearty response and the fifty sets to be loaned were bid for within a day or two after the public announcement appeared in the daily papers.

A RATE WITH AN "ACTIVE-LAMP" READINESS-TO-SERVE CHARGE.

The Chippewa Valley Railway, Light & Power Company which furnishes hydroelectric energy from its Eau Claire and Cedar Falls water-power plants to consumers in Eau Claire, Menomonie, and Chippewa Falls, Wis., and Red Wing, Minn., makes use of an original rate for lighting service which comprises an "active-lamp" readiness-to-serve charge added to an energy-consuming element proportional to the kw-hours registered by the meter.

For residence lighting the rate is 15 cents per month for each "active" connected 50-watt unit, plus 3 cents per kw-hour for all energy consumed by the entire installation, whether active or inactive lamps. Active lamps are defined as those used in main halls, main stairways, parlors, libraries, dens, music-rooms, conservatories and butlers' pantries, besides one 50-watt unit on the second floor. Non-active lamps are those used on porches and in vestibules, lavatories, out-buildings, stables, back halls, back stairways and all other rooms not expressly mentioned under the classification of active lamps. One non-active portable reading lamp is also allowed in rooms where active lamps are installed. The 50-watt graphitized-filament lamp is taken as the unit of consumption, and tungsten and other lamps are compared with it on a watt basis, no unit being computed, however, as less than three-fifths of 50 watts, or 30 watts, on which the charge is 9 cents. All carbon units of 8 cp or less are also rated at 30 watts, on which the readiness-to-serve charge is 9 cents per month in addition to the energy consumed.

It will be noted that the "active" readiness-to-serve schedule does not include fan motors or electric heating appliances, so that the cost of operating this class of apparatus is virtually only 3 cents per kw-hour for the actual energy consumed without demand charges. This attractive low rate has been the means of introducing a large number of electric irons, cooking utensils, etc., onto the lines of the company.

The rate for hotels, clubs and boarding houses is the same as that for private residences except that lamps in dining-rooms, buffets, bars, bowling-alleys, billiard-rooms, card-rooms, barber-shops, lobbies, main halls, corridors and lavatories are all considered as active lamps.

For commercial lighting the rate is 15 cents per month for each connected 50-watt unit (without classification as to whether active or inactive), plus 3 cents per kw-hour for all energy consumed, except where 10 per cent of the total connected rating is used for window-display or advertising purposes, in which case these display lamps are considered inactive and are subject only to a consumption charge. The maximum charge for this class of business in no case exceeds 6 cents.

The minimum residence-lighting charge is $1 per month and for commercial houses $1.50. Customers having less than five 50-watt units are served under a flat-rate schedule, unless the company installs a meter by preference. Under this flat rate the charge is 30 cents per 50-watt unit per month in residences and 50 cents in commercial installations, the minimum bill being 90 cents a month.

Competition from other illuminants is provided against by a clause in the rate schedule which insures that in all residences depending exclusively on electricity for illumination not more than 75 per cent of the total connected lamps may be considered as active, while in houses having auxiliary lighting service all lamps are deemed active and a readiness-to-serve charge is required for each.

This rate schedule has been in use since May, 1910, and its results are reported to be highly successful. Inspections of customers' installations are made every six months for the purpose of noting changes in lamps, etc., but practically no intentional frauds have been discovered in switching lamps from "active" to "inactive" sockets.

LIGHTED FIRE-ALARM BOXES IN ROCHESTER, NEW YORK

At a recent conflagration in the City of Rochester, N. Y., it was brought out that the man who discovered the blaze at night made a conscientious attempt to turn in an alarm, but in his bewilderment and excitement could not remember where the fire-alarm box was located. As a result of this delay the fire gained considerable headway and caused serious loss. The superintendent of the Rochester Railway & Light Company, reading the account in the daily papers and being, like all Rochesterians, envious for the reputation of the Flower City, immediately set about to devise a plan for making fire-alarm boxes so conspicuous at night that a similar delay from a like cause would not obtain.

The scheme as planned by the company consists of lighting every fire-alarm box with an incandescent lamp inclosed in an

Electrically Lighted Fire-Alarm Box.

outer red globe. It was approved by the city engineer, who also became interested in the scheme, and incidentally gives the Rochester Railway & Light Company a gross income of [illegible]

At present the 300 fire-alarm boxes of the city are thus lighted. No change was made in the fire-alarm posts, a special fitting at the top being equipped with a shade holder and a 40-watt, clear-bulb, tungsten lamp over which is a red globe with the words "Fire Alarm" etched in it. The lighting circuit to the post is run underground either from the underground system or from a pole line, the leads in the latter case passing down the pole in conduit to the fire-alarm post. Where the lighting circuits are on the opposite side of the street the circuit is placed underground in an iron pipe, a single conductor being used for one lead and the pipe itself for the other lead. In this way the extra cost of a double conductor is saved and the small transformers—for all the lamps receive energy from an overhead or underground 16-volt, 40-watt transformer connected to the constant-current arc lighting circuits—are effectually grounded. The small transformers are in most cases set in the manholes adjacent to the fire-alarm posts.

In bringing a circuit from a transformer on a pole line it is usually possible to drive the conduit across the street without opening the latter, thus not only saving the expense of digging, but causing no inconvenience to traffic.

Now every fire-alarm box in Rochester is easily discernible at night for a great distance. When looking down a main thoroughfare the red lights thrust themselves into view like so many danger signs along a brightly lighted roadway, and the plan has given complete satisfaction ever since its installation a few months ago.

A SUGGESTIVE GAS CAMPAIGN AT CHICAGO.

Any unusual and successful activity on the part of a gas company should interest central-station men, not only as indicating the competition to be expected from enterprising gas producers, but also as suggesting similar methods for the expansion of their own business. Such is the "amber light" campaign now being conducted at Chicago by the People's Gas Light & Coke Company, which has the monopoly of the local gas business. Like other gas concerns this company has been feeling the inroads of the tungsten lamps, and while the so-called Humphrey "gas arcs" have helped it to hold a good share of its store lighting, these are out of the question for residence work. The use of inverted gas mantles had been tried persistently, but the fixtures in common use were all designed for upward mantles and the mongrel appearance of the resulting combination offset whatever little talking points the inverted type might have. At best this inverted mantle seemed to be only a misfit rearrangement of the more familiar type, lacking the novelty and the talking points which have made the tungsten lamps so effective for the electric light people.

In this emergency the gas company at Chicago turned to the chemically colored mantles lately offered by its ally, the Welsbach Company, selecting one which gives an amber tint to the light instead of the greenish hue of the more familiar gas mantles. With it they planned to offer a self-lighting (by-pass) burner, a glass chimney, a shade holder and an opal dome shade, all for $1.60. Knowing that they could not compete with the tungsten lamps for whiteness of the light, they began by using quarter-page advertisements in the leading daily papers to expound the amber-colored light as "taking the place of the amber-colored glasses which oculists so often recommend." Then they sent out 150 solicitors, each wearing a cap marked "Gas Inspector" and carrying ten of these outfits. Going from house to house, the solicitors offered on behalf of the gas company to show the new lamp right in the user's own house without expense to the latter. Of course, the outfit as thus attached by them showed up far better than any flat flame burner; also better than most of the mantle lamps already in service, as it had a higher grade of mantle than the average and this was brand new, while the mantles already on the fixtures might have lost anywhere from 10 per cent to 70 per cent of their light-giving power. Few gas users know how much a mantle loses in candle-power during service, nor even how much its efficiency depends on its being adjusted for the right pressure, which adjustment would have to be made many times a day to match the widely varying gas pressures found in most parts of Chicago. Of course, the solicitor could easily adjust the air supply to match the pressure while showing the new lamp, leaving any old burners out of adjustment, and hence he could hardly fail to make a good impression.

If the customer wanted the new light the solicitor attached and adjusted the lamps, collecting no money, but getting the customer's signature to an order under which the charge for the outfits would be distributed over several future gas bills. The charge per outfit installed is $1.60, of which 30 cents goes to the solicitor; and as the lights speak for themselves (compared with run-down gas lamps) many of the men sell 250 a month. Where a customer fears that the cost of mantle renewals will be too high the solicitor offers a maintenance contract under which the gas company agrees to inspect the lights every month (or oftener if notified) and to replace any defective or worn-out mantles and chimneys. This is done for a monthly charge added to the gas bill and ranging from 10 cents per lamp, where five or more of the new lights are installed, to 25 cents for a single light.

To make this sales campaign still more effective Mr. T. R. Beebe, of the gas company, arranged to have fortnightly meetings held in rotation at the fifteen different stores in which mantles, gas stoves, etc., are sold by his corporation. Each of these meetings is attended by all of the men connected with the store at which it is held and by the managers of the fourteen other stores. The time is devoted to discussing the devices offered, the methods of installing them and the arguments to be used and met in making sales. Since starting these meetings some two months ago the efficiency of the salesmen is said to have improved so much that the fortnightly sessions are now to be extended so as to include various other devices which will increase the consumption of gas.

For the central-station manager this method of basing a sales campaign upon one particular type of lamp and fixture should be suggestive, as also the plan of holding frequent meetings for the exchange of experiences. The same sort of house-to-house campaign would seem feasible for the electric light men, with certain differences decidedly in their favor. They will not need to tint their lamps with a strong color, for they can offer an almost white light in the tungsten lamp. Neither will they be handicapped by that dissatisfaction which comes from offering a gas lamp adjusted to give a high candle-power when installed during the day, but not giving perhaps half as much light with the changed pressure during the evening. Nor need they try to explain away the blackening of the ceilings above the old lamps or the devitalizing of the air by consuming its oxygen in the gas burners. Hence central stations have nothing to fear from gas campaigns of this sort, but they can profit by the example, and in some cities by an early house-to-house canvass offering tungsten incandescent lamps on a similar easy-payment plan may steal a march on the gas companies, which are just beginning to realize that they must fight hard to hold their own against electrical competition.

WAUPACA STREET-LIGHTING CONTROVERSY.

A controversy over arc street lighting has arisen at Waupaca, Wis., which is of considerable interest to the central-station industry and in many respects is similar to the famous Colorado Springs lighting controversy, which was arbitrated before experts in 1907. A hearing was held before a special agent of the Wisconsin Railroad and Public Service Commission at Waupaca, Wis., Dec. 15 and 16.

The main points at issue in the case appear to be whether a 6.6-amp inclosed series alternating-current arc lamp is the equivalent of a 6-amp or 9.6-amp series open-arc lamp for practical street-lighting purposes; also, whether after the city has accepted the inclosed lamps for a number of years it is legally estopped from claiming any rebate or damages. There were several modifying circumstances in the main points at issue as just outlined, which modifications will be explained in what follows.

It appears from the testimony given at the hearing at Waupaca that the City of Waupaca in 1903 entered into a contract with the Waupaca Electric Light & Railway Company to light the streets for a period of ten years with lamps of nominal 2000 cp. The company was using at the time of the contract the old-style open-arc lamp, but testimony varied as to whether the current was 9 amp or 9.6 amp. This was the same lamp that had been used under previous contracts and had been described in a similar way. In 1903 the company changed its street-lighting system, using series inclosed alternating-current lamps of G. I. manufacture, with G. I. regulators rated for 6 amp to 7 amp. These lamps were, when installed, adjusted, according to all testimony, at 6.6 amp. This condition obtained until about March, 1910, when, after some controversy between the City

Council and the company as to the value of the present street light, the company increased the current to 7 amp.

It appears from the testimony that the change of street lamps was talked over at various times with members of the City Council by Mr. Irving P. Lord, general manager of the company. No formal authorization of the change was made, however. For a period after the change the bills of the company for lighting were receipted with an indorsement to the effect that the city waived none of its rights under the contract in paying these bills. Except for this the city authorities apparently took no definite action until about a year ago, when the Mayor and some members of the City Council, having been led to believe from various sources that the lamps being furnished by the company were not the equals of the old ones, began an investigation with the result that an inspector of the Wisconsin Public Service Commission was sent to Waupaca and also made a brief investigation. The inspector reported upon the history of the case as nearly as he could obtain it by conversation with various parties, and called attention to the Colorado Springs decision and to the 1908 report of the National Electric Light Association committee on street lighting, in both of which the 7.5-amp inclosed arc is rated as the equivalent of the old 9.6-amp open arc and the 6.6-amp arc is placed in a lower classification.

Offers were made for compromise and arbitration by both sides, but apparently without result, and the city refused to pay the company's bills. This resulted in a suit being started by the company to force payment of these bills. It was finally agreed by the company and the city to refer the whole matter to the Wisconsin commission for decision and arbitration.

The hearing, which was held at Waupaca Dec. 15 and 16, was conducted by a special agent of the commission, Mr. Samuel T. Walker, evidence being taken in shorthand for review by the commission at Madison. The hearing was of considerable interest, it being the first time a question of this kind had been brought before the Wisconsin commission. Mr. William T. Fisher, of Merrill, Wis., acted as attorney for the city and Mr. Parks, of Stevens Point, Wis., for the company. The expert on behalf of the city was Mr. James R. Cravath, consulting engineer, Chicago, and on behalf of the company, Mr. W. D'A. Ryan, of the General Electric Company. The testimony was taken under oath as in court proceedings, but many of the court formalities were omitted in order to save time and get quickly at the fact. For example, cross-examination of experts by each other was permitted on technical matters, a proceeding almost unheard of in courts and one at which many lawyers would doubtless hold up their hands in horror, but the result was undoubtedly much saving in time and useless questioning.

The city granted at the outset that the old open lamps fulfilled the specifications of the contract. On the technical points involved the experts were nearly in accord. Both agreed that street illuminants should be rated largely according to the illumination obtained from them at considerable distances from the lamp. In other words, for arc lamps the candle-power between 3 deg. and 5 deg. below the horizontal was agreed upon as being the fairest comparative test. Both experts cited the 1908 report of the committee on street lighting of the National Electric Light Association. This report gives an arbitrary value of 3.5 to the 6.6-amp series alternating-current inclosed-arc lamp as against a value of 4 to 9.6-amp direct-current open-arc lamp. Mr. Ryan, who conducted the tests upon which this rating was based, stated, however, that the actual difference found in the tests was not quite as great as the ratio of 3.5 to 4. The ratio of 3.5 to 4 had been adopted because he considered it undesirable to have too many general classifications. He gave it as his opinion that with lamps properly maintained and operated a 7-amp inclosed lamp would be the equivalent of the old 9.6-amp open arc. He also emphasized the greater steadiness, lower intrinsic brilliancy and better light distribution inherent in the inclosed arc.

In testifying for the city Mr. Cravath cited various tests and opinions to the effect that the 6.6-amp inclosed arc is not the equivalent of the old 9.6-amp open arc, and that if a substitution is made, the 7.5-amp inclosed-arc lamp should be used. He cited the decision in the Colorado Springs case where 20 per cent was awarded as the difference between the two lamps, and summed up the testimony of various experts in that case on this point. He also cited the tests carried on for the National Electric Light Association committee by Prof. C. P. Matthews on the photometric values of arc lamps, and reported to the association at its 1902 convention as showing that the real difference between the two lamps was known as far back as 1902. He also gave his own estimates and cited the opinions of other experts on the saving in cost of trimming and carbons by the introduction of the inclosed-arc lamp. He also gave the results of watt tests taken at the terminals of thirteent different street lamps in Waupaca Dec. 9, 1910, which showed an average of 415 watts. This, he said, indicated that the lamps were not being maintained in a condition to give the light whch should be expected of a 7-amp or even a 6.6-amp lamp. He also gave results of a limited number of candle-power tests made on the same lamps the same night, which also indicated that the lamps were not being properly maintained. These tests were made with the photometer about ten times as far away from the lamp as the height of the lamp to conform to National Electric Light Association recommendations. He did not consider the test extensive enough to be of conclusive value as an average, but in general it indicated bad conditions. The three lamps tested averaged respectively 197 cp, 113 cp and 140 cp. The maximum observed candle-power was 336 and the minimum observed 78.

Mr. I. P. Lord, general manager of the lighting company, and Mr. Francis Raymond, of Chicago, who sold the inclosed-arc lamp equipment, both testified that the 6.6-amp inclosed lamp was being generally sold and installed as an equivalent to the 9.6-amp open arc at the time this change was made.

The case will probably not be decided for some time. Such controversies are unfortunate, and the lesson for electric lighting companies in them is that contracts for street lighting should be as definite as possible, and if not based on illumination performance should be for some specified type of lamp. Eventually all illuminants should have a primary rating based on mean spherical candle-power representing the total light output, with perhaps a derived secondary rating to conform to the type of lamp or conditions of illumination.

Wiring and Illumination

TEMPORARY STREET-LIGHTING CIRCUITS.

By W. S. Quimby

During the recent "Home Coming Week" celebration held at Phœnixville, Pa., effective use was made of special electric signs and street arches. A "Welcome" sign was suspended across one street and festoons of incandescent lamps were placed along both sides of the streets along several blocks in the center of the town. All of the lamp sockets used were of the weatherproof style, placed 2 ft. apart on the conductors, the whole being carried on a steel messenger wire. The wire for the spans, which varied from 50 ft. to 200 ft., was stretched out along the ground, all of the twists, kinks and crosses being removed while it was in this position. As the spans were made ready, they were lifted into position and tied in under the trolley span wires several feet from the poles. A block and tackle was used to tighten up the spans.

At street crossings and at three intermediate places span wires were stretched across the street from the top of the trolley poles and above the trolley wire; on these wires were placed strings of lamps forming small arches.

As the primary leads in the alternating circuits in the part of town where the temporary circuits were installed were already overloaded it became necessary to utilize energy from a 500-

volt motor circuit. The temporary lighting circuits were arranged for multiple-series distribution, the lamps being grouped in banks of five, each bank containing sixty lamps.

In the "Welcome Home" sign use was made of 28-in. letters in the first word and 16-in. letters in the last. The letters were made of tin completely incasing the sockets, which were joined in multiple. The number of lamps in the letters were such that the circuits of two or three letters had to be placed in parallel in order to secure banks of equal size, the extra lamps

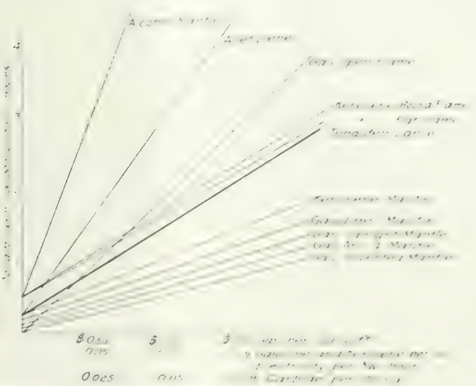
Electric Street Sign.

needed being festooned beneath the sign. A keystone outlined with lamps surmounted the "Welcome Home" sign.

The total number of lamps used in the temporary circuit was 2365, all of which were 16 cp with the exception of 475, which were 8 cp. The latter lamps were arranged in a separate multiple-series circuit. The special lighting was in service for thirty-two hours and consumed 4276 kw-hours. The entire display cost less than $600.

COMPARATIVE COSTS OF PRODUCING LIGHT WITH DIFFERENT ILLUMINANTS.

At a meeting of the Chicago Section of the Illuminating Engineering Society, held on Dec. 15, Prof. J. M. Bryant and Mr. H. G. Hake, of the School of Electrical Engineering, University of Illinois, presented a paper on "Comparative Costs of Producing Light with Different Illuminants," embodying the



Comparative Cost of Total Light Produced by Various Illuminants.

results of investigation and research work carried on at the University Experiment Station at Urbana, Ill.

The data presented dealt with thirty-one different kinds of electric lamps and with ten principal kinds of combustive illuminants. The results of the investigation for the electric lamps were arranged for comparison in a table, reproduced herewith, showing the watts consumed by each illuminant as measured at its terminals, the total lumens produced by it, the kw-hours con- [illegible] determinations, said Mr. Hake, were made in the university laboratory, but in some instances values given by manufacturers and others were taken, where it was possible to check these carefully. The thirty-one illuminants compared are listed as follows in the order of their efficiency:

Regenerative d.-c. series arc	[illegible]	[illegible]	11[illegible]	[illegible]	0.339
R[illegible]	[illegible]	[illegible]	11[illegible]	1[illegible]	0.527
Magnetite d.-c. series arc	[illegible]	[illegible]	7,370	1[illegible]	0.729
[illegible] d.-c., inclined electrodes	[illegible]	[illegible]	8,640	[illegible]	0.837
Me[illegible]	[illegible]	[illegible]	4,400	1[illegible]	0.89
Flame arc d.-c., inclined electrodes	8.0	1[illegible]	6,140	[illegible]	0.966
[illegible] d.-c., vertical electrodes	8.0	1[illegible]	[illegible]	1[illegible]	0.966
Luminous arc, d.-c., multiple	6.6	[illegible]	7,370	9.85	0.988
[illegible] series	9.6	[illegible]	5,025	9.55	1.079
Magnetite arc, d.-c., series	4.0	[illegible]	2,870	11.15	1.13
Flame arc, a.-c., vert. electrodes	10.0	[illegible]	5,340	[illegible]	1.275
Flame arc, a.-c., inclined electrodes	[illegible]	[illegible]	[illegible]	[illegible]	1.275
Open arc, d.-c., series	6.6	[illegible]	2,920	11[illegible]	1.305
Tungsten, series	[illegible]	[illegible]	626	1[illegible]	1.[illegible]
Flame arc, a.-c., inclined electrodes	8.0	[illegible]	3,910	[illegible]	1.405
Inclosed arc, d.-c., series	6.6	[illegible]	3,315	1[illegible]2	1.459
Luminous arc, d.-c., multiple	4.0	[illegible]	2,870	1[illegible]2	1.[illegible]
T[illegible]	0.545	[illegible]	475	1[illegible]	1.[illegible]
N[illegible]	1.87	[illegible]	[illegible]	[illegible]	[illegible]
N[illegible]	1.87	[illegible]	[illegible]	[illegible]	[illegible]
Inclosed arc, [illegible]	7.5	[illegible]	[illegible]	[illegible]	2.05
Inclosed arc, [illegible]-c., series	[illegible]	[illegible]	[illegible]	21[illegible]	2.193
[illegible], multiple	[illegible]	[illegible]	[illegible]	21.1	2.31
T[illegible], multiple	[illegible]	[illegible]	[illegible]	[illegible]	2.504
Carbon, 3.1 w.p[illegible], multiple	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Carbon, 3.5 w.p[illegible], series	[illegible]	210	[illegible]	[illegible]	[illegible]
Carbon, 3.5 w.p.[illegible], multiple	[illegible]	[illegible]	[illegible]	33.7	[illegible]
Inclosed arc, d.-[illegible], multiple	[illegible]	[illegible]	1,535	35.8	[illegible]
Inclosed [illegible], multiple	[illegible]	385	1,030	37.4	[illegible]
Inclosed arc, a.-c., multiple	[illegible]	430	1,124	38.3	[illegible]
Inclosed arc, a.-c., multiple	[illegible]	[illegible]	[illegible]	41.[illegible]	[illegible]

The values given for the cost of operation of the thirty-one illuminants included, besides the cost of electrical energy, the average outlay for maintenance, renewal and cleaning, but did not cover the fixed charges of investment, etc. The flame arcs tested were photometered with their opal globes in place as furnished by the manufacturers. In each case of the original measurements the lamps used were virtually new or newly trimmed, the tests being made as soon as stable conditions were reached and allowance made for the efficiency to be expected during average life conditions.

Mr. Hake also exhibited curves showing the cost of ten principal flame illuminants, using gas, gasoline, kerosene, acetylene and alcohol as fuels at various prices per unit of fuel consumed. For convenience the cost curve of the tungsten electric incandescent lamp was also plotted, as shown in the accompanying diagram. The speaker remarked that the electrical man must find other arguments than low cost of operation to urge even the tungsten lamp against the competitive illuminants. The accompanying diagram of costs, as prepared by Mr. Hake, makes it possible to compare the costs of producing a given quantity of light by any illuminant at given rates of cost of fuel or electricity.

Mr. Ward Harrison, of the National Electric Lamp Association, objected to a comparison of the tungsten lamp with flame illuminants under the conditions given, declaring that the percentage of utilization by reflectors of the light produced with gas, for example, 25 per cent, is much below that possible to utilize with tungsten lamps, 50 per cent to 60 per cent. The initial candle-power of gas-mantle lamps also fails rapidly, due to dust, shocks, minor cracks and chemical changes, with use, showing a sustained value of only 60 per cent or 70 per cent

of that initially recorded, as in the tests of new mantles quoted. The pilot flame of a "gas arc" fixture, he said, constitutes a heavy fixed cost, consuming from 25 per cent to 30 per cent of the amount of gas actually burned in the mantle burners during a year's operation. The relative cost of lighting, with gas at $1 per 1000 cu. ft. and electricity at 10 cents a kw-hour, will be found to vary less than 10 per cent on each side of the same amount when tungsten lamps and gas mantles are used.

Mr. C. M. Axford, Chicago, suggested that a comparison of the effective lumens available on the working plane, rather than the total light flux produced, would be a fairer contrast of the illuminants. On account of the reflecting power of walls and ceilings the relative values given in the paper would apply more correctly, he thought, to interior than to outdoor lighting. Mr. A. L. Eustice, Chicago, observed that the observational data submitted with the results in the paper were too meager to admit of a discussion bringing out much of importance in the comparison of light sources tested. Since practically new units were used in each instance, he said, certain illuminants suffered by comparison with others whose sustained efficiency throughout their life was lower.

Prof. J. M. Bryant closed the discussion by calling attention to the advantages of conducting the tests so as to take account of the total light flux produced by each illuminant, permitting those investigators who want special questions answered to make use of the total flux results in determining the amount of light available for special distributions. Matters of flicker and color differences, said Professor Bryant, made the comparison of some illuminants difficult.

RECENT TELEPHONE PATENTS.

TRANSMITTERS.

A pneumatically operated transmitter is one of the latest instruments invented. The flat diaphragm secured at its edges and attached at its middle to a movable electrode of a microphonic button has long been known to the art. In the above-mentioned instrument, patented by John Sparks, of Kimberly, Cal., a balanced piston valve occupies the position usually given up to the button, while this latter is made double and mounted at any convenient point. Flexible tubes carry the air supply to the piston valve and from it to two air chambers one side of each of which is one diaphragm of the electrical part of the transmitter. When the main instrument is spoken to the diaphragm vibrates, carrying the balanced piston with it and admitting and exhausting air pressure from the pneumatic chambers. It is intended to handle much greater currents in this than in the ordinary transmitter and thus obtain increased volume.

No less than seven patents of recent issue refer to modifications of the transmitter by Mr. Felix Gottschalk, of New York City, all covering transmitters from which the usual flaring mouthpiece is omitted. In general, the patents concern means of concentrating the received tones upon the microphone button through the shape or treatment of the diaphragm. One of the patents describes a transmitter with a large aperture in the front and a disk-shaped diaphragm free at its periphery and secured to the front electrode at its middle. The rim of the disk flares outwardly rapidly at the edge and overlaps and becomes parallel to the front face of transmitter, which it just clears. A round-headed button piece is arranged to screw down over the projecting end of the electrode stud, thus covering it and inclosing the metal lock nuts ordinarily left exposed to the breath of the user.

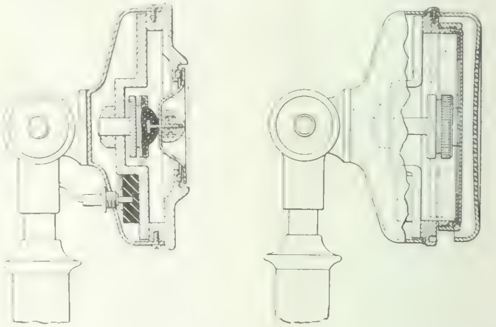
A second transmitter uses a flat diaphragm secured at the edges and exposed to voice waves, the connection between the electrode and diaphragm being made by means of an auxiliary disk or cone-shaped diaphragm bearing against the back of the flat diaphragm. The auxiliary diaphragm is so formed that it presents a flat surface to the rear face of the flat one rather than an edge.

In another a spider replaces the above auxiliary diaphragm and the flat diaphragm is flanged and put under radial tension by a clamping ring bearing upon the flange. The tensioning device is really akin to that of an ordinary drum.

Another patent describes a sheet-metal guard piece with circular perforated front and radial arms extending back to engage the heads of the usual rim screws of the transmitter. The transmitter is provided with the disk-shaped diaphragm and the guard protects it.

As another variation the cone diaphragm is mounted outside the usual flat diaphragm, the cone reaching well up into the usual aperture, from which the rubber mouthpiece has been removed. A ring with inwardly overhanging flanges is then screwed in so that the edge of the cone is not exposed, though free from contact. In another, the face piece of the transmitter casing is made with the overhanging flange at the aperture.

In the last a drum-head diaphragm is used under tension and a perforated box-like sheet-metal cover is arranged to protect the diaphragm. The edge of the cover slips into an angular groove of equal radius made in the face of the transmitter. Pins concealed in the groove engage registering angle slots in the cover piece, so that this latter is secured by a slight angular rotation. The accompanying engravings show two of the above transmitters which may be taken as examples of the two types.



Sound-Reproducing Device.

Mr. G. R. Taylor, of San Francisco, has also patented a transmitter having a special mouthpiece. The scheme may be understood by considering a transmitter of the usual design with a considerable section of the mouthpiece cut away, leaving the small end and the flare end in position. A metal frame is then fitted so as to hold these parts in their proper relative positions. An open wall mouthpiece is thus provided, the free space being greater as the metal frame is lightened.

A very sensitive receiver is the goal sought by Mr. H. R. Stuart, of Wheeling, for use with very weak currents, such as telephone currents. He uses a double receiver with a single diaphragm between the opposing pole-faces of the two co-operating magnetic systems. These are of the double-pole type, the permanent magnets being flanged rings which clamp the diaphragm between them and which are magnetized witn consequent poles. Radial pole-pieces project inwardly from the polar points and these carry, perpendicularly to the diaphragm, the polar extensions with the magnetizing coils.

MISCELLANEOUS APPARATUS.

A telephone repeater of the tele-microphone type forms the subject of the patent issued to Mr. S. L. Campbell, of Prairie City, Ore. The claims relate to structural details of the parts.

A departure in receiver design is shown in the invention of Mr. H. R. Stuart, of Newark, N. J. He uses a pair of solenoids which rock an armature in response to received telephone currents. An arm attached to the armature vibrates the diaphragm in turn, being connected to it by a tension wire. A sound tube leads from either face of the diaphragm.

Letters to the Editor.

Scientific Abstractions in Relation to Scientific Realities.

To the Editor of Electrical World:

Sir:—I have read with interest the comments of Mr. G. T. Hanchett on "wattless power" in your issue of Dec. 15, 1910 (pp. 1430-1431).

Mr. Hanchett's suggestion that we call "reactions" all the excess currents and voltages which appear in circuits, and forever divorce from their names the words "power" and "watt," represents a formula which it is more easy to enunciate than to apply. It is true, perhaps, as a generalization. We can say iron rust is a chemical compound. Such a generalization, though useful for the purpose of general classification, does not tell us much about the nature of the thing, i. e., the "how" and the "why" and the "wherefore" of its "thusness," as one might put it. To get deeper into the nature of iron rust we have to invoke the aid of chemical or physical facts and theories. The facts must, necessarily, be real; the theories need not necessarily be so. Theories are merely psychological expedients whereby facts may be assembled, assorted and explained. A given assemblage of facts may serve as the basis for *several* "correct" and "consistent" theories. Mr. Hanchett's desire to deal with realities and to eschew abstractions is laudable enough as long as we are not interested in "causation." The moment we want to inquire into causes and reasons we find it desirable, and oftentimes we find it necessary, to use imagination.

Mr. Hanchett, as a scientific and philosophic thinker, knows this very well. He knows that science is full of fiction, and that some of the greatest figments of the imagination are to be found, not in romantic, but in scientific, literature. We accept and use them without hesitation, even though they are more impossible of physical realization and of belief than Munchausen's tales. Take a very well known case as an illustration. In mechanics we deal with *masses* as if they were concentrated at a mathematical *point*, and with *forces* as if they acted along mathematical *lines*. Can we conceive of anything more impossible of realization than the condensation of a finite mass having a finite volume into a mass having zero volume without any loss of mass? Could we conceive of a more difficult "miracle" for the Almighty to perform? Yet this miracle has been performed, without a hitch, millions of times, since the days of Newton and Galileo—the first two "wizards" who performed it. This physical impossibility has come to be so "real" and so "natural" to us that we should be surprised if anybody questioned it. What is the reason for our implicit faith in this figment of imagination? Simply this—it has never clashed with the facts, but, on the contrary, has helped us countless times, with unerring precision, to assemble, assort and even *discover* facts. Contrast, in the mind, the ease with which one can grasp the physical significance of a *moment of inertia*, for instance, by the aid of that figment with the difficulty of doing so *without* it. Think how difficult a study analytical mechanics would be if it were not for the very helpful assistance of the "fictions" underlying it. The polygon of forces and substantially the whole of vector geometry are based upon figments of the imagination. Yet, has any instrument or process ever been devised by the human mind which is more wonderful and more powerful for the purposes of analyzing, of combining, decomposing or resolving forces than the polygon of force—vectors? We could not do without it anywhere when we have to deal with forces of composite or complex nature. I can scarcely believe that Mr. Hanchett wants to banish it from alternating-current analysis in spite of his peremptory tone.

If he is willing to admit the existence of current-*reactions* and voltage-*reactions*, he ought to be willing to concede the possibility, at least, of reaction-*currents* and reaction-*voltages*. This is a case where "turn-about is fair play" in more senses than one. Moreover, Mr. Hanchett would find it very difficult indeed to formulate the modernized or extended Ohm's law, to which he refers, without having proper terms to designate the various force-factors of the different kinds of energy which necessarily have to be taken into account, including the energy which is *stored*, *restored* or *dissipated* by means of three distinct kinds of reactions, namely, kinetic or acceleration reactions, potentials or elastic reactions, and damping, attenuating or resistance reactions.

Many of the "reactions" introduced in alternating-current analysis may be mere figments of imagination, whose physical existence, by themselves, could not be demonstrated. That circumstance does not prevent them from being very useful quantities, the same as our fictitious mass of zero-volume. The one strong point in their favor is that the use of these *seemingly* artificial, spurious, unreal "reactions" does not lead us away from the correct *end-results*. We may be flying through empty or imaginary space in using them, as we do when we use masses of zero-volume; but, as we always "land" safely on *terra firma* at the end of the trip, we need not be alarmed. The end justifies the means. *Finis coronat opus.*

So, let us not strain at little "gnats" like "reaction-voltage" or "reaction-current" when we swallow, without hesitation, some "whoppers" among the "camels" of scientific theory. These things are not more fictitious than many others which we all accept without hesitation. Personally I do not consider these "gnats" fictitious at all. On the contrary, I consider them both real and useful. Because the values dealt with practically are "resultants" of a sum of vectors which have various magnitudes and directions we are not justified in denying the existence of the "component" vectors, as a whole, or of any of them in particular. It is not at all necessary that every component should "materialize" separately and individually to prove its existence. It is enough that the existence of some of them has been proved. The existence of the rest follows as a matter of necessity, just as the third side of a triangle "follows" when two of its sides and the included angle are known.

If Mr. Hanchett wants to find some really serious cases of fiction in science, as consolation for such trifling misdeeds, let him read Poincaré's "Science and Hypothesis."

In regard to Ohm's law, it is as wrong to give Ohm too much credit as too little. There is no evidence that Ohm considered anything but the "damping" or resistance reactions. Even Kirchhof, who came after Ohm and certainly went far more deeply into the subject, fell short himself of the generalization which now makes Ohm's law for steady currents a particular case of a law applicable to variable currents and involving all three kinds of "reactions." As a matter of fact, that generalization was apparently unsuspected even as recently as twenty-five years ago. It has been "in the air" only since men like Rayleigh, Heaviside and Mascart began to devote attention to it; and it has been definitely recognized only in the last ten years, after being further elaborated and refined by some of our own contemporaries, chief among whom is Dr. M. I. Pupin.

New York. C. O. Mailloux.

Historical Electrical Apparatus for National Museum.

To the Editor of Electrical World:

Sir:—I have picked up and delivered to the National Museum, Smithsonian Institution, Washington, D. C., a few specimens of early electrical apparatus. This collection contains some very valuable historical specimens and should be added to largely in the line of specimens of early electric-lighting material. The early form of Bradley pressure indicator is very much desired, and there should be one or more of these in existence. This indicator was the invention of Mr. Charles S. Bradley and was first used at the old Pearl Street station. It was nearly 1 ft. square and stood on three leveling screws with fixture and scale at the front, and represented the original form of the Bradley-Howell lamp indicator which was the

standard engine-room voltmeter of the General Edison Com- [illegible]

The balance used for weighing zinc plates for the Edison meter is another desirable item which some of the old Edison central stations should be able and willing to contribute. The earliest form of porcelain cut-out seems to have disappeared from the collections examined. There are many other items which would be of great historical interest and which could be secured at the present time if those in position would take them out from attics and cellars to send to the undersigned or direct to the National Museum. It would have been a piece of great good fortune if any man had done for the development of electrical apparatus in general what Mr. William J. Hammer has done for the incandescent lamp, as all will agree who have seen the remarkable lamp collection so industriously and faithfully got together by Mr. Hammer.

Philadelphia, Pa. CHARLES WIRT.

Regenerative Electric Traction.

To the Editor of Electrical World:

SIR:—I have read with much interest the editorial in your issue of Dec. 15 on "Regenerative Control on Direct-Current Railways," since I have been closely connected for more than seven years with the development and experimental work in that line carried out by the Johnson-Lundell Electric Traction Company, of London, England.

As to the "adjustable-speed motor" being, as stated, more promising than the "shunt-wound" motor for regeneration purposes, so far as I can see, the variable-speed series motor, or, to be more explicit, the series motor capable of speed variation by means of field control, is not any more practical for regeneration than the ordinary series motor controlled by armature resistances.

A shunt characteristic is essential to regeneration, whether this shunt characteristic is obtained by the use of a shunt field proper or by the use of more or less independent excitation. a means for counteracting the armature field and providing a suitable commutating field is no doubt a great help, though from my experience I hardly believe it to be essential, because by providing a suitable series field which is opposed to the independent (of armature current) field during the period of regeneration the maximum rush of current can be adjusted to whatever is desired from a retardation point of view—i. e., to obtain a cushioning effect and avoid jerks—and these requirements will be found to be as such as to limit the current sufficiently to enable ordinary commutating means to take care of it.

The modern tendency to raise the line voltage from 500 volts to 1000 volts or 1500 volts will, of course, necessitate the use of special commutating means for regeneration, but at those voltages these means are needed equally much during propulsion.

It seems a pity that regeneration in connection with direct-current traction does not receive more attention. I do not believe that the possibilities as regards saving to be effected by regeneration and the monetary value of such saving are at all appreciated. If they were, there would be such a strong demand for regenerative traction that it would be but a short time before it would reach the highest practical standard of perfection.

Davenport, Ia. J. GUSTAF V. LANG.

[According to the Standardization Rules of the American Institute of Electrical Engineers, adjustable-speed motors are those "in which the speed can be varied gradually over a considerable range, but when once adjusted remains practically unaffected by the load: such as shunt motors designed for a considerable range of field variation." Variable-speed motors are defined as those "in which the speed varies with the load, decreasing when the load increases: such as series motors." The ordinary direct-current shunt-wound motor is designated as a "constant-speed motor."—ED.]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Three-Phase Series Motor.—R. R[illegible] [illegible] of his article on some properties of the three-phase series motor. The torque is proportional to the square of the voltage

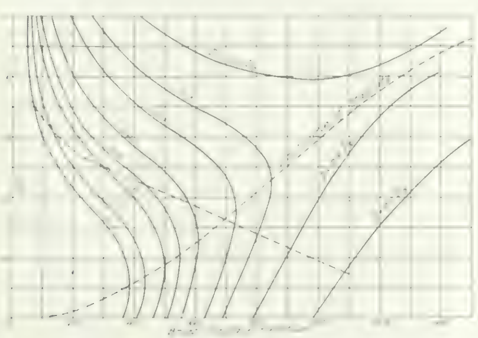


Fig. 1—Variation of Speed with Brush Position at Constant Torque.

[illegible] speed and the angle of brush displacement. Fig. 1 gives the speed as a function of the brush-displacement angle for different constant values of the torque *D*. The normal torque [illegible] [illegible] The ordinates give the ratio of the [illegible] the abscissas the angle of brush displacement. The curves are peculiar. For small brush displacement or for high speed the curves are similar to those

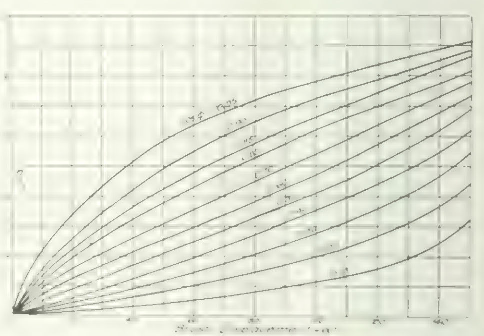


Fig. 2—Relation Between Power Factor, Speed and Brush Position.

of direct-current series motors. The speed decreases gradually with increasing torque and can be regulated very easily by brush displacement. An increase of the brush displacement from the short-circuiting position causes a decrease of the speed. But these statements are correct only to a certain ex-

tent, because the speed curves have a bending point at a lower speed, and especially for higher brush displacements, so that the speed then increases with increasing torque. This represents, of course, an unstable condition; the motor either runs up to a higher stable speed or it stops. The limit curve of stability is given by a dotted line in Fig. 1. Therefore, although it is possible to give to these three-phase series motors a strong starting torque by a suitable brush displacement, yet they cannot be maintained at low speeds; they continue to accelerate until they have passed the stability limit. The region of unstable lower speeds is a great disadvantage for various operations, but it can be completely avoided if the effective number of turns of the stator is made greater by a certain percentage than that of the rotor. Experiment shows that this simple remedy is very effective. The power-factor depends solely on speed and brush displacement. It is zero at rest, equals the cosine of half the brush-displacement angle at synchronism and becomes unity at double synchronism. It is given by the curves of Fig. 2. In order to get a power factor equal to unity for a speed below double synchronism it is necessary to make the effective number of turns of the rotor greater than that of the stator. This condition is just opposite to that given above for improving the stability region. Finally, results of actual tests of a motor are given.—*Elek. Zeit.*, Dec. 1.

Three-Phase Induction Motors.—TH. LEHMANN.—If the rotor of a three-phase motor is artificially brought up to synchronism it is well known that the wattmeter in the primary circuit shows a sudden reduction of the watt consumption when passing through synchronism. This fact has been explained in the past by the rotor hysteresis, the torque of which changes its sign in passing through synchronism. Benischke has recently claimed that the rotor hysteresis does not play any part in this because its torque was claimed to decrease with slip and to become zero at synchronism, and that the sudden drop of power is due to the total iron losses which are transformed at synchronism suddenly from the stator to the rotor and the driving engine. The present author endeavors to show that this theory of Benischke is wrong, and gives the theory of the rotor hysteresis at considerable length. The linear as well as the rotating hysteresis produces a torque independent of the slip. This torque changes its sign at synchronism; its numerical value depends solely on the hysteresis loss per cycle.—*Elek. Zeit.*, Dec. 8.

Ventilation of Inclosed Electric Machines.—P. AMSLER.—In order to cool inclosed electric machines effectively, ventilation channels are provided through which the cooling air is driven through the machine. The air, having passed through the machine, passes into a receptacle in the base of the machine in which it is cooled by means of copper tubes through which cold water flows. The cooled air is then driven again through the channels in the machine. By this simple means inclosed machines can be made to give the same capacity for the same temperature rise as open machines.—*La Revue Elec.*, Nov. 15.

The Irregularities in the Rotating Field of the Polyphase Induction Motor.—C. F. SMITH.—The full paper with illustrations, a shorter account of which was recently noticed in the Digest. The paper describes experiments to determine the amount of the irregularity. The investigations are based on the e.m.fs. induced in search coils on the stators of the motors tested.—Lond. *Electrician*, Dec. 9.

Generation, Transmission and Distribution.

Electric Energy for Agricultural Districts.—K. KROHNE.—The author reproduces an article from a daily German paper with a large circulation among farmers, in which it was claimed that central stations for energy distribution in agricultural districts are pushed by the manufacturing companies simply in order to sell their machines and not in order to help the farmer. It is doubted whether electric energy could be of so much use in agriculture. The present author criticises these remarks and shows in what respects electricity could help the farmer, although too much has been expected from it sometimes. Electric plowing will become more general when satisfactory energy supply will be available from large and efficient transmission plants. In the past at least twenty-eight electric plows have been put into operation. Of these, twelve are operated from an isolated plant, but six of these have already discontinued operation. In four cases a change is to be made to energy supply from a transmission system. Twelve electric plows are operated from transmission systems, but five have not yet been started on account of lack of available energy.—*Elek. Zeit.*, Dec. 8.

Water-Power in Sicily.—A note stating that although Sicily does not possess glaciers and is not rich in forests, there is sufficient water available for hydroelectric generation. In the Province of Syracuse the porous miocene limestone retains the water like a sponge, and powerful sources spring from the porous limestone belonging to the lias and jura of the interior. The eternal snow of Etna also gives plenty of water, and it has been calculated that 50,000 hp of waterfalls are available in Sicily. So far the Societa Elettrica della Sicilia Orientale has two plants—one in the northeast on the Alcantaro, and one in the southeast on the Cassibile. The main aerial distribution lines go along the east cost from Messina to Catania, Syracuse and Modica and have, with branches, a length of 130 miles. Further extensions are contemplated by this company, which has secured most of the water-rights. In the sulphur mines some 20,000 hp could be used. Here steam power is used exclusively at present, though coal is very expensive. The plant on the Cassibile River, on which a fall of nearly 300 ft. is utilized, renders available about 3000 hp. The construction of a reservoir has enabled twice the amount of power to be produced. On the Alcantaro 11,000 hp are gained; energy is generated at 50 cycles per second, 5250 volts, three-phase, and the tension is raised to 40,000 volts for the transmission.—Lond. *Eng'ing*, Dec. 2.

Electric Motors in Tin Mines.—An article on the electrically driven tin mines at Pusing Bharu and Siputeh, in the Malay peninsula. The power house contains three three-phase, fifty-period, 150-kw, 2200-volt generators. The e.m.f. of transmission is 2200 volts. The e.m.f. is reduced to 440 volts for driving various induction motors.—Lond. *Electrician*, Dec. 9.

Generating Station.—SIMONSEN.—The first part of an illustrated paper on the new steam-turbine generating station at Reisholz of the Rhenish-Westphalian electricity works. For the sake of the condensing water the plant has been placed directly on the River Rhine. In the present instalment details are given on the boilers, economizers and the treatment of the feed water.—*Elek. Zeit.*, Dec. 8.

Smoke Prevention.—A. J. SWITZER.—An article on the effectiveness of smoke prevention by means of steam-jet devices for boiler furnaces. The author gives data on the operating cost of these steam-jet devices and finds that they not only prevent smoke, but that the prevention of smoke is of considerable economy.—*Eng. Mag.*, December.

Traction.

Paris North-South Electric Railway.—A note on the recent opening of this railway. A 750-volt, three-wire system of distribution is employed. An overhead conductor is the positive outer, while a third-rail, outside the running rails, is used as the negative and the running rails as the neutral. In this way it is hoped that stray currents will be avoided. To insure perfect balance each train is worked by two motors, one of which is connected between the overhead conductor and the track and the other between the third-rail and the track. These motors are operated simultaneously by a multiple-control system, so that there is equal consumption everywhere. Two 100-kw motors are used with each train. The supply pressure is 2×750 volts. At the substations three-phase current at 10,000 volts or 15,000 volts is brought in from St. Denis or Ivry and is converted to continuous current at the working voltage. Signaling is effected by using a "permissive" signal at the entrance to each station, even if the preceding train has not cleared the block section in front. In case of accident the stoppage of trains in the tunnels is thereby prevented.—Lond. *Electrician*, Dec. 9.

Electric Railways.—C. Heilfron.—The first part of a profusely illustrated French translation of his recent German article on various details of electric equipment on trunk railways, giving an outline of the different systems and especially of the different motors and their regulation.—*La Revue Elec.*, Nov. 15.

Lamps and Lighting.

[illegible] R. W. [illegible] article giving briefly the chief data on service characteristics and relative economy of metallic-filament lamps with reference to different methods of manufacture.—*Eng. Mag.*, December.

Installations, Systems and Appliances.

Austrian Central Stations.—An account of the proceedings of the seventh annual meeting held last summer in Graz by the Association of Austrian and Hungarian Central Stations. The president, Karel, reported on the bureau for buying incandescent lamps which operates in conjunction with the lamp-testing bureau of the Vienna Municipal Central Stations. The value of the lamps bought by the bureau last year was $83,806, of which 63 per cent was for carbon lamps and the balance for metallic-filament lamps. The testing bureau tests about 300,000 incandescent lamps per year. Legislation in Austria and Hungary was the subject of several papers. Heicke reported on the commercial results of the introduction of metallic-filament lamps on the basis of experience of fifty-one central stations. The number of metallic-filament lamps in per cents of all incandescent lamps used by these stations varies between 3 per cent and 100 per cent, and averages about 36 per cent. While formerly the 16-cp carbon lamp was the standard, the average of the lamp size has now been raised to 36 cp for metallic-filament lamps. Only seven out of fifty-one stations experienced a reduction of energy consumption due to the introduction of the metallic-filament lamp; in three of these stations this loss has not yet been overcome. Ten other works have experienced a smaller increase than usual of energy consumption and attribute this to metallic-filament lamps. Out of forty-one stations twenty-eight were able to increase the num- [illegible] thirteen stations did not get such an increase. Out of twenty-four stations, eighteen state that metallic-filament lamps have greatly facilitated competition with gas lighting. New regulations have been proposed for first-help in electric accidents. Hartmann reported on amortization in electricity works.—*Elek. Zeit.*, Dec. 8.

Argentina.—G. Berndt.—An article giving statistical data on the central stations of Argentina. Details are given of the history, equipment, rates, etc., of thirty-seven stations. The total aggregate rating is 99,000 kw. Seventy-four per cent of this equipment is installed in Buenos Ayres. Fifty-four per cent of the total equipment in the country is driven by steam turbines, 40 per cent by steam engines, 5 per cent by water turbines, and 0.5 per cent by suction-gas engines. Twenty-six prime movers of 38,900 kw are of Italian make, twenty-five of 27,143 kw of German make, sixty-eight of 26,204 kw of American and English make, and the balance (a total of 9000 kw) of Austrian, Belgian, French and Swiss make.—*Elek. Zeit.*, Dec. 8.

Wires, Wiring and Conduits.

Submarine Cables.—C. Bright.—The first part of an illustrated paper on submarine-cable laying and repairing.—Lond *Electrician*, Dec. 9.

Electrophysics and Magnetism.

Magnetic Properties of Iron and Its Alloy in Intense Fields.—R. A. Hadfield and B. Hopkinson.—A paper read before the (British) Institution of Electrical Engineers. The magnetic properties of materials in fields of very high density are of great scientific interest, because the relation between B and H then assumes a very simple form. This relation is $B = H + 4\pi I$, where I is the sum of the magnetic moments of the molecular magnets per unit volume. If the moment of a molecular magnet can be assumed unaffected by the applied forces, I is constant when H varies, though it might vary with other physical conditions which affect a separate molecule. In this connection the experiments of Ewing and Low show that in iron, cobalt, nickel and some alloys the mutual attractions between the molecules are almost completely overpowered by a force of 2000 c.g.s. units, while the magnetic moments remain unaltered unless the force exceeds 25,000. The quantity I is called the magnetism of the material. The authors describe in detail experiments that they have made to test the behavior of different kinds of irons and iron alloys in fields more intense than 7000 c.g.s. units. The chief results are as follows: Every alloy examined, without exception, has a definite saturation intensity of magnetization. In most cases this is reached in a field of 5000 units, but in a few there is a small increase, as between 5000 and 25,000. The forms of the curves of magnetization connecting I and H in these exceptional materials, however, leave no doubt of the existence in them also of a saturation value of I. Every one of the materials tested, without exception, behaves as though it consisted of a mixture of magnetic substances with non-magnetic substances having a permeability not differing materially from unity. This holds good also for the non-magnetic or nearly non-magnetic nickel or manganese alloys, and in this respect the results differ from those obtained by Ewing and Low, according to whose experiments a nearly non-magnetic manganese steel had a constant permeability of about 1.4. Among all the alloys which have been tested there is none having a constant permeability differing from unity by more than 2 per cent. There is in the series no alloy having a higher specific magnetism than pure iron. The saturation value of I for pure iron of density 7.80 in absolute units is 1675, within 1 per cent. This is slightly lower than the values obtained by Ewing and Low and other experimenters. In an annealed iron-carbon steel in which other elements are present in small proportions the specific magnetism is less than that of pure iron by a percentage equal to six times the percentage of carbon. This result constitutes a verification, in the case of annealed iron-carbon alloys, of the linear relation connecting the magnetism of a mixture with the magnetism of its constituents. In this case there are two constituents mechanically mixed—namely, the pure iron and iron-carbide—the percentage of iron-carbide being 15.5 times that of the carbon in the steel. It is readily deducted from this equation that the magnetism of carbide of iron is about two-thirds of that of pure iron. Quenching an iron-carbon alloy from a high temperature reduces the specific magnetism by a large but somewhat uncertain amount. The addition of silicon or aluminum to iron results in a reduction in specific magnetism which is roughly in proportion to the amount added as though the addition behaved as an inert diluent. If carbon be present, however, silicon seems to neutralize its action to some extent. For instance, an alloy containing 2.28 per cent Si and 0.67 per cent C is 3.6 per cent less magnetic than pure iron, whereas if the carbon had its full effect, as in iron-carbon alloys, and the silicon were simply an inert diluent, the reduction would be 6.3 per cent. The observations on the alloys of iron with nickel and with manganese, or with both these elements, have failed to reveal any simple relation between their magnetism and their composition. It is probable that this is due to the peculiar effects of heat treatment on these substances.—Lond. *Electrician*, Dec. 9.

[illegible] *Cathode Rays Into Roentgen Rays.*—J. H. Gardiner.—A paper on quantitative measurements of the conversion of cathode rays into Roentgen rays by anticathodes of different metals. Various scientists have suggested that the metals of high atomic weight are best suited as anticathodes for converting the cathode rays which impinge upon them into Roentgen rays. A high melting point is also essential, as the cathodes become strongly heated, and anticathodes of osmium, iridium, tantalum, uranium, as well as anticathodes coated with these metals, have hence been tried. Quantitative measure-

ments of the efficiencies of different metals as anticathodes can be conducted in two ways, either by measuring the conductivity of a definite stratum of air exposed to the radiation (ionization method) or by measuring the density of the deposits of silver obtained after development of the latent image produced in a photographic film by the rays. The present author chose the photographic method, not unprepared for the difficulties he had to overcome. By preliminary experiments he first fixed the direction of maximum intensity of Roentgen-ray emission. According to G. W. C. Kaye (ionization experiment) this direction is at an angle of 30 deg. to the normal to the anticathode; according to the present author it is 30 deg. from the plane of the anticathode. The two observers (or methods) thus differ by 30 deg. The darkness of the silver deposits produced when the rays fell upon the plate through a slit in a lead shield, curved like a bulb, varied sufficiently to allow of measurements. But it was doubtful whether inequality in the thickness of different portions of the glass bulb and the gradual hardening of the bulb while being worked would not vitiate the effects. The author satisfied himself that the bulbs were sufficiently uniform and that the hardening effect, though real, would not disturb his results. He used Ilford X-ray plates, and Mees prepared for him special low-process emulsion plates of perfectly uniform film thickness. The experiments were made by comparing the efficiencies of a half disk of platinum, the standard metal, and of a half disk of the respective metal. The two half disks were mounted on an anticathode of nickel and clamped down upon the nickel and the cathode rays were deflected either to the right or to the left to obtain reflection from the one or the other metal; thus pairs of observations were taken in series. Use was made of direct current at 220 volts interrupted by a mercury jet-interrupter 125 times for each opening of the photographic window, and a plate surface of about 1 sq. cm was exposed for seven seconds after the tube had been working for three seconds. The results were peculiar. The order of the X-ray efficiency of the materials tested was: Iron, 40.4 per cent; nickel, 42.4; carbon, 60.4; aluminum, 65.7; silver, 66.4; gold, 86.1; tantalum, 90.5; uranium, 92; platinum, 100. The order of the atomic weights was: Carbon, 12; aluminum, 27; iron, 56; nickel, 59; silver, 108; tantalum, 181; platinum, 195; gold, 197; uranium, 238.5. Thus carbon and aluminum proved much more effective than would be expected from their low atomic weights, and gold and uranium much less. An alloy of nickel and platinum proved as efficient as platinum, and it resulted that the surface of this alloy to a thickness of 0.001 mm consisted of platinum; this anticathode was, therefore, practically a platinum anticathode—that is, until it cracked and began to fuse. The bulbs themselves did not get hot during the experiment.—Lond. *Eng'ing*, Dec. 2.

Gamma Rays.—D. C. H. Florance.—A paper giving, first, the results of an experimental investigation of the initial absorption of gamma rays by lead under ordinary experimental conditions. In the second part the author takes up the discussion of the secondary gamma radiation, dealing with its distribution and quality and discussing the question whether the secondary gamma rays are true secondary rays or scattered primary rays. His conclusions favor the opinion that the secondary gamma rays are scattered primary rays.—*Phil. Mag.*, December.

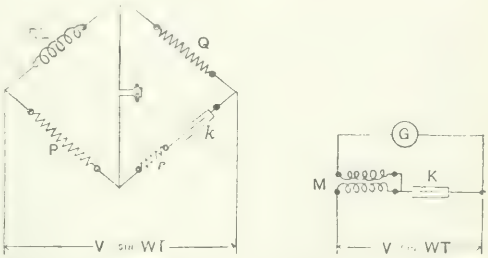
Hysteresis Loss.—R. Richter.—The author proposes to use for the hysteresis loss not the formula of Steinmetz, $V = B^{1.6}$, but a formula containing two terms, $V = aB + bB^2$. The total magnetization heat, including hysteresis loss and eddy-current loss, is then given by the formula $V = aB + (b + d) B^2$. This formula is more convenient for use in connection with the slide rule than the usual formula $V = CB^{1.6} + dB^2$. The author gives seven examples which show that the formula $B = aB + dB^2$ for the hysteresis loss gives results which are in more exact agreement with the measured values than the values calculated by Steinmetz's formula. The differences are less than one-half those found in Steinmetz's formula.—*Elek. Zeit.*, Dec. 8.

Electrochemistry and Batteries.

Ozone for Water Sterilization.—An illustrated article on the Otto system for sterilization of water by means of ozone. Figures are given on the cost of the Bon Voyage plant in Nizza. The energy consumption is 1.26 kw-hours per 100 cu. m, hence, the cost of the kw-hour being 0.6 cent, the cost of electric energy consumption is 0.0076 cent per cubic meter. The cost of maintenance and attendance is 0.036 cent and the cost of pumping 0.033 cent per cubic meter. Hence the total cost is 0.076 cent per cubic foot of water sterilized.—*La Revue Elec.*, Nov. 15.

Units, Measurements and Instruments.

Measurement of Self-Inductance and Effective Resistance at High Frequency.—C. E. Hay.—To measure the effective resistance of inductive circuits at telephonic frequencies is difficult in cases where the inductance is large compared with the resistance, as in loading coils for telephone circuits. On this account all the null methods known to the writer, which have been devised to measure self-inductance alone, are unsuitable, and especially so at frequencies of the order of 2000 per second. The author's new apparatus for this purpose is joined up like a Wheatstone bridge (Fig. 3), a telephone being used



Figs. 3 and 4—Diagrams Showing Connections of Instruments.

in place of a galvanometer. R is the effective resistance to be measured; L the self-inductance to be measured; PQ, non-inductive anti-capacity resistance (variable); r the balancing resistance (variable); k the balancing capacity (variable); w is 2π times the frequency of alternations. The resistance r must be capable of very fine variations, and also the capacity k; for the latter mica and air condensers are necessary. The insulation of the different apparatus and the wiring would be very high and in order that the capacity to earth of the leads to the source of the e.m.f. and the generator should not affect the test it is best to take the current to the network from the secondary of a transformer which has its windings highly insulated from each other. Means should also be adopted to avoid capacity between the primary and secondary windings. L and R are then given of the following formulas:

$$L = PQ \frac{k}{k^2r^2w^2 + 1}$$

$$R = PQ \frac{k^2rw^2}{k^2r^2w^2 + 1}$$

The frequency must, therefore, be known. At the moment of making a test the actual frequency can be determined electrically as follows: A variable mutual inductance and a highly insulated condenser of 1 microfarad are joined up to a sensitive thermo-galvanometer, as in Fig. 4. For the frequencies met with in telephonic work a condenser of 1 microfarad and a small range of low mutual inductance only are necessary. For no current through the galvanometer $w^2MK = 1$. The method is particularly valuable for measuring the effective resistance and self-inductance of loading coils used for telephonic purposes. Its usefulness is, however, not confined to this, as it appears to have great sensitivity over a very large range. The ratio R/L, which is required in connection with the loading of telephone cables, is very easily obtained by the method, being simply equal to krw^2.—Lond. *Elec. Review*, Dec. 9.

Phaseography.—M. Siegbahn.—An illustrated mathematical paper on the study of variable currents by means of the phaseograph. It is an oscillograph with two movable systems, one registering strength of current, the other voltage, and the chief feature is that the two movable systems are made to co-operate. The apparatus consists of two parts: the electromagnet and a box of brass with an ebonite or slate lid. The electromagnet is made of a soft-iron ring with four upright iron rods. Each of these is covered with a solenoid of copper wire. The solenoids have been arranged so as to close to 80 volts if coupled in series. In the brass box are fixed four pole-pieces of the shape indicated by Fig. 5. Each of these is provided with a cylindrical plate which fits one of the four electromagnets. In the magnetic field *NS*, *N'S'* are extended two thin silver wires (diameter 0.02 mm) *AB* and *CD*. The tension in these wires can be regulated by means of special screws. The larger screws are used for turning on the electric current. At the crossing point the two wires are insulated with a plate of mica and are also provided with a smaller mirror. If a constant current is made to pass through one wire, for example, *AB*, one-half will be lifted owing to the magnetic field, and the other will be pressed down, hence the mirror will be turned at a certain small angle. With sufficiently small angles the turning is proportional to the strength of the current. Owing to the great tension in the wire the new equilibrium is not restored until after a considerable time of oscillation. If the box is filled with a suitable damping fluid this movement can be made aperiodic. Castor oil is used. The mounting and the special arrangements are shown in Fig. 6. The Nernst-style *A* throws a sharp light on a small diaphragm, which at exposure can be shut out with a shutter. By the aid of the two lenses, L_1 and L_2, an image is formed on the ground-glass plate *EF*. For photographic purposes the latter is replaced by a chassis with plate. The lens and the diaphragm are sheltered from outside light by a cardboard tube. In order to study a current curve—that is, use the phaseograph as an ordinary single oscillograph—a revolving mirror with driver is put on, and the ground-glass plate is removed. The image then appears on the screen *BC*; the desired current curve is obtained by putting the mirror in rotation. By means of binding-screws and interrupters ($S_{1\ 2\ 3}$) on the outside of the box the electric current is conducted to the electromagnet (S_1) and the two measuring wires (S_2 S_3). The author deals briefly with other double oscillographs and describes more in detail the working of his apparatus and its application to the registration of the relations between current and voltage in alternating-current circuits with self-inductions, capacities, transformers, etc.—*Phil. Mag.*, December.

Figs. 5 and 6—Phaseograph.

Temperature Compensation of M[illegible] The author deals with the temperature compensation of Swinburn for millivoltmeters which with a shunt are to be used as ammeters with zero temperature-resistance coefficient. The arrangement is shown in Fig. 7, where the copper winding w_2 of the instrument is in series with a manganin resistor w_1, so that both together have a temperature coefficient smaller than that of copper. These two resistors are connected in parallel with a copper resistor w_3 and the whole combination is in series with the manganin resistor w_4. Let E be the potential difference between the terminals A and B of the instrument for a current i in the coil w_2 and for a certain initial temperature. It is then always possible to select the resistance of w_4 so that the potential difference E between A and B remains the same for another temperature, the current i being the same. The author deals mathematically with the problem of selecting the resistance of the resistor w_3 and the joint temperature coefficient of $w_1 + w_2$ so that E becomes as small as possible, and of finding the minimum value of E. A numerical example is added.—*Elek. Zeit.*, Dec. 1.

Non-Inductive, Low-Resistance Standard.—C. V. Drysdale.—An illustrated article on a new form of non-inductive, low-resistance standard or shunt. The resistor described is made by cutting the electrodes into a number of thin strips or fingers which intercalate with one another, thus reducing the inductance to a very small figure. Several different forms of construction are described and illustrated.—Lond. *Electrician*, Dec. 9.

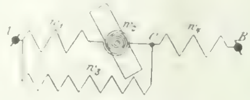


Fig. 7—Plan for Temperature Compensation of Millivoltmeters.

Analysis of Alternating-Current Curves.—A. Schleiermacher.—A mathematical paper on the method of resolving a periodic function in the form of a Fourier series by arithmetical analysis. The object is to reduce as much as possible the number of tiresome multiplications.—*Elek. Zeit.*, Dec. 8.

Telegraphy, Telephony and Signals.

Cable Recorder.—A. C. Crehore and G. A. Squier.—A paper describing a cable recorder in which variations of current are recorded by means of interference bands or fringes. The coil in the recorder carries two small, thin plates of optical glass for producing interference bands. When the current is passed through the coil a torque is produced and transmitted through silk fibers to the upper glass plate, thus changing the pressure between the plates and altering the thickness of the thin film of air confined between them, and thus moving the system of interference bands. A commercial mercury-vapor lamp may be used. A current of 20×10^{-6} amp is a good working value for this recorder. The corresponding value for the syphon recorder is 42.5×10^{-6} amp.—Lond. *Electrician*, Dec. 9.

Frequency of Telephone Currents.—K. W. Wagner.—An account of an experimental investigation carried out in the German Telephone Department. The chief result is that in the transmission of speech by the telephone only the frequencies between $2\pi f = 3000$ and 6000 are essential. To determine the efficiency of telephone transmission it is chiefly necessary to consider the frequency $2\pi f = 5000$ per second. The damping coefficient should be made as small as possible for this frequency, while the uniformity of the damping coefficient for a wide range of frequency is of much smaller importance.—*Phys. Zeit.*, Dec. 1.

Fire-Alarm System.—An illustrated description of a new fire-alarm system devised by L. T. Reichel. It is unaffected by dust and vibration, as no line contacts are involved, nor are there batteries. The Reichel system depends upon the use of thermopiles made up of couples of bismuth and an antimony alloy. Such couples are mounted in a porcelain block *C* in such a way that only one series of junctions *AB* is exposed to the air (Fig. 8). The blocks, with their couples protected from accidental mechanical injury by a suitable grid, are mounted on the ceilings of the apartments which it is desired to protect. The room may be gradually heated to any degree of temperature that comfort or utility demands without affecting the alarm device, due to the fact that the length of each couple is so short that the temperature lag of the unexposed junction follows closely behind the exposed junction, so that at an ordinary rate of temperature increase little or no thermo-e.m.f. is generated, whereas if a sudden rise of temperature occurs in a room where the pile is installed, such

as would arise from even a small conflagration, a thermo-e.m.f. will instantly be generated sufficient to operate the alarm. The indicator, Fig. 9, consists of a sensitive moving-coil relay, the tongue of which carries a light iron disk I upon which the platinum contact point is mounted. In juxtaposition thereto is an adjustable iron screw *AS* which carries the fixed contact and which is magnetized. These contacts form part of a local circuit, including a suitable battery and such warning bells *B*

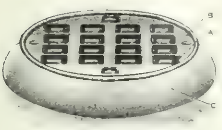


Fig. 8—Thermopile.

Fig. 9—Indicator.

as are necessary. A deflection of the coil from its normal position moves the iron disk into the range of magnetic pull of the screw when the former is pulled over and the contacts held firmly together until the coil is restored by hand. The adjustable screw forms a ready means of fine adjustment of the range of operation of the warning, already approximately determined by the selection of the number of couples in the detectors *T*. The moving coil also carries an arm to which is attached a disk *D*, which, according to its position, displays the words "safe" or "fire" through a window in the indicator case.—Lond. *Elec. Review*, Dec. 9.

Wireless Time Signals.—G. W. O. HOWE.—An illustrated description of the arrangements made at the Central Technical College, in London, whereby the Norddeich wireless-telegraph time signals can be checked against Greenwich time with an error not exceeding 0.1 second.—Lond. *Electrician*, Dec. 9.

BOOK REVIEWS.

ANALYSE DES MÉTAUX PAR ÉLECTROLYSE. By A. Hollard and L. Bertiaux. Paris: H. Dunod and E. Pinat. 256 pages, 18 illus. Price, 9.50 francs.

This is a thoroughly practical treatise on electrolytic analysis of metals, describing processes, details and precautions. The first part deals with the principles of analysis by electrolysis and a classification of metals from this standpoint. The second part discusses the treatment of the electrolytes to be analyzed. The third part takes up the metals in succession, and the fourth gives a number of actual experimental results obtained. The book will be of interest and value to students of electro-chemistry and of chemical analysis. It is very clearly written and each process is reduced to its lowest terms in expression.

THE STORY OF THE ATLANTIC CABLE. By Charles Bright. New York: D. Appleton & Company. 222 pages, 54 illus. Price, $1 net.

Mr. Bright has already written on the submarine cable in more voluminous form, but his larger volumes are not generally accessible to the American public. He now tells the story again very succinctly and well, and his book is a useful and desirable companion to that by Dr. Field, who may perhaps be said to have taken the American point of view. Aside from the historical portion, which is, of course, by no means new, though ever interesting as a narrative of a great achievement, there is much other matter of value, in handy condition. Mr. Bright gives details as to existing lines, tariffs, capitalization, etc. He states that the fifteen Atlantic cables now in existence represent $100,000,000, with a gross annual yield of $6,000,000. The reproduction of some of the old plates and portraits was a good idea. Mr. Bright's treatment of the subject is popular, and is intended for the general reader rather than in any sense for the technical student.

WORK-ACCIDENTS AND THE LAW. By Crystal Eastman. New York: Charities Publication Committee. 361 pages, illus. Price, $1.50.

The present volume is one of six presenting the findings of the Pittsburgh Survey and is one of the Russell Sage Foundation publications. The field work upon which the discussions are based was done between July 1, 1906, and June 30, 1907, a period of great industrial activity during which 526 men were killed in work-accidents in Allegheny County. The work is divided into three parts, namely: Causes of Work-Accidents, Economic Cost of Work-Accidents, and Employer's Liability The last 100 pages are given over to 12 appendixes consisting of articles by various specialists, reports of various bodies and classified data. Miss Eastman immediately dispels certain common illusions by demonstrating that by industrial accidents Allegheny County loses more than 500 workmen every year, of whom nearly 50 per cent are American born, about 70 per cent are skilled workmen and 60 per cent have not yet reached the prime of their life.

In the part on causes the industries are classified under the following heads: Railroads, coal mines, steel mills and miscellaneous, and a chapter devoted to each. The economic cost is studied by analyzing the accident cases occurring in the district and showing the consequences of the accidents and the compensation received.

The facts and data are presented in a very intelligible manner, frequent use being made of diagrams to bring out forcibly the meaning of certain groups of comparative figures. The book represents the results of a great and good work and the information here presented should be of great value in the guidance of those engaged in bettering the existing conditions surrounding American labor.

New Apparatus and Appliances

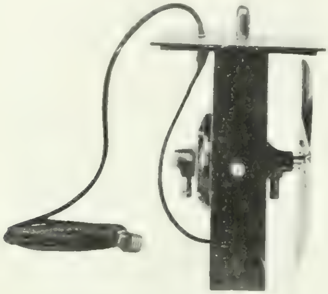
APPLICATION OF FAN MOTORS FOR WINTER USE.

It has been the popular opinion that the range of usefulness of the electric fan motor is limited to the summer months and that its sole utility lies in its application as a means of reducing the temperature of a room or an office. The public, however, is slowly but surely beginning to understand that the usefulness of the fan motor is by no means confined to the hot days of summer. Following are a few of the more important applications of the fan motor to winter use which have from time to time been pointed out in these columns:

The efficiency of the hot-air heating system may be greatly increased by placing a fan motor in the cold-air box to force the air through the registers to all parts of the house. On particularly cold days, when the wind is so strong that it forces the air through the furnace into the rooms without having become heated, a fan motor placed in the cold-air box, after having closed the slide which permits air to come in from the outside and opening the slide which lets the air in from the cellar, will cause an appreciable rise in the temperature of the room without making any increase in fuel consumption.

It is very often the case that the house contains a room or

rooms which under certain conditions are difficult to heat. This difficulty can be overcome by placing a fan motor in front of the hot-air register or over it in case the register is located in the floor. This plan will prove more efficient if the register and fan motor are covered by a box or hood of some kind which will cause the fan motor to draw air from the pipe only and not from the room.



Electric Fan for Winter Use.

In a house heated by hot air or steam increased radiation of heat and consequently a warmer room may be obtained without any difficulty by placing a fan at the end or back of the radiator.

Another manner in which the fan motor may be used to advantage in winter is to prevent the accumulation of frost on show windows of stores. The air from the fan motor directed against the glass of the window will keep it practically free from frost. This application of the motor is a boon to merchants who have heretofore during the cold weather lost practically all the advantage which their window display accomplishes. The outfit shown herewith is built by the General Electric Company.

MILL CLUSTER.

The Benjamin Electric Manufacturing Company, of Chicago, has placed upon the market a cluster fixture which is intended to replace arc lamps in mills, factories, foundries, etc. The accompanying illustration shows one of these clusters with a 24-in. enameled-steel concentrating dome reflector for meeting requirements where it is necessary to hang the light units suffi-

Cluster Fixture

ciently high to clear traveling cranes. A second form has a 24-in. enameled-steel flat-cone distributing reflector, and is designed to be suspended from 25 ft. to 30 ft. above the floor. Both fixtures have sockets for 250-watt large-base lamps and are furnished wired in series for 220-volt circuits or series multiple for 110-volt circuits. The manufacturers state that a reflected light volume of approximately 1500 cp is secured by this means.

AN ELECTRICALLY OPERATED MUNICIPAL PUMPING STATION.

By Alexander J. Lindsay

The question of water supply for any municipality is an extremely important problem. This is especially true if the city is rapidly increasing in population and provision must be made for future growth. One of the best examples illustrating this problem is furnished by the City of Spokane, Wash., which has just completed the fifth addition to its pumping stations within twenty-six years.

Up to 1898 various additions brought the capacity of the pumping system up to 17,000,000 gal. per day. As the city grew the hills south of the business section became rapidly occupied and, as the elevation of these was too great to be served by the same system which furnished water to the rest of the city, it became necessary to build two auxiliary pumping stations, one at Fifth Avenue and Pine Street and the other on Bishop Court near Monroe Street. These supplied 2,500,000 gal. a day from the low-pressure system to the hill section. These pumps were driven by electric motors. An attempt was made to install high-pressure pumps in the main station on the river bank, but it was found that the old low-pressure main was not capable of withstanding the high pressure necessary to reach the hill sections of the city. At the time this attempt was made a new 30-in. riveted steel low-pressure

Fig. 1—Exterior of Spokane Pumping Station. New Electrically Operated Station on the Right.

main and a 20,000,000-gal. reservoir were built for the low-pressure service and four 2,500,000-gal. pumps were installed in the river station. The addition of these pumping units carried the total capacity of this system up to 29,500,000 gal. per day and the low-pressure system of the city was in splendid shape so far as quantity was concerned.

During all this time the valley of the Spokane River was being rapidly settled and the small town of Cœur d'Alene, situated where Lake Cœur d'Alene empties into the Spokane River, was rapidly becoming a city. This condition existing above the point where the water supply for Spokane was secured naturally tended to jeopardize its purity, and city officials eventually found it necessary to condemn the source of water supply. At first it seemed probable that a new and entirely different source would have to be sought and the existing pumping stations abandoned.

During the construction of the up-river pumping station it became necessary to dig pits for placing foundations, and it was found that the water rose in these pits to a considerable height, suggesting that there was a source of water supply either entirely separate from the river or else being supplied by infiltration. When it became necessary to seek a new supply a very thorough investigation of the quantity and character of the underground water supply was made. Test wells were sunk at various points from Cœur d'Alene Lake down the river to the water works. Analyses of the water obtained from these wells showed it to be different from the water of the Spokane River. It was clear and pure and the only objectionable feature was the hardness due to contained mineral matter. It

was thought that a sufficient supply could be obtained from this source, but to make certain before the expenditure became too great a large well 30 ft. in diameter was excavated back of the main pumping station. Two centrifugal pumps with a capacity equal to that of all the pumping machinery in the city were connected to this well and operated for a long time. While the level of the water in the well was lowered to some extent during pumping, it immediately rose when the pump was shut down, and it was evident that the well had more than sufficient capacity amply to supply the city. This well was connected to the pumps in the river station and this supply was substituted for that from the river.

In the spring of 1908, the demand for water having again reached the capacity of the installed pumps, the two remaining wheels in the old station were loaded with two additional pumps of 2,500,000 gal. capacity each, bringing the total capacity of the station to 2,450,000 gal. per twenty-four hours. While this helped out temporarily, it was apparent that additional facilities would have to be supplied and plans were, therefore, put under way to meet the requirements.

It was decided that it would be best to dig a new well tapping the underground supply and to build an electrically operated pumping station, as the power supply obtained from the river was in use to its limit. Plans were drawn, bids advertised for and finally a contract was let to the Allis-Chalmers Company for furnishing three motor-driven centrifugal pumping units. The installation of these has just been completed and is of particular interest as demonstrating the possibilities of this class of machinery for supplying water to large municipalities.

PUMPING STATION.

The new pumping station, which is entirely independent of the older station, is absolutely fireproof, being built with concrete foundations and steel and brick superstructure. It is supported on piling capped with a timber grillage, all of which is below low-water mark. The floor of the pumping station is itself 4 ft. below high-water mark. In order to insure water tightness the basement floor and the walls, to a height of 7 ft., were made waterproof by the use of asphalt felt and asphaltum. The interior walls were also made more impervious to the seepage of water by being plastered with a coat of neat cement, which also improves their appearance. The interior dimensions of the station are approximately 51 ft. 6 in. x 81 ft. 6 in.

The three pumping units now installed are placed along one side of the station with their shafts parallel to each other and at right angles to the side of the station, as shown in the accompanying drawing. They are spaced 15 ft. 6 in. on centers. Each unit consists of a 900-hp, three-phase, 60-cycle, 2300-volt, 880-r.p.m. induction motor direct-connected to two 14-in. two-stage centrifugal pumps.

Inasmuch as this equipment is representative of the most advanced procedure in this class of pumping equipment, a detailed description of both the pumps and motors may be interesting. Each centrifugal pump is of the Allis-Chalmers two-stage, single-end suction, horizontal-shaft type. It is supported by brackets cast integral with the casing, which rest upon and are bolted to a baseplate. The shaft is made of open-hearth steel and is amply large to carry the maximum loads without serious deflection. The impellers, which are of the inclosed type, are made entirely of bronze and are fastened to the shaft by means of a feather key and nut. A bronze sleeve is also used to protect that portion of the shaft exposed to the action of the water. A stationary guide passage is placed between the two impellers, its function being to take the water from the tips of the vanes of one impeller and deliver it through suitably shaped passages to the inlet side of the succeeding impeller. The last impeller discharges in a radial direction through guide vanes into the casing. A balancing disk, connected with both the suction and discharge sides of the pump, maintains a practically perfect running balance. The bearings are of the ring-oiled type lined with composition and the oil is supplied from a large oil reservoir. Stuffing boxes on both the discharge and suction sides of the pump are provided with bronze water-sealing rings to prevent ingress of air.

Fig. 2—Three Motor-Driven Centrifugal Pumping Units in the Spokane Pumping Station. Capacity per Twenty-four Hours, 12,000,000 Gallons Against 260 Ft.-head.

The motors are of Allis-Chalmers standard design. They receive three-phase, 60-cycle currents at 2300 volts and will deliver 900 hp when making 880 r.p.m. The laminations from which the stator core is built up are supported in a substantial cast iron yoke which holds them securely in position. Cored openings are provided in this yoke and allow free circulation of air around the core and coils. Large ventilating ducts are provided. Special care is taken with insulation, and the copper is designed in such a way as to give a very cool-running motor.

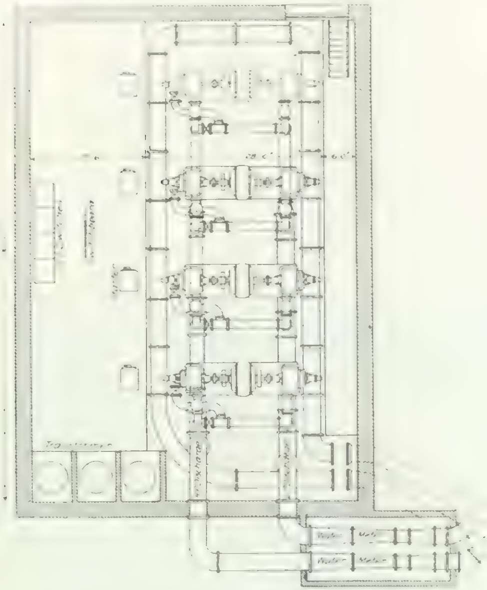


Fig. 3—Plan of Spokane Pumping Station.

The starting devices furnished with each motor include a bank of cast-iron resistance grids mounted in an expanded metal case and arranged for connection with the collector rings. The resistance of the grids is such that a period of two minutes may be consumed in bringing a motor up to full speed with a temperature rise in the resistance not exceeding 175 deg. C. The starters cut out this resistance in steps to secure proper acceleration of the motor. The collector rings are short-circuited by a manually operated device when the motor is up to full speed.

Heavily insulated lead-covered cables placed in the concrete floor connect the motors to the switchboard. Similar cables carried in conduits in the wall of the building connect the transformers to the switchboard.

The switchboard is located at one side of the station with the high-tension oil switches in concrete cabinets back of it. The transformers are placed in one corner of the room. The switchboard is made up of four panels of blue Vermont marble mounted on an iron framework which leaves a space of 25 in. between the bottom of the board and the floor. On the switchboard are mounted an ammeter, a watt-hour meter, a voltmeter and various other necessary instruments. Three 1000-kw, oil-insulated, water-cooled, single-phase transformers change the 13,200-volt line voltage to 2300 volts for the station service. Taps are provided on both windings which give approximately 3 per cent, 6 per cent and 9 per cent lower voltages. Transformers are connected in delta with a grounded neutral so that if one should fail it can be disconnected by means of switches and the station operated at one-half capacity on the two remaining transformers.

The contract required that the machinery be placed in the station by June 1, 1910. Some delay was experienced by the building contractors, and in consequence the machinery was not put in operation until nearly the first of September. This, however, was not due to any fault of the company which furnished the machinery. Although the station was designed for four units, only three have as yet been installed, and the fourth will be placed in position when needed.

After operating the station for a short time in a preliminary way to make adjustments properly, it was put in regular service and has been delivering water to the city for about two months. Every one who has been connected with the work has been extremely gratified with the success which has attended this electrical pumping equipment. The pumping units operate with practically no vibration and are easily regulated to maintain any desired pressure.

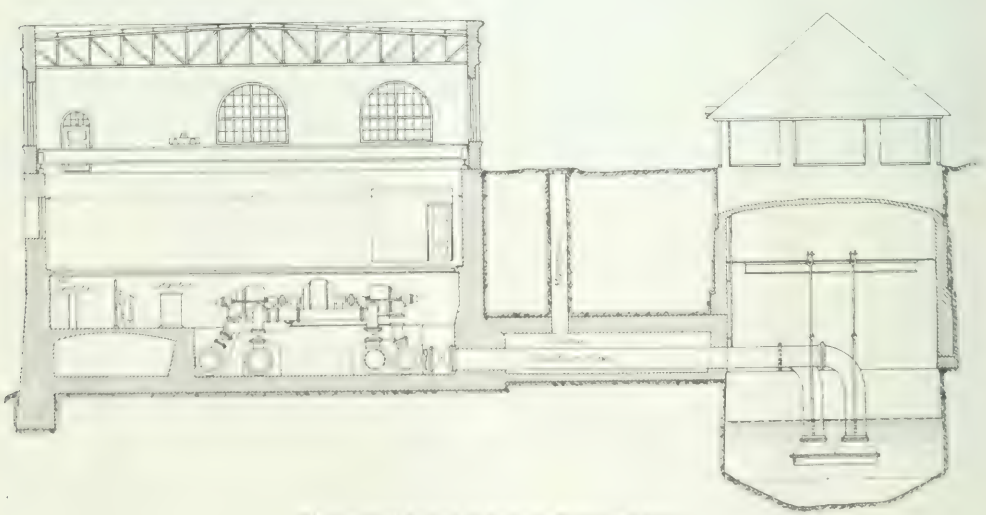


Fig. 4—Cross Section of Spokane Pumping Station.

Industrial and Commercial News

THE WEEK IN TRADE.

HOLIDAY influences furnished the only encouraging feature to general trade last week. The retailers in every part of the country were busy, but it is doubtful if the volume of holiday business will equal that of last year. In contrast with this activity in retail trade was the almost entire absence of orders among the wholesalers and jobbers. Aside from a few scattered reorders to fill depleted stocks, there was no business done in this branch of trade. Speaking sectionally the trade in Western centers was much better than it was in the East and the agricultural districts were much busier than the industrial. In every part of the country there is a disposition to be conservative and individual purchases are in the majority of instances of less expensive wares than heretofore. Industry is even quieter than in previous weeks. Further curtailments are reported among the iron and steel mills. Many furnaces are banked, yet stocks of pig iron are larger than can be comfortably carried. The mills with the exception of those producing wire are not running at half capacity. This is largely due to the almost entire absence of railroad buying and to the discouraging promises that are made for next year. Lower wages are being talked of as a result of the limited demand for steel products, and this it is feared would be followed by strikes. Business in steel rails is very light. The Baltimore & Ohio Railroad, which bought 80,000 tons last year, will take only half that amount in 1911. This instance is illustrative of the entire situation. It is said that a goodly volume of orders are pending for structural material. Canada has purchased 20,000 tons of steel plates, but domestic orders are slack. Prices both for pig iron and for manufactured products are being shaded according to reports, but these concessions have not as yet been successful in stimulating business. Collections, especially in the West, are somewhat better, due to the freer circulation of money, but bank clearings are smaller than they were the same week last year. Business failures for the week ended Dec. 22, as reported by *Bradstreet's*, were 271, as compared with 290 the previous week, 264 in the same week of 1909, 196 in 1908, 248 in 1907, and 161 in 1906.

THE COPPER MARKET.

DURING last week the copper market was practically a negative quantity. While exports were fairly large, much of the metal shipped represented previous sales. It is undeniable, however, that during the week the demand for foreign account displayed more symptoms of life than the demand from domestic consumers. There was practically no demand from local melters, and while it is understood that the business of the electrical companies and the brass foundries has been good there is no disposition to buy copper. The market is not entirely without hope, however, and it is con-

Standard Copper	Bid.	Asked.	Settling Price.
Spot	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]
January	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]

[illegible]

	Noon.	Closing.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

fidently predicted that during the first quarter of 1911 business will be much more active. Some large cable contracts are expected in this period which may call for more copper, and there is always the hopeful anticipation that some of the important steam railroads will carry out their tentative electrification projects. In the meantime the statistical position of copper continues to be "the fly in the ointment." As long as the production of copper is 25 per cent more than the actual consumption prices will be uncertain and confidence in the future lacking. The National Conduit & Cable Company speaks frankly on the subject in its monthly circular. It says: "The maximum capacity at mines and refineries is developed to a point excessively great, and our domestic demand and foreign trade cannot consume present supplies. The total home consumption attained and the heavy outward movement fail absolutely to use up the available metal. The situation calls for energy and intelligence to bring it into a healthy state. Last month's output from American refineries was 119,353,463 lb., and every one knows that when any article is overproduced such faulty methods prove hurtful in many ways. The legitimate laws of supply and demand and a liquid market are the reliable factors in clearing up the whole situation, and against which there can be no law." Exports for the month, including Dec. 23, were 23,224 tons. The daily call on the Metal Exchange Dec. 23 quoted standard copper as per accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Amador Mines, Power & Water Company.—Articles of incorporation have been filed in California for the Amador Mines, Power & Water Company. The capital stock is to be $300,000. It is given out that the purpose of the company is to construct a storage reservoir at Grass Valley, near Pine Grove, Cal., which will have a large capacity and which will cover an area of 150 acres at a depth of 50 ft. It is also proposed to build an electric power plant on Sutter Creek, about five miles from Jackson. This plant will have an initial capacity of 2000 hp. It is expected that one-half of this energy will be used by the Amador mines, and the other half will furnish power and light for the towns of Jackson, Sutter Creek and Amador City. The plant will be so constructed as to add units sufficient to make an ultimate capacity of 18,000 hp.

Edward E. Cary Company.—The Edward E. Cary Company, 30 Church Street, New York, which has for the past four months been selling the output of the Heinrich Electric Novelty Company in Brooklyn, reports that the demand for novelties for the Christmas trade has been far beyond the capacity of the factory to produce. Not only was this true with regard to Christmas tree decorations, but the demand for flash lights and for pocket electrical novelties was greater than ever before known. The capacity of the factory will be increased during the coming year. Mr. Cary, president of the selling company, says that he has made many excellent contracts during the past few months for the Henrion carbons, and has placed quite a number of large orders for these carbons in South America and Canada. Mr. Cary will sail for Europe early in January to be gone about six weeks.

Damage to New York Central's Substation.—The destructive explosion beneath the substation of the New York Central Railroad, at Fiftieth Street and Lexington Avenue, which occurred Dec. 19, did not in any way damage the transformers or rotary converters in that station. In fact, the rotaries were out of commission only three or four minutes on account of the explosion. The storage-battery room, however, which was immediately over the gas tank, was entirely wrecked, and the damage to this plant will not be fully known until all of the debris has been cleared away and a further investigation has been made. This was the largest storage-battery plant in connection with the New York Central service.

Duplex Metals Company.—The Duplex Metals Company is now fully settled in its new headquarters at Chester, Pa. The chief offices of the company were removed to that city several months ago. The selling office will be continued in the Singer Building, New York City. Sales offices have also been established in St. Louis, Portland, Ore., and Cleveland. Representatives of the company declare that business for the year has been very good and many large orders have been taken. One that was recently placed was for 400 miles of No. 8 wire. The sale was made to the Western Electric Company for railroad telephone work.

Boston Suburban Electric Companies.—At the annual meeting of the Boston Suburban Electric Companiess last week Adams D. Claflin, Charles F. Dennison, Sydney Harwood, Alden E. Viles and William F. Hammett were re-elected trustees. Mr. Claflin was re-elected president

Large Government Electrical Pumping Contract.—One [illegible] largest contracts for pumping machinery ever [illegible] has just been awarded to the Alberger Pump Company, of New York City, by the Bureau of Yards and Docks, the total sum involved being slightly over $323,000. The contract covers pumping equipment for the three new dry docks to be constructed by the government at New York, Puget Sound and Pearl Harbor navy yards, and includes all told eleven 54-in vertical volute pumps, each direct-connected to a 550-hp induction motor, and seven 15-in. vertical volute drainage pumps, each direct-connected to an 85-hp induction motor; also all necessary suction and discharge piping, electrically operated gate valves for the same and all electrical controlling apparatus for the motors. Three of the 54-in. units will be located at New York, while four are required for each of the other docks. Each unit is required to operate against a static head, varying from zero when the dock is full to a maximum of 42 ft. to 44 ft. when the dock is completely empty, while operating at a constant speed of 219 r.p.m without exceeding the rated horse-power of the motor at any point. In addition to this, each pump is required to maintain an average capacity of 66,000 gal. per minute when emptying the dock from approximately mean high water to 1 ft. above the elevation of the keel blocks, the static head varying from zero to 32 ft. or 34 ft. Under these conditions the contractor has guaranteed an average efficiency of 45 per cent for New York and Pearl Harbor and 46 per cent for Puget Sound, these efficiencies being the ratio of the actual useful work in pumping the docks to the electrical input to the motors, and consequently including all losses in the motors, pumps and piping. To meet these average efficiencies it is necessary for the pumps themselves to reach a maximum efficiency of nearly 80 per cent. In addition to obtaining a high efficiency, the other characteristics of the pump have to be very carefully determined in order to meet the special conditions involved in this class of work. The Alberger Condenser Company reports that business during the past year has been fairly satisfactory. During the early spring months it was moderately good. Beginning with June, for four months the orders came in more rapidly than they could be filled, and the factory, although run over-time, was still unable to make prompt deliveries. After Oct. 1 the orders were slack until within the past two or three weeks, when they have picked up in a very encouraging manner.

Interurban Railway to Connect Jamestown and Dunkirk, N. Y.—At a recent conference in Jamestown, N. Y., citizens of that city and of Dunkirk and Fredonia conferred with A. N. Broadhead, president of the Jamestown Street Railway Company and the Chautauqua Traction Company, in relation to a proposed electric railway to connect Jamestown to Fredonia and Dunkirk, following the Cassadaga Valley and passing through Ellicott, Gerry, Charlotte, Stockton and Pomfret. Such a line would parallel the Dunkirk, Allegheny Valley & Pittsburgh steam railroad. Preliminary surveys will be made, and Mr. Broadhead is interested in the possibilities of the proposed railway. Jamestown has at present interurban connections with Mayville and Westfield on the north, and with Warren, Pa., on the south. Dunkirk, on the shore of Lake Erie, is connected with Buffalo, Erie and other lake-shore towns by the interurban lines of the Buffalo & Lake Erie Traction Company.

Ontario Power Company.—It is announced that when the construction plans now under way at the plant of the Ontario Power Company, Niagara Falls, Ont., are completed the company will be developing a total of 114,000 hp. This construction work will be completed within a few months. The seven units of the company now in operation are delivering about 70,000 hp. The eighth unit is expected to be in operation within a few days. In connection with its plan to distribute cheap power to Canadian municipalities, the Province of Ontaria has installed a transformer station about half a mile from the Ontario Power Company, and takes energy from the latter by underground cable transmitting 110,000 volts. This reaches the government lines, which distribute to the municipalities throughout the province. This energy is now [illegible] and towns as [illegible] London, Ont.

Marseilles (Ill.) Hydroelectric Development.—Contracts for the hydroelectric power house of the Northern Illinois Light & Traction Company on the Illinois River at Marseilles, Ill., described in the *Electrical World* of Sept. 29, 1910, have [illegible] excavating and concrete structure at power-house site, L. E. Myers Construction Company, Chicago; generators, transformers and other electrical equipment, Westinghouse Electric & Manufacturing Company, Pittsburgh; water-wheels, James Leffel & Co., Springfield, Ohio. The Northern Illinois Light & Traction Company is subsidiary to the Western Railway & Light Company (McKinley system), and H. E. Chubbuck, general manager of the latter company, supervised the placing of the contracts. Mr. C. N. Humphrey, Chicago, is the consulting engineer.

Rapid Transit for Westchester County.—It was officially stated last week at a dinner of the Putnam Association, an organization formed of residents along the Putnam Division of the New York Central Railroad in Westchester County, that the railroad company had completed plans for the electrification of a portion of that division as soon as the new Grand Central Station in New York City has been completed. It is proposed to double-track the line and to bring the trains, which now run only to 155th Street, down to the Grand Central Station. It was also suggested at the same dinner that ultimately Interborough Rapid Transit trains would run over a portion of the Putnam Division.

Motors for Oil Well Drilling.—The Westinghouse Electric & Manufacturing Company has recently been testing, and will soon install, a new type of electric motors on the oil producing property of the Santa Fé Railroad, near Bakersfield, Cal. These motors will be installed just as soon as the Joaquin Light & Power Corporation builds its new transmission line through the Bakersfield district. The motors are of the constant-speed type, similar to those used by the South Penn Oil Company in West Virginia, and the tests are said to have proved entirely satisfactory, both to the Westinghouse engineers and to the Santa Fé officials.

Bankruptcy Legislation.—Louis Starr, merchant of Boston, writes urging the desirability of all business men lending assistance in securing the passage through Congress of an adequate bankruptcy law. The present law, he says, should be so amended that an individual or firm becoming financially embarrassed in business may, by petition of a creditor or by voluntary act, become the direct subject of the court. This would eliminate all the demoralizing and costly go-between red-tape procedure of lawyers, keepers and receivers, who absorb the bulk of the assets which should go to the creditors.

Electrification of Chicago Railroads.—A special committee of the Chicago Association of Commerce, which has for a year been investigating the feasibility of electrifying the steam railroads of Chicago, has reached the conclusion that there is absolutely nothing to prevent this work except the unwillingness of the railroads to incur the expense. The railroad officials, however, are unanimous in the opinion that they cannot bear this expense at the present time. They all agree that electrification would be a good thing, but that at the present time it is financially impossible.

British Columbia Electric Company.—The British Columbia Electric Company, Ltd., of Vancouver, has made an offer to the Western Canada Power Company to purchase the latter on a basis of guaranteeing its bonds and also a 5 per cent dividend on the common stock. The Western Canada Power Company, which has been for some time constructing a hydroelectric plant on Stave River, 35 miles east of Vancouver, will generate, when this development is completed, 52,000 hp. This plant is expected to be in operation some time next spring.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at East St. Louis, Ill.; Bangor, Maine; Webster, Mass.; Valparaiso, Ind.; Portland, Ore.; Douglas, Ariz.; Moberly, Mo.; Plattsburg, Mo.; Darby, Pa.; White Plains, N. Y.; Maricopa, Cal.; Sausalito, Cal.; Rocky Ford, Ga.; Guthrie, Okla.; Wakefield, Mass.; Chehalis, Wash.; Oroville, Cal.; Gardnerville, Nev.; Pocatello, Idaho, and Colliersville, N. Y.

Northern Indiana Interurban Railway.—Plans are being developed for an electric interurban railway to connect the industrial centers of Lake County, Ind., and Chicago. C. H. Geist, of Philadelphia, formerly of Chicago, is said to be interested in the project. The line, if built, will be about sixty miles long, and will connect East Chicago, Indiana Harbor and other points along the southern shore of Lake Michigan.

Financial.

THE WEEK IN WALL STREET.

PROBABLY Wall Street has never experienced, in recent years at least, a more disappointing week or a more apathetic group of traders than that which immediately preceded the Christmas holiday. For the five days of that week the total sales of shares were only 1,421,229, and on the last day before adjournment but little more than 100,000 were sold. It has been the history of the Street that the last weeks of the year have been marked by activity and frequently by an advancing market. Many of the older traders laid their plans in anticipation of this, only to be disappointed. Those who had accumulated holdings that were to be liquidated during the holiday activity found that there were no buyers and that unless they were willing to accept losses they must carry their lines over into the new year, where the sailing is likely to be squally. It is evident, however, that the accounts carried by professional traders are abnormally small. The market has been well liquidated and the short interest is extremely light. This is but another demonstration of the unsettled and uncertain condition of the market. Even the most daring of the speculators have been disposed to go slowly. There is a vast amount of uncertainty as to what the new year will develop. Within a few weeks after 1911 is ushered in we may expect Supreme Court decisions in the important trust cases and probably a decision in the railroad rate case. It is felt in Wall Street that upon these decisions hangs the fate of the financial market—if not the entire commercial business—for the coming year. Adverse decisions will surely be followed by a slump in prices and probably a prolonged period of liquidation; favorable decisions will certainly do much to restore confidence among the regular market traders and possibly might develop the courage of the public to the point of inducing it to buy stocks. The only bright spot in the recent market has been the improved demand for high-class bonds. Much of the money that ordinarily would be used in stock deals has found its way into bonds. The money market in the meantime continues to be very easy, with the banks well supplied with funds. Rates Dec. 23 were: Call, 3 @3½ per cent; ninety days, 4 per cent. The quotations in the table are those of the close Dec. 23.

NEW YORK.

	Dec. 19.	Dec. 23.	Shares Sold†		Dec. 19.	Dec. 23.	Shares Sold†
All. Ch.	8¼*	[illegible]	[illegible]	Int. Met., pfd.	[illegible]	[illegible]	12,[illegible]
Al. Ch., pfd.	30	30*	[illegible]	Mackay Cos.	88*	[illegible]	[illegible]
Amal. Cop.	64¾	[illegible]	[illegible]	Mackay, C., pf.	74¾	[illegible]	400
Am. D. T.	20½*	[illegible]	—	Man. Elev.	138*	130*	400
Am. Loco.	37⅛	[illegible]	800	Met. St. Ry.	15*	[illegible]	—
Am. Loco., pf.	106*	[illegible]	120	N.Y.&N.J.Tel.	[illegible]	[illegible]	—
Am. Tel. & C.	80*	[illegible]	—	Steel, Com.	73⅜	[illegible]	243,[illegible]
Am. T. & T.	141¾	[illegible]	7,800	Steel, pfd.	116¾	[illegible]	1,840
B. R. T.	75½	[illegible]	[illegible]	W. U. T.	74[illegible]	73	[illegible]
Gen. Elec.	[illegible]	[illegible]	[illegible]	West'h, com.	[illegible]	[illegible]	1,0[illegible]
Int. Met.	20¾	[illegible]	6,900	West'h, pfd.	122*	[illegible]	[illegible]

PHILADELPHIA.

	Dec. 17.	Dec. 23.		Dec. 17.	Dec. 23.
Am. Rys.	[illegible]	[illegible]	Phila. Elec.	[illegible]	[illegible]
Elec. Co. of A.	[illegible]	11⅝*	Phila. R. T.	18[illegible]	18¼
Elec. St. B'ty.	[illegible]	[illegible]	Phila. Trac.	83[illegible]	84*
E. S. B'ty., pfd.	[illegible]	[illegible]	Union Trac.	43¼	43

CHICAGO.

	Dec. 17.	Dec. 23.		Dec. 17.	Dec. 23.
Chi. City Ry.	[illegible]	170*	Chi. Tel. Co.	123	123
Chi. Rs., Ser. 1	91*	[illegible]	Met. El. Co.	[illegible]	21*
Chi. Rs., Ser. 2	[illegible]	[illegible]	Met. El., pfd.	[illegible]	[illegible]
Com. Edison	[illegible]	[illegible]	Nat'l Car.	120*	117
Chi. Subways	[illegible]	4	Nat'l Car., pfd.	117½	[illegible]

BOSTON.

	Dec. 17.	Dec. 23.		Dec. 17.	Dec. 23.
Am. T. & T.	[illegible]	[illegible]	Mex. Tel.	4	4*
Cum. Tel.	151	149*	Mex. Tel., pfd.	6¼*	[illegible]
Edison E. Ill.	[illegible]	285	N. E. Tel.	138*	138
Gen. Elec.	[illegible]	155*	W. T. & T.	16*	[illegible]
Mass. E. Ry.	[illegible]	18¼*	W. T. & T., pfd.	90	[illegible]
Mass. E. Ry., pfd.	[illegible]	[illegible]			

*Last price quoted.
†Shares sold for five days, Dec. 19 to Dec. 23.

FINANCIAL NOTES.

Montreal Tramways & Power Company.—It has been officially announced in Montreal that the object of the Montreal Tramways & Power Company, Ltd., which was recently organized in London with a capital of $20,000,000, as referred to in the issue of Dec. 22, is to take over control of the Montreal Street Railway and Canadian Light & Power Companies. President Robert of the Street Railway company has made this statement concerning the project: "Several months ago the Imperial Trust Company was organized with a large capital paid up in cash to finance the acquisition of a majority of the shares of the Montreal Street Railway Company. It secured the co-operation of certain English capitalists, and it was the intention at the outset to obtain control also of a majority of the stock of the Canadian Light & Power Company. One of the objects of the Montreal Tramways Company is to purchase the present holdings of the Imperial Trust Company and eventually acquire a majority of the shares of the Montreal Street Railway Company and the Canadian Light & Power Company and finance these two companies with English capital. The two companies will retain their separate and distinct identities, operating their own plants and working under their respective franchises and be subject as heretofore to all legislative enactments and municipal regulation. It is the object of the organizers of the new company to procure through the medium of a holding company these two properties, so that they shall in future operate in entire harmony. The railway will always have an independent supply of energy and the generating company will always have a customer for its energy."

Interborough Financing Plans.—While no official announcement has been made of the financial plans of the Interborough Rapid Transit Company in connection with the construction of additional subways and elevated lines in New York City, the program of the company has been unofficially discussed. The plan will call for the retirement of the $55,000,000 first mortgage bonds issued for the redemption of outstanding obligations and still held in the treasury. A new issue of $150,000,000 new bonds will be made, covered by a blanket mortgage over all of the Interborough property. This new issue will be used as follows: $75,000,000 for additional subways; $32,000,000 for elevated extensions; $35,000,000 for the retirement of outstanding bonds; $4,584,000 for the redemption of Interborough notes, making a total of $146,584,000. It is also said that if the plans for extensions are approved by the city, there will be a number of changes in the Interborough-Metropolitan board. In fact, these changes may be made at the annual meeting, Jan. 17, under any circumstances. Several of the directors now on the board will resign, and these will be replaced by representatives of J. P. Morgan & Company.

Rochester Traction Consolidation.—Charles D. Beebe, president of the Rochester, Syracuse & Eastern Railroad, has made the announcement that he and a number of associates have purchased the Buffalo, Lockport & Rochester Railway Company. In the last issue was published the report that these two railway properties had been purchased by the New York Central Railroad or interests identified with it. Mr. Beebe states that the lines will be operated separately by himself and independent associates. Securing this property gives the Beebe interests direct connection between Syracuse and Buffalo. The price paid for the Buffalo, Lockport & Rochester property is not given out, but is said to be something like $6,000,000.

Long Acre Electric Light & Power Company.—There were two hearings before the Public Service Commission of the First District last week upon the application of the Long Acre Electric Light & Power Company for permission to issue $10,000,000 stock and $50,000,000 bonds. Attorneys for the New York Edison Company made a vigorous attack on the Long Acre's right to operate under its franchise. Representatives of the Long Acre company contended that the Edison company had no standing in the proceedings and declared that that company was a monopoly and simply seeking to choke off competition. Hearings were continued until Jan. 4.

Springfield (Ohio) Light, Heat & Power Company.—O'Connor & Kahler, bankers of New York and Chicago, are offering an issue of $250,000 first mortgage 5 per cent bonds of the Springfield Light, Heat & Power Company. These bonds are offered at 97½ and interest. In addition to controlling the entire electric light and power business of the City of Springfield, the company owns a power plant located on the main line of the Detroit, Toledo & Ironton Railway. The company also has a system of steam heating mains, through which heat is served to city consumers.

Pensacola Electric Company.—Stone & Webster, Boston, are offering $250,000 of five year 6 per cent convertible gold coupon notes of the Pensacola Electric Company at 97¾. These notes are convertible at the option of the holder into common stock at par after March 1, 1912. The proceeds from the sale of this issue will provide funds for the retirement of the company's floating indebtedness, which was incurred for additions and improvements to the property necessary to meet the increased demands of new business.

Chicago Railways Consolidation.—It is expected that the receivership of the Chicago Railways Company will be lifted within a few days, and it is not believed that a new injunction will be asked for. The hearing on the present injunction comes up in January. Henry A. Blair, who is at the head of the syndicate negotiating the merger of the Consolidated Traction and Chicago Railways properties, says that this merger will be consummated early next month. "We are now in first class shape to have everything cleared up before the first of the year," said Mr. Blair, "and the Railways Company will be taken out of the hands of the receiver. I think that within a few days we shall have but one street car company controlling all the lines on the north and west sides of the city. The Chicago Railways Company has carried out its bargain with the city to the letter, and the new cars for the Consolidated lines have already been ordered. The weather has stopped rehabilitation work, but from the time the extension ordinance was passed until the snow came we worked day and night, and made a record for railroad building. Work will be resumed as soon as the weather will permit." The Cook County Traction Company has been organized by Chicago Railway interests to take over all of the Consolidated lines lying beyond the city limits.

Hartwick Power Company.—The Public Service Commission of the Second District of New York has authorized the Hartwick Power Company in Otsego County to execute a mortgage to the Trust Company of America to secure an issue of $750,000 of thirty-year 5 per cent bonds. The company is authorized to issue at once $400,000 of these bonds to be sold at not less than 80, also to issue capital stock to the amount of $300,000. The proceeds of these issues are to be used in payment to the Susquehanna River Power Company for the purchase of the hydroelectric development at Colliers, Otsego County.

Montreal Light, Heat & Power Buys Shawinigan Stock.—The sale of 5000 shares of stock of the Shawinigan Water & Power Company to the Montreal Light, Heat & Power Company has been confirmed. The figures have not been given out, but it is admitted that a premium was paid for the shares. This transaction indicates closer relations between the two companies, as the Shawinigan company some time ago acquired 10,000 shares of Montreal Power stock, and President J. E. Aldred, of the Shawinigan company, was elected a director of the Power concern.

Central Station Growth at Salem, Mass.—The returns of the Salem (Mass.) Electric Lighting Company to the State authorities for the year ended June 30, 1910, show a gratifying increase in business in comparison with 1909. The total income was $190,226, representing a gain of 11.5 per cent in earnings over 1909. The principal source of increase was the company's electric power business, which gained 51 per cent over the preceding year. Sales of energy for motor service aggregated $36,467.

New York Power Companies Consolidate.—Announcement has been made that the Schoharie (N. Y.) Light & Power Company, the Cairo (N. Y.) Light & Power Company, the Catskill Illuminating & Power Company and the Upper Hudson Electric Company, Coxsackie, N. Y., will shortly be merged. All of these companies have been controlled by the Stevens family, of Hoboken, N. J.

Ohio Traction Consolidation.—It is reported at East Liverpool, Ohio, that New York financiers have brought about a consolidation of all of the traction interests between Pittsburgh and Cincinnati. These include the Ohio Valley Scenic Railway Company, the Tri-State Railway Company and the Panhandle Traction Corporation. Details of this merger have not been given out.

DIVIDENDS.

American Telephone & Telegraph Company, quarterly, 2 per cent, payable Dec. 31.

Bangor Railway & Electric Company, quarterly, 1¾ per cent, payable Jan. 1.

Carolina Power & Lighting Company, Raleigh, N. C., preferred, quarterly, 1½ per cent, payable Jan. 2.

Central & South American Telegraph Company, quarterly, 1½ per cent, payable Jan. 9

Chicago City & Connecting Railways Company, preferred, $2.25 per share; common, $1 per share.

Cincinnati & Suburban Telephone Company, quarterly, 2 per cent, payable Jan. 4.

Cumberland Telephone & Telegraph Company, quarterly, 2 per cent, payable Jan. 2.

Demerara Electric Company, quarterly, 1¾ per cent, payable Jan. 2.

Electrical Securities Company, quarterly, preferred, 1¼ per cent, payable Feb. 1; common, 2 per cent, payable Dec. 31.

Electric Storage Battery Company, quarterly, 1 per cent, preferred, 1 per cent, common; both payable Jan. 3.

Electrical Utilities Corporation, quarterly, preferred, 1¼ per cent, payable Jan. 16.

El Paso Electric Company, semi-annual, 3 per cent; payable Jan. 9.

Empire District Electric Company, monthly, preferred, ¾ per cent, payable Jan. 1.

Halifax Electric Tramways Company, quarterly, 1¾ per cent, payable Jan. 3.

Kansas Gas & Electric Company, preferred, quarterly, 1¾ per cent, payable Jan. 3.

Massachusetts Lighting Companies, quarterly, 1¾ per cent, payable Jan. 16.

Mexican Telegraph Company, quarterly 2½ per cent, payable Jan. 16.

Michigan Light Company, preferred, quarterly, 1½ per cent, payable Jan. 3.

Pacific Telephone & Telegraph Company, preferred, quarterly, 1½ per cent, payable Dec. 31.

Terre Haute, Indianapolis & Eastern Traction Company, preferred, quarterly, 1¼ per cent, payable Dec. 31.

Tri-City Railway & Light Company, preferred, quarterly, 1½ per cent, payable Jan. 3.

Union Railway, Gas & Electric Company, quarterly, preferred, 1½ per cent, payable Jan 3.

Union Gas & Electric Company, semi-annual, preferred, 2½ per cent, payable Jan. 14.

United States Light & Heating Company, preferred, semi-annual, 3½ per cent, payable Jan. 15.

Westinghouse Electric & Manufacturing Company, preferred, quarterly, 1¾ per cent, payable Jan. 16.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
[illegible] Telegraph Company:					
[illegible]	$435,500	$165,000	$270,500		[illegible]
[illegible]	[illegible]	167,000	278,500		
[illegible]					
[illegible] 1910	485,156	[illegible]	287,247		
[illegible]	456,089	183,771	272,318		
Interborough Rapid Transit Company:					
[illegible]	[illegible]	984,727	1,573,553	[illegible]	[illegible]
[illegible]	[illegible]	887,071	[illegible]	881,070	[illegible]
[illegible]					
[illegible]	[illegible]	381,401	263,014	188,643	[illegible]
[illegible]		352,219	254,948	171,429	83,518
[illegible]					
[illegible]	205,000	37,500	167,500		
[illegible]	[illegible]	37,500	[illegible]		
Montreal Street Railway Company:					
[illegible]	366,098	[illegible]	138,656	32,031	106,643
[illegible]	[illegible]	[illegible]	[illegible]	30,803	103,948
[illegible]					
[illegible]	[illegible]	460,201	485,805	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	277,142	[illegible]	[illegible]
[illegible]					
[illegible]	230,300	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1909.	[illegible]	80,062	141,002	[illegible]	[illegible]
[illegible]					
[illegible]	[illegible]		[illegible]	249,849	594,742
[illegible]	[illegible]			[illegible]	[illegible]
[illegible]					
[illegible] 1910	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	21,135		

General News

Construction News.

ALBERTVILLE, ALA.—The proposition to issue $[illegible] in bonds, the proceeds to be used for the construction of an electric light plant, will be submitted to a vote.

BISBEE, ARIZ.—The City Council is reported to be considering the installation of a municipal electric light plant.

DOUGLAS, ARIZ.—Bids will be received by R. G. Arthur, secretary Board of Water Commissioners, about the middle of January for the construction of an electric light plant and water works system in Douglas, to cost about $85,[illegible] [illegible] Archer & Company, of Kansas City, Mo., are engineers.

PHŒNIX, ARIZ.—The Board of Supervisors has granted the Glendale Electric Company, an extension of the Phœnix Street Railway Company, a franchise to cross the county roads from Phœnix to Glendale. The company has secured a private right of way.

MURFREESBORO, ARK.—W. A. Fuller, 1616 Chemical Building, St. Louis, Mo., is engineer in charge of the construction of the proposed power plant of the Pike County Water Company. The cost of the work is estimated at about $[illegible]. As yet no definite plans have been announced.

MARICOPA, CAL.—The Midway Light & Power Company has established a twenty-four-hour service from its Maricopa plant. The company was recently incorporated with a capital stock of $250,000 and has taken over the plant and holdings of the West Side Electric Company, of Maricopa, and proposes to double the output of the plant immediately. Orders for equipment have already been placed. An auxiliary steam power plant will be installed at Taft.

OROVILLE, CAL.—Announcement has been made by the Oro Water, Light & Power Company that extensive improvements will be made to its local water, electric and gas distributing systems during the next year, which will involve an expenditure of about $70,000. R. L. Van der Naillen is manager of the company.

PLACERVILLE, CAL.—Notice of appropriation of 9000 in. of water flowing in the south fork of the American River has been filed by Henry Lahiff. The water is to be used for manufacturing purposes and for generating electricity.

QUINCY, CAL.—The Board of Supervisors of Plumas County will receive bids until Jan. 6 for the franchise applied for by the Portola Electric Light & Power Company to erect transmission lines to transmit electricity on the streets and highways of Beckworth and Quartz townships. L. G. Lane, Charles Fyre and W. J. Crawford are interested in the company.

SACRAMENTO, CAL.—The Sacramento Electric, Gas & Railway Company has applied to the City Council for a twenty-five year franchise for an extension of its system in this city.

SACRAMENTO, CAL.—The Home Telephone Company, which is operating in San Francisco and the Bay cities, contemplates asking for a franchise in Sacramento and other towns in the Sacramento Valley. The company proposes to erect long-distance lines connecting the principal cities in the valley.

SAN FRANCISCO, CAL.—The Columbia Marble Electric Company, of San Francisco, Cal., is reported to be considering the installation of a Fort Wayne electric drill at its quarry.

SAN FRANCISCO, CAL.—Application has been made to the Park Commissioners, by Willis Polk, in behalf of the Great Highway Development Company, for a franchise to construct and operate a miniature railway on the great highway from the Cliff House to Sloat Boulevard, a distance of three miles. He states that the road would cost more than $300,000 and the fare would not be in excess of 5 cents for each passenger. He also offered to turn over the railroad tracks and equipment to the city when [illegible] interest. The commission has taken the matter under consideration.

SAN LUIS, CAL.—A. M. Bianchi, of Cayucos, and James E. McFee are interested in a project to construct an electric railway from San Luis Obispo to San [illegible] Paso Robles.

SANTA BARBARA, CAL.—Contracts have been placed by the Santa Barbara Gas & Electric Company for the erection of three new buildings in connection with its plants in this city. One will be erected on Castillo Street, at a cost of $8,000, the second on Quarantiana Street, to cost $7,000, and a small building will be built on Montecito Street.

SAUSALITO, CAL.—The Northwestern Pacific Railway Company is reported to be in the market for a 2000-kw, direct-current railway generator set for its Alto power station.

DANIELSON, CONN.—Plans have been practically completed by the People's Light & Power Company, of Danielson, for extending its transmission lines to Elmville and Dayville to supply electricity in both villages. Arrangements have been made to install street lamps in Dayville.

MOODUS, CONN.—Application has been made for charter by the Moodus & East Hampton Electric Railway Company to build an electric railway to connect Moodus, East Hampton and Marlboro Mills.

NEW BRITAIN, CONN.—Frank F. Hanford and Charles F. Lewis, of Berlin, Conn., are interested in a project to build an electric railway between New Britain and Meriden. A charter will soon be applied for.

NEW HAVEN, CONN.—The Shore Line Electric Railway Company, which operates an electric railway from Stony Creek along the shore to Saybrook, and thence to Essex and Ivoryton, will petition the next General Assembly to amend its charter, giving it the right to supply electricity from its power house for lamps and motors in the towns of Old Saybrook, Westbrook, Essex, Madison, Guilford, Branford and North Branford, and to build spur tracks from its present line to carry freight and passengers within the above territory. The company proposes to supply electricity for manufacturing purposes.

NORWICH, CONN.—The Board of Gas and Electric Commissioners has decided to install a 750-kw steam turbo generator set and make other improvements to the municipal electric light plant, for which an appropriation of $35,000 was recently made.

OAKVILLE, CONN.—Negotiations are under way between the lighting committee of the Oakville Lighting District and the Housatonic Power Company for lighting the town. It is proposed to install not less than forty 20-cp incandescent lamps, for which the district is to pay $15 per lamp per year.

MADISON, FLA.—The question of establishing a municipal electric light plant in Madison is reported to be under consideration. It is proposed to purchase the plant owned by the Madison Electric Power Company.

AUGUSTA, GA.—The Augusta-Aiken Railway & Electric Company will purchase through the J. G. White Company a large quantity of equipment, machinery, etc., for power plant, inclduding turbines, motor generator sets and switchboards.

ROCKY FORD, GA.—The Ogeechee River Electric Company has applied to the Railroad Commission of Georgia for authority to issue $1,500,000 in capital stock and $1,500,000 in bonds. The company proposes to construct three reinforced dams and three power houses on the Ogeechee River, one to be located at Rocky Ford, another at Scarboro and the third near Oliver, Ga.

POCATELLO, IDAHO.—Announcement has been made that the Idaho Consolidated Power Company is contemplating the construction of a new power house at American Falls and will develop 30,000 hp additional during the coming year.

BELVIDERE, ILL.—It is reported that petitions are being circulated asking for an election to be called to vote on the proposition to establish a municipal electric light plant.

EASTON, ILL.—It is reported that F. H. Conroy and Roy Holly will apply to the Village Board for a franchise to establish an electric light system in Easton.

EAST ST. LOUIS, ILL.—Preparations are being made by the East St. Louis & Suburban Railway Company for the construction of a power plant at Reeb Station, St. Louis, work on which will begin at once. The proposed plant will supply electricity for the Belleville City railway and additional power for the suburban system between Belleville and East St. Louis. C. F. Hewitt is superintendent.

KANSAS, ILL.—The Village Board is reported to have accepted the proposition of the Central Illinois Public Service Company, of Mattoon, Ill., to purchase the municipal electric plant. It is proposed to operate the plant independently until the proposed interurban railway from Charleston, through Kansas to Paris, is completed. Electrical service will then be supplied from the Central power plant.

KEITHSBURG, ILL.—The commissioners of the Keithsburg Drainage District have awarded the contract for furnishing two electrically driven [illegible] W. A. Day & Company, of Chicago, Ill.

MORRISONVILLE, ILL.—The capital stock of the Morrisonville Electric Company has filed an amendment to its charter increasing its [illegible]

[illegible] the market for equipment for an electric light plant, to include a 35-kw direct-current, 110-volt direct-connected generator and engine, also one [illegible]

INDIANAPOLIS, IND.—The Board of Public Works has contracted with the Indianapolis Light & Heat Company to supply incandescent electric lamps to be used as an auxiliary to the present arc lamp street lighting system. The board has placed an order for 150 tungsten lamps, [illegible] Under the company's franchise it agreed to furnish incandescent street [illegible] pany refused to make a contract for the 75-watt lamp at a lower price, [illegible]

[illegible]

VALPARAISO, IND.—The Valparaiso & Northern Railway Company has entered into a contract with the Northern Indiana Gas & Electric Company to supply electricity to operate its railway and the La Porte-Gary division of the Chicago-New York electric air line rail- [illegible] kw converters will be erected at the junction of the two lines. It is expected to have cars operating between La Porte and Chesterton, Ind., [illegible] a temporary station until the substation is completed. Lewis E. Woodward is secretary.

CLEAR LAKE, IA.—The Town Council has authorized the installation of ornamental lamps on five blocks, eight to the block, to cost $65 per lamp standard.

INDEPENDENCE, IA.—The farmers have petitioned the City Council for an extension of the municipal electric light service.

KEOKUK, IA.—The Mississippi River Power Company, recently incorporated, is constructing a large hydroelectric power plant on the Mississippi River, at Keokuk. The work includes the construction of a dam, locks, power house, etc. The Stone & Webster Engineering Corporation, of Boston, Mass., has charge of the work.

INMAN, KAN.—The installation of an electric light system in Inman is reported to be under consideration. It is proposed to secure electricity for operating the system from the electric plant in McPherson, Kan.

SCOTTSVILLE, KY.—The capital stock of the Settle & Gainesville Telephone Company has been increased from $7,500 to $17,500.

ALEXANDRIA, LA.—The City of Alexandria is reported to be negotiating for the purchase of the property of the Alexandria Electric Street Railway Company. If the city takes over the railway it will be operated in connection with the municipal electric light and power plant. If the deal is consummated the proposition will be submitted to a vote of the people.

NAPOLEONVILLE, LA.—The water works and electric light committee has recommended to the City Council that immediate repairs be made to the water works plant. A new pump will be purchased and a pipe line running to the bayou will be started.

BANGOR, MAINE.—The Bangor Railway & Electric Company is contemplating extensive plans for electric railway and electrical power development in the vicinity of Bangor. It is proposed to rebuild the old Veazie dam on the Penobscot River, above Bangor, or else to build a dam at or near Basins Mills.

ANNAPOLIS, MD.—The contract for construction of power plant for the United States Naval Academy, at Annapolis, Md., has been awarded to the Evans-Almiral Company, of New York, N. Y., for $90,545.

BALTIMORE, MD.—The contract for wiring the sewage pumping station on East Falls Avenue has been awarded to the Central Electric Company at $3,526.

OELLA, MD.—W. J. Dickey & Sons, owners of the Oella Mills, are reported to be considering the construction of a dam on the Patapsco River, about 200 ft. long and 26 ft. high, to develop about 1000 hp.

POOLESVILLE, MD.—The Poolesville Telephone Company is contemplating extending its telephone lines and making other improvements to its system.

SALISBURY, MD.—The Wicomico Electric & Power Company has filed preliminary plans for approval with the Public Service Commission of Maryland, providing for the construction of an electric railway from Salisbury to Nanticoke Point. M. V. Brewington is president.

SHARPTOWN, MD.—Preparations are being made for the installation of an electric lighting system in Sharptown. Electricity for operating the system will be supplied from the electric plant in Baurel.

BOSTON, MASS.—The contract for the heating, ventilating and electrical work for the Physicopathic Hospital has been awarded to Lynch & [illegible]

NEWBURYPORT, MASS.—In a decision handed down by the State Board of Gas and Electric Commissioners a reduction is ordered in the price of electricity for lamps in Newburyport from 20 cents per kw-hour to 14 cents per kw-hour, and the rate for gas to be reduced from $1.40 [illegible]

WAKEFIELD, MASS.—Plans are being made for the installation of a larger generator in the municipal electric light plant to meet the increasing demands for electricity. The commissioners state that it will soon be necessary to install a new plant, costing from $25,000 to $75,000.

WEBSTER, MASS.—Extensive improvements and extensions are being made to the plant of the Webster & Southbridge Gas & Electric Company, which will include the installation of a new switchboard and a 1000-kw steam turbine. The floor space of the power house will be double. Contracts have already been placed for the machinery. The [illegible] service in the towns of Webster, Dudley, Oxford, Southbridge and Sturbridge.

WEYMOUTH, MASS.—The Weymouth Light & Power Company has applied to the Massachusetts Gas and Electric Light Commission for per- [illegible]

[illegible] MICH.—[illegible] Municipal Water, Light & Power Company, of Mackinac Island, Mich., are reported to have been purchased by A. J. Doherty, of Clare, Mich., and D. D. Aitkin, of Flint, Mich. The property includes the electric lighting, water and sewerage systems of Mackinac Island.

BRAINERD, MINN.—Work has commenced on the construction of an electric light and power plant in Brainerd. The Toltz Engineering Company, of St. Paul, Minn., has the contract. It is expected to have the plant completed by March 1.

BROWN VALLEY, MINN.—The proposition to issue $10,000 in bonds for the installation of an electric light plant, it is reported, will be submitted to a vote.

DULUTH, MINN.—The Duluth Canal Power Company is reported to be contemplating the construction of an 80,000-hp hydroelectric plant at Ironton, near Cloquet, Minn. Electricity generated at the plant will be transmitted to Duluth, Minn., and Superior, Wis.

FERGUS FALLS, MINN.—The new switchboard in the exchange building of the Northwestern Telephone Exchange Company was recently destroyed by fire, causing a loss of about $15,000.

FOLEY, MINN.—The installation of an electric light plant in Foley is reported to be under consideration.

MANKATO, MINN.—The Mankato Electric Traction Company is reported to be contemplating the extension of its railway from Mankato to St. Peter, via Kasota, a distance of about twelve miles. H. E. Hance is general manager.

MINNEAPOLIS, MINN.—The Minneapolis, St. Paul, Rochester & Dubuque Traction Company is reported to be contemplating the construction of a power house in South Minneapolis, Minn. The company is now operating gasoline cars.

PINE CITY, MINN.—R. P. Allen, general manager of the Eastern Minnesota Power Company, writes that work on its proposed hydroelectric plant will begin in the spring. The initial installation will have an output of 1000 kw, with provision for 1000 kw later. Transmission lines will be erected to Braham, Hinckley and other points. About 100 miles of line will be erected.

VICKSBURG, MISS.—Sealed proposals will be received at the United States Engineer Office, Vicksburg, Miss., until Jan. 18, 1911, for steel hull, self-propelling hydraulic dredge, steel pontoons and pipe line, and also component groups thereof, including steel dredge hull, steel pontoons and pipe line, upper works, steam plant, propelling machinery, electric plant, pumping engine, condenser plant and evaporator, sand pump, suction pipe and ladder, cutter head, gear and engine, winches and refrigerating plant.

IRONDALE, MO.—Arrangements are being made by James P. Ward, of Irondale, Mo., for the construction of an electric railway, 200 miles in length, work on which will begin as soon as plans are completed.

LINN CREEK, MO.—It is reported that the Big Niangua Hydro-Electric Company will start surveys in January in connection with its proposed hydroelectric power plant. The work will include the construction of a dam to cost $900,000. The cost of the entire plant, including dam, machinery, transmission lines, etc., is estimated at $2,000,000. About 22,000 hp will be developed. Roland E. Brunner, of Kansas City, Mo., is interested in the project.

MOBERLY, MO.—It is reported that plans are being considered for an addition to the water works system and the erection of an electric light plant in Moberly. L. G. Knapp & Company, of Kansas City, Mo., are engineers. Rolla Rothwell is Mayor.

PLATTSBURG, MO.—Preliminary plans are being prepared for the construction of a municipal electric light plant and water works system for the City of Plattsburg, to cost about $50,000. Rollins & Westover, Beals Building, Kansas City, Mo., engineers, are preparing plans.

FALLON, NEV.—The City Council is reported to be considering plans for the installation of an electric generating plant in connection with the water and sewerage systems.

GARDNERVILLE, NEV.—William Hansberg, owner of the property known as the Duncan Ranch, is making preparations for the installation of an electric plant this season. Five thousand feet of pipe line will be required, besides open flumes to tap some of the large springs at the base of the mountain.

EAST JAFFREY, N. H.—At a special election to be held soon the citizens will vote on the proposition of petitioning the incoming Legislature for a charter enabling the town to construct and operate a municipal electric plant.

PENACOOK, N. H.—The Penacook Electric Light Company is contemplating extending its transmission line southward on the river road from its present terminus at the Galvin estate to Riverhill, to supply electricity to the summer residents. It is possible that electric lamps will be erected along the river bank.

CARTHAGE, N. M.—Messrs. Stackhouse & Brown, of Carthage, N. M., have submitted a proposition to the federal government to extend an electric transmission line from their power plant at Carthage to the site of the proposed Elephant Butte dam and to supply electricity for carrying on the construction work there, and to provide electricity for lighting the construction camp. The proposed line will be seventy-five miles in length. A power plant will be erected for this special purpose and to provide electrical power for the Kelly and Mogollon mining districts.

[illegible] N. M.—Investigations are being made by J. A. Clay, general manager of the Durango Electric Company and San Juan Water

& Power Company, in Farmington, with a view of extending the electric transmission lines of the companies to this locality to supply electricity to operate the irrigating pumping plants and for other purposes. It is reported that it is proposed to take over the Farmington electric light plant.

LAS CRUCES, N. M.—The Las Cruces Electric Light & Ice Company has extended its electric lighting system to the town of Mesilla Park.

LAS CRUCES, N. M.—At a recent meeting of the Elephant Butte Water Users' Association held in Las Cruces, President H. B. Holt officially reported that the federal government has embraced in its plans for the construction of the large dam and land reclamation enterprise in the upper valley of the Rio Grande the installation of a hydroelectric plant, which will utilize the maximum amount of power afforded by the water storage reservoir. Electricity generated at the plant will be transmitted throughout the valley for use of the farmers.

ALBANY, N. Y.—The contract for construction of hydroelectric plant at the Crescent dam has been awarded to the Wells-Boughton Company, of Troy, N. Y., for $42,940, by F. C. Stevens, superintendent of the State Department of Public Works.

ALBANY, N. Y.—Only one bid was received by the Board of Contract and Supply, Dec. 19, for lighting the streets of the city, which was submitted by the Municipal Gas Company for a term of five years. The bid was rejected immediately as the terms were considered too high. The company put in a bid of 26 cents per arc lamp per night and 5½ cents per night per incandescent lamp. Under the present contract the city pays 27 cents per night for each arc lamp, but has never used incandescent lamps for street lighting. New bids will be called for.

AUBURN, N. Y.—Plans are being considered by the State Water Board for conserving and developing the water-power of Owasco Lake. It is proposed to develop Owasco Lake as one of the reservoirs in the improvement of the water-power of the Oswego River basin. The work will be done entirely at the expense of the State. J. Walter Ackerman, of Auburn, is superintendent of the State Water Board.

BOLTON, N. Y.—The Bolton Light & Power Company has been granted permission by the Public Service Commission, Second District, to supply electricity in the town of Bolton, and also to issue $12,500 in capital stock and bonds to the amount of $10,000, the proceeds to be used for the construction and equipment of its plant.

BUFFALO, N. Y.—The Public Service Commission, Second District, has granted the Niagara & Erie Power Company permission to issue a mortgage on its property and franchises to the Guaranty Trust Company, of New York, N. Y., to secure the payment of bonds to the amount of $1,250,000. The company is authorized to issue presently $510,000, at not less than 85 and $100,000 in capital stock at par, the proceeds to be used for proposed improvements.

CATSKILL, N. Y.—Arrangements are being made for the consolidation of the Schoharie Light & Power Company, the Cairo Illuminating & Power Company and the Upper Hudson Electric Company in the near future. The companies have been controlled by the Stevens family, of Castle Point, Hoboken, N. J.

ELMIRA, N. Y.—The Elmira, Corning & Waverly Railway Company has been authorized by the Public Service Commission, Second District, to issue bonds to the amount of $689,000, the bonds to be delivered to the Southern Tier Development Company for the construction and equipment of an electric railway from Elmira to Corning, a distance of twelve miles.

FREDONIA, N. Y.—It is reported that the power house of the Buffalo & Lake Erie Traction Company, in Fredonia, N. Y., was damaged Dec. 16 by the explosion of two boilers, causing a loss of about $150,000.

HARTWICK, N. Y.—The Public Service Commission, Second District, has authorized the Hartwick Power Company to execute a mortgage to the Trust Company of America to secure an issue of bonds to the amount of $750,000. The company is permitted to issue presently $400,000 of these bonds and to issue $300,000 in capital stock. The proceeds to be used for the purchase of a hydroelectric development system on the Susquehanna River, at Colliers, Otsego County, and for general improvement purposes; also for the purchase of the steam electric power plant, formerly owned by the Otsego & Herkimer Railroad Company, located in Hartwick, N. Y., and for improvements made to the plant by the Trust Company of America, of New York, N. Y.

LYONS, N. Y.—Application has been made to the Public Service Commission, Second District, by the Wayne County Gas & Electric Company and the Geneva & Seneca Electric Company for permission to transfer their franchises, plants and systems to the Western New York Gas & Electric Company, which corporation is to be formed by the petitioners. Application will also be made for authority to the Western New York Gas & Electric Company to issue $450,000 in capital stock for exchange for the stock of the two petitioning companies; for authority to acquire all of the present [illegible] companies and [illegible] permission for the Western New York Gas & Electric Company to make a mortgage for $1,250,000, and to issue $800,000 in bonds to be secured by this mortgage. The company owns plants and franchises in Lyons, Clyde, Palmyra and Newark.

MIDDLEPORT, N. Y.—The Public Service Commission, Second District, has authorized the Middleport Electric Light & Gas Company to exercise its franchise granted by the town of Royalton to furnish electricity for lamps in that town.

NIAGARA FALLS, N. Y.—The Public Service Commission, Second District, has authorized the Niagara Falls Power Company to issue its capital stock to the amount of $1,534,000 per value, the proceeds to be used to take up its series of debentures.

ONEIDA, N. Y.—The Board of Public Works has adopted a resolution calling for a special meeting to be held Jan. 12, 1911, to consider the question of establishing a municipal electric light plant in Oneida.

OSWEGO, N. Y.—The City Council has authorized Mayor Fitzgibbons to engage a hydraulic engineer to examine plans for the new power house which is to be erected by the city. Plans were prepared under the supervision of Superintendent Ormsby, of the Water Department.

OWEGO, N. Y.—The Owego Light & Power Company has been authorized by the Public Service Commission, Second District, to issue $32,000 in capital stock, the proceeds to be used to pay outstanding indebtedness.

PATCHOGUE, N. Y.—The Patchogue Electric Light Company has received authority from the Public Service Commission, Second District, to issue $30,000 in additional capital stock, the proceeds to be used to extend its plant at Centre Moriches.

PHELPS, N. Y.—The Board of Village Trustees has asked for bids on four propositions to light the streets of the village of Phelps, under a five-year contract. Propositions one and two call for an all-night and 12 o'clock service by electricity, respectively, with forty-three arc lamps of 1600 cp. The third and fourth propositions are for a similar service with gasoline substituted for electricity. Bids will be received by the trustees until Jan. 2.

ROCHESTER, N. Y.—The property of the Buffalo, Lockport & Rochester Railway Company has been purchased by Charles D. Beebee, president of the Rochester, Syracuse & Eastern Railway Company, and associates. The Beebee interests have now within their reach direct connection between Syracuse and Buffalo. The Buffalo, Lockport & Rochester Railway was an amalgamation of several small electric railways, and cost $6,000,000 to build.

UTICA, N. Y.—The Public Service Commission, Second District, has authorized the Utica Gas & Electric Company to issue $500,000 in bonds to be sold at not less than 95, the proceeds to be used to discharge an indebtedness incurred for construction and extension of its plant.

WATERTOWN, N. Y.—The Public Service Commission, Second District, has authorized the Deer River Power Company to exercise the franchises granted in the towns of Denmark and Champion and the village of West Carthage to supply electricity in these places.

WHITE PLAINS, N. Y.—The Westchester Street Railroad Company, of White Plains, which operates an electric railway in Mt. Vernon, New Rochelle and White Plains, N. Y., with connecting interurban lines, is reported to have decided to erect a large power house in White Plains, at a cost of $200,000. It is also proposed to enlarge the car barns, improve and rebuild some of its lines.

CHARLOTTE, N. C.—Preparations are being made by the Barium Orphanage for the construction of an electric light plant, water and sewerage systems, at a cost of about $8,000. Rev. George Atkinson is chairman of committee.

NEWBERN, N. C.—Arrangements are being made by the Nuese-Trent Traction Company, of Newbern, N. C., for the construction of a railway four miles in length in this city for which contracts will soon be awarded. Electricity for operating the proposed railway will be supplied by the municipal electric plant. The company is capitalized at $200,000. A. E. Stevens, of Newbern, N. C., is president.

SPRAY, N. C.—The Spray Utilities & Terminal Company has awarded a contract for the construction of its proposed electric railway from Ridgeway, Va., to Spray, N. C., ten miles in length, to the Luck Construction Company. S. H. Marshall is interested in the project.

WINSTON-SALEM, N. C.—The new plant of the Inverness Mills Company, in Winston-Salem, will be completed early in January. The mill will be equipped with 8000 spindles, 200 40-in. automatic looms, etc., for manufacturing print cloths. The company is also building a substation, which is to be equipped to step down electricity from 10,000 volts to 2300 volts for distribution for lamps and motors. Energy for the plant will be supplied from the Winston-Salem transmission line of the Southern Power Company.

BUXTON, N. D.—The Red River Valley Telephone Company has increased its capital stock from $100,000 to $200,000, the proceeds to be used for extensions to its toll lines.

CARRINGTON, N. D.—The Western Electric Company has submitted a proposition to the City Council for lighting the streets of the city and for operating the pumping station of the city water works system. Under the plan submitted for street lighting it is proposed to replace the present arc lamp system for tungsten lamps. It is estimated that a saving of $50 per month can be effected if the city accepts the proposition of the corporation for pumping the city water. The company proposes to install a 20-hp electric motor at the pumping station to operate the pumps.

HETTINGER, N. D.—The erection of a farmers' telephone line south through Bison, S. D., and other towns in Perkins County is under consideration.

JACKSON, OHIO.—Contracts for new equipment for the municipal electric light plant have been awarded as follows: For engines to the Ball Engine Company; heaters and pumps to the Scioto Valley Supply [illegible]

[illegible]

[illegible] OHIO.—The [illegible] Street Railway & Light Company is planning to build an extension of its railway from Sciotoville and Hanging Rock, where it will connect with the Ohio Valley Electric Railway. It is expected that work will begin on the road next summer.

SIDNEY, OHIO.—Bids will be received by the Director of Public [illegible] for lighting the streets of the city [illegible] lamps [illegible] street lamps. [illegible]

GUTHRIE, OKLA.—Sealed bids will be received by A. A. Leer, city clerk, until Jan. 5, for improvements to the municipal filtration plant, including one single-stage centrifugal pump direct-connected to electric motor, motor to be equipped with starting box, pump to supply 1400 gal. [illegible] water per minute; one pressure blower direct-connected to electric [illegible]r to be equipped with starting box, pressure blower to supply 900 cu. ft. of free air at a pressure of 5 lb. per square inch, both to be installed with necessary valves, fitting connections, switching, starting [illegible] for two filter beds, each filter 10 ft. x 18 ft. Electric current furnished by the city for operating motors is 220 volts, three-phase, 60-cycle, alternating current.

EUGENE, ORE.—H. M. Byllesby & Company, of Chicago, Ill., who [illegible]hased several plants in the Willamette Valley of the Northwestern [illegible]rporation last spring, have reorganized the properties under the name of the Oregon Power Company, and are planning extensive improvements, which will involve an expenditure of about $1,500,000. The electric plant in Eugene is to be more than doubled in size and other improvements made at a cost of about $350,000. Electricity generated at the Eugene plant will be transmitted to Junction City and Harrisburg and possibly Albany. The transmission line to Harrisburg, with the exception of the portion which will cross the McKenzie River, is already finished. Electrical service in Albany is now supplied from the Corvallis plant. The plans include the construction of a power plant on the McKenzie River, near St. Martins Rapids, at a cost of about $1,000,000, which will supply electricity for lamps and motors in towns and cities in the Willamette Valley as far north as Albany. The steam plant at Springfield will be used as an auxiliary after the new plant is in operation. As yet no steps have been taken in connection with construction of the proposed plant. All lighting and power contracts are now being taken under the name of the Oregon Power Company. The Northwestern Corporation, with head offices in Philadelphia, Pa., is still in existence.

GRANTS PASS, ORE.—Preparations are being made to enlarge the facilities of the Golden Drift dam irrigation project, next summer, which will involve an expenditure of about $40,000. The company will also spend a large sum for the development of electrical power.

KLAMATH FALLS, ORE.—A preliminary report has been filed with the Secretary of the Interior relative to the proposed hydroelectric power development and roads in Crater Lake National Park. The water for the [illegible]posed development will be taken from Anna Creek, about five miles [illegible]m the camp at Crater Lake.

ONTARIO, ORE.—The Telluride Power Association is reported to [illegible] plant at the confluence of the Malad and Snake Rivers in Idaho. The [illegible]nt will have an output of about 10,000 hp and will supply electricity [illegible] municipal and irrigation purposes. The cost of the plant is esti[illegible]ted at about $2,000,000. A transmission line will extend from the power [illegible] [illegible]l other towns in that vicinity.

PORTLAND, ORE.—The Mount Hood Railway Company has applied for a franchise to construct and operate an electric railway throughout the city. R. C. Gillis, of Los Angeles, Cal., is chairman of board of directors. C. B. Smith is local manager.

PORTLAND, ORE.—[illegible] [illegible]rchased a site on the Willamette River from the Peninsular Lumber [illegible]ompany for its first auxiliary steam power plant. The contract for [illegible]nstruction of the plant has been awarded to Charles E. Moore & Com[illegible]ny, of San Francisco, Cal.

REDMOND, ORE.—The Crook County Water, Light & Power Company, of Redmond, Ore., is reported to be contemplating the construction of an electric railway from Redmond to Prineville. The company is now constructing a hydroelectric power plant at Cline Falls, on Deschutes River, about four miles from Redmond.

BROOKVILLE, PA.—Preparations are being made by the Brookville [illegible] [illegible]tem. New equipment will be purchased, including pumping units and [illegible] engines. Contracts for outside work have already been awarded.

[illegible] awarded contract for the erection of the addition to its power house in [illegible] city, work on which will begin at once. It is understood that con[illegible]tcts for equipment for the plant have not yet been placed. A. Holcroyd, [illegible]

[illegible]

PITTSBURGH, PA.—[illegible] by W. L. [illegible] modeling the building, formerly used by Baur Brothers for a bakery, on Kirkwood Street, between Euclid Avenue and St. Clair Street, for light manufacturing and power plant. The plans call for a fireproof building and the installation of elevators.

PITTSBURGH, PA.—[illegible] submitted to the Common Council by the Allegheny County Light Company for lighting the streets and public buildings for the year 1911, the price for arc lamps furnished on overhead circuits was reduced from $72 to $70 each per year. The price for arc lamps supplied by the underground circuits will be $90 per lamp per year, for 100-watt tungsten lamps $25 each per year, and for 250-watt lamps $40 each per year, which is the same as the present contract.

SHARTLESVILLE, PA.—The Shartlesville Rural Telephone Company is planning to extend its telephone lines to Centreport and Scull Hill.

YORK, PA.—It is reported that the Tennis Company, Magee Building, Pittsburgh, Pa., is preparing plans for the construction of the proposed electric railway of the York & Glen Rock Railway Company, which is to extend from York to Loganville.

CHESTER, S. C.—The equipment of the Springstein Mills is being changed to manufacture a much finer grade of ginghams. The mills are equipped for electrical operation. Leroy Stevens is manager.

ETOWAH, TENN.—Application has been made to the Council by [illegible] F. Peck and others for a franchise to install an electric light, ice plant and water works system in Etowah.

MANCHESTER, TENN.—The City Council is considering the question of issuing bonds for the construction of a municipal electric light plant.

PARKSVILLE, TENN.—The contract has been awarded by the Eastern Tennessee Power Company for electrical equipment for its power plant at Parksville, Tenn., to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa. The contract for four water-wheels having a rating of 5400 hp each was awarded to S. Morgan Smith Company, of York, Pa. M. S. Hopkins is vice-president of the company.

SHELBYVILLE, TENN.—Plans are being considered by W. J. McGill and associates for the erection of a cotton mill in Shelbyville. It is proposed to purchase cotton yarns and weave cloth. Only looms and power machinery will be required. The plant will be operated by electricity.

NACOGDOCHES, TEX.—The City Council has authorized its secretary to secure the cost of erecting an electric light plant, to be owned by the municipality. When the information is obtained the proposition to issue bonds for installation of same will be submitted to a vote of the people. The local company has recently installed meters and discarded flat rates. The minimum charge on a basis of ten lamps is $2; 20 cents per kw-hour [illegible] first 8 kw., [illegible] second 8 kw., [illegible] cents for the third 8 kw, and 5 cents per kw-hour for all above, with a rate of 25 cents per month for meter. If the meter is purchased by the owner of a building, the price is $10.25 for each meter.

PORT ARTHUR, TEX.—It is reported that the Port Arthur Water Company is contemplating increasing the output of its electric light plant.

WACO, TEX.—It is reported that the proposition to issue $250,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant, will be submitted to a vote. P. A. Gorman is city commis-[illegible]

BRATTLEBORO, VT.—At a special town meeting held recently the citizens voted to authorize the Board of Bailiffs to enter into a contract with the Twin State Gas & Electric Company for a term of one year for street lighting. Under the terms of the contract the company is to furnish arc lamps at $70 each per year and incandescent lamps at $17 per lamp per year, with an all-night service. The company has refused to furnish street lamps at the above rates for one year, which were submitted on a basis of a five-year contract. On a one-year contract the company offers to supply arc lamps at the rate of $80 each per year, and 40-cp incandescent lamps at $20 per lamp per year.

IVANHOE, VA.—The Carter Iron Company, Farmers' Bank Building, Pittsburgh, Pa., is reported to be contemplating the construction of a hydroelectric power plant, near its furnace property. It is understood that investigations have been made and report submitted by Lenz & Mole, engineers, 71 Broadway, New York, N. Y.

LEXINGTON, VA.—A consolidation of the Lexington Light & Power Company and the Rockbridge Power Corporation is reported to be under consideration for the purpose of supplying the city with electricity for lamps and motors.

MARTINSVILLE, VA.—At an election held Dec. 8 the citizens voted to issue $35,000 in bonds, the proceeds to be used for improvements to municipal electric light plant and water works system.

SMITHFIELD, VA.—The proposition to issue $55,000 in bonds, the proceeds to be used for the installation of an electric lighting system and sewerage system, will be submitted to a vote at an election to be [illegible]

BISMARCK, WASH.—A bonus of $20,000 has been subscribed by the residents of Bismarck as an inducement to the Tacoma Railway & Power Company to extend its McKinley Park line to the city limits at South Sixty fourth Street.

CHEHALIS, WASH.—The directors of the Twin City Light & Trac-[illegible] [illegible] $[illegible] for improve-

ments to its system, [illegible] the construction of a power house to be equipped with new machinery [illegible] Storer [illegible] is local manager.

COLVILLE, WASH.—The County Commissioners have granted a franchise to Louis P. Larson to construct and operate a water works system in Metaline Falls; also to install and operate an electric light and telephone system.

KENNEWICK, WASH.—The Pacific Power & Light Company, of Portland, Ore., has awarded a contract for poles for the proposed high-tension transmission line from Kennewick to Hanford, Wash., to the R. E. Downie Pole Company, of Seattle, Wash.

MARCUS, WASH.—It is reported that H. V. Gates, of Hillsboro, Ore., and H. R. Williams, of Colville, Wash., have submitted a proposition to the Commercial Club for the installation of an electric light and power plant in Marcus.

RICHLAND, WASH.—Negotiations are under way between the Lower Yakima Irrigation Company and the Pacific Light & Power Company, of North Yakima, Wash., for the erection of a tranmission line to connect with the high-tension lines of the Pacific company to supply electricity to operate the two pumping stations of the irrigation company.

SUMNER, WASH.—Board of County Commissioners has granted the Equality Telephone Company a franchise to erect telephone lines along the county road to Dieringer.

MORGANTOWN, W. VA.—It is reported that plans are being considered by the Morgantown & Dunkard Valley Railroad Company for the construction of a new power house in Morgantown.

ASHLAND, WIS.—Arrangements are being made by E. A. Appleyard, of the Ashland Lighting Company, to begin work on the construction of a power dam on the Bad River, near Mellan, in the near future.

BLOOMER, WIS.—The State Railroad Commission has withheld its decision in regard to the application of the Bloomer Electric Light Company for permission to increase its rates for electrical service. After making an inspection of the plant the commission finds that it is impossible for the company to furnish adequate service with the present equipment. Two propositions were submitted to the company for improving and increasing its service: One was to repair and change the present water-power equipment and to install a gasoline engine, for auxiliary purposes, and the other to purchase energy from the Chippewa Valley Railway, Light & Power Company at its switchboard at Chippewa Falls. The second proposition would necessitate the abandonment of the existing generating station and the construction of an eight-mile transmission line from the present plant to Chippewa Falls. The commission advises the company that it must take immediate steps to bring its service conditions up to the standard required in the State.

ENDEAVOR, WIS.—It is understood that the proposed plant of the Endeavor Electric Light & Power Company will be located in Valders, Wis. The headquarters of the company are at Endeavor.

HATFIELD, WIS.—The report that the La Crosse Water Power Company is to sell its dam and power plant in Hatfield to the Minneapolis, St. Paul, Rochester & Dubuque Traction Company is denied by the officials of both companies. M. W. Savage, president of the traction company, states that the company will build its own plant.

KAUKAUNA, WIS.—As a special election held recently the citizens voted to purchase the plant and holdings of the Kaukauna Electric Light Company. Owing to the city and the company being unable to come to an agreement in regard to requiring the company to improve its service, an appeal was made to the Wisconsin Rate Commission. In the decision handed down the commission favored the city in practically every point [illegible] price.

MADISON, WIS.—J. E. Jones, secretary of the Chicago & Wisconsin Valley Street Railways Company, states that work on construction of its proposed railway will begin in April, 1911, between Madison and Portage. The company has taken offices in the Washington Building, Madison, Wis.

MARINETTE, WIS.—Local business men are considering the question of developing additional power on the Menominee River.

MENASHA, WIS.—The Lakeside Paper Company, recently organized, is [illegible] be equipped for electric motor [illegible] and others are interested in the project

MILWAUKEE, WIS.—The Continental Realty Company is reported to be contemplating the erection of three substations, equipped with transformers. The company operates a large electric power plant in Milwaukee

PRAIRIE DU SAC, WIS.—[illegible] River Power Company for its proposed dam to be erected across the Wisconsin River, near Prairie du Sac. According to the present plans the dam will be [illegible] 25 ft., capable of developing 26,000 hp. Transmission lines will be erected to Milwaukee and Madison and also to North Freedom to supply electricity for the mines in that section. R. G. Walter has charge of the work.

STOUGHTON, WIS.—The City Council has adopted a resolution favoring the purchase of the property of the Stoughton Mill Company, at a cost of $18,700. It is proposed to utilize the power for both the electric light plant and water works system.

VANCOUVER, B. C., CAN.—[illegible] a scheme for improvements [illegible] Mountain, which include the construction of several miles of electric railway, costing $38,000 per mile, on the slope of the mountain. It is understood that a charter has been obtained and work will begin in the spring. C. S. Gzowski, C. H. Allen, Walter Gravely and others are interested in the project.

VICTORIA, B. C., CAN.—It is reported that the city purchasing agent will soon call for proposals for 2000 lb. of copper wire for the municipal lighting department.

HAMILTON, ONT., CAN.—Orders have been placed by the Dominion Power & Transmission Company with the Canadian Westinghouse Company, of Hamilton, Ont., for an 8500-kw generator to be installed in its Decew Falls plant, at a cost of about $200,000. The company is also planning to erect another substation in Hamilton, to be completed by next June.

LONDON, ONT., CAN.—Adam Beck, chairman of the Hydro-Electric Power Commission, has announced the government's plan for supplying electricity for farmers. Low-tension wires are to be erected to radiate thirty miles from the power centers. The government proposes to adopt the same principle as the municipal telephone system, under which twenty farmers could go to the County Council and have a telephone line erected, paying for it on the same basis as a local improvement. It is proposed to have the government erect the lines, which the consumers would pay for at the rate of 4 per cent on the investment, retiring the indebtedness at the end of fifteen or twenty years.

TORONTO, ONT., CAN.—The towns of Midland and Penetanguishene have applied to the Hydro-Electric Power Commission for energy. The commission has already made arrangements to meet the requirements of the Georgian Bay towns, provided the ratepayers vote in favor of the project. Arrangements have been made with the Simcoe Power Company, which owns a large plant at Big Chute, on the Severn River, capable of developing 4000 hp. The company's transmission lines already extend to Midland, and if the towns decide to make a contract with the commission the line would be extended from Midland to Penetanguishene. The [illegible] has not yet been decided upon.

New Industrial Companies.

THE BAYONNE CONSTRUCTION COMPANY, of Bayonne, N. J., has filed articles of incorporation with a capital stock of $50,000 for the purpose of doing a general construction and engineering business. The incorporators are: S. Horwitz, N. Lazarus and others, of Bayonne, N. J.

THE BETTES ELECTRO-CHEMICAL COMPANY, of Kansas City, Mo., has been incorporated, with a capital stock of $50,000, by Ambro Bettes, Francis E. S. Stoddard and others.

THE B. & L. COMPANY, of Norwich, Conn., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing all styles of ball bearings products, which have previously been imported from Germany. Otto Bruenauer is president of the company and B. F. Leavitt treasurer. The New York office is at 50 Church Street.

THE CORPORATION SERVICE COMPANY, of Rochester, N. Y., has been incorporated by Gilbert MacPherson, Roy E. Bowen and Edward J. Meyer, all of Rochester, N. Y. The company proposes to do electrical work of all kinds.

THE DELTA ELECTRO-PLATING & MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $25,000. The incorporators are: J. C. Huss, of Wissahicken, Pa.; S. Zeidman, of Philadelphia, Pa., and J. S. Collins, Jr., of Dover, Del.

THE DUPLEXO VACUUM CLEANER COMPANY, of Brooklyn, N. Y., has filed articles of incorporation with a capital stock of $50,000 to manufacture vacuum cleaners, etc. The incorporators are: Adolph Klindtworth, 363 East Thirty-second Street; Hugo Goldenberg, 110 West Twenty-ninth Street, both of New York, N. Y., and Max French, 842 Madison Street, Brooklyn, N. Y.

THE FLOWER STEEL & ELECTROTYPE COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, by Edwin Flower, 313 Gregory Avenue, Passaic, N. J.; William Hill, 27 William Street, New York, N. Y.; Victor Nivols, 338 First Street, Brooklyn, N. Y.

THE LORAINE DEVELOPMENT COMPANY, of Albany, N. Y., has been granted a charter with a capital stock of $60,000 for the purpose of manufacturing machinery, mechanical apparatus, etc. The incorporators are: C. M. Sand, S. A. Murphy, of Albany, N. Y., and W. Hurst, Jr., of Hurstville, N. Y.

THE MARSH VALVE COMPANY, of Dunkirk, N. Y., has been incorporated with a capital stock of $250,000 to manufacture valves of all kinds. The incorporators are: W. C. Marsh, N. F. Gould and W. J. Reed, of New York, N. Y.

THE NATIONAL AUTOMATIC ROLL ADVERTISING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $200,000, by S. A. Diamond, of Borough of the Bronx; P. A. Diamond and I. Alvia, of New York, N. Y. The company proposes to manufacture advertising devices, etc.

THE NEW ENGLAND AUTOMATIC WATER POWER COMPANY

[illegible] Jackson, of Ossipee, Maine, is president, and S. B. Smith, of Berwick, Maine, treasurer.

THE RELIABLE ARC LAMP COMPANY, of New York, N. Y., has been chartered with a capital stock of $15,000 for the purpose of manufacturing electric light fixtures, etc. The incorporators are: Joseph Boderman, 18 Amboy Street; Joseph Miller, 418 Barbey Street; Nathan Greenberg, 51 Christopher Avenue, all of Brooklyn, N. Y.

THE ROJAS ELECTRO-CHEMICAL COMPANY, of New York, N. [illegible] Schoonmaker, Ralph B. Schoonmaker, 14 Maiden Lane; Carl S. Brown, [illegible] New York, N. Y. The company proposes to [illegible] electroplating, etc.

THE STERN MOTOR COMPANY, of New York, N. Y., has been incorporated by Frank M. Randall, 125 East Forty-seventh Street; Philip K. Stern, 520 West 183d Street; L. Rosenberg, 604 West 162d Street, all of New York, N. Y. The company is capitalized at $100,000 and proposes to manufacture motors, engines, vehicles, machinery, etc.

THE SUFFOLK CONTRACTING COMPANY, of Huntington, N. Y., has been chartered with a capital stock of $20,000 for the purpose of doing a general contracting and engineering business. The incorporators are: John McBrien, Daniel E. Lynch and Marion L. Dawson, all of Huntington, N. Y.

THE UNITED STATES SIGNAL COMPANY, of Pittsburgh, Pa., has been organized for the purpose of establishing a factory for the manufacture of boxes and other apparatus for police and fire alarm systems. Thomas A. McQuaide and others are interested in the project.

THE ZUNNER MACHINES COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $25,000 to manufacture boilers, machinery, hardware, etc. The incorporators are: John H. G. Zunner, William D. Clapp and Hugh Satterlee, all of Rochester, N. Y.

New Incorporations.

DELIGHT, ARK.—The Delight Telephone Company has been chartered with a capital stock of $1,000 by G. M. Parsons, R. W. Stroll and others.

KERMAN, CAL.—The Kerman Telephone Company has filed articles of incorporation with a capital stock of $15,000.

MIDDLETOWN, CONN.—The Middlesex Light & Power Company has been organized by Major T. M. Russell, G. B. Carlson, William L. Whitney, of Middletown, Conn.; Niles E. Gladding, of Essex, Conn., and Ernest L. Pratt, of Saybrook, Conn. The company has applied to the General Assembly for a charter and proposes to do business in Essex, Saybrook, Chester, Haddam, East Haddam, Old Saybrook, Westbrook, Clinton, Madison, Old Lyme and Killingworth.

BLOOMINGTON, ILL.—Articles of incorporation have been filed for the Bloomington, Decatur & Champaign Electric Railway Company by B. E. Bramble, W. H. Carnahan, George R. McComb, L. Campbell and E. S. Cole, all of Champaign, Ill. The company is capitalized at $3,525,000 and proposes to construct and operate an electric railway from Bloomington to Champaign, via Decatur.

ALLERTON, IA.—The Allerton Telephone Company has been incorporated, with a capital stock of $10,000, by W. T. Grimes, R. Z. McCoy, B. Bracewell and others.

ELKADER, IA.—The Boardman-Wagner Telephone Company has been incorporated, with a capital stock of $1,600, by Armund Larson, Jacob Eggiman, William Huebner, Henry Korsch and others.

KEOKUK, IA.—The Mississippi River Power Company has been chartered with a capital stock of $500,000 to construct a hydroelectric power plant. It is understood that the Stone & Webster Engineering Corporation, of Boston, Mass., is interested in the project. For further information, address Jeremiah Smith, Jr., 84 State Street, Boston, Mass.

WAVERLY, IA.—The Washington Rural Telephone Company has been incorporated by H. O. Steege, John J. Becker, Herman Brandt, W. C. Steege, F. H. Meyer and A. F. Sauerbret. The company is capitalized at $6,000.

EVARTS, KY.—The Martin's Fork Telephone Company has been organized by C. Haynes and others. The company is capitalized at $2,000 and proposes to install a telephone system in Evarts with extensions from Evarts to Jonesborough and Poor Fork.

BOSTON, MASS.—The Boston & Suburban Electric Transportation Company has been incorporated with a capital stock of $110,000 for the purpose of doing a general [illegible] D. Stranahan, of Wellesley Hills, president, and W. E. Eldridge, of Salem, Mass., treasurer.

SEDALIA, MO.—The Hughesville & Sedalia Trunk Line Telephone Company has been granted a charter. The incorporators are G. W. Lanes, L. H. Durley, S. E. Harvey and others.

WELLSVILLE, MO.—[illegible] Wellsville Light, Power & Water Company by C. H. Early, J. T. Mitchell, F. R. [illegible]

PHILLIPSBURG, MONT.—Articles of incorporation have been filed for the Flint Valley Telephone Company with a capital stock of $5,000 for the purpose of erecting telephone lines in the valley south of Phillipsburg, and on the upper and lower Rock Creek. Connection with long-distance lines will be made at Phillipsburg. Mrs. E. L. Walker is president and general manager.

JERSEY CITY, N. J.—Articles of incorporation have been filed for the North Carolina Electric & Power Company, with a capital stock of $120,000, by L. H. Sanders. W. P. Riley, of New York, N. Y., and J. R. Turner, of Basking Ridge.

YADKINVILLE, N. C.—The Yadkinville Telephone Company has been incorporated with a capital stock of $6,000 to construct and operate a telephone system. W. L. Hudspeth and others are the incorporators.

Personal.

DR. ALEXANDER GRAHAM BELL has been elected an honorary member of the Royal Institute, London.

MR. EDWARD N. EGGE, formerly of Sheffield, Ia., has been appointed assistant manager of the Home Telephone Company, at Oxnard, Cal.

MR. JOHN M. HANCOCK, a former Mayor of Niagara Falls, N. Y., has been appointed industrial agent of the Cliff Electrical Development Company at Niagara Falls.

MR. BION J. ARNOLD has been elected a director of the Chicago Association of Commerce, succeeding Mr. John M. Roach, of the Chicago Railways Company, resigned.

MR. A. N. BENTLEY, Atlanta representative of the Electric Storage Battery Company, delivered a lecture on "Automobile Batteries" at the Carnegie Library, Atlanta, Ga., on Dec. 14.

MR. CLARK F. ROSS, who has been associated with the Commonwealth Edison Company, of Chicago, for the last three years, has been appointed advertising manager of the Pelouze Electric Heater Company, of that city.

MR. C. L. MORGAN has resigned from the General Electric Vehicle Company to accept the position of advertising and publicity manager with the Lansden Electric Vehicle Company, now allied with the Edison Storage Battery Company.

MR. WILLIAM DARBEE, who has been assistant general manager of the Consolidated Gas, Electric Light & Power Company, of Baltimore, for the past eight years, has resigned to assume charge of the electric plant of the Brooklyn *Daily Times*.

MR. LEROY B. CRAMER, electrical engineer of the Oregon Electric Railway Company, has been appointed electrical engineer of the United Railways Company, Portland, Ore. Mr. Cramer is chairman of the Portland section of the American Institute of Electrical Engineers.

MR. J. E. ALDRED, president of the Pennsylvania Water & Power Company, which has taken over the McCall Ferry Power Company, has been elected president of the Consolidated Gas, Electric Light & Power Company, of Baltimore, to succeed ex-Mayor F. C. Latrobe. Mr. Latrobe will remain a director and will act as special counsel for the company.

MR. F. M. SINSABAUGH, who was manager of the Carrollton (Ill.) Heat, Light & Power Company for fourteen years, has resigned his position to accept the management of the Citizens' Gas, Electric & Heating Company at Mount Vernon, Ill. He will also have the management of the Indiana Water & Light Company at Worthington, Ind., and of the St. Anne Light & Water Company, at St. Anne, Ill.

MR. THOMAS E. MITTEN, president of the Chicago City Railway Company and vice-president of the International Railway Company, of Buffalo, has undertaken the general supervision of the rehabilitation of the property and service of the Philadelphia Rapid Transit Company under a five-year contract. It is said that $10,000,000 is to be expended in betterments and $1,500,000 for repairs and renewals of the Philadelphia street railway system. Mr. Mitten will retain his Chicago position.

MR. EDWARD W. LEANING, of Albany, N. Y., has been appointed by the Public Service Commission, Second District of New York State, assistant chief of the division of statistics and accounts. Mr. Leaning has been for thirty years an employee of the Delaware & Hudson Company, occupying various clerical positions from minor clerk to an executive position as chief clerk in the office of the auditor of disbursements of that company. Mr. Leaning was one of the successful candidates at a recent examination held by the Civil Service Commission. The salary [illegible]

Obituary.

[illegible] and manager of the [illegible] Electric Service Company, Eureka, Ill., met death in a violent form at 11 a. m., Nov. 26, when his arm became caught on the shaft of his 100-hp high-speed engine, tearing the limb from its socket and inflicting other severe wounds on his head and body. He was attempting to adjust a small belt on the engine shaft for driving a drill press when in some way the belt became entangled, throwing him onto the shaft. He is survived by a widow and by four young sons, two of whom witnessed the accident. Mr. Whetzel was forty years of age, and was prominent in a business [illegible] in which he lived. He [illegible] the

Eureka company and built [illegible] six years ago. [illegible] property passes to his widow, Mrs. M[illegible] Whitzel.

MR. SAMUEL S. DICKENSON, [illegible] superintendent and vice-president of the Commercial Cable Company, died at his home in New York City on Dec. 23. Mr. Dickenson was born in Plymouth, England, in 1859. In 1874 he helped to establish the Torbay station of the Direct United States Cable Company. In 1884 he joined the Commercial Cable Company, and established its station at Hazelhill, Canso, Nova Scotia. In 1900 he established the Commercial Cable station at Fayal, Azores, and opened up the first cable communication between Portugal, the Azores Islands and North America. For his services in this connection he was decorated by King Carlos. In 1901 he selected the landing places for the Commercial Pacific Cables in Honolulu, Midway, Guam and Manila. Mr. Dickenson became a full member of the American Institute of Electrical Engineers in 1889. He was also a member of the British Institution of Electrical Engineers.

Trade Publications.

THREE-WIRE GENERATORS.—The Triumph Electric Company, of Cincinnati, Ohio, has issued Bulletin No. 441 describing its line of three-wire generators, ranging in rating from 25 kw up. Three collector rings are mounted on the generator shaft and the armature is tapped at the proper points and connected to these rings. Three balancing coils in a transformer are supplied with energy from these rings and the coils are interconnected, the middle point forming the neutral wire of the three-wire system.

MAGNETO.—Bulletin No. 25, issued by the Connecticut Telephone & Electric Company, of Meriden, Conn., is devoted to a description of the company's new magneto, intended for automobile use. The magneto has a single primary winding running to a switch and all the secondary wires connect from the magneto to the spark plug. The transformer coil, as part of the outfit, is incased in a metal tube threaded into the magneto in cartridge form. Two types are manufactured, one independent and the other for use in conjunction with a battery.

SOLDERLESS CONNECTORS.—In tapping or connecting large cables the use of solderless connectors expedites the work considerably. Connectors of this kind may also be used on all classes of wiring and are approved by the underwriters. Dossert & Company, of New York, have issued Catalog No. 5, illustrating and describing the entire line of solderless connectors manufactured by the company for solid and stranded wires. These include taps, elbows, front-connected lugs, three-way and two-way connectors, equalizers, grounding devices, terminals, etc.

AUTOMATIC ELECTRIC LIGHTING SYSTEM FOR AUTOMOBILES.—The advantages of electricity for lighting automobiles are now generally appreciated by car owners and there are a number of systems on the market, which, in addition to furnishing all the light necessary, supply ample energy for ignition purposes. The Hartman generator system, which is described in a bulletin issued by the Hartman Electrical Manufacturing Company, of Mansfield, Ohio, consists of a low-voltage generator driven from the engine shaft, a battery floating on the line and a regulator operating to maintain constant voltage. Included in the latter is an automatic switch to connect the generator to the battery circuit when the engine reaches a certain speed. The system is wholly automatic and requires no attention other than oiling the bearings. The company also handles the necessary accessories.

BUSINESS NOTES.

CENTURY MOTORS.—The Century Electric Company, St. Louis, reports that the demand for "Century" single-phase motors increased during the year 1910 over 1909 almost 100 per cent. While energetic effort has been made to create this demand, the great increase indicates the growth of favor for the motor driver, and especially for the single-phase motor of the repulsion-induction type. Provision is being made for a corresponding increase in business next year, as the business situation appears to warrant it.

THE MOORE LIGHT COMPANY has recently opened new sales offices and a demonstration room at 500 Fifth Avenue, New York City, where the various forms of the Moore light are on exhibition. The soft white light is artistically installed, showing its correct illuminating value for drawing rooms, art galleries, etc. The yellow light, placed around the picture molding, shows its adaptability for the general illumination of ballrooms, theaters, factories and large halls. The Moore "window," which is factory-made, is especially adapted for furnishing white light where [illegible] matching rooms, etc.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC[illegible]

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

978,828. ELECTRIC ILLUMINATING SIGN; W. W. Arnold, Hamilton, Ohio. App. filed Aug. 10, 1909. Produces illuminated figures for words or symbols through selecting mechanism controlled by a keyboard.

978,841. COMBINED ELECTRIC CONNECTION PLUG AND SOCKET AND SWITCH; W. W. Buckton, London, England. App. filed June 1, 1908. The socket may be rotated when the plug is inserted to operate the switch to open or close the circuit, and the plug cannot be withdrawn until the current has been switched off nor inserted until the switch is in the off position.

978,849. CIRCUIT CLOSER; H. B. Collier, Prairie Grove, Ark. App. filed Sept. 15, 1909. For doors and the like. A casing contains the circuit closer and a hinge which carries a number to actuate the circuit closer.

978,864. HARMONIC PARTY LINE TELEPHONE RINGER; C. J. Erickson, Chicago, Ill. App. filed Aug. 11, 1906. A tuned ringer so that alternating currents of different frequency may be employed for selectively ringing.

978,879. ELECTRIC CIRCUIT CHANGING MECHANISM; F. B. Hall, Wheeling, W. Va. App. filed June 30, 1909. A lock switch operated by a key, for automobiles and the like, the actuation of the lock operating the switch.

978,882. CIRCUIT BREAKER; F. W. Harris, Wilkinsburg, Pa. App. filed Dec. 14, 1908. A heavy current switch with copper and carbon contacts for switchboards with an operating crankshaft and links between the movable member and the shaft, the links extending through an aperture in the base.

978,888. APPARATUS FOR CARRYING OUT THE ELECTROLYTIC PRODUCTION OF SODIUM; P. L. Hulin, Grenoble, France. App. filed April 4, 190[illegible] connected concentric cylinders and a cathode between them.

978,909. COMPOSITE TELEPHONE AND TELEGRAPH SYSTEM; O. M. Leich, Genoa, Ill. App. filed June 19, 1908. Includes telegraph receivers with keys for operating them and telephones connected to the line circuit, a back contact for each key and an impedance coil bridged around the back contact to decrease the telegraph disturbance on the telephone talking circuit.

978,933. SNAP SWITCH HANDLE ATTACHMENT; J. G. Peterson, Hartford, Conn. App. filed Sept. 3, 1910. Handle attachment for rotary snap switch, a washer with spring fingers rotating with the handle and having ratchet teeth held from rotation by the cap.

978,934. PROCESS FOR [illegible] ELECTROLYSIS OF AQUEOUS SOLUTIONS; A. Pietzsch, Triberg, Germany. App. filed Nov. 17, [illegible] due to the products forming at the electrodes conducting the current by causing the electrolyte to flow through an anode chamber past an anode, [illegible] through a [illegible]

978,941. COMBINED CLEAT AND ROSETTE; F. Schimpf, St. Louis, Mo. App. filed June [illegible] an inner section and [illegible] together, which receive the line wires and having an extra portion for receiving the light wires.

978,951. PARTY LINE TELEPHONE; C. A. Soans and A. H. Graves, Chicago, Ill. App. filed May 4, 1907. Lock-out telephone system with a station selecting relay, an associate local circuit controlling relay, a local battery circuit, contacts operable by said latter relay for partially completing the local battery circuit and other contacts operated manually for completing the establishment of the local circuit.

978,953. TROLLEY RETRACTOR; L. B. Stanley, Collinwood, Ohio. App. filed March 19, 1909. A trolley support with a trolley pole swiveled thereto and toggle links fitted to the pole and a fixed part with a spring bearing against the joint of the toggle to force the wheel against the wire in one position of the toggle and to drop the wheel in another position.

978,958. TELEPHONE DESK SET APPARATUS AND CIRCUIT; B. W. Sweet, Cleveland, Ohio. App. filed April 27, 1906. A tubular standard with telephone transmitter and hook and switch actuated thereby and an inductive coil electrically connected with the receiver and within the standard and a removable base on which the standard is mounted.

978,959. LIGHTNING ARRESTER; P. H. Thomas, Montclair, N. J. App. filed June 7, 1905. A vapor device in connection with an air gap as a lightning arrester and vaporizable electrodes therefor and a starting band co-operating with said electrodes with means for abruptly applying the discharge to a starting band.

978,978. CONNECTION FOR STORAGE BATTERIES AND THE LIKE; L. H. Wirne, Philadelphia, Pa. App. filed Dec. 15, 1906. A flexible connection which may be bent repeatedly, including a lug connected to the plate, which lug surrounds the conductor and has a curved lip to permit bending without abrading the cover of the conductor, and a viscous packing between the cover and the lug.

978,980. FLUSH CURLING IRON HEATER; J. I. Ayer, Cambridge, Mass., and H. B. Gale, Natick, Mass. App. filed June 3, 1910. A curling iron heater in the form of a wall pocket with flush face. Details.

978,983. HIGH AND LOW WATER ALARM; C. Brent, Brandon, Manitoba, Canada. App. filed Jan. 2, 1907. Alarm for steam boilers in which the bypass or water gage is surrounded at two points with thermostats to close the circuit when the water level reaches the two points.

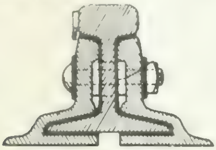
978,992. ELECTROMAGNET; B. G. Dunham, Rochester, N. Y. App. filed June 4, 1906. For electric relays in telephone systems, having pole pieces in the ends of the core, one of the pole pieces offsets with an armature resting in the offset and extending beneath the end of the other pole piece.

978,999. RELAY; H. Gernsback, New York, N. Y. App. filed March 14, 1910. For wireless work, a base carrying a standard on which a horizontal leaf spring is attached, and adjusting screw bearing on the spring, the end of the spring carrying an armature adjacent to the vertical core of the electromagnet.

979,011. SWITCH BOX STRUCTURE; A. D. Levy, Cleveland, Ohio. [illegible]

[illegible] circuit with lines for the [illegible] amplified currents a[illegible] inductive resistance [illegible] for the negative resistance.

[illegible] insulated therefrom and two bonds connect the rails [illegible] he plate [illegible]



[illegible] Rail [illegible]

979,050. ELECTRIC SWITCH; J. A. Ward, Spokane, Wash. App. filed Aug. 21, 1909. A compact switch with special form of handle, and special base to receive the handle with the parts inclosed to prevent short-circuiting if the switch is accidentally opened.

979,064. ELECTRICAL ELEMENTS; A. T. Konstantin Estelle and K. W[illegible] mixture of metallic iron and metallic cadmium finely divided, mixed in a certain proportion to avoid the formation of ferric compounds for use with negative electrodes of batteries with alkaline electrolyte.

979,060. SINUSOIDAL WAVE-CURRENT APPARATUS; F. Cedergren, Hammond, Ind. App. filed Oct. 7, 1907. For electrotherapeutic work, a disk with an annular conductor or strip of resistance material with a pair of brushes on the opposite points of the disk and means for rotating the disk and brushes relative to each other, and a switch to connect the electrodes for the patient either in shunt or in series [illegible]

979,078. ELECTRIC MOTOR CONTROL; H. W. Leonard, Bronxville, N. Y. App. filed April 24, 1903. Four dynamos with separately excited fields and electric motor connected therewith and means for connecting the armatures to the four dynamos in multiple series and in series with each other for varying the speed and torque of the electric motor.

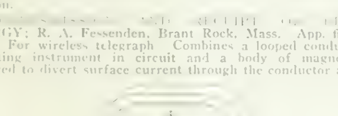
979,081. SIGNALING SYSTEM; C. P. Nachod, Philadelphia, Pa. App. filed Oct. 13, 1908. For a railway with electric motor car which [illegible] ctromagnet which is energized at a fluctuation of voltage far [illegible] normal and a bath of oil for the winding to preserve it against [h]eating at normal voltage.

[illegible] ELECTRIC MOTOR AND CONTROLLING SYSTEM; F. B. Rae, Detroit, Mich. App. filed June 25, 1907. A series motor with [a] field consisting of a plurality of groups proportioned to have a [illegible]um ohmic resistance and magnetizing effect when in series [illegible] controlling switch for cutting out the coils of each group so [illegible] diminish the total ohmic resistance and magnetization to increase [illegible]rrent flow.

979,116. TROLLEY CIRCUIT CONNECTION; C. W. Whaley, Indianapolis, Ind. App. filed July 29, 1909. For diverting the current at special places along the line to operate a sign by combining with spring contacts at intervals along the trolley wire a contact plate on the trolley pole, but insulated therefrom and connected to a local conductor.

979,143. CONTROLLING DEVICE FOR ELECTRICAL APPARATUS; E. F. G. H. Faure, Erie, Pa. App. filed Jan. 31, 1910. For portable electric tools with an electromagnetic field and handle therefor, a switch in the handle, the field maintaining the switch in closed position.

[illegible] ENERGY; R. A. Fessenden, Brant Rock, Mass. App. filed Oct. 31, 1907. For wireless telegraph Combines a looped conductor and an indicating instrument in circuit and a body of magnetic material arranged to divert surface current through the conductor and receiver.



[illegible]

[illegible] resistance alters when heated and means for directing the heat so that the shadow of the moving part of the galvanometer is thrown on [illegible]

[979,]153. ELECTRIC BATTERY CELL; J. H. Gugler, Milwaukee, Wis. [illegible] porous, a battery element within the cup which displaced the liquid and can be raised to bring the level of the liquid therein below the porous portion of the cup.

979,154. COMBINED PRIMARY AND SECONDARY BATTERY SYSTEM; J. H. Gugler, Milwaukee, Wis. App. filed Nov. 6, 1909. Accommodation of a primary battery, a secondary battery and a service circuit, all connected together at one pole of each, a switch connecting the other poles and a resistance connecting the last named poles and the two batteries.

979,155. COMBINED PRIMARY AND SECONDARY BATTERY SYSTEM; J. H. Gugler, Milwaukee, Wis. App. filed Nov. 26, 1909. Combines with a primary battery a storage battery of double the voltage permanently connected to the service circuit with a switch operated by a solenoid for alternating, connecting first one half and then the other of the storage battery in circuit with the primary and thereby charging each half alternately.

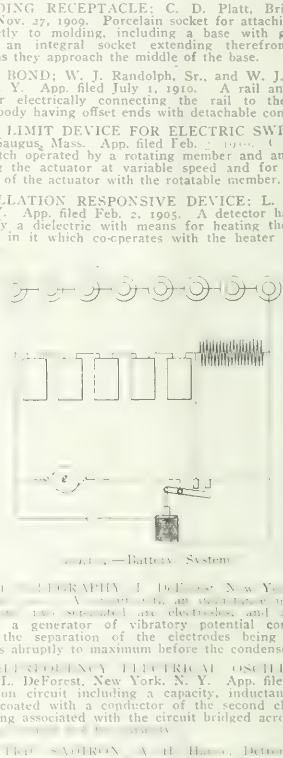
979,164. ELECTROPNEUMATIC TOOL; J. Ten Eyck Hillhouse, New York, N. Y. App. filed July 25, 1908. A plurality of magnets contained in a casing with circuits to energize the magnet and cause adjacent magnets to move to or from each other and cause the difference of fluid pressure within the casing and a piston within the casing arranged to be actuated by the fluid pressure.

979,192. MOLDING RECEPTACLE; C. D. Platt, Bridgeport, Conn. App. filed Nov. 27, 1909. Porcelain socket for attaching incandescent lamps directly to molding, including a base with grooves for the wires and an integral socket extending therefrom, the grooves deepening as they approach the middle of the base.

979,202. RAIL BOND; W. J. Randolph, Sr., and W. J. Randolph, Jr., Moscow, N. Y. App. filed July 1, 1910. A rail and fishplate with a bond for electrically connecting the rail to the fishplate, the connecting body having offset ends with detachable contact points.

[illegible] TIME LIMIT DEVICE FOR ELECTRIC SWITCHES; G. A. Burnham, Saugus, Mass. App. filed Feb. [illegible] Controlling device for the switch operated by a rotating member and an electric motor for rotating the actuator at variable speed and for controlling the engagement of the actuator with the rotatable member.

[979,]275. OSCILLATION RESPONSIVE DEVICE; L. DeForest, New York, N. Y. App. filed Feb. 2, 1905. A detector having electrodes separated by a dielectric with means for heating the dielectric and [a] substance in it which co-operates with the heater to increase the [illegible]



[illegible]—Battery System.

[illegible] TELEGRAPHY; L. DeForest, New York, N. Y. App. [illegible] an [illegible] in series, also a [illegible] separated arc electrodes, and antenna in the circuit and a generator of vibratory potential connected to the electrodes, the separation of the electrodes being such that the voltage rises abruptly to maximum before the condenser discharges.

[illegible] HIGH FREQUENCY ELECTRICAL OSCILLATION GENERATOR; L. DeForest, New York, N. Y. App. filed Feb. 8, 1908. An oscillation circuit including a capacity, inductance and a non-conductor, coated with a conductor of the second class, the coated element being associated with the circuit bridged across the terminal [illegible]

[illegible] ELECTRIC [illegible] Detroit, Mich. App. [illegible] connected together in [illegible] strips wound upon [illegible]

[illegible] TELEPHONE CUT-OUT; [illegible] Va. App. [illegible] point discharge caps and a movable base section which can be lifted to disconnect the contact members, breaking the circuit and throwing out the telephone.

[illegible] TROLLEY WHEEL GUARD; [illegible] Pa. App. filed June 7, 1910. Prevents the trolley wheel from leaving the [illegible] contact face and friction [illegible]

979,354. ELECTRIC SWITCH; G. Sweetser, London, England. App. [illegible] make and break electric thermal switch [illegible] actuated by the expansion device with its fork straddling the plate and carrying contacts.

979,363. CHEMICAL PROCESS; W. C. Arsem, Schenectady, N. Y. [illegible] tungsten with a dry powdered reducing agent and then heats the mixture in a vacuum [illegible]

[illegible] FOR ARMATURE WINDING [illegible]

[illegible] ELECTRIC FIRE ALARM; [illegible] Caledonia, Mich. App. filed March 1, 1910. Thermostatic circuit closer consisting of two [illegible] held apart by bars [illegible] connected by solder which [illegible]

[illegible] THREE-WIRE SYSTEM OF ELECTRICAL DISTRIBUTION; [illegible] Pittsburgh, Pa. App. filed Jan. 21, 1903. A three-wire consumption circuit supplied from an alternating source with the neutral wire connected to an intermediate point in the source and the main conductors connected to the outer terminals, [illegible] connections.

THE ELECTRICAL WORLD'S

STREET-LIGHTING TABLES FOR 1911

TWENTY-SECOND YEAR

These schedules are made up on local mean time. Where standard time is used, and it varies considerably from sun time, the proper deduction or addition must be made.

Time from noon until midnight is in bold-face type; that from midnight until noon in light type. The light type shows time for the morning following the date of the night indicated.

January, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**5:15**	6:20	**5:15**	6:20	**5:15**	6:20
2	**5:15**	6:20	**5:35**	6:20	**5:15**	6:20
3	**5:15**	6:20	**6:40**	6:20	**5:15**	6:20
4	**5:15**	6:20	**7:50**	6:20	**5:15**	6:20
5	**5:15**	6:20	**8:55**	6:20	**5:15**	6:20
6	**5:15**	6:20	**10:05**	6:20	**5:15**	6:20
7	**5:20**	6:20	**11:10**	6:20	**5:20**	6:20
8	**5:20**	6:20	12:25	6:20	**5:20**	6:20
9	**5:20**	6:20	1:35	6:20	**5:20**	**12:00**
9					1:35	6:20
10	**5:20**	6:20	2:50	6:20	**5:20**	**12:00**
10					2:50	6:20
11	**5:20**	6:20	4:10	6:20	**5:20**	**12:00**
11					4:10	6:20
12	**5:25**	6:20	No	light	**5:25**	**12:00**
13	**5:25**	6:20	No	light	**5:25**	**12:00**
14	**5:25**	6:20	No	light	**5:25**	**12:00**
15	**5:25**	6:15	**5:25**	6:50	**5:25**	**12:00**
16	**5:25**	6:15	**5:25**	**8:05**	**5:25**	**12:00**
17	**5:30**	6:15	**5:30**	**9:15**	**5:30**	**12:00**
18	**5:30**	6:15	**5:30**	**10:20**	**5:30**	**12:00**
19	**5:30**	6:15	**5:30**	**11:25**	**5:30**	**12:00**
20	**5:30**	6:15	**5:30**	12:25	**5:30**	12:25
21	**5:30**	6:15	**5:30**	1:25	**5:30**	1:25
22	**5:35**	6:15	**5:35**	2:30	**5:35**	2:30
23	**5:35**	6:15	**5:35**	3:30	**5:35**	3:30
24	**5:35**	6:15	**5:35**	4:35	**5:35**	4:35
25	**5:40**	6:10	**5:40**	5:35	**5:40**	5:35
26	**5:40**	6:10	**5:40**	6:10	**5:40**	6:10
27	**5:40**	6:10	**5:40**	6:10	**5:40**	6:10
28	**5:40**	6:10	**5:40**	6:10	**5:40**	6:10
29	**5:45**	6:10	**5:45**	6:10	**5:45**	6:10
30	**5:45**	6:10	**5:45**	6:10	**5:45**	6:10
31	**5:45**	6:05	**5:45**	6:05	**5:45**	6:05

February, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**5:45**	6:05	**6:50**	6:05	**5:45**	6:05
2	**5:45**	6:05	**7:55**	6:05	**5:45**	6:05
3	**5:45**	6:05	**9:05**	6:05	**5:45**	6:05
4	**5:45**	6:05	**10:15**	6:05	**5:45**	6:05
5	**5:50**	6:00	**11:25**	6:00	**5:50**	6:00
6	**5:50**	6:00	12:40	6:00	**5:50**	6:00
7	**5:55**	6:00	1:55	6:00	**5:55**	**12:00**
7					1:55	6:00
8	**5:55**	6:00	3:05	6:00	**5:55**	**12:00**
8					3:05	6:00
9	**5:55**	6:00	4:10	6:00	**5:55**	**12:00**
9					4:10	6:00
10	**5:55**	5:55	No	light	**5:55**	**12:00**
11	**6:00**	5:55	No	light	**6:00**	**12:00**
12	**6:00**	5:55	No	light	**6:00**	**12:00**
13	**6:00**	5:55	No	light	**6:00**	**12:00**
14	**6:05**	5:50	**6:05**	**8:00**	**6:05**	**12:00**
15	**6:05**	5:50	**6:05**	**9:10**	**6:05**	**12:00**
16	**6:05**	5:50	**6:05**	**10:10**	**6:05**	**12:00**
17	**6:10**	5:50	**6:10**	**11:15**	**6:10**	**12:00**
18	**6:10**	5:45	**6:10**	12:15	**6:10**	12:15
19	**6:10**	5:45	**6:10**	1:20	**6:10**	1:20
20	**6:10**	5:45	**6:10**	2:20	**6:10**	2:20
21	**6:10**	5:45	**6:10**	3:25	**6:10**	3:25
22	**6:10**	5:40	**6:10**	4:20	**6:10**	4:20
23	**6:15**	5:40	**6:15**	5:20	**6:15**	5:20
24	**6:15**	5:40	**6:15**	5:40	**6:15**	5:40
25	**6:15**	5:35	**6:15**	5:35	**6:15**	5:35
26	**6:15**	5:35	**6:15**	5:35	**6:15**	5:35
27	**6:15**	5:35	**6:15**	5:35	**6:15**	5:35
28	**6:20**	5:30	**6:20**	5:30	**6:20**	5:30

March, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**6:20**	5:30	**6:20**	5:30	**6:20**	5:30
2	**6:20**	5:30	**6:20**	5:30	**6:20**	5:30
3	**6:20**	5:30	**8:05**	5:30	**6:20**	5:30
4	**6:25**	5:30	**9:15**	5:30	**6:25**	5:30
5	**6:25**	5:20	**10:30**	5:25	**6:25**	5:25
6	**6:25**	5:20	**11:45**	5:20	**6:25**	5:20
7	**6:25**	5:20	12:55	5:20	**6:25**	5:20
8	**6:25**	5:20	2:05	5:20	**6:25**	**12:00**
8					2:05	5:20
9	**6:30**	5:20	3:00	5:20	**6:30**	**12:00**
9					3:00	5:20
10	**6:30**	5:15	3:50	5:15	**6:30**	**12:00**
10					3:50	5:15
11	**6:30**	5:15	4:30	5:15	**6:30**	**12:00**
12	**6:30**	5:15	No	light	**6:30**	**12:00**
13	**6:30**	5:10	No	light	**6:30**	**12:00**
14	**6:35**	5:10	No	light	**6:35**	**12:00**
15	**6:35**	5:10	**6:35**	**7:55**	**6:35**	**12:00**
16	**6:35**	5:05	**6:35**	**9:00**	**6:35**	**12:00**
17	**6:35**	5:05	**6:35**	**10:00**	**6:35**	**12:00**
18	**6:35**	5:05	**6:35**	**11:05**	**6:35**	**12:00**
19	**6:40**	5:05	**6:40**	12:10	**6:40**	12:10
20	**6:40**	5:00	**6:40**	1:10	**6:40**	1:10
21	**6:40**	5:00	**6:40**	2:10	**6:40**	2:10
22	**6:40**	4:55	**6:40**	3:05	**6:40**	3:05
23	**6:45**	4:55	**6:45**	4:00	**6:45**	4:00
24	**6:45**	4:55	**6:45**	4:40	**6:45**	4:40
25	**6:45**	4:55	**6:45**	4:55	**6:45**	4:55
26	**6:45**	4:50	**6:45**	4:50	**6:45**	4:50
27	**6:45**	4:50	**6:45**	4:50	**6:45**	4:50
28	**6:50**	4:50	**6:50**	4:50	**6:50**	4:50
29	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
30	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
31	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45

April, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**6:50**	4:45	**8:15**	4:45	**6:50**	4:45
2	**6:55**	4:40	**9:30**	4:40	**6:55**	4:40
3	**6:55**	4:40	**10:45**	4:40	**6:55**	4:40
4	**6:55**	4:35	**12:00**	4:35	**6:55**	4:35
5	**6:55**	4:35	1:00	4:35	**6:55**	4:35
6	**6:55**	4:35	1:50	4:35	**6:55**	**12:00**
6					1:50	4:35
7	**7:00**	4:35	2:30	4:35	**7:00**	**12:00**
7					2:30	4:35
8	**7:00**	4:30	3:05	4:30	**7:00**	**12:00**
8					3:05	4:30
9	**7:00**	4:30	3:30	4:30	**7:00**	**12:00**
10	**7:00**	4:30	3:55	4:30	**7:00**	**12:00**
11	**7:00**	4:25	No	light	**7:00**	**12:00**
12	**7:05**	4:25	No	light	**7:05**	**12:00**
13	**7:05**	4:25	No	light	**7:05**	**12:00**
14	**7:05**	4:20	**7:05**	**8:50**	**7:05**	**12:00**
15	**7:05**	4:20	**7:05**	**9:55**	**7:05**	**12:00**
16	**7:05**	4:20	**7:05**	**11:00**	**7:05**	**12:00**
17	**7:10**	4:15	**7:10**	**12:00**	**7:10**	**12:00**
18	**7:10**	4:15	**7:10**	1:00	**7:10**	1:00
19	**7:10**	4:15	**7:10**	1:50	**7:10**	1:50
20	**7:10**	4:10	**7:10**	2:35	**7:10**	2:35
21	**7:10**	4:10	**7:10**	3:15	**7:10**	3:15
22	**7:15**	4:10	**7:15**	3:45	**7:15**	3:45
23	**7:15**	4:05	**7:15**	4:05	**7:15**	4:05
24	**7:15**	4:05	**7:15**	4:05	**7:15**	4:05
25	**7:15**	4:05	**7:15**	4:05	**7:15**	4:05
26	**7:20**	4:05	**7:20**	4:05	**7:20**	4:05
27	**7:20**	4:00	**7:20**	4:00	**7:20**	4:00
28	**7:20**	4:00	**7:20**	4:00	**7:20**	4:00
29	**7:20**	4:00	**7:20**	4:00	**7:20**	4:00
30	**7:20**	4:00	**7:20**	4:00	**7:20**	4:00

May, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**7:20**	4:00	**9:35**	4:00	**7:20**	4:00
2	**7:20**	4:00	**10:50**	4:00	**7:20**	4:00
3	**7:25**	3:55	**11:45**	3:55	**7:25**	3:55
4	**7:25**	3:55	12:35	3:55	**7:25**	3:55
5	**7:25**	3:55	1:05	3:55	**7:25**	**12:00**
5					1:05	3:55
6	**7:25**	3:50	1:35	3:50	**7:25**	**12:00**
6					1:35	3:50
7	**7:25**	3:45	2:00	3:45	**7:25**	**12:00**
7					2:00	3:45
8	**7:30**	3:45	2:22	3:45	**7:30**	**12:00**
9	**7:30**	3:45	2:40	3:45	**7:30**	**12:00**
10	**7:30**	3:45	No	light	**7:30**	**12:00**
11	**7:30**	3:45	No	light	**7:30**	**12:00**
12	**7:30**	3:45	No	light	**7:30**	**12:00**
13	**7:35**	3:45	No	light	**7:35**	**12:00**
14	**7:35**	3:45	**7:35**	**9:50**	**7:35**	**12:00**
15	**7:35**	3:40	**7:35**	**10:50**	**7:35**	**12:00**
16	**7:35**	3:40	**7:35**	**11:45**	**7:35**	**12:00**
17	**7:35**	3:40	**7:35**	12:35	**7:35**	12:35
18	**7:40**	3:40	**7:40**	1:15	**7:40**	1:15
19	**7:40**	3:40	**7:40**	1:45	**7:40**	1:45
20	**7:40**	3:40	**7:40**	2:15	**7:40**	2:15
21	**7:40**	3:40	**7:40**	2:40	**7:40**	2:40
22	**7:40**	3:40	**7:40**	3:05	**7:40**	3:05
23	**7:45**	3:35	**7:45**	3:25	**7:45**	3:25
24	**7:45**	3:35	**7:45**	3:35	**7:45**	3:35
25	**7:45**	3:35	**7:45**	3:35	**7:45**	3:35
26	**7:45**	3:35	**7:45**	3:35	**7:45**	3:35
27	**7:45**	3:35	**7:45**	3:35	**7:45**	3:35
28	**7:45**	3:35	**7:45**	3:35	**7:45**	3:35
29	**7:45**	3:35	**7:45**	3:35	**7:45**	3:35
30	**7:45**	3:30	**7:45**	3:30	**7:45**	3:30
31	**7:45**	3:30	**10:30**	3:30	**7:45**	3:30

June, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**7:50**	3:35	**11:10**	3:35	**7:50**	3:35
2	**7:50**	3:35	**11:40**	3:35	**7:50**	3:35
3	**7:50**	3:35	12:05	3:35	**7:50**	3:35
4	**7:50**	3:35	12:30	3:35	**7:50**	3:35
5	**7:50**	3:35	12:50	3:35	**7:50**	3:35
6	**7:55**	3:35	1:10	3:35	**7:55**	**12:00**
6					1:10	3:35
7	**7:55**	3:35	1:30	3:35	**7:55**	**12:00**
7					1:30	3:35
8	**7:55**	3:35	1:55	3:35	**7:55**	**12:00**
8					1:55	3:35
9	**7:55**	3:35	No	light	**7:55**	**12:00**
10	**7:55**	3:35	No	light	**7:55**	**12:00**
11	**7:55**	3:35	No	light	**7:55**	**12:00**
12	**7:55**	3:30	**7:55**	**9:40**	**7:55**	**12:00**
13	**7:55**	3:30	**7:55**	**10:30**	**7:55**	**12:00**
14	**7:55**	3:30	**7:55**	**11:15**	**7:55**	**12:00**
15	**7:55**	3:30	**7:55**	**11:50**	**7:55**	**12:00**
16	**7:55**	3:30	**7:55**	12:20	**7:55**	12:20
17	**8:00**	3:30	**8:00**	12:45	**8:00**	12:45
18	**8:00**	3:30	**8:00**	1:05	**8:00**	1:05
19	**8:00**	3:30	**8:00**	1:30	**8:00**	1:30
20	**8:00**	3:30	**8:00**	1:50	**8:00**	1:50
21	**8:00**	3:30	**8:00**	2:15	**8:00**	2:15
22	**8:00**	3:30	**8:00**	2:50	**8:00**	2:50
23	**8:00**	3:30	**8:00**	3:25	**8:00**	3:25
24	**8:00**	3:30	**8:00**	3:30	**8:00**	3:30
25	**8:00**	3:30	**8:00**	3:30	**8:00**	3:30
26	**8:00**	3:30	**8:00**	3:30	**8:00**	3:30
27	**8:00**	3:30	**8:00**	3:30	**8:00**	3:30
28	**8:00**	3:30	**9:00**	3:30	**8:00**	3:30
29	**8:00**	3:30	**9:35**	3:30	**8:00**	3:30
30	**8:00**	3:30	**10:05**	3:30	**8:00**	3:30

July, 1911

Night	Table No. 1 All-Night Lighting	Table No. 2 Standard or Philadelphia System	Table No. 3 Frund System

August, 1911

Night	Table No. 1 All-Night Lighting	Table No. 2 Standard or Philadelphia System	Table No. 3 Frund System

September, 1911

Night	Table No. 1 All-Night Lighting	Table No. 2 Standard or Philadelphia System	Table No. 3 Frund System

Night of	Table No. 1 Light	Table No. 1 Exting	Table No. 2 Light	Table No. 2 Exting	Table No. 3 Light	Table No. 3 Exting
23	7:15	4:05	7:15	4:05	7:15	4:05
24	7:15	4:05	7:15	4:05	7:15	4:05
25	7:15	4:05	7:15	4:05	7:15	4:05
26	7:20	4:05	7:20	4:05	7:20	4:05
27	7:20	4:00	7:20	4:00	7:20	4:00
28	7:20	4:00	7:20	4:00	7:20	4:00
29	7:20	4:00	7:20	4:00	7:20	4:00
30	7:20	4:00	7:20	4:00	7:20	4:00

Night of	Table No. 1 Light	Table No. 1 Exting	Table No. 2 Light	Table No. 2 Exting	Table No. 3 Light	Table No. 3 Exting
23	7:45	3:35	7:45	3:25	7:45	3:25
24	7:45	3:35	7:45	3:35	7:45	3:35
25	7:45	3:35	7:45	3:35	7:45	3:35
26	7:45	3:35	7:45	3:35	7:45	3:35
27	7:45	3:35	7:45	3:35	7:45	3:35
28	7:45	3:35	7:45	3:35	7:45	3:35
29	7:45	3:35	7:45	3:35	7:45	3:35
30	7:45	3:30	7:45	3:30	7:45	3:30
31	7:45	3:30	10:30	3:30	7:45	3:30

Night of	Table No. 1 Light	Table No. 1 Exting	Table No. 2 Light	Table No. 2 Exting	Table No. 3 Light	Table No. 3 Exting
23	8:00	3:30	8:00	3:25	8:00	3:25
24	8:00	3:30	8:00	3:30	8:00	3:30
25	8:00	3:30	8:00	3:30	8:00	3:30
26	8:00	3:30	8:00	3:30	8:00	3:30
27	8:00	3:30	8:00	3:30	8:00	3:30
28	8:00	3:30	9:00	3:30	8:00	3:30
29	8:00	3:30	9:35	3:30	8:00	3:30
30	8:00	3:30	10:05	3:30	8:00	3:30

July, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting
1	8:00	3:30	10:30	3:30	8:00	3:30
2	8:00	3:30	10:50	3:30	8:00	3:30
3	8:00	3:30	11:15	3:30	8:00	3:30
4	8:00	3:30	11:35	3:30	8:00	3:30
5	8:00	3:30	11:50	3:30	8:00	3:30
6	8:00	3:30	12:25	3:30	8:00	3:30
7	8:00	3:30	12:55	3:30	8:00	3:30
8	8:00	3:30	1:35	3:30	8:00	12:00
9	8:00	3:35	No	light	8:00	12:00
10	8:00	3:35	No	light	8:00	12:00
11	7:55	3:35	No	light	7:55	12:00
12	7:55	3:35	7:55	9:50	7:55	12:00
13	7:55	3:35	7:55	10:20	7:55	12:00
14	7:55	3:40	7:55	10:50	7:55	12:00
15	7:55	3:40	7:55	11:10	7:55	12:00
16	7:55	3:40	7:55	11:30	7:55	12:00
17	7:55	3:45	7:55	11:55	7:55	12:00
18	7:55	3:45	7:55	12:20	7:55	12:20
19	7:55	3:45	7:55	12:45	7:55	12:45
20	7:50	3:45	7:50	1:20	7:50	1:20
21	7:50	3:45	7:50	2:00	7:50	2:00
22	7:50	3:45	7:50	2:50	7:50	2:50
23	7:50	3:50	7:50	3:50	7:50	3:50
24	7:50	3:50	7:50	3:50	7:50	3:50
25	7:50	3:50	7:50	3:50	7:50	3:50
26	7:50	3:50	7:50	3:50	7:50	3:50
27	7:45	3:50	7:45	3:50	7:45	3:50
28	7:45	3:55	8:30	3:55	7:45	3:55
29	7:45	3:55	8:55	3:55	7:45	3:55
30	7:45	3:55	9:15	3:55	7:45	3:55
31	7:40	3:55	9:35	3:55	7:40	3:55

August, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting
1	7:40	3:55	10:00	3:55	7:40	3:55
2	7:40	3:55	10:25	3:55	7:40	3:55
3	7:40	4:00	11:00	4:00	7:40	4:00
4	7:40	4:00	11:35	4:00	7:40	4:00
5	7:35	4:00	12:20	4:00	7:35	4:00
6	7:35	4:00	1:10	4:00	7:35	12:00
6			...	.	1:10	4:00
7	7:35	4:00	2:10	4:00	7:35	12:00
8	7:35	4:00	No	light	7:35	12:00
9	7:30	4:05	No	light	7:35	12:00
10	7:30	4:05	No	light	7:30	12:00
11	7:30	4:05	7:30	9:15	7:30	12:00
12	7:30	4:05	7:30	9:40	7:30	12:00
13	7:25	4:05	7:25	10:00	7:25	12:00
14	7:25	4:10	7:25	10:25	7:25	12:00
15	7:25	4:10	7:25	10:50	7:25	12:00
16	7:25	4:10	7:25	11:15	7:25	12:00
17	7:20	4:10	7:20	11:55	7:20	12:00
18	7:20	4:10	7:20	12:40	7:20	12:40
19	7:20	4:15	7:20	1:40	7:20	1:40
20	7:15	4:15	7:15	2:45	7:15	2:45
21	7:15	4:15	7:15	4:00	7:15	4:00
22	7:15	4:15	7:15	4:15	7:15	4:15
23	7:15	4:15	7:15	4:15	7:15	4:15
24	7:10	4:20	7:10	4:20	7:10	4:20
25	7:10	4:20	7:10	4:20	7:10	4:20
26	7:10	4:20	7:10	4:20	7:10	4:20
27	7:05	4:20	7:05	4:20	7:05	4:20
28	7:05	4:20	8:00	4:20	7:05	4:20
29	7:05	4:25	8:25	4:25	7:05	4:25
30	7:05	4:25	8:55	4:25	7:05	4:25
31	7:00	4:25	9:30	4:25	7:00	4:25

September, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting.
1	7:00	4:25	10:10	4:25	7:00	4:25
2	7:00	4:25	11:00	4:25	7:00	4:25
3	6:55	4:30	12:00	4:30	6:55	4:30
4	6:55	4:30	1:00	4:30	6:55	12:00
4		.			1:00	4:30
5	6:55	4:30	2:15	4:30	6:55	12:00
5					2:15	4:30
6	6:50	4:30	3:15	4:30	6:50	12:00
7	6:50	4:30	No	light	6:50	12:00
8	6:50	4:30	No	light	6:50	12:00
9	6:45	4:35	No	light	6:45	12:00
10	6:45	4:35	6:45	8:25	6:45	12:00
11	6:45	4:35	6:45	8:55	6:45	12:00
12	6:40	4:35	6:40	9:20	6:40	12:00
13	6:40	4:35	6:40	9:55	6:40	12:00
14	6:40	4:35	6:40	10:35	6:40	12:00
15	6:35	4:40	6:35	11:30	6:35	12:00
16	6:35	4:40	6:35	12:35	6:35	12:35
17	6:35	4:40	6:35	1:45	6:35	1:45
18	6:30	4:40	6:30	3:00	6:30	3:00
19	6:30	4:45	6:30	4:15	6:30	4:15
20	6:30	4:45	6:30	4:45	6:30	4:45
21	6:25	4:45	6:25	4:45	6:25	4:45
22	6:25	4:45	6:25	4:45	6:25	4:45
23	6:25	4:45	6:25	4:45	6:25	4:45
24	6:20	4:50	6:20	4:50	6:20	4:50
25	6:20	4:50	6:20	4:50	6:20	4:50
26	6:20	4:50	6:55	4:50	6:20	4:50
27	6:15	4:50	7:25	4:50	6:15	4:50
28	6:15	4:55	8:05	4:55	6:15	4:55
29	6:15	4:55	8:50	4:55	6:15	4:55
30	6:15	4:55	9:45	4:55	6:15	4:55

October, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting.	Light	Exting.
1	6:10	4:55	10:45	4:55	6:10	4:55
2	6:10	4:55	11:50	4:55	6:10	4:55
3	6:05	5:00	12:55	5:00	6:05	5:00
4	6:05	5:00	2:00	5:00	6:05	12:00
4	.	....	..	...	2:00	5:00
5	6:05	5:00	3:10	5:00	6:05	12:00
6	6:05	5:00	No	light	6:05	12:00
7	6:00	5:00	No	light	6:00	12:00
8	6:00	5:05	No	light	6:00	12:00
9	6:00	5:05	6:00	7:20	6:00	12:00
10	5:55	5:05	5:55	7:55	5:55	12:00
11	5:55	5:05	5:55	8:35	5:55	12:00
12	5:55	5:05	5:55	9:25	5:55	12:00
13	5:50	5:10	5:50	10:25	5:50	12:00
14	5:50	5:10	5:50	11:35	5:50	12:00
15	5:50	5:10	5:50	12:45	5:50	12:45
16	5:45	5:10	5:50	2:00	5:45	2:00
17	5:45	5:10	5:45	3:15	5:45	3:15
18	5:45	5:15	5:45	4:20	5:45	4:20
19	5:45	5:15	5:45	5:15	5:45	5:15
20	5:40	5:15	5:40	5:15	5:40	5:15
21	5:40	5:15	5:40	5:15	5:40	5:15
22	5:40	5:20	5:40	5:20	5:40	5:20
23	5:35	5:20	5:35	5:20	5:35	5:20
24	5:35	5:20	5:35	5:20	5:35	5:20
25	5:35	5:20	5:35	5:20	5:35	5:20
26	5:35	5:20	6:45	5:20	5:35	5:20
27	5:30	5:25	7:35	5:25	5:30	5:25
28	5:30	5:25	8:30	5:25	5:30	5:25
29	5:30	5:25	9:35	5:25	5:30	5:25
30	5:30	5:25	10:40	5:25	5:30	5:25
31	5:25	5:30	11:40	5:30	5:25	5:30

November, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	5:25	5:30	12:50	5:30	5:25	5:30
2	5:25	5:30	1:55	5:30	5:25	12:00
2	....	....	....		1:50	5:30
3	5:20	5:30	3:05	5:30	5:20	5:30
3	....	....	....	....	3:05	5:30
4	5:20	5:30	4:10	5:30	5:20	12:00
5	5:20	5:35	No	light	5:20	12:00
6	5:20	5:35	No	light	5:20	12:00
7	5:20	5:35	No	light	5:20	12:00
8	5:20	5:35	5:20	7:15	5:20	12:00
9	5:15	5:40	5:15	8:15	5:15	12:00
10	5:15	5:40	5:15	9:25	5:15	12:00
11	5:15	5:40	5:15	10:35	5:15	12:00
12	5:15	5:40	5:15	11:50	5:15	12:00
13	5:15	5:40	5:15	1:05	5:15	1:05
14	5:10	5:45	5:10	2:10	5:10	2:10
15	5:10	5:45	5:10	3:15	5:10	3:15
16	5:10	5:45	5:10	4:25	5:10	4:25
17	5:10	5:50	5:10	5:30	5:10	5:30
18	5:10	5:50	5:10	5:50	5:10	5:50
19	5:10	5:50	5:10	5:50	5:10	5:50
20	5:10	5:50	5:10	5:50	5:10	5:50
21	5:05	5:55	5:05	5:55	5:05	5:55
22	5:05	5:55	5:05	5:55	5:05	5:55
23	5:05	5:55	5:05	5:55	5:05	5:55
24	5:05	5:55	5:05	5:55	5:05	5:55
25	5:05	6:00	7:20	6:00	5:05	6:00
26	5:05	6:00	8:25	6:00	5:05	6:00
27	5:05	6:00	9:25	6:00	5:05	6:00
28	5:05	6:00	10:30	6:00	5:05	6:00
29	5:05	6:00	11:35	6:00	5:05	6:00
30	5:05	6:00	12:40	6:00	5:05	6:00

December, 1911

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund Syste	
	Light	Exting.	Light	Exting	Light	Exting.
1	5:05	6:00	1:50	6:00	5:05	12:00
1			....	....	1:50	6:00
2	5:05	6:05	3:00	6:05	5:05	12:00
2			..	..	3:00	6:00
3	5:05	6:05	4:15	6:05	5:05	12:00
4	5:05	6:05	No	light	5:05	12:00
5	5:05	6:05	No	light	5:05	12:00
6	5:05	6:05	No	light	5:05	12:00
7	5:05	6:10	5:05	7:05	5:05	12:00
8	5:05	6:10	5:05	8:20	5:05	12:00
9	5:05	6:10	5:05	9:35	5:05	12:00
10	5:05	6:10	5:05	10:50	5:05	12:00
11	5:05	6:10	5:05	12:05	5:05	12:05
12	5:05	6:15	5:05	1:10	5:05	1:10
13	5:05	6:15	5:05	2:15	5:05	2:15
14	5:05	6:15	5:05	3:20	5:05	3:20
15	5:05	6:15	5:05	4:25	5:05	4:25
16	5:05	6:15	5:05	5:30	5:05	5:30
17	5:05	6:15	5:05	6:15	5:05	6:15
18	5:05	6:15	5:05	6:15	5:05	6:15
19	5:05	6:15	5:05	6:15	5:05	6:15
20	5:05	6:15	5:05	6:15	5:05	6:15
21	5:05	6:15	5:05	6:15	5:05	6:15
22	5:05	6:15	5:05	6:15	5:05	6:15
23	5:05	6:20	5:05	6:20	5:05	6:20
24	5:05	6:20	5:05	6:20	5:05	6:20
25	5:10	6:20	8:20	6:20	5:10	6:20
26	5:10	6:20	9:25	6:20	5:10	6:20
27	5:10	6:20	10:30	6:20	5:10	6:20
28	5:10	6:20	11:35	6:20	5:10	6:20
29	5:10	6:20	12:40	6:20	5:10	6:20
30	5:10	6:20	1:50	6:20	5:10	12:00
30	....		....	....	1:50	6:20
31	5:10	6:20	3:00	6:20	5:10	12:00
31		...			3:00	6:20